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Currency Internationalisation and Exchange Rate Dynamics in Emerging Markets

A Post Keynesian Analysis of Brazil

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Thesis submitted for the degree of PhD in
Economics

2011

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Declaration for PhD thesis

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Abstract

This dissertation presents a theoretical and empirical study of exchange rate determination in emerging markets in the context of the recent process of currency internationalisation using Brazil as a case study. It develops an alternative analytical framework for exchange rate determination in emerging markets based on Post-Keynesian economic thought.

Drawing on several strands of Post-Keynesian economic theory, the critical realist ontological claim of deeper structures and underlying mechanisms, and the view of the exchange rate as international money, the dissertation argues that exchange rates are driven by financial actors' expectations. These expectations are formed in accordance with yields on domestic financial assets and a currency's liquidity premium, which depends on an exogenously given liquidity preference and market participants' perceptions about a country's ability to meet its outstanding external obligations.

The emphasis on expectations in short-term financial markets for exchange rate determination in Brazil is particularly warranted given the recent internationalisation process of its currency. The dissertation consequently shows the different manifestations of this process, the elements of Brazil's financial and macroeconomic environment which contributed to the Brazilian Real's internationalisation, and the implications this internationalisation had for exchange rate dynamics.

To investigate the determinants of the Brazilian exchange rate in the new era of currency internationalisation, the dissertation conducts a mixed-method study combining insights from more than 50 semi-structured international currency trader interviews with advanced time series econometrics. The semi-structured interviews show the important role of short-term (balance of payments) financial flows, short-term returns, liquidity preference, and a country's net short-term foreign obligations for exchange rate dynamics. The interviews also point to the empirical manifestations of these underlying mechanisms.

These empirical manifestations, as exchange rate drivers in the context of currency internationalisation, are econometrically triangulated using the cointegrated VAR methodology, single equation and multivariate cointegration tests and multivariate GARCH analysis. Results show that the Brazilian Real has formed a cointegration relationship with short-term capital flows over recent years. In addition, the econometric results present evidence that despite different structural characteristics, the Brazilian Real exhibits a strong co-movement with other internationally traded currencies, confirming the currency's internationalisation. In addition, short-term returns and international market conditions have an increasing effect on returns of the Brazilian Real.

In conclusion, the dissertation discusses the important implications the internationalisation process of the Brazilian Real has for the ability of the central bank to control and influence the exchange rate and the resulting implications for exchange rate policy.

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List of Abbreviations

ARCH	Autoregressive Conditional Heteroscedasticity
AUSD	Australian Dollar
BCB	Central Bank of Brazil (Banco do Brasil)
BEER	Behavioural Equilibrium Exchange Rate
BEKK	Baba-Engle-Kraft-Kroner
BIS	Bank of International Settlements
BM&FBovespa	Brazilian Equities and Derivatives Exchange
BRL	Brazilian Real
CIP	Covered Interest Parity
CME	Chicago Mercantile Exchange
DCC	Dynamic Conditional Correlation
DEC	Developing and Emerging Countries
EM	Emerging Market(s)
EMTA	Emerging Markets Trade Association
EPRF	Emerging Market Portfolio Research
FEER	Fundamental Equilibrium Exchange Rate
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
IBGE	Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística)
IKE	Imperfect Knowledge Economics
ICI	Investment Company Institute
IFSL	International Financial Services London
IMF	International Monetary Fund
IMF-IFS	International Monetary Fund – International Financial Statistics
IMF-WEO	International Monetary Fund – World Economic Outlook
IOF	Imposto sobre Operações Financeiras
IPO	Initial Public Offering
NDF	Non Deliverable Forward
NZLD	New Zealand Dollar
MEX	Mexican Peso
OTC	Over-the-Counter
PBM	Portfolio Balance Model
PPP	Purchasing Power Parity
RB	Rational Belief
SIFMA	Securities Industry and Financial Markets Association
TKL	Turkish Lira
TNB	National Treasury of Brazil (Tesouro Nacional do Brasil)
UIP	Uncovered Interest Parity
VAR	Vector Autoregression
VECM	Vector Error Correction
WFE	World Federation of Exchanges
ZAR	South African Rand

Chapter 1: Motivation, Objectives and Structure

1.1. Introduction and Motivation

Exchange rate dynamics are a prime concern for developing and emerging countries (DECs). This is so, because the exchange rate is an important relative price, which affects the level and composition of external balances, the allocation of resources in an economy and thus its productive structure, the level and composition of employment, and, though through more complex and indirect channels, income distribution (Williamson 2003; Ripoll 2005; Frenkel and Ros 2006; Rodrik 2008). This important role of the exchange rate is also evidenced by its repeated use as an active development instrument by, for example, the successful late developers in East Asia (Chang 2002; Wade 2003).

However, the exchange rate is not only an important relative price, but, as will be discussed in this dissertation, it reflects the increasing trade of currencies as a financial asset, whose value is determined by positions in domestic, and especially, international financial markets. This use of the domestic currency as financial asset, however, can have significant implications for price dynamics, which become characterised by large swings and high volatility far beyond those warranted by the real economy. Moreover, assuming that money neutrality does not hold, these exchange rate dynamics can have crucial repercussions on the real economy.

Brazil is one of the four main emerging markets, known as BRICs (Brazil, Russia, India and China). In 2010, Brazil's GDP reached an estimated US\$ 2,090 billion, the 7th largest in the world (above Russia and India). GDP per capita measured in Purchasing Power Parity (PPP) amounted to an estimated US\$ 11,240 in the same year, only 71st, but above China and India. Further, for the period 2000 to 2010, Brazil's Gini coefficient reached 0.55, one of the highest in the world and substantially above the other BRIC countries.¹

¹ Over recent years, Brazil has shown some improvements in its inequality measures largely due to social measures such as the social welfare program "Bolsa Familia" and the repeated increases in the minimum wage. In 2009 the Gini coefficient reached 0.543 down from 0.596 in 2001.

Table 1.1 shows several indicators of Brazil's export and productive structure in the millennium. Between 2000 and 2010, Brazil's real GDP grew on average 3.67% (this compares with an average of 6.2% in all DECs). GDP growth was led - on average - by growth in agriculture, followed by services and industry, which grew at an average of below 3% over the period. At the same time, the contribution of the financial sector to GDP grew by an average of nearly 5.6%. This sectors' growth was particularly marked after 2005 and held up even in 2009 during the international financial crisis.

Table 1.1: Real Sector Indicators, Brazil, 2000-2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GDP (US\$)											
Real Annual GDP Growth	4.31%	1.31%	2.66%	1.15%	5.71%	3.16%	3.96%	6.09%	5.16%	-0.64%	7.49%
Real Annual Growth Agriculture	2.72%	6.06%	6.58%	5.81%	2.32%	0.30%	4.80%	4.84%	6.12%	-4.56%	6.46%
Real Annual Growth Services	3.58%	1.90%	3.21%	0.76%	5.00%	3.68%	4.24%	6.14%	4.07%	-6.42%	10.68%
Real Annual Growth Financial Services	2.21%	1.22%	2.26%	-4.78%	3.69%	5.26%	8.37%	15.08%	12.65%	7.09%	10.68%
Real Annual Growth Industry	4.83%	-0.62%	2.08%	1.28%	7.89%	2.08%	2.21%	5.27%	4.07%	-6.42%	10.12%
Real Annual Export Growth	11.10%	9.53%	8.63%	15.73%	19.08%	9.37%	3.34%	5.49%	-2.46%	-10.75%	9.50%
Real Annual Growth Basic Goods	8.46%	33.34%	15.23%	13.13%	13.28%	7.09%	6.06%	11.83%	0.21%	2.86%	11.43%
Real Annual Growth Manufactured Goods	-6.93%	8.32%	13.98%	9.70%	7.19%	6.26%	3.53%	0.72%	-0.88%	-5.04%	6.65%
Real Annual Growth Semi-Manufactured Goods	17.96%	1.27%	5.16%	20.98%	26.08%	10.82%	2.16%	3.23%	-5.00%	-22.83%	8.89%
Unemployment Rate	10%	11.60%	11.40%	12%	10%	9.70%	9.00%	9.30%	7.90%	8.50%	7.40%
Employment in Manufacturing Industry	NA	13.70%	13.50%	13.60%	14.00%	14.10%	14.00%	14.50%	NA	NA	NA
Growth in Persons employed in Industry											
Manufacturing	NA	-1.46%	-0.08%	-2.05%	4.07%	-0.66%	0.75%	3.32%	-1.32%	-2.43%	3.37%
Extractive	NA	0.23%	1.38%	4.48%	4.98%	-3.39%	2.19%	3.95%	3.56%	-0.03%	4.58%

Source: IMF-WEO (2011d); IBGE (2011); Ipeadata; author's own calculations

Table 1.1 also shows Brazil's export performance from 2000 to 2010. One can observe that, after a relatively strong performance at the beginning of the decade, exports slowed markedly in 2006 and contracted further in 2008 and 2009, the time of the international financial crisis. These dynamics were particularly marked in both manufactured goods and semi-manufactured goods. Finally, Table 1.1 shows a few selected labour market indicators. One can observe that unemployment has decreased steadily over the period. However, despite the overall reduction in unemployment, employment in the manufacturing sector increased only marginally. In a similar vein, the number of people employed in the industrial sector shows a volatile and overall contained growth trajectory. The number of people employed in the manufacturing industrial sector grew by a mere annual average rate of 0.35% over the 2000 to 2010 period.

At the same time, Brazil experienced one of the most volatile exchange rates in the world: between the end of 2002 and mid 2008, the Brazilian Real appreciated by more than 130%, followed by a depreciation of nearly 60% within four months during the international financial crisis and one of the strongest renewed appreciations since the

crisis. Although motivated by the important repercussions volatile exchange rate movements have on the real economy, this dissertation does not analyse these real sector effects in detail. Rather, it attempts to explore what caused these volatile exchange rate movements with the ultimate of establishing some policy implications for the management of exchange rates in DEC's.

The remainder of this chapter is divided into three sections. Section 2 will set out the main contributions and limitations of this dissertation and thus embed it into the broader debate and existing literature. Section 3 presents the research questions, and the hypotheses and methodology which aim to answer these questions. Finally, Section 4 presents the structure of the thesis and a short description of the each chapter.

1.2.Thesis Objectives

This dissertation attempts to contribute to the existing literature on three levels: the empirical, the theoretical and the methodological.

Firstly, on the empirical level, this dissertation highlights a very novel phenomenon of international finance: the increased use of emerging market currencies as international store of wealth and speculative asset. The integration of DEC's into international financial markets and the implications of this for price dynamics, and the exchange rate in particular, is a long standing topic of interest (Obstfeld 1998; Eichengreen and Hausmann 1999; Summers 2000; Agénor 2003; Prasad, Rogoff et al. 2004). The recent global expansion of finance, often coined under the heading of financialisation, has seen a substantial increase in this financial integration, both in quantitative and qualitative terms (Epstein 2005). Indeed, in addition to the growing size, the nature and complexity of DEC's financial integration has changed. Two aspects of this qualitative change are highlighted in this dissertation. Firstly, it is argued that one aspect of financialisation is the increased use of short-term trading operations as a risk diversification and income generating device. This has increased the demand for short-term and liquid assets, including in emerging markets. In other words, the focus has shifted from *investing* in emerging markets to *trading* them. Secondly, and most importantly for this dissertation, the focus has shifted from foreign currency denominated assets to domestic currency denominated asset classes. In Brazil, this has manifested itself in two ways: firstly,

increased foreign investment in short-term domestic currency assets and secondly, the trading of the currency as international asset class per se. This dissertation highlights this new phenomenon in Brazil, explores the factors which contributed to the internationalisation of the Brazilian Real, and points to the implications for exchange rate determination and policy.

Secondly, on the theoretical level, the dissertation attempts to present an alternative analytical framework with which to analyse exchange rate determination in DECs. Given its emphasis on stable causal fundamentals, which determine exchange rates at all times and across all countries, mainstream exchange rate theory is not able to account for exchange rate movements, particularly in DECs. The acknowledgment that it is the positions and expectations of actors in currency markets that determine exchange rates has done little to change this view.

In contrast, Post Keynesian exchange rate theory stresses the determining role of short-term financial flows and expectations in these markets (Harvey 2009). Given that expectations are formed under fundamental uncertainty - and are thus necessarily context and time specific - no stable causal fundamentals can exist. The dissertation complements this existing Post Keynesian view of exchange rate determination with the critical realist ontological claim that there are underlying mechanisms and structures which shape actors expectations and positions, even if not always observable or observable under different manifestations. These mechanisms, in turn, are specified in accordance with one of the most important underlying institutions in (Post) Keynesian thought in the presence of uncertainty: money. Thus, it is argued, based on the view of the exchange rate as international money, that it is the yield and liquidity premium of a currency relative to *the* money of the system which shape actors' expectations and positions in short-term financial and currency markets.

Finally, on the methodological level, these underlying mechanisms and their empirical manifestations, as exchange rate drivers in the context of currency internationalisation, are explored using an innovative mixed-method study combining 88 semi-structured interviews with financial sector participants with advanced time series econometrics such as single system and multivariate cointegration analysis and multivariate GARCH models. Given the closed system, positivist-deductive ontological basis of mainstream

economics, the use of mixed-method studies, particularly qualitative methods, is still very limited in Economics (Lawson 1997). However, once the operations of economic agents, under fundamental uncertainty and/or limited or imperfect knowledge become the analytical focus, qualitative methods turn into an important element of empirical inquiry. The use of between method triangulation is consistent and indeed required by the Post-Keynesian, critical realist ontological and epistemological framework adopted in this dissertation; it uncovers underlying mechanisms and structures and can provide rich and multifaceted insights into a layered and structured reality in the presence of fallible knowledge.

At this point it is important to mention two important criticisms, which could be raised against this dissertation. The first is methodological, the second is existential.

Firstly, this dissertation presents a rich theoretical and empirical discussion of the recent process of currency internationalisation at the case study of Brazil. However, the rich contextual information provided comes at the cost of a possible loss of generality and replicability to other countries. In a similar vein, although the use of mixed-method triangulation has attempted to provide validity to the results, not all results have been triangulated making those results particularly vulnerable to these criticisms. However, it is important to note that the methodology chosen for this dissertation has been motivated by the author's understanding of economic reality as an open, complex and structured system. It thus understands that generalisations across objects and time are not given and hinge on very specific preconditions. This does not prevent generalizations per se, but does require a thorough and critical analysis of whether these preconditions are indeed prevalent.

The second point concerns the question "and, so what"? Despite the fact that the dissertation has been partly motivated by the severe real sector implications of exchange rate volatility and large swings in the exchange rate, no in-depth empirical analysis of these repercussions has been presented. As far as this dissertation goes, the closest it comes to discussing "real" sector implications is the severe limitations currency internationalisation imposes on the operations of the central bank. This shortcoming is well acknowledged and has been primarily due to time and space constraints. It was considered important to highlight first the changing nature of Brazil's integration in

international financial markets and its implications for exchange rate dynamics. Future research will involve in-depth studies on the repercussions of these exchange rate dynamics on the real economy, including the productive structure, employment, and distribution (both in income and wealth).

1.3. Research Questions, Hypotheses and Methodology

This dissertation was guided by the overarching research question and hypotheses

RQ1: What determines the exchange rate in Brazil in the era of currency internationalisation?

H1.1: The Brazilian Real has become an internationally traded asset class.

H1.2: As a result, the exchange rate is driven by short-term financial flows and the positions and expectations of operators in these markets.

Based on these overarching research question and hypotheses two main sub-questions were asked.

RQ2: What determines the expectations and positions of actors in short-term financial and currency markets in the new era of currency internationalisation?

RQ3: How and to what extent are these expectations and positions reflected in actual exchange rate drivers?

Following the retroductive strategy suggested by critical realist ontology, several sub-hypotheses were formulated in an iterative and cumulative way.

H2: The expectation formation process in currency markets, particularly with respect to the nature of fundamentals, is time and context specific, including the institutional context actors are operating in.

H3: A few underlying mechanisms and structures shape the expectations and positions of financial agents across institutions and time, particularly the yield

and liquidity premium of domestic currency holdings. These include returns on short-term domestic currency assets, liquidity preference, and financial structure.

H3.1: The importance of liquidity considerations makes the operations of the central bank, as ultimate provider of liquidity, an important element of the expectation formation process and positions of actors in short-term financial and currency markets.

H4: Given that these underlying mechanisms manifest themselves empirically through the expectations and positions of economic agents operating under fundamental uncertainty, these empirical manifestations will depend on the specific market under consideration, its degree and nature of integration in international financial markets and/or might not be apparent at all.

Consistent with the Post Keynesian, critical realist ontological and epistemological framework adopted in this dissertation, these research questions and hypotheses were explored using between method triangulation, which combined semi-structured interviews with advanced time series econometrics using a case study of Brazil. Case studies are consistent with the time and context specific nature of economic reality assumed in open system ontology (Mearman 2004). The semi-structured interviews, in turn, allowed generating rich, in-depth information on the structure of the Brazilian and international foreign exchange market. In addition, 52 semi-structured interviews with financial participants in the Brazilian and other emerging countries currency markets formed the core of the qualitative study. These interviews provided important insights into the motivation and trading strategies of heterogeneous foreign exchange market participants, their perception of fundamentals and the perception's link to actual exchange rate drivers, and finally foreign exchange market operators' views on and interaction with the Brazilian (emerging markets) central bank(s).

The semi-structured interviews were complemented with single equation and multivariate cointegration and multivariate GARCH econometrics. Due to its closure assumptions the use of econometrics in open system ontology is not uncontroversial (Lawson 1989). Based on the presumption that all form of empirical methods assume some extent of closure, several critical realist and Post Keynesian authors have argued

that econometrics is an important additional tool to generate in-depth understanding and *explanations* of an open, complex and structured reality in the presence of fallible knowledge (Dow 1998; Downward and Mearman 2002). In this dissertation, the use of econometrics has complemented the semi-structured interviews on three dimensions: a word-number dimension, which quantifies the empirical regularities discovered through the qualitative approach; a micro-macro dimension, which analyses whether the regularities observed on the level of the individual trader are also reflected in the macroeconomic relationships between the exchange rate and its drivers; and finally a cross-section – time-series dimension, which gauges whether and to what extent the empirical relations uncovered in the cross-sectional study of trader behaviour also held over time.

1.4.Thesis Structure

This introduction aside, the dissertation is divided into nine chapters.

Chapter 2 presents a critical review of existing (mainstream) exchange rate theory, particularly with respect to the concept of fundamentals. It rejects the view of the exchange rate as market equilibrating price and argues that one has to acknowledge the determining role of the expectations and positions of actors in currency markets for exchange rate movements. This makes exchange rate fundamentals necessarily context and time specific or might change the nature of fundamentals altogether. This might be particularly true for DECs, given their different institutional characteristics and integration in a hierarchical international monetary system.

Chapter 3 outlines the alternative analytical framework for the analysis of exchange rate movements in DECs developed in this dissertation. In line with existing Post Keynesian theories of exchange rate determination, it argues that it is short-term financial flows - in DECs still primarily short-term balance of payments capital flows - and the expectations in these markets, formed under fundamental uncertainty, which determine exchange rates. However, in contrast to existing Post Keynesian exchange rate theory, the chapter follows critical realist ontology and goes beyond the emphasis on expectation formation under uncertainty, to highlight the underlying mechanisms and structures which shape the expectations and positions in currency markets. These

mechanisms are specified in accordance with one of the most important institutions in Post Keynesian writings in the face of uncertainty, money. Thus, based on the view of domestic currency as international money, the dissertation highlights the importance of short-term returns (including expected exchange rate appreciation), liquidity preference, and financial structure for determining exchange rates in DECAs. Financial structure, in turn, refers to a country's net short-term foreign obligations and the ability to meet these obligations through its institutional liquidity and autonomous foreign exchange productivity. Importantly, the chapter argues that, given the transformative actions of economic agents under fundamental uncertainty, the empirical manifestations of these underlying mechanisms will depend on the specific structure of the market or might not be apparent empirically at all.

Chapter 4 discusses the recent process of currency internationalisation Brazil. It highlights two manifestations of this process: the increased foreign participation in short-term domestic currency denominated assets, and the trading of the currency as asset class per se. It also shows the implications that this internationalisation of the Brazilian Real has had for exchange rate dynamics, which have been characterised by large swings, high volatility and have become increasingly delinked from domestic economic conditions.

Chapter 5 discusses the factors which have contributed to the internationalisation of the Brazilian Real. Given the Post Keynesian framework adapted in this dissertation, the discussion is framed with respect to the "institutional" liquidity of the Brazilian market, which has provided liquidity to domestic and particularly international investors at the backdrop of the global financialisation process. This "institutional" liquidity comprises, on the one hand, the specific microstructure of the Brazilian financial and foreign exchange market, including a large share of very short-term assets, a sophisticated and heterogeneous financial sector, and finally the existence of a deep and very liquid local derivatives exchange. On the other hand, it involves the existence of an inflation targeting regime and the operations of the Brazilian central bank (Banco Central do Brasil - BCB), as ultimate provider of liquidity. As such, this chapter also introduces the main financial operators in the Brazilian foreign exchange market, which will be interviewed for this study, and the institutional framework in which these foreign exchange market participants are operating.

Chapter 6 gives a detailed account of the ontological and epistemological background and the methodological approach adopted in this dissertation. In a nutshell, it argues that Post Keynesian economic thought unites itself in an open system ontology, which - under certain conditions - can also be characterised as critical realist. It goes on to show that from both, a Post Keynesian and critical realist ontological basis, mixed-method triangulation is a preferred research strategy. The specific mixed-method study conducted for this dissertation is introduced in the second half of this chapter, with particular emphasis on the set-up, conduct and limitations of the qualitative study.

Chapter 7 presents the results from the 52 semi-structured interviews with financial foreign exchange market participants in Brazil and international financial markets. The chapter is divided into three main sections. The first section complements the quantitative results presented in Chapter 5 with additional insights into the motivation, trading strategies, client structure and main markets of operation of the heterogeneous participants in the Brazilian (emerging markets) foreign exchange market(s). Section 2 presents a discussion of the operators' understanding of fundamentals and their link to the actual expectation formation process and exchange rate drivers in the era of currency internationalisation - both in normal times and during the international financial crisis. This also includes a discussion on the importance of technical trading and the concept of an equilibrium exchange rate. Finally, the chapter discusses the interactions between the operations of the Brazilian (emerging market) central bank(s) and the foreign exchange market operators, with particular emphasis on the question of exchange rate management.

The last two chapters of the dissertation econometrically triangulate several of the theoretical conjectures and empirical regularities presented in Chapters 3 and 7. Chapter 8 econometrically analyses the relationship between the Brazilian Real, short-term capital flows, and *expected* returns on these short-term capital flows using the cointegrated VAR model. It also represents an empirical investigation of the first manifestation of the internationalisation of the Brazilian Real. The VAR methodology uncovers important feedback relationships between the *levels* of the variables and puts the emphasis on explorative and explanatory data analysis rather than "closed system" hypothesis testing, consistent with the open system ontology adopted in this

dissertation. The chapter shows that significant and dynamic cointegration relations exist between the exchange rate and short-term capital flows, particularly in the equity market, and the exchange rate and expected returns. Importantly, however, these cointegration relations are interpreted as temporary, local closures depending on the specific context of Brazil in the process of currency internationalisation.

Finally, Chapter 9, using single-equation and multivariate cointegration tests and multivariate GARCH analysis, econometrically triangulates several of the empirical manifestations of underlying exchange rate drivers uncovered in Chapter 7. These include the importance of short-term returns, liquidity preference and, to a lesser extent, the role of financial structure. Chapter 9 can also be seen as an econometric investigation into the second manifestation of the internationalisation of the Real, namely the trading of currency as asset class per se, and its implications for the drivers of the Brazilian exchange rate.

Chapter 10 concludes with some thoughts on the implications Brazil's experience with an internationalised currency could have for exchange rate management and policy in DECs.

Chapter 2: Theories of Exchange Rate Determination: Beyond Market Equilibrating Price

2.1. Introduction

This chapter presents a critical review of mainstream exchange rate theories with a view to preparing the ground for the alternative analytical framework presented in Chapter 3. Few topics of investigation have occupied mainstream economic theory as much as the attempt to understand, explain, or even forecast exchange rate movements. Exchange rate theory has thus evolved interdependently with the changing international economic environment and shifting paradigms in economic theory. Ultimately, however, this has changed little of the view of the exchange rate as market equilibrating price, which stands in a causal relationship with underlying fundamentals.

In the Bretton Woods world of managed exchange rates and closed capital accounts, the view of the exchange rate as relative price adjusting to real fundamentals in order to restore external balance, stood at the forefront of the analysis. The increasing importance of financial considerations and attempts to rationalise and justify the volatility of floating exchange rates in the Post-Bretton Woods era led to a proliferation of asset market approaches to exchange rate determination. In this view, monetary or financial fundamentals drive the exchange rate which adjusts to restore equilibrium in the respective asset market.

The incorporation of expectations in mainstream theory - formed rationally, i.e. endogenously to the model under consideration, or “irrationally” as in recent behavioural finance models - did little to change this view of exchange rate determination as rational traders are ultimately seen to keep the exchange rate in line with “fundamentals” as specified in traditional exchange rate theory. The assumption of an ergodic world where stable probability functions are used to forecast future fundamentals, forces these theories to revert to indeterminate behavioural assumptions to account for empirical phenomena such as bubbles and “excess” volatility.

Two interesting approaches to exchange rate determination are the microstructure view of exchange rate determination and Imperfect Knowledge Economics (IKE); the former, because it highlights the important role institutional structures have for price formation; the latter, because it emphasises the uncertainty reigning in exchange rate markets and the implications of this uncertainty for exchange rate dynamics. Ultimately, however, both approaches also remain committed to the mainstream view of exchange rate fundamentals and so suffer from the same limitations.

The chapter is divided into four parts. Section 2 discusses traditional approaches to exchange rate determination, which consider the exchange rate as a market equilibrating price in goods and asset markets. Building on a critique of this view of the exchange rate, Section 3 presents exchange rate theories which acknowledge the determining role of the expectations and positions of economic agents in financial and currency markets. The discussion is structured according to the assumptions which are made regarding the rationality of economic agents and the availability of information. Section 4 concludes with some implications for an alternative analytical framework of exchange rate determination, particularly in DECs.

2.2. The Exchange Rate as Market Equilibrating Price

In traditional exchange rate theory, the exchange rate is considered a relative price which adjusts to restore equilibrium in a respective market. Changes in underlying parameters or fundamentals therefore require a change in the exchange rate to restore an efficient and desired equilibrium in production and exchange relations. As a result, a stable and deterministic relationship between such fundamentals, whose nature will be determined by the market under consideration, and the exchange rate has to exist.

2.2.1. The Exchange Rate and External Equilibrium

Probably one of the oldest theories of exchange rate determination based on trade balance adjustment is Purchasing Power Parity (PPP). Given a constant real exchange rate, PPP states that the nominal exchange rate of two countries is determined only by

their relative price levels. A rise in the domestic price level will be accompanied by an equi-proportional increase in the nominal exchange rate.²

$$(2.1) e_t = s_t \frac{P_t}{P_t^*}$$

where e_t is the nominal exchange rate, s_t the real exchange rate and P_t and P_t^* the domestic and foreign price level respectively.

While for Gustav Cassel, who rediscovered the parity in the 1920's, the PPP was a gravitational centre for a broad measure of domestic and foreign relative prices, the modern prevailing theoretical underpinning of PPP relies on an arbitrage argument in the goods sector (La Marca 2004). In this view, a loss in competitiveness through an increase in the domestic price level will be neutralised by a proportional nominal depreciation, as supply and demand for foreign exchange adjust. If, as in the monetary tradition the price level is mainly determined by changes in the money supply and the real exchange rate is assumed to be constant, relative money supply becomes the main determinant of the nominal exchange rate.

The empirical evidence for PPP is at best inconclusive. While empirical evidence has at time supported PPP in the 1920s and the very early 1970s, large changes in real exchange rates since then – in tandem with volatile nominal exchange rates and far beyond relative prices - have increasingly put the empirical validity of this goods arbitrage condition into doubt (Baxter and Stockman 1989; Isard 1995). In addition, empirical research based on time series econometrics found that neither the implication that the nominal exchange rate and relative prices form a long-run co integration relationship, nor the mean reverting behaviour (stationarity) of the real exchange rate, seem to hold (Enders 1988; MacDonald 1993; Mark 1995). Some support for PPP was presented by more recent studies using a long-span of data (MacDonald 1997). These long-run studies, however, have been subject to criticism due to their failure to control for different monetary/exchange rate regimes or other important structural breaks. This

²In a “milder” version, relative PPP states that nominal exchange rate depreciation will equal the domestic and foreign inflation differential.

criticism and the assumption that adjustment to PPP is asymmetric, have spurred recent literature on non-linear or time-varying adjustment to PPP. This literature takes account of the fact that adjustment to PPP could be state dependent and finds empirical support for this hypothesis (Driver and Westaway 2004; Sarno 2007). The evidence of parameter instability, however, is difficult to justify with goods sector arbitrage and requires – as discussed below – an alternative theoretical framework.

On the theoretical level, several criticisms can be made of PPP. Firstly, the validity of absolute PPP (not so for relative PPP) is based on a generalization of the “law of one price” to the general price level.³ However, not only have microeconomic studies offered little evidence on the convergence of single traded goods, but this generalisation also assumes identical consumption baskets and goods in the domestic and foreign country and excludes non-tradable goods (La Marca 2004). Secondly, the assumed causality from the price level to the nominal exchange rate does not need to hold. As pointed out by Herr and Hübner (2005) nominal exchange rate movements can become a decisive factor of price developments, rather than the other way round. Finally, there is no reason why the real exchange rate should be constant. If the real exchange rate adjusts to equilibrate the trade balance, it should react to factors that change the competitiveness of and/or demand structure for domestic goods.

Attempts in mainstream economic theory to rationalize sustained deviations from PPP have broadly speaking taken two paths: in the first line of research departures from PPP are “structural”, in the sense that they arise systematically in response to new and lasting changes in relative prices. As a fundamental building block of these models, the domestic price level is decomposed into the price of tradable and non-tradable goods whose ratio, in turn, defines the real exchange rate.

$$(2.2) \quad q_t = \frac{P_T}{P_{NT}}$$

³ The law of one price states that through international goods arbitrage, homogenous goods should sell at the same price in the home and foreign country when converted at the market exchange rate (MacDonald 2007).

While tradable prices continue to be determined by international goods arbitrage, non-tradable prices are set internally, which can lead to sustained deviations from PPP. In a second strand of research, deviations occur in a “transitory” fashion as a result of disturbances to which the economy adjusts with different speeds in goods and asset markets (Sarno 2007). Both approaches will now be analyzed.

The Balassa-Samuelson Effect

One of the first theoretical extensions that allows for country specific deviations from PPP is the Balassa-Samuelson effect. This idea, already pointed out by Ricardo and developed by Harrod, draws attention to the fact that different productivity levels, via their effect on wages and home goods prices, can lead to permanent deviations from Cassel’s absolute version of PPP (Sarno 2007:5). As countries develop, productivity increases through international competition are mainly centred in the tradable sector which compensate for price increases and lead to a relative rise of the non-tradable to the tradable goods price ratio. The result is an appreciating real exchange rate.

In general, results have fared slightly better for productivity augmented PPP, although they continue to depend on the country under consideration and test applied. While the prediction of cointegration between relative prices and relative productivity within a country and between countries has been strongly supported, evidence for a co-movement between the real exchange rate and relative productivity are more controversial (Chinn and Johnston 1999; MacDonald and Ricci 2001; Égert, Halpern et al. 2006).

Ultimately, however, the Balassa Samuelson hypothesis is nothing but a PPP real exchange rate estimation augmented with a productivity effect (La Marca 2004). An arbitrage-based argument, however, cannot account for the effect of other factors which supposedly influence the underlying real exchange rate, e.g. tariffs and quotas, terms of trade, demand shifts or the relaxation of exchange control. In order to explain the incidence of these factors, equilibrium exchange rate macroeconomic models are required.

Equilibrium Exchange Rate Modelling

The common element of equilibrium exchange rate models is the acknowledgment that real exchange rates are not constant but adjust in response to changes in underlying real variables to restore equilibrium in external balances, primarily the current account. However, while one strand of literature adopts a normative theoretical approach where the real exchange rate adjusts to restore simultaneous internal and external macroeconomic balance, a second approach adopts a positive stance with an emphasis on the “rigorous statistical testing” of the drivers of real exchange rate movements (MacDonald 2007). This in turn affects the treatment of dynamics and the time frame on which they concentrate (Driver and Westaway 2004).⁴

The first strand of literature, or the macroeconomic balance approach to real exchange rate modelling, has its theoretical origin in the so-called “dependent economy” or Australian models, originated by Swan (1960) and Salter (1959). Under the assumption of exogenously given terms of trade, perfectly elastic demand for (net) exports, and full employment of labour and capital, agents allocate resources between traded/non-traded goods following the price signals of the exchange rate, which in turn determines the trade balance.

The general underlying model can be described by the following equations

$$(2.3) \quad E = qC_T(q, E) + C_N(q, E)$$

$$(2.4) \quad X_T(q) - C_T(q, E) = NX$$

$$(2.5) \quad X_N(q) = C_N(q, E)$$

$$(2.6) \quad L_N(\omega(q)) + L_T(\varpi(q)) = L$$

⁴ Driver and Westaway (2004) make a distinction between medium and long-run equilibrium. While in the medium term flows remain steady, when stocks are still changing, both are fixed in the long-run. This distinction shall not be considered in this work.

where q is the real exchange rate as defined above. E is the aggregate expenditure in terms of non-traded goods, NX are net exports and the domestic demand for traded goods C_T and non-traded goods C_N are inverse and direction functions of the real exchange rate and both increase with aggregate expenditure E ; traded X_T and non-traded X_N goods production fall and rise with the real exchange rate respectively. Equation (2.3) expresses expenditures in terms of non-tradables, (2.4) and (2.5) are the equilibrium in the non-traded and traded goods markets and (2.6) is the aggregate labour demand function (La Marca 2004).

The model can be closed via different channels (La Marca 2004), two of which are interesting for this chapter. Firstly, as in the dependent economy model, if expenditures are chosen exogenously, the trade balance NX and the real exchange rate q , are determined endogenously by equations (2.4) and (2.5). Analysis of “Dutch Disease” as a result of natural resource related capital inflows and/ or an increase in aid inflows are a case in point. A second possible closure is to determine exogenously the desirable level of the trade balance, or “external equilibrium”, in which case expenditure and the real exchange rate adjust endogenously. This normative route is adopted by general equilibrium steady state or macroeconomic balance models (Faruqee 1994; Stein 1994; Williamson 1994; Isard and Faruqee 1998). For general equilibrium, the exchange rate does not only restore external equilibrium, but also allows attaining internal equilibrium, generally operationalised as potential output and/ or some preferred point on the Phillips curve trade off, e.g. at the NAIRU (Non Accelerating Inflation Rate of Unemployment).⁵

While authors broadly seem to agree on the specification of internal equilibrium, the formulation of external equilibrium has attracted more controversy. In Williamson’s popular Fundamental Equilibrium Exchange Rate (FEER) approach, external balance is defined as the current account deficit compatible with sustainable capital inflows in the medium term.⁶ The difficulty of pinning down the concept of “sustainable capital flows”, and its *ad hoc* nature have led to criticism and attempts to develop the approach

⁵ The concept of NAIRU itself has been subject to extensive criticism (Stockhammer 2006).

⁶ The normative element in the definition of internal and external equilibrium has induced people to call this the desired equilibrium exchange rate (DEER). However, given that this approach is very similar to the FEER, it shall not be treated separately here. This also applies to Stein’s (1994) NATREX approach.

further. One such direction is to link the current account directly to domestic savings and investment and its determinants, rather than the balance of payments. The FEER is then calculated as the real effective exchange rate that will generate a current account equal to savings and investment at full employment levels (Isard and Mussa 1998).

Due to their complexity and size, the application of general equilibrium models has remained confined to specialized institutions (see Williamson (1994) for an overview and results of these models). More common in empirical applications is the partial equilibrium approach, where the economy is assumed to be at internal equilibrium and the external balance serves as a closing condition (Jeong and Mazier 2003; Coudert and Couharde 2005). Macroeconomic balance models are a useful tool to derive some sense of exchange rate valuation from a normative perspective. However, results are crucially dependent on structural assumptions about the economy, which are often not known and/or are subject to continuous change (Costa 2005).

Although very often discussed in tandem with the macroeconomic balance approach, the second approach to real exchange rate modelling, behavioural equilibrium exchange rates (BEER), are based on very different analytical and (if any) theoretical premises. While the macroeconomic balance approach invokes a fundamental, normative equilibrium exchange rate - with a clear view on policy formulations - the BEER is an attempt to model positively the determinants of the real exchange rate. While FEERs are based on a medium term concept, BEERs represent a short-run equilibrium, defined as the exchange rate which would pertain when its fundamental determinants are at their current settings after abstracting from the influence of random effects (for example asset market bubbles) (Driver and Westaway 2004).⁷

As such, the approach is primarily empirical, reflected in the abundance of econometric estimations of real exchange rate fundamentals (MacDonald 2007). The choice of such fundamentals, in turn, has been rather ad hoc, determined more by statistical fit than theoretical considerations. Although results differ depending on the country under consideration and exact technique applied, standard “candidates” for real exchange rate

⁷ The different analytical and theoretical backgrounds of the FEER and BEER models are also reflected in the use of different real exchange rate concepts. While FEER estimations use the theoretical concept of the tradable over non-tradable goods price ratio, the estimations of BEERs are based on the statistical concept of the real exchange rate (domestic over foreign price level).

fundamentals include the terms of trade, productivity differentials (often approximated with GDP growth), tariffs and net foreign assets (Clark and MacDonald 1998).⁸

With the end of Bretton Woods, the advent of floating exchange rates and the increasing importance of financial considerations in the workings of the world economy, the “external balance” view of exchange rate determination has been put increasingly at odds with empirical evidence. Exchange rates do not adjust to restore current account “equilibria”, but are subject to large movements and volatility seemingly unwarranted by real fundamentals. As a result the analytical focus of short-term exchange rate determination shifted to the role of the exchange rate as an equilibrating price on asset, rather than goods, markets.⁹

2.2.2. The Exchange Rate and Asset Market Equilibrium

Two main classes of asset market models for exchange rate determination have been proposed: (a) the monetary approach and (b) the portfolio balance approach. The flexible price, monetary approach to exchange rate determination was born in the 1970s to defend the superiority of a floating exchange rate regime over the just abandoned fixed exchange rate regime of Bretton Woods (Frenkel 1976; Mussa 1976).

Combining continuous PPP and the quantity theory of money, the exchange rate is specified as the relative price of domestic and foreign money, determined by their respective demand and supply.

⁸ Attempts to introduce a notion of sustainability in BEER models are Permanent Equilibrium Exchange Rates (PEER) and a-theoretical permanent equilibrium exchange rates (APEER) (Faruqee 1994; Gonzalo and Granger 1995). These attempts, however, are primarily based on statistical rather than theoretical criteria.

⁹ Several authors (e.g. Sarno and Taylor 2002) discuss the Mundell-Fleming Model (MFM) as distinct model of exchange rate determination. This approach will not be adopted in this paper for several reasons: Firstly, it would make the exposition too extensive. Secondly, the MFM was not formulated as an exchange rate model and is therefore not necessarily relevant for the discussion. Thirdly, the mechanism of exchange rate determination behind the MFM is a simple interest parity which will be discussed below.

Formally,

$$(2.7) \quad e = \frac{M}{M^*} \cdot \frac{L(Y^*, i^*)}{L(Y, i)}$$

Where e is the nominal exchange rate, M the money supply, Y is income and i denominates the nominal interest rate; * denominates foreign variables. Based on a series of restrictive assumptions, such as perfect substitutability of domestic and foreign assets, continuous PPP, immediate and perfect clearing of goods and labour market etc., the exchange rate restores money market equilibrium (Taylor 1995). While an increase in the domestic money supply or the interest rate leads to exchange rate depreciation, an increase in domestic income appreciates the nominal exchange rate.

Although extensively tested, after some initial support in the 1970s, empirical evidence has not been kind to the monetary model of exchange rate determination (neither in its flexible nor fixed price form) –other than in exceptional times such as hyperinflation (Bilson 1978; Frankel 1979; Driskell 1981; Frankel 1982) . Recent empirical work based on (panel data) cointegration techniques argues that while insignificant in the short-run, monetary fundamentals seem to determine the exchange rate in the long-run (MacDonald and Taylor 1993; Mark 1995; Mark and Sul 2001; Rapach and Wohar 2003). However, as Neeley and Sarno (2002) point out in their review, these results are crucially dependent on the time span, data and country under consideration. Again, some evidence seems to exist that parameters are time-varying, calling for a different theoretical framework to account for these dynamics.

In light of this, Plihon (2006) argues that the principal merit of the monetary model is its emphasis on stocks in monetary and asset markets and their relation with flow variables in the determination of exchange rate behaviour. As such it opened the door for a more general model of exchange rate determination, in which the exchange rate equilibrates international portfolio decisions - the portfolio balance model (PBM).

The PBM, which extends Tobin's (1969) financial market analysis to open macroeconomics, explicitly models the role of international asset markets in exchange rate determination (Branson and Henderson 1985). Maintaining the basic principle that

a floating exchange rate should be determined by some contemporary market-clearing mechanism, exchange rate movements in these models result from a (re)-allocation of international assets (Taylor 2004a; Taylor 2004b). As a main extension to the above presented monetary models, international assets cease to be perfect substitutes as risk parameters are taken into account.

In its simplest version the model can be specified as follows (Plihon 2006: 54):

$$(2.8) \quad M = a(i, i^*, r, r^*)W$$

$$(2.9) \quad B = b(i, i^*, r, r^*)W$$

$$(2.10) \quad eF = c(i, i^*, r, r^*)W$$

$$(2.11) \quad W = M + B + eF$$

Acknowledging that $a+b+c=1$ (2.8) to (2.11) can be reformulated as

$$(2.12) \quad eF = (1 - a - b)W = f(i, i^*, r, r^*)W$$

And the exchange rate

$$(2.13) \quad e = (i, i^*, r, r^*) \frac{W}{F}$$

Where M, B, and F are the respective asset stocks (money, domestic bonds and foreign bonds), i and r are the interest rate and risk premium respectively (again * indicates values for the foreign country) and W is the wealth stock. Changes in one asset stock will lead to portfolio adjustment and hence exchange rate movements to restore equilibrium in international asset markets.

The PBM has not attracted a large empirical literature, largely due to data constraints. In general, two types of econometric tests have been conducted: firstly, a direct estimation

of the reduced form solution of the short-run PBM under the assumption of static expectations using cumulated current accounts and bilateral asset stocks as proxies for the stock of foreign assets (Branson, Haltunen et al. 1977; Bisignano and Hoover 1982); the second type of test, the so-called inverted asset demand approach, has concentrated on solving the PBM for the risk premium and tests for the perfect substitution of bonds denominated in different currencies (Frankel 1983). Again results for the PBM were at best mixed (Levich 1985; Sarno and Taylor 2002; MacDonald 2007). Similar to the monetary approach, the increased availability of more powerful econometric techniques, especially cointegration methods, has allowed for some empirical support in more recent studies (Cushman 2006).

Its empirical failure and general criticism (presented below) notwithstanding, Taylor (2004b) has pointed out that ultimately the exchange rate remains indeterminate in portfolio balance models. Due to the net foreign asset constraint there is only one independently clearing asset market in a country. However, if local interest rates clear the domestic asset market, contemporary portfolio adjustment cannot determine the exchange rate.

2.2.3. The Exchange Rate as Market Equilibrating Price?

As discussed above, the empirical evidence on fundamentals driven exchange rate movements is at best inconclusive. In their famous paper, Meese and Rogoff (1983) show that a simple random walk has more predictive power of future exchange rate behaviour than any structural model. Not only have fundamentals little predictive power for exchange rate behaviour, it has also been shown that exchange rates react unpredictably to news about those fundamentals (Goodhart 1988; Goodhart and Figliuoli 1991). More recent evidence, e.g. Andersen, Bollerslev et al. (2003), finds some support that news about fundamentals cause jumps in the conditional mean, while the conditional volatility adjusts gradually.¹⁰

¹⁰The contrasting results may stem from the different definition and operationalisation of news. While for Goodhart and Figliuoli (1991) “news” are just crude announcements of changes in fundamentals, Andersen, Bollerslev et al. (2003) only consider unexpected news, quantified as the difference between expectations and realizations of the announcement.

In principle, the “disconnect” between the exchange rate and its fundamentals could be due to unobserved fundamentals (Frankel and Rose 1996). In this case, the standard classical assumption would still hold that, if volatility were suppressed, it would somehow show up somewhere else. However, as Flood and Rose (1999) and Baxter and Stockman (1989) have shown, exchange rate stabilization does not come at the cost of higher macroeconomic volatility, it simply seems to vanish. In addition, there is compelling evidence that nominal and real exchange rate variability has increased whenever there was a shift from a fixed to a floating exchange rate regime (Mussa 1986).

The empirical failure of traditional exchange rate models is linked to their view of the exchange rate as relative price, which adjusts to restore equilibrium in underlying markets. This leads them to specify a general set of causal fundamentals which determine the exchange rate at all times and in all countries (Harvey 2001). As such, this approach is firmly committed to the efficient market paradigm, where changes in relative prices restore an efficient and desired equilibrium in production and exchange relations.¹¹

In addition, the traditional view to exchange rate determination remains firmly anchored in the classical dichotomy, where price flexibility allows a separation of real and nominal variables: while in the short-run price stickiness or asset market disturbances deviate real exchange rates from their real fundamental values, given by the external equilibrium approach, these influences will evaporate in the long-run and trade or current account adjustments will determine anew exchange rate movements. As prices adjust, including the price of foreign exchange, the real exchange rate is either constant, as in the case of PPP, or changes in line with underlying real variables, such as productivity differentials or change in preferences. Furthermore, these short-run deviations will have no lasting effect on real variables, as long-run money neutrality is maintained. In this view, the nominal sphere, including the exchange rate regime in place, can only be inconsequential (Herr and Hübner 2005).

¹¹Even if the exchange rate did adjust in the right direction to equilibrate external accounts, structural rigidities, supply bottlenecks etc. might not result in the desired outcomes. In addition, in the Keynesian view, external account outcomes are determined by demand conditions, rather than relative prices.

However, the notion of long-run monetary neutrality is empirically and theoretically untenable. It is implausible to assume that investment decisions made today, e.g. due to a competitive exchange rate, do not affect future productivity and hence the long-run level of the real exchange rate. Exchange rates exert influence throughout the economic system, pervading both goods and asset markets, with dynamics in one sector immediately and inevitably feeding back into the other (Fausten 1989).¹²As Engel and West (2002) note, where the exchange rate and fundamentals appear to be linked by a long-run relationship, it may be that the exchange rate helps predict fundamentals, rather than the other way round.

In addition, in line with the Post Keynesian approach presented in Chapter 3, this dissertation would question the distinction between a short-run and long-run. Following Hahn (1984), it is argued that the long-run in itself does not exist, but is merely the sequence of short-run developments. Then, however, asset market driven deviations from equilibrium exchange rate values will be a permanent phenomenon and the importance of the “external balance” view of exchange rate determination becomes reduced to a theoretical normative concept.

Finally, even if traditional approaches to exchange rate determination acknowledge the important role of asset markets for exchange rate determination, they remain firmly embedded in the market equilibrating approach to exchange rate determination. As such, they do not acknowledge the complex working of international financial markets. Exchange rate movements result from static risk and return considerations, where fundamental uncertainty is reduced to measurable risk, without taking into consideration the institutional characteristics and inherently forward looking nature of foreign exchange markets. However, the exchange rate is not a relative price which efficiently adjusts markets, but the outcome of the expectations and positions of heterogeneous participants in the foreign exchange market. As a result, the expectation formation process of financial market participants becomes focus of the analytical endeavour. These expectations, in turn, must be necessarily context and time-specific, which questions the notion of permanent causal fundamentals.

¹²One attempt to incorporate such feedback mechanisms into the PBM is through a current account equation, which in turn equals the rate of change in the domestic wealth stock (MacDonald 2007).

2.2. The Role of Asset Market Players

As argued above, the exchange rate is not a market equilibrating price, but the outcome of the foreign exchange positions of heterogeneous foreign exchange market participants. Their investment decisions, in turn, will be shaped fundamentally by expectations about the exchange rate's future value itself.¹³

This claim is incorporated, and can be shown, with another workhorse of mainstream economics: uncovered interest parity (UIP).

$$(2.14) \quad e^e_t - e_t = i_t - i_t^*$$

Where e^e_t is the log of the expected exchange rate, e_t is the log of the current exchange rate and i_t and i_t^* are the domestic and foreign interest rate respectively. Assuming risk neutral agents with rational expectations, identical countries and assets, and no impediments to capital flows, equation (2.14) implies that the interest rate differential between two countries is offset by the expected exchange rate appreciation. Exact interpretations of equation (2.14) depend on whether the domestic interest rate, the expected exchange rate, or the actual spot rate is assumed to be the endogenous, i.e. equilibrium restoring, variable (Jarchow and Rühmann 2000; Sarno and Taylor 2002; Lavoie 2002-03; Plihon 2006).

In many accounts, interest rates are assumed to be given exogenously, which means that either rational exchange rate expectations adjust endogenously to restore UIP or the current spot rate changes as international arbitrageurs restore UIP (either after a change in interest rates or the expected exchange rate) (Jarchow and Rühmann 2000).

The implications of UIP have been used widely to test for foreign exchange market efficiency and rational expectations. If expectations are formed rationally, i.e. they incorporate all available information, and assuming the interest rate differential to be zero, it must hold that

¹³Following discussion assumes that actors can actually realize their expectations.

$$(2.15) \quad e_{t+1} = e_t^e + u_{t+1}$$

Thus, future spot rates will be a reflection of rational exchange rate expectations and a random error.

The implications of equation (2.15) have been tested using the forward rate as proxy for rational exchange rate expectations. According to covered interest parity (CIP), which will be discussed in more detail in Chapter 3, rational forward speculation aligns the forward rate with the expected spot rate.

Hence,

$$(2.16) \quad e_{t+k} - e_t = a + \beta(f_{t,t+k} - e_t) + \eta_{t+k}$$

where $f_{t,t+k}$ is the k period ahead forward rate and η_{t+k} is a disturbance term. If agents are risk neutral and have rational expectations the slope parameter β should be equal to unity and the disturbance term - the rational expectations forecast error under the null hypothesis - should be uncorrelated with information available at time t.

Empirical studies based on the estimation of (16) for a large variety of currencies and time periods generally report results which are unfavourable to the efficient market hypothesis under risk neutrality (Fama 1984; Hodrick 1987; Bekaert and Hodrick 1993; Engel 1996; Jongen, Verschoor et al. 2008). Indeed it constitutes a stylised fact that estimates of β , using exchange rates against the dollar are generally closer to minus unity than plus unity (Froot and Thaler 1990).¹⁴

Abandoning the assumption of risk neutral investors and perfect asset substitutability, a time-varying risk premium, which explains why rational but risk averse, speculators do not align the forward rate with their expectations, has been most commonly used to

¹⁴Rather than questioning the efficient market hypothesis per se, the failure of UIP to hold empirically has been ascribed to the inability of the forward rate to adequately capture exchange rate expectations (Sarno and Taylor 2002).

account for the empirical failure of UIP (Fama 1984; Hsieh 1984; Wolff 1987).¹⁵ Thus, UIP is written as

$$(2.17) \quad i_t = i_t^* + \Delta e_t^e + \rho_t$$

where ρ_t is the time-varying risk premium (Taylor 1995) .

Econometric tests, however, again had little success in verifying this proposition, partly due to the difficulty in specifying and operationalising the risk premium (Engel 1996; MacDonald 2000; Sarno and Taylor 2002; Jongen, Verschoor et al. 2008). Several authors find that international assets are not perfect substitutes (MacDonald and Torrance 1990; Cavaglia, Verschoor et al. 1993; Frankel and Chinn 1993; Madsen 1996).

Despite its empirical failure, this dissertation argues that UIP can be a helpful starting point to understand exchange rate movements, as it stresses the role of the exchange rate as an asset variable, which floats against its own expected value, while the incorporation of a risk premium pays tribute to the different domestic and international country characteristics.

To illustrate the argument, the parity can be reformulated as

$$(2.18) \quad e_t = \frac{e_t^e}{(i_t - i_t^*) + (1 - \rho_t)}$$

Thus, the current exchange rate floats against subjective expectations of its future spot rate, perceptions of risk, and the interest rate differential between the countries involved.

¹⁵ Other possibilities considered are restrictions on capital mobility and portfolio diversification. However, capital mobility arguments cannot account for the failure of UIP in countries with deep and free capital markets. As to the portfolio diversification argument it is unlikely that diversification varies considerably over time (Harvey 2004).

Based on these considerations, this dissertation argues that trying to understand the formation of expectations and risk perceptions in asset markets will be crucial to gain a deeper insight into the question of exchange rate determination. As such, it argues that the emphasis on the foreign exchange positions of financial market actors and their motivation to take these positions, re-evaluates the question of “fundamentals”, highlights the importance of institutional and structural factors for the price formation process, and opens an important door for exchange rate policy.

2.2.1. Rational Expectations and Market Efficiency

The importance of expectations and their formation has not been ignored in mainstream exchange rate theory. Along with the acknowledgement of asset market consideration (and the search for micro foundations in neoclassical economics) came the incorporation of agents’ expectations and behaviour in exchange rate theory. However, as expectations are formed rationally, in the sense that they are formed endogenously in line with the results of the neoclassical model in question, this ultimately changed little in the nature of exchange rate determination, its fundamentals, and the resulting policy implications (Herr and Hübner 2005).

Rational agents, who act as informed investors guided by their expectations about future underlying fundamentals - specified in line with mainstream exchange rate models - are seen to keep the exchange rate in line with those fundamentals and help to stabilize markets around a new equilibrium (Nissanke 2005). Moreover, in the course of such trading, those whose judgments of an asset’s value are sufficiently mistaken lose money to rational arbitrageurs and so eventually disappear from the market. In this view, trading, which deviates the exchange rate from its “fundamentally” determined value, cannot be profitable (Friedman 1953; Fama 1965). Foreign exchange markets work efficiently in the sense that the price of an asset will reflect all relevant information about the fundamental variables that determine its value.

However, as discussed above, the determining role of fundamentals for exchange rate movements, even if mediated through rational foreign exchange operators, is

increasingly at odds with empirical evidence (Frankel and Rose 1995).¹⁶ In addition, the implication that the price of current exchange rates incorporates all available information, and thus no profits can be generated trading on this information set, was met with varying success in empirical testing (Beechey, Gruen et al. 2000; MacDonald 2000; Jongen, Verschoor et al. 2008).

The hypothesis that all past information is already incorporated into prices implies that the exchange rate should follow a random walk. This property is a variant of weak form market efficiency, which states that no profits should be generated through trading on the history of prices or returns themselves (Campbell, Lo et al. 1997).¹⁷ While Poole (1967) and Liu and He (1991) find significant first order autocorrelation, other studies find little evidence of predictability in returns (Giddy and Dufey 1975; Fong, Koh et al. 1997; Lee, Liu et al. 2001). The random walk hypothesis has also been tested using unit root tests. This strand of literature has largely concluded that shocks to the exchange rate are permanent and rejected the hypothesis that the exchange rate is a stationary mean reverting process (Takagi 1988). Finally, following an argument by Granger (1986), the existence of a cointegration relationship between different currencies has been used to test for weak form market efficiency - with mixed results (Baillie and Bollerslev 1989; MacDonald and Taylor 1989; Sephton and Larsen 1991; Rapp and Sharma 1999).

Another strand of literature testing for weak form efficiency concentrated on the profitability of simple filter rules or technical analysis (Dooley and Shafer 1984; Levich and Thomas 1993; Curcio, Goodhart et al. 1997; Park and Irwin 2007). In general, studies find that these trading strategies, taking advantage of past price behaviour, would have been profitable. However, as Sarno and Taylor (2002) point out, it is usually not clear whether the optimal filter rule size could have been chosen *ex ante* and/or would have been chosen given the possibility of substantial sub-period losses.

¹⁶Probably the most famous attempt to keep the rational agent paradigm alive in view of exchange rates' "excess" volatility was Dornbusch's (1976) overshooting model in which the differential adjustment speed of goods and asset markets leads to an overshooting in the nominal exchange rate (Plihon 2004). However, as noted by Rogoff(2002), the Dornbusch model arguably owes its fame rather to its "theoretical elegance" than its empirical success, as neither of its predictions, e.g. a positive correlation between the real interest differential and the real exchange rate, could be found in practice.

¹⁷ While weak form market efficiency implies that all information contained in past prices is already incorporated in prices, semi-strong form efficiency extends this to public information. Strong form efficiency also includes private or insider information (Campbell, Lo et al. 1997).

In a similar vein, several authors find evidence of momentum, feedback trading and bandwagon effects in exchange rates (Lai and Pauly 1992; Aguirre and Saidi 1999; Okunev and White 2003; Laopodis 2005). Cutler, Poterba et al. (1991) show that while foreign exchange returns are serially correlated on a short horizon, they are negatively correlated on a longer horizon. The authors interpret this as evidence of overshooting in exchange rate returns. This finding is also confirmed by a series of studies using survey data on exchange rate expectations (Frankel and Froot 1987; Frankel and Froot 1990; Cavaglia, Verschoor et al. 1993; Chinn and Frankel 1994; Ito 1994).

Finally, a series of studies, using data on exchange rate expectations from surveys, test directly whether current exchange rate expectations are a good predictor of future exchange rates, i.e. whether there is any bias in exchange rate expectations (Blake, Beenstock et al. 1986; Avraham, Ungar et al. 1987; Sobiechowski 1996; Kim 1997). The null hypothesis of survey unbiasedness is rejected for nearly all currencies at all horizons (Jongen, Verschoor et al. 2008).

Several theoretical extensions are aimed at saving the rational expectations, efficient market hypothesis in the face of this contradicting evidence. Examples include the “peso” problem, rational bubbles, learning about regime shifts, or inefficient information processing (Krasker 1980; Blanchard and Watson 1982; Lewis 1995). Again, however, these extensions had little empirical success in salvaging the rational expectations hypothesis (Taylor 1995). Another strand of literature abandoned (at least for some agents) the assumption of homogenous and/or rational expectations altogether. This literature will be discussed in the next section.

2.2.2. Heterogeneous Expectations and Microstructure

The inability of traditional macroeconomic models to account for exchange rate movements and the rejection of the rational expectations efficient market paradigm have led to two main developments in mainstream exchange rate theory. Firstly, the assumption of homogenous expectations was abandoned. This also brought the institutional characteristics of foreign exchange markets and the way they shape agents’

behaviour to the fore. In general terms, heterogeneity can arise either as a result of market participants' differential access to information, i.e. the existence of private information, or as a result of market participants' different interpretation of publicly observable information. The latter forms the basis of the second major development in mainstream exchange rate theory: the (partial) abandonment of rational expectations.

2.2.2.1. Private Information - Asymmetric Information and Order Flow

Asymmetric Information

In parallel with other areas in mainstream economics, one avenue of theoretical development was the introduction of heterogeneous agents in the foreign exchange market due to different access to information (Stein 1987; Brunnermeier 2001; Stiglitz 2002). In this application of the information theoretic approach to the foreign exchange market, utility maximizing and rational decisions distorted by information constraints or asymmetries lead to "abnormal" asset price behaviour and/or the inability of markets to clear. The basis of a majority of these models is that one part of market participants, informed traders, holds private information which a second part of traders, uninformed traders, does not possess. Prices reflect the private information of informed traders but also noise, which uninformed traders cannot distinguish and allows informed traders to (temporarily) take advantage of their private information (Grossman and Stiglitz 1980).¹⁸ More recent applications of this asymmetric information approach to the foreign exchange market include, among others, Baccetta and van Wincoop (BW) (2004; 2006). For example, in BW (2004) investors have heterogeneous information on some structural parameters of the economy. The resulting rational confusion about the true source of exchange rate fluctuations leads investors to attribute excessive importance to some current macroeconomic fundamentals, the scapegoat. Closer to Grossman and Stiglitz's original paper is BW (2006). Here, the impact of non-fundamental information on the price (liquidity trades or noise) becomes significantly amplified as agents rationally (but heterogeneously informed) misinterpret the resulting exchange rate movements as information about future fundamentals. In addition, the

¹⁸As a result this literature is also called noisy rational expectations literature. Other models and applications include, among others, Hellwig (1980), Diamond and Verrecchia (1981), He and Wang (1995) and Allen, Morris et al. (2006).

rational confusion can be persistent which deviates the exchange rate from its fundamental value. Ultimately, however, investors learn about the actual fundamental exchange rate and return it to its value prescribed by traditional exchange rate theory.

The noisy rational expectations literature can be criticised on several grounds. “Technical” critique, such as the problem of non-generalization, non-strategic behaviour and knowledge of the pricing rule, is presented by Lyons (2001). More fundamentally, Kurz (2008), and also de Long, Shleifer et al. (1990), argue that the assumption of private information in a market like the foreign exchange market is implausible. Data which influence exchange rate dynamics are widely available and private information on such factors such as interest rates, inflation etc. does not seem to warrant systematic deviations from these variables. In this vein, an essential component of these models is the noise/liquidity component which leads to abnormal price dynamics. In many models, however, this component is hardly specified. Both critiques are, to a certain extent, reflected and mitigated by below order flow models in which order flows assume this role of private information. On a more theoretical level, Kurz argues that the assumption of private information, which is unobserved and is often not specified, cannot be falsified, questioning the theories’ scientific content. Similarly, he notes that in these models, it is not clear who is or who are the agents who aggregate all the information into prices. Again, this shortcoming is, at least partly, addressed with the microstructure literature on the foreign exchange market discussed below. Finally, it is not entirely clear why, after learning or repeated trading, the exchange rate should return to its fundamental value. Surely, new private information continuously enters the market which will permanently deviate the exchange rate from its fundamentally determined value.

Even more fundamentally, the asymmetric information approach changes very little of the traditional view of exchange rate determination. While allowing for market inefficiencies, it remains firmly committed to the rational expectations paradigm. Irrationality or market psychology is not admitted. All agents hold the same probability belief but have asymmetric information. This is particularly true for the nature of fundamentals which are considered the same for all agents and remain firmly specified according to the market equilibrating approach to exchange rate determination. In this respect, improved provision of information, e.g. through increased transparency, should

reduce exchange rate anomalies and stabilize financial sector prices - an implication which is not observed in today's currency markets. On the contrary, increased transparency, e.g. about monetary policy through inflation targeting regimes, seems to have led to higher rather than lower exchange rate volatility; an observation discussed in more detail in Chapter 5.

Microstructure - Order Flows

The literature on the microstructure of financial markets is vast and expanding. In its broadest definition it involves the study of “the process and outcomes of exchanging assets under explicit trading rules “ (O'Hara 1995: 1). In the context of the foreign exchange market it has become primarily associated with the order flow approach to exchange rate determination pioneered by Lyons and Evans (Lyons 2001; Evans 2008).¹⁹ Similar to the other models discussed in this section, the order flow approach abandons the assumption of homogenous expectations. In addition, in line with asymmetric information models, it argues that not all information is publicly available but trading on private information takes place. This private information is constituted by order flow, which is defined as *signed* transaction volume or “excess” demand in foreign exchange markets. In contrast to the macroeconomic oriented models discussed here, the order flow literature focuses on the actual trading mechanisms and operations of institutions in the foreign exchange market through which heterogeneous and dispersed information is transmitted into prices. As such the focus is on *how* rather than *which* information is incorporated into prices.

Without going into too much detail, exchange rate markets are distinct from other markets in a number of ways. For example, there is no physical location where dealers meet with customers. Furthermore, the transparency of trade is quite different to other asset markets, as there is no requirement of disclosure (of order flows) (Lyons 2001; MacDonald 2007). Foreign exchange markets are decentralized multiple dealer markets in the sense that trades can be conducted through market makers and brokers. Trading volume is enormous and most trading is conducted between dealers. It is also referred to

¹⁹Other areas of microstructure literature, such as the determination of spreads, will not be discussed here given the focus on exchange rate determination. For a review of the literature on the bid-ask spread in the foreign exchange market see, for example, Sarno and Taylor (2001).

as a continuous market in the sense that trade occurs at its own pace, with transactions being processed as they arrive (Sarno and Taylor 2001). All this and many more institutional characteristics will influence the behaviour of market players and the price formation process.

The three main players in the foreign exchange market are dealers, customers and brokers. Foreign exchange dealers, generally from the financial division of major commercial banks, trade among each other and with customers. Customers are often divided into non-financial institutions (e.g. corporates), leveraged financial institutions (e.g. hedge funds) and unleveraged financial institutions (e.g. mutual funds). Brokers do not trade on their own account, but help dealers and customers to complete their transactions (Lyons 2001; Vitale 2007).

The order flow approach is based on the demand and supply of foreign exchange by these different market participants. It is argued that order flows (either from other dealers or customers) convey private information which acts as a signal to the price setter (e.g. the dealer) that the price needs to be adjusted. As a result this private information is impounded into the exchange rate.²⁰ Thus order flow operates as an intermediate link between information and price. In addition, it is argued that if order flow conveys information, its effect on prices should be long lived. According to Lyons (2001), order flow models cannot only account for the large trading volume in foreign exchange markets (as unwanted order flows are passed on between dealers), but also above presented puzzles in exchange rate economics (fundamentals disconnect; excess volatility; forward premium puzzle).

This raises the question as to which type of private information the order flow is conveying. Or more to the point, what drives order flows? Ultimately order flow is the approximate, not the underlying, cause of exchange rate movements. According to Lyons there are many examples of dispersed information, both about the expected payoff and the discount rate, which become incorporated into the price. These include

²⁰Theoretically, the order flow literature is based on different microstructure models from the equity market (Glosten and Milgrom 1985; Kyle 1985; Lyons 1997). These are primarily information models which aim to explain permanent price adjustment toward a changed expected future payoff through the intermediation of order flows (Lyons 2001).

differential interpretation about news (macroeconomic fundamentals), shocks to hedging or liquidity demands, time-varying risk tolerances etc.²¹

In general, empirical research finds that order flows have significant and persistent effects on exchange rates (Rime 2000; Evans and Lyons 2002; Payne 2003). For example, Berger, Chaboud et al. (2008) and Evans and Lyons (2002) show that order flows have significant repercussions for intra-daily and daily returns. Bjønnes and Rime (2005), Killeen et al. (2006) and Love and Payne (2008) even find a long-run cointegration relation between order flows and exchange rates. Danielsson, Payne et al. (2002) and Evans and Lyons (2005) show that forecast models based on order flows outperform a simple-random walk. Supporting the hypothesis that order flows are a way of transmitting information about fundamentals, Evans and Lyons (2003) and Love and Payne (2008) show that order flow activity increases substantially around news announcements and that a large part of the news is transmitted into prices through order flows. The hypothesis that order flows are important for the decisions of foreign exchange dealers and do not only convey information about other market operators' perceptions of fundamentals is tested by means of survey evidence (Cheung and Chinn 1999; Gehrig and Menkhoff 2004b). For example, Gehrig and Menkhoff find that flow information does not seem to be used to learn about the fundamental information of others, but aims at exploiting semi-fundamental private information. Finally, Carpenter and Wang (2003), Evans and Lyons (2005) and Marsh and O'Rourke (2004) show that order flows from financial customers have a stronger impact on prices than other order flows. This suggests that order flow is not just an undifferentiated demand, but that the orders of some participants are more informative than others.

The order flow approach to exchange rate determination is an interesting approach and has many commonalities with the view adopted in this dissertation. Firstly, it explicitly models the fact that flows, buying and selling decisions of foreign exchange, are the primary drivers of exchange rates.²² This is closely linked to the view that economic

²¹Lyons acknowledges that the assumption of private information about macroeconomic fundamentals is rather difficult. However, order flows might give an indication about the interpretations of fundamentals by market participants.

²²Lyons (2001: 190) points out that there is a link between his order flow approach and the traditional flow approach where balance of payments flows determine the exchange rate (e.g. Robinson 1949; Machlup 1976). There are, however, three main differences: Firstly, in the flow approach exchange rate determination is a by-product and the exchange rate is not determined in its own speculative market.

indicators, i.e. fundamentals, do not affect exchange rates directly but work through the perceptions and interpretations of market participants. It is not the actual pay-offs (e.g. interest rates) which drive exchange rates, but the participants interpretation of the interest rate-exchange rate link which ultimately creates the causality. In addition, the microstructural approach is crucial as it explicitly considers the institutional characteristics of a market and how these shape actors' behaviour and decisions.²³

However, there are also a few shortcomings. Firstly, and most importantly, order flows ultimately remain proxies or transmission mechanisms of underlying foreign exchange decisions. While we don't actually know what determines these foreign exchange decisions, we can say very little about exchange rate determination. Lyons specifies several factors based on a simple model of asset pricing, which considers, on the one hand, the expected pay-off and, on the other hand, the discount rate of holding domestic currency. Whereas the former is represented by the short-term interest rate and traditional macroeconomic fundamentals, the latter incorporates risk aversion, liquidity trades etc. As will be seen in Chapter 3, this comes close to the theoretical approach adopted in this dissertation. In this vein, Lyons also takes the view that once the actions of market operators are considered, a broader view of fundamentals is warranted. "Order flow that reflects information about payoffs - like expectations of future interest rates - is in keeping with traditional definitions of exchange rate fundamentals. But order flow that reflects changing discount rates may encompass non-traditional exchange rate determinants (e.g. changing risk tolerance of financial institutions, changing hedging demands) calling perhaps for a broader definition of fundamentals" (Lyons, 2001: 189). At the moment, however, little empirical research exists as to what are the factors which determine order flows, which seems to leave the theory without much to say about what ultimately drives exchange rates.

Secondly, order flows do not necessarily have to coincide with flows from the balance of payments, and thirdly, in the flow approach, balance of payments flows do not convey any additional information. As discussed in Chapters 3 and 8, the first two points are specific for developed foreign exchange markets and might not be so acute for DECs. The last point could be easily used to augment the existing flow approach.

²³However, the order flow approach is about how different institutional structures affect information transmission rather than how they affect actors' expectation formation.

Secondly, while the approach acknowledges that flows determine the exchange rate, no effect from the exchange rate onto flows is incorporated. Exchange rate dynamics, however, might be an important element of flow decisions themselves.

Thirdly, the order flow approach is based on the institutional features of developed foreign exchange markets and here primarily the spot market with multiple dealer banks. Trading structures and price formation, however, might change in a different institutional setting. This could be particularly true for DECAs with a different institutional structure and integration in the international financial system.

Finally, the order flow approach remains firmly committed to the rational expectations paradigm. The cause for exchange rate puzzles is heterogeneous private information rather than differing interpretations about public information. Approaches which follow the latter path will be presented in the next section.

2.2.2.2. Public Information - Behavioural Finance and Imperfect Knowledge Economics

Behavioural Finance – End to Rational Expectations?

A second strand of literature which emphasises the heterogeneity of expectation formation to explain exchange rate puzzles focuses not on the existence of private information, but on market participants' different interpretations of publicly available information. Reverting to experimental results and evidence from psychology, sociology and organisational behaviour, the behavioural finance approach acknowledges that agents are not rational, only constrained by the availability of information, but differ in their ability to absorb, understand and process information. This induces them to use simple rules based on past price behaviour, rather than fundamentals, to guide their behaviour. The result can be sustained periods of misalignment, excess volatility etc. In addition, it is common to these theories that not only do deviations from the rational stabilizing speculator exist, but they can also be profitable and have a lasting impact on financial sector prices (Shleifer and Summers 1990; Shiller 2003).

Behavioural finance is a large and expanding literature (for a review see Hirshleifer 2001; Barberis and Thaler 2002; Subrahmanyam 2007). Many of the models were developed with a view to explaining “puzzles” on the equity market, but have enough generality to be applied to the foreign exchange market. For example, several authors model theoretically the importance of psychological phenomena in equity markets, including among others, overconfidence and self attribution, optimism and wishful thinking, representativeness, conservatism, framing, anchoring, loss aversion, moods etc. (e.g. Barberis, Shleifer et al. 1998; Daniel, Hirshleifer et al. 1998; Hong and Stein 1999; Barberis and Huang 2001; Hirshleifer and Shumway 2003).²⁴ Other authors discuss the phenomenon that this “irrational” behaviour does not disappear from the market but might have persistent effects on asset prices. This is due to fundamental risk or costs to arbitrage (Shleifer and Vishny 1997). While a large proportion of these models focus on one class of investors, De Long, Shleifer et al. (1990) and De Long, Shleifer et al. (1990) model the important interaction between different investor classes. In these models, noise traders or irrational traders create risk (or profit opportunities) for (risk averse) rational traders, which consequently fail to align asset prices with their underlying value.

Drawing on the seminal work by Frankel and Froot (1988; 1990), models which found the widest application to the foreign exchange market are so called chartist-fundamentalist models. Replicating the features of trading strategies in foreign exchange markets, in these models the interaction of heterogeneous agents, chartists, who use simple trading strategies (technical analysis) based on past price behaviour and thus act destabilizing, and fundamentalists, who know the underlying value of the exchange rate and act stabilizing, determine exchange rate dynamics.

²⁴ These phenomena have been incorporated selectively from psychology into finance theory. For the original psychological work see for example Kahneman and Tversky(2000) and Gilovich, Griffin et al. (2002).

Formally²⁵,

$$(2.19) \quad \Delta e_{t+1} = -\omega_{f,t} \psi(e_t - e_t^*) + \omega_{c,t} \beta \Delta e_t + \varepsilon_{t+1}$$

Where e_t is the exchange rate, e_t^* stands for the fundamental exchange rate, β is the extrapolation parameter of the chartist trading and $\omega_{i,t}$ ($i=f,c$) is the respective share of fundamentalists and chartists. While the first expression represents fundamentalists' stabilizing trading, the second expression shows the destabilizing trading behaviour of chartists. It is important to note that the juxtaposition of chartists and fundamentalists is often interpreted in terms of trading rules, which are combined in one agent and prevail depending on market conditions and time horizon, rather than two types of traders (Frankel and Froot 1990).²⁶

The weight between destabilising chartists and stabilizing fundamentalists is determined by rational ex post risk-return considerations. If an initial shock in the exchange rate increases the profitability of extrapolative forecasting, a higher share of traders will switch to this rule. Although stabilizing fundamentalists recognize that profit opportunities arise when the exchange rate deviates from its fundamental value, they switch to safer and more profitable forecasting rules in the face of the large forecast errors they make during a bubble phase. This lasts until deviations from underlying fundamentals become too large and fundamentalists align the exchange rate again with this underlying value.

Direct econometric evidence on the existence of heterogeneous agents in foreign exchange markets and the presence of noise and/or technical trading is still relatively scarce. However, given that behavioural models were developed *ex post* to account for empirical regularities which stand in contrast to the efficient market rational expectations paradigm, there is extensive indirect empirical evidence which corroborates their findings. In this vein, due to the difficulty specifying and quantifying

²⁵This exposition is primarily based on the application of this framework to the foreign exchange market by de Grauwe and Grimaldi (2006). Other contributions include Brock and Hommes (1998), Lux and Marchesi (2000) and Farmer and Joshi (2002). Westerhoff (2003) and Xu (2010) explicitly focus on the foreign exchange market.

²⁶ However, as Nissanke (2005) points out, it is probably also the case that different market participants follow different trading rules more often.

“fundamentals” as well as destabilizing trader behaviour, empirical applications of many behavioural finance models remain reduced to simulations in which it is “tested” whether the models can account for observed time series properties of exchange rates.

For example, de Grauwe and Grimaldi (2006) and Westerhoff (2003) show in computer simulations that in fundamentalist vs. chartist models, exchange rate dynamics can be characterized by two different kinds of equilibria: a fundamental equilibrium, in which fundamentalists and chartists co-exist and the former keep the exchange rate close to its fundamental value, and a bubble equilibrium, characterised by the predominance of destabilizing chartists. The authors further show that in this scenario the exchange rate is not only very often disconnected from its fundamental value, but also experiences more short-term volatility than the fundamental exchange rate and is occasionally subject to very large changes. In addition, these models can account for the important phenomenon of volatility clustering (e.g. Bollerslev, Chou et al. 1992).

There is some empirical evidence, primarily based on survey studies, that the expectation formation process in foreign exchange markets is not homogenous (Frankel and Froot 1987; Ito 1990).²⁷ MacDonald and Marsh (1996) show strong evidence of dispersion of expectations due to idiosyncratic interpretation of widely available information. Jongen, Verschoor et al. (2008) find that this dispersion arises because of a combined effect of market participants holding individual information and attaching different weight to some elements of the common information set. Jongen, Verschoor et al. (2008) and Menkhoff, Rebitzky et al. (2009) directly test the hypothesis that this heterogeneity in expectation formation is due to chartist and fundamentalist trading. The authors show that while chartist trading predominates in the short-run, fundamentalist trading is more important in the long-run. Moreover, market participants switch between different forecasting techniques, depending upon the position of the exchange rate compared to its fundamental value.

Important insights into the actual expectation formation process of foreign exchange market participants is generated by a series of survey studies using questionnaires, in

²⁷Frankel and Froot (1990), MacDonald and Marsh (1996) and Chionis and MacDonald (1997) also show that heterogeneity in expectations is positively related to trading volume as predicted by the order flow approach.

which the answers from foreign exchange market participants uncover evidence of alternative trading strategies (as opposed to traditional fundamental analysis) (Menkhoff and Taylor 2007). For example, Cheung and Wong (2000) show survey evidence on Asian foreign exchange markets that short-term variability is largely attributed to non-economic forces including bandwagon effects, over-reaction to news, speculation and technical trading, while fundamental trading dominates over the longer horizon. A wide range of literature examines the use of technical analysis among (primarily) foreign exchange dealers (Frankel and Froot 1990; Allen and Taylor 1992; Lui and Mole 1998; Oberlechner 2001). In general, this survey evidence finds that technical trading is an important complement to fundamental analysis, which is used to forecast market psychology and often acts in a self-fulfilling manner, detracting from fundamental analysis. The importance of psychological factors for short-run exchange rate dynamics is directly analysed with survey studies by Cheung and Wong (2000), Cheung and Chinn (2001) and Cheung, Chinn et al.(2004).

Another strand of empirical research which could be accounted for by behavioural finance models, is the existence of non-linearities in the adjustment to fundamentals. For example, Taylor and Peel (2000) show that the exponential smooth transition autoregressive (ESTAR) model parsimoniously describes the deviation of the exchange rate from monetary fundamentals. This model predicts that the exchange rate is nearly unpredictable when the deviation from fundamentals is small, but will strongly revert toward those fundamentals when the deviation is big (Neely and Sarno 2002). Kilian and Taylor (2003) apply the same model to the bilateral nominal US\$ exchange rate for several countries and rationalize their results in a chartist/fundamentalist setting, where uncertainty about the fundamental value of the exchange rate deters agents from speculating against small deviations from fundamentals. Similarly to Taylor, Peel et al. (2001) they specify their fundamental as determined by PPP.

Furthermore, recent empirical papers have shown that the impact of fundamentals might not be constant, but depend on the period of time under consideration. For example, in an interesting paper Heimonen (2006), using Johansen VAR for the cointegrating vectors and Kalman filtering for the time-varying impact of fundamentals, finds time-varying relative impact of the different fundamentals under considerations. In addition to money demand, PPP and UIP he tests for the significance of stock prices in the

determination of the exchange rate and finds supporting evidence. These results are in line with the findings of Goldberg and Frydman (1996), who show, using structural change tests that search recursively for break points, that the co-integrating vector implied by a composite monetary model experiences five parameter shifts over the 1970-1980 floating period. In addition, they find that different sets of fundamental variables are significant during different times – a result which will be discussed in further detail below.

Probably the most direct empirical testing of the chartist vs. fundamentalist framework has been with the use of Markov Switching Models. These models acknowledge that the underlying data generating process might not be constant, but changes according to an unobserved random state variable (Engel and Hamilton 1990). In the context of behavioural finance models, this implies a specification where time series behaviour is either the outcome of noise trading/chartists, operationalised as some simple autocorrelation or more complicated moving average specification, or fundamentalist trading (Vigfusson 1996; Bessec and Robineau 2003; Ahrens and Reitz 2005). Vigfusson (1996) and Bessec and Robineau (2003) find empirical support for the existence of two regimes. Contrary to predictions in the noise trader literature, however, they show that the chartist regime is more common and has a lower variance than the fundamentalist regime.

By allowing for the “irrational”, behavioural finance has, at a first glance, substantially broadened the theoretical and empirical scope of mainstream economics. In addition, it has introduced a role for exchange rate policy as strengthening fundamentalist trading (or deterring noise trading) can stabilize the exchange rate around its fundamental value (Jeanne and Rose 1999; De Grauwe and Grimaldi 2006). At a second glance, however, behavioural finance literature has changed relatively little of the central tenets of traditional exchange rate theory.

Firstly, the assumption of an ergodic world, where true uncertainty is reduced to measurable risk and an immutable probability distribution governs both current and future market outcomes, is firmly maintained (Davidson 1978). As such, the existence of structural breaks or changing institutional, social etc. conditions is not acknowledged (Frydman and Goldberg 2010). This forces these models to revert to behavioural

assumptions or psychological phenomena to explain empirical phenomena, such as excess volatility and misalignment. Ultimately, however, it leaves the theory indeterminate if every empirical phenomenon can be explained *ex post* by some sort of “irrational behaviour” or psychological phenomenon (Alves, Ferrari Filho et al. 2000; Herr and Hübner 2005).²⁸ In addition, the rationality assumption is only superficially abandoned. A class of actors – fundamentalists - know the underlying probability distribution and will align the exchange rate with its fundamental.²⁹ Likewise, the behaviour of noise traders/chartists is described as “irrational” which assumes that the ideal of a rational, fully informed agent, who knows the underlying probability distribution, exists (Frydman and Goldberg 2008).

Secondly, the continuing adherence to the rational expectations and ergodic market framework is also reflected in the fact that expectations continue to be formed in accordance with fundamentals specified as in the traditional “market equilibrating” approach to the exchange rate.³⁰ Although it is acknowledged that expectations might not be rational, ultimately these expectations continue to be formed, at least by a share of the agents, endogenously to mainstream theories of exchange rate determination. The exact nature of these fundamentals, depends on the paper under consideration, ranging from monetary models to FEERs. Thus, while much emphasis is put on specifying the “noise trader” behaviour, the theoretical assumptions about fundamentals remain unquestioned or unclear.³¹

As such, behavioural finance models also firmly maintain the classical dichotomy. While short-run irrational behaviour deviates the exchange rate from its underlying value, this underlying value (unchanged through intermediate exchange rate dynamics) will reign again in the long-run through fundamentalist trading.

²⁸This critique is not unacknowledged by behavioural finance authors. For example, Daniel, Hirshleifer et al. (1998: 1849) write: “...allowing for irrationality opens a Pandora’s box of ad hoc stories that will have little out-of-sample predictive power”.

²⁹Rational risk-return considerations might induce them to use chartist trading for a while. As such, behavioural models do not seem to offer more analytical power than rational bubble models, where rational agents are driven away from the equilibrium model, because they would incur losses if they bet against it.

³⁰In a similar vein, de Grauwe and Grimaldi’s (2006) assumption that the choice between chartist and fundamentalist trading is based on rational *ex-post* risk return considerations misses the essence of financial markets which are inherently forward looking and based on *ex ante* expectations.

³¹For example, de Grauwe and Grimaldi (2006) in their 200 page book spend *one* line on the question of fundamentals, which in their view can be either specified as PPP or a FEER.

However, as will be argued in Chapter 3, once the assumption of rational agents in an ergodic framework is abandoned, there is little reason to assume that fundamentals, as specified in traditional exchange rate models, should remain the main drivers of exchange rate movements. Alternative variables or indicators, which shape asset market decision, will have to be identified and analysed to understand the drivers of exchange rates. In this sense, a critical analysis of the role of fundamentals also requires a clear distinction between the notion of fundamentals as exchange rate drivers and the concept of fundamental in the sense of some normative equilibrium or policy value. No sharp distinction is drawn between them in behavioural finance models. Finally, the emphasis on actors' expectations will require a country-specific approach, taking into consideration different domestic and international structures. This also includes the diverse institutional structures in which actors operate, because, as Keynes always emphasised, no a-historical statements independent from the specific context can be made about expectations (Herr and Hübner 2005).

Thirdly, and related to this last point, chartist vs. fundamentalist models (and particularly their empirical applications) provide very little contextual information on the actual nature of fundamentalists and chartists in foreign exchange markets. Theoretically, it is not entirely clear whether heterogeneous traders refer to different trading rules for one operator or distinguish different operators in the foreign exchange market. Most empirical applications (particularly in the form of survey studies) seem to assume that these are different trading rules combined in one agent. However, very little empirical research exists which matches these stylized trading rules to actual operators in foreign exchange markets.

Finally, chartists vs. fundamentalists models are also based on the institutional framework of developed (spot) foreign exchange markets. However, exchange rate determination, and the type of actors operating in a market, might differ substantially in DECs. In this vein, Nissanke (2005) also argues that the interaction between heterogeneous traders might be fundamentally shaped by the market conditions, understood as linked to “fundamentals” and the institutional characteristics, of a country.

Imperfect Knowledge Economics – End to Perfect Knowledge?

A second strand of literature maintains the assumption that agents are fully rational, but acknowledges that they might not have complete knowledge of the underlying structure of the economy (Kurz 1994; Nielsen 1996; Kurz 1997; Kurz and Motolese 2001). Thus, public information is interpreted differently by market participants, due to diverging beliefs about the structural parameters of the economy. For example, as Kurz and Motolese argue in their Rational Beliefs (RB) theory, agents only have empirical knowledge which is readily observable from the economy, usually in the form of a large amount of data about the past performance of an asset or the economy in general. Thus, rational agents form their opinions about the future by using the empirical distribution that is derived from the occurrence of events in the past and build their own theories based on these data. Given that the underlying distribution is unknown, any convergence to the “true” process through learning is very difficult to achieve.³² Given that the underlying state of the economy is not known, heterogeneous belief of agents can create endogenous uncertainty and abnormal asset price fluctuations. Kurz and Motolese (2001) show how their model can explain “abnormal” asset price dynamics, particularly in the equity market. More generally, however, little empirical research has been done on the implications of RB economics. Like behavioural finance models, most empirical applications have relied on ex post explanation of empirically observed exchange rate “puzzles” (Brav and Heaton 2002).³³

A similar literature, starting from the premise of imperfect knowledge of the underlying structural parameters of the economy, is Imperfect Knowledge Economics (IKE) (e.g. Goldberg and Frydman 1996; Frydman and Goldberg 2010). In these models, agents’ lack of knowledge about the true model under consideration and its relationship to the exchange rate prompts them to pay varying attention to (different) fundamentals or change the type of fundamental they consider in their information set. In addition, the fundamentals considered will be entirely context specific and depend on the agent under consideration.³⁴

³²For different concepts of rationality and the role of learning in these paradigms see Vercelli (2002)

³³Brav and Heaton also point out that empirically and mathematically RB theories are actually quite similar to behavioural finance models.

³⁴As such, IKE also allows expectations to be formed on the basis of a-theoretical components such as technical analysis, rules of thumb, and individual guesses.

In contrast to the above presented RB models, past data are only an imperfect support to expectation formation as the world is characterised by structural shifts, in terms of switches in expectation functions and in the policy environment. According to IKE, agents revert to exchange rate models, but they only provide qualitative rather than quantitative knowledge about the economy as no precise magnitudes of the parameters of the leading theories are known to agents. These qualitative restrictions are formalisations of results from economists, sociologists and psychologists. For example, referring to Kahneman and Tversky's prospect theory, Frydman and Goldberg argue that individuals might change their expectations as the size of their open position in the market increases. Following Keynes (1997), this open position, in turn, is measured by the exchange rate's deviation from some benchmark level (specified as PPP).³⁵

Thus, IKE assumes a distinct conception of rationality, qualitative rationality, which only implies that agents predict the right direction of the currency move. However, due to agents' imperfect knowledge, there is nothing to say when the gap has become too big and/or when adjustment will occur.³⁶ Empirically, IKE can account for the large (asymmetric) swings around benchmark levels (PPP) and the time-varying importance of fundamentals (Goldberg and Frydman 1996; Goldberg and Frydman 1996; Frydman, Goldberg et al. 2009).

IKE allows for important insights into the working of foreign exchange markets, particularly from a Keynesian perspective. It highlights the existence of fundamental uncertainty and the existence of a non-ergodic system. As a result, it stresses the context and time specific nature of fundamentals and acknowledges that the nature and perception of fundamentals might depend on the market actor under consideration. It also highlights the fact that one does not need irrational, noise traders to observe sustained deviations from underlying fundamentals. As such, it comes very close to Harvey's approach to exchange rate determination discussed in more detail in Chapter 3 (Harvey 2009). However, in contrast to full "animal spirits", IKE achieves "closure"

³⁵This benchmark level will differ across asset markets and individuals, based on conventions and historical data. According to the authors, one of the most widely used benchmarks in the foreign exchange market is PPP.

³⁶Goldberg and Frydman also show that these large swings are consistent with different opinions – bulls and bears – in the foreign exchange market exactly due to agents' inability to assess when the gap has become too big and adjustment will occur.

and testable mathematical hypothesis through the assumption of qualitative rationality, i.e. the knowledge about qualitative implications of exchange rate models, such as the existence of asymmetric swings around benchmark levels.

Ultimately, however, these fundamentals remain specified according to mainstream theories of exchange rate determination. As such, IKE does not appreciate the fact that once expectations in financial markets become the main determinants of exchange rates, these expectations might not necessarily be formed in accordance with traditional exchange rate theory. Alternative fundamentals might have to be considered, particularly in the context of DECAs with different institutional structures. In a similar vein, if distinct actors consider different models, it is not entirely clear why market participants should ultimately choose PPP as their benchmark concept. As Goldman and Frydman (2008) point out, benchmark concepts differ across markets and agents.

Stressing the autonomous role of exchange rate expectations under uncertainty, IKE also faces a similar criticism to Harvey (discussed in more detail in Chapter 3), in the sense that it does not consider the important role of financial structure, both on the micro and on the macroeconomic level, which might restrain and shape agents' behaviour.

On a more general, methodological level, IKE is firmly based in methodological individualism which tries to build microeconomic foundations for macroeconomic phenomena based on rational individuals. However, as pointed out already by Keynes, decisions of "rationally" optimizing individuals on the microeconomic level might lead to suboptimal outcomes on the macroeconomic level. Indeed, it was Keynes himself, who gave space to macroeconomics as a autonomous discipline (Dow 2002). In a similar vein, in a Post Keynesian framework the view of economic agents has to go beyond individual agents but consider institutions, classes etc.

Finally, empirical evidence of IKE is based on observed time-series behaviour, such as sustained (asymmetric) deviations from PPP. These deviations, however, could also be explained by behavioural finance models and, as such, do not represent empirical evidence for the mechanisms and theory proposed by IKE. However, once we acknowledge the determining role of agents' context and time-specific expectations and

investment decisions under fundamental uncertainty, we might also require different methods to investigate this expectation formation process. The focus switches from causal explanations and predictions to understanding the mechanisms and processes underlying investment decisions.

2.3. Conclusions

This chapter has presented a short overview of existing mainstream exchange rate theory. It has criticised the notion of the exchange rate as market equilibrating price and emphasised the determining role of exchange rate expectations in short-term asset markets for the exchange rate. It has further argued that although the driving role of exchange rate expectations has been acknowledged in mainstream exchange rate theory, this ultimately changed little in the nature of exchange rate determination as rational agents align exchange rates with their underlying fundamentals.

Two interesting mainstream approaches are the microstructure approach to exchange rate determination and IKE: the former, because it highlights the important role of flows and the institutional characteristics of a market in shaping exchange rate formation; the later because it stresses the uncertainty about the structural parameters of an economy, which might lead different market participants to have very different perceptions of fundamentals.

Ultimately, however, these two approaches also remain closely linked to traditional exchange rate theory in their understanding and specification of exchange rate fundamentals. This dissertation, however, has argued that once foreign exchange market participants are acknowledged to be the driving force of exchange rates, their perception of fundamentals might change and might cease to be linked to mainstream fundamentals. This could be particularly the case in DECs with a different institutional framework and position in the international monetary system. The attempt to present such an alternative analytical framework based on Post Keynesian economic thought is presented in the next chapter.

Chapter 3: An Alternative Analytical Framework for Exchange Rate Determination in Developing and Emerging Countries

3.1. Introduction

As discussed in Chapter 2, in traditional mainstream exchange rate theory the exchange rate is considered a market equilibrating price which adjusts to permanent causal fundamentals to restore equilibrium in underlying product or asset markets. The incorporation of agents' expectations and positions ultimately changed little of this view as, at least some, rational market participants align the exchange rate with its fundamental value given by mainstream exchange rate theory. Two interesting approaches, which have some parallels with the framework developed in this dissertation, are the microstructure approach to exchange rate determination and IKE.

Post Keynesian exchange rate theory explicitly rejects the view of the exchange rate as market equilibrating price and argues that expectations and positions in short-term financial markets drive exchange rates. Short-term financial flows have permanent effects on exchange rates, which can lead to sustained deviations of exchange rates from underlying values given by "real" fundamentals. In addition, given the Post Keynesian emphasis on the expectation formation process under uncertainty, no stable underlying fundamentals exist. Rather, fundamentals are whatever market participants expect fundamentals to be. Thus they will be necessarily context specific and may be very different from those specified by the market equilibrating paradigm. However, focusing solely on expectations under uncertainty runs the risk of being too subjectivist and having very little to say about exchange rate determination beyond the specific context. This dissertation thus complements the existing Post Keynesian exchange rate theory with the critical realist ontological claim that deeper structures and mechanisms shape agents' behaviour and expectations. These mechanisms, in turn, are specified with reference to one of the most important institutions in Post Keynesian theory in the presence of fundamental uncertainty: money. This view not only accounts theoretically for the important role of short-term returns, but also highlights the significance of financial structure and international market conditions for exchange rate determination in DECs.

The next section, Section 2, discusses critically the existing Post Keynesian theory of exchange rate determination. Section 3 outlines Keynes' writings on exchange rate determination and the forward foreign exchange market in the *Tract on Monetary Reform* and the different interpretations these writings have been given by mainstream and Post Keynesian exchange rate theory. Section 4 presents a third interpretation and stresses particularly the role of domestic currency as international money. Based on this view, Section 5 presents an alternative analytical framework to analyse exchange rate determination in DECs. To do so it particularly reverts to Keynes' liquidity preference theory and Chapter 17 of the *General Theory*. Section 5 concludes with some potential limitations of the framework presented.

3.2. Post Keynesian Exchange Rate Theory – The Uncertainty Strand

Post Keynesian writers stress the autonomous nature of expectations that shape market outcomes (Chick 1983; Keynes 1997, Chapter 5; Harvey 2001; Dow 2002). As a consequence, the formation of these expectations becomes the analytical focus. One strand of research, pioneered by Davidson (1978; 2002), highlights the important ontological distinction between risk as calculable probabilities and fundamental uncertainty. For Keynes "human decisions affecting the future, whether personal or political or economic, cannot depend on strict mathematical expectations, since the basis for making such calculations does not exist" (Keynes 1997: 162-163) "There is no scientific basis on which to form any calculable probability whatever. We simply do not know" (Keynes 1971c: 114).

In the presence of fundamental uncertainty, no stable probability function exists to forecast future fundamentals to be used as a reliable guide to the "correct" equilibrium price of financial assets over time. *Convention*, the assumption "that the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change" – and the confidence with which we hold this convention govern investment behaviour (Keynes 1997: 152). Given their dependence on the state of confidence, conventions are precarious and potentially subject to sudden changes or waves of optimism and pessimism. As Keynes (1997) sets out in his famous "beauty contest",

expectations, i.e. foreseeing future conventions, then become crucial to maintain the value of one's portfolio.

This Keynesian view of the price formation process is applied to the foreign exchange market by John T. Harvey (2009).³⁷ In his model, (short-term) capital flows and the expectations in these markets drive exchange rates; there are no underlying objective economic relations that determine exchange rates at all times, but “fundamentals” are whatever market participants expect the drivers of the exchange rate to be in the future. These expectations, in turn, are primarily anchored by social conventions and the confidence with which financial market participants hold these conventions. In addition, given the subjective nature of conventions, psychological phenomena play an important part in Harvey's exchange rate model.

In order to substantiate the mental model of the agents' expectation formation process, Harvey starts with the important observation that “...there exist (outside of official intervention) only three reasons to purchase foreign currency: importation of foreign goods and services, direct foreign investment and portfolio investment. Agents' perception of those processes is what forms their mental model and, therefore, their expectations” (Harvey 2009: 83).

³⁷An application to the analysis of financial crisis is presented by Alves, Ferrari Filho et al. (2000).

Figure 2.1: Exchange Rate Determination in Existing Post Keynesian Exchange Rate Theory

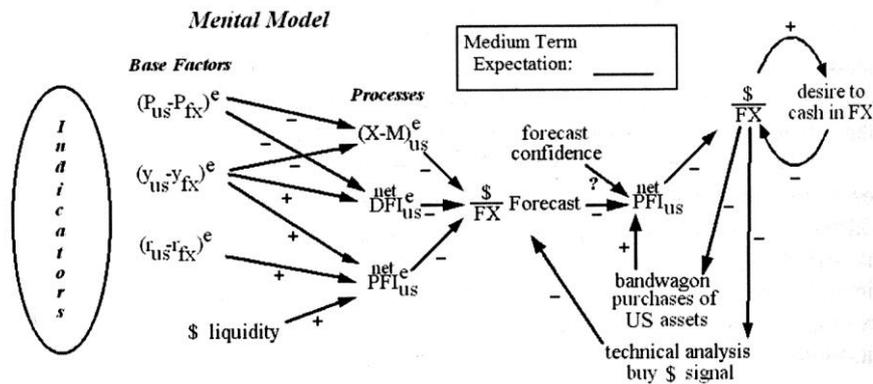


Figure 5.12 Augmented mental model including medium-term expectation, technical analysis, bandwagon, confidence, and cash in.

Source: Harvey (2009: 88)

Expectations about these processes, in turn, are determined by base factors (differential prices, growth rates, interest rates and liquidity), which affect the flows directly, and/or indicators which determine expectations through their influence on base factors (and sometimes the processes themselves). Based on assumed economic relations and historical observations, Harvey (2009) argues that interest rates, unemployment, the trade balance, and inflation have formed the core base factors and indicators considered by agents in forming their forecasts in the post-Bretton Woods era and could thus be considered “fundamentals” in the Post Keynesian sense.

In addition, given the all pervading uncertainty and precariousness of conventions, psychological phenomena play a crucial role in Harvey’s framework. Drawing on Tversky and Kahneman (e.g.1974) and the expanding microstructure literature on the foreign exchange market, he incorporates bandwagon effects, technical analysis, and “cash in” effects in his model. These are complemented by Keynes’ emphasis on actors’ confidence and, following Schulmeister (1988), a variable called “medium term expectations”, which reflects the state of the market (either bullish, bear or neutral) and acts like a filter through which new information is interpreted.

No account of exchange rate dynamics, especially in DECAs, would be complete without incorporating the phenomenon of currency and financial crisis. Harvey does so by highlighting three tension points which can lead to strong exchange rate depreciations: firstly, deviations of actual exchange rate values from agents' mental model (as a result of bandwagon effects in portfolio inflows); secondly, deviations of returns on financial assets from real returns (motivated by Keynes' Ch. 22 of the General Theory); and thirdly, drawing on Minsky's work, financial fragility as agents raise short-term and foreign loans and thus debt to income ratios.

Finally, Harvey rejects the notion of a long-run, equilibrium value for the exchange rate. As such, he argues: "Because Post Keynesians emphasize historical time and path dependence, they see the long-run as simply the aggregation of short runs. The state of the world today is a function of all the various events that shaped it yesterday" (Harvey 2009: 101).

Harvey's Post Keynesian theory of exchange rate determination is very important and shall be used as a starting point for the analytical framework presented in this chapter. In particular his rejection of the view of the exchange rate as market equilibrating price, and his emphasis on the importance of short-term capital (financial) flows and the formative role of expectations in these markets are an important reflection of the working of international foreign exchange markets. However, a few criticisms can be levelled against his approach.

Firstly, although Harvey seems to be using Keynes' original denomination, the use of the term capital flows is slightly confusing without further explanation. In the current literature capital flows primarily refer to balance of payments flows between countries. However, these types of flows could be considered less important for exchange rate determination in developed countries with deep and developed financial markets and large international offshore markets where the currency is traded as an international asset class. Thus, the term financial flows would have probably been more appropriate in this context. However, capital flows, in terms of balance of payments flows, can still be considered very important for DECAs with smaller international offshore markets. As a result, a larger share of foreign trading of the domestic currency in DECAs will be made

onshore in domestic assets, making short-term portfolio flows through the balance of payments an important driver of the exchange rate in these countries.

Secondly, it could be argued that by putting so much emphasis on agents' expectations and their formation under uncertainty, Harvey's theory assumes quite a subjectivist and psychological approach to exchange rate determination. This criticism has been directed towards Post Keynesians who overly stress the formative role of expectations under fundamental uncertainty, e.g. Shackle, and indeed against Keynes' theory of expectations in general (Hodgson 1985).³⁸ In these approaches pervasive uncertainty implies that it is only the subjective perceptions of actors that drive actions, not the objective reality that might underlie the situation. Expectations are entirely individual, which makes any form of orderliness or regularity impossible (Carvalho 1983-84). According to Coddington (1982), this makes these approaches indeterminate and ultimately theory-less as nothing can be said about economy reality beyond the individual.³⁹

Keynes introduces orderliness and uniformity in expectations through social conventions (Carvalho 1983-1984). Indeed, an individual's knowledge, motives, perspectives etc. are not independent of the society in which he or she lives (Lawson 1985). This is exactly the approach Harvey takes when he specifies his base factors and indicators based on "what one would expect" and historically observed patterns. In his mental model, indicators are socially sanctioned and filtered by the world view shared by market participants within a particular social context. Whatever is socially sanctioned, in turn, might change as a result of regime change, structural change, academic and professional theory, and forecast error.

Although Harvey highlights the importance of market structure and social context, his mental model is ultimately presented like a general theory of exchange rate determination. However, his observations are specific to a developed foreign exchange market. Traders' expectation formation process is likely to be very different in DEC

³⁸This critique has also been raised against Austrian Economists.

³⁹This critique is particularly targeted towards authors who emphasise the psychological aspects of expectation formation (e.g. Dow 1985). The unlimited number of psychological phenomena seems to make it impossible to generalize, but confines any specification to the particular empirical case at hand. In this vein, one could also argue that Harvey's choice of psychological phenomena included in his mental model seems slightly ad-hoc.

given their different institutional structures, monetary and exchange rate regimes, integration in a hierarchical international monetary system etc. For example, Harvey assumes the existence of a deep international speculative market of foreign exchange, where the exchange rate is traded as an asset class per se. As mentioned above, though, this might still be less the case in DECs, where large parts of foreign currency investment/trading is made in (onshore) short-term, domestic currency denominated financial assets. This, in turn, might make the returns on these financial assets a crucial driver of exchange rates in DECs. Both types of currency trading are analysed in this dissertation through the two manifestations of the internationalisation of the Brazilian Real.

Thirdly, this criticism is linked to Hodgson's (1985) point that Keynes seems to assume his account of expectation formations applies more or less equably to all economic agents as it is ultimately based on a view of human nature, rather than on one of institutions, structures or social relations.⁴⁰ It would not be fair to extend this critique unqualified to Harvey's mental model. Harvey explicitly refers to the subculture of short-term capital (financial) flows and the specific world-views, morals and sanctions in this market. The problem is that short-term capital (financial) flows are not a uniform category with a homogenous expectation formation process, but constituted by diverse actors characterized by different investment mandates, client structures, balance sheet characteristics etc., which will fundamentally influence their expectation formation process and thus exchange rate dynamics. For example, as highlighted in this dissertation, onshore and offshore foreign exchange operators might have very different perceptions of DEC currencies due to their different trading environment, motivation to participate in the foreign exchange market etc. In addition, these actors' foreign exchange positions might vary due to their different degree of integration in international financial markets, for example through their different funding structures.

This last point is also connected to the final criticism of Harvey's mental model.

Although Harvey incorporates social factors into his analysis, they ultimately appear like an exogenous guideline which agents can *choose* to follow. "This account

⁴⁰As such, Hodgson asks: "What if, for example, finance is provided through the banks, as well as or instead of through the sale of stock? Unless it is assumed that there is near perfect financial market competition between the banks and the stock market (and it is not in the spirit of Keynes' work to assume this) then "average opinion" and "conventions" in the one will not be the same as in the other" (1985: 17).

presupposes notions such as *intention* and *deliberation* and allows the assumption that individuals have the *power to choose*” (Lawson 1985: 919). However, institutions do not only influence the cognitive level of agents, but have an important relational aspect which dynamically links and constraints agents’ expectations and behaviour over time. Probably the most prominent author to stress this relational aspect from a Post Keynesian perspective is Minsky with his emphasis on the relationship between debtors and creditors and the importance of financial commitments in shaping agents’ expectations and actions.⁴¹

These considerations beg the question whether a theory entirely based on the creative role of expectations under uncertainty can say anything about economic reality beyond the specific time and context under consideration? And if not, does this mean we have to accept Coddington’s criticism that such a theory is ultimately theoretically indeterminate?

Harvey does not seem to think so. He appears to put forward a general theory of exchange rate determination, specifying base factors (and to a certain extent indicators) which commonly determine exchange rates. However, without explicitly tying these factors to a specific context, their specification appears slightly ad-hoc or, without an alternative theoretical framework of the exchange rate, remains ultimately tied to mainstream theories of exchange rate determination which form part of agents’ social conventions.

As discussed in more detail in Chapter 6, Post Keynesian writers stressing Keynes’ open system ontology highlight that the expectation formation must be a necessarily institutionally and historically contingent process (e.g. Lawson 1985; Crotty 1994; Dow and Chick 2005). For many of these authors, however, this does not mean that such an approach is ultimately theory-less. Referring to the critical realist ontological claim of deeper structures and mechanisms that are real but are not directly accessible to observation and only discernible through their effects, for these authors the analytical aim is to investigate these underlying real mechanisms and structures, rather than

⁴¹ Although Harvey incorporates Minsky’s emphasis on balance sheets in his financial crisis model, financial structure does not form part of his general model which makes its addition in the crisis time seem slightly ad-hoc. This dissertation, in turn, argues that financial structure is an important element of exchange rate determination, both in normal and in crisis time.

pinning down objective causal relations and permanent fundamentals as in mainstream exchange rate theory. This implies moving from the observed surface phenomenon to a theory which analyses the underlying relations, structures, conditions and mechanisms which are responsible for the given phenomenon. In other words, for critical realism the task of social research is to construct hypotheses about the underlying real mechanisms and to seek out their effects (Bryman 1988). Importantly, these effects can be but do not have to be discernible on the empirical level and might change their manifestations depending on the specific context under consideration.

Indeed, Keynes' analysis of agents' behaviour under uncertainty is not confined to the expectation formation process, but also highlights the implications this uncertainty has for the underlying structures and institutions of an economy. "Although individuals' values, preferences, modes of understanding, and so forth are socially constructed, through individual and collective action people transform their decision-making environment over time by, among other things, creating new institutions and adopting new practices designed to reduce the harmful effects of uncertainty" (Crotty 1994: 13).

One of the most important institutions in this context is the emergence of money and a monetary economy. "The system reacts to the absence of the information the market cannot provide by creating uncertainty-reducing institutions: wage contracts, debt contracts, supply agreements, administered prices, trading agreements. Since all are meant to reduce uncertainty over time, it is natural that their value be denominated in the unit whose value is most stable over time- money..." (Kregel 1980: 46).

The exchange rate, however, is nothing other than the relation of domestic to foreign money. If we interpret domestic currency as international money, Keynes offers us a powerful analytical tool to analyse portfolio decisions under uncertainty and, more specifically, the demand for domestic currency: liquidity preference theory and his analysis of the "own rate of interest" in Chapter 17 of the *General Theory*. The following sections show that this is indeed an interpretation consistent with Keynes' own writings.

3.3. Keynes on Exchange Rate Determination

Keynes' theoretical analysis of foreign currency dealings stems from his first post-war writings (1922), later collected in his *Tract on Monetary Reform* (1923). In chapter 2 of the *Tract* he explicitly deals with the question of exchange rate determination where he, with certain reservations, endorses PPP. Keynes argues that in general the exchange rate adjusts to restore equilibrium between the comparative internal purchasing powers of two countries, which are ultimately determined by their monetary policies. Deviations from this equilibrium condition can occur. These, however, are primarily the result of changes to "real" parameters affecting two countries' trade relations, such as "...movements of capital, or reparation payments, or changes in the relative efficiency of labour, or changes in the urgency of the world's demand for that country's special products, or the like" (p. 80). In addition, seasonal fluctuations, transaction costs and the divergence between tradable and non-tradable goods prices might result in the failure of PPP to hold.

Asset market considerations and speculation more specifically have little long-lasting impact on the deviations of the exchange rate from PPP in his view. "Speculators, indeed, by anticipating the movements tend to make them occur a little earlier than they would occur otherwise, but by thus spreading the pressure more evenly through the year their influence is to diminish the absolute amount of the fluctuation. General opinion greatly overestimates the influence of exchange speculators acting under the stimulus of merely political and sentimental considerations" (Keynes 1923: 92). In his view, speculation "...is only really important on the very rare occasion on which it precipitates a panic – that is to say, imitative action on a large scale by numbers of people who are not speculators at all, but are just terror stricken" (Keynes 1971d: 88). Keynes does, however, concede that large amounts of long-period speculative capital flows, e.g. as a result of a bullish view, can have a sustained influence on the exchange rate. These flows though should be seen as international borrowing rather than speculation (Keynes 1923).

After his (qualified) endorsement of PPP, Keynes goes on to set out his view on the currency forward market in Chapter 3 of the *Tract*, a view which is today reflected in the covered interest parity (CIP) theorem. Although not directly concerned with the

question of exchange rate determination, this view has potentially important implications for analysing exchange rate dynamics in a Post Keynesian framework.

“If dollars one month forward are quoted cheaper than spot dollars to a London buyer in terms of sterling, this indicates a preference by the market, on balance, in favour of holding funds in New York during the month in question rather than in London – a preference the degree of which is measured by the discount on forward dollars” (Keynes 1923: 102). This preference is caused by interest rates obtainable on “short” money, i.e. money lent or deposited for short periods of time in the money markets of the two centres under comparison. “...Forward quotations for the purchase of the currency of the dearer money market tend to be cheaper than spot quotations by a percentage per month equal to the excess of the interest which can be earned in a month in the dearer market over what can be earned in the cheaper” (p. 103f).

Following Lavoie (2000) Keynes’ description of the forward market can be expressed as

$$(3.1) \quad i - i^* = f - e$$

Where i is the domestic interest rate, i^* is the foreign rate of interest, e is the logarithmic value of the spot exchange rate (defined as the domestic currency price of one unit of foreign exchange), and f is the logarithmic value of the forward exchange rate.⁴² With small enough differentials in interest rates the Taylor expansion yields these approximate equalities (Lavoie, 2000). Maturities on the relevant asset and the forward contract coincide. CIP postulates that interest rate differentials between currencies should be perfectly reflected in FX forward rates (or the difference between the forward and the spot rate). Currencies with higher interest rates should trade on a forward discount ($f-e>0$), whereas currencies with lower interest rates trade on a forward premium ($f-e<0$).⁴³

⁴²For Keynes, the Pound Sterling is the home currency. Given the primacy of the Pound Sterling at his time, other currencies are expressed with reference to it. Thus, to fully reflect his considerations on CIP the equation would have to be written as $i^* - i = f - e$. To express the viewpoint of DEC, whose currencies are most of the time quoted in units of the foreign currency (primarily the US\$), Lavoie’s expression has been used.

⁴³In analogue to footnote 6, whether a forward premium/discount assumes a positive or negative value depends on the quotation of the currency. If the exchange rate is expressed in units of the domestic

As discussed in Chapter 2, for mainstream exchange rate theory the forward rate reflects rational exchange rate expectations. As the forward rate deviates from the expected exchange rate, rational speculators will buy/sell the currency forward until $e^e = f$. An implicit premium/discount appears which attracts arbitrageurs to restore UIP.

$$(3.2) \quad i - i^* = e^e - e$$

As also discussed in Chapter 2, UIP - particularly its implication that the forward rate should be a good predictor of the future spot rate - has been met with little empirical success. More empirical support seems to exist for CIP (e.g. Coulbois and Prissert 1974; Frenkel and Levich 1975; Taylor 1986; Baba and Packer 2009). Indeed Coulbois and Prissert (1974) and Lavoie (2000) argue that CIP in international money markets has been shown to hold nearly perfectly. According to the authors, those studies which found large intrinsic discounts/premiums have considered inappropriate interest rates, such as Treasury bill rates or medium to long-term bond rates. Indeed, Keynes (1923) explicitly wrote about short-term money markets where considerations such as default or credit risk are thought to be less prevalent. However, Keynes also acknowledged that, due to political or financial instability which raises concerns about the viability of the domestic banking system and/or the free transferability of funds, implicit discounts on a currency might arise. In this vein, Baba and Packer (2009) show that fear about the liquidity and solvency of banks lead to temporary deviations from CIP during the international financial crisis; a result which is also confirmed for the Brazilian market, as will be shown in Chapter 5.

Finally, Chapter 2 also showed that the most common theoretical device to save UIP in the face of conflicting empirical evidence has been the introduction of a time-varying risk premium (ρ). Thus,

$$(3.3) \quad i - i^* = (e^e - e) + \rho \quad \text{and} \quad f = e^e + \rho$$

currency (as it is often done by North American writers) the forward premium will assume a positive value whereas a discount will be negative.

Again, however, econometric tests had little success in verifying the proposition of a time-varying risk premium (Jongen, Verschoor et al. 2008). In addition, one could argue that on a theoretical level, the specification of this time-varying risk premium has very often remained slightly ad-hoc. Indeed, in the most general case, it is divided into country, credit and currency risk. Country and credit risk, however, are theoretically also present in the case of CIP. Unpredictable currency risk, in turn, is theoretically not possible in the rational expectations-efficient market paradigm.⁴⁴

Post Keynesian theory offers three possible interpretations of Keynes' interest parity theorem and/or the failure of UIP to hold. Two of them will be discussed below. The third forms the basis for the alternative analytical framework for exchange rate determination in DECs presented in the subsequent section.

One strand of Post Keynesian writings emphasises the absence of rational expectations and importance of uncertainty to account for the empirical failure of UIP (Harvey 2004). In this view, a situation might arise in which aggregate investors (speculators) believe that the return that can be earned in one nation exceeds that in another, but they lack the conviction and/or confidence to act. Thus, in this interpretation, exchange rate expectations continue to be formed endogenously with respect to interest parity. In addition, the forward rate remains a representation of exchange rate expectations with potentially predictive powers for the future spot rate.

Another strand of Post Keynesian writings, the so-called Cambist view, rejects the view of the forward rate as expectational variable altogether (Lavoie 2000; Lavoie 2002-03; Smithin 2002-03; Moosa 2004). In this view, exogenously given exchange rate expectations are directly reflected in the current spot rate, which is then marked up by banks with the existing interest rate differential to derive the forward rate. More concretely, Coulbois and Prissert (1974) argue that for hedging purposes every forward transaction by a bank has to be "married" by a spot transaction in the same direction.⁴⁵ In most cases, however, this spot transaction has to be funded on international money markets; this funding operation creates a cost (or profit) for the bank, depending on the

⁴⁴As discussed in detail in Chapter 2, recent theoretical advances in mainstream exchange rate theory, such as behavioural finance models, attempt to build a theoretical case for such a time-varying risk premium through the introduction of "irrational" traders.

⁴⁵This assumes that the bank does not speculate on the currency but hedges all its currency exposure.

existing interest rate differential, which it will charge (discount) in the form of a mark-up over the current spot rate, resulting in the quoted forward rate.⁴⁶ Thus, in contrast to what is argued in mainstream theory, in this view CIP does not result from arbitrage operations of international investors, but is the outcome of a pure arithmetic operation as banks charge their customers forward rates which reflect the spot rate plus a mark up mirroring the interest rate differential. Interest rates are exogenously set by the central bank, which implies that speculators' exchange rate expectations are immediately reflected in the spot rate through the covering sales of banks.⁴⁷

Moreover, while in the mainstream argument deviations from CIP are necessary to create profit opportunities for international arbitrageurs (and might last for a while if this arbitrage is not sufficient), in the Cambist view CIP has to hold nearly perfectly. At the same time, the forward rate cannot have any predictive value for the future exchange rate, which, if interest rates are assumed to be constant, is only determined by current exogenous exchange rate expectations. Thus, in this view, the forward rate has little to do with exchange rate expectations, but is simply a "residual" given the spot rate and existing interest rate differential.⁴⁸

Keynes' view seems to lie somewhere in between. On the one hand, he acknowledges the important role of banks and their covering operations in forward transactions (Keynes 1923: 106). This is, among other things, reflected in his view that CIP has no to little effect on the current spot rate (Keynes 1923: 114). On the other hand, CIP is clearly based on an international arbitrage argument. As a result, sustained deviations from CIP due to strong speculative trading and a lack of arbitrage operations are

⁴⁶ Nowadays, most of the time banks will probably do these operations with a swap, which, however, does not change the general argument.

⁴⁷ Acknowledging the counterparty operations of banks also implies that in the Cambist view of covered interest arbitrage only speculative (uncovered) forward operations can have an effect on the spot rate. In the case of covered forward transactions (a simultaneous forward and spot transaction) a bank which executes the forward transaction for the customer – if it cannot match the transaction with an offsetting order given by another customer – has to cover itself through sales (purchases) on the spot market, which exactly meet the initial spot purchases (sales) of the arbitrageurs. Thus, the two spot transaction cancel each other out, which leaves the spot rate unaffected. This is in contrast to the neoclassical account where deviations from interest parity lead to a simultaneous spot and forward transaction by arbitrageurs, which causes a movement in both the spot and forward rate.

⁴⁸ In this context, Smithin (2002) argues that the Cambist view is actually much stronger than the neoclassical view as it does not rely on capital mobility argument as such. This, however, is only partly true. In the presence of capital controls, forward rates in domestic and foreign markets might differ as banks only have access to either market which might be characterised by different interest rates (Lavoie 2002-03).

possible (Keynes 1923: 107). Finally, in contrast to the Cambists' argument, in Keynes' view exchange rate expectations are reflected in forward rates through the operations of speculators. However, these exchange rate expectations are not formed in accordance with interest rate parity, but are exogenously given.⁴⁹

The Cambist approach is an insightful account of the forward foreign exchange market and reflects the workings of this market under certain market conditions. It is consistent with the Post Keynesian view that exchange rate expectations are not rationally formed to equilibrate markets, but are autonomous and exogenous variables. In addition, it shows the importance of short-term interest rates for exchange rate movements and reflects the determining character of exchange rate expectations for *current* exchange rate movements.⁵⁰

Ultimately, however, it is not a theory of exchange rate determination. What the Cambist view determines is not the spot rate or forward rate individually, but the forward premium. As such, there is a "loose end in the analysis" because "in order to infer the value of the forward rate, there must also be some explanation of the level of the current spot rate, which in turn must entail some explanation as to why, at any point in time, speculators and other participants in the foreign exchange markets are willing to hold the portfolios they currently do" (Smithin 2002-03: 225). In line with Harvey's view of exchange rate determination, for Lavoie (2000) this demand for currency is primarily the result of expected exchange rate changes, which are formed exogenously to the model and caused by news, "which is interpreted one way or another depending on the whims of foreign exchange dealers" (p. 175). As such, it does not have much more to say about exchange rate determination than Harvey's model presented in Section 2. Finally, while Lavoie's framework can accommodate the phenomenon of carry trade (in the sense that short-term interest rates result in sustained exchange rate appreciation), it is at loss when it comes to currency crisis, where central banks try to stabilize the value of their currencies through interest rate policies. In a similar vein, as discussed in more detail below, while the assumption of an independent monetary

⁴⁹ Keynes does not further specify what determines these exchange rate expectations though, but only argues that these are in general right.

⁵⁰ That is in contrast to mainstream theory where exchange rate expectations cause *future* spot rates. Rational expectations theory contends that e_{t+k} and e_t^e should only differ by some random error. The Post Keynesian approach argues that e_t^e determines e_t (Harvey 1998).

policy and freedom to set the interest rate might be valid for developed countries, this might not hold for DEC.

Thus, in sum, Keynes' CIP theorem has been interpreted very differently in mainstream economics and in the Post Keynesian Cambist approach, with important repercussions for their respective views of the forward rate and the workings of international currency markets more generally. A third interpretation, which forms the basis of the alternative analytical framework developed in this dissertation, is presented in the next section.

3.4. The Exchange Rate as International Money

Kregel (1982) argues that Keynes' writings on the forward foreign exchange market should be seen as an early application of his "own rate of interest" equation, which he later developed in Ch. 17 of the *General Theory*, in the international context. Aiming to show that Keynes' "own rate of interest" is a theory of general asset choice, rather than a dichotomous selection between money and bonds such as in Tobin (1987), Kregel points out that if one considers domestic currency (sterling) as "*the* 'money' of the system with durable assets comprised of foreign currency", Keynes' interest parity theorem "provides an explanation of the "preference" for 'liquidity' (sterling) influencing decisions to take positions in other (foreign currencies) assets in terms of their spot and forward prices relative to the sterling" (p. 454). Just as the rate of interest measures the "premium" the market is willing to pay for its preference for liquidity provided by money in a closed economy, the rate of interest on foreign currencies shows the price investors are willing to accept to part with the security provided by *the* money of the system in an open economy.⁵¹ And just as in Keynes' closed economy of the *General Theory*, this "premium" or money rate of interest is "nothing more than the percentage excess of a sum of money contracted for forward delivery, e.g. a year hence, over what we may call the 'spot' or cash price of the sum thus contracted for forward delivery" (Keynes 1997: 222).

The view that Keynes' writing on the "own rate of interest" has to be seen as a theory of general asset demand, which found its antecedent in Keynes considerations on the

⁵¹Implicitly, this interpretation of Keynes' interest parity is also adopted by Taylor (2004a).

foreign exchange forward market, is also advanced by Carvalho (1992). “In a nutshell, the theory says that, for any given durable good, the divergence between its spot and forward prices, that is between the current price for current delivery and the current price for delivery at a specified future date, will reflect the expectation of the market as to the gains to be derived from its possession between the present moment and the specified future date” (p.79).

In this view, Keynes’ writing on the forward foreign exchange market is an explanation of the demand for domestic currency relative to foreign currency, primarily with respect to *the* currency or money of the system. Thus, the domestic currency is considered an asset class whose demand is determined by its net return relative to other currencies. The exchange rate, as the relation between domestic and foreign money, is a manifestation of these differential returns.

3.4.1. Liquidity Preference Theory and “Own rate of Interest”

The net return of holding an asset in the present can, in principle, be measured in terms of the asset itself or in terms of some other asset (Chick 1983). Based on Sraffa’s (1932) “commodity rates of interest” Keynes initially followed the first route, an idea which he called “the own rate of own interest” (Kregel 1982).

Measured in terms of itself, three main elements determine the net benefit of holding an asset: (a) *yield* or output q , in terms of direct satisfaction or capacity to produce saleable output; (b) *carrying costs* c arising from the need to house or store the asset safely; and finally (c) an asset may have a *liquidity premium* l measuring the potential convenience or security given by the power of disposal of the asset in the sense of pure marketability (Chick 1983: 298).

Expressing net returns in different standards, however, defies comparability between asset returns and thus a more general analysis of asset choice. Thus, a common denominator is needed. In this vein, Kregel (1982) writes: “Just as money rates of interest on national currencies vary across countries, so would the own rates of own interest for different durables. Just as international interest-rate differentials were

brought into equality by forward discounts and premiums, taken in terms of a common currency unit, the various different own rates of own interest should also be equalised in equilibrium when they are calculated in a common unit of value. It was thus necessary to convert all “own rates” to a single (money) standard” (p. 455). In principle, which durable asset is chosen has no particular importance. However, just as the sterling had a special role in the international monetary system at Keynes’ time, money had certain characteristics which made it “rule the roost” in a closed economy.

The use of a common standard of measurement adds an asset’s (*expected*) appreciation (a) with reference to the numeraire to the “own rate of interest” equation. In addition l, the liquidity premium, (strictly speaking plus the expected appreciation) resembles the more usual definition of liquidity: the ease of conversion into money without loss (Chick 1983: 298).

Thus, the net return of an asset is determined by its yield minus its carrying costs, plus its expected appreciation and liquidity premium.

$$(3.4) \quad (q - c) + a + l$$

These attributes define a spectrum of assets between which wealth holders can choose, ranging from capital assets, which offer a high yield but little liquidity and high carrying costs, to money for which the yield and carrying cost are nil, but which offers the highest liquidity premium. In this view of liquidity preference theory as a general theory of asset pricing and asset choice, assets with different liquidity premia have to offer different monetary returns to compensate for their relative illiquidity measured against a reference asset, i.e. money.⁵² Assuming perfect competition and no segmentation in asset markets, the buying and selling of assets with different return-liquidity configurations, given existing states of liquidity preference, will equilibrate returns across markets and determines current asset prices (Carvalho 1992).

⁵² This is particularly warranted if one acknowledges that liquidity preference theory is not a theory of the demand for money, but a theory of the determination of the interest rate. The interest rate is the reward for parting with liquidity, i.e. money.

Liquidity preference, in turn, is defined as an individual's "schedule of the amounts of his resources, valued in terms of money or of wage-units, which he will wish to retain in the form of money in different set of circumstances" (Keynes 1997: 166). Underlying liquidity preference is Keynes' acknowledgment of the existence of time, whose passing creates uncertainty between the past and the future. More concretely, Keynes (1997) specified three famous motives why an individual would want to hold money, an asset which has nothing to show other than itself.⁵³

Firstly, the transaction motive, i.e. the need for cash for the current transaction of personal and business exchanges; this can be further divided into the income and business motive depending on which unit is implied in the transaction; in essence however, Keynes' transaction motive is not very different from the neoclassical view of money as primarily a medium of exchange determined by current income. It is in the financial circulation, where money is held as an alternative to other assets, where Keynes' innovative ideas of a monetary production economy appeared (Carvalho 1992).

This financial circulation is approached through two motives for liquidity preference: the precautionary motive, i.e. "the desire for security as to the future cash equivalent of a certain proportion of total resources", and the speculative motive, "the object of securing profit from knowing better than the market what the future will bring forth" (Keynes 1997: 170).

Surprisingly, despite being specifically targeted at dealing with uncertainty, the precautionary motive received a quite perfunctory treatment in the *General Theory*. However, one could argue that it is exactly in relation to the precautionary demand for money that the specificity of Keynes' view on money as an asset in defence against uncertainty should be predicated (Carvalho 1992). Keynes (1997) defines the precautionary motive as "to provide for contingencies requiring sudden expenditure and for unforeseen opportunities of advantageous purchases, and also to hold an asset of which the value is fixed in terms of money *to meet a subsequent liability* fixed in terms of money..." (p. 196). The precautionary motive has sometimes been interpreted as part

⁵³Although analytically separating these different motives, Keynes (1997) also stressed that the "money held for each of the three purposes forms, nevertheless, a single pool, which the holder is under no necessity to segregate into three water-tight compartments" (p. 195).

of the transaction motive (Chick 1983). This dissertation, however, puts particular emphasis on the demand for liquidity to meet subsequent liabilities. Indeed, as will be argued in more detail below, the roles of money as store of value and unit of account are closely related to its power to discharge contractual obligations. In this view, the ability to meet outstanding obligations will be crucial element of the demand for liquidity.

Much more space in the *General Theory* was given to the speculative motive, antecedents of which Keynes had already developed in the *Treatise*, and which directly linked the holding of money with the interest rate. Liquidity is demanded to be able to profit from changes in expected interest rates, and thus expected prices of capital assets, which differed from agents' subjective "normal" rate.

Money is the asset which can fulfil these motives better than any other. Its return is pure liquidity for which it is held despite offering no pecuniary returns. Money's liquidity premium is the highest, because it functions as the general unit of account, the unit in which contractual commitments are denominated. Indeed, as Carvalho (1992) argues, to serve as unit for contracts is the primary function of money and one from which the other properties of money are derived. The object that liquidates contractual commitments denominated in the money of account is money, and for this reason it is "liquid". "Money itself, namely that by delivery of which debt contracts are discharged, and in the shape of which a store of general purchasing power is held, derives its character from its relationship to the money of account, since the debts and prices must first have been expressed in terms of the latter..." (Keynes 1971b: in Carvalho, 1992: 48).⁵⁴

In sum, in a Post Keynesian framework which emphasises the role of money as an asset class, liquidity, i.e. the ability to convert an asset into money, is demanded to take advantage of expected changes in the price of capital assets, the speculative motive, and/or to meet contractual obligations, the precautionary motive.⁵⁵

⁵⁴The stability of money to act as unit of account is guaranteed by two properties of money in a capitalist society: zero or negligible elasticities of production and substitution. While the former assures money is not replaced by another asset when its price rises, the latter makes sure that a rise in the price of money will not lead to increased production (Kregel 1982; Keynes 1997).

⁵⁵This does not mean the transaction motive is not important, but given this dissertation's emphasis on financial operations in domestic currency, it is of lesser interest in this context.

What determines an asset's liquidity in practice is a multidimensional reality, defined by the institutional structure of its market, the properties of the asset itself, i.e. its maturity, and the existing micro and macroeconomic financial structure(s) etc. Carvalho (1992) summarizes a market's "institutional" liquidity in three terms: density, permanence and its organization. Density refers to the depth and tightness of a market, i.e. the number of potential buyers, the frequency of quotations, the transparency of information, the transaction costs etc. (Orléan 1999). Permanence is about the time of operation: the longer a market is open the easier it is going to be to find a potential buyer (seller). Finally, the liquidity of an asset will be fundamentally influenced by the organization of a market. The clearer the rules, standards and acceptable behaviours and procedures are in a given market, the more predictable the liquidity of an asset. Carvalho (1992) further argues: "An organized market is that which avoids excessive potentially disruptive fluctuations in the prices of assets, avoiding thereby solvency crises that could threaten the permanence of that market" (p. 87). Consequently, in addition to the structure of the market itself, the existence of a market maker, which contains the fluctuations in asset prices, becomes a crucial element of the liquidity of an asset (e.g. Davidson 2002). The efficacy of the market maker, in turn, depends on two conditions: the desirability of price fluctuations in a given market and the resources the market maker possesses to affect the operations needed to regulate the market.⁵⁶

3.5. An Alternative Analytical Framework for Exchange Rate Determination in Developing and Emerging Countries

As Kregel suggested, Keynes' liquidity preference theory and "own rate of interest" can be applied to – and indeed found its antecedents in – the international context where sterling was *the* money of the system while other currencies represented alternative durable assets. In fact, Keynes writes himself: "...it may be added that, just as there are differing commodity-rates of interest at any time, so also exchange dealers are familiar with the fact that the rate of interest is not even the same in terms of two different moneys, e.g. sterling and dollars. For here also the difference between the "spot" and

⁵⁶However, as Keynes points out "...the question of the desirability of having a highly organised market for dealing with debts presents us with a dilemma. For, in the absence of an organised market, liquidity preference due to the precautionary motive would be greatly increased; whereas the existence of an organised market gives an opportunity for wide fluctuations in liquidity preference due to the speculative motive (Keynes 1997: 170).

“future” contracts for a foreign money in terms of sterling are not, as a rule, the same for different foreign moneys” (Keynes 1997: 224).

Adopting the view of the currency as international asset class, its return is constituted by its carrying cost adjusted yield, its expected appreciation against *the* currency of the system and finally its liquidity premium, i.e. the ability to convert the currency quickly and without loss of value in the money of the system to meet contractual obligations. “In equilibrium” this return should be equal to the return offered by the currency with the highest liquidity premium, i.e. *the* money of the system (indicated by *).

$$(3.5) \quad (q - c) + a + l = l^*$$

At a given liquidity preference, changes in any of the four elements of a currency’s net return, without a counteracting adjustment of the other elements, will alter the demand for domestic currency and lead to exchange rate movements. Before proceeding to a more detailed discussion of the different elements’ of a currency’s net return, several points are noteworthy.

Firstly, given that this is a model of asset choice under uncertainty, it is primarily investors’ expectations about the elements of a currency’s net return rather than the actual values which are important for exchange rate movements. Current or past realized values are considered only to the extent that they are used by decision makers to form their current expectations of future yields (Carvalho 1992). This also implies that, reflecting the critical realist ontology underlying this dissertation, these underlying factors of asset demand are only reflected in asset prices through the expectations and positions of economic actors, which means that their actual empirical manifestations will be context specific, time-varying and/or might not be empirically manifested at all.

Secondly, and closely related to the first point, although Keynes’s “own rate of interest” evokes an equilibrium concept, it is not guaranteed that this equilibrium is ever achieved. Changes in returns and demand for the currency will set forces in motion which by themselves change the same returns, keeping things in steady motion. In addition, the emphasis on expectations under uncertainty also means that there is no equilibrium level towards which the domestic currency will tend (Carvalho 1984-85).

Finally, it seems puzzling that Post Keynesian writers have a very different, if not opposed, view of the nature of the forward rate in the foreign exchange market. While for the Cambists' Lavoie and Smithin the forward rate had nothing to do with exchange rate expectations, but was the result of a simple mark-up, applying Keynes' liquidity preference theory to the foreign exchange market the forward rate is a reflection of *expected* conditions on this market just as *expected* conditions "determine the size of the offer to repay money in excess of the sum borrowed" (Kregel 1982: 456). This dissertation would argue that these differences reflect the opposing views of Post Keynesian authors about the role of liquidity preference in a closed economy.

On the one hand, "horizontalists", or strong proponents of endogenous money, hold that the money stock in an economy is not exogenously determined by the central bank, but endogenously given by the "real economy". Banks simply transmit this real sector money demand, which, in turn, is fully accommodated by the central bank. Given that any change in money demand can (and will be) fully accommodated by the central bank, the interest rate cannot be an outcome of private sector portfolio decisions. In other words, liquidity preference theory can only hold in the presence of a fixed money supply. If the money supply is not fixed, the central bank has full autonomy over setting the policy or wholesale rate, which is subsequently marked-up by the banks when meeting the private sector demand for credit (Lavoie 1984; Arestis and Eichner 1988; Moore 1988; Wray 1992; Smithin 1994). On the other hand, several Post Keynesian authors, such as Minsky (1975), Dow (1996), Chick and Dow (2002), Bibow (2009), and indeed Kregel (1980; 1982), give some role to Keynes' liquidity preference theory. These authors argue that interest rates are not only exogenously set by the central bank, but are partly endogenous and reflect expected market conditions through the liquidity preference of banks. In this view, banks do not passively accommodate money demand from the real sector, but might raise the price of departing with liquidity (money), i.e. the interest rate, depending on their own liquidity preference schedule and balance sheet considerations. As a result, even in the presence of a totally accommodative money supply, monetary authorities will not be able to exert total control over domestic interest rates.

Lavoie's and Kregel's different interpretations of Keynes' writings on the forward foreign exchange market seem to reflect exactly this divide. For Lavoie, adopting a horizontalist standpoint, it is important to show that even in an open economy in the presence of freedom of capital movements, central banks maintain the autonomy to set interest rates. Interest rates are a policy variable and not the outcome of private sector portfolio decisions. This means that exchange rate expectations have to be immediately reflected in the spot rate and the forward rate is marked with an exogenously given interest rate differential. Kregel, in turn, assumes a role for liquidity preference, which means that expected monetary conditions (or exchange rate expectations) are reflected in the interest rate through private sector portfolio decisions.

Empirical evidence shows that both views are right at certain times. Keynes "own rate of interest", with its emphasis on both the short-term speculative moment, represented by the yield and expected exchange rate appreciation, and the more structural liquidity premium component, can account for this. At times where the liquidity premium is constant, or changes only slowly, interest rates and/or expected exchange rate changes become the driving moment of currency demand. This has been the case, for example, in the recent carry trade period, where high interest rates and expected exchange rate appreciation have led to continuous exchange rate appreciation. On the other hand, a substantial change in a currency's liquidity premium (or liquidity preference) might require an adjustment in interest rates to maintain the demand for the currency. This is particularly the case in the moment of crisis.

One caveat could be applied to this argument. In an important paper Lavoie (1996) argues that the different views of liquidity preference presented above are primarily one of nuances and depend significantly on the type of interest rate under consideration. In this vein, he holds that while Post Keynesians might disagree about the spread between the base rate and lending rate, i.e. the role of banks' liquidity preference schedule, most would agree that the central bank rate can be considered exogenous, because the central bank, as sole issuer of legal tender, can accommodate any increased demand for money through rising bank reserves, i.e. money supply (Lavoie 1996). In his discussion of the forward foreign exchange market Keynes, however, focused on short-term money market rates which move very closely to the base rate, which would support Lavoie's Cambist view presented in Section 3.

This argument, however, hinges fundamentally on the assumption that the central bank can accommodate any rising demand for money, which might not hold in the international context. Indeed, in the international context only one central bank, the issuer of the currency with the highest liquidity premium, can totally accommodate a rising demand for money. All other central banks will be constrained by their “money holdings”, i.e. their foreign exchange reserves. This might make it necessary to increase the base rate in the face of changing liquidity preference and/or a deterioration in the currency’s liquidity premium.

Finally, Keynes’ “own rate of interest” and the incorporation of a liquidity premium, can also account for the failure of UIP without the ad-hoc addition of a risk premium. Assuming that a currency’s yield is primarily constituted by short-term interest rates in international money markets (as indeed Keynes did in the *Tract*) and rewriting capital appreciation as the more familiar exchange rate appreciation⁵⁷, equation (3.5) becomes

$$(3.6) \quad (i - c) - (e^e - e) + l = l^*$$

We further assume that the interest rate on *the* money is not zero and ignore carrying costs for the moment.⁵⁸

$$(3.7) \quad i - (e^e - e) + l = l^* + i^*$$

Reformulating we get something very close to UIP

$$(3.8) \quad (i - i^*) = (e^e - e) + (l^* - l)$$

Equation (3.8) shows that even if agents form their expectations in line with interest parity, they might not fulfil them given the differential liquidity premia of currencies. Thus, as in the Cambist view, the forward rate, which now also incorporates this differential in currencies’ liquidity premia, cannot be a good predictor of the future spot

⁵⁷The sign for the expected exchange rate is negative, because depreciation reflects an increase in the exchange rate.

⁵⁸ The interest rate of *the* money of the system does not have to be zero, but should only the lowest among all currencies.

rate. In addition, although assuming a similar function to mainstream's risk premium, the existence of a liquidity premium is not an ad-hoc addition in a Post Keynesian framework of fundamental uncertainty and, as will be discussed in more detail below, allows for a theoretically substantiated specification of its determinants.

However, this possible consistency notwithstanding, in the Post Keynesian view presented in this dissertation the currency is not a relative price, which establishes equilibrium in an underlying market, but an asset driven by its net return relative to other currencies. The elements of this net return will be discussed in the following sections.

3.5.1. Short-term Returns: Yield and Expected Appreciation

Short-term returns on domestic currency (investments) are crucial to explain exchange rate dynamics in DECs once the domestic currency is considered to be an international asset class. While domestic money is held because of its liquidity premium, the currency as international money might have to offer higher returns to (international) investors to compensate for its lower liquidity premium relative to other currencies. In a similar vein, differential returns on currency holdings might become the driving factor of exchange rate movements in the face of a stable or only slowly changing liquidity premium.

Short-term returns are constituted by a currency's yield (q) and expected capital gains on the exchange rate itself, i.e. expected exchange rate appreciation ($a = e^e - e$).⁵⁹In Keynes' writings on the forward foreign exchange market the yields on currencies are short-term interest rates in international money markets. However, the domestic currency is not only an asset class per se, but as unit of account also denominates all domestic assets and contracts. Short-term financial flows into domestic currency assets might not only be directed towards short-term bank deposits, but will also be targeted at short-term domestic currency instruments such as bonds or equities. In this case, returns on these financial instruments will replace money market rates as the main yield on the domestic currency investment. The exact financial instrument and return considered will

⁵⁹Carrying costs (c) are of less importance for money and financial instruments and will thus be assumed *nil* in this dissertation.

depend on the country under consideration and the nature of its integration in international financial markets. However, these instruments will be characterised by a high degree of liquidity which make them close enough in their properties to money to interpret them as an investment in the domestic currency.⁶⁰

The second return element in the case of short-term domestic currency investments is expected changes in the currency itself (Davidson 1999). In line with Harvey's writings on the foreign exchange market, the formation of these exchange rate expectations will be context and time specific, primarily anchored by social conventions. These conventions, in turn, will be shaped by the specific structure and institutions of the market, its dominant actors, the extent and nature of integration in the world economy etc. In addition, given the reigning uncertainty, social conventions can be subject to sudden changes depending on psychological processes described by Keynes in its famous "beauty contest" and animal spirits, which can lead to trading behaviour characterised by herding, momentum or simple feedback trading (Kahneman and Tversky 1974; Harvey 2009). Thus, these exchange rate expectations come closer to the psychological processes described in behavioural finance or "animal spirits" in Post Keynesian finance theory. This dissertation does not exclude this kind of expectations, but complements them with underlying mechanisms, i.e. element of a currency's own rate of interest, which frequently shape actors' expectations and thus exchange rates.

3.5.2. The Liquidity Premium

The single focus on short-term return considerations does not satisfactorily capture the complex nature and role of money in economic relations. In Keynes' writings money is held because it is a secure abode of purchasing power which transfers wealth in a world of uncertainty and allows meeting contractual obligations. More concretely, adopting a view of the exchange rate as international money and recognising liquidity preference theory as a general theory of asset choice, the demand for domestic currency and thus exchange rate dynamics is determined by the ability of domestic money to meet the three motives of holding liquidity – the transactions motive, the speculative motive and the precautionary motive – relative to other currencies. This is either the result of a

⁶⁰Keynes (1997) himself pointed out that the line between "money" and "debts" can be drawn at whatever point is most convenient for handling a particular problem.

currency's own ability to act as a stable unit of account and store of value, and thus general denominator of contractual obligations, or by the "institutional" liquidity provided by the market, which allows investors to exchange the domestic currency into the money of the system without cost and loss of value. As mentioned above, given this dissertation's emphasis on financial operations, emphasis will be on the speculative and precautionary motive.

Indeed, the emphasis on currencies' differential liquidity premia highlights the structured and hierarchical nature of the international monetary system.⁶¹ While in a closed economy domestic money is the most liquid asset, in the international context this role might be fulfilled by another currency, which better fulfils international monetary functions and acts as the international medium of contractual settlement. For its liquidity, *the* money of the system is used in trade transactions, it is the main denominator of international credit relations and international funding currency and acts as the major reserve currency. In Keynes' time this role was assumed by the Pound Sterling, nowadays it is occupied by the US\$. The hierarchical system also knows intermediate currencies, fully convertible with high liquidity premia and able to defend the external value of the currency with interest rate changes. At the bottom of the system are unstable currencies with a low reputation in their ability to act as a stable store of value and unit of account and often prohibitively high interest rates to induce wealth holders to maintain demand for the domestic currency (Herr 1992).

In addition, the emphasis on a currency's liquidity premium allows one to highlight both the endogenous and exogenous determinants of such a premium and consequently exchange rate dynamics. As to the exogenous component, Dow (1999) emphasizes that very often exchange rate changes are unrelated to domestic economic conditions, but entirely the result of changes in international liquidity preference. These changes will be particularly marked for currencies with a lower liquidity premium. The endogenous components of a currency's liquidity premium can be derived from the motives of holding money. While the speculative motive is analytically still closer to the short-term return elements, the precautionary motive draws attention to the structural determinants of a currency's liquidity premium.

⁶¹ This structural component of the international monetary system is also highlighted by Marx (1967) in his writings on „world money“ (Itoh and Lapavitsas 1999).

3.5.2.1. The Speculative Motive

Speculation and the speculator are important themes in Keynes' *General Theory*. In the context of the liquidity preference theory of Chapters 13 and 15, speculation about future interest rates and thus bond prices establishes the important link between money demand and the interest rate. In Ch. 12 on the state of long-term expectations, Keynes establishes the famous distinction between the purchase of securities for resale at a higher price, which he termed speculation, and enterprise, buying securities for long-term income (Toporowski 2005).

In both cases speculation is discussed with reference to a specific market (the bond and money market on the one hand and securities on the other) and does not form an element of a general theory of asset demand. However, as Chick (1983) points out: "there is no reason to limit one's speculation to this kind of asset. In a broad sense, anyone holding an asset with any thought of future re-sale is speculating, taking an open position in something which may gain or lose capital value - as money itself does, in terms of purchasing power, when the price level varies. Speculation needs only two things: a lively market and sufficient variation in prices to make the game worth playing" (p. 209).

According to Toporowski (2005), Kaldor's (1939) famous paper "Speculation and Economic Activity" attempts to present such a general theory of speculative asset demand by making Keynes' liquidity preference theory consistent with his analysis of speculation in Ch. 12. Kaldor does so by referring to Ch. 17 of the *General Theory*, Keynes' "own rate of interest", which, for him, was an explanation of speculative behaviour.⁶²

Kaldor argues that an asset has to have two main properties to be demanded for speculative purposes: low carrying costs and a perfect or semi-perfect market. The condition of low carrying costs is framed with reference to Keynes' "own rate of own

⁶² Speculation is defined in very similar terms to Keynes as „the purchase (or sale) of goods with a view to re-sale (re-purchase) at a later date, where the motive behind such action is the expectation of a change in the relevant prices relatively to the ruling price and not a gain accruing through their use, or any kind of transformation effected in them or their transfer between different markets“ (Kaldor 1939: 17).

interest". Leaving liquidity premium aside, net carrying costs, defined as carrying costs minus the yield of an asset ($c-q$), are the significant concept for explaining the existence of speculation in certain goods. The emphasis on net carrying costs implies that assets used for speculation have to be perfectly durable and their value has to be high in proportion to bulk. In addition, their yield has to be independent of the speculative stock held, which assures that net carrying cost can never be positive and are negative in the majority of the cases (Kaldor 1939).

Kaldor's emphasis on net carrying costs is consistent with a view of speculation defined as generating returns from capital gains rather than income. By adopting Keynes' original "own rate of own interest", which measures an asset's return in terms of itself, he, however, explicitly excludes "any return due to appreciation of value (in terms of some standard) whether expected or unexpected" (Kaldor 1939: 20). This chapter, in turn, has expressed Keynes' "own rate of interest" in terms of a reference asset: money. This has made (expected) appreciation in relation to this reference asset an important part of returns, which, as has indeed been done by Davidson (1999), could be seen as an important conditioner of speculative asset demand.

The second attribute required to make a good a suitable object of speculation is a "perfect or semi-perfect market". This presupposes that the good must be capable of full standardisation and an article of general demand. Importantly, Kaldor's perfect market is not to be understood in the sense of the efficient market paradigm, but has to be seen in the sense of "perfect marketability", i.e. "goods which can be sold at any time for the same price, or nearly the same price at which they can be bought" (Kaldor 1939: 22). In this sense, Kaldor argues it comes close to what Keynes refers to as "liquidity" in certain parts of the *General Theory*. As such, it is also very similar to the "institutional" liquidity discussed in this dissertation.

Both conditions, Kaldor argues, are especially satisfied by future claims or titles to property, bonds and shares. Their low carrying costs and the existence of liquid markets make financial assets, including foreign exchange, primary objects of speculation.⁶³This

⁶³A slightly different application of Keynes' speculative demand to the international context is presented by Dow (1999). Dow sticks closer to the original definition of the speculative demand for money and

point is also made by Chick (1983), who argues that as a result of their lower transaction costs, active markets and huge potential gains, foreign exchange has become a prime speculative target in recent years.⁶⁴

Kaldor's and Chick's discussions of speculation focus on the asset side of international balance sheets. The emphasis is slightly different in Minsky's (1975) treatment of the speculative motive where future developments of asset prices are crucial to generate a cash flow to meet outstanding obligations. This emphasis on the liability side of balance sheets, and the precautionary element of money demand, form the second element of a currency's liquidity premium which will be discussed in the next section.

3.5.2.2. The Precautionary Motive

Monetary Keynesians after Hajo Riese (1986; 2001), such as Herr (1992), Lüken genannt Klaffen (1993) or Herr and Hübner (2005), explicitly reject the notion that exchange rates are driven only by short-term speculative expectations, primarily governed by animal spirits. For these authors, demand for a currency is fundamentally determined by investors' medium term assessment of its "currency premium". This currency premium, in turn, is the result of a currency's ability to store wealth relative to other currencies. Based on this view, Herr (1992) specifies "Keynesian fundamentals", which reflect a country's expected economic policy and its commitment to maintain the stability of the currency. This includes factors such as the willingness and ability to fight inflation, defend the currency in a crisis, or the exchange rate regime in place. Expectations about these factors are formed through social conventions and ultimately depend on the specific institutional and socio-economic context of the country in question. In addition, currencies' differential ability to store wealth and their position in the international monetary system is fundamentally determined by the size of a country's financial market and the currencies' existing radius of operation. Finally, this

argues that US\$ are held to take advantage of speculative gains in other currencies and/or short-term financial assets.

⁶⁴Chick, however, is also concerned about the theoretical significance of speculation in an asset. For her, "the theoretical importance of speculation in the *General Theory* was that it provided a theory of the general level of interest rates" (p. 209). This chapter has shown that this reasoning could be applied to the international context as the domestic central bank is restricted by its foreign exchange reserves to accommodate demand for "money", which makes, at least under certain conditions, the interest rate an outcome of private sector portfolio decisions.

monetary and financial power has to be complemented with some level of political and economic dominance.

The ability to store wealth is an important element of a currency's liquidity premium. However, this dissertation argues that focusing solely on the asset side of international balance sheets has a few shortcomings. Firstly, it does not entirely explain the position of a currency on the top of the international currency hierarchy. There are many value stable currencies, but only one stands at the apex of the international currency hierarchy. As such, it also does not entirely explain why a country's political and economic power make its currency *the* money of the system. Secondly, this chapter argues, that the single focus on the store of wealth function misses the important structural and relational aspects of international finance. Money is credit money which establishes relations between debtors and creditors. These relations have important repercussions on the position of a currency in the international monetary system. In this vein, one could also argue that the emphasis on the store of wealth function makes it difficult to specify structural, underlying factors which determine a currency's liquidity premium, other than the central bank's commitment to maintain the value of the currency.

Following Minsky (1975) this dissertation emphasises the liability side of international balance sheets. According to Minsky (1975), capital asset pricing and portfolio decision theories should take into account the liability positions that are interrelated with asset positions given that "...a portfolio decision has two interdependent facets. The first relates to what assets are to be held, controlled, or acquired; the second relates to how the position in these assets – i.e., their ownership or control – is to be financed" (p. 70). As such, this chapter stressed the role of money as unit of account and denominator of contractual obligations, particularly debt obligations. In this view, a currency's liquidity premium is determined by its ability to meet outstanding obligations. In the domestic context this is the ability to convert an investment anytime and without loss of value into money, the unit of account and denominator of contractual obligations. In an open economy, liquidity becomes the ability to convert domestic assets into the currency with which positions in these assets have been funded and transfer the foreign currency abroad to meet external obligations.

This emphasis on the liability side of international balance sheets does not only help to explain a currency's position on the top of the international currency hierarchy, but also allows one to specify structural factors which determine a currency's liquidity premium, particularly in the context of DECs.

As to the former, historical evidence shows that both currencies at the pinnacle of the international monetary system, the Pound Sterling and US\$, were the two main creditor currencies of their times (Keynes 1971a; Keynes 1971b; Kregel 1982; Herr 1992; Minsky 1993). Both countries registered large medium to long-term capital outflows, whose income financed (eventual) deficits on the trade balance. Yet, while economic agents cannot be forced to hold their assets in particular currencies, they can be forced to assume their liabilities in them. The economic and political power of the UK then, and US nowadays, made them the primary source of credits in the world economy and their currencies the main creditor currencies. However, "as eventually international indebtedness will be denominated in the currencies of the countries with large offshore assets, they must also accept that their currency will be a reserve currency of their debtors, for it is convenient to hold liquid assets in the currency in which your debts are denominated" (Minsky 1993). Indeed, both countries were also net short-term debtors as international investors sought the security and liquidity of the international reserve currency.⁶⁵

As a result of path dependency and the primacy of their financial sectors, the Pound Sterling, and nowadays the US\$, remained the main denominators of international debt contracts and reserve currencies even after their countries ceased to be the main creditor nations. Herr and Hübner show that in 2003 more than 60% of all credits given by banks outside the Euro area were denominated in US\$, while other "reserve" currencies, such as the Japanese Yen or Swiss Franc only played minor roles in international credit relations (Herr and Hübner 2005: 105). The currencies' primacy in denominating international financial transactions and acting as main international funding currencies, in turn, cemented their leading role in the international financial system. For example, given the quantity of financial institutions' liabilities denominated in US\$, any change

⁶⁵In this vein, Herr (1992) argues that the country with the reserve currency acts like a bank performing maturity transformation for the international monetary system as it accepts short-term liabilities and transforms them into longer term assets.

in international funding conditions, e.g. as a result of an adjustment in international liquidity preference, increases the demand for US\$, which, in turn, supports its value stability and reinforces its role as international reserve currency. This inherent demand and value stability puts it on top of the currency hierarchy and reduces the liquidity premium of other currencies against it.⁶⁶

The reduction in a currency's liquidity premium vis-à-vis the main funding currency will be more marked the higher the potential funding needs. Thus, in line with the theoretical argument presented above, investors' perceptions about a currency's liquidity premium will be fundamentally influenced by its ability to meet outstanding external obligations. According to this dissertation, three structural factors determine this ability, i.e. a currency's liquidity premium.

The first is a country's total stock of net (short-term) external obligations; traditionally, the link between exchange rate dynamics and a country's external liabilities has been analysed in the context of foreign currency denominated debt obligations (e.g. Chang and Velasco 1998; Radelet, Sachs et al. 1998; Rodrik and Velasco 1999; Boyer, Dehove et al. 2004; Kregel 2004). Smithin (2002-03), Smithin and Kam (2004) and Paraskevopolous, Paschakiset al. (1996) explicitly endogenise a currency's liquidity premium according to a country's ratio of foreign debt to GDP. In the face of foreign currency denominated debt, exchange rate changes have an immediate effect on a country's real debt burden and debt servicing costs, potentially leading to illiquidity or even solvency problems. In addition, liabilities denominated in foreign currency exert a latent depreciation pressure on the currency in order to generate the foreign exchange necessary for debt service (including both interest payments and amortisations).⁶⁷ This pressure can be exacerbated in the presence of a large share of short-term debt if quick repayment is demanded by international investors.

⁶⁶However, a country cannot be a large net (short-term) debtor and maintain its currency's position as international reserve currency indefinitely. Indeed, as already pointed out by Triffin in the 1960s in the context of the gold standard, the increasing (short-term) debt of the reserve country will ultimately put the primacy of its currency in doubt. Mateos y Lago, Duttagupta et al. (2009) argue that a similar mechanism has been in place in the current system of floating exchange rates and large global imbalances, which increasingly questioned the role of the US\$ as *the* currency of the system. For a recent discussion on the future of the international monetary system see, for example, Williamson (2010), Stiglitz and Greenwald (2010) or Wyplosz (2010).

⁶⁷This transfer problem has already been pointed out by Keynes in the context of Germany's reparation payments. For a more recent discussion see Milesi-Fereti (2004).

This dissertation, however, would argue that it is not just external currency debt, but any form of net (short-term) external liabilities, i.e. (short-term) domestic assets held by foreign investors, which undermine a currency's liquidity premium through either large and abrupt exchange rate movements and/or the underlying need to generate foreign exchange. Any foreign investment in domestic currency assets, which has been funded in international financial markets, has an immediate effect on the exchange rate as investors convert foreign (primarily US\$) into domestic currency (and vice versa). As such, an external liability position in the international financial system, even if it is in domestic currency, maintains the possibility of large and abrupt exchange rate changes when international investors sell their domestic assets. This undermines a currency's ability to act as a stable unit of account.⁶⁸ Such structural pressure on a currency's liquidity premium will be higher the shorter the maturity of a country's net external liabilities as these can be immediately reversed. In addition to these immediate depreciation pressures, a country's payment commitments on its outstanding liabilities, such as debt service payments but also dividends and profit repatriations, will continue to maintain a constant demand for foreign exchange.⁶⁹

Furthermore, although most obvious in the case of foreign investment in domestic assets, any sizable currency mismatch in agents' balance sheets can lead to abrupt and severe exchange rate movements, thus undermining a currency's liquidity premium. In other words, this dissertation argues that it is the entire net short-term foreign liabilities of a country which determine its currency liquidity premium. This would, for example, also include domestic actors assuming (short-term) foreign liabilities to invest/speculate in domestic assets.

The emphasis on the liability side of (international) investors' balance sheets also highlights the importance of international market conditions in driving exchange rate

⁶⁸Exchange rate volatility might even increase in the presence of foreign investment in domestic currency asset as the exchange rate risk is borne by the foreign investors, which is likely to increase their sensitivity to expected exchange rate changes.

⁶⁹In theory, the demand for foreign exchange generated by profit and dividend remittances should depend more on the economic conditions of a country and thus act countercyclical. In addition, it is expected that parts of these commitments will be reinvested in the country. Nevertheless, even profit and dividend remittances create foreign liabilities which weigh on a country's balance of payments (e.g. Lehmann 2002; Paulani 2008). In addition, balance of payments data from Brazil shows that profits and dividends from previous equity investments did not act countercyclical in the crisis.

dynamics in DECs. The exposure of foreign investors to domestic assets, funded in international financial markets, tightens the link between international market conditions and domestic asset price movements, as any change in international funding conditions can lead to an immediate sell off of domestic assets, entirely unrelated to domestic economic conditions. As outlined above, this sensitivity will be higher, the lower the liquidity premium, i.e. the larger the stock and the shorter the maturity of foreign investments in domestic assets.

The second and third structural element of its currency's liquidity premium are determined by a country's ability to meet its outstanding liabilities through "forcing a cash flow in its favour" (Minsky 1975; Minsky 1986). These liabilities include, on the one hand, the permanent payment commitments set up by the stock of existing liabilities and, on the other hand, the existing stock of short-term net foreign liabilities that can be converted into foreign currency any time.⁷⁰ According to Minsky, this cash flow can be generated either through the income generation process (including income from previous lending) and/or dealing and trading in capital assets and financial instruments.

As to the former, Minsky (1993) argues that liquidity is not just the characteristic of assets; it is also a flow concept in that assured periodic flows of income "liquidify" households, business and governments. In the international context, this becomes the ability to generate the necessary foreign exchange to meet one's payment commitments without sharp changes in the exchange rate (Herr and Hübner 2005). For both Minsky (1993) and Herr (1992), this "foreign exchange productivity" is a function of balance of payments flows. Minsky divides the balance of payments into four tiers depending on the flows' ex-ante determinateness: Tier 1 includes all payment commitments on debts.⁷¹; Tier 2 comprises the balance of trade; Tier 3 long-term capital movements and Tier 4 short-term capital movements, where the latter acts as a regulating factor to restore equilibrium in the balance of payments.⁷² In the case of a debtor country, Tier 1

⁷⁰Indeed, Minsky incorporates a unit's liability structure in Keynes' own rate of interest equation by interpreting carrying costs as the payment commitments set up by a unit's liabilities. These, however, are more narrowly defined than in this dissertation and refer primarily to debt service payments.

⁷¹Minsky does not consider payment commitments in the form of dividends and/or profit remittances. Herr (1992) does so, but subsumes them under Tier 2. Given that these flows represent permanent payment commitments this chapter would classify them under Tier 1.

⁷²However, Minsky (1993) also acknowledges the autonomous nature of short-term capital flows driven by speculative motivations, which can have important effects on the exchange rate.

is in chronic deficit, which has to be covered by Tier 2 flows. If the balance on Tier 1 and Tier 2, i.e. the current account, is in deficit, foreign exchange has to be generated through (short-term) capital movements. These flows, however, weigh on a currency's liquidity premium, through increasing its net foreign liabilities and Tier 1 payments. Thus, following this view, a country's ability to meet its foreign obligations through trade surpluses (or indeed profit and remittances from previous long-term capital flows), i.e. an equilibrated or positive current account as its autonomous source of foreign exchange, becomes another important indicator of its currency's liquidity premium.

Finally, if current cash flows are insufficient to meet outstanding obligations, the ability to "make positions", i.e. to refinance existing debt and/or to liquidate assets, becomes an important determinant of an asset's liquidity (Minsky 1986; Tymoigne 2006). In the international context this becomes the ability to quickly and at low cost convert the domestic asset into the funding currency. This, in turn, brings the "institutional" liquidity of a market to the fore. As discussed in Section 4, this institutional liquidity comprises a myriad of factors, including the properties of an asset itself, the structure of a market, and the agents operating in this market. The existence of a market maker, which is able to provide liquidity to the market and avoid excessive price movements, is a crucial element of this institutional liquidity. In the money and foreign exchange market, this market maker is constituted by the central bank. However, while in domestic currency the central bank can act as a lender of last resort, this ability is limited in the case of foreign exchange. As a consequence, the central bank's stock of foreign exchange, particularly of the funding currency, becomes an important determinant of its ability to provide liquidity in foreign exchange. In addition, this liquidity provision will be fundamentally shaped by the existing exchange rate regime, which determines the central bank's "commitment" to operate in the foreign exchange market.

In sum, these three factors of a currency's liquidity premium, its net (short-term) foreign liabilities, the cash flow to meet these liabilities, and the institutional liquidity of a market, are important underlying mechanisms shaping the expectation formation and positions of economic actors in short-term financial and currency markets. On the one hand, balance sheet adjustment by international investors (or indeed by domestic investors with foreign currency obligations) can lead to sizable exchange rate

movements. On the other hand, these three factors influence agents' perceptions about some form of "medium-term" or "sustainable" exchange rate value.

Again this view of economic dynamics is close to Minsky's. Minsky does not define an equilibrium situation, but he is quite explicit about the sustainability of an economic situation, which is characterized by the existing financial commitments of economic units. In his view, a "critical element in explaining why financial instability occurs is the development over historical time of liability structures that cannot be validated by market determined cash flows or asset values" (Minsky 1982: 13). The more dependent an economic unit is on portfolio operations rather than cash flows to meet its outstanding obligations, the more fragile, i.e. unsustainable, the situation. This is exacerbated in the presence of maturity mismatches, e.g. in the presence of a large share of short-term financing (Minsky 1992).⁷³

Importantly, these financial structures and balance sheet configurations create economic conditions which define a stable or "sustainable" economic situation. However, this does not mean that the economy (or the exchange rate) will ever come to rest at this point. For authors, who stress the pervasiveness of uncertainty in Keynes' economic system, "sustainable" or long-period values only affect prices through (long-run) expectations, i.e. as future values anticipated in the present. "Keynes (and this Post Keynesian group), therefore, could not recognize any role for long run positions which could be established as gravity centres. The economy does not *tend* to anything over calendar time" (Carvalho 1984-1985: 224). Short-run positions might be influenced by deviations from the "long-period", but there is no determinate tendency to achieve this point.⁷⁴ This also means that perceptions about the appropriate financial structure and financial commitments can vary substantially over the business cycle (e.g. Minsky 1986).⁷⁵

⁷³It is important to note, that this dissertation is not trying to apply Minsky's financial instability hypothesis to the open economy. Minsky's theory was quite explicitly about capitalist firms, investment and the acquisition of capital assets. What this dissertation takes from Minsky, however, is the importance of balance sheet considerations in shaping economic dynamics.

⁷⁴This interpretation is consistent with Keynes' first definition of equilibrium that "...relates to a position toward which forces spring up to influence the short-period position whenever the latter has diverged from it" (Carvalho 1990).

⁷⁵It is important to point out that the long-period or "equilibrium value" envisaged by the market might differ considerably from what is judged to be an appropriate exchange rate value from the perspective of the policy maker.

3.5.3. Implications

DECs' history as international debtor countries has undermined the liquidity premium of their currencies and has placed them at the bottom of the international currency hierarchy. Even if selected countries have managed to denominate their debts in domestic currency (or depend increasingly on non-debt generating capital inflows such as flows to the domestic stock market) the liquidity premium of their currencies has remained undermined by a large level of short-term net foreign liabilities funded in international financial markets in the main funding currency, nowadays the US\$. This has maintained their dependence on international market conditions and their currencies' vulnerability to sudden and abrupt exchange rate changes, which has continued to undermine their liquidity premium. The lower liquidity premium of DECs' currencies and the existence of a hierarchical international monetary system, in turn, have important implications for the international and domestic macroeconomic configuration of these countries.

Firstly, as expressed in Keynes' "own rate of interest", the lower liquidity premium of their currencies might require DECs to offer higher interest rates to the investor community to maintain demand for their currencies. This is particularly evident in times of crisis when liquidity preference increases and the currencies' ability to act as a stable unit of account is put into doubt. Higher interest rates might prevent countries from using monetary policy for domestic economic considerations and hamper the accumulation process (Herr 1992). Just like money in the closed economy, the currency with the highest liquidity premium can offer the lowest pecuniary return and target monetary policy to domestic economic conditions.⁷⁶ Beyond this, the return on *the* money of the system acts as a reference point for the return of all other assets (currencies) in the system as "money rules the roost". Thus, changes in monetary conditions in the core country will affect the relative return, and thus monetary conditions, of all other currencies in the system, particularly those with lower liquidity premia.

⁷⁶This is the "exorbitant privilege" as de Gaulle called it (Williamson 2010).

Secondly, it is the endogenous nature of financial flows and ultimately DECs' integration into international financial markets which create the vulnerabilities that lead to large exchange rate movements. Foreign financial flows generate a country's stock of outstanding obligations and hence shape their own behaviour by affecting a currency's liquidity premium. Thus, it is the financial flows themselves which create the conditions that determine their own behaviour (Painceira and Carcanholo 2004). Again, this argument closely follows Minsky's view of the workings of a capitalist system, as decisions taken by economic units endogenously change the financial structure of an economy creating fragilities which can turn into unstable dynamics. The emphasis on a country's net foreign (short-term) obligations as important driver of exchange rate movements also implies that maintaining good macroeconomic "fundamentals", e.g. low inflation, prudent fiscal situation etc., might prove futile to reduce exchange rate volatility. On the contrary, good macroeconomic fundamentals might increase exchange rate volatility through attracting more (short-term) financial inflows, which in turn increase the country's stock of (short-term) net foreign obligations.

Thirdly, the destabilizing nature of (short-term) financial flows implies that DECs might find it difficult to progress from the lower level of the international currency hierarchy. As a result of their currencies' lower liquidity premia very few DECs are able to issue debt in their own currencies. Foreign currency debt, however, exerts structural depreciation pressure which continues to undermine their currencies' liquidity premia.⁷⁷ However, even if countries manage to denominate their debt in domestic currency or attract non-debt generating financial flows, these flows remain predominantly of a short-term nature. The lower liquidity premium of DECs' currencies requires them to offer higher interest rates and/or increase the "institutional" liquidity of their markets. One important element of this "institutional" liquidity is the nature of the financial flows themselves, i.e. their maturity; the shorter the maturity the easier the reversal of resources abroad to meet outstanding obligations. Thus, the result of DECs' lower liquidity premia is a preponderance of short-term financial flows, perpetuating these currencies' lower liquidity premia through the risk of sudden and large reversals.

⁷⁷ Thus, it is DECs' position in a hierarchical international monetary system rather than their "original sin" (Eichengreen, Hausmann et al. 2003; McKinnon and Schnabl 2004), which makes it difficult for these countries to denominate their debt in domestic currency.

Finally, the acknowledgment that a country's monetary configuration and exchange rate dynamics are the result of an endogenously determined liquidity premium also leaves space for economic policy. In this vein, Smithin (2002-03) and Smithin and Kam (2004) argue that a country's ability to reduce its net debtor status will allow it to permanently reduce interest rates and manage them with the domestic economy in mind. Following the broader approach adopted in this dissertation, this would require a reduction in DECs' net short-term foreign liabilities to increase monetary policy autonomy, reduce external vulnerability and reduce the importance of international market conditions for exchange rate determination. This would be particularly vital for DECs, given their structurally lower liquidity premia. In more concrete terms, this would call for a more cautious stance towards financial liberalization, particularly with regards to short-term destabilizing financial flows – an issue which will be discussed in more detail in the concluding chapter of this dissertation.

3.6. Conclusions

This chapter has presented an alternative analytical framework of exchange rate determination in DECs. It has extended existing Post Keynesian exchange rate theory with the critical realist ontological claim of deeper structures and mechanisms, which were formulated with respect to one of the most important institutions in Post Keynesian theory in the presence of fundamental uncertainty: money.

Based on Keynes' writings on the forward foreign exchange market, liquidity preference theory and "own rate of interest", the chapter has argued that the currency, as international money, should be interpreted as an international asset class whose demand is determined by investors' expectations about its net return relative to other currencies, primarily the currency with the highest liquidity premium. This return is constituted by two main elements: firstly, pecuniary returns, which are constituted by returns on short-term financial instruments, denominated in domestic currency, and expected capital gains on the exchange rate itself; secondly, a currency's liquidity premium, which is conditioned by a country's ability to meet its outstanding external obligations. This ability is determined by a country's total net (short-term) foreign liabilities and its capacity to meet these liabilities through (a) its "foreign exchange productivity", primarily the current account, and (b) the "institutional" liquidity of a market which

allows investors to quickly sell their assets and convert them into the funding currency. In addition, Keynes' liquidity preference theory accounts for exchange rate changes due to exogenous shifts in liquidity preference, which will be more marked the lower a currency's liquidity premium. These real underlying mechanisms primarily affect currency prices through the expectations and positions of economic agents, formed under uncertainty, in short-term financial and currency markets. This implies that the exact manifestations of short-term returns and a currency's liquidity premium will depend on the specific market under consideration and/or might not be apparent at all. In addition, no convergence to these factors is guaranteed.

The application of Keynes' liquidity preference theory and "own rate of interest" to exchange rate dynamics in DECs can theoretically accommodate a series of empirical phenomena. Firstly, it theoretically substantiates the important role of short-term interest rates for exchange rate determination in DECs and the changing empirical causality between interest rate and exchange rate movements. Secondly, Keynes' liquidity preference theory points to the existence of a structured and hierarchical international monetary system resulting from currencies' differential liquidity premia. This hierarchic monetary system has important implications for the macroeconomic configuration and exchange rate dynamics in DECs, ranging from sustained higher interest rates and sensitivity to international market conditions to path dependent and self-feeding processes. Thirdly, the emphasis on the liability side of international balance sheets in the definition of liquidity highlights the important role of financial structure and credit relations in accounting for countries' different positions in this hierarchical international monetary system and exchange rate determination in DECs. The emphasis on financial structure also highlights the endogeneity of financial processes, as it is the financial themselves flows which create the external liabilities that subsequently shape financial flows' behaviour through their effect on a currency's liquidity premium. Finally, the emphasis on an endogenously determined liquidity premium has potentially important policy implications, primarily with respect to DECs' integration path in international financial markets.

There are, of course, several shortcomings to this view of exchange rate determination. Firstly, the focus on short-term financial flows ignores operations of other agents in the foreign exchange markets, e.g. foreign direct investment or exporters and importers,

which would have to be included to generate a full picture of exchange rate determination in DECs. Secondly, as already mentioned above, even if the focus is entirely on short-term financial flows one has to be careful about making generalisation of motivations across the different actors and types of financial flows. Different institutions can have different motivations to hold DECs' assets which will determine the factors they consider for their investment/trading decisions. Elements of this heterogeneity will be uncovered with the semi-structured interviews presented in Chapter 7. Particular emphasis will lie on the distinction between onshore and offshore financial investors. This is justified by the analytical focus on the internationalisation process and its implications for exchange rate dynamics highlighted in this dissertation.

Chapter 4: The Internationalisation of the Brazilian Real and its Implications for Exchange Rate Dynamics

4.1. Introduction

Chapter 3 has outlined an alternative framework for analysing exchange rate determination DECs. Based on Post Keynesian economic thought, and the view of the currency as international money, it particularly stressed the importance of short-term financial returns and a currency's liquidity premium in shaping investors' demand for the currency and thus exchange rate dynamics. This emphasis on financial considerations in determining exchange rates in emerging markets and the theoretical focus on the domestic currency as international asset is particularly warranted given a very recent process in international finance: the internationalisation of emerging market currencies, i.e. the increased use of emerging market currencies as international store of wealth and speculative asset. In the Brazilian market, this process had two manifestations: firstly, the increased holding and trading of short-term domestic currency denominated assets by foreign investors and secondly the trading of the currency as international asset class per se.

This chapter presents a detailed discussion of the internationalisation process of the Brazilian Real. This process started in 2003, when liquidity returned to international financial markets, and accelerated during the international financial crisis as investors sought high yielding and liquid assets. Moreover, data show that the internationalisation of the Brazilian Real has continued since. Thus, over recent years, Brazilian assets have become a standard part of international portfolios. This quantitative expansion side, the recent wave of foreign capital to Brazilian assets was characterised by two important qualitative changes.⁷⁸ Firstly, it was directed increasingly at financial instruments for which capital gains, i.e. trading profits, are an important part of returns. This included increased foreign investments in the domestic stock market and, of particular interest for this dissertation, currency trading. Consequently, this chapter argues that Brazil's

⁷⁸As outlined above a large share of foreign financial flows into domestic currency assets in Brazil are still channelled through the balance of payments. In addition, many offshore operations find a counterpart in balance of payments flows through hedging operations. This makes short-term capital flows through the balance of payments still the focal point of the analysis in the Brazilian case.

financial system has experienced a new stage of integration in international financial markets: in contrast to previous experiences with short-term capital flows, which were primarily thought of as *investment* in emerging countries, Brazilian assets have also become international *trading* instruments. Secondly, a large share of foreign flows were directed towards (short-term) domestic currency instruments, such as domestic currency bonds and equities, but also the domestic currency as international asset class per se.

The increased exposure of foreign investors to short-term domestic currency instruments, however, has had important implications for exchange rate dynamics. On the one hand, exchange rate movements have become exacerbated both on the appreciation as well as on the depreciation side. On the other hand, dynamics in the Brazilian Real have increasingly reflected international market conditions rather than domestic economic conditions. This became particularly evident during the international financial crisis. In a first instance, increased uncertainty and liquidity preference in international financial markets led to a huge inflow of short-term foreign capital to Brazil, further appreciating the exchange rate. These flows, however, were quickly reversed with the bankruptcy of Lehman Brothers in September 2008. As a result of the large and primarily short-term positions by foreign investors in the Brazilian Real, the currency experienced one of the highest exchange rate depreciations in the world, largely independent of the domestic economic situation.

This chapter is divided into four sections. Section 2 presents detailed evidence on the internationalisation process of the Brazilian Real. Section 3 discusses the implications this internationalisation of the Real had for exchange rate dynamics before and during the international financial crisis. Section 4 concludes.

4.2. The Internationalisation of the Brazilian Real

The internationalisation of emerging market currencies is a very novel phenomenon, which has been subject to few systematic studies (McCauley 2006; Kenen 2009; Park 2010). In its broadest definition an international currency can be defined as “one which is used and held beyond the borders of the issuing country, not merely for transactions with country’s residents, but also and importantly for transactions between non-

residents” (Kenen 2009: 1). This involves the invoicing of trade in goods and services, on the one hand, and the issuance of financial assets in the domestic currency, on the other hand.

Given its focus on the financial determinants of currency movements and the view of the currency as an asset class per se, emphasis in this thesis lies on the latter aspect of currency internationalisation. The financial aspect of currency internationalisation is also highlighted by McCauley (2006). In his study of the internationalisation of the Australian Dollar McCauley defines an internationalised currency as “one that is freely traded against other currencies and used to denominate contracts, including bank account and bonds, outside its country of issue” (p. 2). In addition, in the case of bonds, it is not sufficient that non-residents become important holders of domestic currency bonds, but they must also figure as issuers.

This thesis adopts a definition of currency internationalisation, which is both narrower and more general than McCauley’s definition. On the one hand, it is narrower, because it also considers the currency, as international money, as an asset class per se. Thus, it distinguishes currency trading from the investment in other domestic currency financial assets, such as domestic currency bonds and equities. This is justified by the definition of money as denominator of contractual obligations and the medium which meets these contractual obligations presented in Chapter 3. Even assets denominated in domestic currency have to be initially converted into domestic money, which can then be exchanged for foreign money, in order to meet external obligations. Thus, in this view, currency internationalisation comprises two different phenomena: firstly, the investment and trading of (short-term) domestic currency assets and secondly, the trading of the currency as asset class per se. Both manifestations will be analysed in this section.

On the other hand, the definition of currency internationalisation adopted in this dissertation is more general, because it considers a rising share of domestic currency held and/or traded by non-residents to be a sufficient and defining dimension of currency internationalisation. This is justified by the important implications an increased share of foreign investors in domestic currency assets has for exchange rate movements. As also discussed in Chapter 3, and as will be shown in the third section of this chapter, an increased participation of foreign investors, funded in international

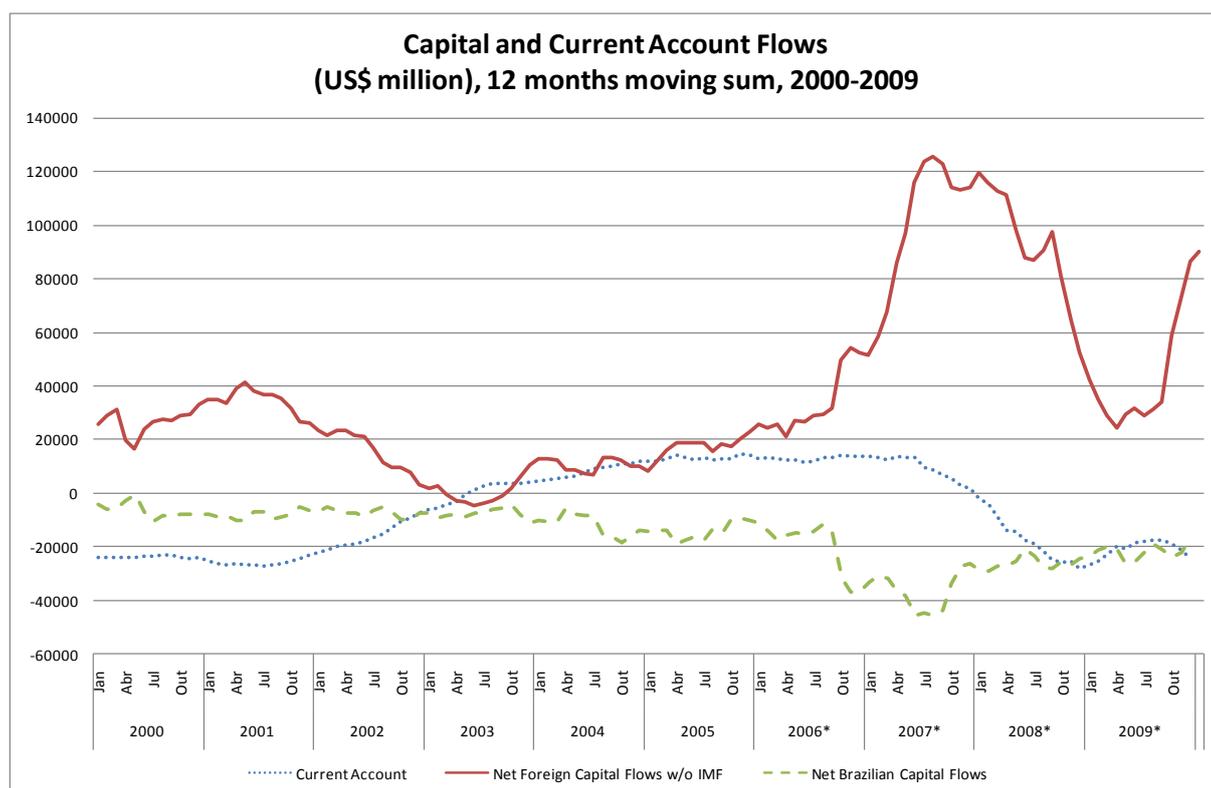
financial markets, tightens the link between international market conditions and domestic asset price movements. Any change in international funding conditions, or increased demand for the US\$, can lead to an immediate sell off of domestic assets unrelated to domestic conditions. The speed of this adjustment is exacerbated in the presence of a large share of short-term operations, which can lead to an immediate reversal of positions. In addition, foreign investments in domestic currency denominated assets imply an inherent currency mismatch for international investors. As a result, any need to adjust portfolios will not only affect asset prices, but will also have an immediate effect on the currency.

It is also important to distinguish an internationalised currency from a merely liberalized foreign exchange market. While such a market is a precondition for an internationalised currency, currency internationalisation refers to the widespread and permanent use of domestic currency by international investors for hedging and especially speculative purposes. While speculative attacks on fixed exchange rate regimes have been an episodic feature of foreign exchange markets, the advent of floating exchange rate regimes in emerging markets has rendered currency trading and currency speculation a permanent feature of these markets.

Figure 4.1 shows the behaviour of the Brazilian current and capital account, excluding transactions with the IMF, from the beginning of 2000 to the end of 2009. The current account was positive since the first quarter of 2003 and turned negative at the end of 2007. After a previous decline, net foreign capital flows to Brazil started to recover in 2003, picked up slightly at the beginning of 2005 and accelerated sharply at the beginning of 2007. However, one can also observe that foreign flows reverted nearly fully in the third of quarter 2008, followed by a sharp recovery since then. The slight increase in Brazilian capital flows abroad at the end of 2006 is primarily driven by foreign direct investment and, to a lower extent, other investments (primarily banking flows).⁷⁹ Brazilian portfolio investments abroad are still very limited.

⁷⁹ Indeed, Brazilian companies, including banks, are expanding strongly in the region, partly driven by favourable exchange rate movements. Although an interesting phenomenon, a detailed analysis of this process goes beyond the remit of this dissertation.

Figure 4.1



Source: BCB (2011b)

Notes: The moving sum representation is used for illustrative purposes; * indicates provisional data

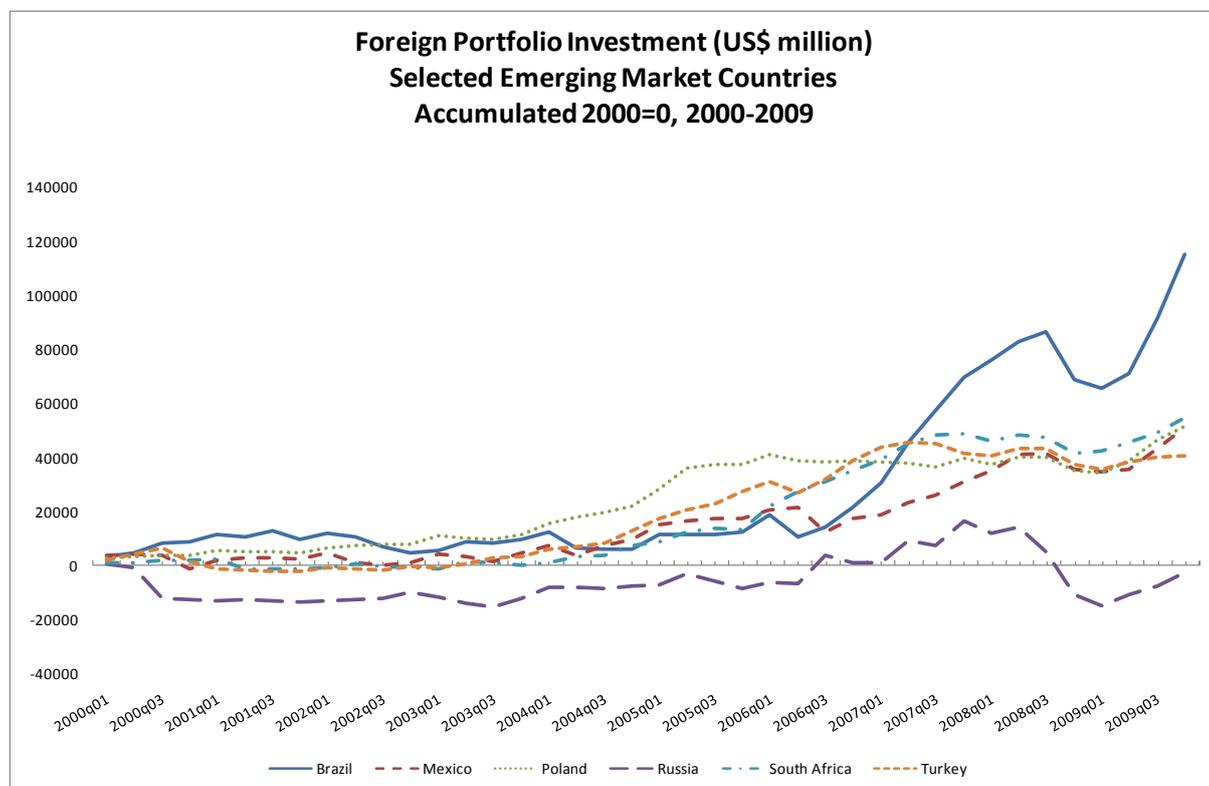
The dynamics of foreign capital flows to Brazil mirror events on international financial markets. The increase in foreign flows in 2003 and their acceleration in 2005 reflect the strong liquidity in international financial markets and the falling profitability of core businesses of international financial institutions which drove international investors to alternative asset classes - including emerging market currencies. Indeed, the start of the housing bubble in the US and the general increase in commodity prices is located around the same time. One hypothesis is that the inversion of the yield curve in the US contributed to the turn to alternative asset classes. Arbitrage operations along the yield curve represent a core business of banks, which had to turn to alternative sources of income as the curve inverted.⁸⁰ In a similar vein, the surge in foreign capital flows at the beginning of 2007 coincides with the first signs of the international financial crisis when repayment rates of sub-prime mortgages in the US first started to deteriorate and uncertainty increased in international financial markets. The adjustment in September

⁸⁰ As of yet, little empirical research analyses the simultaneous increase in the price of several “alternative” asset classes at the end of 2005/beginning of 2006. The hypothesis that this common increase was due to the yield structure in developed financial markets, primarily the US, will be investigated in future research.

2008, in turn, corresponds to the bankruptcy of Lehman Brothers which led to a huge international portfolio adjustment.

Notwithstanding the global nature of the phenomenon, Figure 4.2 shows that short-term foreign capital flows were particularly marked in Brazil. The figure presents accumulated portfolio flows, which include flows to the equity and bond market, to six main emerging market economies. Portfolio flows, which are a sub-group of total capital flows, are of an inherently short-term nature and thus the focus of the analysis of currency internationalisation of this thesis.⁸¹

Figure 4.2



Source: IMF-IFS (2011c)

One can observe the general increase in short-term capital flows to emerging markets in 2003 and their acceleration at the end of 2005. From 2007 onwards, however, the surge was particularly marked for Brazil; as uncertainty increased and yields declined in international financial markets, the demand for liquid and high yielding financial assets

⁸¹ Foreign direct investment and other investments, the other two categories included in capital flows, are considered to be of a more long-term character. Although other investments might also include short-term flows, they are a more heterogeneous asset group including credit and official flows which impairs their representativeness of financial market behaviour.

increased. As discussed in detail in Chapter 5, Brazil offered such a favourable liquidity-return configuration making it one of the prime targets of international financial investors.

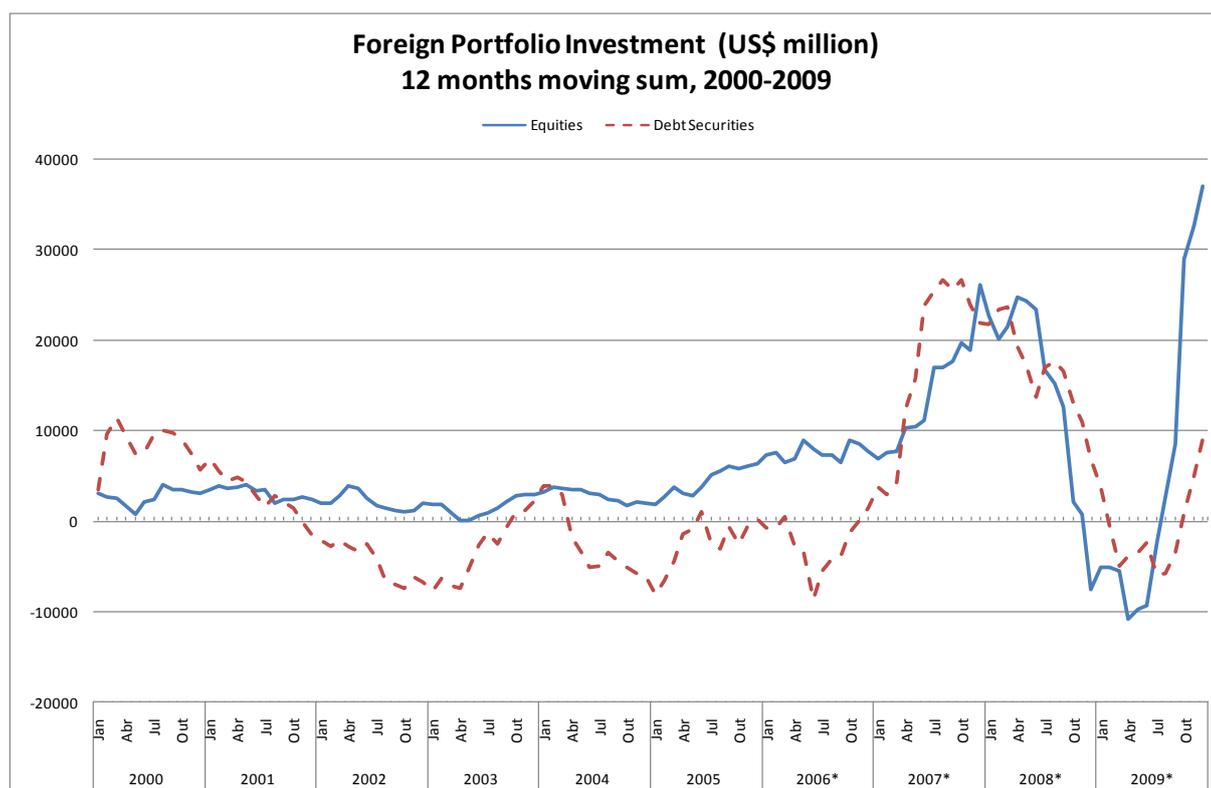
Thus, during this period, Brazilian assets became a standard part of international portfolios. Beyond the *investment* target of a few specialised institutions, Brazilian assets became *trading* instruments, fully integrated in international financial markets. The increased importance of trading operations is mirrored in the rising share of foreign investors in asset classes for which capital gains are an important part of returns, such as equity and currency trading. In addition, one can observe an important structural shift in the currency denomination of assets targeted by international investors. While the main emerging market instruments traded in the 90s and early 2000s were US\$ denominated bonds, foreign investors became increasingly exposed to the domestic currency through their investment in the domestic stock market, local currency bonds or trading of the currency per se.

4.2.1. The First Manifestation

Figure 4.3 gives a more detailed picture of the behaviour of debt and equity flows to Brazil between the beginning of 2000 and end of 2009.⁸²

⁸² Net portfolio flows are essentially driven by foreign investment as portfolio investment abroad by Brazilians is still relatively low.

Figure 4.3



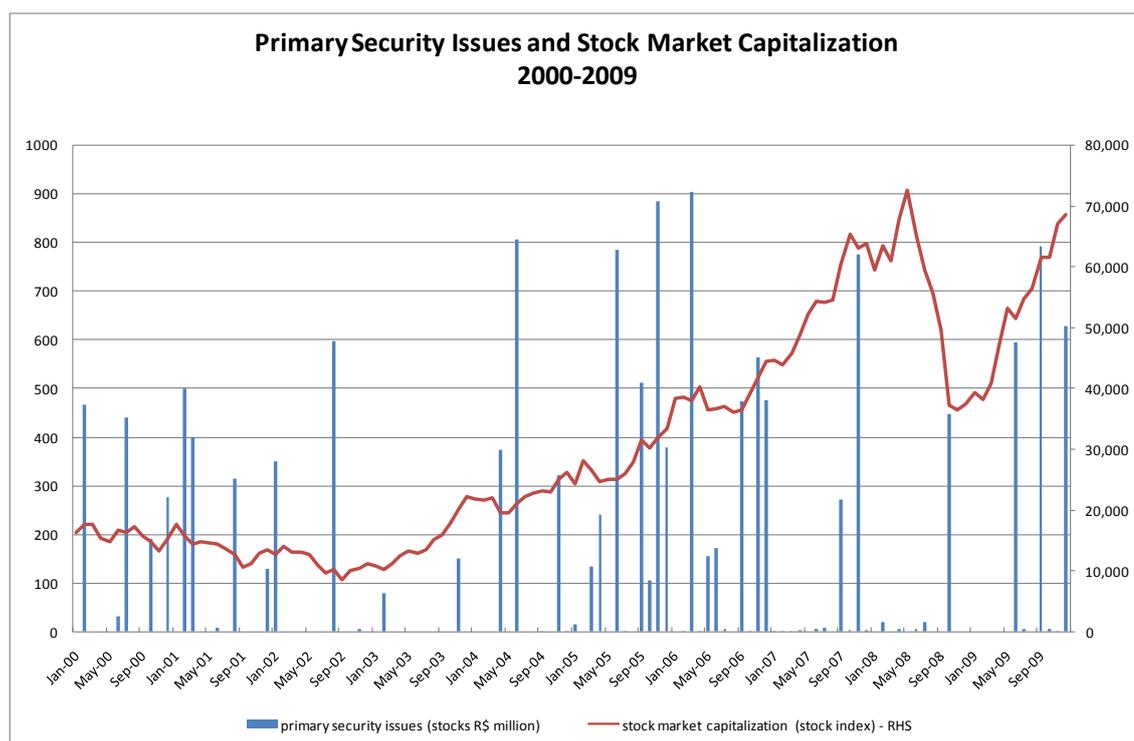
Source: BCB (2011b)

Notes: * indicates provisional data

One can observe the increasing importance of foreign equity investment in the Brazilian economy and the final surge these flows experienced during the first stage of the international financial crisis: between the beginning of 2003 and July 2008, the country received more than US\$ 50 billion foreign investment in equities (half of which left again during the international financial crisis). Primarily due to repayments to the IMF, debt flows oscillate around zero until the beginning of 2007, when they also showed a considerable surge, to then plummet again in the international financial crisis. Both types of foreign flows, particularly to equities, have seen a renewed surge after the international financial crisis.

Figure 4.4 shows the substantial rise in primary security issues and capitalization of the Brazilian stock market.

Figure 4.4



Source: BCB (2011c)

Above balance of payments data testified to the strong participation of foreign investors in this rise. Indeed, according to data of the local derivatives and stock exchange (BM&FBovespa), the foreign participation in Initial Public Offerings (IPOs) increased from 48% in 2005 to 76% in 2007. Foreigners' participation dropped to 48% in 2008 to increase again to nearly 67% in 2009. In mid 2011, the participation of foreign investors in the average monthly trading volume in stock market titles accounted for more than 17%.

Details on asset holdings of international financial institutions, especially by country origin, are hard to obtain. At the same time, data on the foreign participation in domestic stock market issues might underestimate the true importance of foreign investors in Brazilian assets due an increasingly liquid and active off-shore market. The international data company, Emerging Market Portfolio Research (EPRF), has country-specific data of the asset holdings of globally operating equity funds, which gives an interesting notion of the *relative* importance of Brazilian equities in international portfolios.

Table 4.1 shows the percentage share of selected emerging markets' equity titles in the portfolio of three different equity fund groups at the end of September 2008.⁸³

Table 4.1: Share of Brazilian Assets in International Funds' Portfolios (Equity Market)

Country	Funds and Total Funds Size		
	GEM Funds (US\$ 103 billion)	Global (ex US) Funds (US\$ 107 billion)	Global Funds (US\$ 66 billion)
Brazil	14.41%	1.29%	1.01%
China	11.34%	1.31%	1.03%
South Korea	10.26%	1.24%	1.13%
India	7.14%	0.94%	0.38%
Chile	0.76%	0.07%	0.08%
Mexico	6.11%	0.44%	0.33%
Russia	8.44%	0.53%	0.47%
Turkey	3.04%	0.24%	0.08%
South Africa	6.83%	0.87%	0.28%

Source: EPFR (2008a); data from end of September 2008

Notes: Percentages are simple averages; GEM stands for Global Emerging Market Funds, which hold only emerging markets assets; global (ex US) funds invest in equity titles across the globe excluding the United States (US); global funds invest in assets from all countries; data presented are based on a trial sample and have not been purchased

The importance of Brazilian equity titles in the portfolios of international funds is evident. For emerging market funds Brazilian assets top the league with a share of nearly 15%. For Global Funds Brazil is only just overtaken by China and South Korea (which has a very active financial market). For Global Funds (excluding the US) Brazil's share reaches 1.29%. This is nearly as high as the share of Italy (1.32%) and Spain (1.48%).

As could be seen in Figure 4.3, inflows into debt securities also accelerated sharply at the beginning of 2007, reaching nearly US\$ 35 billion between then and July 2008.

⁸³ These values are the outstanding stock to emerging market assets at the end of September 2008, after large parts of the exposure to this investment group had already been reduced. Thus, one can assume, that the exposure was considerably larger before and during the first stage of the international financial crisis. In addition, data are based on a survey of selected funds and are thus not exhaustive. In this respect, primary interest lies in showing the *relative* importance of Brazilian titles in international fund portfolios.

Again, international funds data for end of September 2008 give an indication of the relative importance of Brazilian bond titles in the portfolio of international investors.

Table 4.2: Share of Brazilian Assets in International Funds' Portfolios (Bond Market)

Country	Funds and Total Funds Size	
	Dedicated Emerging Market Bond Funds (US\$ 21 billion)	International Bond Funds (US\$ 17.5 billion)
Brazil	14.6%	1.00%
China	0.49%	0.13%
South Korea	0.23%	1.31%
India	0.29%	0.00%
Chile	0.46%	0.00%
Mexico	7.57%	1.79%
Russia	10.43%	0.21%
Turkey	7.91%	0.08%
South Africa	2.17%	0.34%

Source: EPFR (2008b); data from end of September 2008

Notes: Percentages are simple averages; dedicated emerging market funds invest only in emerging markets; international funds invest in all countries; the data presented are based on a trial sample and have not been purchased

For those funds specifically dedicated to emerging markets Brazilian bonds widely surpass the share of any other country and top the league with nearly 15%. For international bond funds, only Mexico and South Korea have a larger exposure to foreign investment.

In contrast to previous episodes, these inflows were mainly directed towards domestic currency denominated debt. Table 4.3 shows the outstanding stock and annual trading volume of Brazil's main debt securities: while international debt has stagnated, domestic debt has seen a continuous increase.⁸⁴ According to data from the BCB, foreign investors held nearly 10% of domestic government bonds at the end of 2009. This compares to only 5% at the end of 2007.

⁸⁴ Data in Tables 4.2 and 4.3 are not directly comparable. While Table 4.2 only incorporates Brazilian debt held by foreign funds, Table 4.3 refers to the entire stock of Brazilian debt outstanding.

Table 4.3: Outstanding Stock and Annual Trading Volume in Debt Securities; US\$ million

	2004	2005	2006	2007	2008	2009
Outstanding Stock						
External Debt	82,388	81,673	77,173	81,414	75,664	90,815
Domestic Debt	384,757	548,972	696,114	952,768	858,795	1,250,109
Trading Volume						
Sovereign Eurobonds	557,662	925,133	801,231	412,642	192,495	137,335
Corporate Bonds	37,961	45,191	57,980	70,134	49,938	58,518
Local Bonds	624,873	517,975	432,985	459,134	591,172	548,251
Options	72,793	64,210	37,551	24,021	7,057	0
Total	1,382,344	1,554,360	1,423,660	1,134,574	846,972	747,202

Source: EMTA (2005; 2007; 2009); BIS (2010b; 2010c)

Notes: stock data are end of year values and include all issuers (public and private); trading volume data refer to total trading volume over the year based on a survey of at least 60 institutions, both onshore and offshore; local currency assets are converted into US\$ at the current exchange rate

In addition, as can be seen in Table 4.4, the currency profile of both domestic and external public debt has shown a marked shift to local currency denominated bonds.

Table 4.4: Denomination of Domestic and External Public Debt, Share of Total Debt

	2003	2004	2005	2006	2007	2008	2009
Domestic Debt							
Foreign Exchange	10.76%	5.15%	2.70%	1.30%	0.95%	1.06%	0.70%
Fixed Rate	12.51%	20.09%	27.86%	36.13%	37.31%	32.19%	33.71%
Variable Rate (Selic)	63.18%	59.86%	53.91%	40.04%	35.48%	37.40%	36.97%
Price Index	13.55%	14.90%	15.53%	22.54%	26.26%	29.34%	28.61%
External Debt							
Real	NA	0.00%	1.90%	4.68%	9.99%	8.12%	10.74%
Dollar	NA	85.05%	86.10%	83.05%	76.46%	78.78%	77.17%
Euro	NA	12.79%	10.10%	11.06%	12.56%	11.98%	11.21%
Others	NA	2.15%	1.90%	1.21%	0.99%	1.13%	0.88%

Source: TNB (2011); BCB (2011d)

Notes: all data end of year values

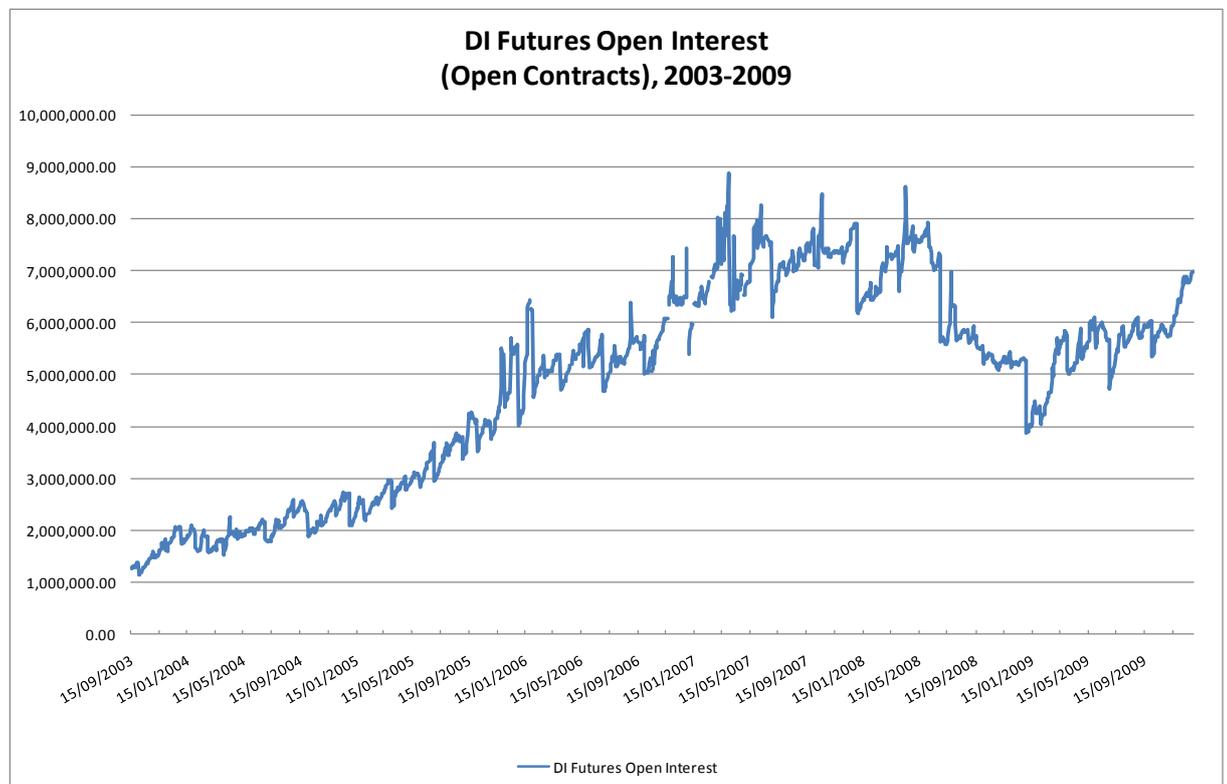
According to data from the BCB, around 6% of Brazil's total external debt is nowadays denominated in domestic currency. This structural shift in currency denomination is also supported by the continuous decline in trading volume in Sovereign Eurobonds shown in Table 4.3. Trading volume in local currency bonds, in contrast, has remained relatively stable.

As discussed in more detail in Chapter 5, one peculiar feature of Brazil's financial system is a liquid derivatives market concentrated in very short maturities. This derivatives market has allowed the effective hedging of any interest rate or currency

exposure. In addition, due to their liquidity, instruments traded on the derivatives exchange have become an important vehicle for foreigners to bet on Brazilian interest rate and currency developments.

Figure 4.5 shows the increase in outstanding open contracts in the DI futures market.⁸⁵ Open contracts picked up markedly in the beginning of 2007 and, after a short dip, continued to do so until September 2008. At its peak, between the beginning of 2007 and mid 2008, the weekly average of outstanding contracts in short-term interest rate futures stood at around 8 billion contracts.

Figure 4.5



Source: *Global Insight* until 13th June 2007; *Datastream* thereafter
 Notes: *Outliers have been removed*

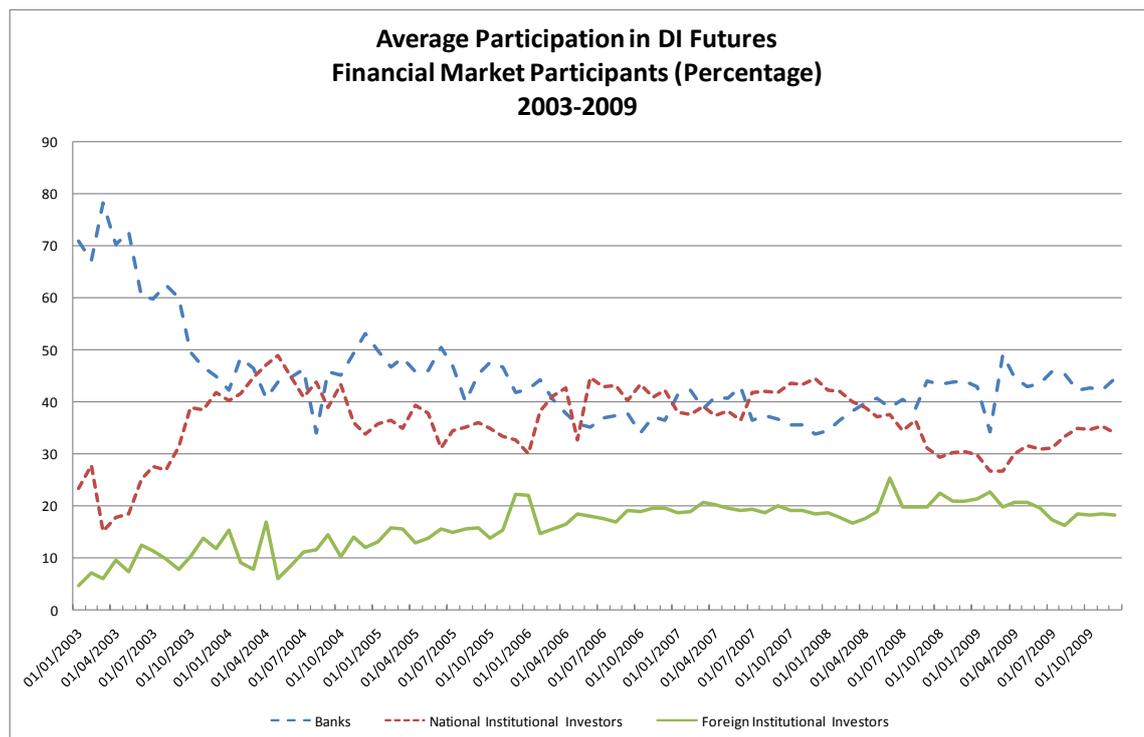
According to Costa, Nespoulet al. (2007) over the first half of 2006, average daily transaction volume in the DI futures market was six times that of the secondary market for fixed-rate government bonds. Thus, although partly driven by increased hedging needs as a result of the rising issue of Real denominated fixed rate government debt, it

⁸⁵The DI rate is the average interest rate on overnight repurchase agreements that are collateralized by private securities and is compiled by the CETIP, a private clearing house.

could be argued that interest rate futures have partly become a substitute for underlying fixed income instruments and traded as a separate asset class.

Figure 4.6 shows the share of the three largest investor groups in DI futures contracts between 2003 and 2009: banks, national institutional investors (domestic funds) and foreign institutional investors (international funds).

Figure 4.6



Source: *BM&FBovespa (2011)*

Notes: Data are from the middle of each month (15th-17th); values indicate the average share of actors' participation in long and short DI future contracts

One can observe the rising share of international institutional investors in DI futures. In 2009, the share of foreign investors in this asset class reached nearly 20%.

In summary, this section highlighted the increased exposure of foreign investors to domestic currency denominated Brazilian assets. As discussed in more detail in Chapter 5, a large share of these assets is characterized by a marked concentration in very short maturities. Foreign investors' increased exposure to short-term domestic currency risk, however, also makes the availability and tradability of the domestic currency essential.

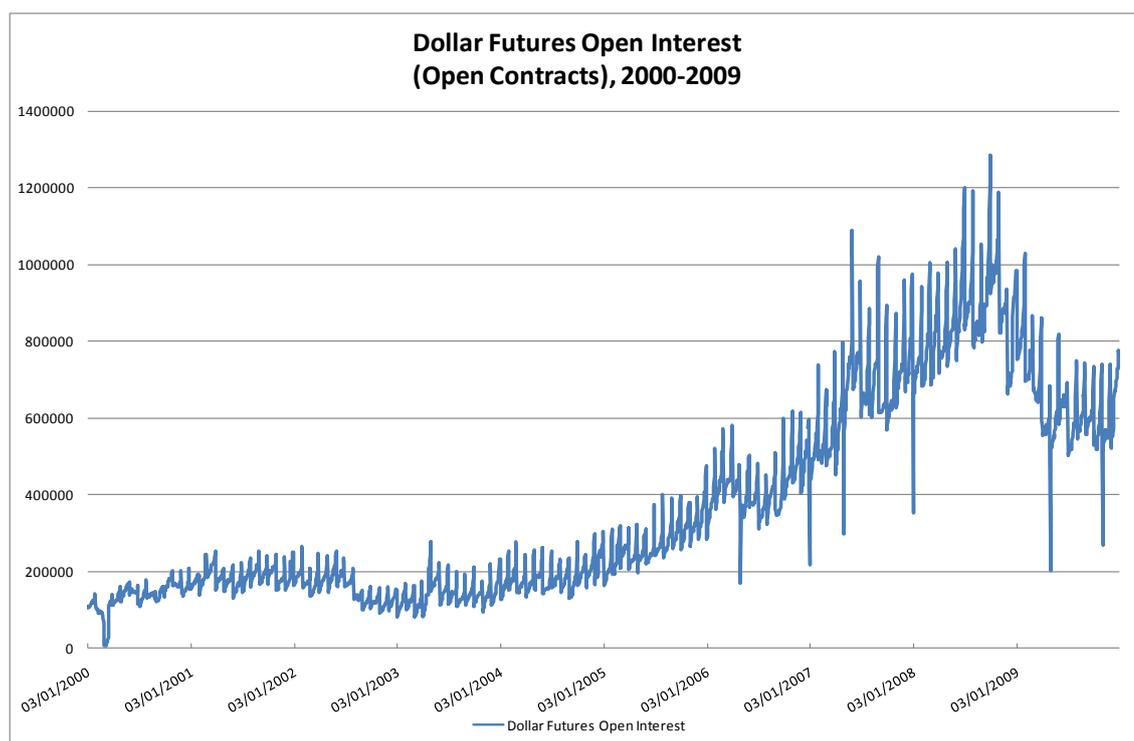
4.2.2. The Second Manifestation

The international trading of the Brazilian Real as asset class per se is the second manifestation of the process of currency internationalisation highlighted in this dissertation. This international tradability is crucial to, on the one hand, being able to hedge any currency exposure and, on the other hand, meeting outstanding external obligations. In other words, securing immediate convertibility of the domestic currency is a prerequisite for international investors to assume domestic currency risk, especially for those primarily targeted at short-term trading profits.

However, domestic currency has not only been held for hedging purposes, but the Brazilian currency, as international money, has become a speculative asset per se. As a financial market participant in London put it “...the majority of people that play into the emerging market side do that on the currency side, because it is probably the most liquid of the asset classes within the emerging market arena... certainly in terms of being able to get in and out, the FX would be the best way of expressing your opinion on that market...”.

As discussed in Chapter 5, operations in the Brazilian spot market remain restricted to authorized institutions (primarily banks). As a result, large parts of currency operations are conducted on the domestic derivatives market. Figure 4.7 shows the increase in open contracts in US\$ futures between the beginning of 2000 and end of 2009. While hovering around 200.000 contracts in early 2000, open interest reached an average of 1.000.000 contracts before the international crisis hit Brazil in September 2008. Again, one can observe a considerable surge in the beginning of 2007, as the first signs of the international financial crisis emerged in the developed world.

Figure 4.7



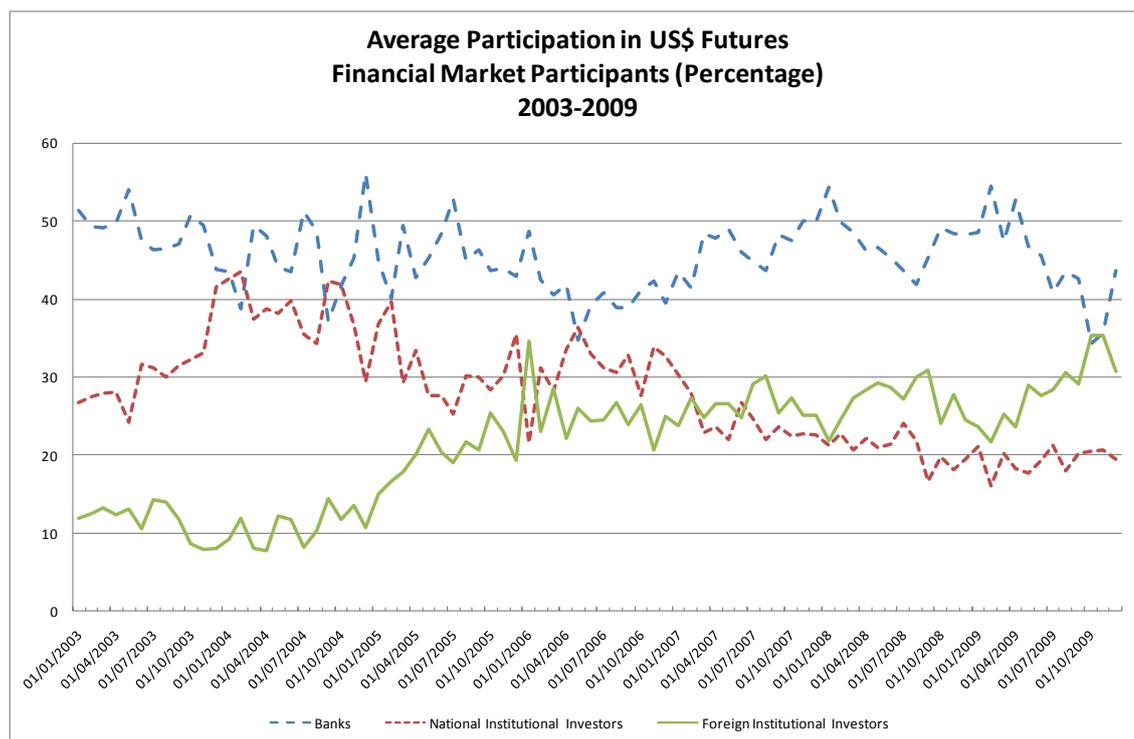
Source: Datastream

Notes: Outliers have been removed

The average daily trading volume in US\$ futures between May and June 2008 was around R\$30 billion, compared to a daily volume of operations of around R\$4.4 billion in the spot market. The derivatives' market liquidity became especially important in August/September 2008: in September 2008 daily trading volume increased to US\$ 41 billion, as international, and domestic, investors tried to cover their large open currency positions.

Figure 4.8 shows the share of the three investor groups, domestic financial institutions (banks), domestic institutional investors, and foreign institutional investors, in US\$ futures contracts. One can observe that foreign investors' share increased substantially over recent years and reached more than 30% at the end of 2009.

Figure 4.8



Source: *BM&FBovespa (2011)*

Notes: data are from the middle of each month (15th-17th); values indicate the average share of actors' participation in long and short US\$ future contracts

Trading of Brazilian Real by foreign investors did not only expand on the local derivatives exchange, but also exploded on offshore markets, most of which are conducted over-the-counter (OTC).⁸⁶ Table 4.5 shows the average daily foreign exchange turnover on OTC markets for selected emerging market currencies.

⁸⁶ The importance of the local derivatives exchange and OTC markets is also reflected in the still relatively low share of Brazilian exchange rate futures traded on international exchanges, such as the Chicago Mercantile Exchange (CME). Current attempts to further promote the internationalisation of the Brazilian Real include the increased trading of Brazilian Real future contracts on the CME. A recent institutional collaboration between the BM&FBovespa and the CME, for example, has set up a high speed and high capacity international connection between the two data centres, which allows the instantaneous exchange of order books between the two exchanges (Best 2009).

Table 4.5: Average Daily Foreign Exchange Turnover on OTC markets (US\$ million), April 2004/2007/2010

Currency	2004				2007				2010			
	Total	Spot	Forward	Swaps	Total	Spot	Forward	Swaps	Total	Spot	Forward	Swaps
Brazilian Real	4,334	2,866	1,072	406	11,112	5,579	5,259	274	22,175	8,518	12,866	791
Local	3,575	2,568	638	369	7,035	4,754	2,133	148	10,209	5,508	4,340	361
Cross-Border	759	298	434	37	4,077	825	3,126	126	11,966	3,010	8,527	429
Mexican Peso	20,312	11,425	1,716	7,171	39,218	14,666	4,594	19,958	47,285	18,158	5,392	23,735
Local	7,192	3,834	726	2,632	15,542	7,150	2,044	6,348	14,766	6,536	1,891	6,339
Cross-Border	13,120	7,591	990	4,539	23,676	7,516	2,550	13,610	32,519	11,622	3,500	17,397
Polish Zloty	7,031	1,566	483	4,982	24,231	4,851	2,644	16,736	29,825	7,193	3,559	19,074
Local	1,759	792	325	642	10,033	1,906	1,000	7,127	8,586	2,513	1,555	4,517
Cross-Border	5,272	774	158	4,340	14,198	2,945	1,644	9,609	21,239	4,679	2,004	14,556
Russian Rouble	12,208	10,345	253	1,609	24,811	17,533	1,253	6,026	34,640	18,139	2,262	14,240
Local	7,426	5,946	50	1,430	17,556	12,421	602	4,533	19,900	11,141	977	7,782
Cross-Border	4,782	4,399	203	179	7,256	5,112	651	1,493	14,740	6,997	1,285	6,458
South African Rand	13,656	2,402	1,122	10,123	28,523	5,668	3,458	19,396	27,594	9,111	2,856	15,628
Local	5,498	1,375	641	3,482	12,148	2,037	1,405	8,706	9,947	3,104	1,367	5,477
Cross-Border	8,158	1,027	481	6,641	16,374	3,631	2,053	10,690	17,647	6,007	1,489	10,151
Turkish Lira	1,991	816	239	936	4,691	2,881	535	1,275	23,620	7,955	3,032	12,634
Local	772	466	155	151	1,131	705	286	140	8,582	3,068	1,392	4,122
Cross-Border	1,219	350	84	785	3,560	2,176	249	1,135	15,038	4,887	1,640	8,511

Source: BIS (2004; 2007b; 2010a)

One can observe the substantial surge in daily OTC foreign exchange trading volume in all currencies over the period. The increase is particularly marked in the Brazilian Real, the Polish Zloty and the Turkish Lira. However, the surge in Brazilian Real trading between 2004 and 2010, especially in outright forwards, widely surpasses the increase in any other currency.

Compared to the other countries presented, the daily OTC trading volume in swaps and spot operations in Brazil is relatively small. As mentioned above, this is mainly due to Brazil's liquid derivatives market on which many of the traditional spot and swap operations are conducted. The volume of outright forwards traded, on the other hand, is substantially larger in Brazil than in any of the other countries. According to the semi-structured interviews conducted with emerging market (EM) currency traders, the majority of forward contracts traded off-shore involving the Brazilian Real is Non Deliverable Forwards (NDFs). A NDF is similar to a regular forward foreign exchange contract, except that at maturity the NDF is settled in another currency, most of the time in US\$, because the domestic currency is "non-deliverable".⁸⁷ According to a 2005 BIS survey, however, international banks have limited interest in NDF contracts to hedge their foreign investments, but mainly use these instruments to take position in EM

⁸⁷ All products traded on the BM&F are settled in Brazilian Real, exposing the investor to currency risk. However, this might also create a source of additional profit in the presence of strong currency appreciation.

currencies (Lipscomb 2005). Many market participants interviewed estimated that as much as 60% to 80% of NDF volume is generated by speculative interest. They also noted a growing participation from international hedge funds in EM currency products, supporting the primarily speculative nature of NDF operations.⁸⁸

In summary, this section has shown the increased participation of foreign investors in (short-term) domestic currency denominated assets in Brazil, including the currency as asset class per se. Chapter 5 will set out the factors which contributed to this internationalisation. Before proceeding to this analysis, though, it is important to highlight the important implications the internationalisation of the Brazilian Real has had for exchange rate dynamics.

4.3. Currency Internationalisation and Exchange Rate Dynamics

As discussed in Chapter 3, the increased participation of foreign investors in domestic currency (assets) can have important implications for exchange rate dynamics. Firstly, exchange rate movements can become exacerbated both on the appreciation and depreciation side. Secondly, exchange rate behaviour becomes increasingly dependent on international market conditions rather than domestic economic fundamentals.

As to the first point, the sheer size of the positions taken by international investors, compared to Brazil's market size, can intensify exchange rate movements. This is partly because of the size of their own positions, but also because directional positions by foreign investors can be taken as a signal for future currency movements and prompt domestic investors to jump on the bandwagon. As discussed in more detail in Chapters 5 and 7, while foreign exchange operations by domestic banks are partly driven by hedging needs of their clients, the positions of domestic and international institutional investors are almost exclusively of a speculative nature. In addition, foreign financial institutions, primarily but not only institutional investors, work on a higher leverage than domestic institutions, which can further increase exchange rate fluctuations. Indeed, Brazilian institutions face relatively stringent restrictions on capital adequacy

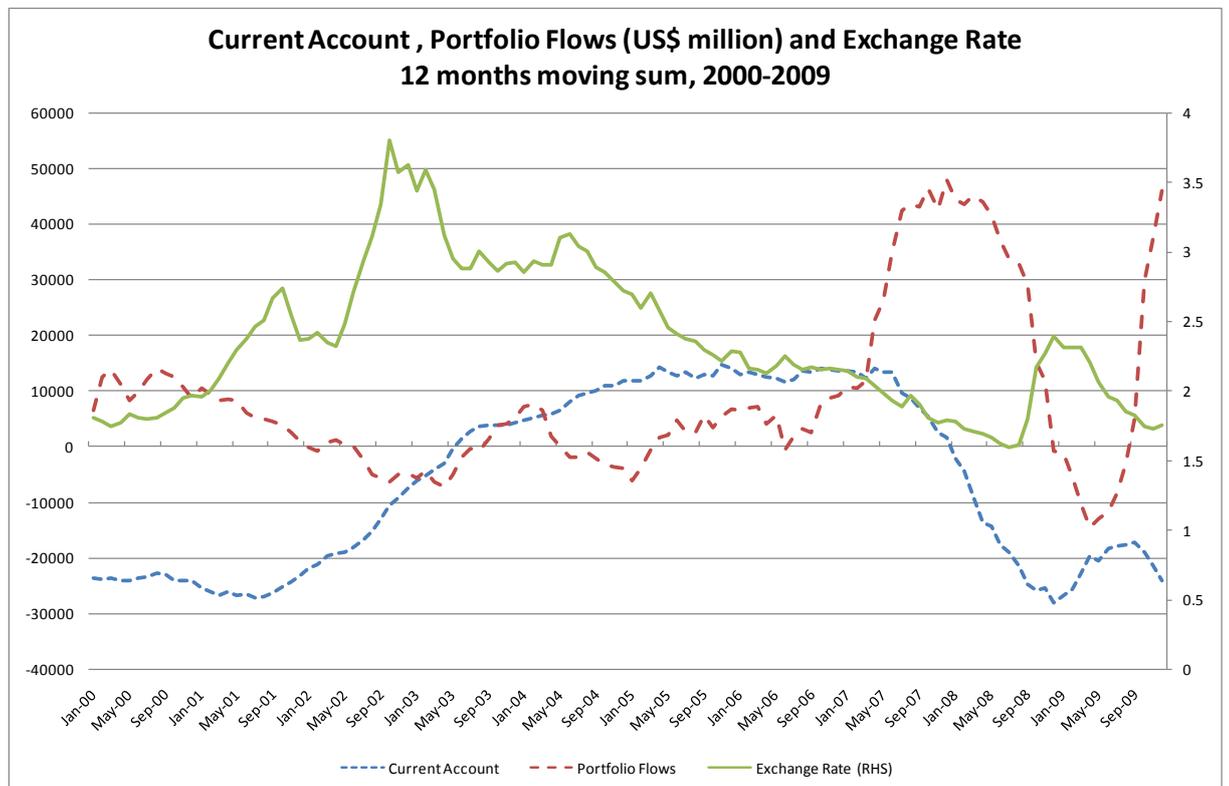
⁸⁸ In addition, due to perceived counterparty and currency risk – as well as remaining transaction costs to operate onshore – NDFs nearly always trade at a premium. This has created arbitrage opportunities for domestic financial market players, which have access to both the onshore and the offshore market.

and leverage, which do not apply to international institutions assuming positions in domestic assets.

As to the second point, the majority of international investors fund their positions in international financial markets which tightens the link between international and domestic market conditions and introduces an automatic currency mismatch when investing in domestic assets.

Figure 4.9 shows the 12 months moving sum of the current account, the exchange rate and short-term capital flows to the Brazilian economy between 2000 and 2009.

Figure 4.9



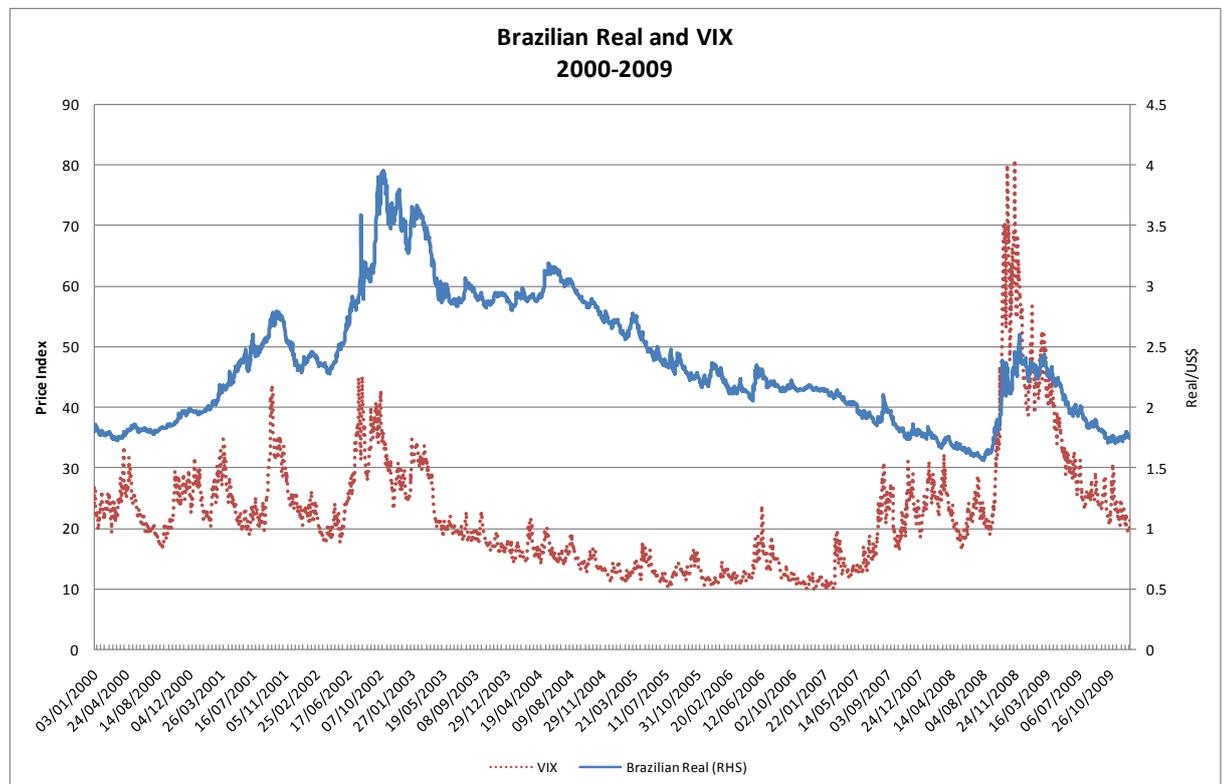
Source: BCB (2011b)

One can observe the large swings in the exchange rate: the Brazilian Real appreciated from nearly R\$ 4 at the end of 2002 to close to R\$ 1.5 to the US dollar in August 2008, to then lose around 60% again until the beginning of December 2008. It had recovered most of this loss by December 2009. Although not totally independent from current account dynamics, the positive current account from the beginning of 2003 onwards contributed to initial stages of the exchange rate appreciation, one can observe the

driving role of short-term capital flows for exchange rate movements (both in the appreciation periods as well as in the crisis time).⁸⁹

Figure 4.10 shows the strong co-movement between the Brazilian Real and the VIX, a measure of the implied volatility of S&P500 index options which is often used as gauge for market mood or risk aversion (Franke, Gonzalez-Hermosillo et al. 2008). One can observe that, as global risk aversion increases, international investors quickly adjust their portfolios to alternative “safer” assets, resulting in a depreciation of the Brazilian Real. In addition to changing preferences on the asset side, funding constraints are likely to become particularly important in times of market dislocations when global risk aversion increases (Brunnermeier and Pedersen 2009). In line with the above, the relationship between the Brazilian Real and the VIX partly breaks down during the first stage of the international financial crisis as rising uncertainty in international financial markets lead to demand for liquid and high yielding assets.

Figure 4.10



Source: Datastream

⁸⁹ In addition, one could argue that rather than the driver, the current account is the result of exchange rate movements.

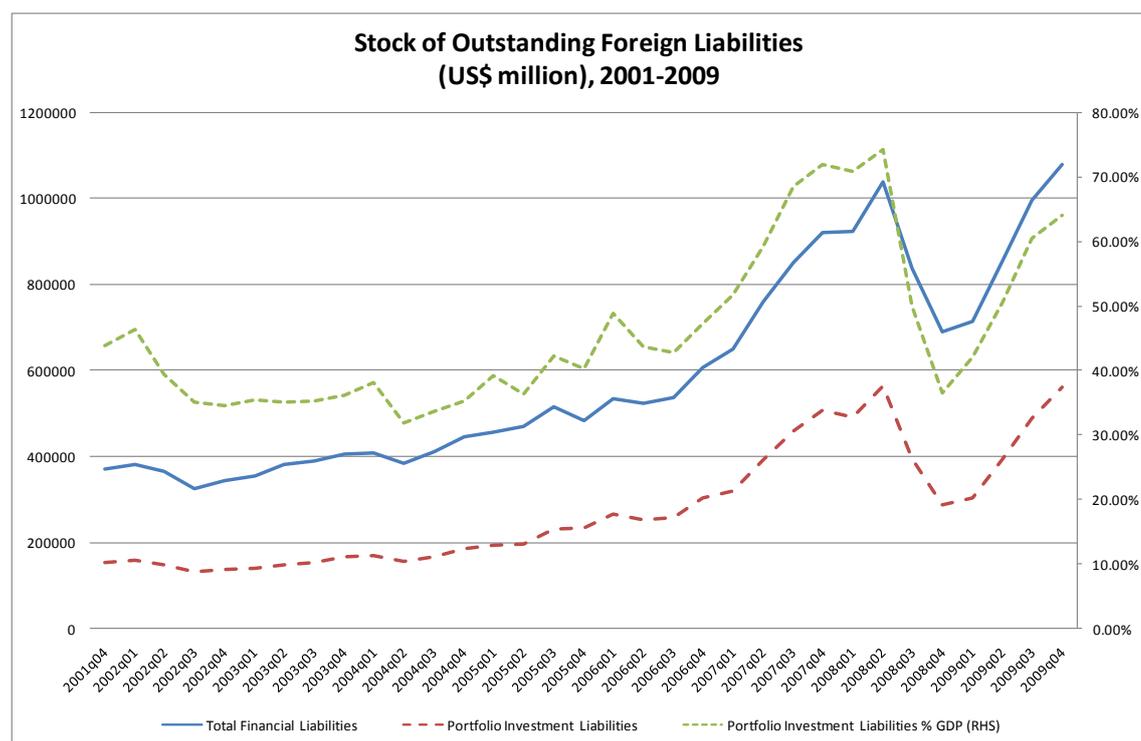
The importance of external conditions and the role of portfolio adjustment for exchange rate dynamics became especially apparent in the international financial crisis. Despite sound macroeconomic fundamentals, as will be shown in Chapter 5 net external debt was negative, the primary fiscal position was in a strong surplus and although deteriorating the current account deficit was very modest, the Brazilian Real depreciated by more than 60% between August and December 2008, one of the highest exchange rate depreciations in the world. This huge depreciation was not the result of underlying economic “fundamentals”, but primarily due to international portfolio adjustment and the direct result of the internationalisation of the Brazilian Real, expressed in the large exposure of foreign investors to short-term domestic currency risk.⁹⁰

While most countries were affected by the international deleveraging, this process was especially severe for Brazil for two reasons. Firstly, as discussed above, the share of Brazilian assets in international portfolios was one of the highest among emerging countries. Figure 4.11 shows that at its peak in the middle of 2008, Brazil’s total outstanding stock of foreign liabilities reached US\$1 trillion, a large part of which was denominated in domestic currency.⁹¹ More than half of Brazil’s external liabilities were constituted by short-term portfolio liabilities. This led to a huge and immediate demand for foreign currency when international investors were forced to sell their Brazilian assets to meet funding requirements in international financial markets.

⁹⁰ The role of financial structure for driving exchange rate dynamics is especially clear in the case of foreign investment in domestic assets and the resulting currency exposure. However, as was discussed in Chapter 3, domestic players speculating in foreign currency create a similar exposure to exchange rate changes. In Brazil, this was the case with domestic companies, who had assumed large positions to bet on the exchange rate appreciation and were facing severe difficulties as the exchange rate started to depreciate.

⁹¹ The stock of outstanding foreign liabilities provided by the IMF is not available for most other emerging markets. However, it was shown in Section 2 that, between 2000 and 2009 cumulative portfolio flows to Brazil, which are a good proxy for a country’s net short-term foreign liabilities, were higher than in any other country.

Figure 4.11



Source: IMF-IFS (2011c)

Secondly, as discussed in Chapter 5, the institutional liquidity provided by the Brazilian market, including a strong concentration in very short-term assets and the willingness of the central bank to provide foreign currency to the market, meant that the country's assets were among the first and with largest volume to be sold to meet outstanding external obligations. In addition, the internationalisation and liquidity of the domestic currency meant that foreign investors could quickly hedge their exposure – both to domestic currency assets and correlated but less liquid other markets - on the local derivatives exchange. More than that, the liquidity of the Brazilian Real had made it a benchmark asset for all other emerging market currencies, which meant that investors sold Real in order to shed general emerging market risk.

This was first reflected in the exchange rate's value in the first week of August 2008 and accelerated markedly in September 2008 with the failure of Lehman Brothers. Table 4.6 shows the depreciation of selected currencies against the US Dollar between the beginning of August 2008 and the first week of December 2008. The second column shows the appreciation of the same currencies since then, between January 2009 and the end of October 2009. The volatility of the Brazilian Real is striking: not only is it the

currency which depreciated by far the most in the international financial crisis, it has also re-gained more than any other currency since then.

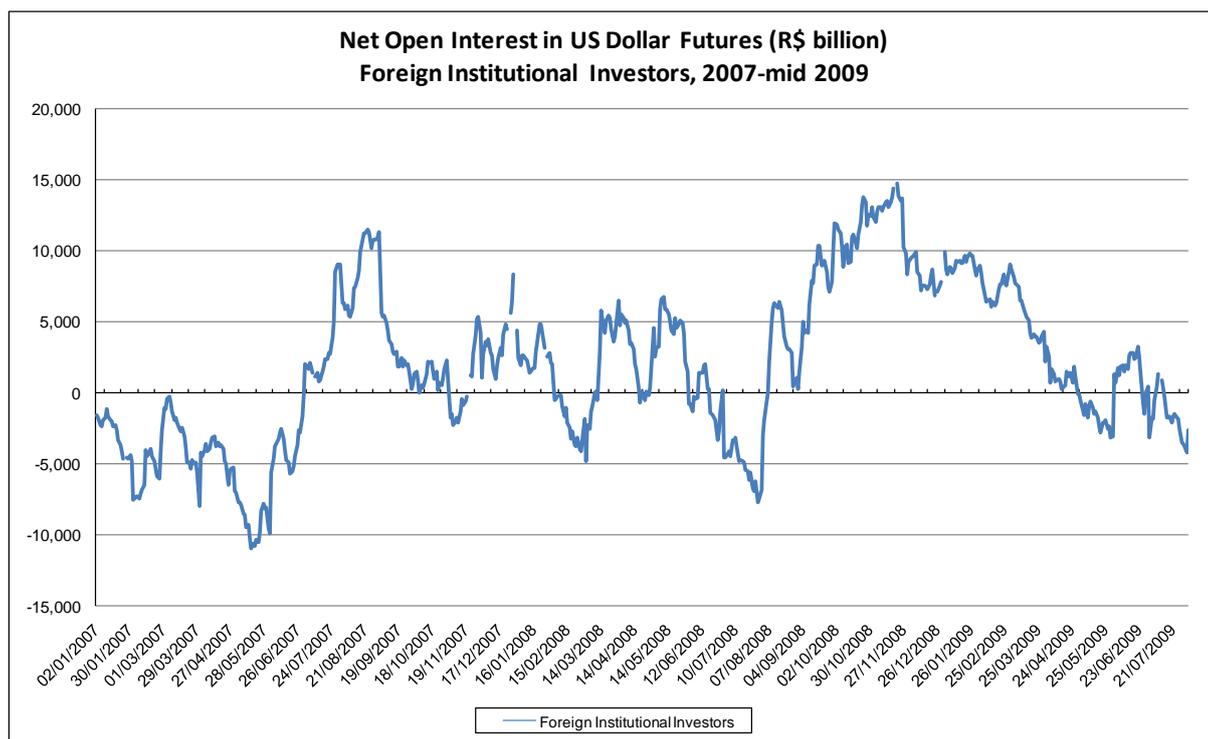
Table 4.6: Exchange Rate Dynamics in the International Financial Crisis

Currency	Depreciation in Crisis	Appreciation
Brazilian Real	66%	-27%
Australian Dollar	23%	-8%
Turkish Lira	39%	-5%
South African Rand	44%	-19%
Russian Rouble	20%	-5%
Hungarian Forint	40%	-7%
Indonesian Rupiah	30%	-14%
Philippine Peso	11%	-1%
Chilean Peso	34%	-17%
Mexican Peso	38%	-6%
South Korean Won	46%	-6%
Polish Zloty	49%	-6%

Source: Datastream

The claim that it was portfolio adjustment by international investors rather than underlying “fundamentals” that led to the depreciation of the Real can be supported with the data on open positions of foreign institutional investors in the US\$ futures market. After years of sustained exchange rate appreciation, the exchange rate turned in the first week of August 2008 and continued to depreciate thereafter. This change in the currency’s tendency coincided exactly with the change of positions of foreign investors in the US dollar futures market.

Figure 4.12



Source: BM&FBovespa (2011)

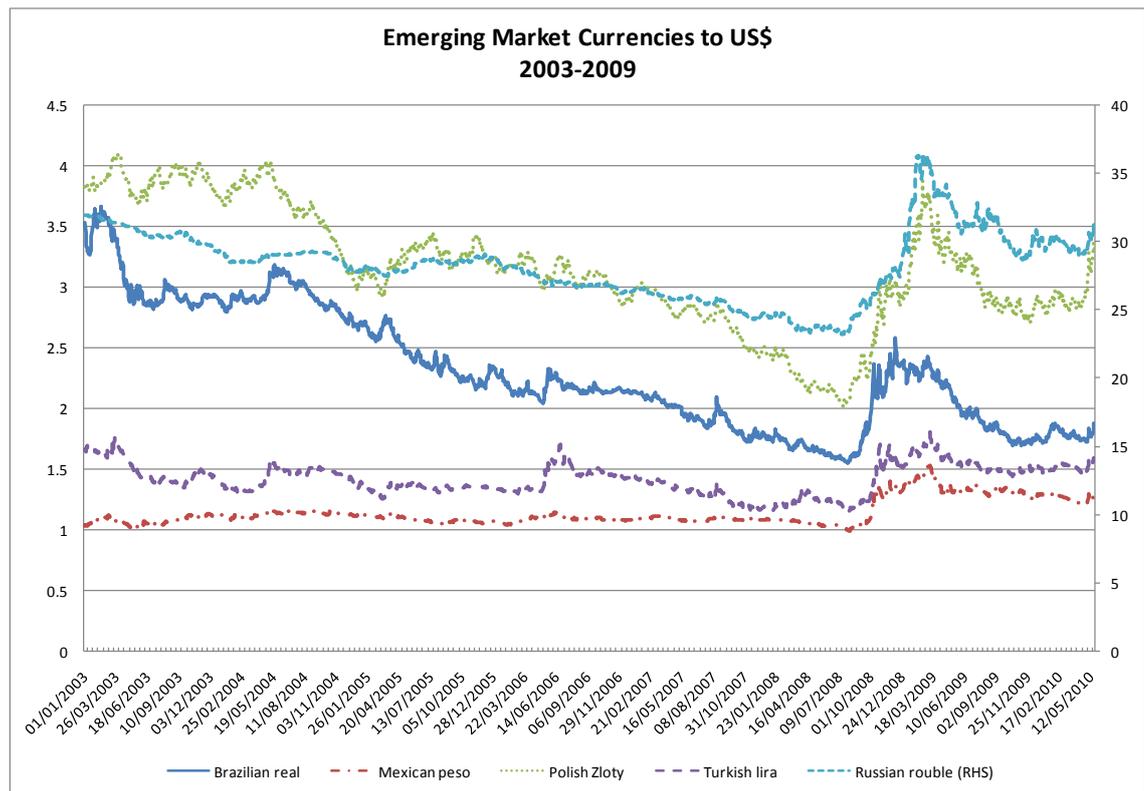
Foreign investors had maintained long Real positions (negative sign) since the beginning of the sustained appreciation trend in the middle of 2004 and kept their positions all the way through the outbreak of the international crisis in August 2007. Although switching to short positions in times of increased market uncertainty, e.g. at the near failure of Bear Sterns in March 2008, the tendency for long positions remained even during the first stage of the international financial crisis. In the first week of August 2008, however, these investors abruptly changed to short positions, which were further exacerbated as the financial crisis intensified in international financial markets. This switch was partly due to investors' attempt to hedge their exposure in domestic asset markets. Moreover, as pointed out above, the US\$ future was the main market of operations for short-term speculative currency operations in the Brazilian Real, which were reverted as the international financial crisis struck.

The driving role of positions taken by foreign investors on Brazil's futures market is further supported by actual foreign exchange flow data provided by the BCB. Despite financial outflows, which had turned negative in April 2008, the balance of commercial and financial foreign exchange transactions was positive in August and September 2008

(with a surplus of US\$ 1.9 and US\$ 2.8 billion respectively), due to a continued strong trade balance. Nevertheless, the exchange rate started to depreciate at the same time as foreign investors changed their positions in the derivatives market.

Evidence that this change in position by foreign investors was the result of a general deleveraging process is presented in Figure 4.13, which shows 5 of the most liquid emerging market currencies since the beginning of 2003. Their general co-movement aside, it is interesting to note that all five currencies, from three different emerging market regions, experienced their turning point in the first week of August. Although similar macroeconomic characteristics might have contributed to this dynamic, this highly synchronized movement seems to support the hypothesis of international portfolio adjustment as main driving factor of exchange rate movements.

Figure 4.13



Source: Datastream

Indeed, probably the main unifying characteristic of these countries is their relatively high integration in international financial markets and exposure to international financial flows. Although a detailed analysis of the nature of this financial integration

would be necessary, data on exchange based and OTC currency trading show that these currencies are among the most liquid and widest traded currencies internationally. This intensified, on the one hand, the appreciation trend throughout the first stage of the international financial crisis as international investors sought liquid and high yielding assets. On the other hand, this contributed to the high and synchronized depreciation in the second half of 2008 as previously built positions had to be unwound due to the international financial market meltdown. This deleveraging was done first and most markedly in liquid assets available – including emerging market currencies.

4.4. Conclusions

This chapter has highlighted the changing nature of Brazil's integration in international financial markets. In addition to a renewed surge of foreign capital into Brazilian assets, these foreign flows were characterised by two important structural changes: Firstly, one could observe an increased foreign participation in assets for which capital gains, i.e. trading, are an important part of returns; secondly, the recent surge in foreign flows was primarily directed towards domestic currency denominated assets. This internationalisation of the Real consisted of two closely related phenomena: the increased exposure of foreign investors to short-term domestic currency denominated assets and the trading of the Brazilian currency as international asset class per se.

In a second part, the chapter highlighted the important implications, this internationalisation process of the Real had for exchange rate dynamics. It showed that the Brazilian exchange rate has been characterised by large swings, both on the appreciation and depreciation side. In addition, it illustrated that exchange rate movements have become increasingly influenced by international market conditions, independent of domestic economic fundamentals. This increased vulnerability on international market conditions was particularly visible during the international financial crisis.

The following chapter will discuss the factors which contributed to the internationalisation of the Brazilian Real and show the important implications the Real's

internationalisation has had for the ability of the BCB to effectively influence the exchange rate.

Chapter 5: Liquidity and Currency Internationalisation

5.1. Introduction

Chapter 4 presented a detailed discussion of the internationalisation process of the Brazilian Real. This chapter will set out the factors which contributed to this process. In line with the Post Keynesian approach adopted in this dissertation, the discussion is couched in terms of the Brazilian Real's "own rate of interest". Particular emphasis lies on the "institutional" liquidity of the Brazilian market, which increased the Real's attractiveness for international investors. This institutional liquidity comprises, on the one hand, the specific microstructure of the Brazilian financial and foreign exchange market and, on the other hand, the existing macroeconomic framework of an inflation targeting regime and the operations of the central bank within this regime.

The emphasis on the institutional liquidity of Brazil's market is particularly warranted given recent changes in international financial markets. These changes, often coined under the heading of financialisation, involve both a considerable expansion of finance into new markets and important qualitative transformations. The qualitative transformation particularly highlighted in this chapter refers to the increased importance of short-term *trading* operations, rather than *investing* in financial assets and long-term financial relations for income generation and risk diversification. The increased importance of trading makes the liquidity of financial markets and assets a prime concern of international investors. The increased demand for liquidity was further exacerbated during the international financial crisis as uncertainty, i.e. liquidity preference, increased in international financial markets.

By highlighting the institutional structure and macroeconomic framework of the Brazilian financial and foreign exchange market, this chapter also presents a detailed discussion of the structure within which the foreign exchange market participants, interviewed for the qualitative part of this study, operated. In addition, it presents the main financial actors in the Brazilian foreign exchange market, and their preferred trading strategies and motivation to operate in the foreign exchange market.

This chapter is divided into three further sections. Section 2 presents the international environment as a background to the internationalisation process of the Brazilian Real. Section 3 discusses the institutional liquidity of the Real. Section 4 concludes with some initial observations on the implications the Real's internationalisation has had for macroeconomic and exchange rate management.

5.2. Liquidity and Financialisation

A large and expanding literature, often coined under the heading of financialisation, points to the substantial increase in the role of financial considerations in the world economy (Epstein 2005; Palley 2007). Finance has expanded into a myriad of areas, ranging from subprime housing and pension provision to commodity markets and new forms of emerging market assets.

In addition, financialisation has meant important structural changes in the real and financial sector and the interrelationship between the two spheres.⁹² In the financial sector, companies' increased reliance on open markets and banks' resulting turn towards generating profit through intermediating and investing in financial assets, rather than bank lending, considerably strengthened the role of markets in the process of financial intermediation. Consequently, rather than "long-term" income through corporate lending, the marketability or tradability of financial assets became increasingly important for banks (Chesnais 2005). Risk management through close relationships between debtors and creditors was replaced by finding ways of breaking down complex risks into elements to which theoretical probability distributions could be assigned. These could then be repackaged into a one-dimensional structure of spreads above conventional benchmark prices and traded according to the risk preferences of financial investors (Aglietta and Breton 2001). The ability to evaluate, homogenize and "trade" risk became crucial to manage risk in a financial system increasingly dominated by the market.⁹³ As a result, the trading of bonds and equities as well as the marketing of

⁹² For authors focusing on the real side see e.g. Krippner (2005); Lazonick and O'Sullivan (2000). For an empirical investigation into the negative real effects of financialisation see e.g. Stockhammer (2004).

⁹³ For this, the development of derivatives markets was essential: by breaking down risks into their generic parts, derivatives enable investors to decide which type of risk they wish to assume and to what degree (Aglietta and Breton 2001: 439; Boyer, Dehove et al. 2004).

hitherto illiquid instruments through securitization became the central components of the financial industry (Brunnermeier 2009; Brunnermeier, Crocket et al. 2009).⁹⁴

The rising importance of trading activities in financial markets was also reflected in the changing nature of the institutions operating in these markets. In addition to the growing importance of institutions which traditionally focused on such trading, like investment banks and hedge funds, commercial banks themselves have undergone important structural changes over the past years. As pointed out by Ertürk and Solari (2007) and Lapavitsas (2009), commercial banks increasingly began to resemble investment banks, generating revenue through proprietary trading, fees and commissions, rather than business lending and the resulting interest rate margin.

This dissertation argues that the increased role of trading for risk management and income generation is an important structural change on international financial markets and one manifestation of financialisation. In doing so, it comes close to Hardie (2007), who defines financialisation as the ability to trade risk. Hardie, however, does not theoretically define what determines this ability to trade risk, but lists possible empirical aspects, such as actors' investment mandates etc.

Following the Post Keynesian framework adopted in this dissertation, however, once trading is acknowledged to be an important element of international financial markets, two determinants of asset demand in the spirit of Keynes' (1997) Chapter 17 become important: the ability to generate capital gains and an asset's liquidity, i.e. the ability to convert the asset quickly and at no cost in the (international) funding currency.

The increasing importance of trading as a result of the proliferation of market based systems and the importance of liquidity for the ability to trade risk is also highlighted by Aglietta and Breton (2001). In their view, in addition to evaluating risk, financial systems are expected to provide liquidity to economic agents in an uncertain environment. Referring to the equity market the authors write "The price level and its variation over time, depends mainly on a process that can be qualified as speculative

⁹⁴Indeed, mainstream literature acknowledges the important expansion and changes in international financial markets. However, mainstream literature does not discuss these changes under the umbrella of a broad-based structural process, i.e. financialisation.

and which arises from strategic interdependence among market operators. Such a process is significantly affected by operators' concern for market liquidity, rather than being the straightforward outcome of the evaluation of the characteristics of the companies in question" (p. 438).

Both in Hardie's definition of financialisation as the ability to "trade risk", and in Aglietta and Breton's emphasis on risk and liquidity, stands a dual demand on the financial sector: (a) the ability to evaluate risk and (b) the ability to trade it, i.e. the provision of liquidity. In the spirit of Keynes' liquidity preference theory, however, these two demands are not independent from each other. For Keynes, agents' ability to evaluate risk is limited by fundamental uncertainty (Davidson 2002). The higher this uncertainty, or the lower the ability to trade risk, the more important becomes liquidity, i.e. the ability to trade it. Or, put differently, the more liquid a market the lower the demand on its ability and/or willingness for risk assessment.

This complementary relationship between risk and liquidity shows the importance of trading in market organised systems. In recent years, financial markets have been characterised by volatility and large swings in asset prices. This increased the uncertainty about future returns, tilting investors towards more liquid investments and strengthening the importance of the tradability of financial assets (Felix 1998). At the same time, this rising liquidity of financial markets lowered the necessity of risk assessment and allowed financial institutions to engage in increasingly risky operations. However, while greater liquidity, the ability to quickly divest oneself of a risky asset, might seemingly reduce the risk for the individual investor, on a macro-level one cannot reduce risk through increasing tradability. The increased demand for liquidity in the face of rising uncertainty becomes especially obvious in the times of crisis. The growing unpredictability of future asset price movements increases the attractiveness of assets which can be sold any time and at low cost.

As discussed in Chapter 3, the concrete manifestation of liquidity is a multidimensional reality defined by the institutional structure of a market, the properties of the asset itself, in particular its maturity, and the existing micro and macroeconomic financial structure(s) etc. Indeed, recent institutional changes in international financial markets were primarily aimed at creating greater liquidity for the financial community, in order

to reduce private risk and allow larger positions in financial assets. Financial liberalisation has reduced transaction costs, both through lower regulation, increased competition and technical innovations. At the same time, financial globalisation has substantially increased the number of participants in international financial markets, multiplying the amount of possible buyers and sellers and increasing the frequency of quotations. Finally, financial liberalisation and globalization have led to an ever increasing standardisation and homogenisation of financial products and techniques, which has increased the harmonisation of evaluation and thus reduced the cost of trading for a wide public beyond the individual specialist (Orléan 1999).

Table 5.1 shows both the rising size and increased liquidity of international financial markets since the millennium. Market size is approximated with assets outstanding and stock market capitalization. The liquidity of a market is more difficult to measure. The Bank of International Settlement summarizes its multidimensional reality in three keywords: depth, tightness and resilience. Although imperfect measures, commonly used indicators to measure these characteristics are bid-ask spreads as a measure of tightness and trading volume as an indirect measure of depth. A market's ability to absorb shocks has been approximated with its day to day price volatility (CGFS 2001; BIS 2007a).

Bid-ask spreads are difficult to obtain for a wide range of markets. Table 5.1 shows the average daily trading volume (ADTV) across global financial markets. One can observe the continuous increase in ADTV and the substantial adjustment in 2008, as the international financial crisis struck in the developed world.

Table 5.1: Market Size and Trading Volume in Main Financial Markets, US\$ billion

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bond Markets										
Issues Outstanding%GDP	170%	180%	188%	196%	197%	202%	211%	221%	226%	237%
ADTV	358	509	630	752	819	919	893	1,015	1,034	815
Stock Markets										
Market Capitalization%GDP	96%	84%	69%	84%	88%	91%	103%	109%	53%	82%
ADTV	199	152	132	133	169	204	280	452	454	245
Foreign Exchange Markets										
Notional Value Outstanding%GDP	NA	4%	NA	NA	4%	NA	NA	6%	NA	NA
ADTV	NA	20,435	NA	NA	31,500	NA	NA	57,597	NA	NA
Derivatives Markets										
<i>Notional Value Outstanding%GDP</i>										
Exchanges	44%	74%	72%	98%	110%	126%	141%	142%	94%	126%
OTC	295%	347%	592%	691%	614%	657%	847%	1070%	976%	1043%
<i>ADTV</i>										
Exchanges	358	653	680	829	1,114	1,370	1,721	2,151	1,515	1,778
OTC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source: SIFMA (2010); BIS (2001; 2004; 2007b; 2010d); WFE (2010); IMF-IFS (2011c); author's own calculations

Notes: data include all countries for which financial transactions are reported; bond market data are only for the US; stock market data for 2009 only includes electronic order book traders; market size data (except the bond market for which US GDP has been used) have been standardized with global GDP⁹⁵

Table 5.2 shows the volatility, measured by the annual standard deviation, of some major bond, stock and currency markets, as a measure of tightness of major financial markets.

Table 5.2: Annual Standard Deviation of Selected International Financial Market Indicators

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
US benchmark government bond (10 years)	0.401	0.289	0.541	0.341	0.270	0.183	0.239	0.297	0.449	0.396
Japan benchmark government bond (10 years)	0.101	0.103	0.188	0.349	0.179	0.116	0.147	0.123	0.141	0.079
Germany benchmark government bond (10 years)	0.169	0.186	0.312	0.222	0.214	0.197	0.216	0.195	0.408	0.153
FTSE All World Price Index	8.376	13.702	13.734	12.964	6.181	6.865	9.914	11.076	40.309	24.453
Euro/US\$	0.059	0.033	0.061	0.039	0.027	0.032	0.024	0.028	0.051	0.038
Japanese Yen/US\$	2.129	3.377	5.464	4.473	2.724	4.984	2.092	3.718	5.391	3.581

Source: Datastream; author's own calculations

Notes: Government bond refers to interest rates on these bonds

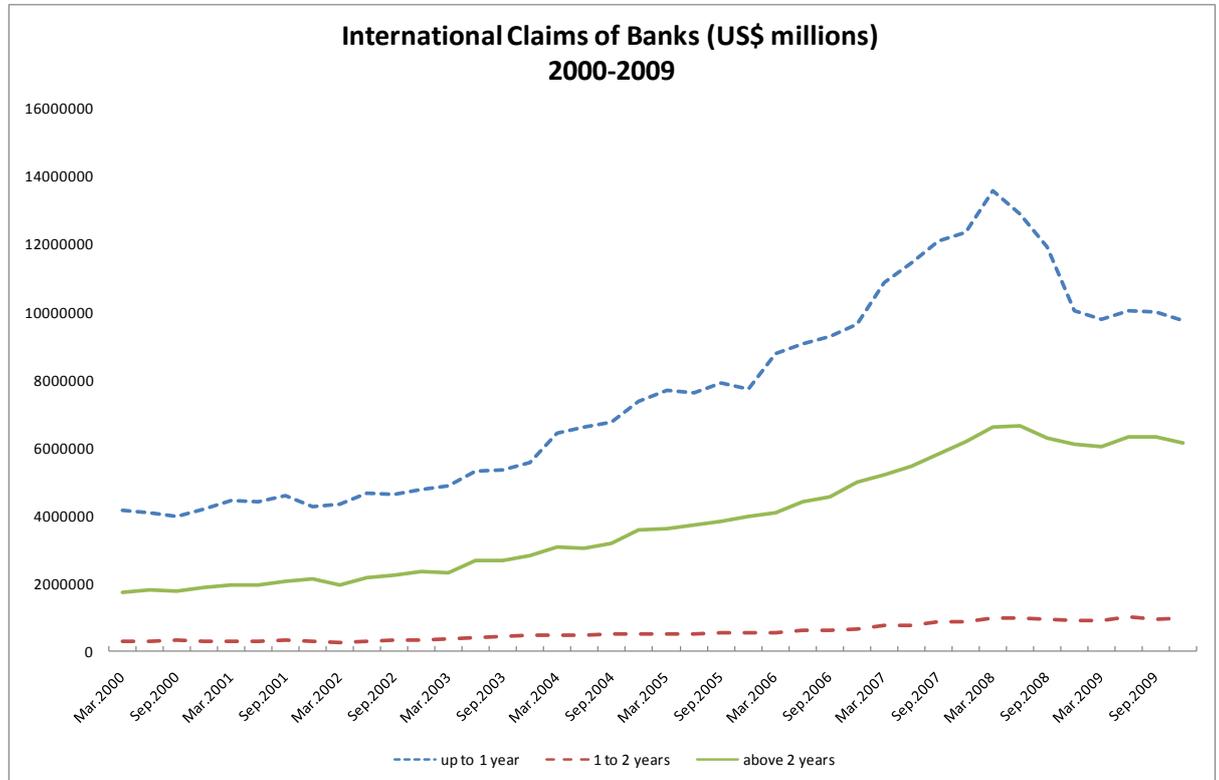
One can observe the falling volatility before the international financial crisis and its upsurge during the crisis. The dynamics are particularly apparent in the US 10 year benchmark bond, the FTSE all world price index and the Euro/US\$ exchange rate.

The intensified demand for liquidity during the international financial crisis can be observed in Figure 5.1, which shows international claims of banks, as proxy of international cross-border transactions, according to their maturity structure. Given their importance in international financial markets and limited availability of portfolio data of

⁹⁵ Although some smaller countries, which do not have an exchange or do not report data, are not included in global financial market indicators, it is assumed that their contribution to global GDP is not too substantial.

non-bank international financial institutions, these data can be taken as proxies for general financial market behaviour during the international financial crisis.

Figure 5.1

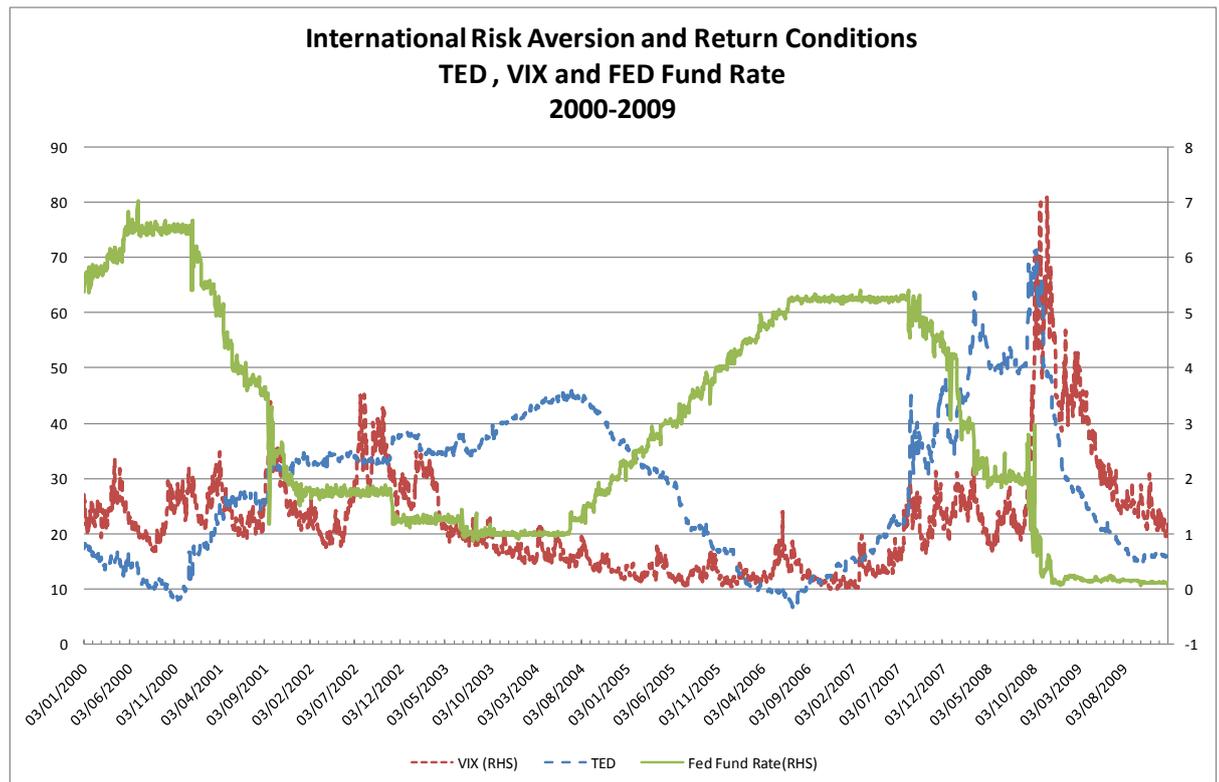


Source: BIS (2011)

Figure 5.1 shows that short-term assets, claims with a maturity of up to one year, picked up in 2003, accelerated in 2005, and further increased at the beginning of 2007 - as the first signs of the international financial crisis emerged and short-term capital flows to emerging markets saw a considerable uptake.

The increased international risk aversion and demand for liquidity in the international financial crisis can also be seen in Figure 5.2, which shows the VIX and the TED spread. The VIX was introduced in the preceding chapter. The TED spread measures the difference between the London Interbank Offered Rate (LIBOR) and the risk-free T-bill rate and is an important indicator of international risk aversion and international funding conditions (Brunnermeier, Nagel et al. 2008; Büyükşahin and Robe 2010).

Figure 5.2



Source: Datastream

One can observe that both indicators of international risk aversion increased substantially from the beginning of 2007. Figure 5.2 also shows the Fed Fund rate as a proxy for international return conditions. After a continuous increase over 2004 and 2005, the Fed Fund rate started to decline at the beginning of 2007. However, the US government’s decision to lower its policy rate to deal with the effects of the international financial crisis lead to a hunt around the globe for high yielding and liquid assets, a combination offered by Brazilian assets.

5.3. Brazil’s Institutional Liquidity

The importance of trading increased not only in terms of depth in developed financial markets, but also in breadth, as the search for highly liquid assets extended into DECs. This move was primarily driven by developments in international financial markets: increased competition and abundant liquidity pushed financial institutions into new areas of investment; growing co-movement of financial assets in developed financial markets increased the attractiveness of DECs’ assets for international portfolio

diversification. This became further exacerbated during the first stage of the international financial crisis as the reigning “decoupling-hypothesis” seemed to offer safe returns in DECAs in the face of rising uncertainty and falling profitability in the developed world.

The global nature of the phenomenon notwithstanding, the extent of a country’s integration in this international financial system was fundamentally determined by its ability and willingness to supply liquid assets to the international investor community and by its domestic return characteristics. In relation to returns, for the first time in Brazil, these included gains on the exchange rate. In relation to liquidity, as discussed in Chapter 3, its exact manifestation is an institutional and context specific reality. Several elements of this liquidity in the Brazilian context will now be discussed.

5.3.1. Financial Liberalization

As mentioned above, financial liberalisation is targeted at increasing the liquidity of an asset through reducing transaction costs, increasing the availability of information and number of operators in the market etc. Though a relative late-comer in South America, Brazil intensified its financial opening and liberalization in the 1990s as part of an exchange rate based inflation stabilization program. The Lula administration on the while continued this process in the 2000s (Prates and Paulani 2007).

With reference to the foreign exchange market and the promotion of the Brazilian Real as international currency several measures are particularly noteworthy. Firstly, resolution Nr. 2,689 from January 2000 which eased restrictions on foreign investors’ access to the stock, fixed-income and local derivatives market. Secondly, probably the most important measures in the foreign exchange market were introduced in the first quarter of 2005 with resolution Nr. 3,265. These measures included the unification of the commercial (livre) and tourism (flutuante) foreign exchange market and the abolition of the “Conta de Nao-residentes” (CC5), which removed all limits on the amount of domestic currency which physical and juridical entities could convert into US\$. For the first time, domestic entities were permitted to buy unlimited foreign currency directly from banks, which could then be invested abroad. In addition, returns

on such investments did not have to be repatriated to Brazil but could be re-invested overseas.

Thirdly, in February 2006 the Lula administration exempted foreign investment in public titles and venture capital funds from income and excise tax (Contribuição Provisória Sobre Movimentação Financeira (CPMF)) on primary equity issues and increase in business capital by private companies (Prates 2007). Also in 2006, the administration extended the time and amount exporters could keep their foreign exchange receipts abroad. This measure was further extended in 2008 with resolution Nr. 3,548 which allowed exporters to keep 100% of their export receipts overseas (Prates 2007; Prates and Farhi 2009).

Finally, in 2008, several laws and resolutions consolidated these liberalizing reforms, including several measures simplifying the (international) tradability of the Brazilian Real. Among others, resolution Nr. 3,568 allowed banks to receive and send spot currency overseas. In a similar vein, Law 11,803 allowed banks to provide spot currency abroad through Brazilian Real held in deposit accounts at offshore banks. Finally, the same resolution authorized the BCB to maintain Real deposits held by central banks and other internationally accredited institutions that provide clearing, settlement and custody services in international financial markets. This latter measure, particularly the provision of clearing services, was crucial to foster the internationalisation of the Real, as it reduced the risk to international investors from different time zones and opening hours of global markets (BCB (Central Bank of Brazil) 2009a).

As a result of the strong short-term capital inflows and their implications for the exchange rate, the trend of lowering costs for international investors was slightly reversed from October 2009, when the Lula government introduced a 2% tax on foreign investments (Imposto sobre Operações Financeiras (IOF)).⁹⁶This tax was further extended to 6% for fixed income investments in March 2010. As discussed in more detail in Chapter 10, initial empirical evidence shows that these measures were only of limited success.

⁹⁶ This tax was initially levied only on fixed income instruments and was abolished altogether in October 2008.

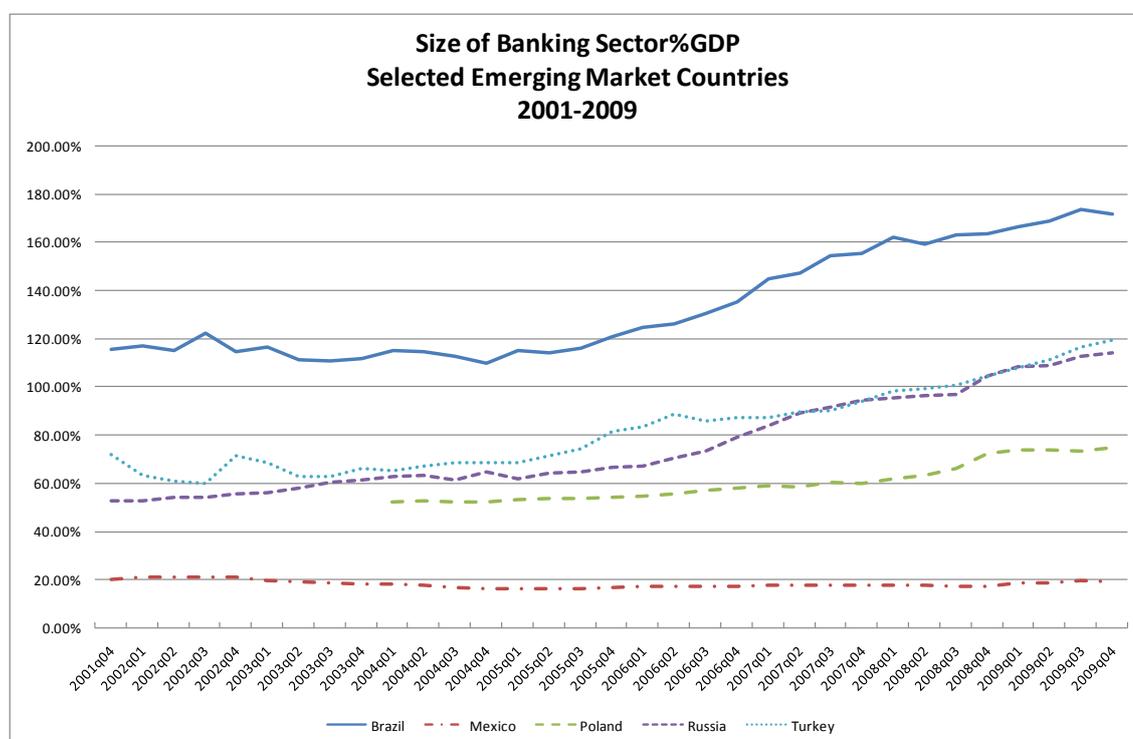
5.3.2. Financial System and Foreign Exchange Market Structure

Brazil's increased liquidity through financial liberalisation and financial opening was complemented by several institutional features and peculiarities of the Brazilian financial and foreign exchange market. These features include a relatively big and sophisticated financial system with a large amount of heterogeneous market players, a focus on short-term trading operations, among other things evidenced by a marked concentration in assets of very short maturities, and finally, as probably the most peculiar characteristic of the Brazilian financial market, the existence of a very deep and actively traded local securities and derivatives exchange, the BM&FBovespa.

5.3.2.1. General Financial System Structure

Figure 5.3 shows the size of the banking sector as a percentage of GDP of 6 selected emerging countries from the end of 2001 to the end of 2009.

Figure 5.3



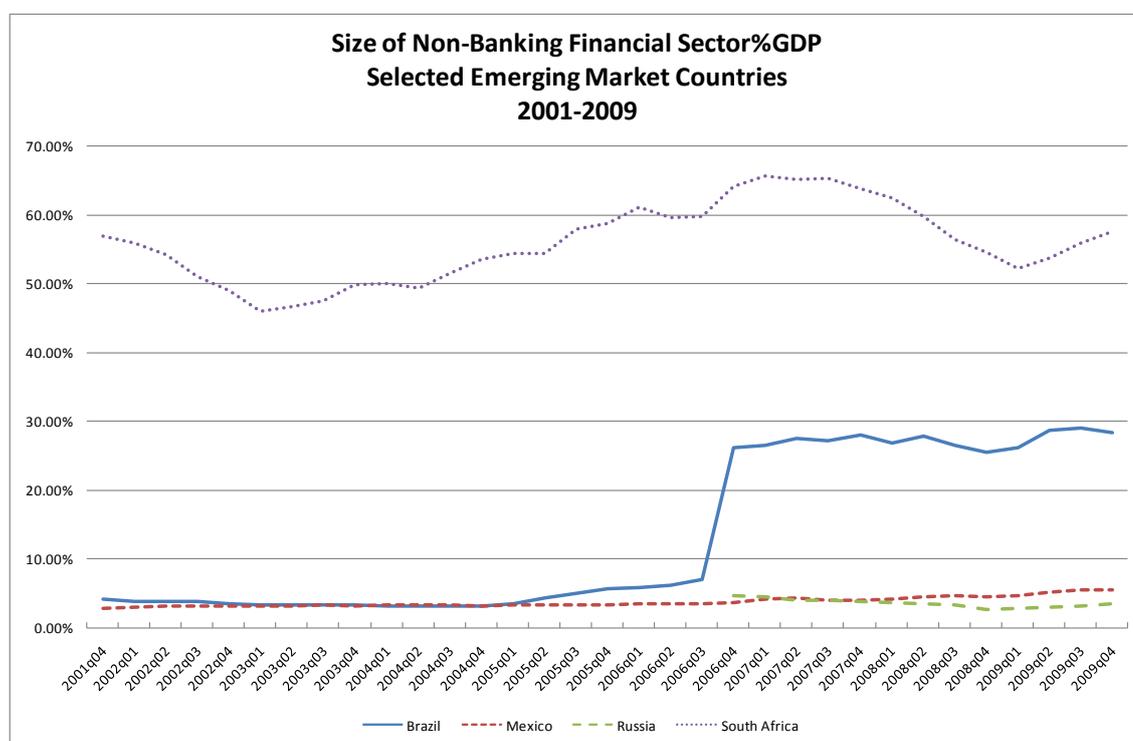
Source: IMF-IFS (2011c); author's own calculations

Notes: Size of banking sector measured as total assets of depositary corporations defined in IMF (2011b)

One can observe the large size of the Brazilian banking sector compared to the other emerging markets presented. As discussed in more detail below, banks are crucial for providing liquidity to (international) investors, mainly through their role as intermediaries and market makers.

Figure 5.4 shows the size of the non-banking financial sector, such as pension funds, insurance companies and corporative and building societies, as a percentage of GDP for those emerging countries for which data were available. Since mid 2006, the size of Brazil's non-banking financial sector surpasses most of the other countries under consideration.⁹⁷

Figure 5.4



Source: IMF-IFS (2011c); author's calculations

Notes: Size of non-banking sector measured as total assets of other financial corporations defined in IMF (2011b); data on the non-banking financial sector for Poland and Turkey not available

Indeed, in addition to a relatively deep and active banking system, Brazil has a large and heterogeneous landscape of domestic financial market players, which provided liquidity

⁹⁷ One exception is South Africa, which has a very large non-bank financial sector. This is due to the existence of large financial conglomerates which are tightly linked to the domestic mining sector (Fine 1997). The jump in the Brazilian data in mid 2006 is due to an increase in both claims on the private sector and other sectors. Most likely this abrupt change is related to the inclusion of a data category which was previously not considered in the data.

to foreign investors through acting as counterparties, offering financial products, lowering the spread through heightened competition etc.

Table 5.3 shows the worldwide total net assets and number of mutual funds for selected emerging and developed countries.

Table 5.3: Total Net Assets and Number of Mutual Funds in Selected Emerging and Developed Countries, 2004-2009

	2004	2005	2006	2007	2008	2009
Total Net Assets of Mutual Funds (US\$ million)						
Brazil	220,586	302,927	418,771	615,365	479,321	783,970
Mexico	35,157	47,253	62,614	75,428	60,435	70,659
Poland	12,015	17,651	28,959	45,542	17,782	23,025
Russia	1,347	2,417	5,659	7,175	2,026	3,182
South Africa	54,006	65,594	78,026	95,221	69,417	106,261
Turkey	18,112	21,760	15,462	22,609	15,404	19,426
Germany	295,997	296,787	340,325	372,072	237,986	317,543
United States	8,095,082	8,891,108	10,397,935	12,002,283	9,603,604	11,120,196
United Kingdom	492,731	547,092	755,163	897,460	504,681	729,141
Worldwide Number of Mutual Funds						
Brazil	2,859	2,685	2,907	3,381	4,169	4,744
Mexico	411	416	437	420	431	407
Poland	130	150	157	188	210	208
Russia	210	257	358	533	528	480
South Africa	537	617	750	831	884	904
Turkey	240	275	282	294	304	286
Germany	1,041	1,076	1,199	1,462	1,675	2,067
United States	8,040	7,974	8,118	8,027	8,022	7,685
United Kingdom	1,710	1,680	1,903	2,057	2,371	2,266

Source: ICI (2011)

Notes: All data end of year values

One can observe the large size of total net assets of mutual funds in Brazil compared to other emerging countries, but also developed ones, such as Germany. Varga and Wengert (2010) note that in 2007, the assets held by mutual funds in Brazil made up more than 85% of all mutual fund assets in Latin American and more than 50% of mutual fund assets in the BRICs. According to data from the BCB, in March 2010 nearly a third of these assets were held by so called “Fundos Multimercados”, which are comparable to hedge funds in developed financial markets (Petersen 2007). The total number of mutual funds operating in Brazil is only surpassed by that in the United States.

In a similar vein, as can be seen in Table 5.4, Brazilian pension fund assets by far surpass those in other emerging (and even developed) countries.

Table 5.4: Global Pension Fund Assets (US\$ billion)

	2001	2005	2006	2007	2008
Brazil	71	138	166	288	288
Mexico	27	77	98	120	230
India		45	51	62	62
France		124	155	179	199
Italy	35	54	62	77	88
Germany	65	113	512	154	172
United States	11134	14428	15886	20244	15612
United Kingdom	1472	2539	2913	3323	2318

Source: IFSL (2008); IFSL (2010)

Finally, and more recently, large Brazilian companies (primarily exporters) have become very active in trading operations in financial markets. For example, de Oliveira and Novaes (2007) show that nearly half of all companies using foreign exchange swaps do so for speculative, rather than hedging, purposes. According to their results, this speculative activity was particularly pronounced among companies with large export receipts and during times of heightened exchange rate volatility. Speculative foreign exchange operations by companies, became especially important during the international financial crisis (Farhi and Borghi 2009). On the one hand, their speculative exchange rate positions (particularly in OTC options) were an important counterpart to both domestic and foreign investors, particularly in the face of a worsening international market as international investors sought to close their positions in Brazil. On the other hand, it was exactly these companies' open foreign exchange positions by companies which contributed to the large depreciation of the Real when the crisis finally hit Brazil.

In addition to its large size, several authors have noted the relative importance of short-term trading operations in the Brazilian financial market (Goldfajn, Hennings et al. 2003; Hardie 2007).⁹⁸ Table 5.5 shows the annual trading volume in several financial assets in selected emerging and developed countries.

⁹⁸This importance of short-term trading operations can be partly explained as a legacy of the hyperinflationary period during which Brazilian banks developed a high degree of technological and operational sophistication, which supported their ability to be active players in the market.

Table 5.5: Annual Trading Volume in Selected Emerging and Developed Financial Markets

	2004	2005	2006	2007	2008	2009
Local Currency Bonds (US\$ mn)						
Brazil	459,134	432,985	517,975	624,873	591,172	548,251
Mexico	806,826	696,660	1,252,802	1,206,380	92,291	116,175
Poland	114,853	254,845	288,165	270,281	123,031	138,559
South Africa	147,809	187,825	342,389	450,728	314,943	106,848
Turkey	82,005	281,864	284,803	327,684	282,749	300,974
Domestic Stocks (US\$ mn)						
Brazil (Bovespa)	103,990	165,276	276,150	597,924	724,199	626,221
Mexico (Mexican Exchange)	45,389	56,683	96,918	143,945	110,474	84,255
Poland (Warsaw SE)	16,269	30,422	56,373	87,962	69,499	53,509
South Africa (Johannesburg SE)	161,073	201,779	311,041	423,385	395,235	266,006
Turkey (Istanbul SE)	146,605	200,858	222,724	294,295	247,893	301,122
United States (American SE)	590,652	608,091	601,188	670,191	561,603	NA
Short-term Interest Rate Futures (Nr. Contracts)						
Brazil (BM&F)	134,385,483	143,655,871	180,822,732	221,627,417	166,983,583	170,190,085
South Africa (Johannesburg SE)	NA	0	667	NA	NA	40,000
United States (CME)	300,849,399	411,706,656	503,729,899	623,411,052	597,774,076	438,095,073
Exchange Rate Futures (Nr. Contracts)						
Brazil (BM&F)	24,741,990	1,293,181	1,726,351	88,237,446	87,627,320	67,437,189
Poland (Warsaw SE)	3,455	6,216	3,144	6,101	132,559	162,239
South Africa (Johannesburg SE)	NA	NA	NA	199,633	NA	7,177,562
Turkey (Turkish Derivatives Exchange)	NA	1,603,797	4,598,416	7,849,609	14,110,292	13,759,748
US (CME)	48,772,627	81,105,391	110,338,043	139,793,600	152,215,936	152,694,240

Source: EMTA (2005; 2007; 2009) ; WFE (2010) ; author's calculations

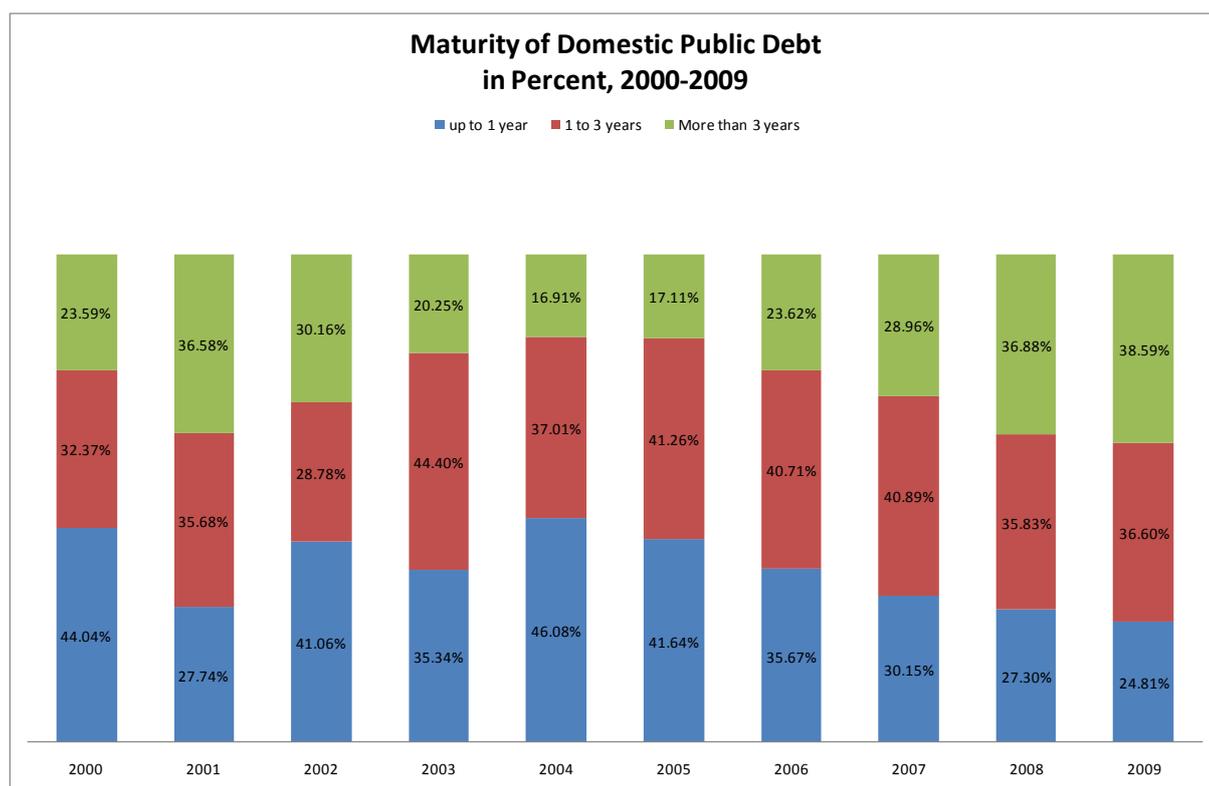
Notes: Data for annual stock trading volume data between 2000 and 2008 represent total share trading including electronic order book and negotiated deals. For 2009, data represents only electronic order book deals; annual trading volume on derivatives markets has been presented according to data availability

One can observe the large trading volume in the Brazilian market compared to the other emerging countries across all financial markets presented. In the local derivatives market, trading was particularly active in short-term interest rate and exchange rate futures. For example, in 2009 the annual trading volume in short-term interest rate futures reached 170 million contracts, nearly half of the contracts traded on the Chicago Mercantile Exchange (CME), one of the largest derivatives exchanges in the world. From 2006 onward, annual trading volume in foreign exchange futures reached around half of that on the CME.

This active trading environment and liquidity of the Brazilian market has been supported by a marked concentration in short-term maturities of Brazilian financial assets.

Figure 5.5 shows the maturity profile of Brazil's domestic public debt.

Figure 5.5



Source: BCB (2011d); data are from December each year

Although lengthening, one can observe that nearly 25% of Brazil's outstanding domestic public debt was still of a maturity of up to 1 year in 2009. Indeed, as can be seen in Table 5.6, Brazilian public bonds still have the lowest maturity compared to all regional averages.

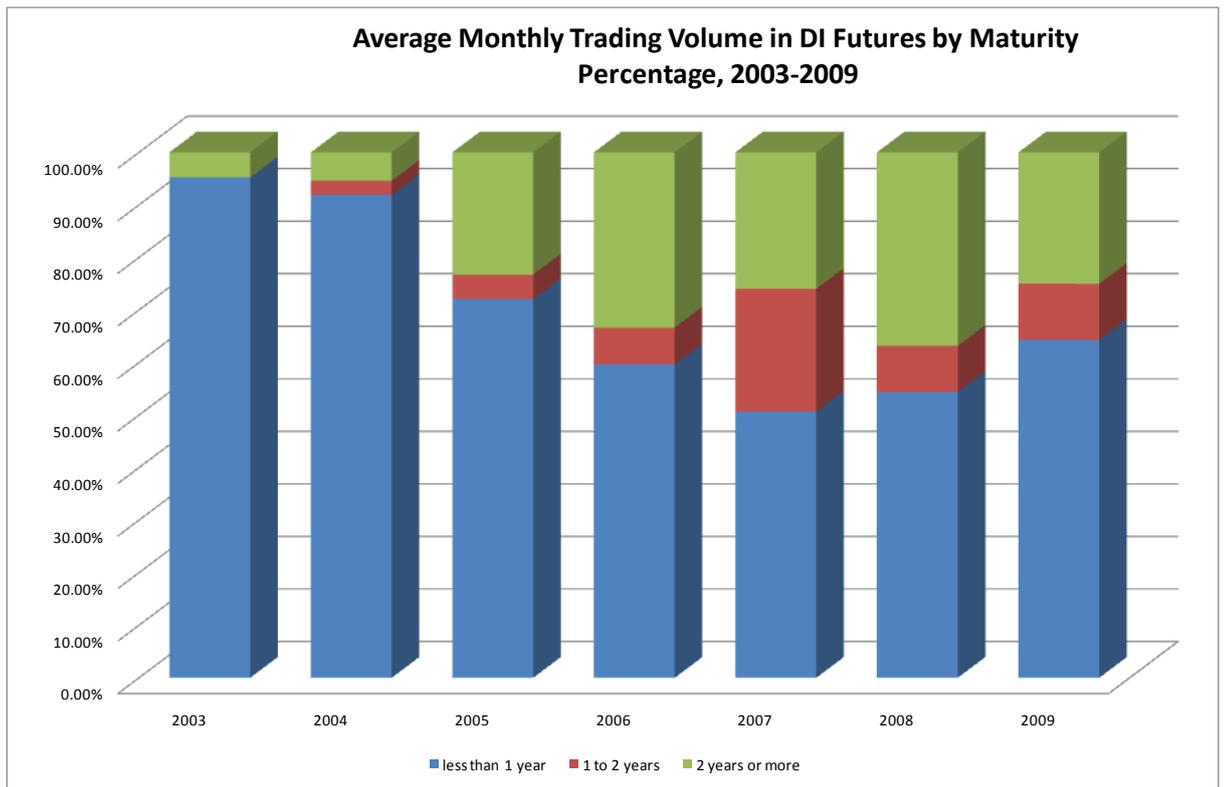
Table 5.6: Remaining Maturity in Years of Domestic Central Government Debt Outstanding

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Brazil	2.50	3.00	2.90	2.70	2.70	2.30	2.60	3.00	3.30	3.40
Latin America	2.70	3.30	2.80	2.50	2.40	3.90	4.00	4.40	4.90	4.50
Asia, larger economies	5.30	6.50	7.00	7.10	7.30	7.00	6.90	7.10	7.60	7.50
Other Asia	5.70	4.80	5.70	6.00	5.90	5.50	5.60	7.10	5.10	4.30
Central Europe	3.00	3.00	3.30	5.10	3.80	4.00	4.30	4.40	4.40	4.20
Other	5.40	5.60	5.60	7.40	4.40	4.30	4.10	3.40	4.10	4.50
Total Emerging Markets	4.20	4.60	5.10	8.10	4.90	5.00	5.10	5.20	5.50	5.20
Industrial Countries	6.50	5.60	5.20	10.00	4.90	5.90	5.00	5.40	5.00	5.10

Source: BIS (2010e)

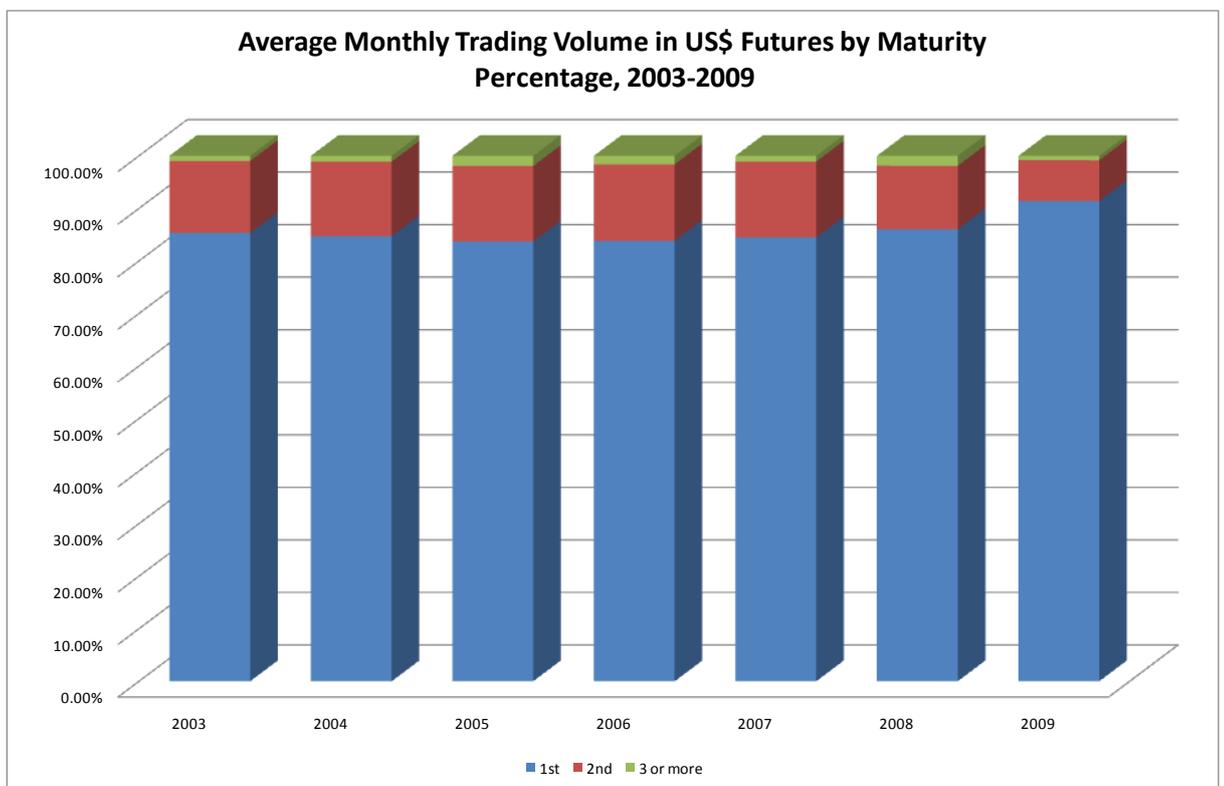
This marked concentration in short-term maturities is particularly evident for assets traded on the local derivatives exchange. Figure 5.6 and Figure 5.7 show the share of different maturities in the total average monthly trading volume in DI and US\$ Futures.

Figure 5.6



Source: Credit Suisse (2011)

Figure 5.7



Source: BCB (2004; 2005; 2006; 2007; 2008; 2009b)

Notes: Maturities refer to months

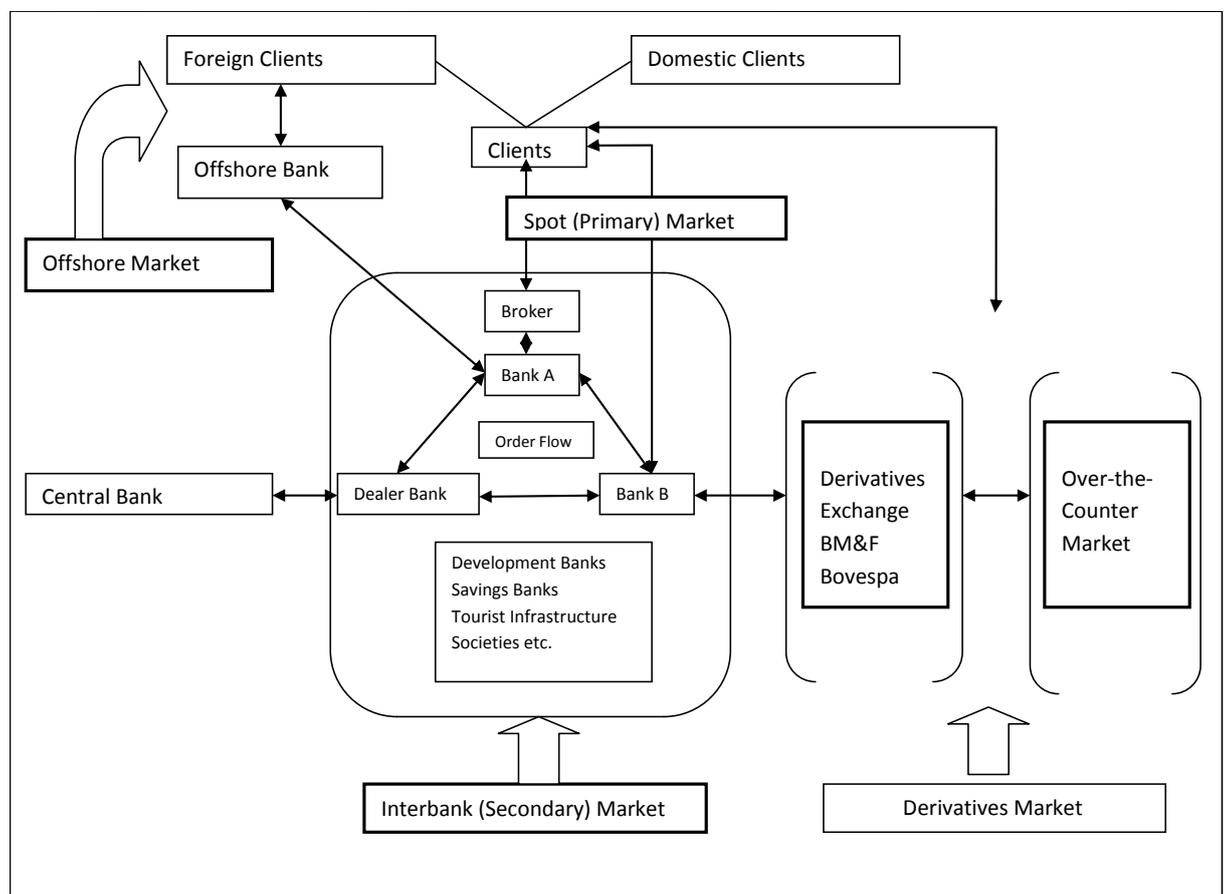
A general lengthening notwithstanding, a large share of DI futures traded is still concentrated in a maturity of less than a year. The concentration in very short maturities is particularly striking for the US\$ Futures, for which, on average, around 85% are traded in the first maturity, i.e. one month.

Finally, probably the most distinctive characteristic of Brazil's financial market is the existence of a very deep and actively traded derivatives market, the BM&FBovespa, which is analysed in the next section.

5.3.2.2. Foreign Exchange Market Structure

Figure 5.8 shows a schematic picture of the structure of the Brazilian foreign exchange market.

Figure 5.8: The Brazilian Foreign Exchange Market



One can see the five main markets where the Brazilian Real is traded: the spot (primary) market, the interbank (secondary) market, the derivatives exchange (BM&FBovespa), the OTC derivatives market and finally the offshore market. In addition, foreign currency operations are conducted between the central bank and selected dealer-banks through which the central bank intervenes in the foreign exchange market.⁹⁹ The primary market is the market where spot currency is traded between the banks and the clients, i.e. where currency demand and supply pressures (flows) are transmitted from the clients to the banks. According to the microstructure literature presented in Chapter 2, this is the market where “fundamental” information is transmitted to the banks. In the secondary market banks trade the spot currency coming from the primary market, which transmits this information into the price.

In general, only institutions authorized by the central bank are allowed to operate in the spot market. These include banks (commercial, universal, investment), development banks, savings banks (caixa economica), credit, financing and investment societies, securities, stocks and foreign exchange brokers, securities and stock dealer societies, tourist agencies and tourist accommodations. As of 2011, 127 institutions were authorized to operate in the spot foreign exchange market, 89 of which were banks. While banks are authorized to conduct all general foreign exchange operations, the operations of the other institutions are restricted to specific operations depending on the nature of their participation in the spot market. The Brazilian foreign exchange market is regulated by the National Monetary Council (Conselho Monetario Nacional – CMN) and the BCB.

Brazil’s spot market is organised as a decentralized multiple dealer market. Banks can trade either directly with each other and their clients or through brokers (corretoras). Brokers do not assume foreign exchange positions themselves but match buying and selling orders from different banks.¹⁰⁰ In contrast to other markets, Brazil does not possess an electronic negotiation system. Operators communicate over the counter, per telephone or other media of communication. According to Garcia and Urban (2005) the

⁹⁹ There are currently 14 selected dealer banks. Dealer banks are chosen by the BCB every six months and at least three institutions must swap functions in each period. The choice is based on 5 criteria, including the volume of operations in several markets and the quality of information provided to the BCB (Credit Suisse 2011).

¹⁰⁰ Under certain exceptional circumstances, e.g. in the case of foreign exchange operations for tourism purposes, brokers can also conduct foreign exchange operations on their own account.

operational cost and risk of this decentralised form of negotiation leads to the widespread use of a few large brokerage houses. In addition, as discussed in more detail below, the resulting operational risk has prompted banks to migrate large parts of their operations onto the liquid derivatives exchange.

All foreign exchange transactions between banks and clients have to be inputted into the SISBACEN, an electronic system of collection, storage and exchange of information which gives the BCB a detailed overview of all spot transactions in the Brazilian market. The transactions are settled either directly between the parties through their reserves with the BCB (or current account if the operator, such as a few investment banks, don't have an account with the BCB) or increasingly through a clearing system at the BM&FBovespa. The settlement of foreign currency is conducted between the corresponding foreign banks, primarily located in the US (for a detailed overview of the different settlement mechanisms in the Brazilian market see Garcia and Urban (2005)).

Foreign exchange derivatives are traded both on the OTC market and most importantly on the local derivatives exchange, the BM&FBovespa.¹⁰¹ According to Brazil's CETIP, a private clearing house, in June 2007 the total amount of outstanding swap contracts in Brazil's OTC market was R\$ 209.9 billion.¹⁰² The main foreign exchange instruments traded on OTC markets are foreign exchange swaps and to a lesser extent options. Like in other countries, Brazil's OTC market is bifurcated between an inter-dealer market where dealers exclusively trade with each other, and a customer market where end users trade with one or more of the available dealers. In both markets, trading is primarily done by voice over the phone, either directly between the participants or via brokers. There are reported to be 15 to 20 active dealers in the market (Dodd and Griffith-Jones 2007).

Table 5.7 gives an overview of the main instruments and their relative share traded on the BM&FBovespa in 2007 and 2008.

¹⁰¹ To support the liquidity of spot foreign exchange trading the BM&FBovespa also introduced spot dollar trading on the derivatives exchange in February 2006. However, up to now, the liquidity of these operations remains very low with an average daily trading volume of roughly US\$ 0.4 billion in 2010 (Credit Suisse 2011).

¹⁰² These are total swap contracts. A breakdown into different instruments, e.g. currency swaps, is not available at the CETIP.

Table 5.7: Amount and Relative Share of Instruments Traded on the BM&FBovespa

	2007		2008		2007		2008	
	Volume traded (Nber of Contracts)		Notional value (USD millions)		Open interest (Nber of contracts)		Number of trades	
Absolute Amount								
Single Stock Options	367,305,446	350,063,630	1,056,343	855,130	2,705,526	2,853,694	9,174,323	11,877,646
Stock Index Options	1,111,852	1,440,602	NA	NA	34,895	43,489	22,860	19,816
Stock Index Futures	26,550,491	20,226,662	731,643	616,422	221,491	100,939	1,132,013	1,006,866
Short-term interest rate options	14,202,606	21,233,242	NA	NA	5,253,123	5,292,946	11,129	9,518
Short-term interest rate futures	221,627,417	166,983,583	9,982,519	7,886,598	7,903,570	5,332,632	626,235	572,024
Long-term interest rate futures	180,877	160,533	14,949	14,765	6,295	948	904	962
Currency Options	24,682,702	30,588,575	NA	NA	1,440,493	1,632,131	34,444	33,402
Currency Futures	88,237,446	87,627,320	4,289,040	4,322,398	977,281	1,021,356	1,645,967	1,920,346
Commodity Options	286,902	498,912	NA	NA	39,702	59,303	1,333	2,270
Commodity Futures	2,075,617	3,114,258	23,797	43,949	84,161	50,247	246,978	388,156
TOTAL	746,261,356	681,937,317	16,098,292	13,739,262	18,666,537	16,387,685	12,896,186	15,831,006
Relative Values								
Single Stock Options	49.22%	51.33%	6.56%	6.22%	14.49%	17.41%	71.14%	75.03%
Stock Index Options	0.15%	0.21%	NA	NA	0.19%	0.27%	0.18%	0.13%
Stock Index Futures	3.56%	2.97%	4.54%	4.49%	1.19%	0.62%	8.78%	6.36%
Short-term interest rate options	1.90%	3.11%	NA	NA	28.14%	32.30%	0.09%	0.06%
Short-term interest rate futures	29.70%	24.49%	62.01%	57.40%	42.34%	32.54%	4.86%	3.61%
Long-term interest rate futures	0.02%	0.02%	0.09%	0.11%	0.03%	0.01%	0.01%	0.01%
Currency Options	3.31%	4.49%	NA	NA	7.72%	9.96%	0.27%	0.21%
Currency Futures	11.82%	12.85%	26.64%	31.46%	5.24%	6.23%	12.76%	12.13%
Commodity Options	0.04%	0.07%	NA	NA	0.21%	0.36%	0.01%	0.01%
Commodity Futures	0.28%	0.46%	0.15%	0.32%	0.45%	0.31%	1.92%	2.45%

Source: WFE (2010)

The two main instruments traded on the BM&FBovespa are single stock options and short-term interest rate (DI) futures. Currency futures are the third most important group with a share of nearly 13% of the total volume of contracts traded. The trading of dollar futures is organized as an auction, where participants may place purchase and sell orders as well as close business against previously placed orders. The trading floor is divided between an electronic trading system and an open outcry or “pit” system, but the two never run concurrently. Every working day of the month a new contract opens which is due for delivery on the last working day of the month. The dollar futures contract is standardized to US\$ 50,000. It sets forth a daily adjustment of positions between buyers and sellers and requires them both to deposit margins at the BM&FBovespa. Upon maturity, the open position will be settled by the BM&FBovespa using the PTAX800 FX rate.¹⁰³ As shown above, despite the existence of contracts with a maturity of up to a year, the vast majority of the volume of dollar futures traded corresponds to the first maturity (30 days) (Ventura 2008; Credit Suisse 2011).

Finally, as discussed in Chapter 4, trading of the Brazilian Real also takes place in offshore markets, which are primarily organised as OTC markets. Trading is carried out

¹⁰³ The PTAX800 (or simply PTAX) is the official exchange rate used for the settlement of financial contracts indexed to the dollar, including dollar futures and NDFs traded offshore. To avoid manipulations, from July 2011 onwards the PTAX is calculated based on four daily price surveys (rather than just one as previously), disregarding the two highest and lowest prices (Credit Suisse 2011).

either through domestic and foreign banks, which have an offshore representation, or offshore banks.¹⁰⁴ Given that the Brazilian Real remains non-deliverable on offshore markets, the main instrument traded are Non-deliverable forwards (NDFs).

Table 5.8 gives an indication of the relative liquidity, approximated by the average daily trading volume, of these 5 different foreign exchange markets. Given that the liquidity of the Brazilian foreign exchange market is concentrated in US\$/Brazilian Real operations, data on this currency pair are reported. Data on the interbank and offshore market are not publicly available. Thus, for these two markets, anecdotal evidence from newspaper and investments reports had to be presented (Brown Brothers Harriman & CO (BHH) 2010; Raedle 2010). According to estimations from Pires de Souza and Hoff (2006), the outstanding volume of NDF contracts at the end of 2005 amounted to US\$ 75 billion. In addition, some approximation about the daily trading volume on offshore markets can be derived from the BIS triennial OTC foreign exchange survey.

Table 5.8: Approximated Average Daily Trading Volume in Brazilian Real (US\$ million)

	Spot Market	Interbank Market	BMF&Bovespa (FX Futures)	BMF&Bovespa (FX Options)	OTC Market	Offshore Market
2007	4,754	NA	17,507	4,897	2,281	3,252
2010	5,508	3,000	21,140	5,072	4,701	8,956

References: BIS (2007b; 2010a); WFE (2010); author's own calculations

Notes: data on the spot and the offshore market are from the BIS triennial foreign exchange survey; for the offshore market only the trading volume in cross border outright forwards and swap contracts has been considered as spot currency is still not tradable on offshore markets

One can observe the large average daily trading volume of currency futures on the BM&FBovespa. In 2010, the average daily trading volume in currency futures was nearly 4 times the trading volume in the underlying spot market. Indeed, as can be seen in Table 5.9, in 2008, the total volume of derivatives traded on the BM&FBovespa reached 681 billion contracts, the 7th largest volume in the world. In 2009 the trading volume had reached nearly 912 billion contracts, compared to around 2,500 billion contracts on the CME.

¹⁰⁴ Banks with both an offshore and onshore presence have a considerable advantage in accessing foreign clients. The offshore presence allows them to capture clients, whereas onshore operations allow them to effectively hedge their operations both on the spot market and the BM&FBovespa.

Table 5.9: Size of Derivative Exchanges

Exchange	2007	2008	2007	2008	2007	2008
	Volume traded (Nber of contracts)		Notional value (USD millions)		Open interest (Nber of contracts)	
Chicago Mercantile Exchange (CME) Group	3,150,460,638	3,277,239,904	1,224,687,735	1,122,063,519	67,711,205	41,371,648
Korea Exchange	2,777,416,445	2,867,277,263	70,878,174	50,245,489	3,390,829	3,262,892
Eurex	1,899,778,357	2,164,766,857	170,829,703	166,386,668	105,980,701	56,249,131
Chicago Board Options Exchange (CBOE)	921,046,369	1,167,323,875	31,839,502	30,145,034	277,416,624	246,184,086
NYSE Liffe (European Markets)	949,025,452	1,049,729,652	624,606,277	692,064,978	72,076,623	66,251,520
International Securities Exchange (ISE)	804,359,093	1,007,661,590	NA	NA	NA	NA
BMF&Bovespa	746,261,356	681,937,317	NA	NA	18,666,537	16,387,685

Source: WFE (2010); data only refer to exchange based trading and do not include OTC operations

Notes: Eurex is one of Europe's largest derivatives exchanges and it is jointly operated by Deutsche Boerse AG and SIX Swiss Exchange; NYSE Liffe is the global derivatives business of the New York Stock Exchange (NYSE) Euronext group

In the foreign exchange market, the relative liquidity of the futures market to the spot market has reached such an extent that the futures market has become the main market for foreign exchange related operations. Its importance goes so far that many market participants argue that the price of the Brazilian exchange rate to the US\$ is now formed in the futures market rather than the underlying spot market (Dodd and Griffith-Jones 2007; Brown Brothers Harriman & CO (BHH) 2010). Garcia and Urban (2005) and Ventura (2008) present empirical evidence in support of this hypothesis.

This migration from the spot to the futures market has been supported by continued regulation on spot market operations and the marked concentration in very short-term maturities in the futures market itself. In addition, Garcia and Urban (2005) argue that after the financial crisis of 1999 a large share of the speculative operations previously conducted by the treasuries of domestic banks were moved to newly created investment and hedge funds, which were not allowed to operate in the spot market and added further liquidity to the futures market.

However, the ability to trade the Brazilian Real on this highly liquid futures market concentrated in very short maturities has increased the liquidity of the Brazilian Real for foreign investors in several respects:

1. The large and heterogeneous number of domestic operators on the exchange meant that foreign investors could find sufficient counterparties for their positions.
2. The short-term nature of the assets traded implied that foreign investors could close their positions and transfer the foreign exchange abroad very quickly.

3. The standardization of contracts and uniform contract sizes traded on the exchange contributed to the Brazilian Real's liquidity as little informational effort is required to uncover the main characteristics of the asset traded.
4. Since the BM&FBovespa assumes the credit risk for all trades executed on the exchange, this makes them seem close to risk free for the individual trader.¹⁰⁵ In addition, instead of having to perform a credit evaluation of every actual and potential trading partner, the futures trader has only to evaluate the creditworthiness of the clearing house, which most of the time carries a triple A rating (Dodd and Griffith-Jones 2007).¹⁰⁶
5. Trading on the derivatives exchange limits the possible daily loss of an exchange rate position to the daily oscillation limit of 5%.
6. The relatively tight regulations in Brazil notwithstanding, operations on the derivatives market still allow much higher leverage than spot market operations, as the only cash transactions involved are the deposits of margins at the exchange. The ability to operate on leverage significantly expands the actors' ability to trade risk and expand their balance sheets. This is especially interesting for foreign investors, who are subject to less stringent regulations on balance sheet exposure in their country of origin and choose their country allocation according to their ability to assume leverage.
7. Finally, derivatives markets may also create new arbitrage opportunities across local financial markets, encouraging new trading strategies and thus profit opportunities for financial institutions (BIS 2009: Chapter E). For example, in the Brazilian market, these include arbitrage operations between interest and foreign exchange

¹⁰⁵ Indeed, credit risk is an important issue for trading in OTC markets, which became apparent in the international financial crisis. However, as argued in Section 2, while the existence of a centralized exchange might seemingly eliminate credit risk for the individual trader it cannot do so for the system as a whole.

¹⁰⁶ To ensure the creditworthiness of the clearinghouse relatively tight regulations are in place. These include strict margin requirements with daily adjustments. In addition, the BM&FBovespa has a multi-tiered level of capitalization to enhance its creditworthiness. Finally, institutions operating on the exchange are required to provide relatively detailed information on their clients' exposure to the exchange. This is also true for OTC operations, which have to be registered at the CETIP. This gives the BCB a relatively detailed picture of the credit exposure of the system.

instruments and those which combine the interest rate and exchange rate in one product (cupom cambial).

However, the important role of Brazil's highly liquid derivatives market for the internationalisation of its currency goes beyond applications on the futures market itself. As argued in Chapter 4, the ability to hedge foreign exchange exposure on the local exchange contributed significantly to foreign investors' demand for domestic currency denominated assets.¹⁰⁷ In addition, the liquid exchange contributed crucially to the increased trading of Brazilian Real on offshore OTC markets. The cost and complexity of depositing margins at the exchange and/or the remaining convertibility risk might deter international investors from operating on the local exchange. The existence of a deep derivatives market made it possible for (foreign) banks with an account at the local exchange to sell domestic currency offshore and hedge their exposure locally. As one Brazilian trader pointed out, the offshore market would not exist with the liquidity it has if it were on its own. It is the local market which brings liquidity to the foreign market.

5.3.2.3. The Financial Foreign Exchange Market Participants

This dissertation has argued that market participants' perception of fundamentals is fundamentally shaped by their institutional framework and the motivation of their institution to operate in the foreign exchange market. The most common analytical distinction between different market operators is made between speculators, arbitrageurs and hedgers. Although a useful analytical tool for the analysis of heterogeneous market behaviour, clear cut distinctions between these three groups might be difficult to make in practice and/or discern based on quantitative data.

Figure 5.8 also shows the main operators in the Brazilian foreign exchange market. These include on the one hand banks, both operating onshore and offshore, and on the other hand banks' clients. Onshore banks can again be divided into domestic and foreign banks, depending on their capital structure. In addition, banks are divided into commercial, investment and universal (multiple) banks.

¹⁰⁷ As will be discussed further below, in the times of crisis liquidity was provided primarily by the BCB.

Table 5.10 gives a succinct overview of the structure of the Brazilian banking sector.

Table 5.10: Structure of the Brazilian Banking Sector

	2007	2008	2009
Number of banks according to functional classification			
Universal (Multiple) Banks	135	140	139
Commercial Banks	20	18	18
Investment Banks	17	17	16
Savings Banks	1	1	1
Development Banks	4	4	4
Number of banks according to capital structure			
Public Banks	13	12	10
Domestic Private Banks	143	147	148
Private Banks with Foreign Control	49	56	54
Foreign Banks	7	6	6
Percentage Share of Participation in the banking sector			
Public Banks	4.25%	5.11%	2.13%
Banco do Brasil	13.77%	14.38%	17.44%
Federal Savings Bank	9.91%	8.83%	9.57%
National Private Banks	50.33%	49.11%	51.61%
Private Banks with Foreign Control	20.24%	21.24%	17.80%
Credit Cooperatives	1.50%	1.33%	1.45%

Source: BCB (2011e) ; Data are from December of each year;

Notes: Banks according to capital structure only refer to universal, commercial and savings banks

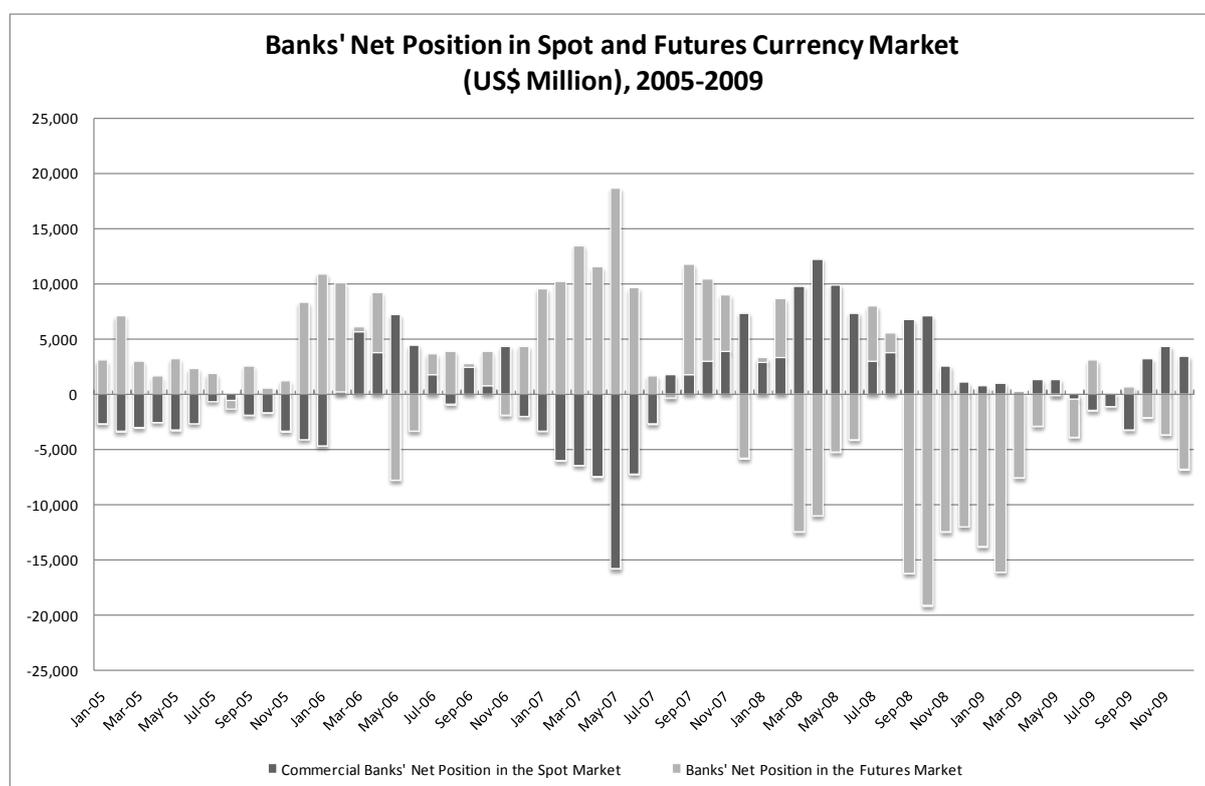
Onshore clients can be roughly divided into financial clients (pension funds, hedge funds etc.), commercial clients (primarily importers and exporters) and the Treasury. Given the dissertation's focus on (speculative) foreign exchange positions by private sector financial market actors, emphasis will be placed particularly on the operations of onshore financial clients and here primarily onshore institutional investors. Offshore clients can also be divided into commercial and financial clients. Given the emphasis on directional foreign exchange positions in international financial markets emphasis will again be on the latter group, i.e. foreign institutional investors. The focus on these three market participants - banks, onshore institutional investors and offshore institutional investors - is also justified by their relative importance in currency futures trading discussed in Chapter 4.

Banks' operations in the foreign exchange market are, in principle, underpinned by all three motivations, i.e. for hedging, speculative and arbitrage purposes. In their primary function, banks provide foreign exchange liquidity to clients. Banks can then *hedge*

their resulting foreign exchange exposure either in the interbank market or, in the Brazilian case, on the large and liquid derivatives exchange. In this hedging operation banks can generate profits on the bid-ask spread, i.e. on the difference between the price they charge to their clients in the spot (primary) market and the price they pay for the foreign exchange in the interbank (secondary)/futures market.¹⁰⁸

Data on banks' interbank market operations are not publicly available. Figure 5.9 shows the open foreign exchange position of banks in the spot and currency futures market.¹⁰⁹

Figure 5.9



Source: BCB (2011c); BM&FBovespa (2011); author's own calculations

¹⁰⁸ Garcia and Urban (2005) refer to banks' simultaneous operations in the primary and secondary/futures market as arbitrage operations. The instrument used by banks to hedge their spot position on the futures market is called the "casado", a swap peculiar to the Brazilian market. The price of this swap is the present value of the capitalized Real interest payments against a value of the dollar on the front month futures contract (Dodd and Griffith-Jones 2007).

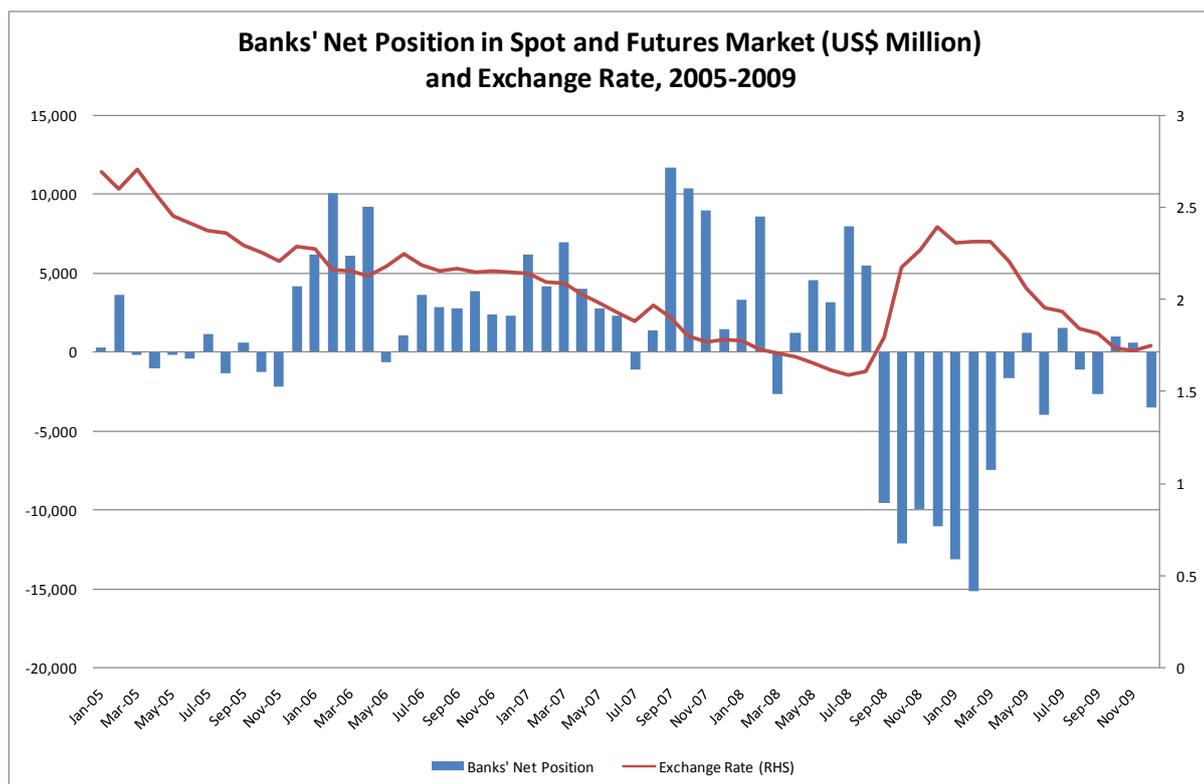
¹⁰⁹ It is important to note that data on spot and futures currency operations are not directly comparable. For example, while spot market data also include the BNDES, the Brazilian development bank, futures market data don't. On the other hand, not all banks included in the futures market data might be authorized to operate in the spot market. Thus, a comparison between spot and futures market operations should be primarily seen as indicative to highlight general trends.

Positive values indicate that banks' are in a long US\$ position, negative values imply that they are short in US\$. One can see that banks' positions in the spot market are most of the time mirrored with the opposite position in the futures market as banks aim to hedge their open foreign exchange exposure in the spot market in the futures market and vice versa. In general terms, banks were short in US\$ in the spot market and long in the US\$ futures market until around mid 2007, when their positions inverted. Until 2007, banks sold US\$ in the spot market and bought it forward on the futures market to hedge their spot market operations. Banks can either be short in the spot market because customers demand spot currency or they sell spot currency to some other agent. In the Brazilian case, until around September 2007, this other agent was the BCB. Banks, facing strong foreign exchange inflows from their clients (as could be seen in the balance of payments data presented in Chapter 4), sold their foreign exchange to the BCB, i.e. assumed a short US\$ position in the spot market, which they hedged with a long US\$ position in the futures market. This dynamic turned in September 2007, where banks assumed long positions in both markets. This was primarily due to the increased uncertainty in international financial markets and banks' attempt to protect their balance sheets. The dynamic changed again in mid 2008 as the situation on international financial markets deteriorated. Similar to the period before September 2007, banks, which started to face outflows on the spot market, had to buy foreign currency from the BCB - they went long US\$ in the spot market - and hedged their operation with an inverted positions on the futures market.¹¹⁰

If banks were fully hedging their positions, the difference between their spot and futures market position should equal to zero. However, as can be seen in Figure 5.10, which shows the differential between banks' spot and futures market positions, most of the time this was not the case.

¹¹⁰ However, these dynamics were often not as unidirectional as described above. Frequently the operations of the banks were not initiated by spot market flows, but by the operations in the futures market itself. For example, during the international financial crisis, foreign investors started to build long positions in US\$ in the futures market. Banks assumed the counterparty, i.e. they went short in the futures market, and had to hedge their operations through long positions in the spot market. This was possible through the foreign exchange sales of the BCB, which thus provided liquidity to the banks and indirectly the international investors. The role of the central bank in providing liquidity to the market will be discussed in more detail below.

Figure 5.10



Source: BCB (2011c); BM&FBovespa (2011); author's own calculations

While banks were net long in US\$ until September 2008, their position switched to a strong short US\$ position at this date. The banks' net foreign exchange positions were largely mirrored by movements in the exchange rate. During times of appreciation, banks were net long US\$, while during times of depreciation, they were short US\$. However, as will be discussed further below, long US\$ positions in the times of appreciation imply a loss on foreign exchange dynamics and vice versa for short US\$ during times of depreciation. At the same time, if banks were net long US\$ during the appreciation and net short during the depreciation, and losing money on exchange rate developments, some other party/ies must have been on the winning side. And indeed, as will be shown below, these parties were, on the one hand, domestic institutional investors and, on the other hand, foreign institutional investors. In other words, through their positions, mostly on the futures market, banks acted as important counterparties to the positions of domestic and foreign institutional investors and thus provided liquidity to these "speculative" investor groups. However, it was not only the banks providing liquidity to domestic and foreign investors; as discussed above, the BCB frequently

“hedged” banks in the spot market, allowing them to take opposite positions on the futures market, and thus indirectly provided liquidity to the foreign investors.

One can also note in Figure 5.10 that banks’ net positions in the foreign exchange market were not always characterized by “hedging” or liquidity provision. On several occasions, particularly in 2005 and the beginning of 2009, banks were short US\$ in the times of strong exchange rate appreciation. In other words, banks were successfully speculating on exchange rate developments. These speculative operations are particularly interesting in the beginning of 2009. Domestic investors seemingly captured the renewed appreciation trend in the Brazilian Real before foreign investors, who remained long in US\$.¹¹¹

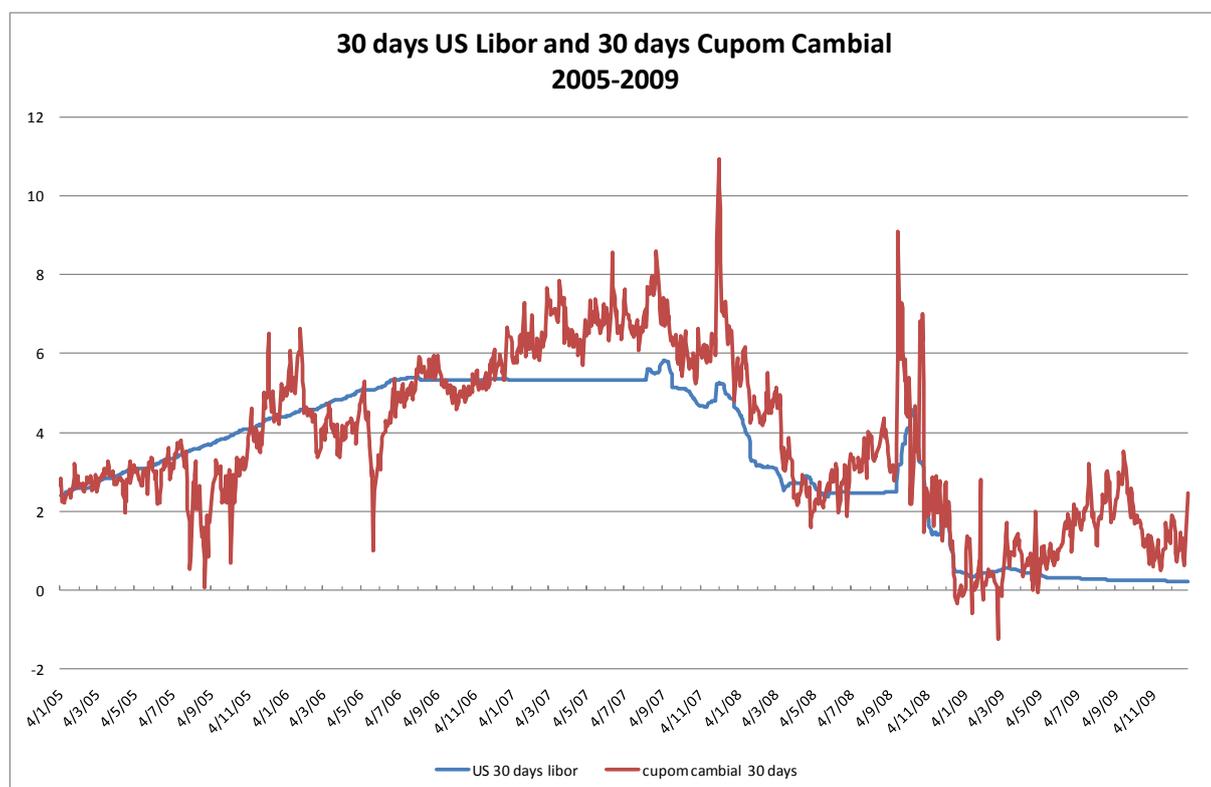
Banks do not only speculate in the futures market, but also in the interbank market. However, these operations are primarily concentrated in intraday activities, where banks take advantage of small exchange rate changes during the day (and in certain cases also overnight). Given the lack of data on interbank market activity, speculative activity in this market is difficult to discern. Wu (2007), who had access to exclusive order flow data in the Brazilian market, estimates that between the beginning of 1999 and mid 2003, banks made an annualized profit rate of 9.3% in foreign exchange speculation in the interbank market.

Finally, although banks’ may have made losses on the exchange rate in the above *hedging* operations, they could gain considerable profits through *arbitrage* operations. Two possible “arbitrage” operations, already discussed above, are between the banks’ positions in the primary market and the secondary (interbank) and futures market respectively. A final and very important arbitrage operation, especially for (foreign) banks with good access to international money markets, are arbitrage operations between the offshore US\$ interest rate and the implied onshore US\$ interest rate in the domestic market, the *cupom cambial*. The implied onshore US\$ interest rate is the sum of the domestic currency interest rate and the rate of expected currency depreciation calculated from the difference between the spot and forward exchange rate. If CIP held, the offshore US\$ rate and onshore implied US\$ rate should be the same.

¹¹¹ Indeed, many of the Brazilian foreign exchange traders held that the first quarter of 2009 was one of their most profitable quarters ever.

As can be seen in Figure 5.11, which shows the 30 days cupom cambial and 30 days US\$ Libor as offshore rate, this was not always the case.¹¹²

Figure 5.11



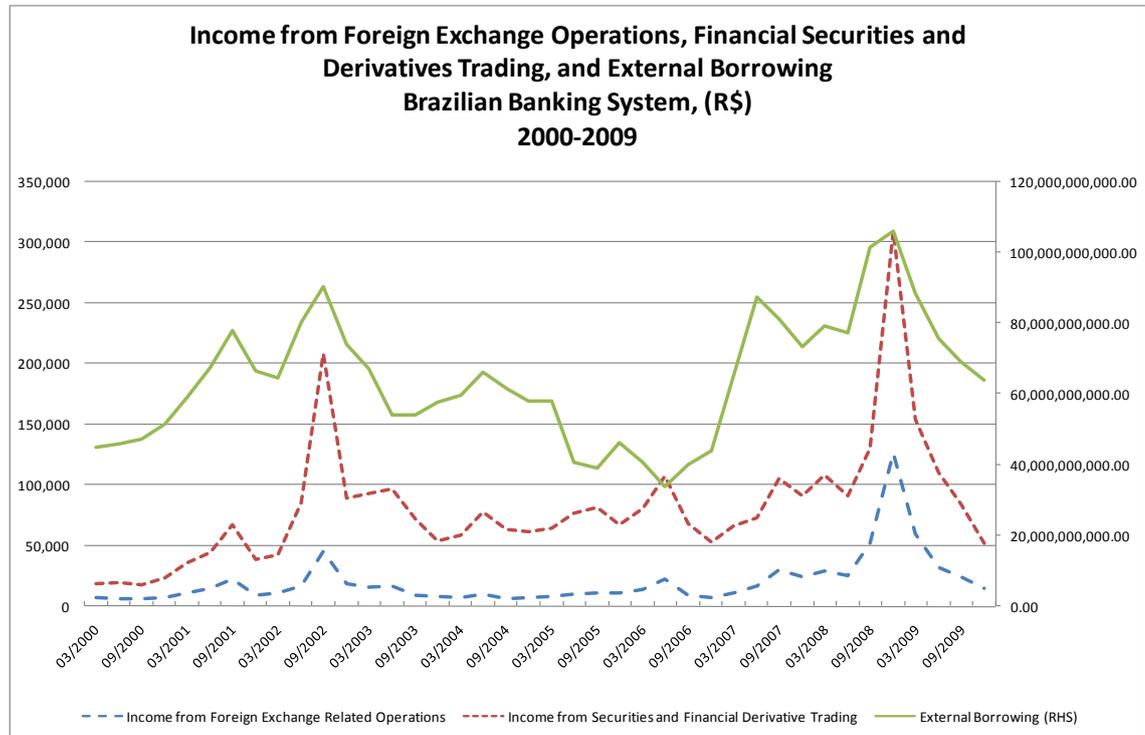
Source: *BM&FBovespa (2011); Reuters*

Indeed, since mid 2006 the onshore implied US\$ rate was consistently above the US\$ Libor. This difference was particularly marked during the international financial crisis. Thus, banks with access to international money markets could borrow abroad, convert these funds into Real at the spot exchange rate and invest the proceeds at local interest rates. At the same time, the banks could purchase (go long) US\$ futures to cover their obligations to repay the loan. If the differential between the forward and the spot rate did not fully reflect the existing interest rate differential, which it did not since mid 2006 as shown in Figure 5.11, the bank could make a profit free from currency risk on this operation (Stone, Walker et al. 2009).

¹¹² As discussed in chapter 3, several reasons might lead to this deviation from CIP. The most important are credit and liquidity factors when lending to a foreign counterparty. Others are frictions to international transactions, for example, through the recent introduction of the IOF (IMF (International Monetary Fund) 2010).

Figure 5.12 shows the income Brazilian banks have made from foreign exchange related operations and trading of financial securities over the period 2000 and 2009. In addition, Figure 5.12 shows banks' borrowing abroad.

Figure 5.12



Source: BCB (2011f)

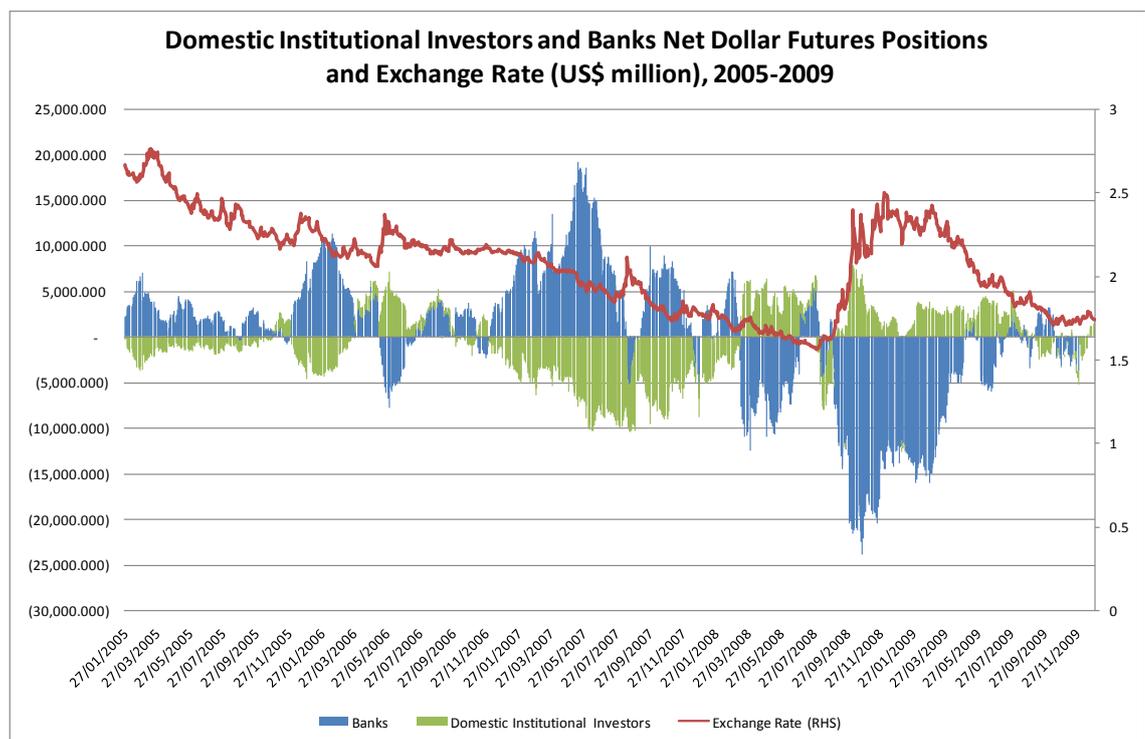
One can observe the increase in income from both foreign exchange related operations and trading in securities and financial derivatives over the period. More markedly, one can observe the high profitability of foreign exchange and financial trading in crisis situations. The first spike in 2002 coincides with the exchange rate volatility around President Lula's election. The second large spike coincides with the international financial crisis. Finally, Figure 5.12 also shows that banks' external borrowing picked up in mid 2006, just when the difference between the offshore and implied onshore US\$ interest rate widened.

However, ultimately, these aggregate balance sheet data do not allow one to discern which foreign exchange operations - hedging (client operations), speculation or arbitrage - were most profitable for Brazilian banks. Some further insights into this

question based on semi-structured interviews with financial market participants will be presented in Chapter 7.¹¹³

The second main group of financial operators in the foreign exchange market are domestic institutional investors, primarily hedge funds. Chapter 4 has shown that the participation of domestic institutional investors in currency futures has consistently reached more than 20% over recent years. However, having no underlying spot operations, positions by domestic hedge funds in currency futures are of primarily speculative nature.¹¹⁴ Figure 5.13 shows the net positions of onshore institutional investors and banks in currency futures and the exchange rate from 2005 to the end of 2009.

Figure 5.13



Source: BCB (2011c); BM&FBovespa (2011)

¹¹³ Future research will also include a more detailed analysis of the balance sheets of Brazilian banks. Although a distinction between hedgers, speculators and arbitrageurs remains difficult, a detailed balance sheet data analysis may allow one to distinguish between the importance of financial trading operations for, among others, domestic and foreign banks.

¹¹⁴ In theory, positions could be due to the hedging operations of foreign investments. However, most domestic funds are not authorized to invest in international financial markets.

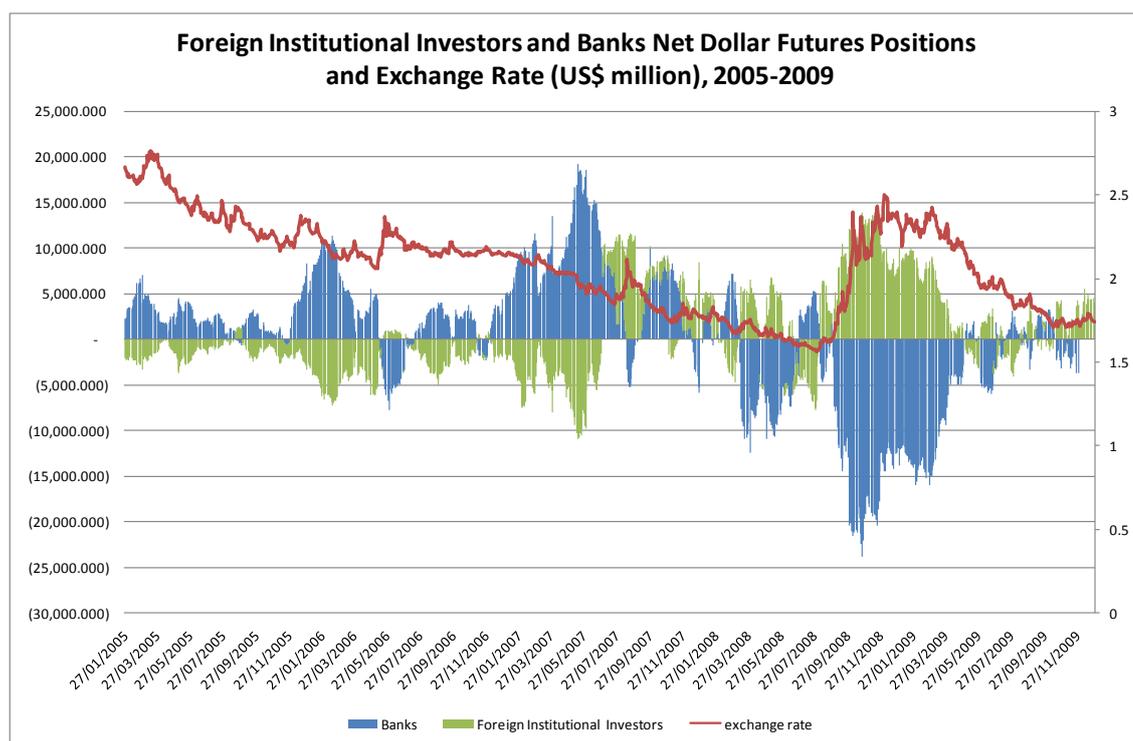
Two main observations are important to highlight. Firstly, domestic institutional investors were consistently on the “right” side of the currency game: they assumed short US\$ forward positions during times of appreciation and went long US\$ in the futures market during times of depreciation. Secondly, domestic institutional investors’ operations in the futures market are mirrored by the position of the banks in the opposite direction. As already pointed out above, banks (and indirectly the BCB) assumed the counterparty and thus provided liquidity to the speculative positions of domestic hedge funds. In other words, banks bought US\$ from domestic institutional investors, which they could re-purchase at the expiry of the contract with a stronger (appreciated) local currency and thus profit on the intermediate exchange rate appreciation.

Finally, as discussed in detail in Chapter 4, foreign institutional investors have become increasingly important operators in the Brazilian Real. Foreign operators can either trade the Real on offshore OTC markets with foreign banks using NDFs, or alternatively, they can open a so called 2,689 omnibus account (established with resolution 2,689/2000 of the National Monetary Council), which allows them to have access to the same investment products as would a resident Brazilian investor. In addition, under this account, capital gains remain untaxed until they are repatriated to the country of origin.¹¹⁵

Gauging the amount and behaviour of offshore operations is difficult and can only be approximated with the hedging operations of banks on the futures exchange. Operations by non-resident investors through the 2,689 account are registered with the BM&FBovespa. Figure 5.14 shows the net positions of foreign institutional investors between 2005 and 2009. Again, the banks’ positions and the exchange rate are also included.

¹¹⁵ Indeed, as a result of this favourable tax treatment, local investors often decide to operate “offshore” through this 2,689 account.

Figure 5.14



Source: BCB (2011c); BM&FBovespa (2011)

The behaviour of foreign operators is very similar to domestic hedge funds: in times of exchange rate appreciation foreign investors assume a net short futures position in US\$ profiting from the appreciating exchange rate and vice versa in times of exchange rate depreciation. Again, foreign investors' operations are mirrored by those of the banks, which assume the counterparty to these speculative foreign exchange operations.

5.3.3. The Macroeconomic Framework

In addition to the liquidity provided by the institutional characteristics of its financial and foreign exchange markets, Brazil's macroeconomic configuration contributed significantly to its attractiveness for international investors. This macroeconomic framework comprises of an inflation targeting regime with an, at least officially, floating exchange rate, the orthodox macroeconomic policy in support of the inflation targeting regime, and a substantial improvement in Brazil's traditional external vulnerability indicators. Finally, the operations of the BCB, as market maker and ultimate provider of liquidity, contributed significantly to the liquidity of the Brazilian market.

5.3.3.1. Macroeconomic “Fundamentals”

After a short period of an exchange rate based inflation stabilization programme during the 1990s, Brazil introduced an inflation targeting regime and an officially floating exchange rate on 1st July 1999. By making inflation the primary goal of monetary policy, an inflation targeting regime assures financial markets that any inflationary risk to the real returns of their asset holdings will be minimized. In addition, it offers a predictable and standardised macroeconomic framework, homogenizing the criteria according to which currencies can be assessed across the globe. Indeed, not only should any (expected) failure to meet the inflation target lead to interest rate action, but transparency and communication of monetary policy is an important pillar of an inflation targeting regime (Bernanke and Mishkin 1997).¹¹⁶

Although no strict penalty regime has been in place to ensure that the inflation target is met, the BCB has repeatedly proven its commitment to macroeconomic stability in the attempt to build credibility in financial markets. As can be seen in Table 5.11, actual inflation has surpassed its target range only 3 times in the last 10 years.

Table 5.11: Macroeconomic Indicators, 2000-2009

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Inflation Indicators											
Effective Inflation Rate	8.9	6.0	7.7	12.5	9.3	7.6	5.7	3.1	4.5	5.9	4.3
Inflation Target	8.0	6.0	4.0	3.5	4.0	5.5	4.5	4.5	4.5	4.5	4.5
Revised target					8.5		5.1				
Target met (within band of 2%)?	YES	YES	NO	NO	NO	YES	YES	YES	YES	YES	YES
Return Indicators											
Domestic short-term Interest Rate (Selic)	26.1	17.6	17.5	19.1	23.3	16.2	19.1	15.3	12.0	12.4	10.0
US short-term term Interest Rate (FedFund)	5.0	6.3	3.9	1.7	1.1	1.4	3.2	5.0	5.0	1.9	0.2
Emerging Market Bond Index (EMBI) Brazil	1036.1	727.4	889.8	1372.4	836.5	541.8	399.0	235.0	180.6	300.8	306.0
Annual Exchange Rate Variation	48.4%	8.5%	18.5%	53.2%	-18.5%	-7.9%	-12.4%	-8.5%	-16.6%	31.0%	-25.2%
Fiscal Indicators (%GDP)											
Primary fiscal balance	3.2	3.5	3.4	3.2	3.3	3.8	3.9	3.2	3.4	3.5	2.1
Nominal fiscal balance	-10.0	-4.5	-4.8	-9.6	-3.8	-2.6	-3.2	-3.5	-2.6	-2.0	3.2
Net domestic public debt	35.2	36.5	42.3	44.6	43.5	42.5	44.9	48.0	52.5	49.3	52.0
Net external public debt	9.4	9.0	9.9	16.1	11.5	8.1	3.3	-1.1	-7.4	-10.9	-9.2
GDP Growth (%)	0.3	4.3	1.3	2.7	1.1	5.7	3.2	4.0	6.1	5.1	-0.2

Source: Ipeadata; BCB (2011c); Datastream; Barbosa-Filho (2008); author's own calculations; interest rates and EMBI are yearly averages; exchange rate variations refers to the change in the exchange rate over the year; a negative value indicates an appreciation

¹¹⁶ To reduce uncertainty for the market and communicate its intentions the Brazilian monetary policy committee immediately announces its decisions. The reasons explaining the decisions are published within a week of the meeting. Similarly, a quarterly inflation report gives a detailed analysis of expected inflation and the parameters influencing interest rate decisions (Bogdanski, Tombini et al. 2000).

Inflation control was achieved with one of the highest real interest rates in the world.¹¹⁷ Although declining, the interest rate differential between Brazil and the US remained consistently above 10%. In addition, since 2002 (and except in the international financial crisis) the exchange rate has consistently appreciated with a maximum exchange rate gain of 25% in 2009.

Bogdanski, Tombini et al. (2000) and Barbosa-Filho (2008) argue that due to a lack of other monetary policy instruments, the interest rate and the exchange rate have become Brazil's main monetary policy instruments. Alternative monetary policy instruments, e.g. bank reserve requirements, work mainly through the credit and monetary channels, which have been found ineffective for Brazil. Short-term interest rates, in turn, operate through various other transmission channels, such as effective demand, expectations and probably most importantly the exchange rate. Indeed, in DEC countries with low financial penetration and a relatively high content of imported goods the exchange rate is an effective tool for inflation control. This, in turn, Barbosa-Filho (2008) argues has maintained high interest rates, despite falling inflation and good macroeconomic fundamentals, and created a bias towards an appreciated exchange rate.

Against the backdrop of low and stable inflation and the liquidity provided by Brazil's financial market, the combination of high real interest rates and strong exchange rate appreciation offered phenomenal US\$ returns to international investors, underpinning the internationalisation of the Real. In addition, as can also be seen in Table 5.11, the spread on Brazilian bonds denominated in foreign currency, approximated by the EMBI, declined consistently over the periods. The lower return on these financial instruments, further increased the attractiveness of domestic currency assets.

Brazil's commitment to maintain price stability and build credibility in financial markets is also reflected in the importance of fiscal discipline. While interest rates control inflation in the short-run, the reduction of fiscal dominance is seen as a crucial

¹¹⁷ This chapter focuses on the liquidity aspect of currency demand. Chapter 7 will present a more detailed empirical analysis of the return element in driving exchange rate dynamics. This also includes comparative empirical data on the real returns in several emerging and developed countries.

prerequisite to maintain price stability in the medium term. Table 5.11 shows the sustained increase in the primary surplus since the turn of the century.¹¹⁸

Finally, this dissertation has argued that a country's ability to meet its outstanding external obligations is an important determinant of its liquidity for international investors. As detailed in Chapter 3, this includes "traditional" external vulnerability indicators related to a country's external debt situation. Table 5.12 shows a selection of these indicators for the Brazilian economy between 1999 and 2009.

Table 5.12: Traditional External Vulnerability Indicators

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
External Vulnerability Indicators											
Total external debt (TED)/GDP (%)	38.4	33.6	37.9	41.8	38.8	30.3	19.2	15.9	14.1	12.1	12.6
Net total external debt/GDP (%)	29.7	26.5	29.4	32.7	27.3	20.4	11.5	6.9	-0.9	-1.7	-3.9
Total external debt/exports (g&s)	4.1	3.4	3.1	3.0	2.6	1.8	1.3	1.1	1.0	0.9	1.1
International reserves/TED (%)	16.1	15.2	17.1	18	22.9	26.3	31.8	49.7	93.3	104.3	120.6
International reserves/short-term ED	56.6	60.4	66.7	64.6	82.9	99.3	133.4	211.7	289.9	349.8	455.1
Debt service/GDP (%)	10.4	7.6	8.9	9.9	9.6	7.8	7.5	5.2	3.8	2.3	2.8
Debt service/exports (%)	126.5	88.6	84.9	82.7	72.5	53.7	55.8	41.3	32.4	19	28.6
International reserves /debt service	0.6	0.7	0.7	0.8	0.9	1.0	0.8	1.5	3.5	5.5	5.5
Foreign Exchange Productivity											
Trade Balance % GDP	-0.2%	-0.1%	0.5%	2.6%	4.5%	5.1%	5.1%	4.3%	2.9%	1.5%	1.6%
Current Account Balance % GDP	-4.3%	-3.8%	-4.2%	-1.5%	0.8%	1.8%	1.6%	1.3%	0.1%	-1.7%	-1.5%

Source: BCB (2011c); Ipeadata; author's own calculations

Notes: If not indicated otherwise values are end of year values

One can observe a continuous improvement in all the indicators until 2009, when the international crisis led to a slight increase in external debt and debt service payments. In addition, as discussed in Chapter 4, not only did total external debt decline substantially over the recent decade, the currency composition of Brazil's (public) debt also changed strongly from foreign currency to domestic currency denominated debt. At the same time, at least until 2008, falling external and foreign currency denominated debt was met with an improved autonomous capacity to generate foreign exchange through the trade balance and the current account.

Thus, Brazil's "fundamentals" were in a good shape. Nevertheless, as was shown in Chapter 4, the Brazilian Real was one of the currencies which depreciated most during the international financial crisis. This is linked to "new forms" of external vulnerability. In Chapter 3, this dissertation argued that it is not only foreign currency denominated

¹¹⁸ Table 3, however, also shows the contradiction between the interest rate as short-term goal and fiscal policy as medium term goal to maintain price stability. Despite a comfortable primary surplus, the actual fiscal deficit has remained in a substantial deficit due to high interest rate payments. In a similar vein, net domestic public debt has continued to increase.

external debt, but any form of net short-term foreign obligations which create vulnerabilities to external conditions and can lead to large exchange rate depreciations. Indeed, one could argue that through promoting the internationalisation of the Brazilian Real, it was exactly this macroeconomic stability, prescribed by mainstream economics and targeted at creating financial stability, which contributed to the serious exchange rate volatility experienced during the international financial crisis.

5.3.3.2. The Central Bank

Finally, Chapter 3 argued that an important element of a market's liquidity is the existence of a market maker and its ability to contain asset price fluctuations and provide liquidity. In the foreign exchange market, this brings the operations of the BCB and its availability of foreign exchange reserves to the fore of the analysis.

Under the institutional arrangement of an inflation targeting regime, monetary policy is primarily directed at keeping inflation within a pre-announced band. To do so, the interest rate functions as the main policy instrument, whereas the exchange rate should only enter in the central bank's objective function if its dynamic adversely affects the inflation target. Thus, central bank intervention in the foreign exchange market should only be directed at containing exchange rate depreciation. Nevertheless, the BCB has been a key operator in the foreign exchange market, both in times of depreciation and in times of appreciation.

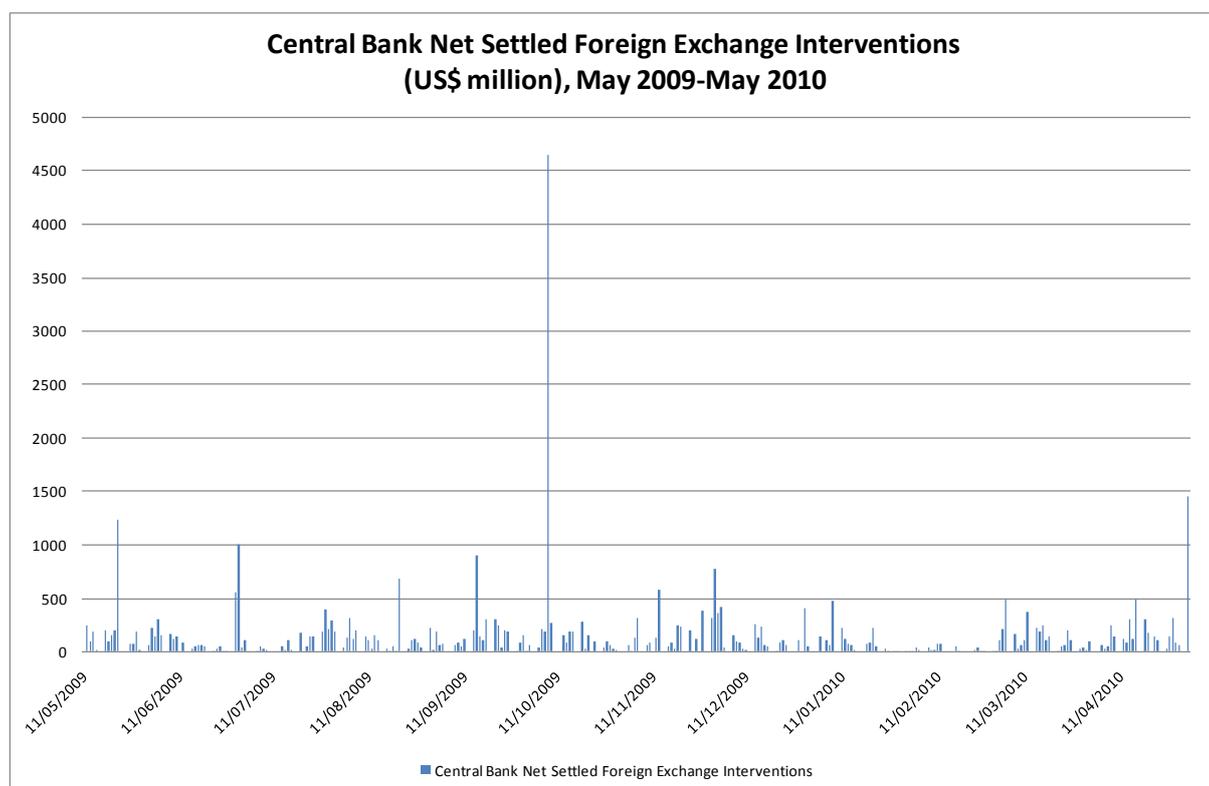
These interventions were directed partly at building a "war-chest" of foreign exchange reserves against possible speculative attacks, and partly at smoothing the appreciation path of the currency.¹¹⁹ Thus, despite its official announcement of a floating exchange rate, the BCB has practically followed something which comes closer to a dirty float (Fischer 2001; Calvo and Mishkin 2003).

¹¹⁹ The phenomenon that, despite officially floating exchange rate regimes, emerging market central banks intervene heavily in the foreign exchange market has also been observed in other countries and has become known under the term of "fear of floating". For a detailed discussion and empirical investigation see for example Calvo and Reinhart (2000) or McKinnon and Schnabl (2004).

The BCB intervenes in the foreign exchange market through two main channels: Firstly, through electronic spot currency auctions, where the BCB purchases and sells foreign exchange from designated dealer banks; secondly, through direct operations on the derivatives market itself.

Data on spot exchange rate interventions have only become available recently. Figure 5.15 shows the series from mid 2009 to mid 2010.

Figure 5.15



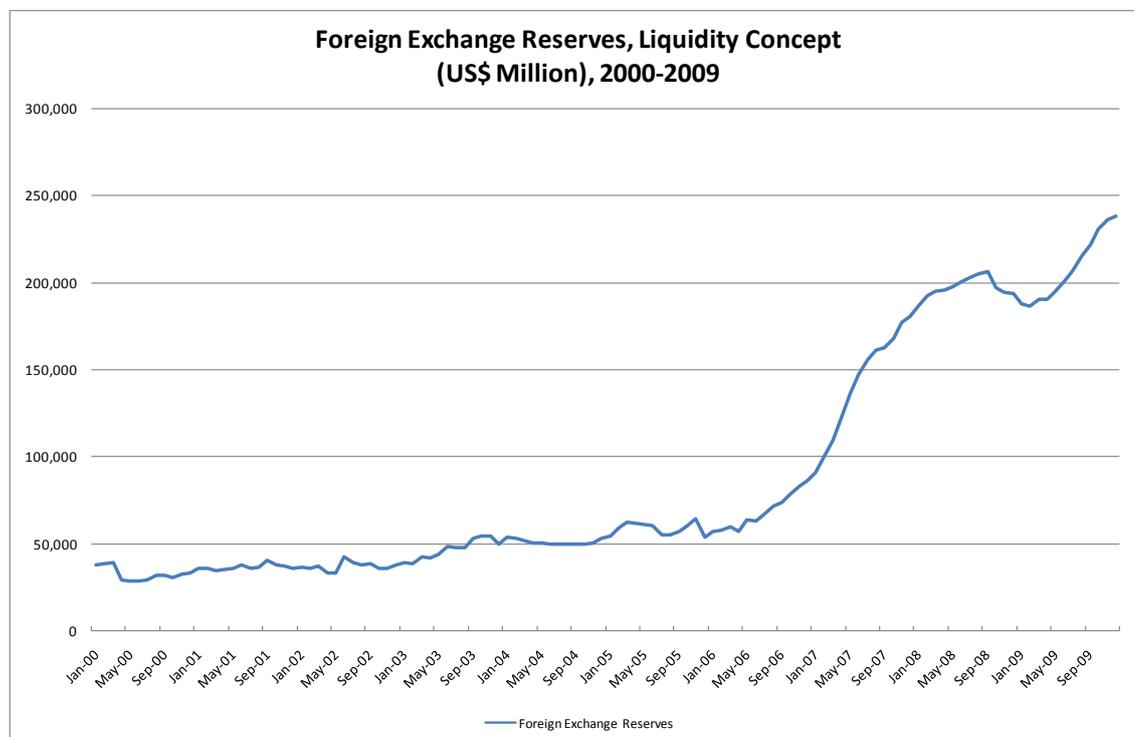
Source: BCB (2011c)

One can observe that the BCB has been a regular and active operator in the spot foreign exchange market. Indeed, the large size of banks' short spot positions between 2006 and 2008 presented above shows that the BCB bought nearly all, if not sometimes more than the spot flow arriving at the Brazilian market, a result which is also confirmed by calculations made by Prates (2007).¹²⁰

¹²⁰ Indeed, based on the evidence that the exchange rate continued to appreciate despite the BCB's strong interventions in the spot foreign exchange market, Prates (2007) argues that it was the speculative futures positions which led to the strong appreciation of the Real. This hypothesis will be subject of future research.

Figure 5.16 shows the stock of foreign exchange reserves which the BCB accumulated between the beginning of 2000 and the end of 2009.

Figure 5.16



Source: BCB (2011c)

One can observe the steady increase in foreign exchange reserves until 2006 and the surge after this date. Between the beginning of 2006 and August 2008, the BCB bought more than US\$150 billion from the private sector, leading to a stock of foreign exchange reserves of more than US\$200 billion in September 2008 before the international financial crisis hit Brazil.

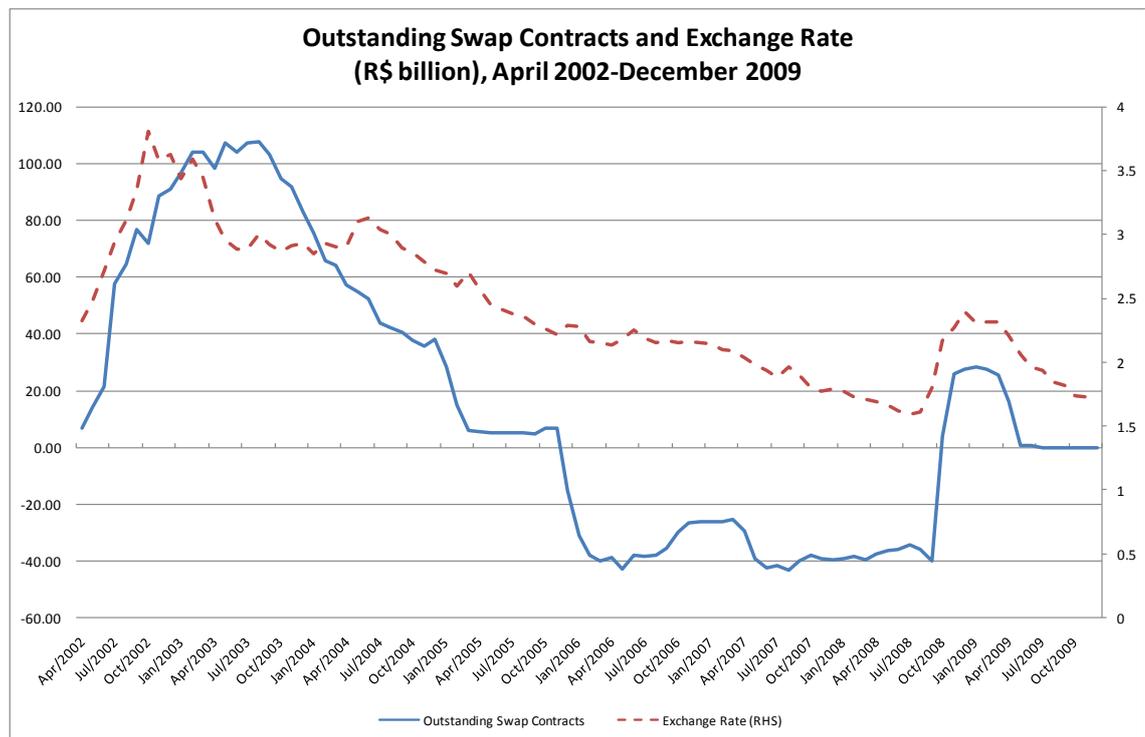
As discussed above, one peculiar feature of the Brazilian foreign exchange market is the existence of a liquid derivatives market concentrated in very short maturities to which a large share of traditional spot operations have migrated. This institutional feature of the Brazilian foreign exchange market undermined the effectiveness of spot foreign exchange interventions and prompted the BCB to intervene also directly in the derivatives market.¹²¹ It does so by so called “swap cambiais” (FX swaps) or “swap

¹²¹ Central bank interventions in the derivatives market were introduced in April 2002 in the wake of Brazil’s confidence crisis during Lula’s election campaign. The increased importance of the futures market aside, these interventions were motivated by the then low level of foreign exchange reserves

cambiais reverso” (reverse FX swaps). The FX swap is a financial derivative through which one agent takes an active position in respect of the interest rate and a passive position in foreign currency plus internal dollar yield rate and the other agent takes an inverted position in both assets.

Figure 5.17 shows the amount of FX swap interventions by the central bank and the exchange rate.

Figure 5.17



Source: BCB (2011d)

Positive values imply the issuance of FX swaps contracts in which the BCB is assuming a future short position on the US Dollar and a long position in domestic interest rates. Negative values mean issuance of reverse FX swap contracts in which the BCB is taking long positions on the US Dollar and short position in domestic interest rates. In simple terms, while the FX swap aims to avoid excessive exchange rate depreciation, through assuming a future short position in US\$, the reverse FX swap aims at buffering

(which are not affected by derivatives operations), the high premium on traditional instruments such as domestic public securities and the fact that private sector agents were primarily interested in hedging their exposure, rather than acquiring spot currency.

excessive exchange rate appreciation. This mechanism can be strongly observed in Figure 5.17. While periods of exchange rate depreciation, particularly the crises in 2002 and 2008, were characterised by a strong issuance of FX swaps, times of exchange rate appreciation have seen the redemption of these swaps and the issuance of reverse FX swaps to smooth the appreciation of the Real. Indeed, given that derivatives operations do not affect the level of reserves, these interventions are primarily targeted at smoothing exchange rate movements.

These interventions by the BCB, both on the spot and the derivatives market, provided liquidity to domestic and foreign investors through several channels. Firstly, the large stock of foreign exchange reserves at the BCB increased protection against speculative attacks by assuring investors that sufficient liquidity in foreign currency was available. The security that the BCB could exchange a large amount of domestic into foreign currency and thus provide liquidity to the market at any time acted like a security pillow for international investors and substantially increased the attractiveness of Brazilian assets.

Secondly, through its regular foreign exchange interventions, the BCB acted as counterparty to many of the financial operations and thus assured (foreign) investors that they would find a buyer in a market which was mainly dominated by sellers during times of strong (expected) exchange rate appreciation. As discussed in Section 3.2.3, this was true for its operations in the spot market, but it was also the case for its interventions on the derivatives exchange. Foreign operators, seeking to sell the US\$ forward, could do so to the BCB which was prepared to assume the counterparty to these operations through its reverse FX swap operations.¹²²

Finally, as discussed in more detail in Kaltenbrunner and Paineira (2010) as a result of the attempt to sterilize its US\$ purchases, the BCB supplied a large amount of very short-term securities (repos) to the domestic banking sector. These securities, in turn, allowed the banking sector to hold liquid and high yielding assets, which they could use

¹²² As a result, several foreign exchange operators argued that the reverse FX swap operations by the BCB contributed, rather than quelled the exchange rate appreciation, through attracting further capital inflows. In addition, in the times of appreciation, these operations are very costly to the BCB, which (a) loses on the exchange rate appreciation and (b) has to pay the high domestic interest rates as the second leg of the swap operation.

as a security against other financial operations, e.g. borrowing on international financial markets.

In sum, through its active operations in the foreign exchange market, the BCB provided liquidity to foreign investors which further increased the attractiveness of Brazilian assets. In fact, as was shown in Chapter 4, despite the BCB's extensive interventions, the Brazilian Real appreciated strongly before the international financial crisis (and indeed afterwards). This shows the augmented complexity of macroeconomic and exchange rate management in an increasingly liberalized and integrated financial system. As a result of this financial integration, the effectiveness of BCB foreign exchange interventions has become severely limited, as it was exactly these interventions which provided liquidity to foreign investors and thus fuelled further short-term capital inflows.

This mechanism was further aggravated by the asymmetric nature of the BCB's interventions. In its communications to the financial market, the BCB was always very clear that it would not attempt to influence the exchange rate level, but was primarily interested in smoothing exchange rate volatility. Thus, foreign investors knew that despite the BCB's interventions, the appreciation trend would continue, making them even more eager to buy domestic currency. Moreover, the announcement by the BCB that it would smooth exchange rate volatility guaranteed these investors that excessive risk to their domestic currency investments would be avoided. This rhetoric was supported by the institutional framework of an inflation targeting regime. As mentioned above, an inflation targeting regime introduces an appreciation bias in the exchange rate as exchange rate appreciation is an important tool for inflation control, while exchange rate depreciations might negatively affect domestic inflation through the exchange rate pass through. In other words, the institutional framework of an inflation targeting regime ties the central bank to asymmetric behaviour in the foreign exchange market, which promises sustained exchange rate gains to foreign investors safe in the knowledge that excessive risks through exchange rate depreciations will be avoided.

This is exactly what the BCB did during the international financial crisis. As detailed in Paineira (2010) and Stone, Walker et al. (2009), in contrast to previous crises, the BCB provided large amounts of liquidity to domestic and international financial investors,

allowing fast and near immediate exit and thus reducing their losses on Brazilian investments. The liquidity provision in foreign exchange consisted of spot sales, repos operations and trade finance loans. In January 2009 the total stock of foreign exchange liquidity supplied since September 2008 reached a level of US\$26 billion.¹²³ The BCB also intervened in the derivatives markets through FX swap contracts and the direct sale of dollar future contracts. As can be seen in Figure 5.17, during the crisis, the BCB changed its foreign exchange exposure in FX swaps from long to short positions. As a result, its exposure to domestic federal debt and swap contacts increased from US\$15 billion (long) in September 2008 to US\$18 billion (short) in December 2008 (Kaltenbrunner and Paineira 2010).

5.4. Conclusions

This chapter has set out the peculiar features of Brazil's financial and foreign exchange markets and the macroeconomic configuration which contributed to the internationalisation of the Brazilian Real. The former included a deep and heterogeneous financial sector, a marked concentration in short-term assets, and a very liquid derivatives market. The latter particularly referred to macroeconomic "fundamentals" and the existence of an institutional framework of inflation targeting *cum* - at least officially - floating exchange rate. In this way, this chapter has also described the institutional and macroeconomic framework within which foreign exchange market participants in the Brazilian market form their expectations in the new era of currency internationalisation. The discussion was couched in terms of the "institutional" liquidity of the Brazilian market, which was particularly warranted given the increased importance of trading operations on international financial markets.

The chapter finished with a short discussion of the complex role the BCB's foreign exchange interventions played in this internationalisation process. Indeed, it was shown that, despite the official inflation targeting regime *cum* floating exchange rate, the BCB has been an active operator in the foreign exchange market, both in times of appreciation and depreciation. The size and type of these interventions pointed to the fact that these were not only aimed at building foreign exchange reserves to protect

¹²³Of this US\$13 billion, US\$7 billion and US\$6 billion were of spot sales, repos and trade loans respectively.

against speculative attacks, but were also geared to influence the exchange rate. Nevertheless, as was shown in Chapter 4, the Brazilian exchange rate has been subject to large and sudden swings over recent years. In this sense, this chapter has also argued that in the face of increased financial integration, DECs' central bank foreign exchange interventions may become increasingly ineffective or even counterproductive. The difficulty of managing exchange rate movements has been further aggravated by the institutional framework of an inflation targeting regime and its asymmetric impact on the exchange rate. Further insights into this increased exchange rate management complexity in the new era of currency internationalisation and its interrelation with an inflation targeting regime will be presented in Chapter 7. First, however, Chapter 6 goes on to outline the methodology adopted in this dissertation to investigate empirically exchange rate dynamics in the context of an internationalised currency.

Chapter 6: Methodological Considerations

6.1. Introduction

Methodological considerations are an important element of scientific research. However, in large parts of the economic profession methodology is not discussed and deductive, quantitative methods are seen as the only appropriate tool to conduct research (Lawson 1997). Even within heterodox economic circles, methodological considerations are not always considered an important element of scientific research.

In general terms, there are two approaches to methodology and the consequent choice of method(s). Firstly, a pragmatic approach which advocates that the choice of method should be motivated by the research question at hand; secondly, a “methodological purist” approach which argues that the choice of a methodology and consequently method(s) rests on ontological and epistemological presuppositions with which this choice has to be consistent (McEvoy and Richards 2006).¹²⁴

This dissertation has adopted a Post Keynesian approach to analyse exchange rate dynamics in Brazil. This poses the question of the ontological and epistemological background of Post Keynesianism and the corresponding methodology, in terms of research strategy, and appropriate method.¹²⁵ Indeed, if Post Keynesian economic thought is characterised by a distinct ontology and epistemology, which then influences the research strategy and choice of method, this will have an important bearing on how research should be conducted from a Post Keynesian perspective.

This chapter is divided into five parts. Following this first section, Section 2 will discuss questions of ontology and epistemology and show that indeed it has been argued that Post- Keynesian thought can be characterized by one common ontological and

¹²⁴ These two approaches are not necessarily independent of each other. A researcher’s ontological and epistemological framework will influence which and how research questions are asked; this in turn will frame the choice of method.

¹²⁵ In the literature, the term methodology is used to describe both, an approach’s overarching ontological, epistemological and methodological framework, and a specific research strategy (e.g. Blaikie 2000; Bryman 2001; Dow 2001). The term will be used interchangeably here, but it will be pointed out if it refers to a specific research strategy.

epistemological framework. Particular emphasis in this section will be on the question as to whether this common position can also be characterised as critical realist. Section 3 discusses the corresponding research strategy and choice of method given this common ontological and epistemological basis. It shows that both Post Keynesian and critical realist methodology make a case for mixed-method research. Finally, in Section 4, the chapter discusses the specific mixed method study conducted for this dissertation. Particular emphasis will be on the set-up, conduct and limitations of the qualitative study. A final section concludes.

6.2. Ontological and Epistemological Considerations

As part of the attempt to establish Post Keynesian writing as a consistent and coherent school of economic thought the question of Post Keynesian ontology has become increasingly discussed in the literature (e.g. Arestis 1996; Arestis, Dunn et al. 1999; Dow 1999). Following critical realist terminology, two main ontological positions are distinguished: closed and open systems.¹²⁶

In closed systems, bounds, constituent variables and relations are known or are at least knowable. There is a natural order which can be captured in laws of nature and constant conjunction of events arise (Dow 1996; Lawson 1997). This event regularity follows from two particular forms of closure: the intrinsic and the extrinsic. The intrinsic condition of closure (ICC) - which can be loosely characterised as implying that a cause always produces the same effect – suggests that the structures of the phenomena under study are constant, unchanging and for any intrinsic state only one outcome is possible. The extrinsic condition of closure (ECC) – which can be loosely understood as implying that an effect always has the same cause – suggests that the phenomena under study are isolated from other potential influences (Arestis, Dunn et al. 1999; Downward and Mearman 2002).

¹²⁶ Dow (1996) distinguishes between the Euclidian/Cartesian and Babylonian approach, which are described by the duals closed vs. open, atomistic vs. organistic and dual vs. non-dual. Given that the closed vs. open system distinction is the most common terminology in the literature this distinction has been adopted in this dissertation. Other elements of Dow's distinction will be subsumed under this broad classification.

In open systems, the bounds, constituent variables and relations are not known. Conditions for closure do not apply because the phenomena under study are either transmutable or organically linked. In open systems, elements cannot be reduced to their smallest components such that one set of axiom can be identified, but the system is organic, i.e. it involves interdependencies which precludes the selection of one set of axiom as universally causal (Dow 1996; Arestis, Dunn et al. 1999). Dualism, the ability to reduce the world to mutually exclusive categories with fixed meaning, cannot exist (Dow 1996).

Open systems have often been interpreted as a lack of event regularities or system, which poses severe limitation on scientific knowledge. However, as will be argued in more detail below, a certain degree of regularity or closure is possible in open systems, i.e. there are underlying forces which maintain or restore order in an indeterminate way.¹²⁷ That said, given the continual interplay between (intrinsic) reflexive human agency and structure, these regularities will be partial and multifaceted, and neither predictable nor universal (Dow 1996; Arestis, Dunn et al. 1999; Mearman 2004).

On an epistemological level, closed system approaches have been most commonly associated with the positivist approach. For positivists only phenomena which are observable can validly be called knowledge and regarded as real; truth and meaning reside in objects independently of any consciousness (Bryman 2001; Crotty 2003). Given the closed and atomistic ontology underpinning positivism, this reality is constituted by atomistic events and their constant conjunctions which can be represented by universal causal propositions. In Lawson's (1997) words this leads to a view of (economic) reality which implies that whenever event (type) X then event (type) Y. The law-like nature and constancy of causal mechanisms also implies that in this view, science has to be value free, independent of the observer and void of normative statements (Tashakkori and Teddlie 2008).

Open system methodology is associated with varied epistemological strands, summarized under the heading of constructivism or interpretivism.¹²⁸ Again, in very

¹²⁷ Keynes' conventions are a case in point.

¹²⁸ These methodological strands include approaches such as hermeneutics, phenomenology, symbolic interactionism, postmodernism and rethoric etc. (Dow 1996; McEvoy and Richards 2006).

general terms, constructivist epistemology holds that while reality may be independent of human thought, meaning or knowledge is always a human construction. Thus, the knower and unknown are inseparable. This also implies that general laws and time and context free generalisations are not possible and that it is impossible to distinguish causes from effects. Thus, the aim of the constructivist researcher is to explain and gain a deeper understanding of human social reality and to find out what meanings people give to the actions that lead to identified patterns (Dow 1996; Crotty 2003; McEvoy and Richards 2006; Tashakkori and Teddlie 2008).

A detailed critique of these two epistemological approaches would go far beyond the remit of this chapter. A more recent epistemological (and indeed ontological) approach which stands between the “determinism” of positivism and “subjectivism” of constructivism is critical realism (Lawson 1997; Lawson 2003). Like positivism, critical realism accepts the existence of a material world independent of the thoughts and consciousness of individuals. But like constructivists, they reject the singular focus on observable surface events and the atomistic view of the elements of a social system which are linked by law-like causalities independent of social context, history etc. (McEvoy and Richards 2006).

On the ontological level critical realism argues that reality is structured (it includes, but is irreducible to, actualities such as events and states of affairs and our experiences of them), open (event regularities are not ubiquitous – due especially to the multiple and perpetually shifting mix of causes of events) and differentiated (closure, sustaining event regularities, do occur under some, but only under some very specific conditions) (Lawson 1999). As a result, critical realists distinguish between three different ontological domains or modes of reality: the empirical (what can be observed), the actual (events whether they can be observed or not) and the real (structure and mechanisms that produces these events) (Lawson 1997).

Consequently, critical realist theorising involves moving from the empirical surface phenomena to the underlying real and irreducible structures, mechanisms and tendencies that govern observable surface phenomena. However, these deeper structures are not in any sense natural or immutable and might not be reflected in surface events or be out of phase with them (Lawson 1997; Arestis, Dunn et al. 1999). Given the number

of causal mechanisms working at the same time it is unlikely that one mechanism would dominate for the full period under consideration. In addition, the underlying processes and structures are organically intertwined in a complex way and open to unpredictable influences and institutional change (Dow 1996). It is therefore more appropriate to think in terms of tendencies and demi-regularities than in terms of empirical generalisations (Lawson 2003). Thus, the open system ontology of critical realism provides a basis for researchers to expect both co-determination of events, but also irregularities (Downward, Finch et al. 2003).

Emphasising the transformability and transmutability of deeper structures, critical realism also advances a specific view of human agency based on the intentionality of (economic) agents and their transformative capacity of the system. The actuation of agents is governed by existing (social) structures, but it is precisely these actuations which shape existing structures (Lawson 1994; Arestis, Dunn et al. 1999).

On the epistemological level, critical realists hold that knowledge is acquired by formulating some idea (model) of the underlying mechanisms, structures etc, which are then “tested” using a selection of different techniques (Lawson 1994). Although the deep structures of reality are understood to have objective existence, given their “hidden”, mutable and organic nature there is no mechanism for establishing true knowledge of them in any absolute sense (Dow 1996). Knowledge is fallible and transformable and there can never be an assurance of having identified the truth (Downward and Mearman 2002). This also implies that the aim of science has to be explanation rather than prediction (Dow 2001).

6.2.1. A Common Ontological and Epistemological Basis for Post Keynesian Economics?

Post-Keynesian ontology and epistemology is still an issue under debate. Three different “positions” can be distinguished. First, a large part of Post Keynesians do not touch upon the question of ontology and its corresponding methodology at all. Methods, primarily quantitative, are applied without questioning their ontological basis. A second position holds that a common ontological and methodological basis is a crucial unifying element of Post Keynesian economics (Arestis 1992; Lavoie 1992; Lawson 1994; Chick

1995; Arestis, Dunn et al. 1999; Dow 1999).¹²⁹ A final, though much smaller, strand argues that finding such a common methodological basis might indeed be counterproductive for the Post Keynesian project as it would limit the approach in reach and breadth (Walters and Young 1999). Emphasis in this chapter shall be on the second strand, although concerns raised against assuming a common ontological and methodological background will also be considered.

Given the widespread emphasis in Post Keynesian literature on uncertainty, historical processes and real choice it is argued that Post Keynesians share a common open system ontology (Dow 1998). Indeed, by overthrowing the ergodic axiom and emphasising the determining role of context specific expectations, Keynes' system rejects the assumption of the immutable nature of economic phenomena over time. In addition, Post Keynesians explicitly reject the assumption that knowledge of atomistic behaviour is sufficient to construct (macroeconomic) outcomes. Human agency is socially contingent, in an organic rather than atomist view of the economic process. At the same time, human agency reproduces and transforms social structures, which prevents full closure and the elaboration of a deterministic account of economic phenomena (Arestis, Dunn et al. 1999; Dow 2001).

Thus, unanimity seems to reign among Post Keynesians as to the open system ontology of their research program. There is less consensus over the specific form of this open system ontology and consequent epistemology and research strategy. Within Post Keynesian open system theorizing, three different approaches have been distinguished: firstly, the Babylonian method by Dow (Dow 1990; Dow 1996; Dow 1998; Dow 2001), secondly critical realism, and finally the "generalizing method most closely associated with Davidson" (Arestis, Dunn et al. 1999; Walters and Young 1999; Dow 2001; Lee 2002).¹³⁰ Given that the primary emphasis in the literature lies on the first two, this is where emphasis in this dissertation shall be placed. The question which arises here is, to what extent are these two approaches compatible for the formation of a common

¹²⁹ Indeed, several authors, particularly Dow (1999) and Lawson (1994), argue that it is precisely this common ontological and epistemological basis which unites Post Keynesian thought in the presence of a wide disparity of theories and methods used.

¹³⁰ It is important to note here that the borders between ontology, epistemology and methodology are difficult to draw. For example, although generally being an open system approach, critical realism makes additional ontological claims which might not be reflected in Dow's Babylonian method. As discussed below, this particularly refers to the emphasis on underlying mechanisms and deep structures.

methodological basis for Post Keynesian thought. It will be argued that a synergy of these two approaches is possible: while critical realism has more developed ontological foundations and implications for economic methodology, Dow's Babylonian method seems to offer more epistemological considerations.

Post Keynesian economics has been widely characterized as realist (Arestis 1992; Lavoie 1992; Chick 1995). Dow (1999) argues that although not explicitly espousing critical realism, the content and the manner in which these authors present their methodological statements indicate a strong affinity with critical realism. Arestis (1996), McKenna and Zannoni (1999), Rotheim (1999), Lee (2002), Dunn (2004), and most prominently Lawson (1994), argue that Post Keynesian ontology is a critical realist one. According to Lawson (1994) this can be seen in Post Keynesians' enduring focus on uncertainty; an explicit view of economies as dynamic historical processes shaped by economic and political institutions; an acceptance of the reality of human choice understood as being able to always have acted otherwise; a prevalence of sets of competing substantive accounts of a given phenomenon etc. (Lawson 1999). Post Keynesians emphasis on the importance of institutional and political structures which shape human agency in particular, have been seen as a reflection of critical realists' conception of society as structured and intransitive and critical realists' emphasis on deeper structures and mechanisms (Lee 2002). In a similar vein, the Post Keynesian stipulation that economies must be seen as dynamic historical processes is reflected in the critical realist transformational conception of social activity (Lawson 1994).

Thus, following Rotheim (1999), this dissertation argues that insofar as Post Keynesians make it their analytical endeavour to uncover underlying mechanisms and processes, acknowledge the context, time specific, and transformative actuation of economic agents and aim to explain rather than predict, their research project can indeed be seen as a critical realist one. For example, with reference to the operations of economic agents under uncertainty, which were discussed in Chapter 3 of this dissertation, Rotheim argues that this is only the case if Post Keynesian economists do not seek refuge in two extremes: either the extreme form of fundamental uncertainty and "animal spirits" which reduces individual behaviour to atomistic, subjective operations independent of their social context or the construction of formalistic deductivist models based on the representative agent which relies on perfect certainty and full closure.

Importantly, Rotheim (1999) also argues that it is not in the critical realists' remit to describe what the exact underlying processes and mechanisms are. This is up to the individual science, for example Post Keynesian theory.¹³¹

The second type of open system ontology proposed for Post Keynesianism is Dow's Babylonian method. The Babylonian method asserts the existence of a complex, organically linked, transmutable reality, which makes it impossible to use one set of axioms as universally causal and makes it not amenable to formalization with respect to separable elements within a single system of reasoning (Dow 1996). Thus, Dow's Babylonian method also advocates open system ontology and the existence of something "real".¹³² However, in contrast to critical realism, it is not entirely clear what this reality consists of.¹³³ In some papers Dow argues that Babylonian thought assumes the existence of real processes and mechanisms which cause events (Dow 1998; Dow 1999). She thus seems to be accommodating critical realist ontology. In a similar vein, she argues that there is no tension between the irreducible complexity and openness associated with the Babylonian method and the elucidation of deep causal structures associated with critical realism, as these causal structures are not immutable, but open and indeterminate (Dow 1999). However, it is not clear whether she sees the Babylonian method and critical realism as coinciding or merely consistent where the Babylonian method constitutes a more general umbrella accommodating critical realist ontology. In this sense, critical realism seems to be ontologically more precise and developed with consequent implications for methodology and the conduct of scientific research.

On the epistemological level, however, Dow's writings are very rich. Given the open, organic, complex and transmutable nature of reality, knowledge of this reality can

¹³¹The extent to which existing Post Keynesian work effectively adheres to a critical realist perspective is subject to debate (Downward 2000). For example, while Walters and Young (1999) argue that much of the work by Keynes, Kalecki and their followers could not be classified as critical realist, Arestis, Dunn et al. (1999) and Rotheim(1999), argue that indeed Keynes' focus on uncertainty, a money-wage economy, a monetary theory of production and the principle of effective demand as underlying mechanisms are indeed manifestations of a critical realist form of scientific endeavour.

¹³² Thus, as Dow (1999) argues the verdict that Babylonianism is constructivist is not correct.

¹³³ However, Dow seems to argue that the quest for knowledge in Post Keynesian thought is structured by principles peculiar to Post Keynesianism (Dow 2001). These core and unifying principles are that the economic process is being ordered to a considerable degree because of institutions and conventional behaviour; that there are inevitable limits to knowledge; a focus on production rather than exchange; the importance of money; and finally a significant emphasis on investigating the nature, causes and consequences of income distribution.

always only be partial. Knowledge is treated as being incomplete in a fundamental sense, fallible and transformable. Given that full knowledge is impossible to attain, a range of explicitly partial analyses is necessary to deal with that incompleteness. Consequently, separate fields, theories and indeed methods are required to analyse the different facets of reality. Epistemologically, in this view, knowledge can be generated by decomposing the system and employing several strands of arguments which have different starting points and reinforce each other (Dow 1990; Dow 1996).

In sum, this section has shown that Post Keynesian economics is characterized by open system ontology. In addition, it has argued that critical realism and Dows' Babylonian method can complement each other in providing a common methodological basis for Post Keynesian economics. On the one hand, critical realism has more structured, independent ontological roots, and, as will be discussed in the next section, has been more fully developed in terms of its implications for economic methodology than the Babylonian approach (Dow 1999). Insofar as Post Keynesians put the emphasis in their analytical endeavour on identifying those mechanisms that explain the organic nature of a capitalist economy, where individuals are capable of purposeful intentional choices, Post Keynesian ontology and epistemology can indeed be considered critical realist (Rotheim 1999). On the other hand, Dow's writings on the fallibility of knowledge and its epistemological implications have important repercussions for the conduct of scientific research from a Post Keynesian perspective. In addition, following Rotheim (1999), given that much of the critical realist literature is on the philosophical level, Post Keynesianism can contribute a body of substantive economic doctrine that possesses powerful explanatory potential and provides economic theory for the assumed underlying mechanisms and processes.

6.3. From Ontology and Epistemology to Methodology and Method

Having identified the common ontological and epistemological basis of Post-Keynesian economics, this poses the question for the appropriate methodology, in the sense of a research strategy, and consequent method(s) for scientific research in a Post Keynesian tradition.

In very general terms, the closed system positivist ontology and epistemology of mainstream economics has been primarily associated with deductive or inductive reasoning, where either pre-formed hypothesis are put against empirical data to test specific propositions (theories) or scientific theories are formed through the accumulation of verifiable facts (Blaikie 2000; Bryman 2001). Given the underlying objectivism, interested in counting and measuring observable aspects of social life and establishing causal processes, the methods applied in this approach are primarily quantitative with an interest in generalisation, replicability and objectivity (Bryman 2001).¹³⁴

On the other extreme, open system constructivist approaches have been primarily associated with research strategies which aim to generate scientific knowledge from the research subject's account, including abduction, grounded theory etc. Given the emphasis on social actors' meanings and understandings and rich contextual information, the methods here used are primarily of a qualitative nature (Bryman 2001).

As discussed above, critical realism takes an ontological middle-ground which argues for an existing reality of underlying mechanisms and structures, which, however, only manifest themselves on the empirical level under certain conditions. The epistemological emphasis in critical realism thus lies in uncovering these underlying real mechanisms and structures which (can) cause empirical surface events. The research strategy suggested to do so is retrodution. Critical realists argue that we can get an insight into mechanisms and deeper structures through beliefs and hypotheses about these underlying factors, which are then investigated against empirical evidence in an iterative and cumulative process (Lawson 1994; Lawson 1997; Walters and Young 1999). However, as Downward and Mearman (2003) argue, little specific practical guidance is offered how this is done in practice. According to Lawson (1997), this will depend on the specific context at hand, although some guidance can be given by realist abstraction and the existence of demi-regularities, which indicate the potential need for retrodution (Downward and Mearman 2003).¹³⁵

¹³⁴ Although a strict correspondence between ontology and method is implied here, we will see later that this direct association has been questioned over recent years (Bryman 1984).

¹³⁵ Realist abstraction stands in contrast to instrumentalism, in which the mechanisms posited can be ideal or fictional, not subject to empirical check, and are assessed only by their ability to yield successful predictions rather than explanations (Downward and Mearman 2003).

Given the open, structured and organic nature of reality and the fallibility of knowledge, several authors argue that critical realist ontology and retrodution as its corresponding research strategy, require the use of a mixed-method triangulation (Dow 2001; Olsen 2002; McEvoy and Richards 2006; Downward and Mearman 2007).

Mixed-method research has been suggested for several purposes broadly summarized as triangulation, development and complementarity (Greene, Caracelli et al. 1989; Bryman 2001; Bryman 2006). In this literature, triangulation refers to the simultaneous use of different methods for the same research question with the aim to increasing the validity and reliability of results through counteracting the biases of specific methods.

Development indicates the use of one method to aid or inform research using the other research strategy. Complementarity occurs when two different methods are employed to dovetail different aspects of an investigation (Bryman 2001).

Although critical realists advocate the use of mixed-methods under the heading of triangulation, they ultimately reject the ontological underpinnings of triangulation as defined above, i.e. combining methods with the aim of compensating respective biases and thus increasing the validity of results. Downward and Mearman (2007) argue that this view implicitly assumes that methods are associated with different ontological domains. In contrast, the authors hold that quantitative and qualitative research methods differ more in emphasis than in kind as both of them necessarily invoke a degree of closure (although it could be argued that this closure is more profound in statistical testing). Consequently, they argue for a shift towards seeing methods as re-descriptive devices revealing different aspects of objects of analysis. In a similar vein, Olsen and Morgan (2005) argue that research methods should not be confounded with methodologies; whereas the latter often have embedded in them an assumption about the nature of reality, methods are primarily to be seen as tools.

Supporting the aim of retrodution, these different tools, or methods, are crucial to reveal different features of the same layered and structured reality. For example, while quantitative methods can uncover demi-regularities in the empirical domain, qualitative methods can uncover the causal mechanisms underlying the observed events. Thus, in an argument coming close to the complementary aim of mixed-method research, the

aim is to construct a nexus of mutually supportive claims of reality, without the presumption of being exhaustive, in which the whole stands distinct from its parts. These mutually supported propositions are where mixed-method triangulation adds “validity” (Downward and Mearman 2007). The use of different methods is necessary because of the open, organic and structured nature of reality and the fallibility of knowledge (Downward and Mearman 2002). Indeed, referring to Dow’s epistemological writings, Downward and Mearman (2002) argue that in a system where knowledge is necessarily incomplete, the use of different methods is not only possible but also necessary.

This case for mixed-method research holds also true for the Babylonian method. As discussed above, Dow highlights that true knowledge can never be attained. Given the complexity of the economic system, Dow advocates using a range of methods to gain - at least partial - knowledge of the whole. According to Dow, “diversity of method, indeed, is the inevitable outcome of an epistemology which focuses on grounds for rational belief when knowledge is imperfect” (Dow 1998: 379). All that is ruled out on epistemological grounds is the assertion that a theory is anything other than partial.¹³⁶

By advocating mixed-methods studies to support their ontological and epistemological background, Post Keynesian and critical realist methodology break down the dichotomy between those who advocate mixed-methods for pragmatic reasons and the “methodological purist” camp, which argues that quantitative and qualitative methods constitute irreconcilable views about how social reality is constituted. In this latter view, mixed-method research would not be possible from a consistent ontological, methodological perspective (Bryman 1984; Bryman 2001; Plano Clark and Creswell 2008). By viewing methods as mere instruments to illuminate certain aspects of a phenomenon, critical realists/Post Keynesians adopt a clear pragmatic approach, which is nonetheless entirely consistent with their ontological and epistemological view of a structured reality and fallible knowledge.

¹³⁶ A third research strategy that has been suggested for Post Keynesian economics is grounded theory, where theory is developed directly from the data (which are not necessarily objective data as in the inductive method) (Lee 2002). Indeed, in its iterative process where data collection, theoretical analysis and theory building occur simultaneously, this method could come close to the retroductive method. Danermark, Ekstrom et al. (2002), however, argue that grounded theory is ultimately too inductive. Moreover, Downward and Mearman (2007) opine that grounded theory does not provide a strong ontological base for mixed method research.

Thus, the critical realist/Post Keynesian pragmatic view of methods is only appropriate if a common ontological and epistemological position is sustained (Dow 1998; McEvoy and Richards 2006). This consistency has been particularly controversial when it comes to the role of econometrics in an open system ontology (Sayer 1992; Lawson 1997). This is so, because econometrics requires both intrinsic and extrinsic closure (Lawson 1989).

In line with the arguments for methodological triangulation, several authors have argued that the use of closed methods, such as analytical statistics or econometrics, does not necessarily violate the open system ontology. Methods are just practical devices and it is the methodology, the way research is conducted, which matters. In this vein, Downward and Mearman (2002) argue that most forms of empirical research which want to establish regularity, including qualitative methods, imply some form of closure.¹³⁷ From an open system ontology, however, it is important to acknowledge that these are temporary, local closures in an inherently open system (Lawson 1997). This line of reasoning is also echoed by Olsen and Morgan (2005) who hold that methodological closure does not necessarily imply realist closure.

This “critical” view of econometrics also implies that certain methods are more consistent with a critical realist methodology than others. For example, time-varying or non-parametric methods which analyse one case study are preferable to panel or cross sectional studies. In addition, this means that econometrics should be conducted primarily for explanatory rather than predictive reasons. Finally, this view also puts the emphasis on the interpretation of economic results. For example, Olsen and Morgan (2005) write:

“ ..the validity of interpretation..is what social scientists should argue about. Therefore what matters is how warranted arguments are built by the researcher using statistics.

¹³⁷ Indeed, even in an open system there are underlying forces which maintain or restore order (if in an indeterminate way) (Dow 1996). This is the result of (a) the existence of relatively enduring underlying mechanisms and processes and (b) economic agents seeking stability in their decision making (Keynes’ conventions are an excellent case in point). If these two coincide, underlying mechanisms and structures might be reflected in observable, regular events on the empirical level (so-called demi-regularities in critical realist terminology) (Downward and Mearman 2003; Setterfield 2003; Mearman 2004) .

Our argument supports seeking surprising findings; being aware of the caveat that demi-regularities do not necessarily reveal laws; and otherwise following advice given from the “sceptical” school” (p. 280).

However, both Olsen and Morgan (2005) and Downward and Mearman (2002) do not only build a justification, but also a positive case for the use of econometrics as part of a retroductive mixed-method triangulation. In addition to pointing to demi-regularities on the empirical level, which can then be explored for causal mechanisms, econometric results can add important insights into the causal mechanisms and deeper structures in a world of fallible knowledge. For example, according to Downward and Mearman (2002) : “...while descriptive and historical analysis might be suggestive of the causal mechanisms themselves, the effect of their action can be assessed, and hence the purported causal mechanism supported, with reference to more quantitative analysis” (p. 15). In a similar vein, Olsen and Morgan (2005) argue : “...some aspects of relationships – e.g. liabilities, capacities, and generative mechanisms – can be revealed to observers through the use of analytical statistics...” (p. 266). In sum, econometrics can play an important role in adding knowledge about a multi-layered, complex, open and dynamic reality. At the same time, however, the researcher needs to be constantly aware that she is moving in an open system reality, where closure will be temporary and context-specific.

6.4. A Mixed-Method Study of Exchange Rate Dynamics in Brazil

6.4.1. Ontological and Epistemological Background

This dissertation has adopted a Post Keynesian theoretical approach. It has argued that exchange rate dynamics in Brazil are determined by the positions and expectations of investors in short-term financial markets. These expectations, in turn, are formed under fundamental uncertainty, which makes them, and indeed exchange rate movements, necessarily context and time specific. As a result, there are no permanent causal relationships between exchange rates and fundamentals. Thus, stressing the non-ergodicity of economic processes, this dissertation has explicitly embraced the open system ontology of Post Keynesian economic thought.

However, this dissertation has also rejected over emphasis on the role of uncertainty and animal spirits in expectation formation. As discussed above, uncertainty fundamentalism runs the risk of reducing economic processes to the subjective and atomistic behaviour of economic agents, devoid of social context, structures, mechanisms (Rotheim 1999). Thus, while rejecting the closed system positivist ontology and epistemology of mainstream economics which sees permanent relations between exchange rates and underlying fundamentals, this dissertation has also objected to a constructivist standpoint which would argue that exchange rate dynamics are the sole outcome of the subjective expectations and perceptions of individuals operating in foreign exchange markets. In contrast, it has inquired after the *real* underlying mechanisms, processes and structures which shape economic agents' expectations, financial positions and thus exchange rate dynamics. In addition, it has argued that economic agents' behaviour shape the underlying mechanisms and structures in a process which can be described as transformative. Consequently, this dissertation's ontological stance could also be considered critical realist.

Given its proximity to critical realist ontology, this dissertation has pursued a retroductive research strategy. Based on initial beliefs and hypotheses, it has generated knowledge about the underlying mechanisms and processes in an iterative empirical analysis. Two main pieces of information were taken into account in forming initial beliefs about the underlying mechanisms and structures shaping exchange rate dynamics in Brazil.

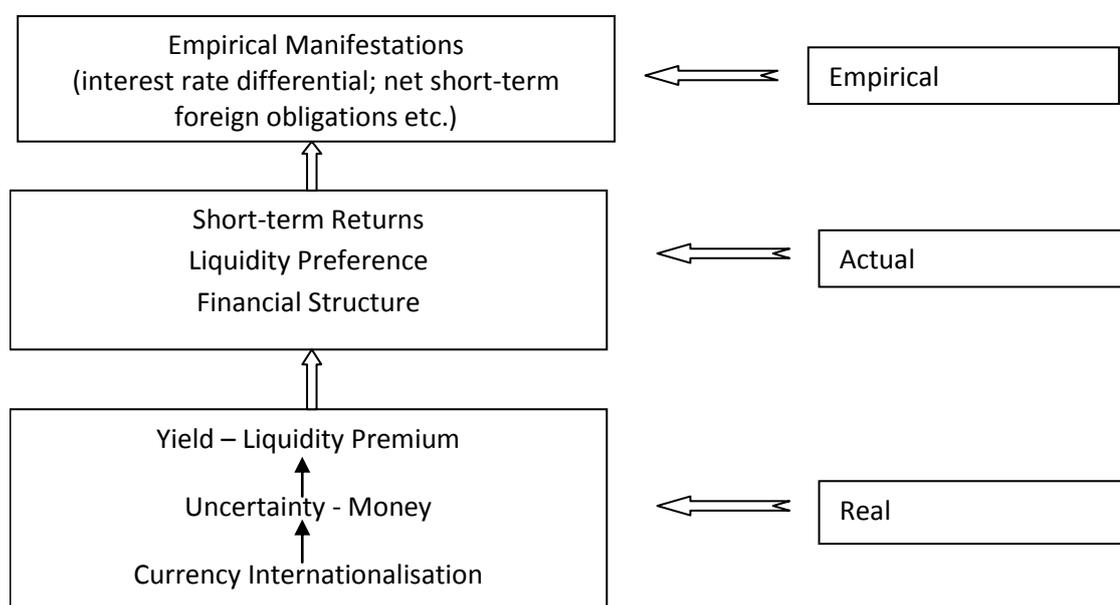
The first piece of information was observations of event regularities on the empirical level and preliminary quantitative and qualitative research; as to the former, this dissertation was motivated by the observation, described in Chapter 4, that over recent years the Brazilian Real has been subject to large swings, excess volatility and sudden and large exchange rate movements, mostly independent of underlying fundamentals. It was further observed that these movements largely coincided with short-term domestic returns and conditions on international financial markets. Preliminary data analysis, including both quantitative and qualitative data, supported these initial beliefs and

hypothesis.¹³⁸ This preliminary analysis also pointed to the recent process of currency internationalisation.

Secondly, these empirical observations were complemented by Post Keynesian theoretical conjectures about the underlying mechanisms and structures. As discussed above, while critical realist ontology highlights the importance of deeper structures and mechanisms, their specification is up to the particular theoretical approach adopted. This dissertation did so by focusing on one of the most important underlying mechanisms which emerges in an economy under fundamental uncertainty in the writings of Keynes: money (Arestis, Dunn et al. 1999; Rotheim 1999).

Figure 6.1 shows a schematic picture of the structured and layered reality of exchange rate determination in Brazil assumed in this dissertation.

Figure 6.1: Exchange Rate Determination from a Post Keynesian/Critical Realist Perspective



The underlying “deeper” structure in the *real* domain is the recent process of currency internationalisation discussed in Chapters 4 and 5. This currency internationalisation has made the positions of economic agents in short-term, domestic currency denominated

¹³⁸ One element of the preliminary quantitative analysis was an explorative event study, presented in Appendix 1. Initial qualitative insights were generated with interviews during the preparatory fieldwork described in Section 4.3.

financial assets an important determinant of the exchange rate in Brazil. Based on the view of the exchange rate as international money these decisions, in turn, are shaped by the domestic currency's yield and liquidity premium relative to the money of the system. On the *actual* level, these real mechanisms show themselves in the form of returns on short-term financial assets (including expected exchange rate appreciation), liquidity preference and financial structure. Financial structure also includes the institutional liquidity of a market and its foreign exchange productivity to meet outstanding external obligations. Finally, these mechanisms *can* manifest themselves on the *empirical* level through different indicators, e.g. short-term returns on domestic assets or a country's net short-term foreign liabilities. Importantly, it has been argued that, given the complex, open and organic nature of economic processes and the transformative actions of economic agents, the empirical manifestations of the underlying real mechanisms will be context and time specific or might not be observable at all.

Following critical realist and Post Keynesian methodology, this layered and structured reality was analysed using mixed-method triangulation. This methodological pluralism allows "testing" of the assumed mechanisms and structures in an iterative process and sheds light on the complex and structured reality assumed both in Post Keynesian and critical realist thought. Reflecting the open system ontology adopted in this dissertation, empirical results were based on a case study of the Brazilian foreign exchange market. By employing a case-study design, a variety of data collection techniques, variables and actors can be taken into consideration, allowing for a more holistic and interpretive analysis of the hypotheses (Creswell 2003). In this vein, Mearman (2004) argues that case studies might avoid some of the problem of closure by focusing on a small group or even individual, requiring that the homogeneity required is more likely to be achieved.

6.4.2. The Methods Applied

This dissertation has combined insights from 88 semi-structured interviews with financial market participants, with advanced time series econometrics, such as the cointegrated VAR and multivariate GARCH models. 52 of the semi-structured interviews were conducted with currency traders, both in Brazil and in developed

financial markets (primarily London), which constitute the core of the qualitative study. A discussion of the specific econometric methods will be presented in Chapters 8 and 9. A detailed presentation of the qualitative study conducted will be subject of Section 4.3.

The qualitative study was motivated by several considerations. Firstly, given the focus of this dissertation on financial actors' positions and expectations, it aimed at exploring how market participants operate in short-term financial and currency markets. Based on the critical discussion of the nature of fundamentals presented in Chapters 2 and 3, emphasis was placed on interviewees' perceptions and understanding of fundamentals, and ultimately the mechanisms and structures underlying their trading decisions and thus exchange rate dynamics. This also included discovering any important heterogeneity among the interviewees and the important role of institutional factors in shaping agents' decisions.

Secondly, the interviews aimed to explore the link between actors' understanding and perceptions of exchange rate fundamentals and the underlying mechanisms, on the one hand, and the empirically observed exchange rate drivers, on the other. Thus, the analytical focus was whether, and if so, when and how the underlying real mechanisms manifested themselves on the empirical level as actual exchange rate drivers.

Thirdly, the semi-structured interviews provided rich contextual information on the structure of the Brazilian and international foreign exchange markets, the different institutions operating in these markets, their motivation to do so, their client structure and main trading strategies. In this sense, the semi-structured interviews were also crucial to uncover and shed more light on the recent process of currency internationalisation.

Results from the qualitative study were complemented with advanced time series econometrics. As discussed above, as part of a mixed-method triangulation analytical statistics can be an important complement to qualitative data to highlight different facets of the same phenomenon. In this dissertation, time series econometrics was used to further analyse the *empirical* manifestations of the *real* mechanisms and structures shaping economic agents' operations in the foreign exchange market, i.e. the exchange rate drivers in the context of currency internationalisation.

More concretely, time series econometrics has complemented the qualitative results on three dimensions. Firstly, a “word-number” dimension: econometric results allowed a deeper insight into the actual magnitudes of the empirical regularities invoked by the qualitative results. Secondly, a “micro-macro” dimension: the econometric results allowed one to analyse whether the mechanisms invoked on the micro-level, i.e. the level of the individual traders, were also reflected in the macroeconomic relationship between the exchange rate and the empirically observed causal mechanisms. Thirdly, a “cross-section vs. time-series” dimension: the econometric results allowed one to gauge whether the causal relations uncovered in the cross-sectional study of trader behaviour also held over time. The latter aspect was particularly important, given that it has been argued that closures can always only be local and temporary. The econometric investigation allowed consideration of whether such closure held over time and whether some form of generalisation over time was indeed possible.

6.4.3. A Qualitative Study of Foreign Exchange Market Behaviour

The conduct of 88 semi-structured interviews with financial market participants and in particular interviews with 52 onshore (Brazilian) and offshore currency traders constituted a crucial element of this dissertation’s empirical analysis. In addition to the methodological considerations presented above, the use of semi-structured interviews, particularly in contrast to a survey study, was also motivated by practical reasons.

Firstly, the population of economic agents trading the Brazilian Real is more limited than those trading developed market currencies. This is particularly true given the demand of this study to interview agents from heterogeneous institutional backgrounds. Secondly, foreign exchange traders are a notoriously difficult group to research. This is partly due to time constraints, but also due to the opaque nature of financial markets in general. Traders are not public personalities and are very difficult to contact. Sending untargeted questionnaires would have been very unlikely to succeed. Conducting a large number of questionnaires in persona was impossible, due to the time and effort involved in establishing and conducting the interviews.

Given the qualitative nature of this study and above described characteristics of the interviewees, sampling was conducted on a purposive basis (Miles and Huberman 1994; Bryman 2008). During a first fieldwork stay in Brazil in July and August 2008 the peculiarities of the Brazilian foreign exchange markets, its market structure and thus main interview groups were investigated. To this aim, 12 semi-structured interviews with economists, central bank and financial sector representatives and foreign exchange traders were conducted. In addition, pilot interviews were conducted with foreign exchange traders as part of the retroductive strategy adopted and to refine the interview questions. The second and main round of interviews in Brazil was conducted during April and June 2009 in São Paulo and Rio de Janeiro. Interviews were set up based on personal contacts, contacts established during the first fieldwork stay or other “intermediate” interviews.¹³⁹ Subsequent interviews were arranged through snowballing, primarily via the currency traders themselves.

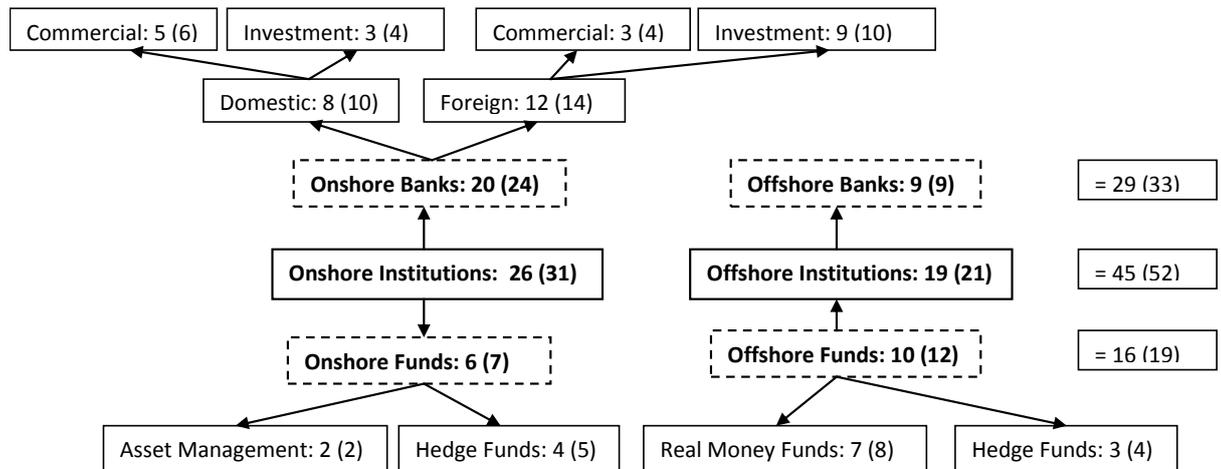
The choice of offshore institutions was to large parts based on progressive theoretical sampling (Bryman 2008). Results from onshore financial institutions were used to decide on the important offshore interview partners. Interviews with offshore operators were conducted primarily in London between November 2009 and November 2010. Sampling was again based on initial contacts and subsequent snowballing.

Figure 6.2 presents the main institutions interviewed. Numbers in parenthesis indicate the total number of operators interviewed per institution.¹⁴⁰

¹³⁹ In total, 8 additional semi-structured interviews with financial market participants and 6 interviews with economists of local institutions were conducted to arrange contacts with foreign exchange traders and conduct further research on the structure of the Brazilian foreign exchange market.

¹⁴⁰ For a few institutions more than one trader was interviewed. If questions referred to the institution overall, only one response was counted (in all cases responses were consistent across traders from the same institution).

Figure 6.2: Type and Number of Institutions (Operators) interviewed



In total, 52 operators from 45 different institutions were interviewed.¹⁴¹ For analytical purposes the main criterion of classification is between onshore and offshore institutions. This classification is motivated by the emphasis on the internationalisation process of the Brazilian Real. In addition, given their distinct motivation to participate in the foreign exchange market and thus potential differences in price impact and trading behaviour, a distinction is also made between banks and funds. This classification is also consistent with the three main operators in the Brazilian foreign exchange market - banks, domestic institutional investors and foreign institutional investors - discussed in Chapter 5.

As also discussed in Chapter 5, banks with an onshore presence can be further distinguished into domestic and foreign (depending on the location of their head-quarter) and commercial and investment banks.¹⁴² The latter distinction is more difficult to make in the case of offshore banks given the size, complexity and heterogeneity of these institutions. Offshore banks have thus been treated as a homogenous group. Some

¹⁴¹ Appendix 2 gives a list of the onshore and offshore banks interviewed, except when anonymity was explicitly requested. To safeguard respondents' anonymity, no detailed information is given on onshore and offshore funds. Given that these institutions are often very small, mentioning the institutions' names might allow identification of the operators interviewed. For the same reason, not detailed information on interviewees' positions within the institutions has been given in the case of the banks.

¹⁴² As could be seen in Chapter 5, the majority of banks operating in the Brazilian foreign exchange market are classified as universal banks. To derive a more nuanced distinction into commercial and investment banks, banks' balance sheets and the primary areas of their operations, i.e. retail or capital market operations, were considered. These classifications were confirmed with the responses of the traders themselves. A detailed overview of banks' classifications is also presented in Appendix 2.

insights into the operations of this group can be made from results of foreign banks operating in the Brazilian market.

Onshore funds are distinguished into asset management arms of banks, on the one hand, and hedge funds on the other. Offshore funds are differentiated into real money investors and hedge funds.¹⁴³ Given the difficulty accessing balance sheets of these institutions (and to draw inference from these balance sheets on the main operations of the institutions) these differentiations were primarily based on the responses of the operators themselves. Differences among these subgroups will be highlighted in the results if noteworthy and sufficiently robust.

It is important to note that within several onshore primarily large commercially oriented banks, a distinction between two different types of foreign exchange traders could be made: “flow traders”, or traders who are primarily responsible for “giving prices” to clients, and proprietary traders who operate on the account of the bank.¹⁴⁴ Given this dissertation’s focus on institutions’ motivation to participate in the foreign exchange market and the emphasis on directional foreign exchange positions, interviews were primarily targeted at proprietary traders or ideally head traders.¹⁴⁵

The majority of interviews were conducted in person and lasted between 20 minutes and 2 hours (a few interviews were conducted over the phone). Most of them were conducted in English or, if necessary, in Portuguese. No translator was required. All interviews, except one, were recorded with consent of the interviewees and transcribed by the researcher.

The interviews were conducted in a semi-structured manner, meaning that a structured set of questions were followed; however deviations from the exact order of questions

¹⁴³ Real money investors primarily refer to more long-term oriented investment funds, whose clients, among others, include institutional investors such as pension funds.

¹⁴⁴ The institutional structure of banks varied significantly. Several banks had a clear separation between client oriented foreign exchange desks and proprietary desks (this was primarily the case for large commercially oriented banks), whereas other banks (often, but not only, smaller investment banks) combined flow and proprietary trading in one person. In a similar vein, several banks had a distinction in spot and derivatives desks, where the former was primarily oriented towards client operations.

¹⁴⁵ Given the difficulty to access offshore institutions (and their bigger size and complexity) no such distinction could be made for offshore banks. However, some inference can again be drawn on these institutions from the results of foreign banks operating in the Brazilian market.

and indeed sometimes from the exact wording of questions were tolerated. A main set of questions was asked to all interviewees. More detailed or follow-up questions were asked depending on the time available and the interviewees' prior response. Given that the focus was on financial market participants' perceptions and priorities, all questions were open ended (Foddy 1993). The types of questions asked were to a large extent set prior to the fieldwork, although these were adapted and refined while in the field. Interview sheets differed slightly between the different market participants to accommodate their distinct institutional characteristics. For offshore traders in particular, questions were extended to the emerging market space as not all interviewees were sufficiently familiar with the Brazilian case. Exact interview sheets are presented in Appendix 3.

In general terms, the questions aimed to explore four main areas. Firstly, to gain a better understanding of the structure of the Brazilian foreign exchange market, operators were asked about their (and their institution's) motivation to participate in the foreign exchange market, their client structure, market of operation and most profitable trading strategies. The second section focused on the question of fundamentals and exchange rate drivers, i.e. the perception of foreign exchange market participants of fundamentals and these fundamentals' link with actual determinants of the exchange rate. This also included questions about operators' perceptions of the existence and use of a long-run or equilibrium exchange rate value and the use of technical analysis. The third section explored foreign exchange market participants' operations during the international financial crisis, again, with a focus on the exchange rate fundamentals and variables which traders consider in their trading/investment decisions. The final section investigated foreign exchange market actors' perceptions of the operations of the central bank.

Operators' responses were analysed following Miles and Huberman's (1994) stages of data processing. Following data collection and transcription, data reduction was achieved through focused coding (Bryman 2008). Codes were either given by economic theory or emerged through the interviewees' responses. If possible, results were verified through respondents' answers and consistency to other questions.

6.4.4. Possible Weaknesses of this Study

Several points of criticism or weakness could be raised against this study. These can be divided into general critiques of mixed-method case studies, on the one hand, and critiques of the specific design and assumptions of this study on the other hand.

General Critique

Although validation, in the sense of counteracting the respective biases of methods, has been rejected from a critical realist perspective, this dissertation has attempted to grant “validity” to its results through the use of different methods. This has been particularly important for aspects of the qualitative results where the research has attempted to establish regularities between operators’ trading decisions and empirically observed exchange rate movements. Although certain elements of this link have been triangulated, others have not. For this latter group, particularly given the relatively small (sub) samples, doubts about the reliability and representativeness of results could be raised. These results, thus, have to remain explorative and possibly subject of future quantitative analysis.

A second, related, criticism is that of generalisation. While providing rich contextual information, a case study approach might lack generality and applicability to other countries. Two points are important to make here though. Firstly, this dissertation has explicitly adopted an open system approach which advocates the context specific nature of economic phenomena and questions the possibility of broad generalisations a priori. Secondly, while the first point remains valid, that is not to say that under certain conditions and comparable structural and institutional characteristics, similar results could not be observed in other countries. Indeed, following Keynes, finding the same mechanisms in different contexts/countries might lend further validity to the results, though this cannot be assumed a priori (Downward and Mearman 2002).

Specific Critiques

In addition to these general critiques, several weaknesses of this specific study, particularly as to its qualitative element, could be raised.

Given the nature of the study and interviewees, this dissertation has used non-probability sampling. The use of snowballing and theoretical sampling, however, could lead to possible biases in the sample. Firstly, there could be a tendency for participants to recommend like-minded operators and/or operators from a similar institutional background, which could lead to an over-representation of a certain group in the sample. The first possible bias could not be observed in the data. The second bias was counteracted through more purposive sampling. The attempts to reduce any biases notwithstanding, the difficulty to gaining access to financial market operators made the collection of a stratified sample very difficult and eventual biases have been considered when conducting data analysis. Secondly, eventual biases might also arise through the use of theoretical sampling. More concretely, onshore institutions might have a biased view of the relative importance of other market participants as a result of their client structure, market position etc. Interviews with economists and other financial market participants, which were assumed to have a more objective view of Brazil's foreign exchange market structure, were conducted to avoid these biases.

As already mentioned in chapter 3, the dissertation also faces some important omissions from the population of foreign exchange market participants. In particular, no interviews have been conducted with (local) non-financial corporations. This has been justified by this dissertation's focus on financial operators in the foreign exchange market. However, as discussed in Chapter 5, local companies have become increasingly engaged in speculative foreign exchange operations in Brazil over recent years, which could have warranted their inclusion in the sample. In addition, international pension funds and institutional investors are increasingly important operators in emerging market foreign exchange markets as they diversify their portfolios in emerging market assets. Thus, they could also be considered as a separate interview group.

In addition to errors and biases created by the sampling procedure, the use of (semi-structured) interviews might also instil certain biases in results. These could be divided into interviewer and interviewee biases.

As to the former, interviewer's attributes can unduly shape and influence respondents' replies. For example, the fact that the interviewer came from an academic background sometimes prompted interviewees to make academic references even if those were not important for their investment decisions. Through probing, soliciting and comparing consistency with other answers, it was attempted to reduce such biases. In a similar vein, although the interviewer tried to be as objective as possible and questions were formulated to be as neutral as possible, certain biases from the interviewers' actions during the interview cannot be excluded.

On the other hand, there might also be biases stemming from the interviewees themselves. Interviewees might try to impress the interviewer, might give responses even if they don't know the answer or have difficulties recalling certain issues. Further, it has been argued that interviewees attitudes, beliefs etc. are actually quite unstable and that the relationship between what interviewees say and do is often not very strong (Foddy 1993). Again, attempt was made to reduce these biases to a minimum through follow-up questions, verifications and consistency with other responses. However, in several instances apparent inconsistencies or instabilities in beliefs actually formed part of the research question and confirmed hypotheses about operators' decision making in financial markets.

Finally, given the open ended nature of questions, a large part of the answers are not exclusive. Thus, multiple answers are possible and indeed wished for in this study. This, however, could impart biases in results if certain respondents, e.g. representatives of hedge funds, are more prone to multiple answers. Again, this type of pattern could not be observed in the data.

In addition to more general shortcomings of sampling and non-sampling biases, there are several further points of critique which could be raised against this study and the implications drawn.

In many cases this study draws inference from individual respondents' answers onto the operations of the institution overall. This assumes a degree of representativeness of the individual which might hold in practice. In addition, even if solicited to consider the operations of the institution overall, a trader's knowledge might not be sufficient to do so. To mitigate this problem head and prop traders have been targeted. In addition, the connection between institutional characteristics and trader behaviour is an important issue under investigation in this dissertation. In other words, any pattern in interviewee's responses according to their different institutional backgrounds might reflect on the institutions and their motivations to operate in the Brazilian foreign exchange market. Finally, as mentioned above, in certain cases questions to offshore institutions had to be extended to other internationally traded currencies as interviewees were not sufficiently familiar with the Brazilian case. Given the focus on other internationally traded currencies though, operators' responses still gave important insights into exchange rate determination in emerging markets in the context of currency internationalisation. Moreover, their responses broadly coincided with those of the interviewees who were familiar with the Brazilian case.

6.5. Conclusions

This chapter has argued that Post Keynesian economics can be characterised by a common open system ontology. In addition, insofar as Post Keynesian research strives to uncover real underlying mechanisms and processes, it can also be characterised as critical realist. The chapter has shown that for this dissertation, this is indeed the case. Both critical realist and Post Keynesian methodology advocate the use of methodological pluralism or mixed-method studies to enlighten the different layers of a structured and organic reality. Furthermore, the use of mixed-method studies was motivated by the pervasive fallibility of knowledge.

Based on these considerations the chapter presented the specific mixed-method study conducted in this dissertation, which combines a large number of semi-structured interviews with advanced time series econometrics. It was shown that while the semi-structured interviews are aimed at exploring how economic agents operate in the foreign exchange markets, their conception of fundamentals, the underlying real mechanisms and ultimately their empirical manifestations as exchange rate drivers, the time-series

econometrics aims at empirically triangulating and validating certain aspect of the qualitative results. This is particularly the case of for the empirical manifestations of underlying real mechanisms, i.e. exchange rate drivers in the era of currency internationalisation, uncovered in the qualitative study. The results of this qualitative study are presented in the next chapter.

Chapter 7: Exchange Rate Fundamentals – What do Traders think?

7.1. Introduction

Having set out the methodological framework in Chapter 6, this chapter will present the results from the 52 semi-structured interviews conducted with currency traders in Brazil and London. This dissertation has argued that the recent process of currency internationalisation in Brazil has made the trading and investment decisions of short-term financial actors, particular in domestic currency (denominated assets), an important determinant of exchange rate movements. This brings the expectation formation process of financial market participants to the fore of the analytical endeavour.

As shown in Chapter 2, although mainstream exchange rate theory acknowledges the determining role of actors' expectations in short-term financial markets for exchange rate movements, this acknowledgment has ultimately had little impact on traditional exchange rate theory. Expectations continue to be formed rationally, at least by some of the agents, and align the exchange rate with its fundamentals. These fundamentals remain firmly specified in line with the "market equilibrating" approach to exchange rate determination.

Post Keynesian exchange rate theory stresses the formation of expectations under fundamental uncertainty, which makes them necessarily context and time specific. As a result, no permanent causal fundamentals can exist. In addition, the nature of fundamentals might change, particularly in DEC's given their different structural characteristics, integration in a hierarchical international monetary system etc. Based on critical realist ontology, this dissertation, however, has also argued that agents' expectations will be shaped by underlying mechanisms and structures, which were specified in line with the view of the exchange rate as international money.

Thus, it has been argued that actors' expectations and positions will be fundamentally shaped by a currency's return relative to *the* money of the system. This return is constituted by yields on short-term domestic currency denominated financial assets and a currency's liquidity premium. This premium depends, on the one hand, on an

exogenously given liquidity preference and, on the other hand, on the existing financial structure, i.e. operators' perceptions about a country's (currency's) ability to meet its outstanding external obligations. This ability, in turn, is determined by a country's total stock of net short-term foreign obligations and its capacity to meet these obligations through its foreign exchange productivity and institutional liquidity. Importantly, given the open and organic nature of social reality and the transformative actions of economic agents which operate under fundamental uncertainty, the empirical manifestations of these underlying real mechanisms will depend on the specific structure of a market, its integration in international financial markets, or might not be apparent at all. Therefore, it has also been argued that market participants' view of fundamentals and underlying real mechanisms and structures will be fundamentally shaped by the institutional framework they are operating in and an operators' position in the institution itself.

To analyse the expectation formation process in the Brazilian foreign exchange market a qualitative study in the form of 52 semi-structured interviews with foreign exchange market participants in Brazil and offshore markets was conducted. As discussed in Chapter 6, these interviews aimed to explore how actors operate in short-term financial and currency markets, including their perceptions of fundamentals and the underlying real mechanisms which shape their expectations and positions. They also aimed to uncover the relation between these fundamentals and real mechanisms and actual, observed exchange rate drivers in the context of currency internationalisation. Finally, with a view to formulating possible policy implications, the interviews focused on the interaction between financial actors and the BCB.

The chapter is divided into six sections. Section 2 reviews existing studies of foreign exchange market behaviour and contrasts them to the empirical research conducted in this dissertation. Section 3 describes the main financial operators in the Brazilian foreign exchange market and the actors interviewed for this study. Primary emphasis lies on operators' motivation for participating in the Brazilian foreign exchange market, their market of operation, client structure, and their preferred trading strategies. Section 4 shows the operators' perceptions of fundamentals, both in ordinary circumstances and in times of crisis, and their link to actual exchange rate drivers. Section 5 discusses the interaction between traders' positions and central bank operations focusing particularly

on the question of exchange rate management. Section 6 concludes with some observations on the theoretical and empirical implications of this study.

7.2. The Study of Foreign Exchange Market Behaviour in Economic Literature

The use of qualitative methods for the studies of financial markets in Economics is still very limited. This is largely due to the profession's deductive methodological stance, which focuses on testing pre-formed hypotheses and is primarily interested in causal relations between variables rather than the underlying mechanisms and processes which generate market outcomes. In addition, the demand for stability, generality and representativeness often excludes the use of qualitative methods, which tend to highlight the importance of change and heterogeneity.¹⁴⁶

The use of quantitative survey studies is more common. These have been particularly popular in testing for heterogeneity in expectation formation and uncovering alternative (short-term) influences on trading behaviour. For example, in a seminal paper Frankel and Froot (1987) use exchange rate expectations survey data to point to the potentially important role of heterogeneous expectations. As discussed in Chapter 2, the heterogeneity of expectations is also tested using survey data by, among others, Ito (1990), MacDonald and March (1996), Frenkel, Ruelke et al. (2009) and Menkhoff, Rebitzky et al. (2009).

The papers above use survey studies to test hypotheses about exchange rate expectations, rather than generating information about the actual formation of these expectations from market participants. The latter approach is adopted by a range of papers which, using questionnaire answers from foreign exchange market participants, uncover evidence of alternative trading strategies, as opposed to traditional fundamental analysis (Menkhoff and Taylor 2007). In this vein, a wide range of literature examines the use of technical analysis among (primarily) foreign exchange dealers (Frankel and Froot 1990; Allen and Taylor 1992; Lui and Mole 1998; Oberlechner 2001). The

¹⁴⁶ Some authors derive their hypotheses from qualitative methods such as interviews. For example, in his seminal work, Shiller (2000) refers to conversations with market participants. Oberlechner (2001) and Gehrig and Menkhoff (2004b) derive information for their questionnaires from semi-structured interviews. Oberlechner (2001) also uses qualitative information to provide contextual background to his results. However, qualitative data remain subordinate to quantitative data and primarily serve a development purpose.

importance of psychological factors for short-run exchange rate dynamics is directly analysed with survey studies by Cheung and Wong (2000), Cheung and Chinn (2001) and Cheung, Chinn and Marsh (2004). Finally, Menkhoff (1997) and Gehrig and Menkhoff (2004b) use survey studies to analyse the importance of order flow for trader decisions.

These studies provide important insights into the different, non-fundamental, trading strategies used by foreign exchange dealers. However, they do not consider institutional differences of operators in the foreign exchange market. In addition, as highlighted in Chapter 2, these studies do not question the nature and role of fundamentals per se.

As to the first criticism, Gehrig and Menkhoff (2004a), in what is to this authors' knowledge the only paper investigating the different trading strategies used by heterogeneous foreign exchange market participants using survey evidence, show important differences in trading strategies between foreign exchange dealers (the primary target of previous survey studies) and fund managers. While banks do not behave as long-term position takers, operating mainly in the intraday with a short-term trading horizon, fund managers take positions in currencies and operate on a slightly longer time horizon (which potentially gives them a greater impact on price formation). The authors show that, as a result of these different trading strategies, fund managers rely more on fundamentals in their analysis than foreign exchange dealers. However, the paper also shows that fund managers cannot be considered fundamentalists, especially in the short-term where their behaviour becomes close to the operations of banks.¹⁴⁷

As to the second point, probably closest to this dissertation comes the paper by Cheung and Chinn (1999). In addition to questions about short-term influences on exchange rates, their questionnaire also covers questions on fundamentals, long-run exchange rate concepts and central bank intervention. Similar to this study, their paper is not only interested in the techniques applied, but also in the beliefs and attitudes of the traders themselves. Interestingly, the authors find that fundamentals (which are primarily important in a more medium term horizon) vary over time, although interest rates appear always to be important. Moreover, traders do not view PPP as a useful concept

¹⁴⁷ This is in contrast to Spahn's (2002) conjecture that chartists may be found more among institutional investors, such as investment fund managers, rather than dealers-arbitrageurs.

with less than half (40%) agreeing that it has only value above a time frame of 6 months. For 66% of the respondents, a concept like PPP is merely “academic jargon”.

This dissertation draws on the above presented literature using evidence from survey studies, while differing from and complementing it in several respects. Firstly, all these studies focus on highly liquid (developed) foreign exchange markets with a given and well researched institutional framework. This dissertation, in contrast, emphasises the novel process of currency internationalisation, i.e. the trading of emerging market currencies. This, in turn, requires an analysis of the institutional structure of emerging market foreign exchange markets, the way these currencies are traded, the operators in these markets etc. Differences between developed and emerging market currencies might fundamentally affect market participants’ expectation formation process and thus fundamentals and exchange rate drivers.

Secondly, all these studies take the nature of fundamentals as a given. Fundamentals are either specified in line with the market equilibrating approach to exchange rate determination, stated in a slightly ad-hoc manner, or not at all. This dissertation, however, has argued that once operators in short-term financial markets are acknowledged to be the driving force of exchange rate dynamics, the nature of fundamentals can change depending on what these operators consider fundamentals to be. Thus, rather than on non-fundamentals factors such as chartism, technical trading, psychological influences, etc., the focus of this work is on traders’ perception of fundamentals per se and their link to actual exchange rate drivers.

Thirdly, this dissertation has argued that market participants’ trading strategies, and indeed their perceptions of fundamentals, will depend significantly on the institutional structure in which they operate. Different trading horizons, trading mandates and client structures will fundamentally influence the way traders act. Thus, in addition to the heterogeneity of trading strategies for individual market participants, particular focus lies on the heterogeneity of trading strategies between operators depending on their institutional context.

Fourthly, rather than focusing on foreign exchange dealers, this dissertation explicitly studies market operators who take positions in foreign exchange. These might be more

important for actual exchange rate dynamics than dealers who primarily operate for clients and do not hold open positions for a long time.

Fifthly, given the creative power of financial market participants for price formation and the emphasis on their expectation formation process, this dissertation is not only interested in the observed market outcome in terms of price movements and techniques applied, but also the underlying mechanisms and processes which generate this outcome.

Consequently, and probably most fundamentally, while all the studies discussed above use a quantitative survey approach with closed questions to test previously derived hypotheses on trader behaviour, this dissertation uses a qualitative study with open questions to explore traders' perceptions, beliefs and priorities and analyse the specificities of the Brazilian exchange rate with the hope of uncovering important elements of trading behaviour not yet considered in economic theory.

7.3. The Market Players

One argument of this dissertation is that foreign exchange market participants' expectations and foreign exchange positions will be significantly shaped by the institutional framework in which they operate. Initial insights into the structure of the Brazilian foreign exchange market and the operations of the main financial actors based on quantitative data have been presented in Chapter 5. This section will complement these quantitative results with qualitative data from the semi-structured interviews. It will discuss in more detail heterogeneous institutions' motivation for operating in the foreign exchange market, their trading strategies, markets of operation and client structure. It will finish with a discussion on the potential importance of these institutions for exchange rate dynamics.

7.3.1. The Onshore Players

Table 7.1 summarizes the different aspects of institutions' motivation for operating in the Brazilian foreign exchange market according to the interviewees.

Table 7.1: Motivation of Onshore Institutions' Participation in the Foreign Exchange Market

		Domestic Banks	Commercial	Investment	Foreign Banks	Commercial	Investment	Hedge Funds	Total
Motivation	Client	8	5	3	12	3	9	0	20
	Proprietary	7	4	3	12	3	9	6	25
	Total	8	5	3	12	3	9	6	26
Importance	Client	4	3	1	1	0	1	na	5
	Proprietary	4	2	2	7	1	6	na	11
	Equal	0	0	0	3	2	1	na	3
	Total	8	5	3	11	3	8	na	19
Strategy	Volatility	4	4	0	3	2	1	0	7
	Trend	4	1	3	6	1	5	5	15
	Total	8	5	3	9	3	6	5	22
Exposure	intraday	2	2	0	2	2	0	0	4
	short-term	1	1	0	5	2	4	0	6
	medium-term	5	2	3	3	0	3	6	14
	Total	8	5	3	10	4	7	6	24

Notes: Total indicates total number of valid responses; Responses in the first row are not exclusive

Row 1 of Table 7.1 shows the institutions' main motivation for participating in the foreign exchange market. It can be seen that all banks operate in the foreign exchange market for client related and proprietary activities, i.e. foreign exchange trading on their own account. These proprietary operations amount to banks' speculative foreign exchange operations.¹⁴⁸ Only one respondent indicated that his bank, a client oriented domestic commercial bank, conducts no proprietary operations. The operations of hedge funds, having no client induced foreign exchange transactions, are of an inherently speculative nature. More generally, according to the majority of respondents, foreign exchange related operations are an important source of revenue for their institution. This holds for both client oriented institutions and more proprietary focused institutions, such as hedge funds. According to representatives of several hedge funds, income from foreign exchange related speculation amounts to more than 30% of their institution's revenue.

A more detailed insight into the main foreign exchange activities of different banks is presented in Row 2, which shows the relative importance of client and proprietary operations for the banks (most responses are in terms of revenues). As expected, commercial banks are more likely to generate income from client operations, whereas investment banks conduct more proprietary operations. This differentiation notwithstanding, there seems to be a bias towards proprietary operations in the Brazilian market, particularly among foreign banks. No foreign commercial bank indicated that

¹⁴⁸ Following Kaldor's (1939) definition presented in Chapter 3, speculation is defined as the purchase of a good with the sole motivation of later resale at a higher price and no gain accruing from any form of income. In addition, as discussed in more detail below, a difference will be made according to when resale is planned with shorter time periods pointing to more speculative behaviour.

client business was vital to its operations. In a similar vein, two domestic commercial banks responded that proprietary operations were more important for them than client ones.¹⁴⁹

The results on the relative importance of client vs. proprietary operations are also reflected in interviewees' responses regarding their preferred trading strategy presented in Row 3 of Table 7.1. Trading strategies have been divided into short-term, volatility strategies on the one hand and trend oriented strategies on the other hand. It can be seen that in general, short-term, volatility oriented trading strategies are more important for commercial banks than for investment banks and hedge funds. While commercial banks have client flows, which allow them to generate revenue through the bid-ask spread and trading around the (anticipated) flows, this information is not (or to a lesser degree) available to investment banks and particularly hedge funds. As a result, these institutions are more likely to take directional positions on the currency. This result is also broadly confirmed by the institutions' average exchange rate exposure. As can be seen in the last row of Table 7.1 these tend to be shorter for commercial banks than for investment banks and hedge funds.¹⁵⁰

Overall, trend oriented strategies were considered more profitable by the onshore respondents. According to the interviewees, however, this profitability depended crucially on market conditions and particularly the existing volatility and uncertainty about future price movements. As volatility increases, as it does for example in the moment of crisis or in a purely floating exchange rate regime, the size and length of foreign exchange exposure decreases.

Other distinguishing features of the institutions operating in the Brazilian foreign exchange market, especially among the banks, are their client structure and main market of operation presented in Table 7.2.

¹⁴⁹ However, several banks also indicated that they wished to expand into more client oriented operations. Although little money can be generated through the bid-ask spread, due to high competition, the flow which is generated by clients is considered important information for proprietary activities. In addition, several respondents indicated that operating with clients gives banks increased and improved access to the central bank.

¹⁵⁰ It is interesting to note that the interviewees' perceptions of short-term and medium-term varied significantly depending on the type of trader and institution under consideration. In general, short-term refers to a horizon of 2 days to 3 weeks, whereas medium-term is everything beyond. That having been said, few respondents take positions longer than several months.

Table 7.2: Client Structure and Markets of Operation of Onshore Institutions

		Domestic B	Commercial	Investment	Foreign B	Commercial	Investment	Hedge Fund	Total
Clients	Domestic	6	5	1	2	1	1	3	11
	Foreign	1	0	1	7	1	6	0	8
	Total	7	5	2	9	2	7	3	19
Clients	Commercial	6	5	1	2	2	0	na	8
	Financial	1	0	1	5	0	5	na	6
	Total	7	5	2	7	2	5	na	14
Market	Spot	2	2	0	0	0	0	0	2
	Futures	5	2	3	7	2	5	4	16
	Total	7	4	3	7	2	5	4	18
Offshore	Not Important	7	4	3	2	1	1	na	9
	Important	0	0	0	2	2	0	na	2
	Very Important	0	0	0	5	0	5	na	5
	Total	7	4	3	9	3	6	na	16

Notes: Total indicates total number of valid responses; all responses are exclusive

The results are in line with what one would expect. Rows 1 and 2 of Table 7.2 show that domestic banks have a preponderance of domestic clients, whereas foreign banks continue to cater to the foreign market. Domestic hedge funds primarily cater to domestic clients. In a similar vein, commercial banks are more characterised by commercial clients whereas investment banks exclusively have financial clients (the exception is one domestic investment bank which has a relatively large commercial client base). According to the interviewees, the financial clients include offshore hedge funds, real money investors and to a lesser extent institutional investors, such as pension funds. It is important to note, however, that both domestic and foreign banks stressed the wish to expand their operations to foreign and domestic clients respectively. According to the respondents, this would allow them, on the one hand, to acquire increased information about client flows and, on the other hand, to be able to conduct profitable onshore-offshore arbitrage operations.

Rows 3 and 4 of Table 7.2 show the relative importance of the different foreign exchange markets presented in Chapter 5 for the onshore respondents. Results are divided between the spot and futures markets, on the one hand, and the offshore market, on the other hand. One can observe the outstanding importance of the futures market for a large part of the interviewees. All respondents indicated the futures market as their main market of operation except two client oriented domestic banks. According to the respondents, the futures market was particularly important for their proprietary and speculative operations. In line with the results on their respective client structure, the offshore market is of primary importance for foreign banks and here especially for investment banks. In addition to flow information and arbitrage opportunities mentioned

above, one main reason for banks to operate offshore is client demand, as they shy away from the complexities and costs associated with onshore operations. Although difficult to quantify, all traders agreed that the offshore market is of primary importance for the Brazilian Real with estimations of its size ranging from 20% to 60% of the domestic market's volume.

7.3.2. The Offshore Players

Table 7.3 shows the offshore institutions' motivation for participating in emerging countries' currency markets.

Table 7.3: Motivation of Offshore Institutions to Participate in Emerging Market Currencies

		Banks	Funds	Real Money	Hedge Fund	Total
Motivation	Client (Importance)	2	na	na	na	2
	Prop (Importance)	3	na	na	na	3
	50-50	1	na	na	na	1
	Total	6	na	na	na	6
	Diversification	na	5	4	1	5
	Yield	na	8	6	1	8
	Liquidity	na	6	3	2	6
	Total	na	9	7	3	9
Strategy	Volatility/Spread	2	na	na	na	2
	Directional	7	na	na	na	7
	Total	9	na	na	na	9
	Carry Trade	na	6	6	0	6
	Trading	na	4	1	3	4
	Buy-Hold	na	5	5	0	5
	Total	na	9	6	3	9
	Total	9	10	7	3	19
Exposure	0-3 days	1	0	0	0	1
	3 days-3 months	4	4	1	3	8
	3-6 months	0	2	2	0	2
	above 6 months	0	4	4	0	4
	Total	5	10	7	3	15

Notes: Total indicates total number of valid responses; Responses of offshore funds in row 1 are not exclusive

As detailed in Chapter 6, offshore banks constitute a heterogeneous group which makes it difficult to draw general conclusions particularly with respect to their main motivation for operating in emerging market currencies. Like representatives of onshore banks, operators in offshore banks also indicated that they operated in both client and proprietary related activities. In addition, offshore banks confirmed the continued importance of short-term financial clients, such as hedge funds. The results are more informative for the offshore funds. Asked for their main motivation for operating in emerging market currencies, 8 respondents indicated they were attracted by the yield, 6

mentioned liquidity considerations and 5 pointed to the motive of diversifying their assets away from the Dollar and developed currencies more generally. Answers were not intended to be exclusive. Although it is difficult to draw robust conclusions about differences among offshore funds, yields seemed to have been very important for real money investors, whereas hedge funds generally pointed to liquidity considerations. These referred, on the one hand, to the liquidity of currency trading per se and, on the other hand, to the increased liquidity of emerging market currencies, which made them attractive for international investors. Indeed, all funds indicated that domestic currency returns have become an increasingly important element of their emerging market returns. For one fund these reached up to 75% of excess returns.

Rows 2 and 3 of Table 7.3 show the different trading strategies adopted by the offshore institutions. Again these strategies have been generalized for analytical purposes.¹⁵¹ One can observe that, just as for onshore banks, strategies of offshore banks can be distinguished into volatility and/or spread trading, on the one hand, and position taking, on the other hand. Although results have to be interpreted with caution, due to the relatively small sample, the preponderance of directional position taking is interesting to note. In a similar vein, the preferred trading strategies adopted by offshore funds could be classified into currency trading and buy-and-hold approaches. While the former could be classified as *speculative*, the latter is more characterised by *investing* motives. Currency trading seems to be more preponderant among hedge funds, while real money funds seem to be more characterised by a buy and hold approach. This classification notwithstanding, it is important to note that real money investors are also strongly motivated by expected gains on emerging market currencies. Interestingly, and in line with the above presented results, carry trade operations have been primarily mentioned by real money investors, which are attracted by the high yields on emerging market domestic currency bonds.¹⁵² The difference between trading (speculation) and investing

¹⁵¹ The two general trading strategies presented above cover a wide range of different trading methods ranging from macro-trading to relative value and index trading. Relative value trading implies being long in one asset and short another asset to profit from possible mispricing while being hedged against broad market moves. Index trading, often applied by real money investors, refers to the general tracking of an index of selected emerging market asset. These strategies are very often applied simultaneously and crucially depend on the currency and time under consideration.

¹⁵² It is interesting to note though that market participants had very different conceptions of carry trades and none of the respondents really thought they were part of this “notorious” activity. While hedge funds referred to real money and Japanese investors as the main operators in the carry trade, several real money funds did not think their activity could be described as carry trade due to their longer trading horizon.

motives is also reflected in the different language used by the respondents. While respondents from banks and hedge funds referred to their operations as trading, representatives from real money funds primarily referred to investing in emerging currencies.

These heterogeneous trading strategies are also reflected in the institutions' average currency exposure. The time intervals are dictated by the traders' responses.¹⁵³ Banks (on their proprietary budget) and hedge funds have a similar length of relatively short-term exposure, reaching up to 3 months. Real money investors assume longer exposure, from 3 months up to 5 years. However, respondents again referred to the importance of market conditions for their average time and size of exposure. In line with results from onshore institutions, these depended crucially on the volatility of the market and respondents' confidence and convictions about the success of a trade.

Finally, Table 7.4 shows the main markets, instruments and currencies traded by the offshore respondents interviewed. The main instruments to assume domestic currency exposure are local currency bonds, equities and NDFs. While real money funds invest in all three instruments (depending on the duration of the exposure they wish to assume), banks and hedge funds, in accordance with their shorter trading horizon, primarily take local currency exposure with the more short-dated NDFs.

Table 7.4: Markets/Instruments of Operation of Offshore Institutions

		Banks	Funds	Real Money	Hedge Fund	Total
Market/Instrument	Local Currency Bond	1	5	4	1	6
	Equities	0	4	4	0	4
	NDF	5	7	4	3	12
	Total	8	9	6	3	17
Currencies	Brazilian Real	3	5	2	3	8
	South African Rand	3	3	1	2	6
	Turkish Lira	2	4	1	3	6
	Polish Zloty	1	4	2	2	5
	Mexican Peso	1	4	1	3	5
	Total	5	6	3	3	11

Notes: Total indicates total number of valid response; responses not exclusive

¹⁵³ The time intervals given by respondents broadly coincided, indicating similar time references used by financial market participants. Moreover, these time references were generally longer than those of Brazilian respondents, laying testimony to the relatively short-term nature of the Brazilian market.

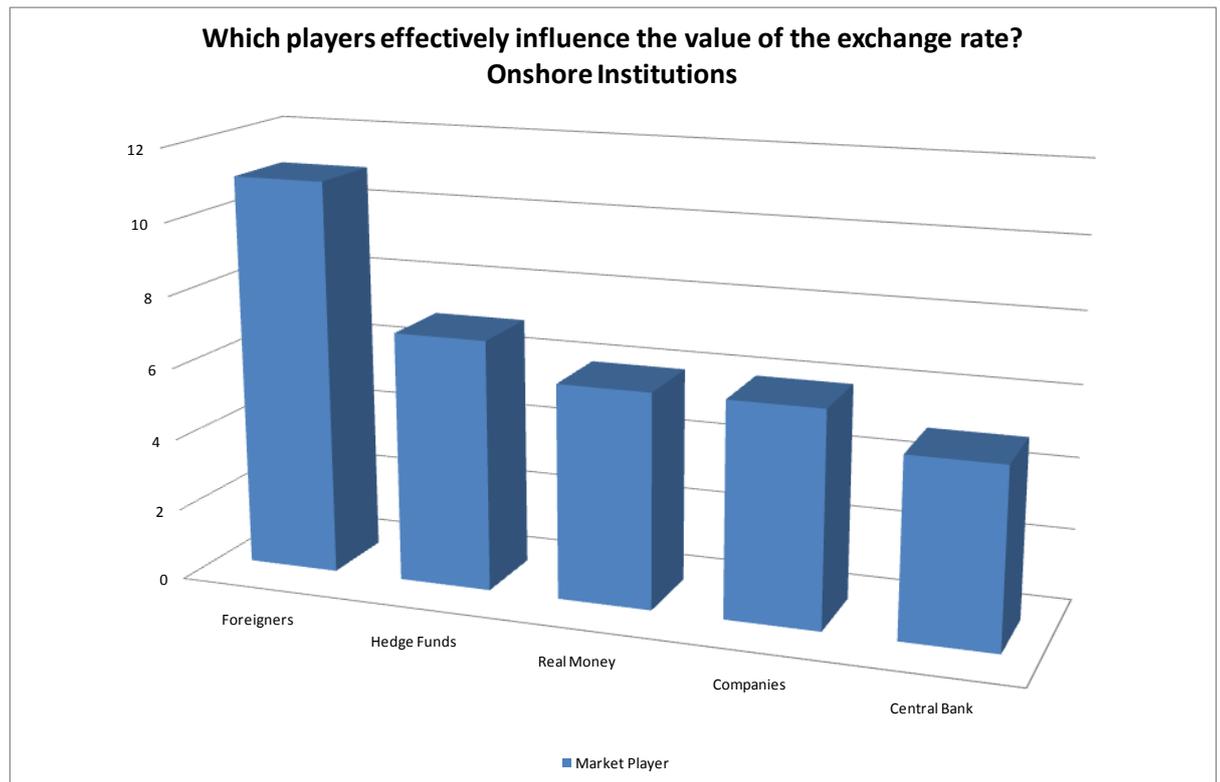
Given that the domestic currency is not deliverable, most of the offshore respondents interviewed operate through local brokers/dealer banks. According to the interviewees, the decision to operate offshore was further motivated by convertibility risk and the cost of depositing a margin at the local exchange. Some institutions expressed the interest to operate locally due to the higher liquidity of the BM&F, which would allow them to offer more competitive spreads to customers, and the possibility to engage in onshore-offshore arbitrage.

Table 7.4 also shows the main emerging market currencies traded by offshore respondents. It is interesting to observe that all five currencies mentioned (except the South African Rand) are also the ones which showed a synchronized movement with the Brazilian Real during the international financial crisis as discussed in Chapter 4. The main reason indicated by the offshore institutions for the attractiveness of these currencies is their high liquidity. All traders agreed that the Brazilian Real was one of the most liquid and widest traded emerging market currencies.

In sum, this section has shown that for all respondents interviewed, foreign exchange operations were an important part of their returns. In addition, a large majority of institutions interviewed engaged in speculative operations in the Brazilian Real. In the domestic market, these operations were particularly important for foreign investment banks and hedge funds. Domestic commercial banks, in turn, could be more classified as “hedgers” whose foreign exchange operations are largely client induced. Inference on offshore banks has to be made from foreign banks operating onshore. However, one could also observe the importance of position taking for offshore banks. As to offshore funds, the results seemed to indicate that hedge funds engage more in short-term speculative foreign exchange trading, while real money funds take longer positions and are attracted by Brazil’s high domestic interest rates. In general, directional/trend strategies and position taking were identified as the more profitable trading strategy in the Brazilian market. This profitability, however, depended crucially on market conditions, such as volatility and market uncertainty.

Given these differences in trading strategies, one question directed at onshore institutions sought to uncover which type of institution was considered most influential for exchange rate dynamics in the Brazilian market. Figure 7.1 shows the results.

Figure 7.1



Notes: Number of total responses: 27; responses not exclusive

For a large share of onshore institutions, offshore investors are the driving force for price dynamics. According to the interviewees, this influence on price dynamics is not necessarily the result of the total volume of operations (which several traders agreed is bigger domestically), but the directional nature and large size of the positions taken by offshore investors. According to the respondents, this is particularly true for hedge funds and real money investors.

7.4. Trading Emerging Market Currencies – What to look out for?

The above section has given a detailed account of the different motivations and trading strategies of heterogeneous financial participants in the Brazilian foreign exchange market. This section will analyse respondents' perceptions of emerging market currencies' fundamentals and these fundamentals' link to the actual expectation formation process, trading behaviour and exchange rate drivers. For analytical purposes, the main criterion of classification is between onshore and offshore institutions. Other differences between institutions will be mentioned if sufficiently robust and noteworthy.

Before doing so, however, it is interesting to investigate whether, according to the offshore respondents, structural differences between developed and emerging market currencies exist. And if so, what implications these have for their trading strategies. Table 7.5 shows the results.

Table 7.5: Main Differences between Emerging Markets and G10 Currency Trading

Main Difference	Implications for Trading Strategy	Numbers of Mentioning
Lower Liquidity	More Positioning	9
	Flow Information	5
	Market Moving	4
	More Macro View/Less Technicals	3
	Funding Risk	3
	Cross-Hedging	2
		1
Higher Volatility (Risk)	Risk-Devaluation Expectations	7
Capital Regulation and Institutional Development		3
		7
Central Bank Intervention	Quality Arbitrage	1
Carry		4
		4

Notes: Number of valid responses: 19; responses not exclusive

One can observe the primary role of liquidity considerations for the offshore respondents. In line with the “institutional” liquidity described in Chapters 3 and 5, important elements of this liquidity were the size of bid-offer spreads, 24 hour market access and the ability to conduct major transactions without moving the market. This also included the resilience of a market in times of crisis. Other components of a market’s “institutional” liquidity discussed in this dissertation were the institutional development of the market, existing restrictions and regulation of capital movements and finally the operations of the central bank – all of which are mentioned by the offshore respondents as main distinguishing features of emerging market currencies. Finally, several institutions pointed to the higher risk environment and the important role of carry trade operations for emerging market currencies.

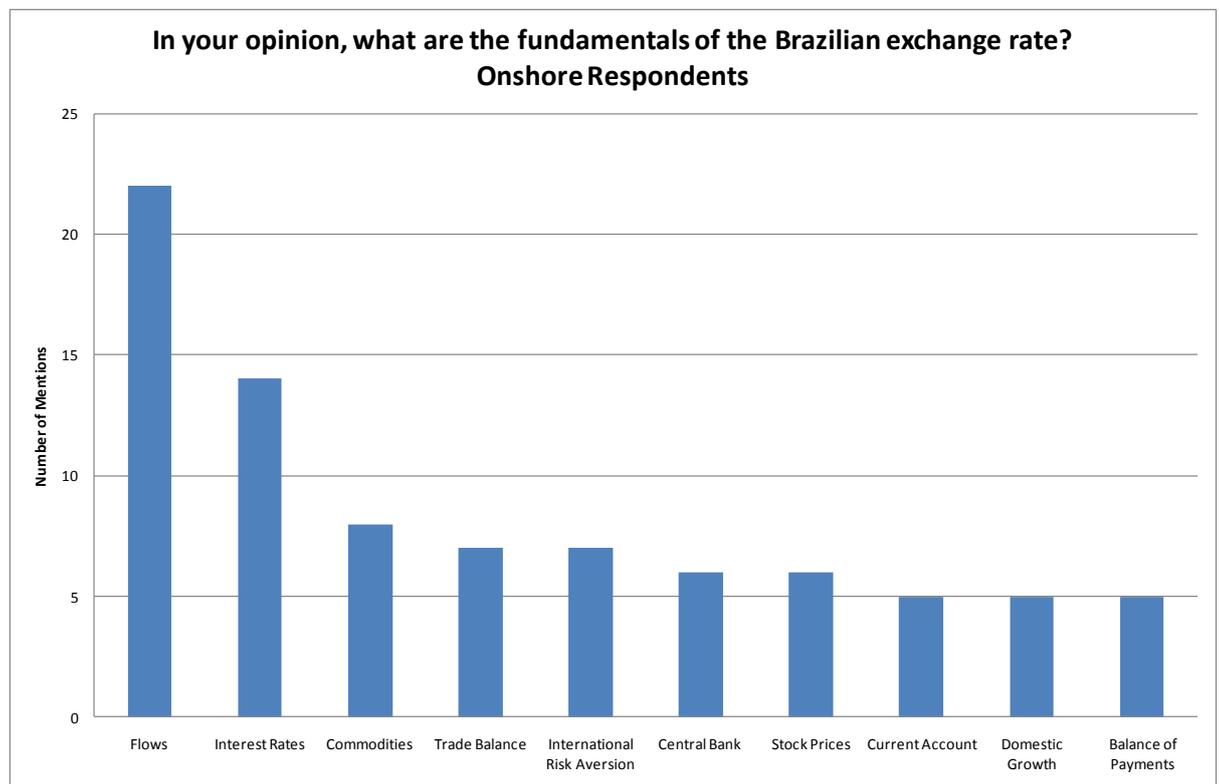
Table 7.5 also shows the implications these factors, particularly the lower liquidity, have for respondents’ trading strategies. In line with the results above, several respondents pointed to the relatively more important role of position taking in emerging market currencies. This is partly due to the difficulty of unwinding positions, but also the ability of large offshore players to influence price formation (move the market). The lower liquidity of emerging market currencies also led respondents to consider flows

more important for price formation. In a similar vein, technical analysis was considered less important by the market participants.

7.4.1. The Quest for Fundamentals

Figures 7.2 and 7.3 present onshore and offshore respondents' understanding of exchange rate fundamentals.

Figure 7.2



Notes: Total number of responses: 30; responses not exclusive

Several points are noteworthy. Firstly, the majority of onshore respondents understood exchange rate fundamentals as the effective drivers of exchange rate movements. There was a sense that these fundamentals could change and several traders referred to the important role of market expectations and perceptions in establishing such fundamentals. Only 7 traders invoked an equilibrium or sustainability concept when asked about exchange rate fundamentals. The general uncertainty about the nature and concept of fundamentals was also reflected in the fact that onshore respondents mentioned a total of 28 possible fundamentals for the Brazilian exchange rate, severely questioning the hypothesis of rational and homogenous expectations.

Secondly, results seem to indicate some support for the Post Keynesian framework of exchange rate determination. One can observe the overriding importance of flows and interest rates for onshore respondents.^{154/155} In addition, international risk aversion and stock prices play an important role for the expectation formation of onshore operators. While the former reflects the important role of liquidity preference, the latter are another empirical manifestation of the importance of short-term returns on domestic financial assets for exchange rate movements. Commodities have also become an important element of respondents' expectation formation. As discussed further below, and shown econometrically in Chapter 9, emerging market currencies and commodities are increasingly traded as similar (risky) asset classes. Thus, although partly related to trade balance factors, the significance of commodity prices for the Brazilian Real also reflects the important role of liquidity preference. Finally, the majority of those respondents who did invoke an equilibrium or medium term concept, referred to an equilibrated trade balance, current account and/or the balance of payments more generally, reflecting a country's autonomous "foreign exchange productivity".¹⁵⁶

Thirdly, no robust pattern of heterogeneity between the operators of different banks could be observed. There was some evidence that flow information was considered less important by onshore hedge funds, which could reflect on their more "macro" oriented trading strategies.

Finally, results show the important role of the BCB as the ultimate provider of liquidity, an issue discussed in more detail in the final section of this chapter.

¹⁵⁴ In contrast to the order flow literature presented in Chapter 2, these flows primarily refer to balance of payments flows. As discussed in more detail in Chapters 2 and 8, order flows and balance of payments flows can, but do not have to, coincide. For institutions without clients, the flows considered are primarily balance of payments flows. Even for respondents from banks it was evident that they primarily referred to client flows related to the balance of payments. However, whereas other institutions have to wait for available statistics (or have to acquire information from other operators), banks have the informational advantage of knowing about these flows when (or even before) they happen.

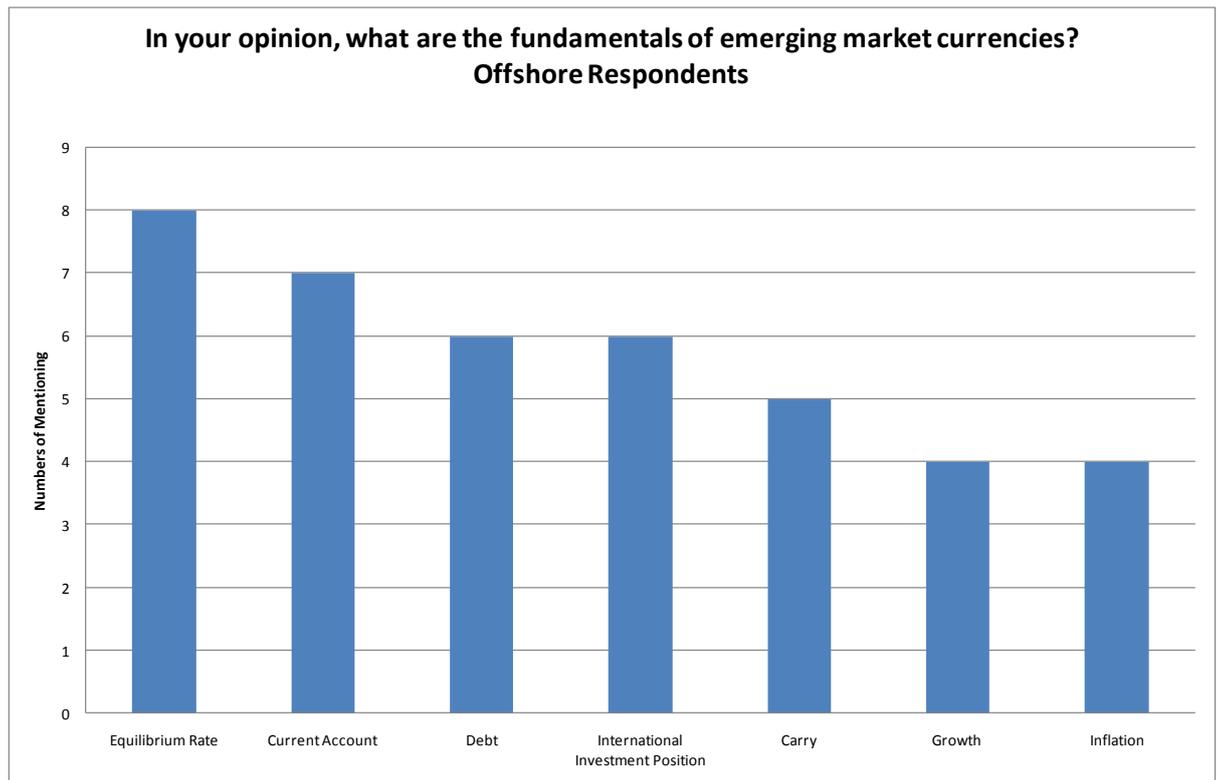
¹⁵⁵ The interpretation of flows as exchange rate "fundamental" was also corroborated by several market participants' understanding of speculation, which they defined as exchange rate movements not caused by flows. Several market participants, however, also acknowledged that large parts of short-term capital flows were motivated by speculative considerations, which makes an analytical separation between flows on the one hand and speculation on the other hand very difficult.

¹⁵⁶ Several respondents also referred to these balances, but as sources of flows rather than equilibrium concepts.

Interestingly for this dissertation, while technicals in the forms of graphs, charts etc. played a rather limited role for onshore traders, positioning was considered an important fundamental of the Brazilian Real (in the short-term), particularly by hedge funds. Positioning refers to the overall exposure of the market to possible exchange rate changes, i.e. the sensitivity of the market to exchange rate movements. It is synonymous to the term that a market is “overbought” or “oversold”, which refers to the overall exposure of (primarily foreign) participants to a certain currency. As such, it is one manifestation of the important role of financial structure or a country’s net short-term foreign obligations for agents’ expectation formation and thus exchange rate movements highlighted in this dissertation. Respondents also pointed out that data on the positioning of the market are difficult to obtain and never complete. One proxy is the net open positions by foreign institutional investors on the local derivatives exchange. Banks can derive a notion of the exposure of the market through their clients and/or conversations with operators in other banks.

Figure 7.3 shows offshore respondents’ understanding of exchange rate fundamentals in emerging markets.

Figure 7.3



Notes: Total number of valid responses: 21; responses not exclusive

Again, several points are noteworthy. Firstly, while the majority of onshore respondents had interpreted fundamentals as effective exchange rate drivers, offshore institutions more frequently saw fundamentals as a medium to long-run concept. This was particularly true for real money investors, but also hedge funds and proprietary oriented traders in banks. This result could reflect the fact that, due to a lower level of client flows, offshore institutions are more oriented towards taking positions in emerging market currencies as was shown in the previous section. In addition, the lack of flow information requires offshore institutions to take a more “fundamentally” oriented view.

Secondly, the exact nature of these fundamentals depended on the respondents’ trading horizon and trading strategy. While proprietary traders and hedge funds with a shorter trading horizon pointed to macroeconomic indicators such as growth, inflation and also the current account, real money investors understood fundamentals as a long-term equilibrium rate. As to this equilibrium rate, traders used several models ranging from PPP to more sophisticated fundamental equilibrium exchange rate (FEER) models. In general, results also corroborated the uncertainty about the nature of fundamentals as respondents mentioned a total of 23 possible variables.

Thirdly, the results confirmed the important role of financial structure, foreign exchange productivity, and short-term returns for agents' expectation formation process. A country's debt and/or international investment position, which encapsulate both the old and new forms of external vulnerability discussed in Chapters 3 and 5, are among the most frequently mentioned fundamentals for offshore respondents (across all institutions). Indeed, according to several traders, a country's international investment position gives an important indication of whether exchange rate dynamics are due to underlying real sector dynamics, or are the result of (short-term) capital flows which can be easily reversed and expose the currency to sudden exchange rate changes. The current account, which has been identified as the most important indicator of a country's foreign exchange productivity in Chapter 3, is the second most frequently mentioned fundamental by offshore respondents (again across all institutions). Finally, carry trade considerations, or domestic short-term interest rates, were also frequently mentioned.

However, although offshore respondents seemed to have a clearer perception of medium to long-term fundamentals, a large number of interviewees pointed to flows and domestic interest rates as the ultimate drivers of exchange rates in emerging markets.¹⁵⁷ More than half of all offshore respondents referred to the importance of flows in determining exchange rates.

Of interest to this dissertation, and a Post Keynesian view of exchange rate determination more generally, is the question: which type of flow is considered particularly important for exchange rate movements? Table 7.6 shows the foreign exchange market participants' views.

¹⁵⁷ It is interesting to note that, depending on their trading horizon, offshore respondents had different perceptions of interest rates, i.e. the carry. While respondents with shorter horizons considered the carry an exchange rate fundamental, respondents with longer horizons (particularly real money investors) juxtaposed carry trade operations to "fundamental" trading.

Table 7.6: Relative Importance of Flows

	Onshore	Offshore	Total
Short-term Capital Flows	16	9	25
Equity	6	6	12
Fixed Income	3	0	3
Foreign Hedge Funds	2	1	3
Foreign Direct Investment	7	3	10
Trade Flows	6	3	9
All (Size)	5	0	5

Notes: Total number of valid responses: 52; answers are not exclusive; all mentioning of capital flows in the interview were counted; if respondent had referred to flows in a previous question a follow up question aimed at uncovering the relative importance of flows; all mentioning of equity, fixed income and offshore hedge funds were counted as short-term capital flows

The overriding importance of short-term capital flows is evident. More than half of all respondents either mentioned short-term capital flows during the interview or confirmed their relative importance in a follow-up question. Within this category equity flows were particularly frequently mentioned. This is partly due to the overall size of this type of short-term capital flow and partly due to its nature. On the one hand, IPOs generate a large one-off foreign exchange inflow, which creates profit opportunities especially for more short-term oriented traders. On the other hand, equity flows were considered more volatile and sensitive to international market conditions and thus potentially more important for short-term exchange rate movements. More generally, according to several traders, foreign direct investment and trade flows indicate the direction of exchange rate movements and were considered “fundamental”, whereas short-term capital flows add to the speed and size of the adjustment.

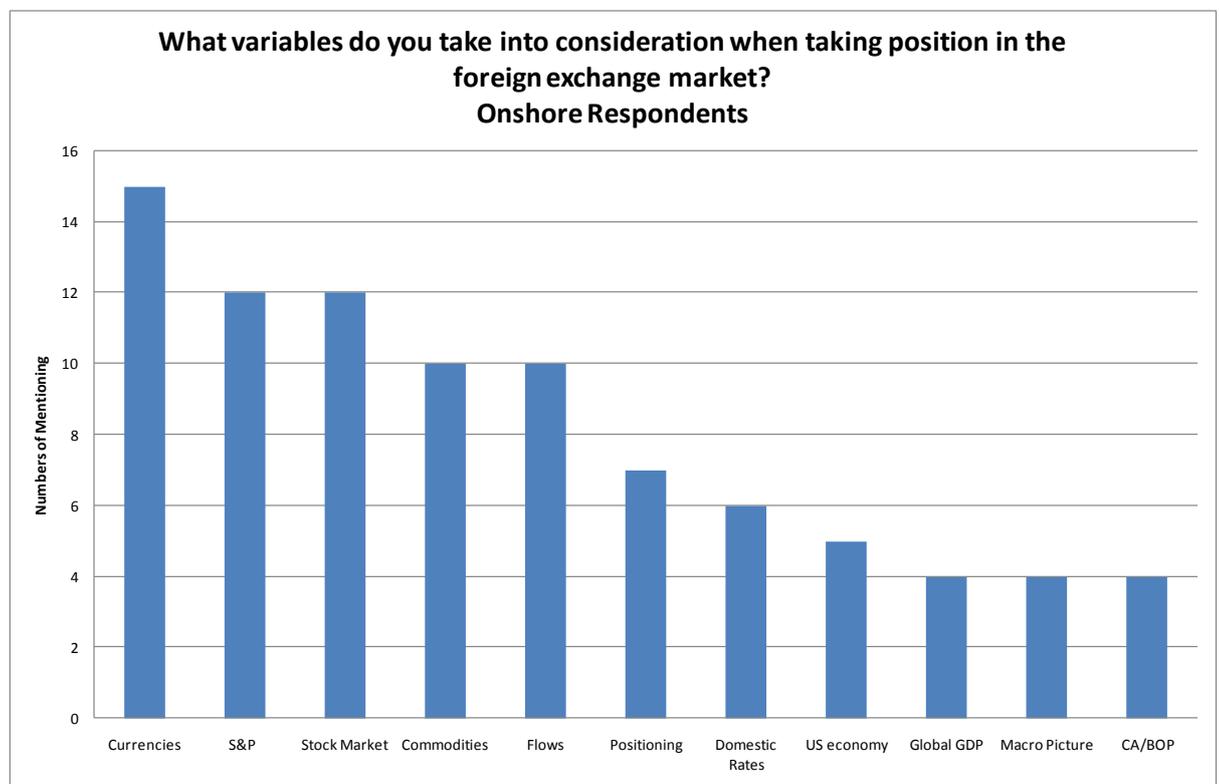
In summary, this section focused on respondents’ perceptions of fundamentals. It found that these varied substantially depending on the operator’s trading horizon, institution and market of operation (onshore vs. offshore) and ranged from a focus on flows to conceptions of equilibrium exchange rates. However, despite the large variety of fundamentals mentioned and the general uncertainty about the nature of fundamentals, several factors were commonly referred to across all interviewees: flows, particularly short-term capital flows through the balance of payments; short-term returns, especially interest rates; the current account as indicator of a country’s foreign exchange productivity; and finally the importance of financial structure, either in the form of debt, a country’s international investment position, or in the form of positioning.

7.4.2. Exchange Rate Drivers in the Context of Currency Internationalisation

This section focuses on the actual indicators market players use to form their expectations about future exchange rate movements. It thus aims to investigate the link between respondents' understanding of fundamentals, their actual expectation formation process, and the drivers of the Brazilian/emerging market exchange rate(s) in the era of currency internationalisation. In critical realist terms, it aims to investigate the empirical manifestations of the underlying mechanisms highlighted in the previous section.

Figures 7.4 and 7.5 show the results for the onshore and offshore respondents.

Figure 7.4



Notes: Total number of responses: 29; responses not exclusive

Interviewees' responses strongly reflect the "fundamentals" highlighted in the previous section and the analytical framework presented in Chapter 3. They point to the important role of short-term capital flows for exchange rate movements in Brazil, and to short-term returns, liquidity preference and short-term net foreign liabilities as crucial drivers of these flows. In addition, responses show the internationalisation process of the Brazilian Real.

The main indicators onshore respondents consider, when taking a position in the Brazilian Real, are other currencies. The majors (US\$ and Euro) aside, these currencies are (ranked according to the frequency mentioned): the Australian Dollar, the Mexican Peso, the Turkish Lira, the New Zealand Dollar and the South African Rand. It is interesting to note that these currencies are, the Australian Dollar and New Zealand Dollar aside, exactly those emerging market currencies which are most heavily traded by offshore respondents discussed in section 2, evincing the internationalisation process of these currencies. The Australian and New Zealand Dollar are among the most liquid and widest traded carry trade and commodity currencies.

The second most frequently mentioned indicator of future movements in the Brazilian Real is the S&P 500, one of the most prominent indicators of international risk aversion. The importance of the S&P indicates the key role of international liquidity preference for movements in the Brazilian Real (and also the internationalisation process of the Brazilian currency). Other empirical manifestations of the importance of international market conditions, and indeed liquidity preference considerations, are the frequent citing of the US economy and global GDP. Figure 7.4 also confirms the importance of domestic interest rates and stock prices, as empirical manifestations of a currency's yield, and the role of flows, for onshore respondents' expectation formation process.

Two more indicators must be mentioned. Firstly, Figure 7.4 corroborates the important role of positioning, i.e. the exposure of the market to potential exchange rate movements, for respondents' expectation formation. Positioning is analytically closely linked to a country's international investment position. Both reflect the financial structure of an economy and its potential vulnerability to sudden exchange rate changes. Many market participants, however, don't have the time and capacity to calculate a country's international investment position; the positioning of the market serves as a useful proxy and "short-term" indicator of the underlying investment position. According to several market participants, it is particularly the positions of short-term investors (such as hedge funds), which are important for their expectation formation, given the increased danger of sudden exchange rate changes.

Secondly, Figure 7.4 also confirms the important role of commodities for future movements in the Brazilian Real. According to a large number of respondents, emerging market currencies and commodities are traded as similarly risky asset classes, which establishes a tight correlation between them. Very few traders held that they considered Brazil's actual export profile in assessing the economic significance of commodities for the Brazilian economy/currency.

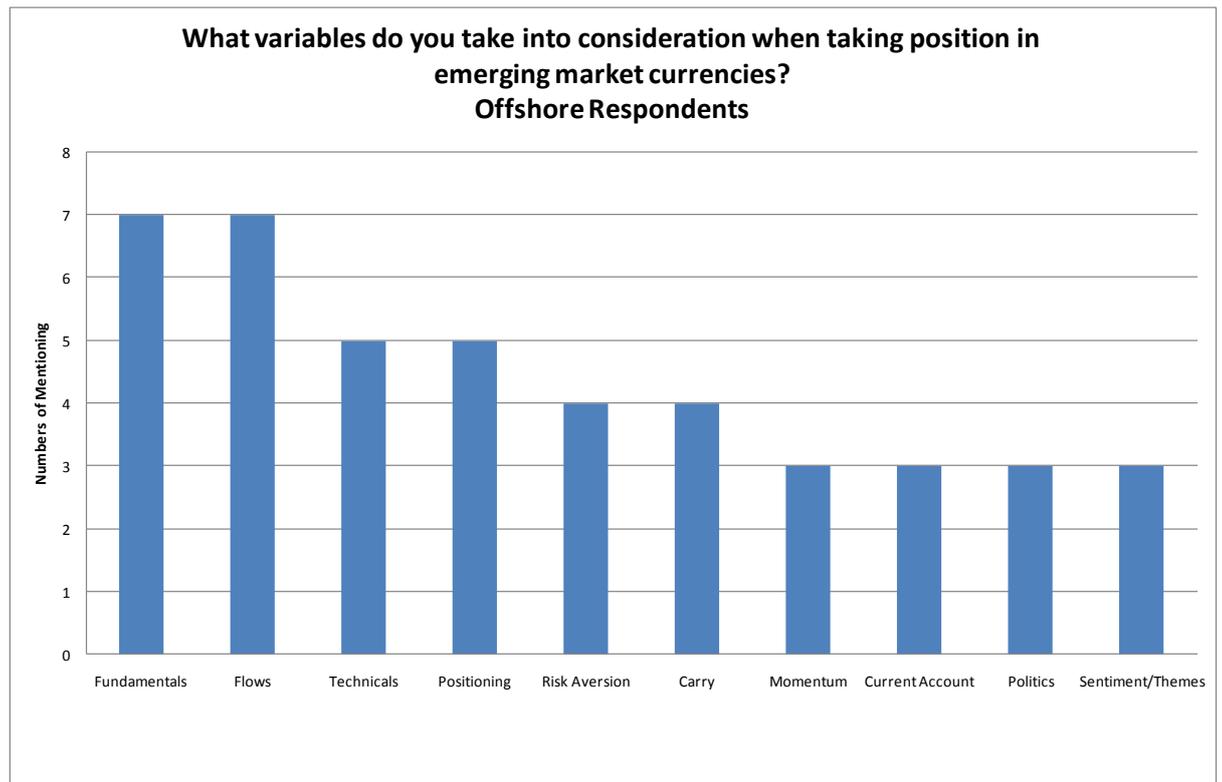
In general, results also broadly confirmed the heterogeneity of the expectation formation process. While indicators such as international market conditions, flows, and returns on domestic assets were important for all market participants, it was mainly hedge funds that also explicitly considered macroeconomic indicators, such as the current account or the balance of payments in their expectation formation.

Finally, it is important to note that many onshore respondents mentioned that the indicators which influenced their trading decisions did not necessarily remain stable over time. According to the interviewees, it is the market, i.e. the interaction of different institutions operating in foreign exchange, which establishes correlations between assets. As a result, these correlations can disappear as quickly as they had appeared. Given the general uncertainty, traders would adhere to emerging correlations, which in turn became a self-fulfilling prophecy.¹⁵⁸

Figure 7.5 shows the main indicators mentioned by the offshore respondents.

¹⁵⁸ Interestingly, none of the interviewees was able to say where these correlations came from. In a similar vein, the market was always seen as an external entity rather than something in which financial market actors played an important part.

Figure 7.5



Notes: Number of total responses: 16; responses not exclusive

Again, responses are consistent with the results on exchange rate fundamentals and broadly in line with the analytical framework underlying this study. Fundamentals are almost exclusively mentioned by real money investors and refer to some conception of an “equilibrium” rate. These are contrasted with the important role of flows, which is confirmed across the different institutions. Capital flows and foreign direct investment are specifically mentioned. Results also confirm the important role of positioning, risk aversion and carry trade considerations for exchange rate movements. While these indicators are mentioned broadly by all different institutions, technicals, in the forms of charts etc., are exclusively important for institutions with a shorter trading horizon. Current account and politics, in turn, are primarily mentioned by representatives of offshore funds.

In general, responses by offshore institutions also confirmed the pervasive nature of uncertainty and the creative role of the market. Again, interviewees, even those with a longer trading horizon, argued that few stable correlations existed, which made the use of quantitative models very difficult if not impossible. This was also evidenced by the

mention of momentum trading, mood and sentiment as important indicators for trading/investment decisions.

7.4.3. Technical Analysis in Emerging Market Currencies

One element of currency traders' behaviour, which has received increased attention in the literature, is technical trading. The above discussed survey evidence reports that technical trading is an important complement to fundamental analysis, used to forecast market psychology and often acting in a self-fulfilling manner, removing the exchange rate from its "fundamental" value (Menkhoff and Taylor 2007). In general, while substantive academic literature exists on the phenomenon of technical trading in developed currency markets, little empirical evidence exists as of yet for emerging countries. Table 7.7 shows the results from the interviews conducted for this dissertation.

Table 7.7: The Use of Technical Trading in Emerging Currency Markets (Brazil)

		Important	Sometimes Important	Not Important	Total
Onshore	Bank	10	6	6	22
	Hedge Fund	1	0	3	4
	Total	11	6	9	26
Offshore	Bank	4	2	1	7
	Hedge Fund	2	1	0	3
	Real Money	3	0	1	4
	Total	9	3	2	14
Total		20	9	11	40

Notes: Total number of valid responses: 40; answers are exclusive

Table 7.7 shows that for nearly half of the interviewees, technical analysis is an important element of their trading strategy. In relative terms, the importance seems to be slightly higher for offshore than for onshore institutions. According to the interviewees, this is partly related to the fact that local institutions have more flow information; according to all traders the occurrence of flows considerably undermines the efficacy of technical analysis. In addition, offshore traders seem to have more expertise on the use of different models compared to local traders. Finally, given that offshore participants consider several currencies at the same time, an in-depth country analysis is often not possible, which encourages the use of homogenous technical tools. Interestingly, little heterogeneity could be observed between the institutions as, confirming results by Gehrig and Menkhoff (2004a), real money investors also apply technical analysis.

A large proportion of onshore respondents indicated that they used technical analysis because others were using it. They saw the profitability of technical analysis as a self-fulfilling prophecy, established by the use of similar models by a wide range of different actors. This perception was also echoed by offshore operators, who indicated that the profitability of technical analysis fundamentally depended on the liquidity of the currency market under consideration. As mentioned above, there was a sense that technical analysis was less important for emerging markets, due to their lower liquidity and importance of flow information. However, several offshore respondents also indicated that a few emerging markets, such as Mexico, Korea and also Brazil, had reached a stage of liquidity which made the use of technical analysis nearly comparable to G10 currencies.

In support of the results presented above, several traders pointed again to the importance of positioning in the context of technical analysis. For many traders, acquiring a sense of the exposure of the market and thus its sensitivity to possible exchange rate changes, was an important part of their analysis.

7.4.4. What about an Equilibrium Rate?

Previous sections on fundamentals and agents' expectation formation have permitted some initial insights into the concept of a long-run exchange rate fundamental and its importance for respondents' operations. Responses showed that the interviewees had, if any, different conceptions of long-run fundamentals, including external balances, a country's debt and international investment positions, and long-run equilibrium models. However, there also seemed to be a perception among respondents that these long-run fundamentals, particularly in the form of long-run equilibrium exchange rate models, had little influence on the exchange rate.

The next set of questions aimed to probe more deeply into this question of the long-run fundamental or sustainable rate. Table 7.8 shows interviewees' responses to the question of whether they had some notion of an equilibrium or long-term value, and if so, whether this notion impacted their foreign exchange operations.

Table 7.8: Long-Run/Equilibrium Exchange Rate

		Yes	Influence?	No	Total
Onshore	Bank	11	2	8	19
	Hedge Fund	2	1	3	5
	Total	13	3	11	24
Offshore	Bank	7	1	2	9
	Hedge Fund	2	2	2	4
	Real Money	8	8	0	8
	Total	17	11	4	21
Total		30	14	15	45

Notes: Total number of valid responses: 45; answers are exclusive

More than two-thirds of all respondents had some notion of an equilibrium or long-run value of the exchange rate. For only 14 of those, however, this value had a significant influence on their foreign exchange operations. In line with respondents' perceptions of exchange rate fundamentals, offshore participants, even among banks, seemed to be more familiar with equilibrium exchange rate concepts than onshore traders. These concepts, however, were primarily important for the investment decisions of long-term oriented real money investors.

In addition, perceptions about the nature of such long-run or equilibrium rate varied substantially between onshore and offshore respondents. Reflecting responses about exchange rate fundamentals, the majority of Brazilian interviewees referred to the sustainability of external accounts.¹⁵⁹ No specific models were mentioned. For three onshore respondents, relative prices, i.e. some form of PPP concept, was important. Offshore traders, in turn, all referred to several types of equilibrium exchange rate models, such as PPP, FEER etc., produced by in-house research departments or banks.

The semi-structured interviews also provided insights into the reasons for these responses. Interviewees, who had rejected the notion of an equilibrium rate, referred to the pervasive uncertainty in foreign exchange markets and the lack of knowledge of such a rate. Several operators mentioned the subjective nature of foreign exchange trading and the importance of "feeling". These responses were also echoed by those interviewees who had acknowledged the existence of an equilibrium exchange rate value, but for whom this value had no influence on their trading behaviour. Reasons

¹⁵⁹ It is important to note, that onshore respondents seemed to make a difference between long-run fundamentals and an equilibrium rate. Whereas the former referred to flows from the trade balance, the latter invoked a market equilibrating concept.

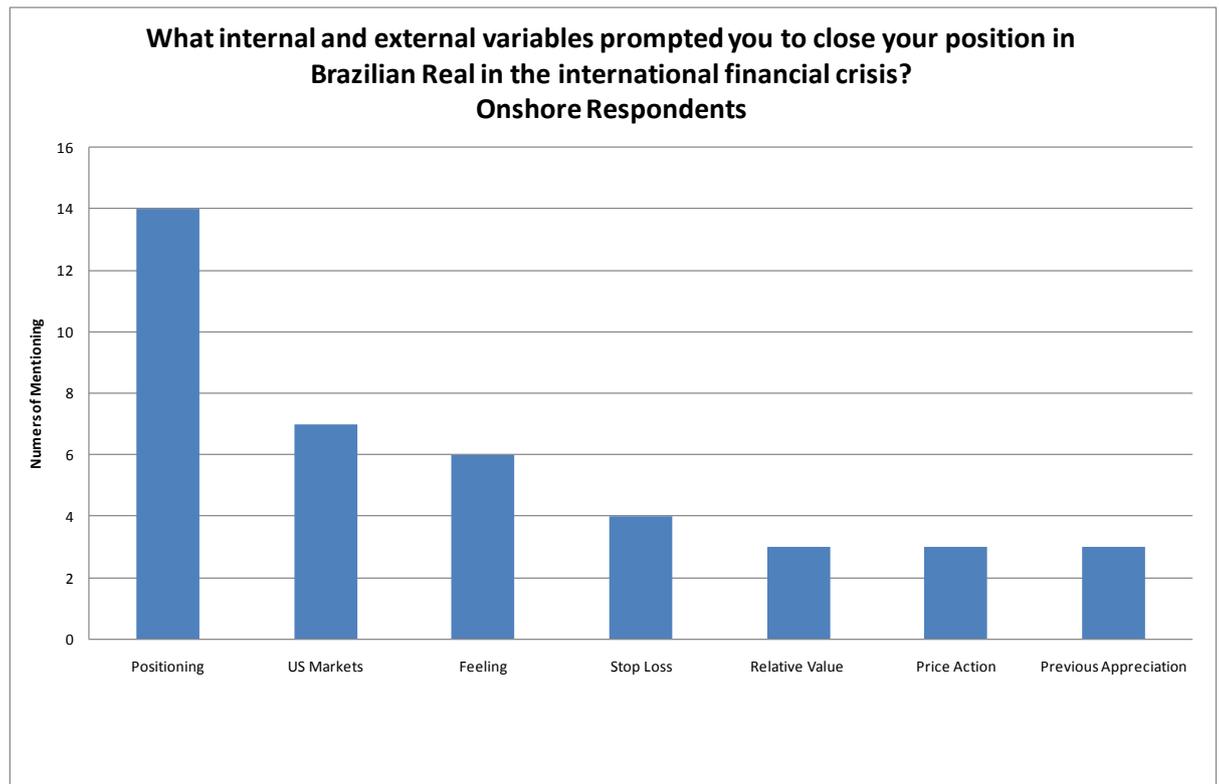
included respondents' short trading horizon, which meant that they were primarily interested in the change rather than the level of the exchange rate; the importance of other factors, such as flows, the general state of risk aversion, and carry trade considerations; and finally the poor forecast performance and arbitrariness of model specification. For those market participants for whom equilibrium exchange rate models played a role, these were used to acquire some notion of whether a currency was trading cheaply or expensively and thus the risk of investing in such a currency. All respondents agreed that these were merely tools and that a host of other factors, such as flows, central bank intervention, carry etc., could mean long lasting deviations from these long-run valuations.

7.4.5. Exchange Rate Fundamentals in the International Financial Crisis

The final section of the interviews which explicitly dealt with the question of “fundamentals” and determinants of trading decisions focused on interviewees' decisions during the international financial crisis. It asked when and why they closed their positions in Brazilian Real (emerging market currencies), whether they thought the Brazilian Real (emerging market currencies) were overvalued before the international financial crisis and (if they were sufficiently familiar with the Brazilian case) why, in their opinion, the Brazilian Real depreciated so much during the crisis.

Figure 7.6 shows onshore respondents' reasons to close their long positions in Brazilian Real (or change their view about the currency's path).

Figure 7.6



Notes: Total number of valid responses: 28; answers not exclusive

The results show the prominent role of positioning for the interviewees. A majority of onshore operators closed their long Brazilian Real exposure due to concerns about the large short US\$ positions in the foreign exchange market, i.e. the stock of net short-term liabilities in US\$. According to the interviewees, they were concerned about both the large share of (short-term) offshore investors in domestic currency instruments (funded abroad and often highly leveraged) and domestic companies which had speculated on a continuous exchange rate appreciation. In both cases, operators knew that any adjustment of positions could lead to sharp and large exchange rate changes and potential difficulties to meet obligations denominated in US\$.

Indeed, for nearly all the onshore market participants interviewed, it was exactly this large stock of net short-term foreign obligations which led to the large depreciation of the Brazilian Real during the international financial crisis. Several interviewees also referred to the effect of herding which was caused by concerns about the foreign exchange exposure of the market and further exacerbated the depreciation. None of the

market participants thought that speculation against the currency was an important factor in the exchange rate depreciation.¹⁶⁰

The role of uncertainty in foreign exchange markets is also underlined by the frequent referrals to “feeling” and the scale of the previous appreciation in operators’ decision to close their positions. Stop loss orders and price action (in the sense of large intra-day moves) were primarily mentioned by short-term traders which operate for clients and have relatively low limits.

The responses also reflect the importance of international market conditions and the internationalisation of the Brazilian Real, either directly through mention of US markets or indirectly through mention of relative value trading. As to the latter, market operators observed a break-down in the correlation between the Brazilian Real and other similar asset classes, primarily the Australian Dollar and commodities, which served as an indicator that international market conditions had changed and would affect the Brazilian Real sooner or later.¹⁶¹

Finally, it is interesting to observe *when* market participants effectively closed their long positions in Real. While little heterogeneity could be observed between the respondents as to *why* they closed their positions, some differences existed when it came to the timing. Whereas the majority of traders in banks closed their positions in August 2008 (when the exchange rate turned) or latest with the Lehman Brothers collapse, representatives of hedge funds indicated that they had closed their positions slightly earlier (the majority in the second quarter of 2008).¹⁶²

As discussed in Chapter 4, the international financial crisis can be divided into two phases: a first period between July 2007 and August/September 2008, characterised by

¹⁶⁰ A few respondents, however, indicated that they went long US\$ during the crisis which is evidence of some speculative behaviour.

¹⁶¹ Although this question was not systematically asked to traders of foreign banks, results seemed to indicate that the difficulties of these banks abroad had a varying impact on domestic operations. While some traders saw their risk limits considerably reduced (although this did not reduce their profits due to the high volatility environment), others saw themselves little affected by headquarter decisions.

¹⁶² Several proprietary or head traders of banks also closed their positions before August 2008. The different trading horizon and mandate of banks and hedge funds was also reflected in the fact that while the majority of respondents in banks could only remember the actual exchange rate value at which they closed their positions, respondents in hedge funds had a clearer time line and also remembered the date.

deteriorating conditions on international financial markets, strong capital flows to the emerging world and an acceleration of the internationalisation of the Brazilian Real, and a second period from around August/September 2008 onwards, when the financial crisis also hit the emerging world. Responses for offshore institutions are thus divided into these two periods and presented in Table 7.9.

Table 7.9: Offshore Respondents' Behaviour during the International Financial Crisis

First Phase		Second Phase	
Adjustment Factor	Total	Adjustment Factor	Total
Risk	11	Liquidity (Cash)	5
Liquidity	10	Redemptions	4
Decoupling	7	Positioning	4
Fundamentals	6	Credit Risk	3
Cash (Redemptions)	4		
Positioning	4		
Total	18	Total	13

Notes: Total indicates total number of valid responses; responses are not exclusive

Responses reflect the observations made in Chapter 4. In the initial phase of the crisis investment decisions were primarily based on the imperative to reduce risky and illiquid positions. This also included reducing positions which seemed “overbought”, i.e. with a large share of offshore investors present, and a switch to trading rather than position making. According to several respondents, liquid emerging market currencies were among the prime asset classes to fulfil these two requirements. Although emerging market assets normally form part of risky assets, the reigning decoupling hypothesis made many of these countries look safer than developed financial markets (this is also evinced by the breaking correlation between the S&P and emerging market currencies presented in Chapter 4). In addition to the decoupling story, several traders mentioned continuing good “fundamentals” in the form of balance of payments flows, commodities, and carry, as a reason to stay “invested” in emerging market currencies.

This changed with the deterioration of international market conditions in August 2008 and particularly with the collapse of Lehman Brothers in September 2008. Nearly all of the respondents adjusted their exposure to Brazil (emerging markets) between August 2008 and October 2008. Differences between institutions are difficult to discern and might lack robustness. The majority of the traders in banks indicated that they adjusted their exposure with the collapse of Lehman Brothers as they had to generate cash. A

large proportion of the hedge funds and some of the real money investors stated that they cut their positions in August/early September 2008 partly due to increasing redemptions but also due to concerns about credit risk and positioning in those markets.¹⁶³ Another group of real money investors only significantly reduced their exposure around and after Lehman, primarily due to redemption payments.

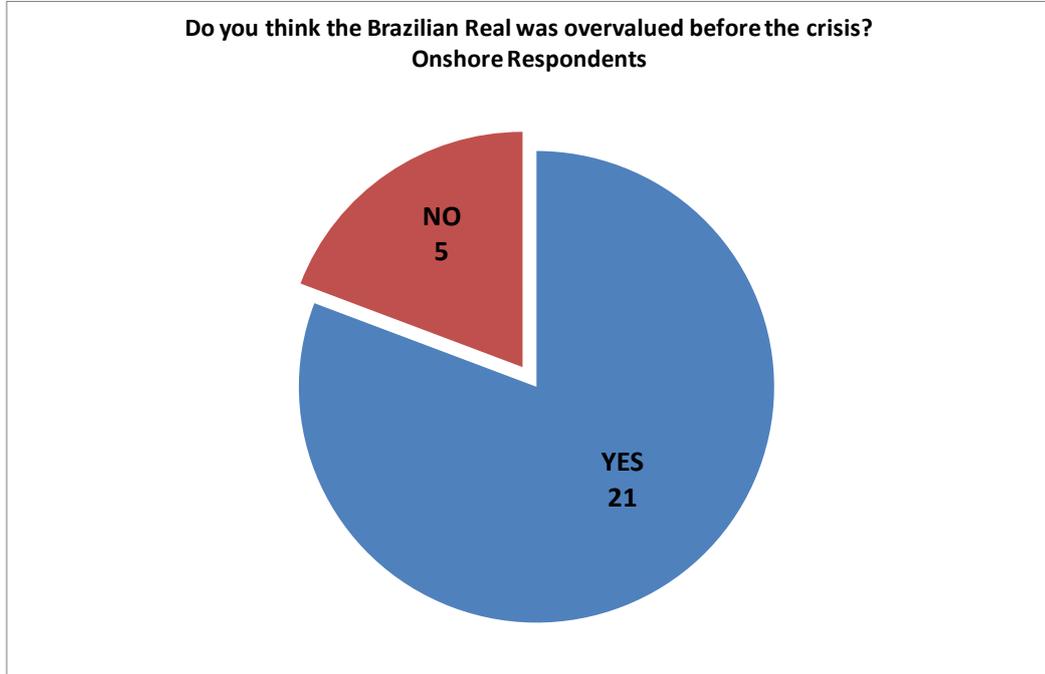
Given the importance of August 2008 for both exchange rate dynamics (as discussed in Chapter 4) and indeed the trading/investment decisions of the interviewees, one sub-question aimed at identifying the reasons for the simultaneous adjustment in several currencies around this date. Interestingly, very few respondents could remember or identify the trigger of the adjustment at this date. For many interviewees there was no such final trigger, but the positioning of the system had reached such a point (both worldwide and in the Brazilian market) that any small change in conditions could have turned the system from a fragile to an unsustainable state. The few respondents who thought that they could remember market dynamics at that date, pointed to a drop in commodity prices and a reduction in Japanese carry trade investors as the ultimate trigger of price adjustment in all these countries.

The above discussion shows that respondents' operations during the international financial crisis were to a large extent motivated by liquidity considerations and concerns about Brazil's financial structure, in the form of the existing short-term foreign exchange exposure. Indeed, none of the respondents indicated worsening economic fundamentals as the reason to reduce their exposure to Brazilian exchange rate risk. This begs the questions whether respondents actually thought that the Brazilian exchange rate was valued correctly before the international financial crisis, how they assessed the Real's relative valuation and finally why, if they thought that the Real was overvalued, this overvaluation did not seem to have played a role in their decision making during the crisis.

¹⁶³ Results might be biased though due to a clear case of selection bias, as those institutions which did not adjust their positions at this date might have disappeared from the market. That said, the result that foreign hedge funds had closed (or at least reduced) their positions before the collapse of Lehman Brothers (and also before real money investors) was also confirmed by onshore banks with foreign hedge fund clients.

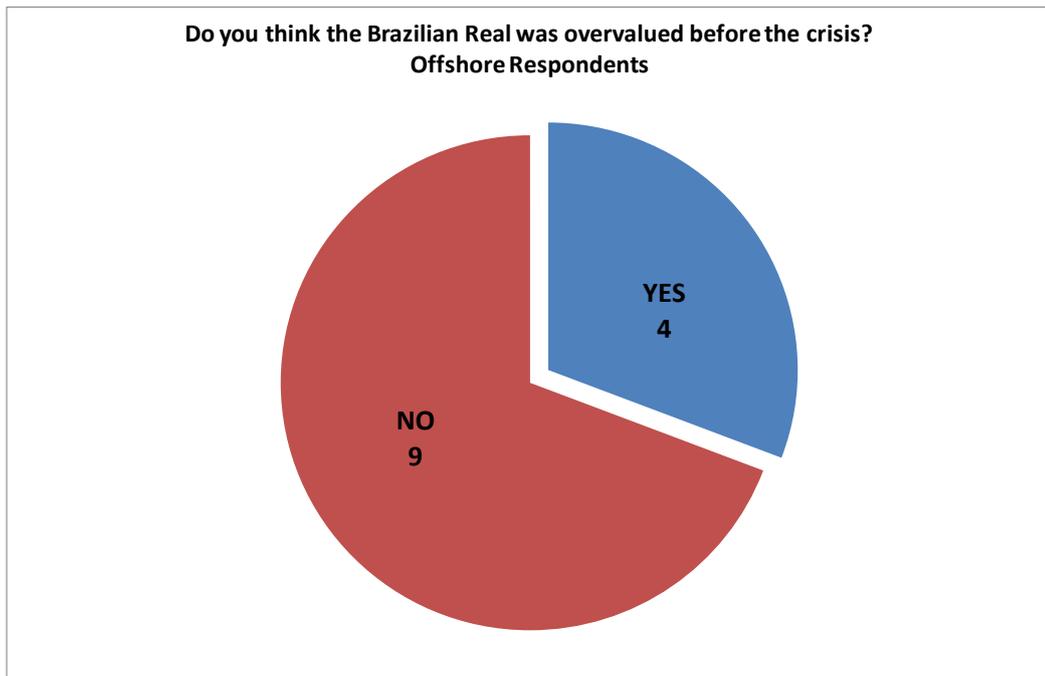
Figures 7.7 and 7.8 show interviewees' perceptions about the Real's valuation before the crisis.

Figure 7.7



Notes: Total number of responses: 26

Figure 7.8



Notes: Total number of responses: 13

The difference in the answers is striking. While the majority of onshore actors thought that the Brazilian Real was overvalued before the crisis, the majority of offshore investors did not. This is particularly striking as only 12 (out of 24) onshore respondents had thought that there was something like an equilibrium or long-run rate, compared to 17 (out of 21) offshore investors who thought there was one. Thus, although a majority of onshore participants did not believe in the existence of an equilibrium rate, they had some sense of valuation for their currency.

The factors which shaped onshore respondents' sense of valuation were broadly consistent with their responses on a possible long-run fundamental presented above. 6 respondents referred to the deterioration of external balances for their assessment, while 5 referred to some form of PPP concept (although these were generally more empirical references in the sense that the traders found Brazil expensive or cheap to travel abroad). Finally, and again echoing results presented throughout this chapter, 7 traders thought that the exchange rate was overvalued because of the large share of speculative flows in the market and the big short-term exposure of domestic and foreign players to exchange rate changes. Asked why they did not close their positions, despite this sense of overvaluation, nearly all onshore respondents held that the momentum in markets was too strong, the amount of flows too large and the party too good for them to have closed their positions earlier.

The importance of positioning is also reflected in the responses of offshore operators. For half of the respondents which had indicated that they thought the exchange rate was overvalued, the primary indicator was the technical position of the market and the preponderance of short-term speculative flows in the Brazilian Real. While no differences in responses could be observed among the onshore respondents, it is important to note that positioning seems to have been more important for offshore operators in banks than hedge funds or real money investors. However, when solicited for their assessment of the importance of positioning for exchange rate movements all respondents of the latter group confirmed that it was an important indicator for trading decisions, particularly in the moment of crisis. A slight heterogeneity among the offshore respondents could also be observed as to the reasons why they did not think the Real was overvalued. While representatives of banks referred to the fact that everything was overvalued and Brazil did not outperform its peers, hedge funds and real money

investors were more likely to refer to long-term global rebalancing which seemed to justify the exchange rate value.

The distinct responses of onshore and offshore respondents also shed some light on their different expectation formation processes and assessments of exchange rate dynamics. While for onshore respondents domestic dynamics play a primary role, offshore investors adopt a global view assessing countries in relative terms rather than on their own account. This, in turn, could lead to sustained periods of “overvaluation” within individual countries as long as they do not “outperform” their peers.

7.5. Trading Decisions and the Central Bank

The final section of the semi-structured interviews concerned respondents’ opinions, perceptions and preferences with respect to the operations of the (Brazilian) central bank. This section was considered particularly important with regards to possible implications for exchange rate management in the context of an internationalised currency.

A first part aimed at generating a general understanding of foreign exchange market operators’ perceptions of the central bank. In total, 22 valid responses by onshore operators and 17 by offshore operators were collected. Answers varied distinctly between the two; while onshore respondents were primarily concerned with the actual foreign exchange interventions of the BCB, offshore respondents, consistent with their understanding of fundamentals, adopted a more “macro” view when assessing central bank operations.

All onshore operators agreed that the BCB is a very active and important player in the foreign exchange market. Three aspects of importance were distinguished. Firstly, the intraday or day-to-day trading environment: for intraday operations the BCB was identified as the most important player in the market whose positions are bigger than those any other operator. “Going against” the central bank in the intraday trading was considered a risky strategy with large possible losses. Secondly, the moment of crisis which will be discussed in more detail below. Finally, the exchange rate trend or level: there was a clear perception among the onshore respondents that the BCB did not, and

indeed could not as discussed below, target a certain exchange rate level or even influence the exchange rate trend. Reflecting the BCB’s own rhetoric in the existing inflation targeting regime, a large part of the respondents pointed out that the regular interventions by the BCB were not aimed at influencing the exchange rate level or trend, but to smooth, i.e. reduce the volatility, of exchange rate movements.

Interestingly, more than half of all onshore respondents also mentioned that the type and nature of the BCB’s operations contributed to, rather than quelled, speculative directional positions of domestic and foreign operators in the Brazilian Real. On the one hand, through its regular interventions in the foreign exchange market to absorb the large foreign exchange inflows, the BCB provided liquidity to those who wanted to sell the foreign exchange. On the other hand, operators knew that the BCB would not try to halt the appreciation, “guaranteeing” gains on the exchange rate appreciation. Indeed, for many operators the BCB’s purchases in the foreign exchange market were a sign of continuing foreign exchange inflows, which further stimulated their speculative foreign exchange positions. At the same time, the operators’ knowledge that the BCB would smooth exchange rate movements lowered the risk on their open foreign exchange positions and induced them to take even larger positions.¹⁶⁴

Offshore respondents had a more “macro” view of central bank operations in Brazil/emerging markets. Table 7.10 shows the results. Responses from onshore interviewees which adopted a broader view are also included.

Table 7.10: How do Operations of the Central Bank affect your Trading Decisions?

Concepts	Onshore	Offshore	Total
Liquidity	4	3	7
Reserves	2	3	5
Predictability+Transparency	1	4	5
Monetary Policy (Interest Rates)	0	4	4
Capital Controls	0	3	3
Credibility	0	3	3
Consistency	0	2	2

Notes: Total number of valid responses: onshore: 22; offshore: 17; responses are not exclusive

¹⁶⁴ The argument that it was the types of intervention by the BCB, which contributed to the speculative positions in the Brazilian Real, was also supported by four offshore traders familiar with the Brazilian market.

Liquidity provision and the stock of foreign exchange reserves, together with predictability and transparency, credibility and consistency, were among the most frequently mentioned considerations. These considerations, however, coincide closely with the elements of a market's institutional liquidity related to the central bank and macroeconomic management discussed in Chapters 3 and 5. It is interesting to note that monetary policy, and thus interest rate decisions, were considered particularly important by offshore investors, reflecting the importance of carry trade considerations for these operators. Finally, capital controls found frequent mention among offshore investors. This, however, might be due largely to the fact that some of the interviews with foreign investors were conducted just when the BCB introduced the extended IOF tax.

As seen above, predictability and credibility are important elements of central bank operations for currency traders. It has been argued in Chapter 5 that an inflation targeting regime provides exactly this predictability and credibility. Table 7.11 shows the view of selected onshore and offshore respondents.

Table 7.11: How does the Existence of an Inflation Targeting Regime affect your Trading Decisions?

Concept	Onshore	Offshore	Total
Predictability	8	3	11
Credibility	3	5	8
Critique	0	4	4
Pass Through	4	0	4
Transparency	0	3	3

Notes: Total number of valid responses, onshore: 15; offshore: 11; responses are not exclusive

The answers confirm the importance of predictability and credibility for both, onshore and offshore respondents. There are however some differences in responses regarding other aspects of an inflation targeting regime. On the one hand, several offshore respondents raised critiques against inflation targeting regimes in emerging markets. Although providing predictability and credibility, there was also a notion that too strong a fixation on inflation, rather than the exchange rate for example, could lead to higher volatility and negative effects on growth. Onshore traders, on the other hand, were more concerned with the potential pass through from large exchange rate movements to inflation in the case of exchange rate depreciations. As also discussed in Chapter 5, an inflation targeting regime imposes asymmetric behaviour on the central bank with

regards to exchange rate movements; while exchange rate appreciation helps to tackle inflation, exchange rate depreciation might call for central bank intervention in the case of a high pass through to inflation.

As could be seen in Table 7.10, currency market operators considered liquidity provision as one of the most important tasks of the central bank. This liquidity provision became especially important during the international financial crisis. Given that the questions about the international financial crisis primarily concerned the specific operations of the BCB, the below discussion is largely based on the responses by onshore interviewees and selected offshore interviewees, which were very familiar with the Brazilian case.

Overall, respondents thought that the BCB operated very well during the international financial crisis. It provided as much liquidity to the market as it required, and indeed even more than some market participants had expected, but without reducing the existing level of foreign exchange reserves by a substantial amount (through intervening in the derivatives exchange), unlike Mexico for example. According to the respondents, the BCB's message to offer as much liquidity as needed anytime was an important factor in halting the depreciation. As one interviewee put it "if I needed money, if I needed cash, I went to Brazil, because that is where the liquidity was". The general approval notwithstanding, several respondents thought that the BCB had waited too long and came to the market slightly belatedly.¹⁶⁵

Interestingly, a large share of respondents (20 out of 21) expected the BCB to intervene in the crisis to prevent further depreciation. Thus, while there was no feeling that the central bank should or could stop the exchange rate appreciation, the operators thought that the central bank had an obligation to halt the exchange rate depreciation and avoid sharp and large exchange rate movements (some respondents even contacted the BCB and told them to do so).¹⁶⁶

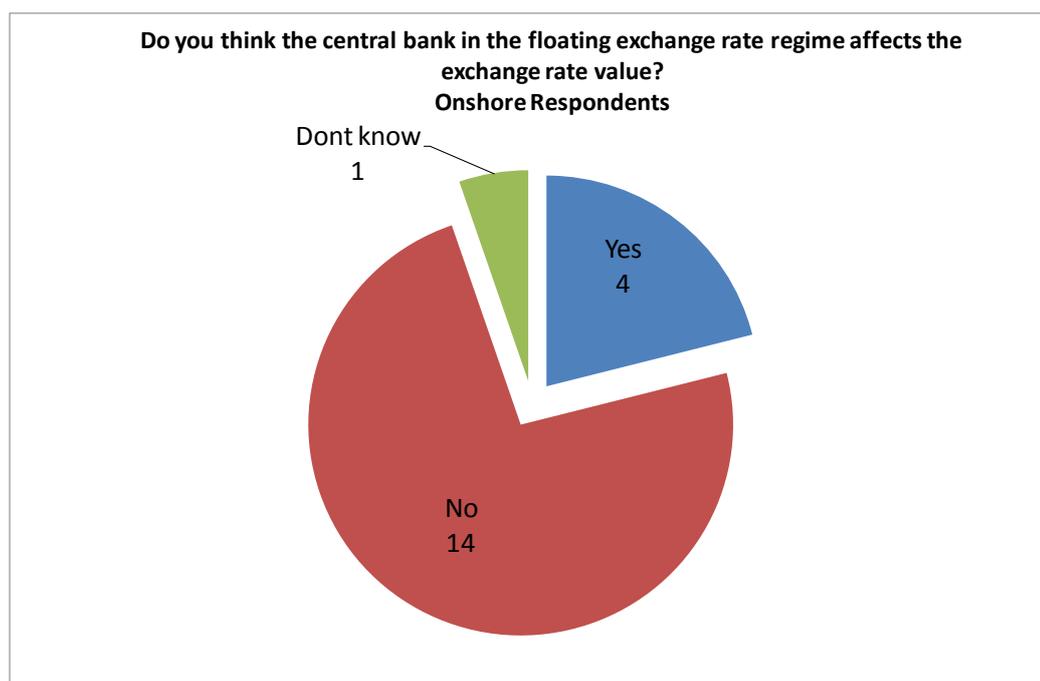
¹⁶⁵ Respondents did not agree on the causes for the slightly belated reaction. Some thought that the BCB had underestimated companies' foreign exchange exposure, whereas others thought the BCB wanted to "teach them a lesson". Several argued that the BCB entered the market when the companies' problems started to pose a risk to the solvency of the banks.

¹⁶⁶ Supporting the internationalisation of the Real, a few traders pointed out that the BCB intervened particularly when movements in the Brazilian Real went beyond those observed in its "peers", i.e. similar emerging market currencies.

Finally, the majority of respondents (22 out of 23) thought that the large level of foreign exchange reserves at the BCB made an important difference in the crisis through providing confidence, actual liquidity and avoiding speculation against the Brazilian Real. However, very few of the respondents held that a large level of foreign exchange reserves could ultimately protect the central bank from a run on the currency. In a similar vein, several respondents argued that rather than the actual level of reserves, it is the size and structure of outstanding liabilities, i.e. a country's net-short foreign obligations, which will determine the success and outcome of central bank interventions in the moment of crisis.

The final set of questions regarding central bank operations explicitly referred to the issue of exchange rate management. Three main questions were asked. Firstly, whether the interviewees believed that the operations of the BCB in the floating exchange rate regime affected the value of the currency. Secondly, whether operators thought that if the Brazilian/emerging markets central bank(s) decided to manage the exchange rate, e.g. for a particular level or within a band, they could do so in a credible fashion and what would lend them credibility. And finally, whether they, as foreign exchange market operators, would want central bank(s) to manage the exchange rate and if so how. Given the explicit focus on the operations of the BCB, the first question was primarily targeted towards onshore respondents; the two latter questions were formulated in a more general way for offshore respondents. Figure 7.9 shows the onshore interviewees' answers to the first question.

Figure 7.9

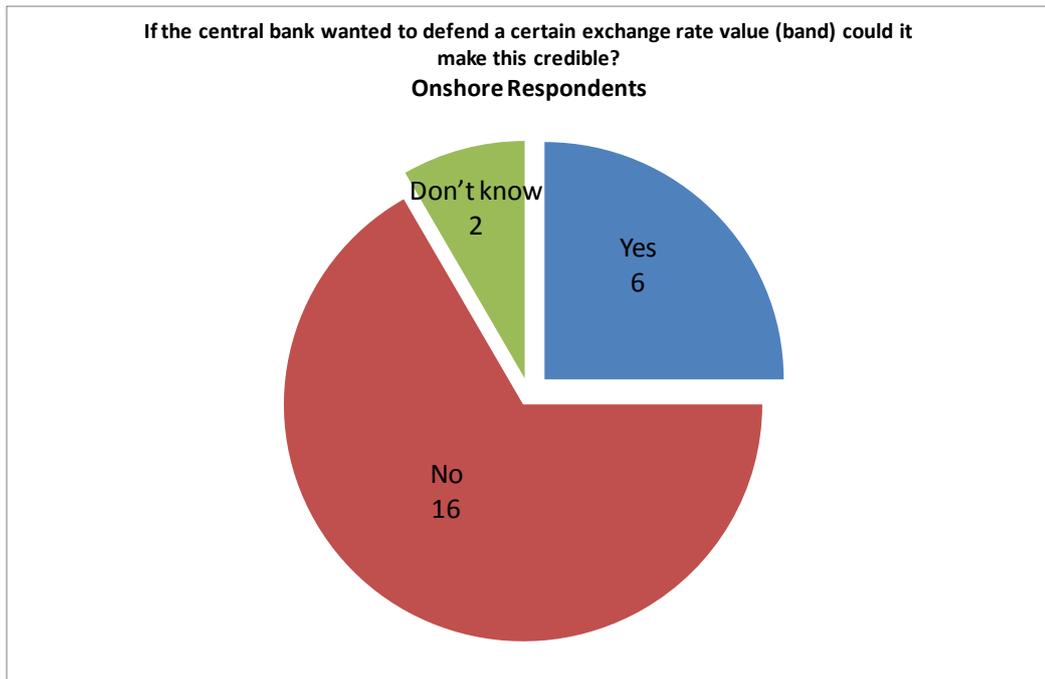


Notes: Total number of valid responses: 19; responses are exclusive

In line with the results above, nearly three quarters of all Brazilian foreign exchange traders did not think that the BCB is or should be targeting the level of the exchange rate. Those who did think that the BCB had an effect on the exchange rate primarily saw this as a by-product of the BCB's attempt to build foreign exchange reserves. According to the respondents, the only purpose of the central bank is to smooth volatility. Recurrent reference was made to the negative effect of exchange rate volatility on real sector outcomes; interestingly, no such negative effect was assumed for sustained periods of exchange rate appreciation.

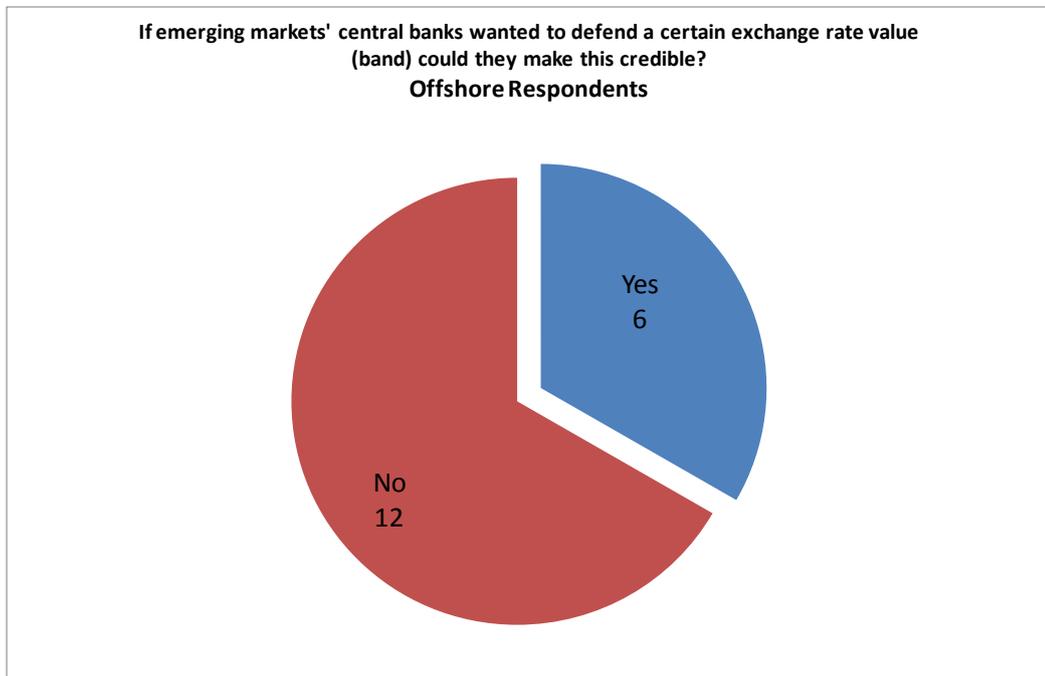
Figures 7.10 and 7.11 show the answers of onshore and offshore respondents to the second question.

Figure 7.10



Notes: Total number of valid responses: 24

Figure 7.11



Notes: Total number of valid Responses: 18

A majority of respondents did not think that the Brazilian/emerging market central bank(s) could manage their exchange rate(s) credibly. The institutional framework of an

inflation targeting regime aside, two reasons were most frequently mentioned: Firstly, the size, liquidity and the amount of short-term capital flows entering these markets, which meant that central banks(s) did not have sufficient resources to control the exchange rates; secondly, the difficulty defining an appropriate exchange rate value. Several traders argued that they would attack the exchange rate immediately in the case of an apparent distortion in the real economy. In a similar vein, respondents argued that in the time of currency internationalisation the BCB could not deviate the Real too much from its “parity” with other internationally traded currencies.

Those respondents who did think that a credibly managed exchange rate regime could be possible most commonly held the view that the central bank would have to make it its main strategic objective and policy target, i.e. abandon the inflation targeting regime, and be very clear regarding its objectives and aims. Interestingly, in relative terms, offshore traders seemed to be slightly more likely to believe that such a credibly managed exchange rate regime was possible.¹⁶⁷ In general, respondents considered it more likely that the central bank could successfully manage the exchange rate in an appreciation rather than a depreciation period. Although very costly in Brazil, given the high sterilization costs in the presence of the high real interest rates, respondents argued that the central bank would just have to buy more than the arriving foreign exchange inflow to halt the (expected) exchange rate appreciation.

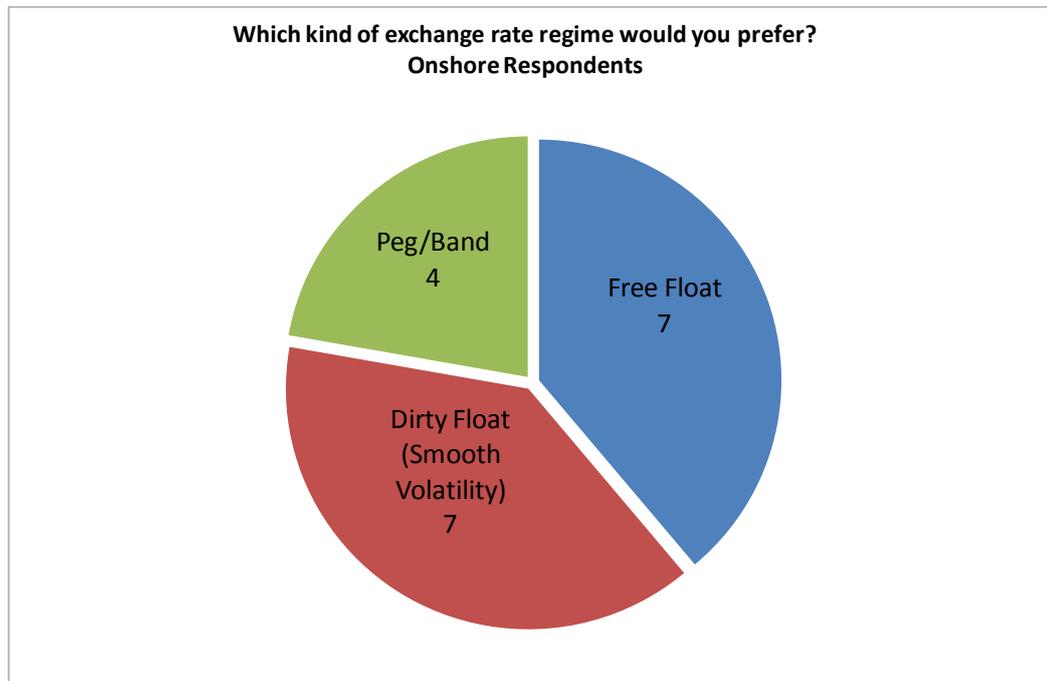
The task was acknowledged to be more difficult in the case of an (expected) depreciation. Few respondents believed that a large level of foreign exchange reserves would credibly protect the central bank against a speculative attack. Interestingly, the number of respondents who did think that the size of foreign exchange reserves could make a decisive difference in the case of depreciation was again higher among offshore (5) than onshore (1) respondents. In this respect it is important to note that a large share of respondents (12) mentioned that the only credible way of managing exchange rates in emerging markets would be with the support of capital controls. According to several interviewees, in the Brazilian case, this would involve restrictions on foreign, and indeed also domestic, operations on the liquid local derivatives exchange. However, several respondents also acknowledged the difficulty of such measures, particularly in

¹⁶⁷ This could be due to the fact that some of them also traded Asian currencies. Asian countries have managed their exchange rates more or less successfully over recent years.

view of the large and growing foreign exchange offshore market as discussed in Chapter 4.

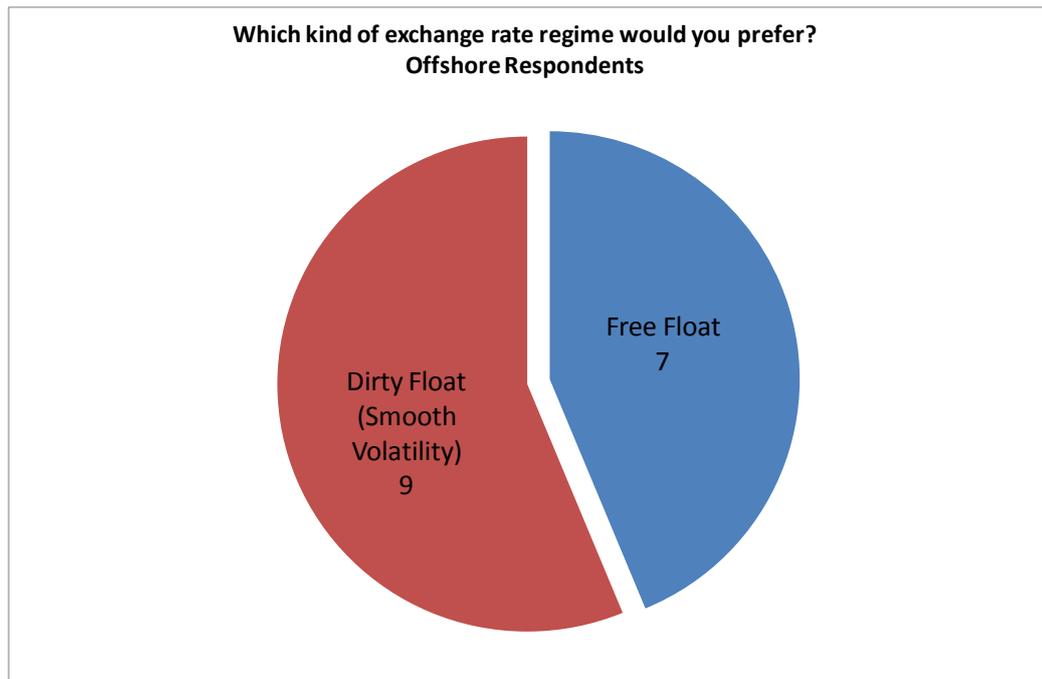
The final question aimed to gain a deeper insight into which form of exchange rate regime was most profitable and preferable for the foreign exchange operators themselves. Figures 7.12 and 7.13 show the results.

Figure 7.12



Notes: Total number of valid responses: 18

Figure 7.13



Notes: Total number of valid responses: 16

More than half of all respondents would actually prefer some form of managed exchange rate regime over a pure float. The most preferred option seems to be something like a managed or dirty float. Although at first sight surprising, as one would expect foreign exchange market participants to favour exchange rate volatility to speculate on future exchange rate movements, above results have indeed shown that respondents were concerned about large and sudden exchange rate movements and did favour some form of volatility smoothing. As discussed above, a smoothed exchange rate or dirty float gives foreign exchange market operators confidence that excessive losses will be avoided while at the same time promising continuing profits on exchange rate appreciation. In addition, respondents stated that less volatile movements are often more sustainable and less likely to be reversed. This increases the Sharp ratio on their foreign currency investments and allows them to more effectively hedge their operations. Finally, according to the respondents, given that smoothed/managed exchange rates postpone, rather than avoid exchange rate appreciations, this type of exchange rate management gives time to build even larger speculative exchange rate positions.

Finally, although not very robust and consistent, some differences could be observed among the respondents. While intraday and high frequency traders and real money investors seemed to favour a floating exchange rate, proprietary traders of banks and hedge fund managers seemed to favour a slightly managed exchange rate. This could be explained by the fact that high frequency investors largely base their trading decisions on statistical models which require “random” exchange rate movements as in floating exchange rates. Real money investors are less affected by sudden and large exchange rate movements due to their longer trading horizon. Interestingly, these differences between respondents also held when it came to the role of capital controls or a Tobin tax to manage exchange rates. Although not specifically targeted in this research and a subject of future research, several real money investors mentioned that a short-term Tobin Tax or a tax on capital inflows did not pose a problem to their operations. Any forms of capital controls, in contrast, were categorically rejected by all other respondents.

7.6. Conclusions

This chapter has presented the results from a qualitative study in the form of 52 semi-structured interviews with operators in the Brazilian Real (and emerging market currencies more generally) both onshore and on offshore markets. In contrast to previous studies on the behaviour of foreign exchange market participants the analytical focus was placed on market participants’ perceptions of fundamentals and these fundamentals’ link with exchange rate drivers. In addition, the study focused explicitly on an emerging country to investigate the process of currency internationalisation highlighted in this dissertation and to uncover the (potentially different) nature of fundamentals and exchange rate drivers in this context.

Four main groups of foreign exchange market participants were investigated: onshore and offshore banks and onshore and offshore funds. The latter were again divided into real money investors and hedge funds. It was shown that while commercial banks operate primarily in the short-term with and on client flows, funds, with no client base on their own, but also investment banks with fewer clients engage more in directional, speculative foreign exchange operations. While the operations of offshore hedge funds can be characterized as speculative trading and medium-term position taking, offshore

real money investors are characterized by a longer time-horizon and invest, rather than trade, in emerging market currencies. In general, longer term positioning or “trend trading” was found to be more profitable than client business in the Brazilian market. This, however, depended crucially on market conditions. In addition, results from offshore respondents showed that position taking might be more prevalent in emerging market currencies, primarily due to these markets’ lower liquidity.

The study found that foreign exchange market participants’ understandings of fundamentals was very context specific, i.e. depended on their market of operation (onshore vs. offshore), institution etc. Indeed, respondents’ perceptions of fundamentals ranged from flows in the case of commercial and domestically operating investment banks, to equilibrium exchange rate models in real money funds. While participants with a shorter-horizon tended to interpret fundamentals as actual exchange rate drivers, respondents who took positions in currencies had a more medium to long-term conception of fundamentals. Thus, in addition to findings that market participants use both fundamental and non-fundamental information (both within one market participant and different institutions), this study also showed that market participants hold very different perceptions of what fundamentals actually are.

Although the conceptions of fundamentals differed widely among the respondents, some underlying factors or mechanisms, in line with the Post Keynesian framework presented in Chapter 3, could be observed across all actors. Firstly, all respondents highlighted the important role of short-term financial flows, particularly in the form of short-term capital flows through the balance of payments, for exchange rate determination in emerging markets. Secondly, returns on short-term domestic financial assets, in the form of short-term interest rates and stock market prices, featured strongly in agents’ responses. Thirdly, international risk aversion or liquidity preference was given a primary importance. Finally, and of particular interest to this dissertation, was the significance market participants attributed to a country’s net short-term foreign liabilities for their trading decisions, i.e. its financial structure. Financial structure was important for actors’ operations both in the form of a country’s debt and international investment position, and in the form of positioning, as its “short-term” indicator.

These underlying mechanisms found their empirical manifestations in the indicators foreign exchange operators considered for their trading operations, such as other currencies, the S&P or, to a certain extent, commodity prices. The importance of these indicators, respondents also argued, could change over time and/or disappear altogether. Indeed, while reflections of underlying mechanisms, foreign exchange operators pointed out that observed phenomena are established by the evaluation of economic agents, the market, and can thus disappear as quickly as they have appeared. Financial structure, in the form of Brazil's large share of short-term foreign currency exposure, for example, became particularly important during the international financial crisis. While many (especially) onshore respondents did not have a notion of an equilibrium rate, positioning was an important element in shaping their sense of the Real's valuation before the international financial crisis.

Respondents' answers also reflected the internationalisation of the Brazilian Real highlighted in this dissertation. This process was evidenced by the importance of short-term foreign capital flows for exchange rate movements and onshore respondents' perception that it was foreign operators which effectively shaped exchange rate dynamics in the Brazilian market. In addition, offshore respondents themselves referred to the increasing importance of emerging market currency for their returns. Further, results showed that the most important indicators for future exchange rate movements considered by (onshore) participants were indicators of international risk aversion, and other currencies and commodities, which were traded as similar (risky) asset classes by offshore participants.

Finally, this chapter presented insights into foreign exchange market operators' perceptions of central bank operations. In support of the arguments presented in chapter 5, it showed that the type and nature of the operations of the BCB contributed rather than quelled speculative flows in the Brazilian Real. According to the results, the current macroeconomic framework of an inflation targeting regime with a smoothed exchange rate is "trader heaven" as it promises high returns on the exchange rate with low(er) risk. This issue will be taken up again in the conclusions of this dissertation, which discusses possible implications for exchange rate policy.

This chapter has provided important insights into the workings of the Brazilian (emerging market) foreign exchange market(s), in the context of the recent process of currency internationalisation. It also provided empirical evidence for the Post Keynesian critical realist view of exchange rate determination proposed in this dissertation. It showed that rather than mainstream fundamentals such as underlying equilibrium rates, operators in short-term financial markets are primarily driven by short-term returns and liquidity considerations. Perceptions of a “long-run” or sustainable exchange rate are significantly determined by actors’ perceptions of a country’s ability to meet its outstanding external obligations. The importance of these factors, however, can result in exchange rate movements characterised by large swings, “excess” volatility, and increased dependence on international market conditions, highlighted in Chapter 4.

However, as discussed in Chapter 6, while allowing important insights into underlying mechanisms and structures which shape agents’ expectation formation and positions, qualitative results are weaker on representativeness and generality. To at least partially overcome this weakness, elements of the qualitative results presented above are econometrically triangulated in the two following chapters. While chapter 8 focuses on the role of short-term capital flows for movements in the Brazilian Real, emphasis in Chapter 9 is placed on the empirical manifestations of the underlying mechanisms identified in this chapter.

Chapter 8: The Brazilian Real and Short-Term Capital Flows

8.1. Introduction

The dissertation has argued that short-term (foreign) financial flows are an important determinant of exchange rates in DECs in the context of currency internationalisation. This chapter investigates this claim empirically.

As discussed in Chapter 2, in mainstream exchange rate theory short-term financial flows cannot have lasting effects on the exchange rate as ultimately - some - rational agents align the exchange rate with its fundamentals, which remain firmly specified according to the market equilibrating approach to exchange rate determination. One interesting approach in mainstream exchange rate theory, which explicitly acknowledges the determining role of flows, i.e. the buying and selling decisions of foreign exchange, is the order flow approach to exchange rate determination. Order flows transmit fundamental information into the exchange rate through the price setting of dealer banks. In addition, in Lyons' (2001) work this fundamental information is interpreted more broadly beyond traditional fundamentals including factors such as liquidity demand or time-varying risk preferences. At the moment, however, little empirical research exists as to which are the factors that drive order flows and thus ultimately exchange rates. In addition, the order flow approach has a different conception of flows from that adopted in this dissertation. While in the microstructure literature order flows denominate all signed transactions in foreign exchange, including operations between dealers, this dissertation only refers to financial client flows. In addition, in this chapter particular emphasis lies on (foreign) flows which enter the country and are thus recorded in the balance of payments. As discussed in more detail below, these types of flows can, but need not, coincide.

Post Keynesian exchange rate theory explicitly highlights the determining role of short-term financial flows for exchange rate movements. In addition, due to uncertainty the effects of these flows are permanent as financial market actors do not and cannot know the underlying fundamentals as specified in mainstream exchange rate theory.

This dissertation has further argued that once short-term financial flows in domestic currency instruments are acknowledged to be an important determinant of exchange rates, the “yield” on these instruments becomes a crucial factor for exchange rate movements. The exact empirical manifestations of this yield, in turn, will depend on the specific domestic asset classes under consideration. These include short-term interest rates in international money markets, but also returns on domestic currency bonds and equities. The second yield element in the case of short-term domestic currency investments are expected changes in the currency itself. These can, among other things, be the result of psychological processes, such as Keynes’ famous “beauty contest” and animal spirits, which cause trading behaviour characterised by herding, momentum or simple feedback trading (Kahneman and Tversky 1974; Harvey 2009).

The qualitative results presented in Chapter 7 have given a first indication of the importance of short-term financial flows and the returns on these flows for exchange rate determination in Brazil. For many market participants short-term financial flows, primarily short-term capital flows through the balance of payments, were an important fundamental of the Brazilian exchange rate. Indeed, this dissertation had argued that in DECs most financial flows in domestic currency (assets) will still be directed through the balance of payments, making these flows the focal point of analysis. Even those foreign exchange market participants, who had a more medium to long-term perception of fundamentals, acknowledged that ultimately it was short-term capital flows and the “carry” which has an important impact on exchange rates in Brazil.

This chapter econometrically triangulates these theoretical conjectures and qualitative results and investigates the relationships between the Brazilian Real, short-term capital flows and returns on these flows. Short-term capital flows are divided into flows to the domestic bond and equity market respectively. Thus, this chapter also represents an empirical investigation into the first manifestation of the internationalisation the Brazilian Real, i.e. the increased foreign participation in domestic currency denominated assets. Given the Post Keynesian emphasis on expectations in short-term financial markets, *expected* rather than actual returns on these domestic currency assets are included in the model. Expected gains on the currency itself are approximated with simple feedback trading mechanisms.

The methodology used is the cointegrated VAR model proposed by Johansen (1988) and Juselius (2006). The cointegrated VAR allows one to analyse the relationship between the financial variables and the *level* of the exchange rate, shows the short-run adjustment processes of these relationships and highlights the important feedback dynamics between the variables. Indeed, as will be seen below, these feedback and reflexive mechanisms can lead to self-feeding and explosive processes. Importantly, in line with the open system ontology adopted in this dissertation, cointegration relations are not interpreted as long-run steady relations, but are seen merely as a statistical tool to analyse the relationship between the level of variables over time. These relationships, in turn, are interpreted as local and temporary closures depending on the specific context of the Brazilian Real's internationalisation process.

The chapter is divided into five sections. Section 2 presents a summary of the empirical literature on the relationship between exchange rates, short-term capital flows and returns on these capital flows. Section 3 shows the methodology adopted in this chapter. Section 4 presents the Brazilian case study and baseline model. Section 5 discusses the results and Section 6 concludes.

8.2. The Exchange Rate and Short-Term Capital Flows in Empirics

One of the first systematic attempts to test directly for the relationship between short-term capital flows and the nominal exchange rate is Brooks, Edison et al. (2001), who, using simple unidirectional regression analysis in first differences, find that equity flows, in contrast to traditional bond flows, have acquired increased importance in driving the exchange rate of the US Dollar to the Euro and the Yen. Hau and Rey (2004; 2007) consider the potentially dynamic relationship between the exchange rate and short-term capital flows. The authors develop an equilibrium model in which exchange rates, stock prices and equity flows are jointly determined under incomplete foreign exchange risk trading. Several conjectures about the feedback effects between these variables are tested using the impulse response functions and variance decomposition of a VAR process. In line with their theoretical model, the authors find that shocks in equity flows lead to currency appreciation, while current exchange rate appreciation

leads to equity outflows.¹⁶⁸ In addition, the authors find that equity flow shocks and relative equity return shocks explain 10-20% of the exchange rate variance, which is considered very high given the poor performance of macroeconomic fundamentals to explain exchange rate volatility.

Very similar results are derived by Chai-Anant and Ho (2008), who, primarily using VAR analysis, find that while currency returns matter relatively little for net equity purchases, net purchases (sales) are significantly associated with near-term currency appreciations (depreciations). The paper which probably comes closest in its empirical strategy to this work is Siourounis (2004). Similar to Hau and Rey and Chai-Anant and Ho, Siourounis uses a VAR approach and its corresponding impulse response functions and variance decomposition to investigate the dynamic relationship between the exchange rate and capital flows. Going beyond these works, however, he also includes short-term debt flows and interest rates in the system to investigate which flows are important for exchange rate movements. His results confirm the importance of equity flows. For the UK, Germany and Switzerland, a positive shock to net purchases of U.S. equities leads to a significant appreciation of the US\$ against these currencies that lasts between 10-17 months. Net purchases of U.S. bonds in contrast are immaterial for exchange rate movements.

The VAR methodology used by many of these papers allows one to take account of the important feedback effects between the exchange rate, short-term capital flows and returns on these flows. In addition, it acknowledges the changing realities and creative power of economic agents and conducts explorative and explanatory analysis instead of testing deductively derived hypothesis (Juselius and Ordóñez 2009:4). However, although it acknowledges the determining role of short-term capital flows for the exchange rate, the above literature continues to consider it a short-run phenomenon which temporarily affects exchange rate *returns* (for authors who explicitly make this argument see e.g. Froot and Ramadorai (2002)). This dissertation, in turn, argues that short-term capital flows and their respective return indicators have medium to long-term effects on the *level* of the currency. In addition, the above literature focuses on the

¹⁶⁸ The latter result is in line with their “uncovered equity parity condition”, which states that higher returns in the home equity market (in local currency) are associated with home currency depreciation. Similar criticisms as to UIP presented in Chapter 2 apply. In addition, the chapter shows that the authors’ contentions do not hold for the Brazilian case.

contemporaneous relationship between the exchange rate, capital flows and return indicators. In the Post Keynesian framework adopted in this dissertation *expected* returns on short-term capital flows, rather than actual returns, will be the important determinant of exchange rate movements.

As discussed above, analysing the relationship between nominal exchange rate movements and (short-term) capital flows, this chapter also comes close to the order flow literature. Chapter 2 showed that several authors find a cointegration relationship between the level of the exchange rate and order flows (Killeen, Lyons et al. 2006; Love and Payne 2008). Insofar as these flows are divided into commercial and financial investors, they can also give interesting insights into the important role of short-term financial flows (Gradojevic and Neeley 2008). However, there is no necessary correspondence between order flows and the balance of payments flows considered in this chapter. This correspondence only holds if the order flows under consideration are flows from clients engaged in international transactions. This excludes, for example, foreign exchange operations by domestic financial clients for purely “speculative” reasons or offshore operations which are not hedged onshore. The correspondence could be considered closer in DEC countries with smaller financial and foreign exchange markets and a higher proportion of (foreign) short-term capital flows. However, order flow data are hardly available for these countries. In addition, while order flow data might allow one to distinguish between commercial and financial flows, no distinction between different types of financial flows, such as bond and equities, is possible.

The potential effect of short-term capital flows on the exchange rate is also considered in the literature on the determinants of the real effective exchange rate. For example, analysing the effect of different types of capital flows on the exchange rate, Athukorala and Rajapatirana (2003) and Bakardzhieva, Naceur et al. (2010) find that, among all types of capital flows, short-term capital flows have the strongest appreciating effect on the exchange rate. Again, these papers focus primarily on exchange rate returns, rather than its level.

The notion that short-term capital flows can have an influence on the level of the exchange rate is, at least implicitly, acknowledged in papers in the tradition of the equilibrium approach to exchange rates. In this literature, sustained deviations from

equilibrium values are often interpreted as resulting from destabilizing short-term capital flows (e.g. Faruquee 1994; Williamson 1994; MacDonald 1997; Clark and MacDonald 1998). However, this relationship between the exchange rate and short-term capital flows is not explicitly tested for. In addition, in contrast to what would be argued in a Post Keynesian framework, the exchange rate is ultimately expected to return to its equilibrium level dictated by real underlying fundamentals.

Exceptions are Elbadawi and Soto (1994), Carrera and Restout (2008) and Combes, Kinda et al. (2010), who include short-term capital flows explicitly in the long-run relationship with the real exchange rate (the former using single equation cointegration analysis the latter two using panel cointegration methods). While, Elbadawi and Soto and Carrera and Restout do not find robust effects between these variables for Latin America and Chile respectively, Combes, Kinda et al. show for a wide sample of 42 developing countries that short-term capital flows have a strong effect on the level of the real exchange rate. Although focusing on the real effective rather than the nominal exchange rate these papers are close in spirit to this dissertation.¹⁶⁹ However, none of the papers consider the important feedback effects between the exchange rate and short-term capital flows. In addition, these papers do not explicitly incorporate (expected) financial returns in their model or differentiate short-term capital flows into debt and equity flows. Finally, on a more general level, although empirically very interesting, the theoretical basis of these papers is not entirely clear. Indeed, without further explanations, it seems theoretically questionable to incorporate short-term capital flows as determinants of the equilibrium level of the real exchange rate in a framework which attempts to assess a “long-run” or sustainable exchange rate level.

¹⁶⁹ Given its emphasis on investors’ portfolio decisions this chapter focuses on the nominal exchange rate of the Brazilian Real to the US Dollar. Due to slow adjustment in goods prices and large nominal exchange rate movements, one can observe a relatively close co-movement between the nominal and real exchange rate in Brazil. Indeed, all results presented in this chapter have also been estimated with the real exchange rate and have been nearly identical. To fully gauge the effect of short-term capital flows on Brazil’s economy, real effective exchange rates will also be used in future research. In addition, the time period considered in these models is generally longer than in this chapter. This is largely due to data reasons, as the focus in this work is on the nominal exchange rate in the floating exchange rate regime in Brazil. In addition, the concept of a long-run value has to be seen critically from a Post Keynesian perspective (Carvalho 1984-1985; Harvey 2001). Moreover, even “medium-run” effects can have detrimental and long-lasting effects on the productive structure of an economy.

8.3. Econometric Methodology

The most common framework used to examine multiple cointegration vectors in a single country context is the Cointegrated Vector Autoregressios (VAR) model which allows one to combine short-run and long-run information in the data by exploiting the cointegration property.

The unrestricted VAR model of order k with p endogenous variables is given by

$$(8.1) \quad x_t = \Pi_1 x_{t-1} + \dots + \Pi_k x_{t-k} + \phi D_t + \varepsilon_t$$

Where x_t is a vector of the p variables at time t , Π are $p \times p$ matrices of parameters with $i=1, \dots, k$, D_t is a vector of deterministic components with a vector of coefficients ϕ , and ε_t is a $p \times 1$ vector of errors. We assume that the errors are identically and independently distributed and follow a Gaussian distribution, $\varepsilon_t \sim \text{iid} N_p(0, \Omega)$, where Ω denotes the variance-covariance matrix of errors.

The unrestricted VAR model can be given different parameterizations without imposing any binding restrictions on the model parameters, i.e. without changing the value of the likelihood function. The so-called vector equilibrium correction model (VECM) gives a convenient reformulation of the basic VAR model in terms of differences, lagged differences, and levels of the process.

$$(8.2) \quad \Delta x_t = \Pi x_{t-1} + \Gamma_1 \Delta x_{t-1} + \dots + \Gamma_{k-1} \Delta x_{t-k+1} + \phi D_t + \varepsilon_t$$

Where $\Pi = -(I - \Pi_1 - \dots - \Pi_k)$ and $\Gamma_i = -\sum_{j=i+1}^k \Pi_j$. The VECM representation significantly reduces the multicollinearity effects which are typically strongly present in time series data. More importantly, its interpretation is more intuitive than the VAR model as the coefficients can naturally be classified into short-run and long-run effects, where all the information about the long-run effects are summarized in the levels matrix (Π) (Juselius 2006).

Within the VAR model, the cointegration hypothesis can be formulated as a reduced rank restriction on the Π matrix. If all the variables are stationary, Π is a full rank matrix and a normal VAR can be estimated. If all the variables are non-stationary of the same order and not cointegrated, $\Pi = 0$ and a VAR in first differences is appropriate. If the variables are non-stationary but a linear combination of them is stationary, i.e. they are cointegrated with r cointegrating vectors, then Π has rank r . Then we can write the model as

$$(8.3) \quad \Delta x_t = \alpha \beta' x_{t-1} + \Gamma_1 \Delta x_{t-1} + \dots + \Gamma_{k-1} \Delta x_{t-k+1} + \mu_0 + \mu_1 t + \phi D_t + \varepsilon_t$$

Where $\beta' x_{t-1}$ is an $r \times 1$ vector of stationary cointegration relations and α is a $p \times r$ matrix of “adjustment” coefficients which measures how deviations from these cointegration relations feed back in to changes of the variables. μ_0 and μ_1 are deterministic components in the form of a constant and a trend defined as $\mu_0 = \alpha \beta_0 + \gamma_0$ and $\mu_1 = \alpha \beta_1 + \gamma_1$ respectively. If there is cointegration, some of the α must be non-zero, there must be some feedback on x_t to keep them from diverging.

If there are r cointegrating vectors and Π has rank r , it will have r non-zero eigenvalues. Johansen (1988) provides a way of estimating these eigenvalues and two tests for determining the cointegration rank: the trace and the maximum eigenvalue test. The trace statistic tests the null hypothesis of r cointegration relations against the alternative of k cointegrating relations, where k is the number of endogenous variables, for $r=0,1,\dots,k-1$. For the null hypothesis of r cointegrating relations it is computed as:

$$(8.4) \quad LR_{tr}(r | k) = -T \sum_{i=r+1}^k \log(1 - \lambda_i)$$

Where λ_i is the i -th largest eigenvalue of the Π matrix.

The maximum eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative of $r+1$ cointegrating relations. This test statistic is computed as

$$(8.5) \quad LR_{max}(r | r + 1) = -T \log(1 - \lambda_{r+1}) \\ = LR_{tr}(r | k) - LR_{tr}(r + 1 | k)$$

For $r=0,1,\dots,k-1$.

The critical values of these tests will fundamentally depend on the deterministic components included in the model. Five possible cases are discussed in Juselius (2006:99) and shall not be repeated here in detail. In practice, three different specifications are of relevance: a constant term restricted to the co-integration space ($\mu_1 = 0; \gamma_0 = 0; \text{but } \beta_0 \neq 0$), in which case, there are no linear trends in the data; an unrestricted constant resulting in a non-zero mean in the co-integration relationship and a linear trend in the data ($\mu_1 = 0, \text{ i. e. } (\beta_1, \gamma_1) = 0$); an unrestricted constant and a restricted trend, resulting in a trend in both the co-integration relationship and the levels of the series ($\gamma_1 = 0, \text{ but } (\gamma_0, \beta_0, \beta_1) \neq 0$).

However, the cointegrating relations suffer from an identification problem. Since $\Pi = \alpha\beta = (\alpha P^{-1})(P\beta) = \tilde{\alpha}\tilde{\beta}$ the α and β are not uniquely determined. There is always a non-singular $r \times r$ matrix P such that $\alpha\beta$ and the new estimates $\tilde{\alpha}\tilde{\beta}$ are observationally equivalent, though they might have different economic interpretations. This requires r^2 restrictions, r on each cointegrating vector. One of the restrictions is normally given by normalization, the others require prior economic assumptions based on the broad economic relationships assumed in the research.

Two stationary variables which form a cointegration relation are driven by one common shock, or stochastic/common trend. More generally, it holds that if there are $r < p$ cointegrating vectors, then x_t will also be determined by $p-r$ stochastic trends. The effect of these common trends can be represented by the moving average representation, which in its simplest form (ignoring all deterministic components) can be represented as:

$$(8.6) \quad x_t = C \sum_{i=1}^t \varepsilon_i + C^*(L)\varepsilon_t + \tilde{X}_0 + \text{deterministic components}$$

Where $C = \beta_{\perp}(\alpha' \Gamma \beta_{\perp})^{-1} \alpha'_{\perp} = \tilde{\beta}_{\perp} \alpha'_{\perp}$ and α_{\perp} and β_{\perp} are the $p \times p-r$ orthogonal complements of α , β , describing the common stochastic trends, $\alpha'_{\perp} \sum_{i=1}^t \varepsilon_i$, and their loadings, $\tilde{\beta}_{\perp}$. \tilde{X}_0 contains both the initial values, x_0 , of the process x_t and the initial

values of the short-run dynamics $C^*(L)\varepsilon_0$. The MA representation shows that x_t can be described by stochastic trends $C \sum_{i=1}^t \varepsilon_i$, stationary stochastic components $C^*(L)\varepsilon_t$, and initial values. Thus, while the cointegration relations show the stationary relationships towards which the system is pulled, the MA representation illustrates how the variables move in a non-stationary manner described by the common driving trends $\alpha'_{\perp} \sum_{i=1}^t \varepsilon_i$, i.e. the pushing forces of the system.

8.4. Data and Baseline Model

The cointegrated VAR model aims at uncovering relations between variables and extracting as much information as possible from the data based on broadly defined theoretical relations (Juselius 2006). Six variables are considered in this chapter. The nominal exchange rate e_t , expressed as the Brazilian Real over the US\$; expected stock prices sp_t^e ; the expected interest rate i_t^e ; short-term capital flows to the equity market ef_t and debt market df_t and finally the inflation rate Δp_t .

$$x_t' = [e_t, sp_t^e, i_t^e, ef_t, df_t, \Delta p_t]$$

The inflation rate has been included in the system for two reasons. Firstly, to allow for the possibility of a nominal to real transformation in the presence of near I(2) series (Juselius 2006).¹⁷⁰ Secondly, the inclusion of the inflation rate could allow for some interesting insights into the effect of “traditional” fundamentals on the exchange rate (and indeed the other variables included in the system).

The exchange rate is assumed to stand in a relationship with equity flows, debt flows, expected stock prices and the expected interest rate.

$$(8.7) \quad e_t = f(ef_t, df_t, sp_t^e, i_t^e)$$

¹⁷⁰ A nominal to real transformation allows converting a series which is almost I(2) into an I(1) series. Several studies in the literature show that the price level often approximates an I(2) series, potentially making the inflation rate I(1) (e.g. Juselius 1991; Johansen 1992; Johansen, Juselius et al. 2007). These studies also find that in certain cases the nominal exchange rate could approximate an I(2) series.

where $f_{e,ef}, f_{e,df}, f_{e,sp^e} < 0, f_{e,i^e} </> 0$. Thus, an increase in short-term portfolio flows is expected to appreciate the exchange rate as a result of the increased demand for the domestic currency. An increase in expected stock prices also appreciates the exchange rates as market participants expect future flows and thus more exchange rate appreciation. The sign on the expected interest variable is more ambiguous. On the one hand, higher expected interest rates indicate increased debt flows and thus exchange rate appreciation. On the other hand, higher expected interest rates might reflect increased economic uncertainty and thus current exchange rate depreciation.¹⁷¹

Equity flows are assumed to form a negative relationship with the exchange rate and a positive relation with expected stock prices.

$$(8.8) \quad ef_t = f(e_t, sp_t^e)$$

$f_{ef,e} < 0, f_{ef,sp^e} > 0$. As the exchange rate appreciates, equity flows increase due to higher domestic currency returns.¹⁷² Similarly, an increase in expected stock prices attracts more equity flows.

Similarly, the debt flow variable is assumed to stand in a negative relationship with the exchange rate as higher domestic currency returns attract more flows.

$$(8.9) \quad df_t = f(e_t, i_t^e)$$

$f_{df,e} < 0, f_{df,i^e} </> 0$. The relation to expected interest rates is again ambiguous: on the one hand, higher interest rates indicate higher returns and thus attract flows. On the other hand, higher expected interest rates could relate to debt outflows if authorities try to stabilize currency demand with higher interest rates.

¹⁷¹This empirically indeterminate relationship between the exchange rate and the interest rate was also reflected in the different interpretations of CIP by Post Keynesian authors discussed in Chapter 3. This dissertation has argued that this is ultimately an empirical question and (theoretically) depends on whether the liquidity premium is stable (improving) or deteriorating.

¹⁷²This is opposed to the sign expected by Hau and Rey (2004) and reflects the different theoretical approach adopted in this chapter.

Expected stock prices are supposed to be in a positive relationship with equity flows and a negative relation with the exchange rate.

$$(8.10) \quad sp_t^e = f(ef_t, e_t)$$

$f_{sp^e, e} < 0$, $f_{sp^e, ef} > 0$. A current rise in equity flows increases stock prices. Given assumed momentum in expectation formation, expected stock prices will also increase. As an appreciating exchange rate is assumed to increase equity flows, the exchange rate stands in a negative relationship with expected stock prices.

Expected interest rates are supposed to stand in a negative relation with the debt flow variable and a positive relation with the exchange rate.

$$(8.11) \quad i_t^e = f(df_t, e_t)$$

$f_{i^e, df} < 0$, $f_{i^e, e} > 0$. Rising debt flows lead to a fall in current interest rates and given assumed momentum also in expected rates. This is also reflected in the positive relation with the exchange rate: as the exchange rate appreciates debt flows increase which leads to an expected fall in domestic interest rates.

Finally, the inflation rate is assumed to stand in a positive relationship with the exchange rate. As the exchange rate increases so does inflation and vice versa.

$$(8.12) \quad \Delta p_t = f(e_t)$$

where $f_{\Delta p_t, e} > 0$.

No a priori theoretical relationships are assumed between the other variables.

This dissertation has further held that in addition to expectations about short-term financial returns, capital gains on the exchange rate itself are an important element of portfolio decisions. These can be influenced by psychological phenomena resulting in, for example, herding, momentum or simple feedback trading. In an initial specification,

exchange rate expectations from survey data were included in the cointegration space. Given the close co-movement of this variable with the actual exchange rate this resulted in strong multicollinearity. The inclusion of the expectations variable in the short-run structure was not significant. As a result, in this chapter, psychological phenomena have been approximated with the lagged return of the exchange rate in the short-run structure. An interesting element of future research will be to include deviations of the actual from the expected exchange rate in the cointegration system and analyse the variables' adjustment dynamics to this variable.

The exchange rate is the log nominal exchange rate to the US\$. Expected stock prices have been measured by the log of the settlement price of the futures of the main stock market index (Ibovespa) traded on the BM&FBovespa.¹⁷³ The expected interest rate has been approximated by the 360 day Pre-DI Swap rate, where Pre is the fixed rate and DI is the floating rate. The DI is the average one day interbank deposit rate, known as the CDI or overnight DI rate. The annualized rate has been linearly transformed to monthly values. The capital flow variables have been calculated as the first difference of the log of the accumulated equity and debt flows registered in the balance of payments. As discussed in the introduction, these short-term capital flows also represent an approximation of the first manifestation of the internationalisation of the Brazilian Real. While equity flows are inherently in domestic currency, it has been shown in Chapter 4 that nowadays the majority of Brazilian bonds issued domestically are denominated in domestic currency.¹⁷⁴ Finally, the Brazilian inflation rate was calculated as the first difference of the log of the country's most commonly used consumer price index (IPCA). All variables are monthly and, if applicable, end of month values have been chosen.

The model is estimated from January 2003 to September 2009. Despite having to work with a relatively short sample, the choice of this data period was based on two considerations. Firstly, an estimation of the entire floating period ranging from the beginning of 1999 to September 2009 resulted in models characterised by strong

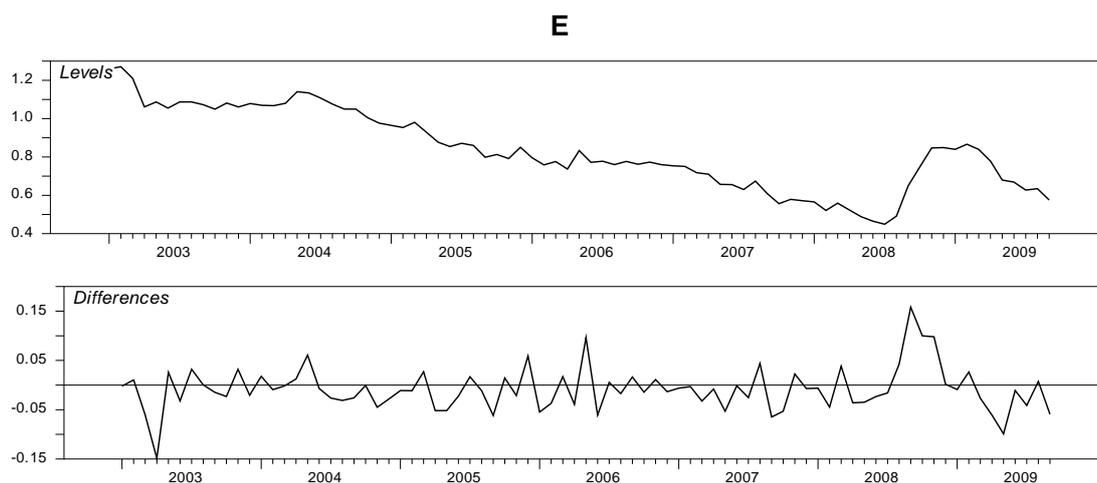
¹⁷³ The Ibovespa consists of 54 public and private securities, weighted by their daily trading volume.

¹⁷⁴ Balance of payments flows do not take account of Brazilian assets traded on offshore markets. This is particularly important for Brazilian equities traded offshore, so-called ADRs (American Depositary Receipts). Although decreasing, the majority of Brazilian bonds issued internationally is still denominated in foreign currency. Overall one could argue that the inclusion of offshore purchases of domestic currency assets would only strengthen the results derived from balance of payments data.

autocorrelation and non-normality.¹⁷⁵ Secondly, it was in the beginning of 2003 that Brazil became increasingly integrated in international financial markets and a new cycle of international liquidity started. January 2003 is thus considered a structural break in the Brazilian economy justifying estimation from this date.¹⁷⁶

Figures 8.1 to 8.6 show the level and first difference of the six series under consideration. Although the cointegrated VAR analysis does not require an initial pretesting of the order of integration of the variables a preliminary analysis of their time series properties to uncover structural breaks and outlier is important to derive a well specified model for further cointegration analysis. Appendix 4 also gives a detailed description of the series' residuals in the basic unrestricted VAR (2) model.¹⁷⁷

Figure 8.1: Level and First Difference of the Nominal Exchange Rate



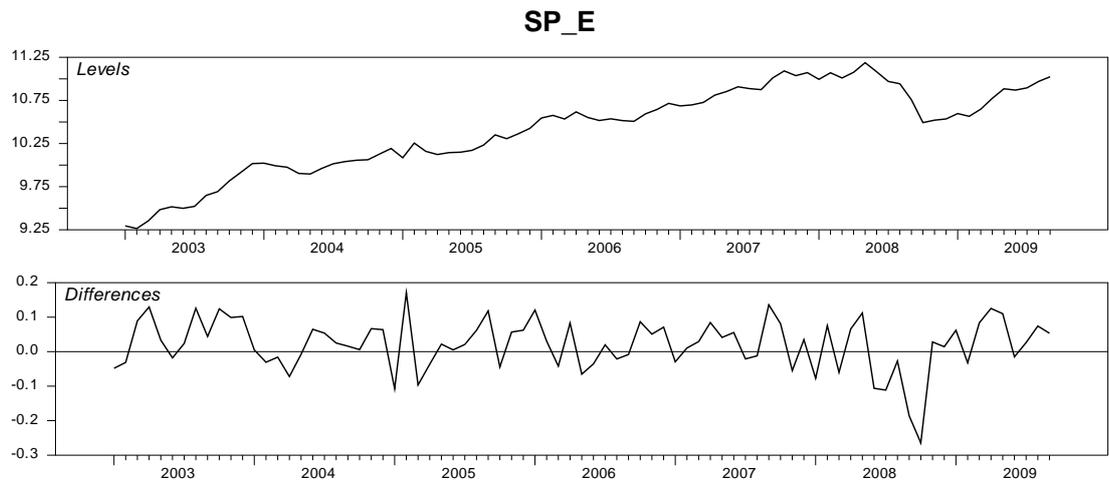
Source: Ipeadata

¹⁷⁵This non-normality and autocorrelation primarily stemmed from strong exchange rate and interest volatility in the wake of Brazil's 2002 crisis.

¹⁷⁶In a similar vein, October 2009 when the Brazilian government started to implement increased capital regulation measures could be seen as such a structural break. Future research will extend the sample beyond this date to analyse whether these capital regulation measures indeed changed the relationship between short-term capital flows and the exchange rate.

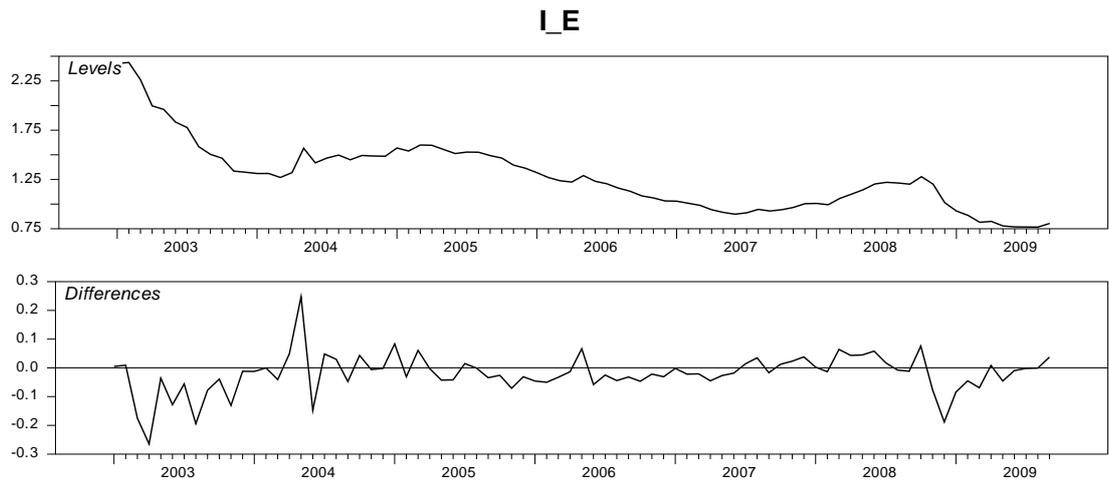
¹⁷⁷Two lags were chosen to derive the most parsimonious model which controls for residual autocorrelation.

Figure 8.2: Level and First Difference of Expected Stock Market Prices



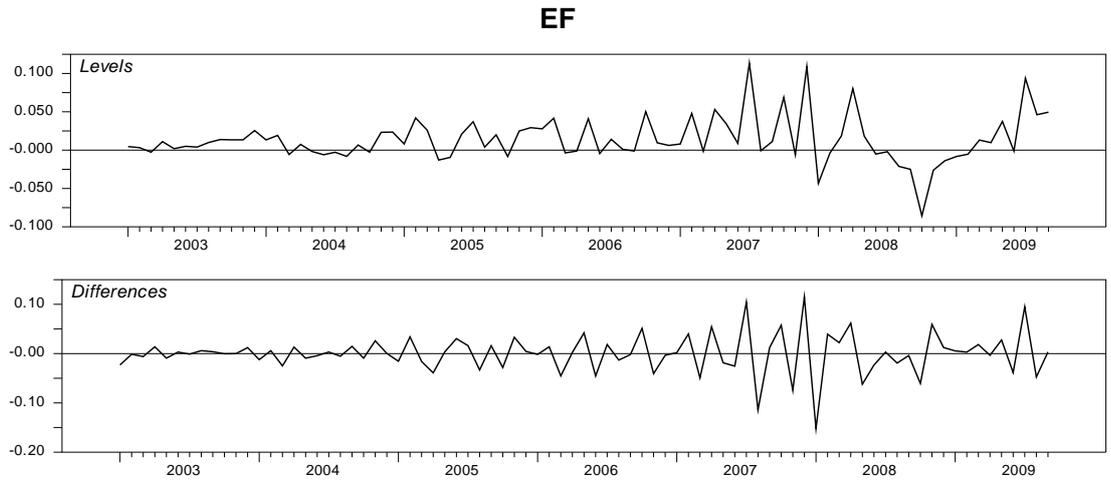
Source: Ipeadata

Figure 8.3: Level and First Difference of the Expected Interest Rate



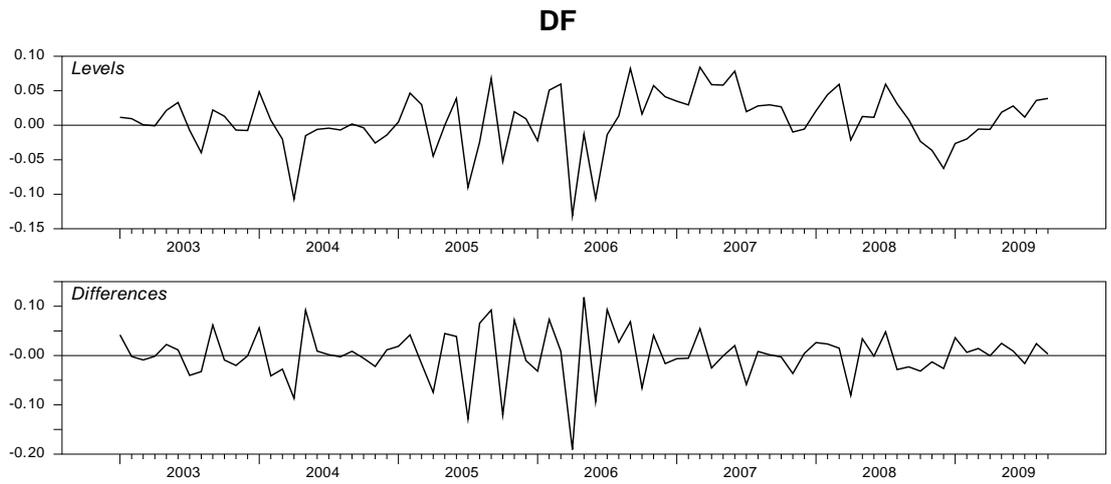
Source: Ipeadata

Figure 8.4: Level and First Difference of Equity Flows



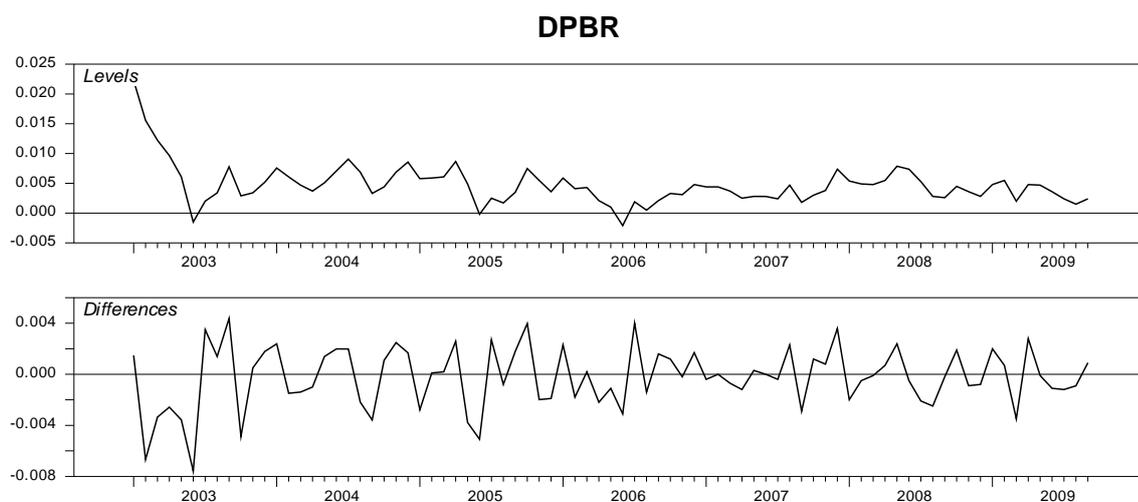
Source: BCB (2009c)

Figure 8.5: Level and First Difference of Debt Flows



Source: BCB (2009c)

Figure 8.6: Level and First Difference of the Inflation Rate



Source: Ipeadata

The exchange rate appreciates strongly until September 2008 and then depreciates sharply in the international financial crisis. This leads to a considerable spike in the first difference of the series at this time and excess kurtosis. Although the currency started to appreciate soon afterwards again, there seems to be a temporary level shift in the series and considerable volatility over the crisis period. While the exchange rate level looks non-stationary, the first difference seems to approximate a stationary series relatively well, which seems to point to an I(1) series.

Similar to the exchange rate series, the expected stock market index shows a sustained appreciation period, interrupted by the international market turmoil in 2008. The adjustment in the stock market index seems to occur slightly before the exchange rate, around May/June 2008. Although showing some stronger and slightly persistent movements towards the end of the sample, the first difference of expected stock prices also seems to be relatively random around the mean, pointing to an I(1) series.

The expected interest rate shows some long swings falling until the beginning of 2004, rising until mid 2005 and then declining again until mid 2007, when the international financial crisis burst in developed financial markets. One can observe a few outliers in the series at the beginning of 2004. In addition, the series is characterised by some degree of persistence in the first difference, which could point to an I(2) series. Tests on

the individual series and the model, however, indicated that the expected interest rate can be considered I(1).

One can observe the sustained increase in equity and debt flows to Brazil and the sharp drop these capital flows experienced in the international financial crisis. Similar to expected stock prices, in the international financial crisis short-term capital flows started to adjust slightly earlier than the exchange rate, around June 2008. In addition, equity flows experienced some idiosyncratic volatility at the end of 2007, debt flows in July 2005 and April 2006. Both series show some persistence in their levels and good stationary properties in the first difference, pointing to I(1) series.¹⁷⁸ Finally, Brazilian consumer price inflation looks relatively stable over the period under consideration. There seems to be some persistence in the level of the series, with little in the first difference.

In order to control for above discussed breaks and outliers in the series, deterministic components are included in the model. Details and misspecification tests on the final baseline model are presented in Table 8.1. It is important to note, however, that these deterministic components were mainly included to account for any deviations from the basic assumptions of residual independence, heteroscedasticity and normality, and did not change the basic results of the cointegration analysis significantly.

¹⁷⁸ The observation that capital flows are non-stationary is interesting in itself, as it points to the important persistence in the series. This shows that capital flows are not random but possibly characterized by some feedback trading in mean and/or volatility of the series.

Table 8.1: Deterministic Components and Misspecification Tests

Deterministic Components				
Date	Variable (s)	Empirical Phenomenon	Dummy	Economic Calendar
2004:05	I_E	Non-cumulative blip	Transitory	International Financial Turmoil
2006:04	DF	Cumulative blip	Permanent	International Financial Turmoil
2005:07	DF	Non-cumulative blip	Transitory	International Financial Turmoil
2007:12	EF	Non-cumulative blip	Transitory	International Financial Crisis
2008:09	E/SP_E/EF	Cumulative blip	Permanent	International Financial Crisis
Whole Period	All Variables	Seasonality	Centred Seasonal Dummies	
Date		Empirical Phenomenon	Deterministic Component	Economic Calendar
Whole Period	All Variables	No trend in Data or CI	Constant	
2008:06	SP_E/EF/DF/I_E	Level Break	Permanent	International Financial Crisis
Misspecification Tests of Baseline Model				
		Chi-Sq(df)	Test-Statistic	P-Value
	Residual Autocorrelation-LM(1)	36	42.80	0.202
	Residual Autocorrelation-LM(2)	36	38.30	0.356
	Normality - LM	12	14.62	0.263
	ARCH-LM(1)	441	384.56	0.975
	ARCH-LM(2)	882	880.01	0.513

Notes: Permanent dummies are defined as $dum0y:mp$ which are 1 in $200y:m$, 0 otherwise; transitory dummies are defined as $dum0y:m$ which are 1 in $200y:m$, -1 in $200y:m+1$ and 0 otherwise, where y stands for year and m for month; the inclusion of a restricted level shift implies a permanent dummy in the unrestricted model

Most outliers and breaks were modelled with transitory and permanent dummies. The large break in expected equity prices and capital flows in May/June 2008 seemed to have affected the cointegration relations and has thus been modelled with a level shift restricted to the cointegration space. Given that most variables adjusted in September 2008, this effect cancelled out in the cointegration relations and could be modelled with a permanent unrestricted dummy.¹⁷⁹ Appendix 5 shows the cointegration relations.

¹⁷⁹The restricted level shift was chosen for June rather than May 2008 as this seemed to model the data better. The inclusion of a level shift in June 2008 and a permanent dummy in September 2008 was also supported by misspecification tests and the significance of the variables throughout further estimations.

In addition, an inspection of the series shows that none of the series exhibits a clear linear trend. Arguably, the exchange rate and stock market series could be characterized by a broken trend, however, the included constant was not significant consistently. Thus, the constant was restricted to the cointegration space, which implies no trend in the series. Given that there is no trend in the data, none can exist in the cointegration relations.

8.5. Cointegration and Identification

Once the model has been correctly specified, the unrestricted VAR can be tested for the co-integration rank. The co-integration rank divides the data into r cointegration relations towards which the process is adjusting and $p-r$ stochastic trends which are pushing the process (Juselius 2006).

The choice of rank r of the system has been based on the small sample adjusted trace test, the characteristic roots of the companion matrix (where the rank of matrix Π is chosen such that the largest unrestricted root is far from the unit circle), and the t -values of the α_i , $i=1, \dots, p$, the adjustment coefficients. In the trace test, critical values have been bootstrapped to account for the deterministic components. Small sample adjusted critical values are applied. Summarized results are presented in Table 8.2.

Table 8.2: Cointegration Tests

Small Sample Adjusted Trace Test						
Stat\R	0	1	2	3	4	5
Eig.Value	0.655	0.436	0.334	0.286	0.245	0.070
Trace*	188.578	113.617	75.853	48.128	23.780	5.298
P-Value*	0.000	0.000	0.003	0.010	0.071	0.491
Largest Unrestricted Characteristic Root						
R\Roots	1	2	3	4	5	6
r=0	1.000	1.000	1.000	1.000	1.000	1.000
r=1	1.000	1.000	1.000	1.000	1.000	0.649
r=2	1.000	1.000	1.000	1.000	0.646	-0.529
r=3	1.000	1.000	1.000	0.729	0.729	-0.496
r=4	1.000	1.000	0.83	0.756	0.756	-0.473
r=5	1.000	0.796	0.735	0.735	0.627	-0.019
r=6	0.946	0.767	0.767	0.749	0.585	-0.026
T-values of α Coefficients						
Var\T-Stat	α_1	α_2	α_3	α_4	α_5	α_6
E	-4.716	1.830	1.526	-0.814	0.696	2.040
SP_e	0.892	-0.642	3.137	1.073	-0.782	-2.013
I_e	0.279	1.650	0.703	-4.094	2.398	1.061
EF	-7.269	-2.935	-0.593	-0.171	1.240	-1.614
DF	-1.470	-1.283	0.729	-3.160	-3.992	-0.223
ΔP	-0.544	7.504	0.681	-0.714	-0.695	-0.413

Notes: Values of t-statistics above 2.6 are in bold; *indicates small sample critical values

The rank test seems to indicate either four or five cointegration relations. The null hypothesis of a rank of 4 is rejected with a p-value of 0.071. The roots of the companion matrix point to 5 cointegration relations: imposing one unit root the next unrestricted root is 0.796. In addition, at least one of the alpha coefficients of the first five cointegration relations has a t-statistic above 3.5, supporting the conclusion of five possible cointegration relations and one stochastic trend in the model.¹⁸⁰ This choice of rank is also supported by parameter constancy tests, presented in Appendix 6, which point to a very stable system. In particular the trace statistic strongly confirms the existence of five cointegration relations.¹⁸¹

As discussed in the theoretical section, the cointegration relations and stochastic trends embedded in the Π matrix are not economically identified, which requires restrictions

¹⁸⁰ Under the null hypothesis of non-stationarity the test statistic follows a Dickey-Fuller Distribution with critical values around 3.5.

¹⁸¹ Imposing a rank of 4 did not significantly change the final identified structure. However, a rank of 4 did not allow separating the long-run equations for the interest rate and debt flow variable, which would have suppressed the interesting relationship for the debt flow variable with the exchange rate.

on the α and β coefficients. In the case of non-stationary data two identification problems have to be considered: identification of the long-run structure (the co-integration relations) and identification of the short-run structure. While the former is about imposing long-run economic structure on the unrestricted co-integration relations, the latter is about imposing short-run dynamic adjustment structure on the equations of the process (Juselius 2006). The following section focuses on the identification of a suitable long-run structure. Based on such identified long-run relations, the short-term adjustment parameters are statistically and economically identified in a second step.

The long-run Structure

The identification of the long-run structure is guided by the underlying theoretical framework and the significance of parameters in the Π and α matrix.¹⁸² In addition, testable hypotheses on β , the cointegration relations, and α , the adjustment parameters, to identify pulling and pushing forces of the system can be used to derive a fully identified system.

The t-statistics of the alpha coefficients presented in table 8.2 show that the exchange rate and equity flows significantly adjust to the first relation, while the second and third relation seems to describe a long run equation for the inflation rate and expected equity prices respectively. Finally, the fourth and the fifth relation seem to describe dynamics in the expected interest rate and debt flow variable.

The unrestricted reduced rank estimates of $\Pi = \alpha\beta'$ are reported in Table 8.3.

¹⁸²The Π matrix can be thought of as the reduced form that any identified structure has to replicate in order to pass the test of over-identifying restrictions.

Table 8.3: II-Matrix for $r=5$

	E	SP_e	I_e	EF	DF	ΔP	C(2008:06)
ΔE	-0.182 (-2.209)	-0.117 (-2.260)	-0.079 (-1.952)	-0.712 (-3.362)	0.034 (0.225)	-3.758 (-1.604)	-0.013 (-1.558)
ΔSP_e	-0.372 (-2.265)	-0.263 (-2.545)	-0.162 (-2.009)	0.728 (1.726)	-0.274 (-0.919)	4.751 (1.018)	-0.007 (-0.413)
ΔI_e	0.154 (1.271)	0.071 (0.926)	-0.076 (-1.271)	0.118 (0.380)	-0.176 (-0.796)	0.600 (0.174)	-0.040 (-3.187)
ΔEF	-0.227 (-4.198)	-0.120 (-3.534)	-0.082 (-3.100)	-1.040 (-7.504)	0.030 (0.304)	2.621 (1.709)	-0.017 (-2.972)
ΔDF	-0.159 (-2.286)	-0.067 (-1.538)	-0.050 (-1.475)	-0.058 (-0.322)	-0.649 (-5.130)	2.684 (1.357)	-0.011 (-1.494)
$\Delta \Delta P$	0.011 (2.797)	0.006 (2.208)	0.005 (2.682)	0.017 (1.648)	0.008 (1.130)	-0.757 (-6.652)	0.001 (2.630)

Notes: Dependent variables are presented in the first column in first differences; p-values in parenthesis; numbers in bold are significant at a critical value of 1.96

The first row of Table 8.3 describes the equation for the exchange rate, which confirms the relationship between the exchange rate and equity flows. The exchange rate also co-moves with expected stock prices and - though to a lesser extent - the expected interest rate. As assumed, the relationships are negative: as expected returns or equity flows increase the exchange rate appreciates.

The second row describes the relationship for expected stock prices, which adjust negatively to the exchange rate and expected interest rates. Although not very significant, expected stock prices have a positive relationship with equity flows. The expected interest rate variable presented in row 3 seems to have very little relation with the other variables in the system as only the level break is significant for this series.

More interesting is the equation for equity flows in row 4. Supporting the evidence of a bi-directional relationship between the exchange rate and equity flows, these short-term capital flows adjust strongly (and negatively) to movements in the exchange rate. Equity flows also adjust negatively to the expected return indicators. This, however, seems to be a result of the negative relationship between the exchange rate and expected return indicators. Similar to the expected interest rate, the debt flow variable presented in row 5 shows little relation with the other variables of the system, except with the exchange rate. As assumed, the relationship is negative: as the exchange rate appreciates debt flows increase (and vice versa). Finally, the inflation rate co-moves positively with the exchange rate and the expected return indicators.

In sum, the Π matrix seems to indicate long-run relations for the exchange rate, expected equity prices, equity flows and inflation. Expected interest rates and debt flows, in turn, seem to be relatively exogenous to the system. These results are broadly confirmed by formal tests on the β and α coefficients presented in Table 8.4. While tests on β focus on the cointegration relations, tests on α are closely linked with hypotheses about the common driving trends of the system.

Table 8.4: Tests on β and α

	E	SP_e	I_e	EF	DF	ΔP
Variable Exclusion Test						
Chi-SQ (4)	24.971	22.58	17.121	52.926	5.014	21.644
	[0.000]	[0.000]	[0.002]	[0.000]	[0.286]	[0.000]
Chi-SQ (5)	33.294	35.388	33.495	66.682	21.038	37.808
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]
Test of Stationarity						
Chi-SQ (4)	13.723	9.806	4.276	13.327	7.715	2.466
	[0.001]	[0.007]	[0.118]	[0.001]	[0.021]	[0.291]
Chi-SQ (5)	11.473	7.717	2.122	11.368	3.64	2.405
	[0.001]	[0.005]	[0.145]	[0.001]	[0.056]	[0.121]
Testing a zero row in α (weak exogeneity)						
Chi-SQ (4)	21.202	7.700	4.361	38.522	3.587	22.284
	[0.000]	[0.103]	[0.359]	[0.000]	[0.465]	[0.000]
Chi-SQ (5)	21.987	9.536	17.429	42.219	19.907	37.877
	[0.001]	[0.090]	[0.004]	[0.000]	[0.001]	[0.000]
Testing a unit vector in α (pure adjustment)						
Chi-SQ (4)	6.659	1.137	1.720	9.252	2.915	3.880
	[0.036]	[0.566]	[0.423]	[0.010]	[0.233]	[0.144]
Chi-SQ (5)	6.576	1.017	0.239	6.950	0.001	3.414
	[0.010]	[0.313]	[0.625]	[0.008]	[0.973]	[0.065]

Notes: *p-values in parenthesis*

A formal variable exclusion test rejects the hypothesis that any of the variables can be excluded from the cointegration space. Tests of stationarity, however, show that at rank 5 (and indeed also at rank 4) the expected interest rate is stationary around a constant mean and level shift in 2008. This could explain why the interest rate variable should not be excluded from the cointegration space despite its lack of relation with the other variables of the system. The same applies for the inflation rate, which is stationary from rank 2 onwards and the debt flow variable, which is borderline stationary at rank 5.

Testing restrictions on the α coefficients help identify the pushing and pulling forces of the system. The test of a zero row in α is the equivalent of testing whether a variable can be considered weakly exogenous for the long-run parameters, thus whether the cumulated sum of the empirical shocks to this variable define the common driving trend. The test of a unit vector in α defines a variable which is exclusively adjusting and whose shocks have no permanent effects on the system. According to Table 8.4 at rank 5 none of the variables can be clearly considered weakly exogenous. Expected stock prices are borderline. If one considers the system also at rank 4, expected stock prices, expected interest rates and debt flows seem to be exogenous to the system. The results on the unit vector on alpha are more clear-cut: at rank 5 the exchange rate, equity flows and the inflation rate can be considered endogenous, while the unit vector in alpha cannot be rejected for expected stock prices, interest rates and the debt flows. Thus, while the exchange rate, equity flows, and inflation seem to be the pulling (adjusting) forces of the system, shocks to the expected stock prices, interest rate and debt flows push (determine) it.

Based on these insights and the theoretical assumptions about the relations between the variables, the below long-run structure of cointegration relations has been derived. The structure is generically and empirically identified as defined in Johansen and Juselius (1994) and was accepted based on a p-value of 0.567.

Table 8.5: An Identified Long-Run Structure

	E	SP_e	I_e	EF	DF	ΔP	C(2008:06)	Constant
β ₁	0.057 (5.206)			1.000 (NA)			0.008 (1.966)	-0.057 (-5.980)
α ₁	-0.697 (-3.339)			-1.031 (-7.459)				
β ₂	1.000 (NA)	0.712 (20.991)	0.366 (8.810)					-8.752 (-21.962)
α ₂	-0.171 (-2.318)	-0.359 (-2.444)		-0.176 (-3.613)		0.009 (2.398)		
β ₃		0.001 (2.216)				1.000 (NA)		-0.017 (-2.901)
α ₃						-0.758 (-6.636)		
β ₄	0.069 (2.537)				1.000 (.NA)			-0.064 (-2.783)
α ₄					-0.637 (-5.091)			
β ₅			1.000 (NA)				0.452 (4.877)	-1.201 (-19.351)
α ₅			-0.089 (-3.350)			0.002 (2.489)		

Notes: *t*-statistics in parenthesis

The *first relation* describes the co-movement between the level of the exchange rate and equity flows.

$$(8.13) \quad ef_t = 0.057 - 0.057e_t - 0.008dums_{0809t}$$

(5.98) (5.21) (1.96)

As expected the relationship is negative: exchange rate depreciation leads to capital outflows and vice versa. Although only marginally significant the level break improves the stationarity properties of the model considerably. Given, that adjustment to this cointegration relation seems to be stronger for the equity than the exchange rate variable, normalisation on the former has been chosen.

The *second* cointegration relation describes the co-movement between the exchange rate and the two expected return indicators.

$$(8.14) \quad e_t = 8.752 - 0.712sp_t^e - 0.366i_t^e$$

(21.96) (20.99) (8.81)

As already indicated above, the relationship is negative implying that an increase in expected stock prices and the expected interest rate leads to a current exchange rate appreciation (and vice versa, as the exchange rate depreciates expected stock prices and the interest rate decline). This acts as strong support to the importance of expectations and return variables for the medium term level of the exchange rate. In line with the importance of equity flows for the Brazilian Real uncovered in Chapter 7, the effect of expected stock prices is stronger than that of the expected interest rate. Given the significant adjustment of the exchange rate to this relation and the fact that the exchange rate had been identified as pulling factor of the system, the equation has been normalized on this variable.

The *third relation* is an equation for the domestic inflation rate. As discussed above, the inflation rate is stationary around a constant mean, but also seems to adjust to the exchange rate, the expected interest rate and expected stock prices. Only the latter had a significant effect on the inflation rate and was thus included in the cointegration relation.

$$(8.15) \quad \Delta p_t = 0.017 - 0.001sp_t^e$$

(2.90) (2.22)

The co-movement is negative, albeit with a relatively small coefficient: as expected stock prices increase, inflation declines. Although inconsistent with economic theory, this result is in line with the recent empirical dynamics in Brazil. While the inflation targeting regime has successfully reduced consumer prices, asset prices have been on a continuous increase.

Relation 4 shows an equation for the debt flow variable. Although borderline stationary by itself, the addition of the exchange rate variable to the debt flow equation, as indicated by the parameters of the Π matrix, makes this relationship significantly more stable.

$$(8.16) \quad df_t = 0.064 - 0.069e_t$$

(2.78) (2.54)

The debt flow variable adjusts strongly to this relationship and the coefficient on the exchange rate is slightly higher than in the cointegration relation with equity flows. As expected, the relationship is negative: as the exchange rate appreciates debt flows increase and vice versa. In contrast to its relationship with the equity flow variable, however, the exchange rate does not adjust significantly to this relationship.

Finally, *relation 5* confirms the result that the expected interest rate is stationary around a constant mean and level shift in June 2008.

$$(8.17) \quad i_t^e = 1.201 - 0.452dums_{0809t}$$

(19.35) (4.87)

Parameter constancy tests (a selection of which are shown in Appendix 6) confirm the stability of the restrictions imposed on the long-run structure of the model.

The Moving Average Representation

Expected stock prices, the expected interest rate and debt flows have been identified as the pushing forces of the system. In order to derive a notion of how shocks to these variables affect the system, the moving average (MA) representation of the system with 4 cointegration relations is presented in Table 8.6.¹⁸³ The results reported are derived under the “joint unit vector in α ” restriction of the exchange rate, equity flows and the inflation rate, explaining the zero columns of the shocks to these variables in the C matrix.

¹⁸³As discussed above, the existence of cointegration relations and common trends is two sides of the same coin. By incorporating the fifth cointegration relation for the debt variable in the system this work has “endogenized” the debt variable and thus reduced the number of common trends to one. However, in order to derive a notion of how shocks to expected stock prices, the debt flow variable, and the expected interest rate – which were identified as the pushing forces of the system - affect the system, the MA representation of the system with 4 cointegration relations has been presented.

Table 8.6: Moving Average Representation at $r=4$

	ε_e	ε_{sp_e}	ε_{i_e}	ε_{ef}	ε_{df}	$\varepsilon_{\Delta p}$
α_{o1}	0.000	0.976	-0.220	0.000	0.000	0.000
α_{o2}	0.000	-0.015	-0.068	0.000	0.998	0.000
The long-run impact Matrix C						
E	0.000 (0.000)	-0.731 (-3.275)	0.149 (0.575)	0.000 (0.000)	0.227 (0.951)	0.000 (0.000)
SP_e	0.000 (0.000)	1.369 (3.228)	-0.305 (-0.621)	0.000 (0.000)	-0.054 (-0.118)	0.000 (0.000)
I_e	0.000 (0.000)	-0.513 (-2.182)	0.193 (0.711)	0.000 (0.000)	-1.086 (-4.319)	0.000 (0.000)
EF	0.000 (0.000)	0.036 (2.331)	-0.013 (-0.716)	0.000 (0.000)	0.065 (3.952)	0.000 (0.000)
DF	0.000 (0.000)	0.087 (0.889)	-0.067 (-0.597)	0.000 (0.000)	0.669 (6.402)	0.000 (0.000)
ΔP	0.000 (0.000)	-0.003 (-2.788)	0.000 (0.217)	0.000 (0.000)	0.005 (4.936)	0.000 (0.000)

Notes: *t*-statistics in parenthesis; coefficients significant at 1.96 level in bold

One can observe that the first common stochastic trend $\hat{\alpha}'_{0.1} \sum \varepsilon_i$ is approximately measured by the shocks to expected stock prices and the expected interest rate, however, with a much stronger impact from expected stock prices. In other words, shocks to expected stock prices have been pushing the system. Its long-run impact on the variables of the system appears from the ε_{sp_e} column of the C matrix. Confirming results from the cointegration relations, a positive shock to expected stock prices has a significant negative long-run impact on the exchange rate, the expected interest rate and inflation. It positively affects itself and the equity flow variable.

There is strong evidence that the second stochastic trend $\hat{\alpha}'_{0.2} \sum \varepsilon_i$ consists of the cumulated empirical shocks to the debt flow variable. This shock, shown in the ε_{df} column, has a very strong negative long-run impact on the expected interest rate variable. It positively affects itself, equity flows and the inflation rate. Thus, in contrast to equity flows which have a strong unit vector, debt flows seem to be relatively exogenous to the system driven by considerations other than domestic return indicators.

The short-run Structure

The above discussion focused on the identification of the long-structure of the model, i.e. the β s of the Π matrix. The conditions for generic identification, however, also apply to the short-run structure. While the cointegration relations are identified as r long-run simultaneous relationships between p variables, the short-run structure consist of p equations, between p current variables, Δx_t , $p(k-1)$ lagged (predetermined) variables, Δx_{t-1} , $i=1, \dots, k-1$ and r lagged (predetermined) equilibrium errors, $(\beta^c)'x_{t-1}$. Thus, the cointegrated VAR model allows for the possibility that the observed change in a variable results from (1) an equilibrium correction towards a sustainable long-run equilibrium state (the adjustment coefficient α), (2) a temporary reaction to previous and current changes in the basic behavioural variables and/or (3) extraordinary events (captured by the dummies). While identification of the long-run structure requires at least $r-1$ restrictions on each relation, identification of the simultaneous short-run structure of the p equations requires a minimum of $p-1$ restrictions. This is facilitated by the existence of the lagged variables, which implies that if the short-run model does not include current effects, it is exactly identified and any additional restrictions on the lagged values will be over-identifying (Juselius 2006).

While macroeconomic theory is usually quite informative about prior economic hypotheses relevant for the long-run structure, much less seems to be known about the mechanisms underlying the short-run structure. Thus, the identification of the short-run structure often aims at the “identification” of a parsimonious parameterization, by removing insignificant coefficients, rather than testing well specified economic hypotheses. Although less precise in terms of an underlying theoretical model, this makes it far more flexible in terms of actual macroeconomic behaviour.

Table 8.7 shows the over-identified short-term structure for the identified long-run model and the covariance matrix. Panel 1 presents the model with no current effects; panel 2 incorporates such. Given that they are not essential for our theoretical framework, the dummies have not been included in the results table. The structures were accepted with a p-value of 0.8881 and 0.8779 respectively.

Table 8.7: An Identified Short-Run Structure

	Without Current Effects (Panel 1)						With Current Effects (Panel 2)					
	ΔE	ΔSP_e	ΔI_e	ΔEF	ΔDF	$\Delta \Delta P$	ΔE	ΔSP_e	ΔI_e	ΔEF	ΔDF	$\Delta \Delta P$
ecm1(-1)	-0.735 (0.002)	0.872 (0.018)		-0.937 (0.000)		0.018 (0.024)	-1.231 (0.000)			-0.905 (0.000)		0.018 (0.018)
ecm2(-1)	-0.219 (0.000)	-0.201 (0.038)		-0.139 (0.001)		0.005 (0.063)	-0.301 (0.000)	-0.442 (0.000)		-0.130 (0.003)		0.018 (0.056)
ecm3(-1)						-0.521 (0.000)						-0.522 (0.000)
ecm4(-1)					-0.646 (0.000)						-0.648 (0.000)	
ecm5(-1)	-0.042 (0.001)		-0.096 (0.000)					-0.043 (0.033)	-0.092 (0.000)			
$\Delta E(-1)$					-0.310 (0.000)							-0.307 (0.000)
$\Delta SP_e(-1)$	-0.165 (0.003)	0.188 (0.078)		0.220 (0.000)						0.206 (0.000)		
$\Delta I_e(-1)$			0.270 (0.002)	0.189 (0.000)					0.320 (0.000)	0.168 (0.002)		
$\Delta EF(-1)$	0.555 (0.000)	-0.774 (0.002)					0.538 (0.000)					
$\Delta DF(-1)$												
$\Delta \Delta P(-1)$		-5.975 (0.018)							-5.679 (0.025)			
ΔE									-1.078 (0.000)			
ΔI_e							0.468 (0.000)					
ΔEF									-0.382 (0.044)			
Correlation of Structural Residuals												
ΔE	0.035	-0.677	0.581	-0.451	-0.120	0.154	0.027	0.084	-0.201	-0.013	-0.060	-0.043
ΔSP_e	-0.677	0.069	-0.506	0.464	0.188	0.090	0.084	0.052	-0.249	0.285	0.159	0.236
ΔI_e	0.581	-0.506	0.052	-0.285	-0.081	0.180	-0.201	-0.249	0.052	-0.291	-0.079	0.181
ΔEF	-0.451	0.464	-0.285	0.023	0.088	-0.287	-0.013	0.285	-0.291	0.023	0.090	-0.285
ΔDF	-0.120	0.188	-0.081	0.088	0.030	0.018	-0.060	0.159	-0.079	0.090	0.030	0.017
$\Delta \Delta P$	0.154	0.090	0.180	-0.287	0.018	0.002	-0.043	0.236	0.181	-0.285	0.017	0.002
Cointegration Relations												
ecm1	deq=0.057-0.057e-0.008dum											
ecm2	e=8.752-0.712fubov-0.366s360											
ecm3	dpbr=0.017-0.001fubov											
ecm4	ddeb=0.064-0.069e											
ecm5	s360=1.201-0.452dum											

Notes: *p*-values in parenthesis

Primary interest lies in the coefficients on the five equilibrium errors, ecm1(-1) to ecm5(-1), which indicate the mechanisms that have pulled the system back to “steady-state” after it has been pushed away by the exogenous shocks. To organise the discussion, emphasis will be placed on the exchange rate and its relationship with the other variables of the system. A first analysis will concentrate on the results with no current effects.

One can observe the strong adjustment of the exchange rate to deviations from the first and second long-run relations, i.e. its relation with the equity flows and the expected financial returns. Equity flows and expected stock prices also adjust to these two relations (although expected stock prices are not equilibrium adjusting to the first relation). This underlines the presence of important feedback effects between the

exchange rate, equity flows and expected stock prices, whose dynamics reinforce and exacerbate each other. These “reflexive” relationships, however, could potentially give rise to destabilizing bubble dynamics.

The importance of equity flows and expected stock prices for the Brazilian Real is also reflected in the lagged values of the first differences. In line with previous results, past changes in expected stock prices have a negative effect on the current exchange rate. Interestingly, the effect of past changes in equity flows on the exchange rate is positive: an increase in equity flows over the previous month leads to current exchange rate depreciation. This result is particularly interesting in the context of the international financial crisis. As discussed in Chapter 4 and confirmed by the semi-structured interviews in Chapter 7, it was exactly the large increase in short-term capital flows to Brazil before the international financial crisis, which led to the large exchange rate depreciation during the crisis.¹⁸⁴ Although the exchange rate also adjusts to the fifth cointegration relation, constituted by the expected interest rate, this effect disappears once current effects are considered. Similarly, no evidence of momentum or herding, approximated by the first lag of the differenced exchange rate series, could be discovered.

Some evidence of herding can be observed in expected stock prices, which adjust positively to its past values. Expected stock prices also adjust negatively to changes in the inflation rate which supports the evidence of a negative long-run relation between the two variables. As expected, past expectations of future stock price increases lead to a rise in equity flows. Interestingly, this also seems to apply to changing expectations about future interest rates.

The result that debt flows and especially expected interest rates could be treated as near weakly exogenous to the system is also supported by the short-term parameters: the expected interest rate only adjusts to its own cointegration relation and past values. The short-term parameters, however, confirm the important role the exchange rate has in determining debt flows. Not only does the debt flow variable strongly adjust to

¹⁸⁴This effect of large changes in past capital flows is also visible in the expected stock price variable: as past equity flows increased, current expectations about future equity prices declined.

deviations from its medium-run relation with the exchange rate, past exchange rate changes also have a strong negative effect on current changes in debt flows.

The VAR model is a reduced form model in the short-run dynamics in the sense that potentially important current (simultaneous) effects are not explicitly modelled but are left in the residuals.¹⁸⁵ Large off-diagonal elements in the covariance matrix Ω can be a signal of significant current effects between the system variables. And indeed, one can observe relatively strong negative correlation between the exchange rate and expected stock prices and equity flows (-0.677 and -0.451 respectively) and relatively strong positive correlation between the exchange rate and the expected interest rate (0.581). There is also some significant correlation between the expected interest rate and expected stock prices and equity flows.

While a simplification search in the reduced form VAR model is relatively straightforward, this is generally not the case when the current effects measured by the covariance matrix Ω are part of the identification process. An attempt of such identification, imposing general restrictions on the short-run structure and ideally reducing the serial correlation, is based on Juselius' "conditioning" rule. In simple terms, this rule involves the incorporation of significant residual correlation coefficients as current effects in the equation system. To do so, identifying restrictions are imposed on variables which significantly determine the two correlated variables (for details see Juselius 2006, Chapter 13). In our case, Δe was included in Δsp_e restricting the 2008:09 dummy in the sp_e equation to 0; Δi_e was included in the Δe equation, restricting $\Delta i_e(-1)$ to 0. Finally, Δdf was included in the Δe equation while simultaneously restricting $\Delta sp_e(-1)$ to 0. The choice of explanatory/dependent variable was based on the variable's significance and its effect on the correlation matrix. The results are presented in Table 8.7, Panel 2.

The adjustment coefficients to the equilibrium relations are not invariant to transformations of the short-term structure. The exchange rate ceases to adjust to the

¹⁸⁵ Simultaneous effects can be the result of either data aggregation, the incorrect instrumentalisation of expectations or, in the worst case, the result of omitted variables. The last point makes it hard to argue that the residuals could possibly be a measure of autonomous errors (structural shocks) and requires the identification of such simultaneous effects. Only if residuals of a short-run structural model are approximately uncorrelated these residuals can be interpreted as autonomous errors (Juselius 2006).

interest rate relationship in the transformed model, while expected stock prices now have a significant and negative adjustment coefficient with this relation. On the other hand, expected stock prices cease to adjust significantly to the medium term relation between the exchange rate and equity flows. All other adjustment coefficients remain the same with relatively unchanged values (with exception to the exchange rates' adjustment to the first cointegration relation which has increased substantially).

In addition, the current effects broadly confirm the results of the long and short-run structure. The exchange rate has a negative contemporaneous relationship with equity flows. Thus, while past equity flows lead to a depreciating exchange rate, current equity flows appreciate the exchange rate. One can also observe the contemporaneous negative effect of exchange rates on expected stock prices: as the current exchange rate depreciates, stock prices are expected to fall. Finally, the exchange rate positively adjusts to expected interest rate changes. The correlation structure of the residuals indicates that the inclusion of contemporary effects in the model successfully reduced the correlation coefficients between the variables.

8.6. Conclusions

In accordance with Post Keynesian writings on exchange rate determination, this dissertation has argued that short-term financial flows have a strong and medium term effect on the exchange rate. In contrast to what is argued in mainstream economics, short-term financial flows do not only have temporary effects on exchange rate *returns*, but permanently affect the *level* of the exchange rate. In addition, Post Keynesian economic thought stresses the creative and autonomous role of expectations: if short-term financial flows are a medium term driver of the exchange rate level, so should be the *expected* (rather than contemporaneous as advocated in mainstream theory) returns on these flows. Finally, Post Keynesian theory highlights the important dynamic and reflexive relationship between the exchange rate and its “fundamentals”, which can lead to self-feeding and explosive processes.

In this chapter, these hypotheses were econometrically tested in the context of the Brazilian foreign exchange market using the co-integrated VAR model (VECM)

proposed by Johansen and Juselius. Particular emphasis was on foreign flows into domestic currency denominated assets recorded in the balance of payments and the returns on these assets. As such this chapter also represented an empirical investigation into the first manifestation of the Brazilian Real's internationalisation.

The use of the VECM model was considered appropriate for several reasons: Firstly, cointegration analysis allows taking into consideration important information about the co-movement between the *levels* of the series, rather than merely their returns. Importantly, however, rather than a long-run steady state relationship between (two or more) variables, this dissertation interprets the existence of a cointegration relation as temporary closure at the empirical level dependent on a specific context and time under consideration. Secondly, the VAR methodology lets "the data speak" within broadly assumed relationships between the variables which puts the emphasis on explorative and explanatory data analysis rather than "closed system" hypothesis testing. Finally, and closely linked to this, the VAR methodology allows uncovering interesting feedback effects and dynamic relationships between the variables as it does not impose a priori causalities.

The results supported the significant role of short-term capital flows and expected asset prices for the level of the Brazilian Real in the context of currency internationalisation. In general, the results showed that in line with the qualitative results presented in the previous chapter, equity flows are very important for exchange rate dynamics in Brazil standing in a dynamic medium-run relationship with the Brazilian Real. This dynamic relationship, however, could give rise to self-feeding and "explosive" processes as an appreciating exchange rate attracts equity inflows, which in turn appreciate the exchange rate and attract further equity flows (and the possible opposite in the times of financial crisis). Equity flows have also been found significant for the return in the Brazilian Real. Debt flows, on the other hand, seemed to have little effect on the exchange rate, however, were strongly influenced by exchange rate developments themselves (while expected interest rates seem to have little effect on debt flows). Finally, the important role of *expected* financial variables for the medium run exchange rate level were proven by a cointegration relation between the exchange rate and the expected interest rate and equity prices towards which the exchange rate adjusted significantly.

Chapter 9: The Brazilian Real as an International Asset Class

9.1. Introduction

In Chapter 7, this dissertation probed into the expectation formation of actors in short-term financial and currency markets. It aimed to explore the underlying mechanisms and structures and their empirical manifestations which shape actors' expectations and currency positions in the context of currency internationalisation. Results pointed to the key role of short-term returns, liquidity preference and financial structure for agents' expectations. These factors manifested themselves on the empirical level through the importance of short-term interest rates (the carry), the S&P, other liquid internationally traded currencies, and - to a certain extent - commodity prices. In this sense, the qualitative results also confirmed the important internationalisation process of the Brazilian Real highlighted in this dissertation.

Following on from these findings, this chapter has two objectives. Firstly, it aims to present an empirical investigation into the second manifestation of the internationalisation of the Brazilian Real, i.e. the rise in foreign flows into the domestic currency as an asset class per se. Secondly, it intends to econometrically triangulate the insights into the underlying mechanisms and their empirical manifestations, as important drivers of the Brazilian Real in the context of currency internationalisation, derived from the semi-structured interviews.¹⁸⁶

This chapter conducts two related econometric studies. Firstly, to investigate the second manifestation of the internationalisation of the Brazilian Real, it investigates the co-movement between the Brazilian Real and other internationally traded currencies highlighted in the qualitative part of this study. It analyses both the co-movement in

¹⁸⁶ The focus on price implications rather than actual flow data to investigate the second manifestation of the Brazilian Real is partly motivated by data reasons. As highlighted in Chapter 4, an increasing share of operations in the Brazilian Real is conducted on offshore OTC markets for which data are not available. An empirical investigation into the relation between the Brazilian Real and foreign positions in US\$ futures in the BM&FBovespa, as the main domestic market of speculative Real operations, will be subject of future research. This data issues notwithstanding, to assess the broader implications of currency internationalisation, e.g. for exchange rate management, an identification of the main exchange rate drivers in this context is considered crucial.

levels, using single-equation and multivariate cointegration analysis, and the co-movement in returns and volatilities using multivariate generalized autoregressive conditional heteroscedasticity (GARCH) models. Results show that despite different regions and macroeconomic configurations all currencies have shown increased co-movement pointing to one potential common driver: international market conditions. As indicated by the semi-structured interviews, the co-movement for the Brazilian Real is particularly strong with the Australian Dollar, one of the most liquid and widest traded carry and commodity currencies. Indeed, results show that the Brazilian Real and the Australian Dollar have formed a cointegration relation since the second quarter of 2005, which, according to Kühl (2008), could be interpreted to mean that international investors have considered these two currencies similar asset classes since then.

The second econometric study is an exploration of the implications this internationalisation process has had for exchange rate dynamics. More specifically, it investigates the theoretical hypothesis, and indeed the empirical result presented in Chapter 7, that the Brazilian Real has become increasingly determined by short-term returns and international liquidity preference (risk aversion). To this end, the empirical manifestations uncovered in the qualitative study are included in the mean equations of the multivariate GARCH models. To derive first insights into the importance of financial structure, particularly the role of foreign investors' funding in international financial markets, two further indicators of international risk aversion and funding conditions, the VIX and TED spread, are included in the mean equations of the multivariate GARCH models.¹⁸⁷

The rest of this chapter is divided into four sections. Section 2 gives a short overview of the literature, which was used to motivate the empirical strategy adopted in this chapter. Section 3 shows the exact methodology adopted. Section 4 presents the data and results and Section 5 concludes.

¹⁸⁷ The role of financial structure, both in the form of a country's international investment position and its more "short-term" indicator of positioning, will be investigated in more detail in future research. Very often these indicators are in a different frequency than the daily data considered in this chapter. In addition, as discussed in Chapter 7, the empirical manifestations of positioning are incomplete and only partially available.

9.2. Currency Internationalisation in the Empirical Literature

The integration of DEC's currencies into international financial markets is a very new phenomenon, which has been subject to few systematic empirical studies. Several authors discuss the potential implications currency internationalisation can have for exchange rate movements, including large and sudden depreciations and increased vulnerability to external shocks (Genberg 2009; Kenen 2009; Park 2010). However, to this author's knowledge, no econometric analysis has so far been conducted to examine the internationalisation of DEC's currencies and the implications this internationalisation has had for exchange rate dynamics.

Given the lack of empirical research on currency internationalisation in DEC's, this chapter -informed and complemented by the qualitative results - draws on two related strands of empirical literature to econometrically investigate the internationalisation of the Brazilian Real.

The first strand of literature examined is that of the financialisation of commodity markets, which shows that a rising integration in international financial markets leads to increased sensitivity to international market conditions and greater co-movements of diverse assets despite different structural underlying characteristics (e.g. Pindyck and Rotemberg 1990; Kyle and Xiong 2001; Büyükşahin and Robe 2010; Silvennoinen and Thorp 2010; Tang and Xiong 2010). For example, Kyle and Xiong (2001) argue that if different financial assets are all held by a growing number of investors with similar portfolios, the set of common state variables increases. This raises correlation between asset classes since bad news becomes more likely to force liquidation of asset holdings in several markets at the same time. In this vein, Tang and Xiong (2010) and Silvennoinen and Thorp (2010) find, using single regression analysis and multivariate GARCH models, an increased co-movement between commodities and equity prices.¹⁸⁸ In addition, Silvennoinen and Thorp (2010) show that these correlations depend on international market conditions and rise in the times of international financial crisis. This result is also consistent with Franke, Gonzalez-Hermosillo et al. (2008) and Franke

¹⁸⁸ This is in contrast to Büyükşahin and Robe (2010), Chong and Miffre (2010) and Gorton and Rouwenhorst (2004), who find a negative correlation between commodities and equity prices, which supports the traditional argument of diversification gains from investing in commodities.

(2009), who show, using multivariate GARCH models, how liquidity shocks in the US led to an increased co-movement among (seemingly unrelated) asset classes. Finally, and closely related to the above arguments, Pindyck and Rotemberg (1990), Tang and Xiong (2009) and Silvennoinen and Thorp (2010) hold that if commodity futures are considered a unified international asset class by investors, rather than individual securities, one will observe increasing co-movement between apparently unrelated commodities. The authors show that this has indeed been the case over recent years.

With regards to the second strand of literature, this dissertation has defined currency internationalisation as the increased foreign investment in short-term domestic currency denominated financial assets. As such, it is closely related to, and indeed comprises, the recent carry trade phenomenon which has attracted considerable attention in the literature (Burnside, Eichenbaum et al. 2001; Burnside, Eichenbaum et al. 2006; McGuire and Tarashev 2006; Plantin and Shin 2006; Brunnermeier, Nagel et al. 2008; Chung and Jorda 2009; Hattori and Shin 2009; Jorda and Taylor 2009).¹⁸⁹ In its traditional definition, carry trade refers to the movement of capital across borders predominantly driven by interest rate differentials (Greenville 2010). More recent literature, reflecting changes in international financial markets, has adopted a more specific notion of carry trade as one form of short-term speculative (currency) trading (e.g. Galati, Heath et al. 2007; Cecchetti, Fender et al. 2010). In this literature, three characteristics define carry trade operations: firstly, their short-term nature; secondly, the significance of exchange rate movements as a return element; thirdly, the importance of the funding structure as investors borrow, mainly short-term, funds at a low interest rate in one currency (the funding currency) and buy a higher yielding currency asset in another currency (the target currency). The Japanese Yen, and more recently the US Dollar, have been the prime funding currencies. Target currencies include currencies with high real returns and sufficient liquidity, particularly the Australian and New Zealand Dollar and high yielding emerging market currencies such as the Turkish Lira, the South African Rand and indeed the Brazilian Real.

Several papers discuss the important implications carry trade activities can have for exchange rate dynamics. For example, several authors show that carry trade leads to

¹⁸⁹ Importantly, however, carry trade is only one manifestation of the wider process of currency internationalisation described in this dissertation.

peculiar price patterns, where target currencies are subject to prolonged periods of appreciation disrupted by shorter periods of sharp devaluations as carry traders unwind their positions (Brunnermeier, Nagel et al. 2008; La Marca 2008). While during the appreciation period volatility is very low, the depreciation period is characterised by high volatility, which, among other things, imparts skewness in exchange rate returns (Gagnon and Chaboud 2007). The occurrence of dramatic exchange rate movements as a result of carry trade activity is also pointed out by Cairns, Ho et al. (2007), Hui, Genberg et al. (2009) and McCauley and McGuire (2009). In addition, it is argued that these sudden and large exchange rate changes are largely unrelated to domestic economic conditions. In this vein, Brunnermeier, Nagel et al. (2008), for example, argue that carry trade currencies are subject to crash risk due to the unwinding of carry trade as speculators near their funding constraints.

In general, the literature on the price implications of carry trade activities indicates that exchange rate movements become increasingly determined by interest rate differentials and international market conditions, rather than underlying economic fundamentals (Nishigaki 2007; Brunnermeier, Nagel et al. 2008). For example, several authors show that currencies with similar financial characteristics, such as interest rates in Brunnermeier, Nagel et al. (2008) and/or short (long) positions of speculators as in Brunnermeier and Pedersen (2009), are characterised by increased co-movement, independent of underlying macroeconomic fundamentals. Finally, Gagnon and Chaboud (2007) argue that carry trade activities impart momentum or feedback trading in exchange rate returns due to the leveraged nature of these operations.

Thus, based on the literature presented above, this chapter applies two main strategies to empirically investigate the internationalisation of the Real and its implications for exchange rate dynamics. Firstly, it is argued that the increased trading of the Brazilian Real in international financial markets will lead to a rise in the co-movement with other internationally traded currencies, despite different macroeconomic characteristics and geographical regions. It is held that the co-movement will be particularly strong with currencies which have similar financial characteristics, i.e. a similar liquidity-return configuration. Secondly, it is argued that once a currency has become an internationally traded asset class, short-term returns and international market conditions become prime determinants of exchange rate movements. International market conditions, in turn,

comprise both international risk aversion (liquidity preference) and international funding conditions. The latter also measures the important role of financial structure, in the form of a large exposure to short-term foreign financial flows funded in international financial markets, for exchange rate dynamics.

9.3. Methodology

To explore the relationship between the currencies' level, cointegration analysis is used (Engle and Granger 1987; Johansen 1988; Juselius 2006). Following an argument by Granger (1986), the existence of a cointegration relation between two currencies has traditionally been used to test for weak form market efficiency (Hakkio and Rush 1989; Sephton and Larsen 1991; Baillie and Bollerslev 1994; Diebold, Gardeazabal et al. 1994). If markets are weakly efficient, prices should reflect all information available and should thus not be predictable conditional on all past values of the prices. This, however, excludes a cointegration relationship, which is equivalent to the existence of an error correction term (Campbell, Lo et al. 1997).

Following an argument made by Kühn (2008), who refers to papers by Dwyer Jr. and Wallace (1992), Baffes (1994) and Ferré and Hall (2002), this dissertation adopts a different interpretation of a cointegration relationship between two currencies. It is argued here that the existence of such a relationship indicates that financial market participants consider the two currencies similar asset classes. Resulting arbitrage operations will eliminate sustained deviations from the currencies' relative values against a base currency which causes a cointegration relationship. Moreover, the existence of a cointegration relationship reflects on sufficiently liberalized markets and liquidity of the currencies, such that these arbitrage operations are possible.¹⁹⁰

Several techniques are applied to test for cointegration between the Brazilian Real and other internationally traded currencies. First, single equation methods proposed by

¹⁹⁰ Another reason for a cointegration relation between two currencies could be the existence of a managed exchange rate regime where the central bank maintains the value of the two currencies within a certain band, e.g. as it was in the case of the European Monetary System (EMS). For example, Haug, McKinnon et al. (2000) find evidence of a common stochastic trend between the exchange rates which participated in the EMS before the introduction of the Euro. The possibility of central bank intervention, however, can be excluded for the currencies considered in this study.

Engle and Granger (EG) (1987) and Phillips and Ouliaris (PO) (1990) are applied. Then, GARCH adjusted Error Correction Models (ECMs) are estimated to model the feedback relationship between the variables and perform an additional test for cointegration. Finally, the multivariate method according to Johansen (1988) is used to test for robustness of the single cointegration methods and for cointegration in a system of currencies.

Single equation cointegration methods are based on the time series properties of the residual of a bivariate cointegration relation, such that

$$(9.1) \quad y_t \sim I(d) \quad \text{and} \quad x_t \sim I(d)$$

if $y_t = c + x_t + \varepsilon_t$ and $\varepsilon_t \sim I(p)$ where $p < d$

The EG and PO differ in their method of accounting for serial correlation in the residual series; while the EG test uses a parametric, augmented Dickey-Fuller (ADF) approach, the PO test uses the nonparametric Phillips-Perron (PP) methodology.

Following Engel and Granger (1987) if two variables are cointegrated they can be represented in an Error-Correction Model (ECM):

$$(9.2) \quad y_t = \alpha_1 + \sum_{i=1}^n \beta_{1i} \Delta y_{t-i} + \sum_{i=1}^n \gamma_{1i} \Delta x_{t-i} + \delta_1 \varepsilon_{y,t-1} + v_{y,t}$$

and

$$(9.3) \quad \Delta x_t = \alpha_2 + \sum_{i=1}^n \beta_{2i} \Delta x_{t-i} + \sum_{i=1}^n \gamma_{2i} \Delta y_{t-i} + \delta_2 \varepsilon_{x,t-1} + v_{x,t}$$

where $\varepsilon_{x,t-1}$ and $\varepsilon_{y,t-1}$ are the error correction terms which must be stationary if x_t and y_t are integrated of the order 1 and form a cointegration relationship (Engle and Granger 1987). The coefficients on lagged returns, γ_{1i} and γ_{2i} , represent the short-run elasticities of Δx_t and Δy_t with respect to Δy_t and Δx_t respectively (Ryoo and Smith 2004). The coefficients on the disequilibrium errors, δ_1 and δ_2 , measure the speed of adjustment of x_t and y_t to the error in the previous period. With cointegration, at least

one of the $\delta_i \neq 0$. Under the null hypothesis the distribution of the test statistic is non-standard and special critical values apply (Bannerjee, Dolado et al. 1998).

The robustness and efficiency of the cointegration tests based on the ECM will depend on whether the assumptions for the errors of no autocorrelation and no heteroscedasticity hold. While lags of the dependent variable aim to control for the problem of autocorrelation, modelling the volatility structure of the ECM as a simple GARCH process accounts for the time-varying volatility often found in higher frequency time series (Engle 1982; Bollerslev 1986; Engle and Bollerslev 1986; Bollerslev, Chou et al. 1992). Thus,

$$(9.4) \quad y_t = x_t' \theta + \epsilon_t$$

$$(9.5) \quad \sigma_t^2 = \omega + \alpha \epsilon_{t-1}^2 + \beta \sigma_{t-1}^2$$

Equation (9.4), the mean equation, is constituted by the ECM model. Equation (9.5), the conditional variance, is specified as a function of a constant ω , news about volatility from the previous period measured as the lag from the squared residual from the mean equation $\alpha \epsilon_{t-1}^2$ (the ARCH term), and last period's forecast variance $\beta \sigma_{t-1}^2$ (the GARCH term).

Cointegration analysis in a system of variables has been discussed in detail in Chapter 8. This chapter will thus place more emphasis on the methodology of multivariate GARCH models, which are used to analyse the co-movement between the returns and volatilities of the currencies under consideration.

Multivariate GARCH models have been proposed to study the volatilities and co-volatilities of several markets (Karolyi and Stulz 2002). Applications include tests for increased correlation between domestic and international financial markets as a result of financial liberalization (Karolyi 1995; Longin and Solnik 1995), for increased correlation of certain asset classes as a result of "financialisation" (Büyüksahin and Robe 2010; Chong and Miffre 2010; Silvennoinen and Thorp 2010), and for the existence of contagion as volatility from one market spills over to other markets

(Dungey, Fry et al. 2003; Beirne, Caporale et al. 2008; Franke, Gonzalez-Hermosillo et al. 2008; Marçal and Pereira 2008).

All three aspects are present in the study of the correlation pattern between the Brazilian Real and other currencies. An increased correlation of the Real with other internationally traded currencies signals rising financial liberalization and “financialisation” of the currency. In addition, it is expected that this correlation will be particularly high in times of market dislocation as portfolio adjustment leads to large synchronised movements in exchange rates.

Similar to univariate models, multivariate GARCH models are constituted by a mean equation and a structure for the volatilities. In many applications the mean equation is specified in a vector autoregressive (VAR) form, which enables the measurement of the effects of the changes in the mean currency returns of one series on its own lagged returns and those of the lagged returns of other markets (Worthington and Higgs 2004).

Thus, the following conditional expected return equation accommodates each market’s own return and the returns of other markets lagged one period.

$$(9.6) \quad r_t = \alpha + Ar_{t-1} + X + \varepsilon_t$$

Where r_t is an $n \times 1$ vector of daily returns at time t for each market and $\varepsilon_t | I_{t-1} \sim N(0, H_t)$. X is a vector of current or lagged external regressors as indicated by the model under consideration. The $n \times 1$ vector of random errors ε_t is the innovation for each market at time t with its corresponding $n \times n$ conditional variance-covariance matrix H_t . The market information available at time $t-1$ is represented by the information set I_{t-1} . The $n \times 1$ vector α represents long-term drift coefficients.

What remains to be specified is the conditional variance-covariance matrix H_t . In general terms, multivariate GARCH models face a trade-off between modelling the volatility structure as accurately as possible and finding a specification which is parsimonious enough to allow for relatively easy estimation of the model. In addition,

positive definiteness of the covariances has to be assured (Bauwens, Laurent et al. 2006; Silvennoinen and Teräsvirta 2008). Several methods have been proposed in the literature, two will be estimated here: the Baba-Engle-Kraft-Kroner (BEKK) model proposed by Engle and Kroner (1995) and the Dynamic Conditional Correlation (DCC) model introduced by Engle (2002). In the first method, the conditional covariance matrix H_t is modelled directly. The second method is built on the idea of modelling the conditional variances and correlations instead of straightforward modelling of the conditional covariance matrix. In a comparison of different multivariate GARCH models, Marçal and Pereira(2008) show that the best results in terms of information criteria were obtained by the DCC-Engle model followed by the BEKK model.

The BEKK model has the attractive property that the conditional covariance matrices are positive definite by construction. In addition, it builds in sufficient generality, allowing the conditional variances and covariances to influence each other without requiring the estimation of a large number of parameters (Karolyi 1995).¹⁹¹ However, given that the entire variance and covariance structure is considered, BEKK models incorporating more than a few variables can quickly become infeasible to estimate. For the bivariate case, Scherrer and Ribarits (2007) show that the BEKK parameterization is indeed the most general one. As a result of this, and given that this chapter's interest is primarily in the co-movement between the Brazilian Real and the other currencies, only bivariate BEKK models are estimated.

Following Engle and Kroner (1995) the BEKK parameterization of the conditional covariance matrix for a simple GARCH(1,1) can be written as:

$$(9.7) \quad H_t = C_0' C_0 + \sum_{k=1}^K A_{1k}' \varepsilon_{t-1} \varepsilon_{t-1}' A_{1k} + \sum_{k=1}^K G_{1k}' H_{t-1} G_{1k}$$

Where c_{ij} are elements of an $n \times n$ symmetric matrix C_0 , which is restricted to be upper triangular. The elements a_{ij} of the symmetric $n \times n$ matrix A_{1k} measure the degree of innovation from market i to market j , allowing for own market and cross market

¹⁹¹Marçal and Pereira (2008) present evidence of significant interdependencies in the volatilities. A diagonal BEKK would thus result in a considerable loss of information.

influences in conditional variances. The elements g_{ij} of the symmetric $n \times n$ matrix G_{1k} indicate the persistence in conditional volatility between market i and j . Summation limit K determines the generality of the process.

For a bivariate GARCH (1,1) with $K=1$, this can be written as

$$(9.8) H_t = C_0' C_0 + \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \varepsilon_{1t-1}^2 & \varepsilon_{1t-1} \varepsilon_{2t-1} \\ \varepsilon_{2t-1} \varepsilon_{1t-1} & \varepsilon_{2t-1}^2 \end{bmatrix} \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} + \begin{bmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \end{bmatrix} \begin{bmatrix} h_{1t-1} & h_{12t-1} \\ h_{21t-1} & h_{22t-1} \end{bmatrix} \begin{bmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \end{bmatrix}$$

Due to its matrix form, the parameters c_{ij} , a_{ij} and g_{ij} cannot be interpreted on an individual basis. Instead the functions of the parameters which form the intercept terms and the multivariate ARCH and GARCH effects are of interest (Tsay 2001).

Equation (9.9) to (9.11) solve for the cross effects in the variance equations implied by the BEKK specification (Kasch-Haroutounian and Price 2001).

$$(9.9) h_{1t} = c_{01} + a_{11}^2 \varepsilon_{1t-1}^2 + 2a_{11} a_{21} \varepsilon_{1t-1} \varepsilon_{2t-1} + a_{21}^2 \varepsilon_{2t-1}^2 + g_{11}^2 h_{1t-1} + 2g_{11} g_{21} h_{12t-1} + g_{21}^2 h_{22t-1}$$

$$(9.10) h_{12t} = c_{02} + a_{11} a_{12} \varepsilon_{1t-1}^2 + (a_{21} a_{12} + a_{11} a_{22}) \varepsilon_{1t-1} \varepsilon_{2t-1} + a_{21} a_{22} \varepsilon_{2t-1}^2 + g_{11} g_{12} h_{1t-1}^2 + (g_{21} g_{12} + g_{11} g_{22}) h_{12t-1} + g_{21} g_{22} h_{22t-1}^2$$

$$(9.11) h_{22t} = c_{03} + a_{12}^2 \varepsilon_{1t-1}^2 + 2a_{12} a_{22} \varepsilon_{1t-1} \varepsilon_{2t-1} + a_{22}^2 \varepsilon_{2t-1}^2 + g_{12}^2 h_{1t-1} + 2g_{12} g_{22} h_{12t-1} + g_{22}^2 h_{22t-1}$$

Volatility spillovers and volatility persistence from the other five currencies to the Brazilian Real are reflected in the parameters a_{1j} and g_{1j} , where j are the other five currencies under consideration. For details on estimation and the log-likelihood function see Engle and Kroner (1995).

As mentioned above, the BEKK parameterization is the most general in the bivariate case, however, it becomes very difficult to estimate in the case of more than 2 or 3 variables. One method which allows for large covariance matrices are Dynamic Conditional Correlation (DCC) models (Christodoulakis and Satchell 2002; Engle 2002;

Tse and Tsui 2002). Correlation models are based on the decomposition of the conditional covariance matrix into conditional standard deviations and correlations. In contrast to Constant Conditional Correlation (CCC) models, in the DCC class of models the conditional correlation matrix is allowed to be time-varying.

Following Engle (2002), the DCC-MGARCH model is estimated in a two stage estimation procedure which makes this approach feasible when the number of variables is high. The first stage is the conventional univariate GARCH parameter estimation for each zero mean series. The residuals from the first stage are then standardised and used in the estimation of the correlation parameters in the second stage.

The H_t matrix can thus be written as

$$(9.12) \quad H_t = D_t R_t D_t$$

Where D_t is the $n \times n$ diagonal matrix of conditional standard deviations from univariate GARCH models

$$(9.13) \quad D_t = \text{diag}(\sqrt{h_{it}})$$

And h_t is most commonly modelled as a univariate GARCH. In this case the conditional variances can be written as

$$(9.14) \quad h_{it} = \omega_i + \sum_{p=1}^{P_i} \alpha_{ip} r_{it-p}^2 + \sum_{q=1}^{Q_i} \beta_{iq} h_{it-q}$$

for $i=1,2,\dots,k$, with the usual GARCH restrictions for non-negativity and stationarity being imposed, such as non-negativity of variances and $\sum_{p=1}^{P_i} \alpha_{ip} + \sum_{q=1}^{Q_i} \beta_{iq} < 1$. The subscripts are present on the individual P and Q for each series to indicate that the lag lengths chosen need not be the same (Engle and Sheppard (2001)).

R_t is the time-varying correlation matrix and is given as

$$(9.15) \quad R_t = Q_t^{*-1} Q_t Q_t^{*-1}$$

The proposed dynamic correlation structure is:

$$(9.16) \quad Q_t = (1 - \sum_{m=1}^M \lambda_m - \sum_{n=1}^N \mu_n) \bar{Q} + \sum_{m=1}^M \lambda_m (\varepsilon_{t-m} \varepsilon'_{t-m}) + \sum_{n=1}^N \mu_n Q_{t-n}$$

where the covariance Q_t is calculated as the weighted average of \bar{Q} , the unconditional covariance of the standardized residuals from the first stage estimation; $\varepsilon_{t-m} \varepsilon'_{t-m}$, a lagged function of the standardised residuals; and Q_{t-n} , the past realizations of the conditional covariance. In the DCC(1,1) specification, only the first lagged realisation of the covariance of the standardised residuals and the conditional covariances are used. Q_t^* is a diagonal matrix whose elements are the square root of the diagonal elements of Q_t .

$$(9.17) \quad Q_t^* = \begin{bmatrix} \sqrt{q_{11}} & 0 & 0 & \dots & 0 \\ 0 & \sqrt{q_{22}} & 0 & \dots & 0 \\ & & \cdot & & \\ & & \cdot & & \\ 0 & 0 & 0 & \dots & \sqrt{q_{kk}} \end{bmatrix}$$

The typical element of R_t will be of the form $\rho_{ijt} = \frac{q_{ijt}}{\sqrt{q_{ii}q_{jj}}}$ where ρ_{ijt} is the conditional correlation between market 1 and market 2. It follows that if \bar{Q} and $\varepsilon_{t-m} \varepsilon'_{t-m}$ are positive definite and diagonal, then Q_t will also be positive definite and diagonal. For further discussion on positive definiteness, estimation and the log likelihood function please refer to Engle and Sheppard (2001). A drawback of the DCC model is that λ and μ are scalars, so that all the conditional correlations obey the same dynamics. This is necessary to ensure that R_t is positive definite $\forall t$ through sufficient conditions on the parameters.

9.4. Data and Results

To test for the internationalisation of the Brazilian Real (BRL), its co-movement in the levels, returns and volatilities with five other currencies are considered: the Australian Dollar (AUD), the New Zealand Dollar (NZLD), the Mexican Peso (MEX), the

Turkish Lira (TKL) and the South African Rand (ZAR). These are, as has been shown in Chapter 7, the currencies most frequently considered by currency traders to assess future movements in the Brazilian Real. As already mentioned in this context, the Australian Dollar is one of the most liquid and widely traded international currencies and is often used as a benchmark for carry trade activity. The New Zealand Dollar is also an important carry trade currency, however traded far less widely. Both currencies also have an important commodity element as will be discussed in more detail below. The other three currencies are, as has also been shown in Chapter 7, among the most liquid and widely traded emerging market currencies.

In a second step, this chapter investigates empirically the implications that the internationalisation of the Brazilian Real has had for the drivers of the exchange rate. Thus, it triangulates the empirical manifestations of short-term returns, both in the form of short-term interest rates and expected gains on the exchange rate, liquidity preference and financial structure. According to the semi-structured interviews presented in Chapter 7 the most important empirical manifestations of these underlying mechanisms are: the S&P, short-term interest rates, and commodity prices.

The S&P500 is the dominant risky asset in most institutional portfolios and a prominent gauge for conditions on international financial markets. The short-term interest rate reflects the importance of carry-trade considerations in determining movements in the Brazilian Real.¹⁹² This indicator has been measured with the difference between the Brazilian overnight rate, the Selic, and the US Fed Fund rate.¹⁹³ Similar to Chapter 8, expected currency gains have been approximated with autoregressive moments to capture momentum or feedback trading.

The relationship between (emerging market) currencies and commodity prices, which have been measured by the Commodity Research Bureau (CRB) spot price index, is

¹⁹² In contrast to Chapter 8, this chapter considers interest rates in short-term money markets. This is justified by the different manifestations of currency internationalisation emphasised in the two chapters. While Chapter 8 focused on short-term domestic currency assets, this chapter centres on the currency as asset class per se.

¹⁹³ In alternative specifications the interest rate differential with the Japanese Yen has also been included in the model, but was not found significant. Japanese Yen funded carry trade operations are one aspect of short-term speculative currency operations. In general, as has been argued theoretically in Chapter 3 of this dissertation, the US\$ remains the main funding currency in international financial transactions.

complex and worth investigating. On the one hand, commodity prices represent a clear “fundamental” link, in which commodity prices affect the exchange rate through its affect on external balances. On the other hand, as highlighted in the literature on the financialisation of commodity markets, commodities have also become internationally traded assets. Consequently, and as indeed discussed in Chapter 7, international currency traders often trade commodities and emerging market currencies as similar asset classes, arbitraging their exposure and hedging between them. A further investigation into this “financial” link between (emerging market) currencies and commodities forms an interesting element of this chapter.

Finally, the semi-structured interviews also pointed to the important role of financial structure for exchange rate movements. Financial structure referred in particular to the large exposure of foreign investors to (short-term) domestic currency risk. Brunnermeier, Nagel et al. (2008) point out that in the presence of a large share of short-term foreign investors funded in international financial markets, any change in international funding conditions, e.g. as a result of increased risk aversion, can lead to an immediate reversal of positions and large exchange rate changes, largely independent of domestic economic conditions. Thus, to explore the importance of financial structure, i.e. a country’s net short-term foreign liabilities, for exchange rate movements indicators of international funding conditions are also included in the mean equation. These indicators are the VIX and in particular the TED spread, which represents the difference between the LIBOR and the risk-free T-bill rate, as discussed in Chapters 4 and 5 (Brunnermeier, Nagel et al. 2008; Büyükkahin and Robe 2010). For both interest rates, US data are used.

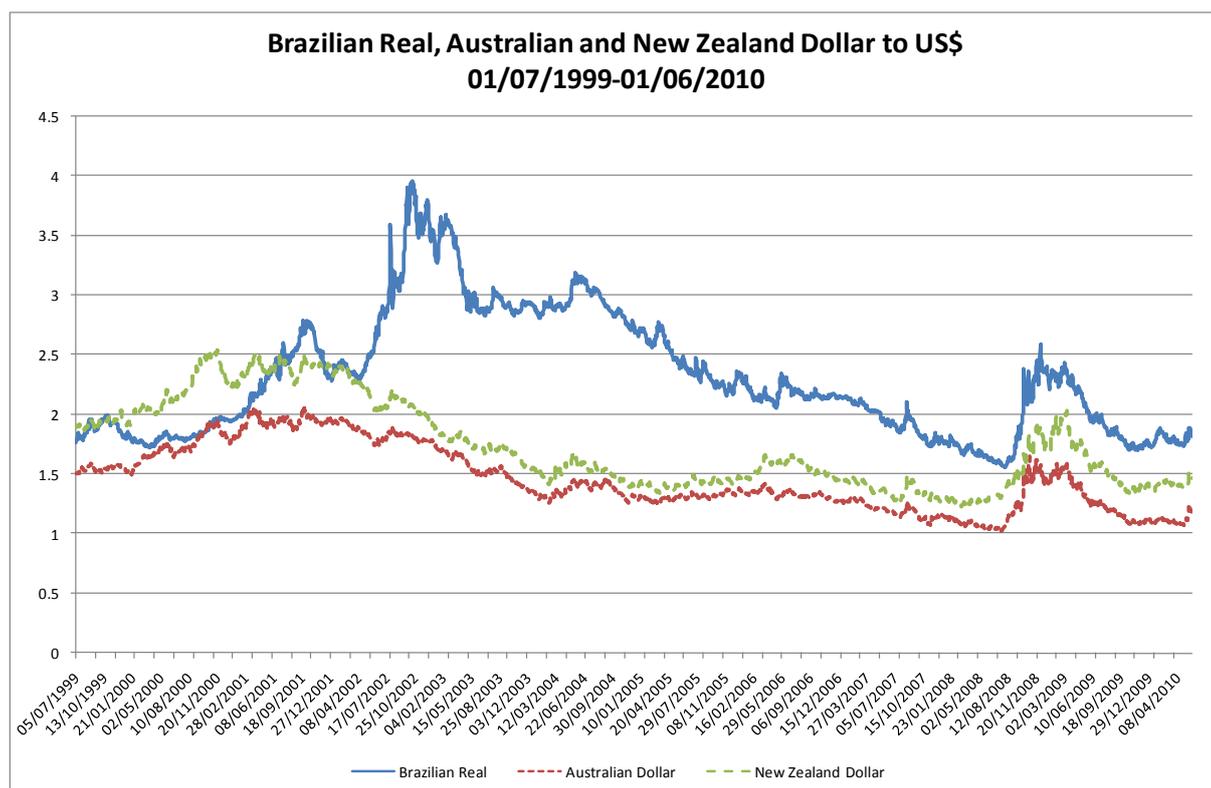
All series are downloaded from Datastream; exchange rate series are supplied by Reuters World Market Research (WMR). The series are daily and expressed in their natural logarithm (except interest rates). Exchange rates are expressed as domestic currency to US\$, thus an increase in the exchange rate represents a depreciation. For the multivariate VAR-GARCH analysis first differences are used to avoid non-stationarity in the data.

The data period chosen for estimation ranges from the 1st of July 1999, when Brazil officially introduced its inflation targeting cum floating exchange rate regime, until the

1st of June 2010.¹⁹⁴ Reflecting the open system ontology adopted in this dissertation, which argues that any form of closure on the empirical level can only temporary, several sub-periods are estimated.¹⁹⁵ Firstly, from January 2003 to June 2010: it was in 2003 that liquidity returned to international financial markets and the demand for emerging market assets started to rise. Secondly, from April 2005 to June 2010: as discussed in Chapter 5 a series of liberalisation measures, in particular with respect to the international tradability of the BRL, were introduced in the first quarter of 2005. Finally, from August 2007 to March 2009: this period accounts for the changing dynamics during the international financial crisis.

Figures 9.1 and 9.2 show the six currencies and their co-movements over the entire sample period.

Figure 9.1

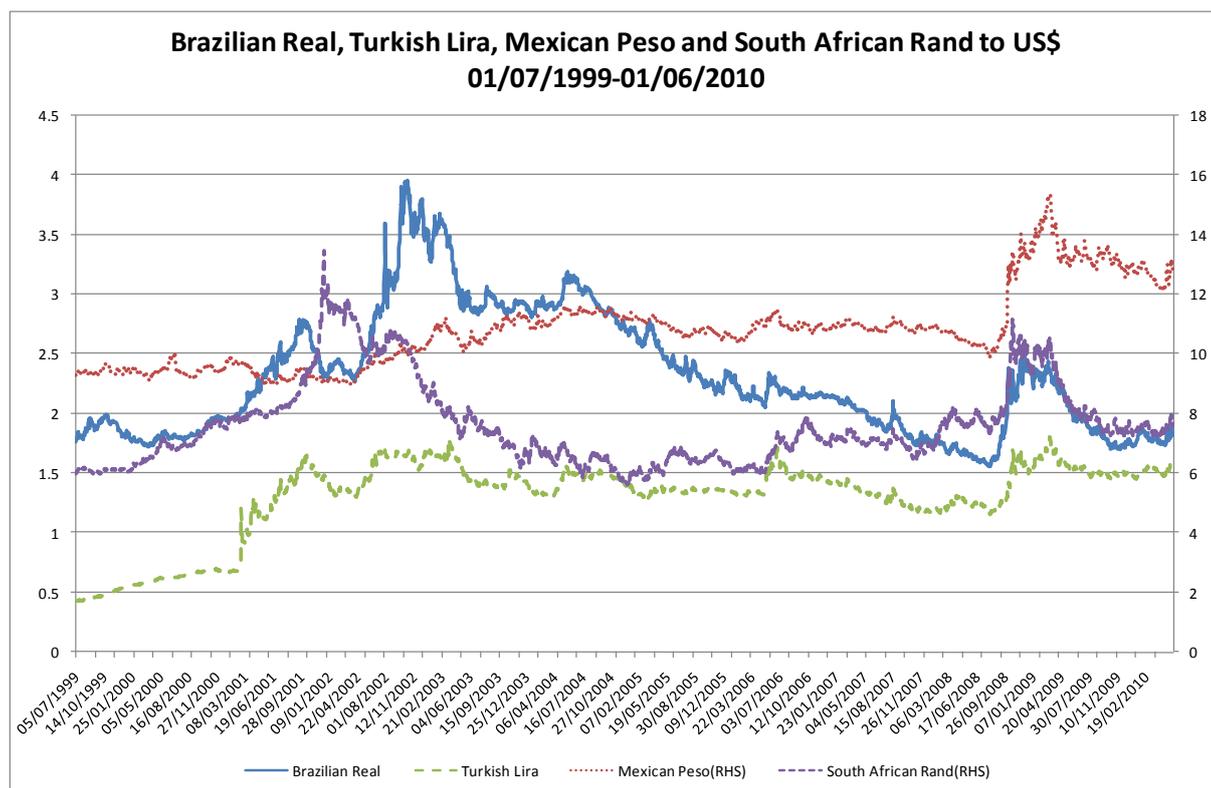


Source: Datastream

¹⁹⁴ Turkey had a pegged exchange rate regime until 2001, which was ended by a financial crisis. Estimations with the TKL are thus only conducted from 2003 onwards.

¹⁹⁵ The open system ontology is also reflected in the use of GARCH models which account for the *time-varying* volatility between variables.

Figure 9.2



Source: Datastream

One can observe the strong co-movement between the BRL and the other currencies, particularly with the AUD, NZLD and TKL. As already discussed in Chapter 4, all currencies experience a large and simultaneous adjustment during the international financial crisis at the time of the collapse of Lehman Brothers. In addition, particularly for the AUD, NZLD, BRL and TKL, one can observe the typical carry trade pattern of sustained appreciation trends, followed by shorter periods of sharp devaluations.

Table 9.1 shows the average of several economic indicators for these currencies over the 2003-2009 period.¹⁹⁶

¹⁹⁶ This period has been chosen to exclude the substantial volatility around President Lula's election.

Table 9.1: Economic Indicators: 2003-2009

	Brazil	Australia	New Zealand	Mexico	Turkey	South Africa
Overnight Rate (%)	15.48	5.04	6.11	7.28	19.78	7.97
Annual Exchange Rate Change (%)	-8.31	-5.03	-2.76	3.55	0.08	0.36
Annual Inflation Rate (%)	2.82	5.77	2.65	4.35	10.01	5.42
Daily Trading Volume (US\$ million)	22,175	280,735	59,867	52,774	23,602	27,594
Daily Trading Volume Outright Forward (US\$ million)	12,866	28,836	5,076	5,391	3,032	2,856
o/w offshore	8,275	15,564	2,884	3,500	1,640	1,489
Current Account % GDP	0.31	-5.24	-6.68	-0.80	-4.35	-4.43
External Debt % Reserves	268%	2081%	NA	237%	383%	314%
Commodity Exports % Total Exports	38.79%	58.76%	38.34%	15.67%	5.46%	58.24%

Sources: IMF-WEO(2011d);IMF-IFS (2011c); BIS (2010a); Datastream; Bloomberg; author's own calculations

Notes: All values are averages for 2003-2009; data on the stock of short-term net foreign liabilities are from 2003-2008 only; overnight rates for Mexico were not available, 3-month interbank rates have been used instead; data on commodity exports are not homogenous and thus not directly comparable;

Several points are noteworthy. Firstly, Table 9.1 shows that the BRL had by far the highest *real* interest rates among all countries, making it a very attractive currency for carry trade operations. At the same time, the BRL also offered the highest gains on currency movements. Despite the international financial crisis, the BRL appreciated by more than 8% over the sample period. Secondly, Table 9.1 illustrates the relative liquidity of the six currencies, approximated with the average daily trading volume in OTC markets in April 2010. Although the total trading volume in Brazil was lower than in other currencies, the trading in outright forwards, a large part of which are non-deliverable forwards (NDFs), was only surpassed by that of Australia. However, as discussed in Chapters 4 and 7, these instruments are primarily used for speculative operations to take positions in Brazilian currency and interest rates. Thirdly, one can observe the quite distinct macroeconomic configurations in the seven countries, ranging from a current account surplus in Brazil to a current account deficit of nearly 7% in New Zealand. Gross external debt as a percentage of foreign exchange reserves was by far the highest in Australia, while the fiscal situation was generally better in Australia and New Zealand than in the emerging countries. Inflation has been relatively low in all countries, with the exception of Turkey. Finally, Table 9.1 also shows the seven countries' share of commodities in total exports. The share of commodity exports in Australia and South Africa was nearly 60%, whereas it was around 10% in Mexico and Turkey. Brazil and New Zealand occupied the middle ground with around 38% of total exports each.

Table 9.2 shows standard descriptive statistics, autocorrelation coefficients (AC) and correlation coefficients with the first difference in the FED fund rate (Δ FED rate) and

the countries' interest rate differential with the US (Δ IRD) for the daily exchange rate returns. Again, data are shown from 2003 onwards. Results excluding the international financial crisis are also presented.

Table 9.2: Preliminary Statistical Indicators, Daily Returns, January 2003-June 2010

	Brazilian Real		Australian Dollar		New Zealand Dollar		
	entire period	w/o crisis	entire period	w/o crisis	entire period	w/o crisis	
Mean	-0.0003	-0.0005	-0.0002	-0.0004	-0.0001	-0.0003	
Max	0.0812	0.0505	0.0883	0.0301	0.0665	0.0352	
Min	-0.0739	-0.0319	-0.0670	-0.0198	-0.0588	-0.0273	
Standard Deviation	0.0102	0.0079	0.0096	0.0064	0.0097	0.0072	
Skewness	0.7013	0.7285	1.1086	0.5177	0.4927	0.5613	
Kurtosis	12.3488	7.0029	16.6553	4.9511	8.7370	4.8606	
Jarque-Bera	***7205.2	***903.518	***15430.2	***242.9221	***2731.9	***235.131	
AC Coefficient (LBQ)							
	1	(-)0.015 (0.46)	***0.062(4.65)	*(-)0.030 (1.75)	0.035 (1.47)	**0.033 (2.06)	***0.047 (2.64)
	2	***(-)0.033 (2.56)	***(-)0.039 (6.49)	*(-)0.006 (1.83)	*(-) 0.020 (1.95)	***0.017 (2.62)	***(-)0.030 (3.73)
Corr Δ FED Rate (t-stat)	**0.048 (2.11)	0.028 (0.98)	*0.038 (1.68)	0.011 (0.39)	0.035 (1.54)	0.036 (1.27)	
Corr IRD (t-stat)	(-)0.024 (1.08)	(-)0.018 (0.63)	(-)0.029 (1.32)	(-)0.015 (0.51)	***(-)0.075(3.30)	**0.072 (2.48)	
Corr IRD (-1) (t-stat)	***(-)0.076 (3.36)	0.030 (1.04)	*(-)0.039 (1.75)	0.020 (0.69)	(-)0.015 (0.68)	**0.072 (2.49)	
		Mexican Peso		Turkish Lira		South African Rand	
		entire period	w/o crisis	entire period	w/o crisis	entire period	w/o crisis
Mean		0.0001	0.0000	0.0000	-0.0002	-0.0001	-0.0002
Max		0.0755	0.0288	0.0677	0.0677	0.0981	0.0449
Min		-0.0477	-0.0154	-0.0643	-0.0479	-0.0639	-0.0375
Standard Deviation		0.0068	0.0047	0.0094	0.0082	0.0117	0.0105
Skewness		0.8836	0.5943	0.7039	1.1721	0.4341	0.2126
Kurtosis		19.7346	5.0107	10.8704	11.9301	7.0751	4.1194
Jarque-Bera		***2283.6	***271.658	***5153.9	***4244.373	***1399.7	***71.38781
AC Coefficient (LBQ)							
	1	(-)0.011 (0.22)	(-)0.013 (0.19)	(-)0.021 (0.84)	*(-)0.092 (10.14)	**0.032 (1.98)	0.029 (0.98)
	2	***0.035 (2.58)	(-)0.030 (1.29)	***0.040 (3.99)	***0.094 (20.62)	***(-)0.020 (2.78)	(-) 0.014 (1.21)
Corr Δ FED Rate (t-stat)		***0.060 (2.66)	(-)0.022 (0.79)	0.037 (1.61)	(-)0.005 (0.18)	0.022 (1.00)	0.011 (0.38)
Corr IRD (t-stat)		**0.049 (2.16)	***0.079 (2.76)	(-)0.011 (0.50)	0.023 (0.80)	(-)0.036 (1.58)	*(-)0.053 (1.822)
Corr IRD (-1) (t-stat)		(-)0.027 (1.19)	**(-)0.064 (2.21)	**(-)0.069 (3.07)	**(-)0.068 (2.35)	***(-)0.062 (2.72)	(-)0.044 (1.50)

*Notes: the entire periods spans from 01/01/2003 to 31/5/2010; the non crisis period spans from 01/01/2003 to 31/7/2007; *, **, *** indicates significance at 10%, 5% and 1% level respectively; critical values are expressed in absolute values; overnight rates are used for the interest rate differential, except for the Mexican Peso where 3-month interbank rates had to be used*

Table 9.2 confirms the positive returns (international) investors would have earned on the BRL between January 2003 and June 2010 (even including the crisis period). The mean appreciation (for both periods) was highest for the BRL, followed by the AUD. In addition, sustained appreciations were paired with relatively low standard deviations, which reduced the value at risk (VAR) and further increased the attractiveness of these

currencies for carry trade operations.¹⁹⁷ The potential importance of carry trade operations in these currencies is also reflected in the strongly non-normal returns. While excess kurtosis is an indicator of a greater likelihood of extreme events, skewed returns can result from the typical exchange rate pattern in carry trade currencies, where slow and sustained appreciations are followed by abrupt and strong depreciations (Brunnermeier, Nagel et al. 2008). Finally, indications of the importance of short-term returns and international liquidity conditions for exchange rate dynamics are given by the correlation coefficients between the exchange rates and the Fed Fund rate and the differential between the domestic and US interest rates respectively. All currencies (except Mexico) show a negative correlation with the interest differential. In addition, for three currencies, the BRL the AUD and MEX, exchange rate returns are significantly, and positively, related to changes in the Fed Fund rate. Initial evidence for the existence of possible momentum or feedback trading is given by significant and positive autocorrelation coefficients for the BRL, NZLD and TKL before the international financial crisis.

9.4.1. The Internationalisation of the Brazilian Real - Cointegration Analysis

The results of the cointegration analysis are presented in Tables 9.3 to 9.7. Table 9.3 shows that, according to Phillips-Perron unit root tests, all currencies can be considered I(1) for the periods under consideration.¹⁹⁸

Table 9.3 Adjusted Test-Statistics of Phillips Perron Test (in absolute values)

Adjusted t-statistics of Phillips Perron Test (in absolute values)						
Period	BRL	AUSD	NZLD	MEX	TKL	ZAR
01/07/1999-01/06/2010	1.35	1.01	1.13	1.22	NA	1.97
01/01/2003-01/06/2010	1.88	2.69	2.65	1.55	2.49	2.22
01/04/2005-01/06/2010	2.23	1.77	1.86	1.16	1.70	1.88
01/08/2007-01/04/2009	1.37	1.39	0.68	0.14	1.21	1.63

Notes: *, **, *** indicates significance at 10%, 5% and 1% significance level respectively; Bartlett-Kernel is chosen as spectral estimation method; the bandwidth is based on the Newey-West criterion; an intercept is chosen as external regressor

¹⁹⁷ Indeed, in addition to high interest rates, low exchange rate volatility is important for the profitability of carry trade operations as any large and sudden change in the value of the currency can quickly erode the profits gained from the interest rate differential.

¹⁹⁸ Given the potential heteroscedasticity in the daily exchange rate series, the Phillips-Perron test was considered more robust than the Augmented Dickey Fuller (ADF) test. Results from the ADF test confirmed the I(1) nature for all series.

Table 9.4 illustrates the results of the single equation cointegration tests. Two tests statistics are presented; one based on the t-statistic for testing the null hypothesis of non-stationarity (no cointegration) (ρ ; *tau – statistic*) and one directly based on the normalized autocorrelation coefficient of the test regression ($\hat{\rho} - 1$; *z – statistic*). For each period, the forward and reverse regressions are presented.

Table 9.4: Single Equation Cointegration Test-Statistics (in absolute values)

Currency Pair	Period	Engle-Granger		Phillips-Ouliaris		Engle-Granger		Phillips-Ouliaris		
		t-stat	z-stat	t-stat	z-stat	t-stat	z-stat	t-stat	z-stat	
BRL-AUSD	01/07/1999-01/06/2010	1.53	3.78	1.56	3.91	AUSD-BRL	1.16	2.59	1.21	2.86
	01/01/2003-01/06/2010	2.41	11.77	2.11	9.15		3.08	17.51	2.84	14.66
	01/04/2005-01/06/2010	***4.37	***27.23	***4.12	**21.80		***4.11	***26.64	**3.81	**21.37
	01/08/2007-01/04/2009	*3.33	**21.83	2.92	16.70		**3.37	**22.01	2.97	16.93
BRL-NZLD	01/07/1999-01/06/2010	1.39	3.38	1.44	3.58	NZLD-BRL	1.21	2.76	1.17	2.58
	01/01/2003-01/06/2010	1.46	4.50	1.39	4.08		2.45	11.22	2.40	10.77
	01/04/2005-01/06/2010	2.97	10.54	2.92	9.49		2.54	10.11	2.50	9.69
	01/08/2007-01/04/2009	2.39	10.35	2.20	8.60		2.38	9.91	2.23	8.52
BRL-MEX	01/07/1999-01/06/2010	1.36	3.45	1.40	3.66	MEX-BRL	1.33	3.98	1.29	3.79
	01/01/2003-01/06/2010	1.94	4.88	1.92	4.67		1.69	6.22	1.67	6.10
	01/04/2005-01/06/2010	2.25	7.02	2.19	6.40		1.07	2.75	1.09	2.82
	01/08/2007-01/04/2009	2.73	14.25	2.65	13.38		2.56	12.82	2.50	12.19
BRL-TKL	01/07/1999-01/06/2010	NA	NA	NA	NA	TKL-BRL	NA	NA	NA	NA
	01/01/2003-01/06/2010	0.93	1.94	0.93	1.89		2.00	9.06	2.10	9.55
	01/04/2005-01/06/2010	2.25	6.33	2.22	5.85		1.52	5.06	1.59	5.54
	01/08/2007-01/04/2009	2.03	8.14	2.06	8.38		1.89	7.43	1.99	8.17
BRL-ZAR	01/07/1999-01/06/2010	1.16	2.87	1.21	3.05	ZAR-BRL	1.83	6.10	1.84	6.21
	01/01/2003-01/06/2010	2.28	6.04	2.27	5.74		2.51	10.76	2.51	10.69
	01/04/2005-01/06/2010	2.27	7.74	2.21	7.04		1.93	6.62	1.93	6.62
	01/08/2007-01/04/2009	1.44	4.04	1.47	4.27		1.67	4.47	1.76	5.12

Notes: *, **, *** indicates significance at 10%, 5% and 1% level respectively; non-standard critical value apply; both test regressions are adjusted for degrees of freedom; the long-run variances for the PO test are computed using a non-prewhitened Bartlett kernel estimator with a fixed Newey-West bandwidth; the Schwarz Information Criterion is used to choose the optimal lag length in the EG test; again a constant is included as an external regressor

No cointegration relation can be detected for the entire inflation targeting period or from 2003 onwards. From April 2005 onwards, however, both tests point to a robust cointegration relationship between the BRL and AUD. Although less robust, this relationship also holds throughout the crisis period. As discussed in Chapter 5, it was indeed exactly at the beginning of 2005 that Brazil engaged in significant liberalisation measures to enhance the international tradability of the Brazilian Real. Furthermore, the BRL has been traded in a tight band with one of the most liquid and widely traded carry trade currencies. Thus, following the interpretation of a cointegration relationship adopted in this paper, it could be argued that (international) investors have increasingly considered the BRL a liquid, internationally traded currency, whose dynamics are closely linked to carry trade operations.

Table 9.5 shows the ECM with GARCH (1,1) errors for the BRL and the AUD from April 2005 to June 2010 and the crisis period respectively. The coefficients of the long-run relation are presented at the bottom of the table. Diagnostic tests don't reject the null hypothesis of no autocorrelation and no heteroscedasticity in the errors.

Table 9.5: ECM for the Brazilian Real and Australian Dollar

Period	BRL-AUSD				Period	AUD-BRL			
	01/04/05-01/06/10		01/08/07-01/04/09			01/04/05-01/06/10		01/08/07-01/04/09	
	Coefficient	z-statistic	Coefficient	z-statistic		Coefficient	z-statistic	Coefficient	z-statistic
Constant	* (-)0.00	(-)2.86	*(-)0.00	(-)2.99	Constant	(-)0.00	(-)1.75	(-)0.00	(-)0.13
ECM(-1)	***(-)0.01	(-)4.01	*(-)0.03	(-)2.96	ECM(-1)	***(-)0.02	(-)4.23	(-)0.00	(-)0.82
D(AUSD)	***0.56	28.31	***0.60	20.46	D(BRL)	***0.46	27.45	***0.67	25.33
D(BRL(-1))	(-)0.03	(-)1.06	*(-)0.13	(-)2.57	D(BRL(-1))	0.03	1.16	*0.11	2.46
D(BRL(-2))	*(-)0.08	(-)2.79	(-)0.09	(-)1.68	D(BRL(-2))	*0.06	2.72	0.07	1.62
D(AUSD(-1))	0.04	1.46	0.08	1.72	D(AUSD(-1))	(-)0.02	(-)0.93	(-)0.07	(-)1.45
D(AUSD(-2))	0.05	1.71	0.05	1.15	D(AUSD(-2))	(-)0.02	(-)0.86	(-)0.05	(-)1.16
ARCH	***0.14	5.29	**0.16	3.54	ARCH	***0.06	4.79	*0.09	2.69
GARCH	***0.82	28.03	***0.82	21.53	GARCH	***0.93	59.19	***0.89	24.56
Long-Run	***1.07	69.66	***0.94	73.78	Long-Run	***0.73	69.66	***0.98	73.77

*Notes: *, **, *** indicates significance at 10%, 5% and 1% level respectively; z-values in parenthesis; for non-standard critical values see Bannerjee et al. (1998); Given that normality has been strongly rejected, a Generalized Error Distribution (GED) is assumed for the GARCH estimation*

Coefficients on the lagged disequilibrium error (ECM(-1)) confirm the presence of a cointegration relationship between the BRL and the AUD since April 2005. Both currencies significantly adjust to deviations from the equilibrium relationship in the previous period. For the crisis period, the relationship is slightly less robust and slightly more complex. While the AUD ceases to adjust to the equilibrium relationship, the BRL still does so (if slightly less significantly). Thus, one could argue that in the crisis period, movements in the BRL were more geared towards remaining in line with the AUD, rather than vice versa. The short-run coefficients also show significant dependence between the two series. Contemporaneously, the relationship is bi-directional: while for the whole period returns of the Australian Dollar seem to have stronger effects on the Brazilian Real, this is inverted in the crisis period.

Table 9.6 shows the results of the Johansen multivariate cointegration tests. The table indicates whether and how many cointegration relations were present. Exact critical values are not presented, but available upon request. In line with the above, no trend is assumed in the data. An intercept is included in the cointegration relations to account for units of measurement.

Table 9.6: Johansen Multivariate Cointegration Tests – Number of Cointegration Relations

Period	BRL-AUSD		BRL-AUSD-NZLD		BRL-AUSD-MEX		BRL-AUSD-TKL		BRL-AUSD-ZAR	
	Trace Test	Eigenvalue	Trace Test	Eigenvalue	Trace Test	Eigenvalue	Trace Test	Eigenvalue	Trace Test	Eigenvalue
01/07/1999-01/06/2010	0	0	0	0	0	0	NA	NA	0	0
01/01/2003-01/06/2010	0	0	0	0	0	0	0	0	0	0
01/04/2005-01/06/2010	1	1	1	1	1	1	0	0	1	1
01/08/2007-01/04/2009	0	0	0	0	0	0	0	0	0	0
Period	BRL-AUSD-ZAR-NZLD		BRL-AUSD-ZAR-TKL		BRL-AUSD-ZAR-MEX		BRL-AUSD-NZLD-MEX-ZAR		BRL-AUSD-NZL-MEX-TKL-ZAR	
	Trace Test	Eigenvalue	Trace Test	Eigenvalue	Trace Test	Eigenvalue	Trace Test	Eigenvalue	Trace Test	Eigenvalue
01/07/1999-01/06/2010	0	0	NA	NA	0	0	0	0	0	0
01/01/2003-01/06/2010	0	0	0	0	0	0	0	0	0	0
01/04/2005-01/06/2010	0	1	0	0	0	1	0	0	0	0
01/08/2007-01/04/2009	0	0	0	0	0	0	0	0	0	0

The Johansen multivariate cointegration tests confirm the relationship between BRL and the AUD for the period after April 2005 (but not for the international financial crisis). This relationship is also maintained if other currencies are included in the system (except with the Turkish Lira). No other cointegration relations seem to exist.

Given the strong commodity component of several of the currencies under study, one could argue that rather than carry trade operations, commodity prices act as a common stochastic factor driving the co-movement between the BRL and AUD. To test this hypothesis and gain some insights into the relationship between commodity and emerging market currency trading, commodity prices (Comm) are incorporated into the Johansen cointegrating system. Results are presented in Table 9.7.

Table 9.7: Johansen Multivariate Cointegration Tests – Number of Cointegration Relations

Period	Comm-AUSD		Comm-BRL		Comm-ZAR		Comm-NZLD		Comm-AUSD-BRL	
	Trace Test	Eigenvalue	Trace Test	Eigenvalue						
01/07/1999-01/06/2010	1	1	0	0	0	0	0	0	1	1
01/01/2003-01/06/2010	1	1	0	0	0	0	0	0	1	1
01/04/2005-01/06/2010	1	1	1	1	0	0	0	0	2	2
01/08/2007-01/04/2009	1	1	0	1	0	0	0	0	1	1

Indeed, both the AUD and BRL form a significant cointegration relationship with commodity prices. Interestingly, despite having a far higher (or at least equal) commodity export content, no such relationship exists for the ZAR or the NZLD.¹⁹⁹ This result seems to support the hypothesis that the co-movement between commodities and currencies is not necessarily linked to “real” economic factors, but is to large parts determined by international investors trading commodities and (emerging market) currencies as similar (risky) asset classes.

¹⁹⁹ No cointegration relationship is detected for the MEX and TKL either. Results available upon request.

This result, however, also raises the question of whether the common stochastic trend between the BRL and AUD is due to this joint commodity element, or indeed due to carry trade considerations as argued in this chapter. The last column of Table 9.7 aims to answer this question. If both, the AUD and BRL, are included in the system with commodity prices, the Johansen test discovers 2 separate cointegration relationships for 2005 between each currency and commodity prices. Thus, in addition to the cointegration relation between the two currencies and commodity prices, a second long-run relation between the two currencies seems to exist. This relationship could be the result of the similar financial characteristics of these currencies, i.e. their attractiveness for carry trade operations.

9.4.2. The Internationalisation of the Brazilian Real - Multivariate GARCH Models

Tables 9.8 to 9.12 show the results of the bilateral BEKK estimation between the BRL and the other five currencies for the four periods under consideration. To produce the maximum likelihood parameter estimates and their corresponding asymptotic standard errors the Broyden, Fletcher, Goldfarb, Shanno (BFGS) method is used. As recommended by Tsay (2005), the simplex method is applied to refine the initial guess values. To test whether the model is correctly specified, the Ljung Box Q-statistic is employed.

The first part of tables 9.8 to 9.12 shows the results of the VAR mean equation with the BRL as the dependent variable. The second part presents the results for the other currencies as dependent variable. The multivariate GARCH structure and the Ljung Box Q-statistic (MVQ; MVQ-SQ) are presented at the bottom of the tables.

Table 9.8: BEKK Mean Equation: Brazilian Real – Australian Dollar

Brazilian Real - Australian Dollar	01/07/99-01/06/10		01/01/03-01/06/10		01/04/05-01/06/10		01/08/07-01/04/09	
	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
RBRL(-1)	*0.029	1.75	0.021	1.22	(-)0.010	(-)0.47	*(-)0.084	(-)1.75
RAUSD(-1)	0.026	1.50	*0.026	1.79	**0.062	2.15	***0.150	3.13
RVIX	*0.005	1.89	0.003	1.11	(-)0.003	0.77	0.001	0.18
RSP	***(-)0.076	(-)5.15	***(-)0.111	(-)6.09	***(-)0.199	(-)7.66	***(-)0.117	(-)4.36
RCRB	***(-)0.191	(-)6.89	***(-)0.282	(-)8.63	***(-)0.299	(-)7.97	***(-)0.681	(-)10.50
RRONBU(-1)	(-)0.000	(-)0.82	(-)0.000	(-)0.24	**(-)0.003	(-)2.03	***(-)0.007	(-)3.57
RBRL(-1)	***0.043	3.44	***(-)0.059	4.81	0.013	0.58	(-)0.054	(-)1.16
RAUSD(-1)	(-)0.005	(-)0.26	(-)0.242	(-)1.24	0.000	0.97	***0.126	2.59
RVIX	(-)0.002	(-)0.74	***(-)0.010	(-)2.68	***(-)0.017	(-)3.86	0.000	0.08
RSP	*(-)0.030	(-)1.95	***(-)0.098	(-)4.43	***(-)0.187	(-)6.42	***(-)0.069	(-)2.63
RCRB	***(-)0.303	(-)11.28	***(-)0.388	(-)11.62	***(-)0.382	(-)10.37	***(-)0.816	(-)11.75
RRONBU(-1)	0.000	0.998	(-)0.000	(-)0.06	(-)0.002	(-)1.31	***(-)0.006	(-)2.95
C(1,1)	***0.126	9.59	***0.136	8.66	***0.164	9.23	***0.191	4.48
C(2,1)	(-)0.006	(-)0.74	0.007	0.35	0.027	1.18	***0.193	4.93
C(2,2)	***0.076	7.56	***0.077	6.29	***0.089	6.78	0.000	0.00
A(1,1)	***0.374	19.557	***0.358	15.42	***0.345	9.76	0.006	0.09
A(1,2)	0.014	1.58	0.030	1.60	0.013	0.52	***(-)0.250	(-)5.4
A(2,1)	0.007	0.73	0.028	1.12	**0.101	2.57	***0.382	7.11
A(2,2)	***0.216	18.17	***0.222	14.14	***0.264	11.97	***0.474	12.11
G(1,1)	***0.918	107.36	***0.918	94.34	***0.911	61.23	***1.026	51.49
G(1,2)	(-)0.003	(-)1.07	(-)0.007	(-)0.915	0.004	0.68	***0.197	9.53
G(2,1)	0.008	1.15	0.004	0.47	(-)0.016	(-)1.000	***(-)0.250	(-)10.20
G(2,2)	***0.972	308.68	***0.972	203.75	***0.957	134.64	***0.792	39.33
	T-Statistic	P-Value	T-Statistic	P-Value	T-Statistic	P-Value	T-Statistic	P-Value
MVQ	50.12	0.13	41.99	0.38	44.95	0.27	49.08	0.15
MVQ-SQ	34.78	0.70	23.89	0.98	26.85	0.94	51.67	0.10

Table 9.9: BEKK Mean Equation: Brazilian Real – New Zealand Dollar

Brazilian Real - New Zealand Dollar	01/07/99-01/06/10		01/01/03-01/06/10		01/04/05-01/06/10		01/08/07-01/04/09	
	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
RBRL(-1)	*0.031	1.84	0.025	1.37	(-)0.002	(-)0.07	*(-)0.092	(-)1.75
RNZLD(-1)	0.019	1.40	0.001	0.07	0.017	0.8	0.070	1.49
RVIX	0.005	1.57	0.004	1.07	(-)0.002	(-)0.53	0.011	1.18
RSP	***(-)0.078	(-)4.86	***(-)0.107	(-)4.56	***(-)0.190	(-)7.25	*(-)0.067	(-)1.70
RCRB	***(-)0.195	(-)7.39	***(-)0.284	(-)8.29	***(-)0.295	(-)7.97	***(-)0.615	(-)9.10
RRONBU(-1)	(-)0.000	(-)1.09	(-)0.000	(-)0.16	*(-)0.003	(-)1.79	**(-)0.005	(-)2.22
RBRL(-1)	***0.035	2.75	*(-)0.025	1.96	(-)0.023	(-)1.07	(-)0.020	(-)0.39
RNZLD(-1)	0.024	1.29	(-)0.020	(-)1.09	0.038	1.57	***0.143	2.97
RVIX	(-)0.003	(-)0.96	***(-)0.010	(-)2.31	***(-)0.016	(-)3.27	(-)0.002	(-)0.16
RSP	***(-)0.046	(-)2.68	***(-)0.104	(-)4.40	***(-)0.196	(-)6.31	***(-)0.104	(-)2.35
RCRB	***(-)0.275	(-)9.79	***(-)0.359	(-)9.64	***(-)0.344	(-)8.06	***(-)0.847	(-)11.29
RRONBU(-1)	(-)0.000	(-)0.60	(-)0.000	(-)0.43	(-)0.002	(-)1.18	***(-)0.006	(-)2.65
C(1,1)	***0.122	9.46	***0.125	7.90	***0.147	6.87	***0.215	4.06
C(2,1)	(-)0.029	(-)1.27	(-)0.028	(-)1.12	(-)0.013	(-)0.41	***0.163	2.07
C(2,2)	***0.090	6.66	***0.090	5.61	***0.102	5.86	**0.083	1.96
A(1,1)	***0.385	20.90	***0.364	15.42	***0.370	10.74	***0.491	7.87
A(1,2)	0.007	0.69	0.005	0.26	(-)0.006	(-)0.23	***0.192	3.14
A(2,1)	(-)0.009	(-)0.52	0.007	0.28	0.042	1.15	***(-)0.264	(-)4.38
A(2,2)	***0.186	13.94	***0.191	13.40	***0.215	9.42	0.032	0.52
G(1,1)	***0.915	105.90	***0.918	94.18	***0.910	62.40	***0.866	29.29
G(1,2)	0.000	0.17	0.006	0.80	0.012	0.82	***(-)0.080	(-)2.81
G(2,1)	0.014	2.12	0.011	1.47	0.007	0.61	*0.034	1.83
G(2,2)	***0.976	289.44	***0.973	202.88	***0.967	117.10	***0.997	80.10
	T-Statistic	P-Value	T-Statistic	P-Value	T-Statistic	P-Value	T-Statistic	P-Value
MVQ	38.75	0.53	34.26	0.73	42.20	0.38	45.23	0.26
MVQ-SQ	48.80	0.16	26.12	0.96	29.70	0.88	28.51	0.91

Table 9.10: BEKK Mean Equation: Brazilian Real – Mexican Peso

Brazilian Real - Mexican Peso	01/07/99-01/06/10		01/01/03-01/06/10		01/04/05-01/06/10		01/08/07-01/04/09	
	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
RBRL(-1)	***0.038	2.63	**0.034	2.41	0.015	0.60	(-)0.026	(-)0.58
RMEX(-1)	0.013	1.50	0.018	0.95	0.035	0.91	0.115	1.45
RVIX	0.005	1.46	0.005	1.25	0.002	0.59	**0.017	1.97
RSP	***(-)0.090	(-)5.53	***(-)0.117	(-)6.08	***(-)0.154	(-)7.31	(-)0.048	(-)1.39
RCRB	***(-)0.236	(-)8.77	***(-)0.325	(-)9.72	***(-)0.349	(-)8.49	***(-)0.631	(-)9.80
RRONBU(-1)	(-)0.000	(-)0.93	(-)0.000	(-)0.27	**(-)0.003	(-)2.00	**(-)0.004	(-)2.20
RBRL(-1)	0.008	1.16	0.007	0.67	(-)0.016	(-)1.16	**(-)0.041	(-)2.06
RMEX(-1)	*0.026	1.90	*0.026	1.79	**0.054	2.11	**0.106	2.21
RVIX	*0.003	1.71	0.001	0.67	0.000	0.24	0.007	1.50
RSP	***(-)0.062	(-)5.63	***(-)0.084	(-)6.81	***(-)0.102	(-)7.59	*(-)0.047	(-)1.95
RCRB	***(-)0.130	(-)7.72	***(-)0.166	(-)7.86	***(-)0.162	(-)6.69	***(-)0.193	(-)6.59
RRONBU(-1)	(-)0.000	(-)0.48	(-)0.000	(-)1.55	***(-)0.002	(-)3.30	***(-)0.003	(-)3.42
C(1,1)	***0.126	11.02	***0.131	8.17	***0.151	7.50	***0.239	5.00
C(2,1)	***0.038	4.78	***0.043	4.57	***0.052	4.99	*0.033	1.90
C(2,2)	***0.042	6.95	***0.029	3.73	***0.027	2.84	**(-)0.042	(-)2.52
A(1,1)	***0.382	19.94	***0.345	14.69	***0.339	11.70	***0.350	6.43
A(1,2)	***0.035	4.46	***0.044	3.36	**0.033	2.08	0.006	0.26
A(2,1)	(-)0.036	(-)1.47	0.025	0.80	0.062	1.60	***0.271	3.47
A(2,2)	***0.239	16.72	***0.253	11.55	***0.292	10.88	***0.458	10.66
G(1,1)	***0.921	130.31	***0.928	102.38	***0.926	79.49	***0.899	31.16
G(1,2)	***(-)0.013	(-)4.32	***(-)0.018	(-)3.43	***(-)0.017	(-)2.74	***0.197	9.53
G(2,1)	0.004	0.54	(-)0.006	(-)0.671	(-)0.013	(-)1.03	***(-)0.090	(-)3.15
G(2,2)	***0.970	244.27	***0.968	171.22	***0.960	121.82	***0.907	63.83
	T-Statistic	P-Value	T-Statistic	P-Value	T-Statistic	P-Value	T-Statistic	P-Value
MVQ	40.37	0.45	49.11	0.15	*55.91	0.05	34.34	0.72
MVQ-SQ	***74.8	0.00	***69.06	0.00	**26.85	0.04	35.76	0.66

Table 9.11: BEKK Mean Equation: Brazilian Real – Turkish Lira

Brazilian Real - Turkish Lira	01/07/99-01/06/10		01/01/03-01/06/10		01/04/05-01/06/10		01/08/07-01/04/09	
	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
RBRL(-1)			0.005	0.24	0.002	0.08	(-)0.006	(-)0.11
RTKL(-1)			*0.033	1.75	0.016	0.57	0.057	1.07
RVIX			0.002	0.57	0.002	0.44	**0.019	2.02
RSP			***(-)0.121	(-)7.07	***(-)0.184	(-)8.03	***(-)0.102	(-)2.76
RCRB			***(-)0.273	(-)8.02	***(-)0.351	(-)9.37	***(-)0.729	(-)8.985
RRONBU(-1)			0.000	0.84	**(-)0.003	(-)2.11	**(-)0.003	(-)2.096
RBRL(-1)			**0.026	2.23	(-)0.001	(-)0.04	(-)0.031	(-)0.60
RTKL(-1)			0.012	1.00	0.054	1.96	*0.090	1.76
RVIX			0.003	1.04	0.003	0.77	0.010	1.01
RSP			***(-)0.119	(-)10.45	***(-)0.202	(-)9.34	***(-)0.153	(-)3.642
RCRB			***(-)0.207	(-)6.37	***(-)0.226	(-)6.32	***(-)0.495	(-)6.75
RRONBU(-1)			(-)0.000	(-)0.57	(-)0.004	(-)2.75	***(-)0.006	(-)2.95
C(1,1)			***0.107	6.60	***0.263	5.24	**0.374	3.27
C(2,1)			***0.075	3.46	0.028	0.32	0.282	1.43
C(2,2)			***0.113	8.20	0.042	0.15	***0.216	3.87
A(1,1)			***0.321	12.54	***0.428	12.74	***0.841	8.66
A(1,2)			0.024	0.97	***0.308	9.72	***0.354	3.39
A(2,1)			**0.052	2.23	***(-)0.230	(-)6.74	**(-)0.376	(-)2.56
A(2,2)			***0.363	15.17	***0.173	5.31	(-)0.030	(-)0.24
G(1,1)			***0.943	99.41	***0.494	11.10	***0.634	10.89
G(1,2)			(-)0.007	(-)0.75	***(-)0.467	(-)11.75	***(-)0.242	(-)4.63
G(2,1)			**(-)0.018	(-)2.07	***0.566	11.71	0.123	1.02
G(2,2)			***0.923	101.49	***1.07	26.16	***0.998	14.04
			T-Statistic	P-Value	T-Statistic	P-Value	T-Statistic	P-Value
MVQ			45.72	0.25	51.13	0.11	*54.79	0.06
MVQ-SQ			***75.69	0.00	***81.53	0.00	44.78	0.28

Table 9.12: BEKK Mean Equation: Brazilian Real – South African Rand

Brazilian Real - S. African Rand	01/07/99-01/06/10		01/01/03-01/06/10		01/04/05-01/06/10		01/08/07-01/04/09	
	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
RBRL(-1)	*0.032	1.81	0.032	1.49	0.020	0.66	(-)0.030	(-)0.63
RZAR(-1)	0.008	0.75	0.010	0.79	0.019	0.88	0.033	0.90
RVIX	0.005	1.6	0.003	1.05	(-)0.002	(-)0.42	**0.020	2.22
RSP	***(-)0.082	(-)5.15	***(-)0.118	(-)6.73	***(-)0.192	(-)6.06	(-)0.039	(-)1.00
RCRB	***(-)0.214	(-)7.94	***(-)0.320	(-)9.19	***(-)0.341	(-)8.12	***(-)0.616	(-)9.66
RRONBU(-1)	(-)0.000	(-)1.06	0.000	0.45	(-)0.002	(-)1.36	*(-)0.003	(-)1.94
RBRL(-1)	(-)0.015	(-)1.00	0.011	0.43	(-)0.021	(-)0.63	(-)0.030	(-)0.56
RZAR(-1)	***0.059	3.33	**0.052	2.51	**0.067	2.48	0.068	1.43
RVIX	**0.01	2.75	0.000	0.16	(-)0.006	(-)1.00	0.005	0.51
RSP	**(-)0.039	(-)2.24	***(-)0.138	(-)4.47	***(-)0.228	(-)5.79	***(-)0.134	(-)3.05
RCRB	***(-)0.167	(-)4.77	***(-)0.328	(-)6.98	***(-)0.309	(-)6.07	***(-)0.531	(-)6.97
RRONBU(-1)	(-)0.000	(-)0.04	(-)0.002	(-)1.42	**(-)0.004	(-)2.21	***(-)0.006	(-)2.72
C(1,1)	***0.137	11.77	***0.140	8.37	***0.169	6.66	***0.245	3.96
C(2,1)	0.023	1.62	**0.064	2.45	*0.060	1.84	***0.365	2.64
C(2,2)	***0.065	6.05	***0.082	5.08	***0.079	3.73	***0.367	5.39
A(1,1)	***0.400	21.11	***0.391	17.35	***0.405	11.68	***0.637	10.46
A(1,2)	*0.022	1.70	***0.078	2.86	0.053	1.59	***0.419	6.31
A(2,1)	(-)0.005	(-)0.59	(-)0.010	(-)0.74	(-)0.005	(-)0.197	(-)0.288	(-)0.60
A(2,2)	***0.263	21.59	***0.199	13.04	***0.207	9.10	**0.160	2.37
G(1,1)	***0.909	106.03	***0.913	97.54	***0.903	56.65	***0.780	23.86
G(1,2)	*(-)0.009	(-)1.07	**(-)0.024	(-)2.20	(-)0.007	(-)0.44	***(-)0.207	(-)6.26
G(2,1)	0.004	1.39	0.001	0.3	(-)0.000	(-)0.00	0.033	0.61
G(2,2)	***0.966	316.11	***0.977	283.36	***0.972	177.47	***0.870	13.16
	T-Statistic	P-Value	T-Statistic	P-Value	T-Statistic	P-Value	T-Statistic	P-Value
MVQ	43.52	0.32	47.25	0.20	*55.85	0.05	41.95	0.38
MVQ-SQ	33.88	0.74	37.36	0.59	46.83	0.21	38.67	0.53

Notes to Tables 8 to 12: *, **, *** indicates significance at 10%, 5% and 1% standard normal level respectively; R indicates return, i.e. first difference; RRONBU(-1) is the difference between the Brazilian overnight rate (Selic) and the US Fed Fund rate.

Overall, the models fit the data very well. This is especially the case for the bilateral relationship between the BRL and the AUD, NZD and - for most periods - the ZAR, in which no autocorrelation or heteroscedasticity is remaining in the errors. This supports the finding that the BRL has shown increased synchrony with liquid, internationally traded carry trade currencies, such as the AUD and the NZD. In addition, all these currencies share an important commodity element.

The driving role of the AUD for Brazilian exchange rate dynamics is also evident in the mean equation of the VAR-MGARCH model. Past returns of the AUD (RAUSD(-1)) have a positive effect on current BRL returns (RBRL). In addition, this effect rises in economic and statistical significance and becomes particularly strong during the international financial crisis. The return of no other currency has a robust significant effect on the RBRL for any of the periods under consideration. Similarly, dynamics of

the RBRL have little robust and consistent significance for the dynamics of the other currencies.

In addition to the co-movement between the returns of the six currencies, multivariate GARCH models allow analysis of the own and joint volatilities of the variables under consideration. Indeed, it has been argued that one sign of the currencies' rising internationalisation will be a rise in their joint volatilities as currencies are increasingly subject to common shocks. It is evident from Tables 9.8 to 9.12, that all currencies have significant own volatility spillovers (ARCH effects, reflected in the parameters $A(1,1)$ and $A(2,2)$) and significant volatility persistence (GARCH effects represented by $G(1,1)$ and $G(2,2)$). The joint volatility spillovers and volatility persistence between the currencies are represented by $A(1,2)$ and $A(2,1)$ and $G(1,2)$ and $G(2,1)$ respectively, where 1 stands for the RBRL and 2 for the respective other currency. In general terms, the results seem to indicate that, up to the international financial crisis, volatility spillovers and persistence are bigger between the RBRL and the other emerging market currencies than with the two liquid carry trade currencies, RAUSD and RNZLD. This differentiation disappears in the international financial crisis, where the volatility correlation between all pairs surges substantially. In general, volatilities seem to spill over *to* the BRL rather than vice versa.

The changing nature of the joint volatility dynamics between the six currencies can be better observed in Figures 9.3 to 9.12, which show the time-varying correlation patterns of the BEKK and Engle's (2002) two-stage DECC model. Given the emphasis on the covariance structure a simple VAR (1) mean equation to reduce autocorrelation is estimated for the DCC model. Results for all currencies (Table A7.1) and a model including only the RBRL, RAUSD, RNZLD and RZAR (Table A7.2) to reduce residual heteroscedasticity are presented in Appendix 7.²⁰⁰

²⁰⁰For all currencies own ARCH and GARCH effects (represented by α_{\cdot} and β_{\cdot}) are strongly significant. In addition, the models find strong interdependencies between the volatilities of the currencies represented by the λ and μ coefficient. The sums of the λ and μ coefficients are smaller than one, indicating stable relationships.

Figure 9.3: Time-Varying Correlation (BEKK): Brazilian Real - Australian Dollar

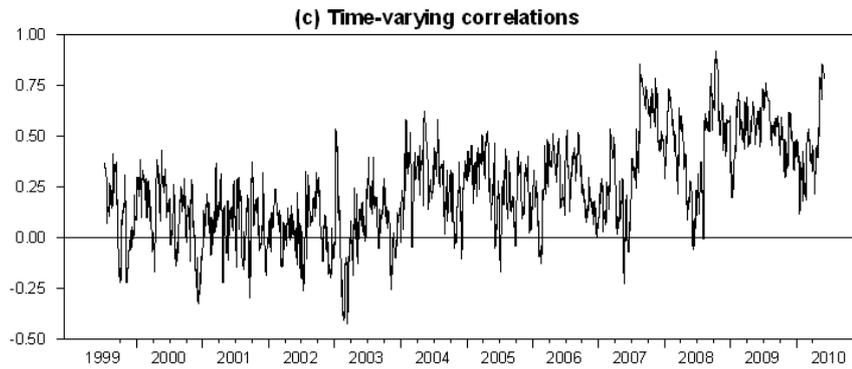


Figure 9.4: Time-Varying Correlation (BEKK): Brazilian Real - New Zealand Dollar

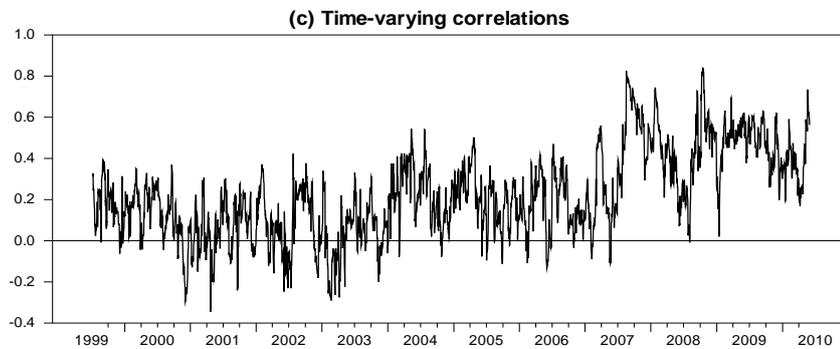


Figure 9.5: Time-Varying Correlation (BEKK): Brazilian Real - Mexican Peso

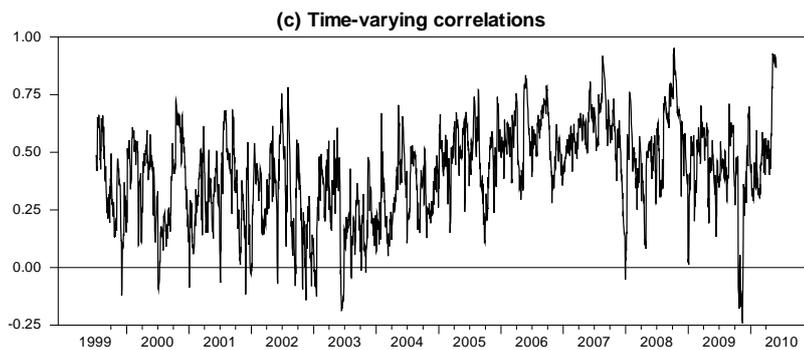


Figure 9.6: Time-Varying Correlation (BEKK): Brazilian Real - Turkish Lira

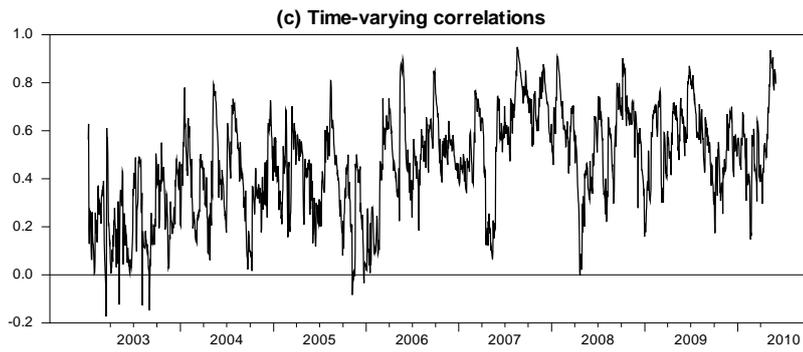


Figure 9.7: Time-Varying Correlation (BEKK): Brazilian Real - South African Rand

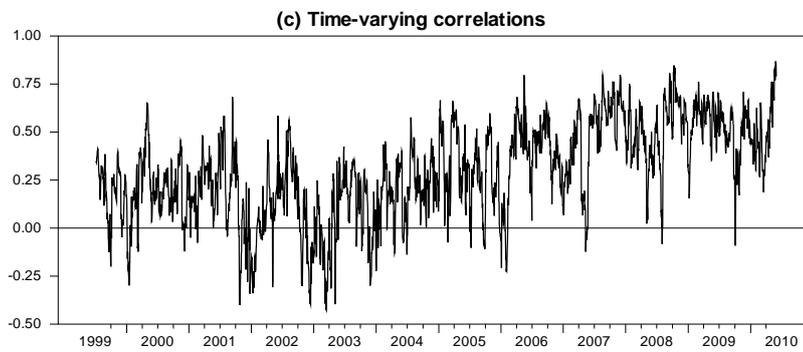


Figure 9.8: Time-Varying Correlation (DCC): Brazilian Real - Australian Dollar

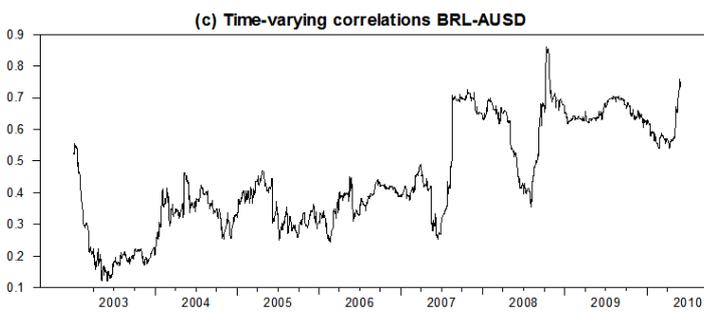


Figure 9.9: Time-Varying Correlation (DCC): Brazilian Real - New Zealand Dollar



Figure 9.10: Time-Varying Correlation (DCC): Brazilian Real - Mexican Peso

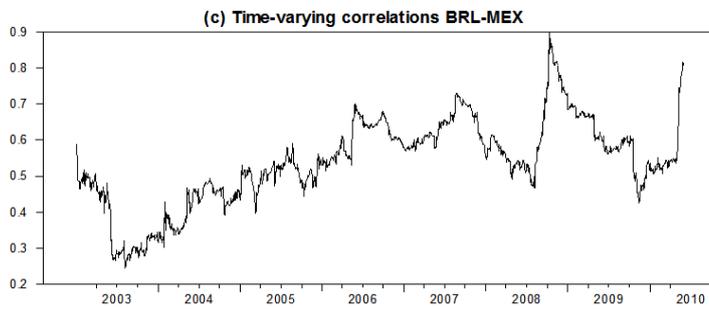


Figure 9.11: Time-Varying Correlation (DCC): Brazilian Real - Turkish Lira

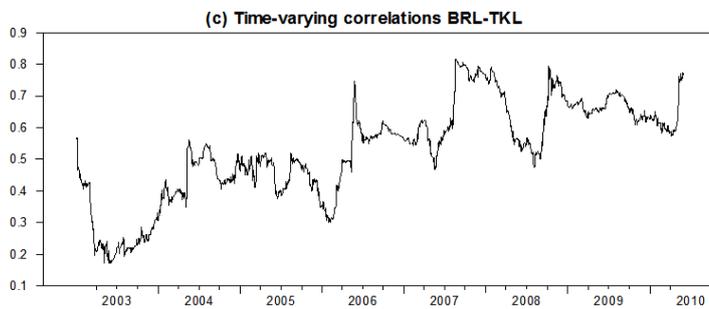
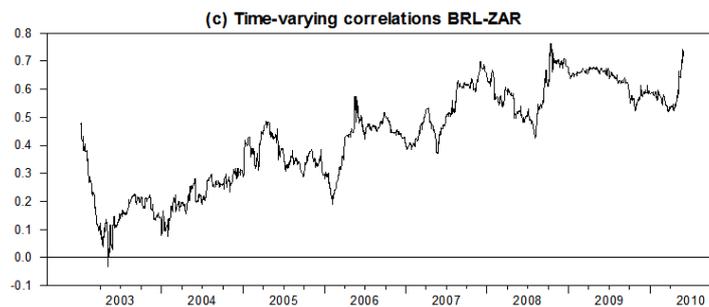


Figure 9.12: Time-Varying Correlation (DCC): Brazilian Real - South African Rand



Several results are noteworthy. Firstly, one can observe the strong and rising correlation between all six currencies since 2003; despite being from different regions characterised by varying macroeconomic configurations all currencies have shown an increasingly similar volatility pattern. This could point to one underlying state factor driving exchange rate dynamics, for example conditions on international financial markets. Secondly, while volatility dynamics in emerging market currencies seem to be more important for the BRL before the international financial crisis, its correlation with the AUD and NZD surges dramatically in mid 2007. As discussed in Chapter 4, this is exactly when the first signs of the international financial crisis emerged in mature financial markets. Rising uncertainty and falling interest rates in developed markets made liquid, high yielding currencies the prime target of international investors. The BRL, together with the AUD and NZD, seems to have been at the forefront of this process. Thirdly, the time-varying correlations show the synchronized surge in correlations at the beginning of the third quarter in 2008 as the collapse of Lehman Brothers led to a global adjustment in portfolios. The BRL's correlation is highest with the MEX and AUD. The first could be explained by the currencies' regional proximity. The second could be further evidence of the increasing importance of short-term carry trade operations in the BRL which are unwound together with positions in the AUD. Finally, one can observe that all correlations have remained relatively high since the international financial crisis. This, in turn, could act as evidence that Brazil's internationalisation has become a permanent feature of the Brazilian economy and the international financial system.

A second element of this chapter, and indeed an indirect "test" for the internationalisation of the Real, has been the empirical triangulation of the implications this internationalisation process had for the drivers of the Brazilian Real. The upper rows of Tables 9.8 to 9.12 show the results. It can be seen that the lagged short-term interest rate differential with the US ($RRONBU(-1)$) significantly determines the RBRL, albeit with a relatively small coefficient, in all bilateral estimations from April 2005 onwards.²⁰¹ The effect is negative: as the interest rate differential increases the exchange rate appreciates. In addition, the coefficient increases in the international

²⁰¹ The only exception is the BEKK estimation with the ZAR for the 2005 onward period, for which the contemporaneous interest rate differential is significant.

financial crisis. As discussed in Chapter 4, a fall in US interest rates, paired with rising rates (and continued exchange rate appreciation) in Brazil, further stimulated yield-driven short-term capital flows to Brazil during the first stage of the international financial crisis.²⁰²

The existence of feedback and momentum trading was approximated with the currencies' own lagged returns. These are positive and significant for the RBRL for the whole estimation period, pointing to positive (destabilizing) feedback trading. The data also show relatively robust evidence of positive momentum in the RMEX and the RZAR. All currencies, except the RBRL, are characterised by positive feedback trading during the international financial crisis. The negative coefficient for the RBRL could be explained by some form of overshooting in the crisis. As discussed in Chapter 4, the Brazilian Real's large depreciation between September and December 2008 was followed by one of the strongest renewed exchange rate appreciations afterwards.

International market and funding conditions have been approximated with three indicators: the S&P 500 (RSP), the VIX (RVIX) and the TED (RTED) spread. The S&P 500 has a strong negative effect on all currencies. Its effect rises over time and illustrates the degree to which various assets that are to large parts fundamentally unrelated have all been whipsawed by a single common factor: international risk attitude, i.e. liquidity preference. The coefficient is generally slightly higher for the four emerging market currencies. It is highest for the TKL and ZAR. The BRL holds the middle ground. In line with the "decoupling" story at the beginning of the international financial crisis the coefficient drops slightly during the crisis period and even ceases to be significant in certain cases.

In line with the literature, the VIX becomes a significant determinant of the RBRL during the international financial crisis as funding conditions become binding and international investors have to liquidate their short-term positions in BRL (Brunnermeier, Nagel et al. 2008). However, the VIX is only significant for the bilateral estimations with the other emerging market currencies. This could support the notion

²⁰² The interest rate differential is also significant for the other currencies in the international financial crisis. This is most probably the effect of falling rates in the US, which stimulated short-term capital flows to emerging markets during this time.

that international risk aversion is particularly important for emerging market currencies. Surprisingly, the VIX is not significant for any of the other currencies in the crisis.

The importance of international funding conditions is more directly tested with the TED spread. Table 9.13 shows the results for the four periods under consideration. The results are based on the BEKK model presented above, in which the interest rate differential has been replaced by the TED spread (and its first lag) to avoid multicollinearity. The coefficients of all other variables remained very similar and are thus not presented.

Table 9.13: BEKK Mean Equation – The TED Spread

TED	01/07/99-01/06/10		01/01/03-01/06/10		01/04/05-01/06/10		01/08/07-01/04/09	
	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
BRL-AUSD	(-)0.002	(-)0.92	(-)0.004	(-)1.59	(-)0.004	(-)1.5	**0.007	2.44
AUSD-BRL	**0.003	2.15	0.002	0.85	0.000	0.16	***0.010	3.43
BRL-NZLD	(-)0.001	(-)0.57	(-)0.003	(-)1.03	(-)0.003	1.08	0.004	1.30
NZL-BRL	0.002	0.57	0.001	0.41	(-)0.001	(-)0.36	*0.007	1.81
BRL-MEX	0.000	0.06	(-)0.001	(-)0.50	(-)0.001	(-)0.25	(-)0.001	(-)0.16
MEX-BRL	0.000	0.00	(-)0.001	(-)1.23	(-)0.001	(-)1.29	0	0.06
BRL-TKL			(-)0.001	(-)0.31	0.002	0.48	**0.006	2.04
TKL-BRL			(-)0.001	(-)0.57	(-)0.001	(-)0.28	*0.004	1.35
BRL-ZAR	0.002	0.82	(-)0.001	(-)0.39	(-)0.001	(-)0.37	0.003	0.83
ZAR-BRL	0.000	0.14	(-)0.004	(-)1.31	(-)0.002	(-)0.53	0.002	0.53
TED(-1)	01/07/99-01/06/10		01/01/03-01/06/10		01/04/05-01/06/10		01/08/07-01/04/09	
	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
BRL-AUSD	(-)0.000	(-)0.50	0.002	0.66	***0.008	2.58	**0.006	2.06
AUSD-BRL	**0.004	2.08	***0.007	2.59	***0.013	4.83	***0.009	2.90
BRL-NZLD	(-)0.000	(-)0.57	(-)0.000	(-)0.08	0.004	1.23	*0.005	1.65
NZL-BRL	0.002	0.57	0.000	0.10	*0.005	1.82	0.001	0.32
BRL-MEX	(-)0.000	(-)0.18	0.001	0.35	(-)0.002	(-)0.81	*0.006	1.80
MEX-BRL	(-)0.000	(-)0.27	(-)0.001	(-)0.36	(-)0.000	(-)0.27	0.000	0.42
BRL-TKL			(-)0.001	(-)0.47	0.002	0.46	0.005	1.57
TKL-BRL			(-)0.001	(-)0.22	0.002	0.42	***0.009	2.72
BRL-ZAR	(-)0.001	(-)0.71	(-)0.001	(-)0.35	0.002	0.63	0.002	0.67
ZAR-BRL	(-)0.003	(-)1.37	(-)0.001	(-)0.24	0.003	0.96	0.005	1.30

*Notes: *, **, *** indicates significance at 10%, 5% and 1% standard normal level respectively*

In line with the evidence from the VIX, the TED spread (or its first lag) is positive and significant for the RBRL in all currency pairs (except the ZAR) during the international financial crisis. Interestingly, the TED spread is not significant for any of the currencies for the first three sub-periods except the AUSD, which depreciates as international funding conditions tighten. This seems to support the conjecture that a higher degree of internationalisation increases a currency's sensitivity to international liquidity and funding conditions.

Finally, Tables 9.8 to 8.12 also show that commodity prices (CRB) had a strong and negative effect on the six currencies over all four periods estimated. The fact that all six currencies, independent of their export profile, are strongly related to commodity prices supports the hypothesis that this co-movement has become partly independent of underlying fundamentals, and instead is the result of (emerging market) currencies and commodities being traded as similar (risky) asset classes. This general significance of commodity prices notwithstanding, some differentiation between the currencies can be observed. The RAUSD, RNZLD, RBRL and RZAR have a higher commodity coefficient than the RMEX and RTKL. Interestingly, and in line with above cointegration results, commodity prices have a stronger effect on the RBRL than the RZAR, despite having a considerably lower share of commodity exports in total exports. The strong effect of commodity prices on exchange rate dynamics increases over time and reaches its peak in the crisis period. Indeed currencies and commodity prices experienced a final peak in July 2008 and plunged nearly simultaneously in early August 2008.

9.5. Conclusions

This chapter empirically investigated the second manifestation of the Brazilian Real's internationalisation: the trading of the currency as an asset class per se. The empirical study conducted had two main objectives. Firstly, it aimed at presenting econometric evidence demonstrating that the Brazilian Real had indeed become an internationally traded currency. To do so, the chapter held that the internationalisation of a currency will lead to its increased co-movement with other internationally traded currencies, largely independent of underlying economic structures and fundamentals. This co-movement, it argued, would be particularly strong between currencies with similar financial characteristics. Secondly, the paper aimed to investigate the theoretical conjecture, and indeed qualitative result, that the internationalisation process of a currency leads to an increased importance of short-term returns, (international) liquidity preference, and financial structure - in the form of a country's net short-term foreign liabilities - for exchange rate dynamics. The latter was approximated with indicators of international funding conditions. As such, this chapter also represented an econometric triangulation of the qualitative results presented in Chapter 7 of this dissertation.

The econometric methodologies used were single equation and multivariate cointegration analysis and multivariate GARCH models. This combination of methods allowed analysis of the co-movement between the currencies in levels, returns and volatilities. In addition, the multivariate GARCH models enabled a robust estimation of exchange rate drivers in the times of currency internationalisation through their inclusion in the mean equation.

The results were broadly supportive of the above conjectures. Firstly, the chapter found that since the second quarter of 2005, after a series of important financial liberalisation measures in the Brazilian foreign exchange market, the Brazilian Real and Australian Dollar demonstrated a robust cointegration relationship. It was argued that this cointegration relationship indicated that since then currency traders had seen these two currencies as similar asset classes, in particular with respect to their return-liquidity characteristics and a certain commodity element. The importance of the Australian Dollar for movements in the Real was also confirmed in the multivariate GARCH analysis.

Secondly, the chapter has shown that all currencies under consideration experienced a substantial increase in their joint volatilities. Despite different macroeconomic configurations and fundamentals, all currencies seem to have been driven by one underlying common factor - international liquidity conditions. This joint volatility increased substantially during the international financial crisis as international portfolio adjustment led to large and synchronous movements in all currencies.

Thirdly, the chapter presented evidence that, as a result of the Brazilian Real's rising internationalisation, the short-term interest rate differential with the US assumed increased importance for exchange rate dynamics. The same applied for international liquidity preference, approximated with the S&P500, which was found highly significant for all periods under consideration. International funding conditions were particularly important during the international financial crisis.

Finally, the chapter has shown that commodity prices were a strong and common factor for explaining exchange rate dynamics in all six countries, despite very different underlying economic structures. This, in turn, the chapter argued shows the important

financial link between commodity prices and (emerging market) currencies, which are traded as similar asset classes by international investors.

Chapter 10: Conclusions

10.1. Introduction

This dissertation has presented a detailed analysis of the recent process of currency internationalisation in emerging markets in the case of the Brazilian Real. It particularly focused on the factors which contributed to this internationalisation and the implications it has had for exchange rate dynamics. The discussion was couched in terms of an alternative analytical framework based on Post Keynesian economic theory and the critical realist ontological claim of underlying mechanisms and deeper structures.

The dissertation argued theoretically and showed empirically that in the context of currency internationalisation the Brazilian Real has been largely driven by short-term returns on domestic financial assets and international market conditions. In addition, actors' perceptions of a sustainable exchange rate value were frequently shaped by Brazil's outstanding external obligations and its ability to meet them, rather than a long-term equilibrium value as proposed by mainstream exchange rate theory. The importance of these factors, however, can lead to large swings in exchange rates, sudden depreciations and a general disconnect from domestic economic conditions as was also shown in this dissertation. The exchange rate, however, is not only a financial sector variable, but also an important real sector relative price, whose dynamics can have significant implications for the productive structure, employment and income distribution of a country. This is particularly true for DECs, for which the exchange rate has historically played an important role as development instrument. These observations bring once more the question of appropriate exchange rate and macroeconomic management in DECs to the forefront of the analysis.

This chapter consists of four sections. Section 2 presents a concise summary of the research conducted in this dissertation. Section 3 discusses the possible implications the findings of the dissertation could have for macroeconomic and exchange rate management in DECs. Finally, Section 4 concludes with some possible avenues of future research. In particular it highlights the need to complement the research

conducted in this dissertation with an investigation into the real sector implications of exchange rate dynamics in the context of currency internationalisation.

10.2. Research Summary

This dissertation was divided into 10 chapters. After a concise summary of the motivation, main contributions and structure of the thesis in Chapter 1, Chapter 2 presented a critical review of mainstream exchange rate theory, particularly with respect to the concept of fundamentals. It highlighted the determining role of the actors' positions and expectations of actors in short-term financial and currency markets, and the consequent contextual and time specific nature of fundamentals. In addition, it argued that once the transformative role of economic agency is acknowledged, the nature of fundamentals may change altogether. This may be particularly true for DEC's given their different market structures and integration in a hierarchical international monetary system.

Chapter 3 presented existing Post Keynesian exchange rate theory, which stresses the determining role of expectations in short-term financial markets and, given that these expectations are formed under fundamental uncertainty, the context and time specific nature of fundamentals. This existing Post Keynesian view of exchange rate determination was complemented with the critical realist ontological claim of deeper structures and mechanisms, which were formulated with respect to one of the most important mechanisms in the presence of fundamental uncertainty from a Post Keynesian perspective: money. Thus, based on the view of the exchange rate as international money, it was argued that it is (a) yields (including expected currency appreciation) on short-term domestic currency denominated assets and (b) a currency's liquidity premium that shape exchange rate movements in DEC's. A currency's liquidity premium was divided into an exogenous liquidity preference and an endogenous element depending on a country's ability to meet its outstanding external obligations, i.e. its financial structure. This ability was determined by a country's total stock of net-short term foreign obligations and the ability to meet these obligations through its autonomous foreign exchange productivity and institutional liquidity. Consistent with the critical realist ontology adopted in this dissertation, it was argued that the empirical

manifestations of these underlying mechanisms will depend on the specific context under consideration or might not be apparent at all.

The emphasis on (foreign) agents' expectations and positions in short-term financial and currency markets for exchange rate determination in DECs, and its theoretical embedding in the role of the exchange rate as international money, has become particularly warranted given the recent process of currency internationalisation. Chapter 4 discussed this process for the Brazilian Real. It showed its two manifestations, i.e. the increased participation of foreign investors in short-term domestic currency denominated assets, and the international trading of the currency as international asset class per se. The chapter further highlighted the implications currency internationalisation has had for exchange rate dynamics, which have been characterised by sustained appreciations, sudden and large depreciations and an increasing dependence on international market conditions.

Chapter 5 set out the factors which contributed to the internationalisation of the Brazilian Real. In line with this dissertation's Post Keynesian approach, the discussion was couched in terms of the institutional liquidity of the Brazilian market, which increased the attractiveness of Brazilian assets for (foreign) market participants in the context of an international financial system increasingly dominated by short-term trading operations. Particular emphasis was placed on the specific microstructure of the Brazilian financial and currency markets, the existing inflation targeting regime with an officially floating exchange rate, and the operations of the BCB as ultimate provider of liquidity. As such, this chapter also introduced the institutional background and the main financial operators in the Brazilian foreign exchange market interviewed in the qualitative part of this study.

Chapter 6 presented the methodological framework. It showed that from both a Post Keynesian and critical realist ontological stance, mixed-method triangulation was the preferred research strategy. The chapter consequently introduced the specific mixed-method study conducted for this dissertation, with a particular emphasis on the design, conduct and limitations of the qualitative element of the study.

The qualitative results were presented in Chapter 7. The chapter showed the different motivations and trading strategies of heterogeneous market participants in the Brazilian foreign exchange market. It further demonstrated that these different trading strategies, and the institutional structures underlying these trading strategies, had a crucial influence on actors' different perceptions and understandings of fundamentals. This heterogeneity notwithstanding, a few common factors were identified across all operators: firstly, the role of short-term financial flows, primarily in the form of short-term capital flows through the balance of payments, and returns on these flows for exchange rate determination in Brazil; secondly, the important role of international risk aversion, i.e. international liquidity preference, for expectation formation; and thirdly, the importance of financial structure for actors' operations. The interviews also pointed to the empirical manifestations of these underlying factors, which, according to the market participants, depended on the creative role of the market and could change over time. Overall, the "fundamentals" and indicators considered by the interviewees also reflected the internationalisation process of the Brazilian Real. Finally, Chapter 7 confirmed the crucial contribution Brazil's existing inflation targeting regime and the foreign exchange operations of the BCB made to this internationalisation process.

Chapter 8 econometrically triangulated the determining role of short-term (balance of payments) flows into domestic currency assets and expected returns on this flows using the cointegrated VAR methodology proposed by Johansen and Juselius. Thus, this chapter also represented an empirical investigation into the first manifestation of the internationalisation of the Brazilian Real. Results showed that, indeed, since 2003 the Brazilian Real formed a cointegration relationship with both equity and bond flows. In the case of equity flows this relationship was bi-directional, which could give rise to self-feeding and explosive processes. In addition, the results confirmed a cointegration relation between the exchange rate and expected financial returns. Importantly, these cointegration relations were not interpreted as long-run, steady-state relations, but as temporary empirical closures between the levels of the variables under consideration.

Finally, Chapter 9 econometrically triangulated some of the empirical manifestations of exchange rate "fundamentals", identified in the qualitative chapter, using single-equation and multivariate cointegration analysis and multivariate GARCH models. It thus also represented an empirical investigation into the second manifestation of the

Real's internationalisation, the trading of the currency as an asset class per se, and the implications this process has had for the drivers of the Brazilian Real. The chapter showed the increased co-movement between the Brazilian Real and other internationally traded currencies, particularly the Australian Dollar. In addition, it presented evidence of the increased importance of the indicators of international risk aversion, short-term returns and financial structure for movements in the Brazilian Real in the new era of currency internationalisation.

10.3. Theoretical and Policy Implications

As outlined above, the adverse exchange rate dynamics observed in Brazil's new era of currency internationalisation bring, once again, the question of macroeconomic management in DECs to the forefront of the debate. Following the speculative attacks on intermediate or pegged exchange rate regimes and severe financial crisis in the late 1990s, many countries with high capital account openness were recommended to adopt an inflation targeting regime with a floating exchange rate. It was argued that the inflation target would serve as a nominal anchor, while the exchange rate could adjust to adverse shocks and avoid sustained periods of misalignment and current account deficits (as frequently experienced during fixed or very rigid intermediate exchange rate regimes). At the same time, the floating exchange rate should avoid large and abrupt exchange rate changes due to speculative attacks and allow countries to use monetary policy for domestic economic goals (rather than defending an exchange rate target) (Obstfeld and Rogoff 1995; Frankel 1999; Fischer 2001; Yagci 2001; Frankel 2003; Plihon 2006).

In the context of Brazil's increased financial integration, of which the currency internationalisation highlighted in this dissertation is just one aspect, the outcomes from this policy were slightly different from those envisaged. Over recent years the Brazilian Real was characterised by large swings and sustained appreciation trends. Indeed, according to Goldman Sachs, at the end of 2009 the Brazilian Real was *the* most overvalued currency in the world (Weitzman 2009). In addition, the Brazilian Real experienced one of the highest exchange rate depreciations during the international financial crisis. This large depreciation was not the result of a speculative attack on the

currency, but caused primarily by the large share of foreign investors in short-term domestic currency assets, who withdrew their funds for reasons largely independent of domestic economic conditions. Finally, the officially floating exchange rate only partially increased monetary policy autonomy: domestic interest rate stayed among the highest in the world and the BCB was a constant and active operator in the foreign exchange market to manage the exchange rate.

Indeed, a sizable literature points to the fact that despite their officially floating exchange rate (often combined with an inflation targeting regime), most emerging markets continue to manage their exchange rates actively. This “fear of floating” phenomenon has been ascribed to existing liability dollarisation, a high exchange rate pass-through and/or the importance of the exchange rate for competitiveness (Calvo and Reinhart 2000; Hausmann, Panizza et al. 2001; McKinnon and Schnabl 2004). The importance of the exchange rate for emerging markets has led several commentators to advocate some form of exchange rate management within an inflation targeting regime (Mishkin and Savastano 2001; Goldstein 2002). For example, in Goldstein’s (2002) “managed floating plus”, the nominal and overriding anchor is given by an inflation target, however, the authorities are allowed to intervene in the foreign exchange market from time to time to “smooth” excessive short-term fluctuations in the exchange rate and/or to maintain market liquidity. Importantly, no explicit exchange rate target or deviations from an “equilibrium” rate are allowed to be considered; market forces have to remain the ultimate determinant of the exchange rate.²⁰³

However, the role of the exchange rate in an inflation targeting regime is a complex issue, particularly in emerging markets (Ho and McCauley 2003; FitzGerald 2004; Ito and Hayashi 2004; Mishkin 2004; Vargas 2005; Barbosa-Filho 2008). In the case of depreciation, a traditionally higher pass-through from the exchange rate to inflation and/or existing liability dollarisation can severely complicate the inflation targeting (Ball 1998; Aghion, Baccetta et al. 2000). The conflict between an inflation targeting regime and a managed exchange rate becomes particularly acute in the case of exchange rate appreciation, especially if this appreciation is caused by strong capital inflows fuelled by high domestic interest rates. Rising interest rates, for example as a result of a

²⁰³ In addition, in order to reduce some of the “vulnerabilities” of emerging markets, Goldstein’s regime would be accompanied with a series of explicit measures to avoid balance sheet mismatches.

booming economy and inflation concerns, will attract short-term capital flows, which appreciate the exchange rate.²⁰⁴ The attempt to “smooth” the exchange rate effect through foreign exchange intervention, however, will require subsequent sterilization to avoid monetary expansion and inflationary pressures. This sterilization maintains interest rates high and thus attracts further short-term capital inflows.

In addition, this dissertation has shown that the foreign exchange interventions by the BCB, without a clear exchange rate target, attracted further short-term capital inflows as they provided liquidity to foreign investors with the simultaneous “promise” of continuous exchange rate appreciation and limited downside risk. Thus, even if emerging market authorities wanted to manage the exchange rate in this context, the existence of an inflation targeting regime would make this nearly impossible. As FitzGerald (2004) points out, an inflation targeting regime in emerging markets has a “...built-in bias towards over-valuation of the exchange rate” and “...exposes the macro-economy to exogenous capital account shocks with no feasible means of countering them” (p. 13-14).

This dissertation, however, has been motivated by the view that the exchange rate is not only a financial sector variable, but also an important real sector relative price. Thus, sustained periods of appreciation and misalignments, and indeed sharp and sudden exchange rate depreciations, can have detrimental effects on the real economy.

This acknowledgment forms the basis of a second form of intermediate exchange rate regime proposed in the literature: the Band Basket Crawl (BBC) regime (Williamson 1996; Williamson 2000). In a nutshell, Williamson’s BBC proposal involves floating the exchange rate around an (announced or un-announced) reference rate within a - relatively wide - band. The reference rate is set according to a basket of a country’s main trading partners to avoid real exchange rate misalignment. In addition, the band crawls in line with a country’s inflation differential to avoid overvaluation. Thus, this proposal aims to combine the flexibility of a floating exchange rate regime with the stabilizing properties of a managed regime.

²⁰⁴ Often this booming economy is caused by the strong capital inflows themselves.

Due to space constraints, only a few observations can be made here on Williamson's BBC proposal. In general terms, two main criticisms have been raised. The first is the inability to find or define an equilibrium or reference rate. However, this criticism is not decisive. As has been argued theoretically and shown empirically in this dissertation, there is nothing like an equilibrium rate. Ultimately, this equilibrium or reference rate is a policy decision and can be set by the authorities given their specific policy objectives in mind. These could include issues like the external balance, employment or even the inflation.²⁰⁵ In addition, the equilibrium or reference rate can be changed according to real sector outcomes to avoid "misalignments" in the face of shocks or structural changes of the economy. The important role of the reference rate is to stabilize financial market expectations and reduce (self-fulfilling) speculation on future exchange rate changes.

The second and main issue is how to stabilize exchange rate expectations credibly around the reference rate, i.e. the design of the band. In general, two main approaches can be distinguished. Firstly, Williamson argues against a firm commitment to intervene at the band (or even announce a band at all). According to the author, a so called monitoring band reduces the likelihood of a speculative attack and avoids the risk of the central bank losing credibility in case it fails to defend the band (Williamson 2010). At the same time, the knowledge that the central bank can and will intervene, but at unpredictable times, will increase uncertainty and make the market fearful to push the rate (Williamson 1998). Secondly, Nissanke (2005) argues that in order to stabilize expectations credibly around or within a band, a firm commitment has to be in place.²⁰⁶ In her view, reverting to Spahn's (1996; 2002) two-tier currency tax proposal, this commitment could be enhanced by a prohibitive, possibly staggered, currency surcharge on foreign exchange operations beyond the pre-announced band as one element of a refined multi-tier currency tax system.

The semi-structured interviews in this dissertation have shown that from the market participant perspective, exchange rate targeting would only be possible in an explicit,

²⁰⁵ Importantly, however, the inflation could not be the only aim of the government.

²⁰⁶ This argument is close to Krugman's (1991) famous case for a target zone, in which the authorities' firm commitment to intervene at the band stabilizes exchange rate expectations and makes the interventions ultimately unnecessary. In emerging markets, this credibility would lower the need to hold (costly) foreign exchange reserves as a protection against speculative attacks.

consistent and credible framework. Thus, in order to crystallize expectations, an explicit exchange rate target and the abandonment of the inflation targeting regime is necessary. At the same time, however, the interviewees were also clear that any announcement of a band or specific rate at which the rate would be maintained, would not be credible and become subject of a speculative attack. According to the foreign exchange market operators, this would be the case even in the presence of a large level of foreign exchange reserves. These results seem to support Williamson's more flexible approach, where the central bank does not have a firm commitment to intervene but enters the market at unpredictable times. The knowledge that the exchange rate will be maintained within a certain range, combined with the uncertainty about the timing and size of interventions, could anchor expectations and increase the risk of one way bets, deterring (short-term) speculators from the market.

However, these measures would not be sufficient in the face of the large capital flows experienced over the recent years. In addition, they would not deter foreign investors attracted by the high domestic financial returns.²⁰⁷ In fact, the majority of foreign exchange operators interviewed for this dissertation agreed that any form of exchange rate management would only be possible in the presence of capital controls. These results confirm Nissanke's (2005) contention that in order to effectively influence exchange rate expectations, a managed exchange rate regime would have to be accompanied by skilful capital flows management. Moreover, this dissertation has argued that a substantial share of net short-term foreign obligations alone can result in large and sudden exchange rate changes, entirely independent of economic conditions. In this view, a reduction in short-term foreign capital inflows would be necessary to stabilize exchange rates and lower their dependence on international market conditions.

In fact, most discussion on macroeconomic management in emerging markets has taken capital mobility to be an untouchable fact, i.e. the impossible trinity was assumed to hold. However, there is no reason why this has to be the case. Financial integration is not an irreversible process. History shows that many countries have adopted a diverse range of capital regulation measures with the exact measures depending on the precise

²⁰⁷ In theory, a stabilized exchange rate should also lead to lower domestic interest rates. However, as argued in Chapter 3, interest rates in DECs are likely to stay above those in developed markets, due to these countries' structurally lower liquidity premium and position in a hierarchical international monetary system.

policy aims, type of integration, nature of capital flows etc (Boyer, Dehove et al. 2004). A recent review by the International Monetary Fund (Ostry, Ghosh et al. 2010) shows that controls on capital inflows significantly affected the composition of flows, monetary policy autonomy, output declines in the recent international financial crisis and, though to a lesser extent, the total volume of capital flows and the exchange rate. Controls on capital outflows can be an important tool against speculative attacks (Boyer, Dehove et al. 2004). Magud and Reinhart (2006) present summarized evidence that controls on capital outflows were, on average, successful in making monetary policy more independent, whereas their effect on the total volume of flows and the (real) exchange rate were mixed.

The negative effects of short-term capital flows have not remained unacknowledged in Brazil. Indeed, as mentioned in Chapter 5, since October 2009 Brazil has reintroduced and extended a tax on foreign investments in debt and equity securities (IOF), which was recently extended to positions on the local derivatives exchange. In addition, in early 2011, the Brazilian government implemented a 60% non-remunerated reserve requirement on banks' short-term FX positions in the spot market, which, as has also been discussed in Chapter 5, were an important counterpart to the speculative operations of foreign investors. The empirical verdict on these measures is still outstanding and will be subject to future research. First empirical and anecdotal evidence (not yet incorporating the measures on the derivatives exchange), however, shows that the measures had little effect on the exchange rate or the total volume of capital inflows. There was some evidence that the composition of flows changed from equity flows to bond flows and, particularly markedly, positions on the local derivatives market (IMF (International Monetary Fund) 2010; IMF (International Monetary Fund) 2011a).

This preliminary empirical evidence seems to indicate that Brazil's measures have not been bold enough yet, particularly if their aim was to ease the pressure on the exchange rate. Future capital account regulations might have to include braver instruments, including potentially a multi-tier currency tax as proposed by Nissanke (2005). While complex in the time of appreciation, this measure might be particularly important in the

time of crisis to avoid large and sudden depreciations.²⁰⁸ However, the design and ineffectiveness of recent capital control measures in Brazil also show the increasingly complex nature of Brazil's integration in international financial markets. This complexity requires an in-depth and detailed analysis of the nature and channels of this financial integration, such as it was done at the aspect of currency internationalisation in this dissertation, in order to formulate appropriate and effective policy recommendations.

Obviously an accommodative macroeconomic framework, including capital control measures, is not sufficient to promote sustainable and equitable growth in DECs. Accompanying microeconomic measures are crucial. At the same time, however, DECs, cannot ignore the important role the exchange rate plays for their development trajectory. This, in turn, severely questions whether its determination should be left to the market.²⁰⁹

10.4. Avenues for Future Research

Based on the results presented in this dissertation and their policy implications discussed above, three main areas of future research are of interest.

The first is an extended analysis of the new channels of emerging markets' integration in international financial markets and the implications these increasingly complex channels have for macroeconomic management. This, in turn, comprises two main research projects: firstly, a further analysis of Brazil's new forms of financial integration and its implications for monetary policy autonomy, including a detailed examination of recent capital control measures; secondly, this research could be extended to other emerging markets, their specific and new channels of financial

²⁰⁸ A detailed discussion of potential capital control measures goes beyond this conclusion and will be subject of future research. However, one possibility would be a staggered tax in the times of appreciation which makes foreign investments increasingly expensive as the currency appreciates. This would avoid a total stop of foreign capital inflows for long-term investment purposes, such as foreign direct investment, but might be easier to administer than selective quantitative controls.

²⁰⁹ It is also important to note that capital regulation on the national level might not be sufficient given increasingly globalised financial market. Thus, some form of capital management on the global level, e.g. in the form of a Tobin Tax, will be crucial to complement domestic capital regulations (Haq ul, Kaul et al. 1996; Spahn 1996; Plihon 2003; Boyer, Dehove et al. 2004).

integration and the complications this integration has brought for macroeconomic management.

The second area of interest is in an extended theoretical and empirical analysis of the role of the exchange rate in an inflation targeting regime in DECs. As discussed above, the exchange rate assumes a crucial role in DECs. However, results for Brazil have shown that the aim to manage the exchange rate might not only complicate, but indeed be inconsistent with an inflation targeting regime. Surprisingly little literature exists on this conundrum. Future research will aim to fill this gap through comparative case studies of DECs following an inflation targeting regime.

Finally, and most importantly, future research will tackle the question: “And, so what”? As mentioned in Chapter 1, this dissertation has been motivated by the important repercussions exchange rate dynamics can have for the real economy, including on growth, employment, and the distribution of wealth and income. However, no empirical research has – as of yet – been conducted to analyse these implications. Thus, to complement the insights generated in this dissertation an in-depth empirical study of the real sector implications of exchange rate dynamics in the new era of currency internationalisation (in Brazil) is warranted. Although a few empirical studies analyse the relationship between the (real) exchange rate, growth and employment, very little research exists as to the effects of exchange rate dynamics on the distribution of wealth and income (Min 2002; Leung and Yuen 2005; Ripoll 2005). This, however, is an important issue in assessing the advantages and disadvantages of the integration of DECs in international financial markets and will thus be a priority in terms of future research.

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Appendices

Appendix 1: Event Study Analysis

To gain an initial insight into the underlying mechanisms and their empirical manifestations, which shaped exchange rate dynamics in Brazil in the new era of currency internationalisation, an event study similar to Kaminsky and Schmukler (1999) was conducted. To analyse the importance of herding in the Asian financial crisis, Kaminsky and Schmukler identify the 20th largest one-day changes in the local stock prices of 8 Asian countries (Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand). In a subsequent step, the causes of these 190th “events” are identified through a review of the financial press and the prominent news on this day (primarily Bloomberg). Based on this content analysis the authors classify news in eight categories: (1) agreements with international organizations or the financial community; (2) credit ratings by international agencies; (3) economic news, including both real, financial, and external sector news; (4) monetary policy; (5) fiscal policy; (6) political news, including political events and talk; (7) capital controls; and (8) no news. These news are then converted into dummies, which take the value of +1 in the case of good news and -1 if the news are bad, and are included in a regression analysis with the return of stock prices as dependent variable. Kaminsky and Schmuckler find that days with no news have a strong effect on local stock prices, pointing to the importance of herding. Among the other “events”, news related to international financial organisation and rating agencies have the strongest effect.

In line with this dissertation’s retroductive strategy, Kaminsky and Schmukler’s method was considered suitable for a first exploration of the data with a view to forming initial hypotheses about the process of exchange rate determination in Brazil. Thus, this dissertation identified 30 “events” based on the largest absolute change in exchange rate returns between January 1999 and November 2008. A subsequent analysis of the financial press, using different sources such as Reuters, Bloomberg and local press, identified 8 main causes of the observed exchange rate movements: (1) international financial crisis (IFC; 8 events); (2) no news (NN; 8 events); (3) credit relations, such as news about a new IMF support package or a statement by credit rating agencies (CR; 6

events); (4) central bank intervention (CB; 4 events); (5) global recession (GR; 3 events); (6) US interest rate decisions (R; 3 events); (7) concerns about the health of the domestic financial system (FS; 1 event) ; and finally (8) political factors (PF; 1 event). As in Kaminsky and Schmukler, these news events were transformed into dummies, however, only with the value +1 if the causal factor was present. These dummies were incorporated into the mean equation of a GARCH model. Given that the domestic financial system and political factors were only mentioned once, these were excluded from the equation. No residual heteroscedasticity or autocorrelation could be observed. Table A1.1 shows the results.

Table A1.1: Event Study – GARCH Estimation

Dependent Variable: RETURN
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 12/09/08 Time: 17:04
Sample (adjusted): 3 2433
Included observations: 2431 after adjustments
Convergence achieved after 56 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(8) + C(9)*RESID(-1)^2 + C(10)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
RETURN(-1)	0.124825	0.021514	5.802162	0.0000
CB	-0.022998	0.003416	-6.731628	0.0000
CR	0.000689	0.000886	0.777634	0.4368
GR	0.024088	0.021192	1.136638	0.2557
IFC	0.002555	0.001194	2.139129	0.0324
NN	0.004772	0.002095	2.277898	0.0227
R	0.012175	0.002576	4.725937	0.0000
Variance Equation				
C	2.92E-07	4.99E-08	5.848411	0.0000
RESID(-1)^2	0.180350	0.014498	12.43975	0.0000
GARCH(-1)	0.809256	0.013854	58.41194	0.0000
R-squared	0.111895	Mean dependent var		4.23E-06
Adjusted R-squared	0.109696	S.D. dependent var		0.004422
S.E. of regression	0.004172	Akaike info criterion		-8.624272
Sum squared resid	0.042196	Schwarz criterion		-8.600430
Log likelihood	10492.80	Hannan-Quinn criter.		-8.615604
Durbin-Watson stat	1.934228			

One can observe the significant effect of central bank interventions, the international financial crisis and US returns on the Brazilian Real. While central bank interventions have a positive (appreciating) effect on the exchange rate, the international financial crisis and interest rate decisions in the US depreciate the exchange rate. One can also

observe the important role of no news, i.e. sharp exchange rate appreciations in the absence of any major news. Overall, these results point to the important role of international market conditions and central bank interventions for the Brazilian Real. The significant effect of “no news”, pointed to other important underlying factors which could not be observed by the financial press and which were aimed to be uncovered with the semi-structured interviews.

Appendix 2: Classification of Banks Interviewed

Onshore Banks

DMB Domestic Multiple (Universal) Bank

DCB Domestic Commercial Bank

DIB Domestic Investment Bank

FMB Foreign Multiple (Universal) Bank

FCB Foreign Commercial Bank

FIB Foreign Investment Bank

Table A2.1: Classification of Onshore Banks Interviewed

Bank	Central Bank Classification	Nationality	De Jure Classification	De-facto
Itau Unibanco	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	D	DMB	DCB
Credit Suisse	BANCOS DE INVESTIMENTO	F	FIB	FIB
Citibank	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	F	FMB	FCB
Banco Rendimento	BANCOS COMERCIAIS	D	DCB	DCB
HSBC	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	F	FMB	FCB
Pactual (UBS)	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	D	DMB	DIB.
Deutsche Bank	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	F	FMB	FIB
Santander	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	F	FMB	FCB
Goldman Sachs	BANCOS MULTIPLOS SEM CARTEIRA COMERCIAL	F	FIB	FIB
Merrill Lynch	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	F	FMB	FIB
BNP Paribas	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	F	FMB	FIB
Banif	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	F	FMB	FIB
Safra	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	D	DMB	DCB
Votorantim	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	D	DMB	DIB
BBM	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	D	DMB	DIB
Banco do Brasil	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	D	DMB	DCB
JP Morgan	BANCOS COMERCIAIS	F	FCB	FIB
Bradesco	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	D	DMB	DCB
Morgan Stanley	BANCOS MULTIPLOS COM CARTEIRA COMERCIAL	F	FMB	FIB
Standard Chartered	BANCOS DE INVESTIMENTO	F	FIB	FIB

Source: BCB(2011a)

Notes: Nationality based on ownership structure; de-jure classification based on balance sheet data and whether bank has a majority of retail capital market operations; de-jure classifications cross-checked with responses from the semi-structured interviews; Standard Chartered had not yet started operations in

Brazil at the time of the interview, responses on the institutions are thus not counted; given that the interviewee had worked with other foreign investment bank before, responses were counted as valid and could be classified as belonging to a FIB;

Offshore Banks

1. Large Commercial Bank (Interviewee explicitly requested not to be mentioned)
2. Nomura
3. Large Investment Bank (Interviewee explicitly requested not to be mentioned)
4. Lloyds Banking Group
5. Northern Trust
6. BNP-Paribas
7. Standard Chartered
8. RMB Private Bank
9. Merrill Lynch

Appendix 3a: Interview Sheet Onshore Banks

Notes: Questions underlined are core questions and where aimed at all interviewees; other questions were asked if time was available or if necessary for probing

Introductory Questions

What is your position in the institution?

How long have you worked for the institution?

Microstructure

What functions do foreign exchange operations (both spot and derivative market) fulfil in your institution?

How important are these functions in terms of revenue?

- How important is foreign currency trading for your institution in terms of revenue?
- Did that change during the crisis?

Can you describe me a little bit your role in the institution?

- Functions/markets/instruments
- Do you operate in different market/instruments whether you hedge or speculate?

For how long do you keep exposure in foreign exchange?

In a similar vein, could you quickly describe the institutional structure of your institution with regards to foreign currency operations?

- How many trading desks?
- What kind of operations?
- How do the trading desks link to other areas of the banks' operations?

What share of your foreign currency operations are client initiated and what share is proprietary trading (Institution and Trader)?

- What determines the size of your proprietary trading budget?
- What determines the size of the position you take?

Who are your main clients (Institution and Trader)?

- What assets do they mainly invest in?
- Do you hedge all your exposure to clients?

Do you operate differently whether you operate with your proprietary budget or for your clients?

- And if so, how?

How important is the off-shore market for your institution's operations?

- For the Brazilian Real in general?
- What are the main reasons for you to operate off-shore?

Trading Strategy

Which foreign currency related operations you conduct are most profitable?

- Do you make more money on the trend or the volatility? (intra-day vs. long-term exposure)
- Do you change your strategy?
- What about the crisis?

Which arbitrage operations you conduct are most profitable?

- spot vs. futures market
- on-shore vs. off-shore

According to the popular academic distinction which financial institutions affecting the value of the exchange rate would you classify as arbitrageur- hedger – speculator?

- What about your institution?
- What about your trading?

Which institutions operate on the highest exchange rate exposure?

- What about your institution?
- What about your trading?

Which institutions operate on the highest leverage?

- What about your institution?
- What about your trading?

Fundamentals

In your opinion, what are the fundamentals of the Brazilian exchange rate?

- Why do you think these are the fundamentals?
- Does the nature of fundamentals change over time?

Do you think there is a distinction between long and short-run fundamentals?

- Which would you consider short run fundamentals and which long-run fundamentals?
- Are there times when the exchange rate follows its long-run fundamental? And if so when?

What drives exchange rate in the short-run?

How important do you think is speculation for currency movements?

- For volatility and trend?

Trading Behaviour

What variables do you take into consideration when taking position in the foreign exchange market?

- at end of business day (intra-day trading)?
- next month?
- next year?

- Which horizon is most important for your trading decisions?

What indicators did you look at to assess the currency's value

- before the crisis (before September 2008)
- as the crisis broke out?
- during the crisis?
- now?

Which flows are most important for your trading decisions?

(trade balance, different capital flows?)

- When are flows not important?
- Which variables are important when flows are not important?

When is technical analysis/momentum trading (past exchange rate values) important for your trading decisions?

How do returns on other assets, mainly in fixed income and the stock market, affect your trading decisions?

- In other words, how important is the carry trade for your operations?

Is there a fundamental value of the Brazilian exchange rate?

- And if so, what determines the fundamental value of the Brazilian exchange rate?
- And if so, how does it influence your trading behaviour?
- And if so, how can this fundamental rate be attained?

Is the behaviour of other eme currencies important for your trading decisions?

- And if so, which?
- How would you compare the Brazilian real to other emerging market currencies?

Does the behaviour of other institutions in the market effect your trading decisions?

- Which institutions are particularly important for your trading decisions?
- When is the behaviour of other market participants important for you?

Financial Crisis

Can you remember when you closed your long positions in reais?

What internal and external variables prompted you to close your position?

How did the performance of your institution outside of Brazil affect your trading during the crisis?

Which clients were the first ones to cut their positions in Brazilian Real?

- Did that affect your decision to close your position?

How important were stop-loss orders?

- For yourself?

- For market movements?

In your trading decisions did you follow other institutions?

- And if so which one?

How important was the freeze in international money markets?

Why did the exchange rate depreciate so much?

- Was there active speculation against the real and if so by what institutions?
- Was there positive feedback trading?

Do you think the exchange rate was overvalued before the crisis?

- Why do you think it was overvalued?
- And if so, why did you not close your position before?

Exchange Rate Management

Did you expect the central bank to intervene and contain the depreciation?

- If so at what level?
- Do you think the central bank was effective in containing the depreciation?
- If the central bank would not have had 200 billion forex reserves, would you have traded differently (speculated against the real)?

How do the operations of the central bank affect your trading decisions?

- Volatility vs. Trend?

How does the existence of an inflation target affect your trading strategy?

In your view, does the central bank in the floating exchange rate regime influence the exchange rate's value?

- And if so, how?
- Do you think the central bank was effective in containing the exchange rate trend?
- Do you think the reverse FX swap was effective in containing the inflation trend?
- How do you think the central bank could affect the real's value more effectively?

Would you want the central bank to defend a certain exchange rate value?

- Why?
- At certain times?

If the central bank decided to defend a certain exchange rate value, how could it make this strategy credible?

- Would a large level of foreign exchange reserves make it credible?
- Would a "sustainable" exchange rate value make it credible?
- What determines this "sustainable" exchange rate value?
- Where do you think would the sustainable value be?

Appendix 3b: Interview Sheet Onshore Hedge Funds

Notes: Questions underlined are core questions and where aimed at all interviewees; other questions were asked if time was available.

Introductory Questions

What is your position in the institution?

How long have you worked for the institution?

Microstructure

Can you explain me a little how trading for a hedge fund differs from trading for a bank?

- Functions/markets/instruments

What functions do foreign exchange operations (both spot and derivative market) fulfil in your institution?

- How important are these functions in terms of revenue?
- How important is foreign currency trading for your institution in terms of revenue?
- How important are fx operations compared to other assets (fixed income; equity)?
- Did that change during the crisis?

For how long do you keep exposure in foreign exchange?

In a similar vein, could you quickly describe the institutional structure of your institution with regards to foreign currency operations?

- How many trading desks?
- What kind of operations?
- How do the trading desks link to other areas of the banks' operations?

How important is the off-shore market for your institution's operations?

- For Brazilian Real in general?
- What are the main reasons for you to operate off-shore?

Trading Strategy

Which foreign currency related operations you conduct are most profitable?

- Do you make more money on the trend or the volatility? (intra-day vs. long-term exposure)
- Do you change your strategy?
- What about the crisis?

Which arbitrage operations you conduct are most profitable?

- spot vs. futures market
- on-shore vs. off-shore

According to the popular academic distinction which financial institutions affecting the value of the exchange rate would you classify as arbitrageur- hedger – speculator?

- What about your institution?
- What about your trading?

Which institutions operate on the highest exchange rate exposure?

- What about your institution?
- What about your trading?

Which institutions operate on the highest leverage?

- What about your institution?
- What about your trading?

Fundamentals

In your opinion, what are the fundamentals of the Brazilian exchange rate?

- Why do you think these are the fundamentals?
- Does the nature of fundamentals change over time?

Do you think there is a distinction between long and short-run fundamentals?

- Which would you consider short run fundamentals and which long-run fundamentals?
- Are there times when the exchange rate follows its long-run fundamental? And if so when?

What drives exchange rate in the short-run?

How important do you think is speculation for currency movements?

- For volatility and trend?

Trading Behaviour

What variables do you take into consideration when taking position in the foreign exchange market?

- at end of business day (intra-day trading)?
- next month?
- next year?
- Which horizon is most important for your trading decisions?

What indicators did you look at to assess the currency's value

- before the crisis (before September 2008)
- as the crisis broke out?
- during the crisis?
- now?

Which flows are most important for your trading decisions?
(trade balance, different capital flows?)

- When are flows not important?

- Which variables are important when flows are not important?

When is technical analysis/momentum trading (past exchange rate values) important for your trading decisions?

How do returns on other assets, mainly in fixed income and the stock market, affect your trading decisions?

- In other words, how important is the carry trade for your operations?

Is there a fundamental value of the Brazilian exchange rate?

- And if so, what determines the fundamental value of the Brazilian exchange rate?
- And if so, how does it influence your trading behaviour?
- And if so, how can this fundamental rate be attained?

Is the behaviour of other eme currencies important for your trading decisions?

- And if so, which?
- How would you compare the Brazilian real to other emerging market currencies?

Does the behaviour of other institutions in the market effect your trading decisions?

- Which institutions are particularly important for your trading decisions?
- When is the behaviour of other market participants important for you?

Financial Crisis

Can you remember when you closed your long positions in Brazilian Real?

What internal and external economic variables prompted you to close your position?

How did the performance of your institution outside of Brazil affect your trading during the crisis?

Which clients were the first ones to cut their positions in Brazilian Real?

- Did that affect your decision to close your position?

How important were stop-loss orders?

- For yourself?
- For market movements?

In your trading decisions did you follow other institutions?

- And if so which one?

How important was the freeze in international money markets?

Why did the exchange rate depreciate so much?

- Was there active speculation against the real and if so by what institutions?
- Was there positive feedback trading?

Do you think the exchange rate was overvalued before the crisis?

- Why do you think it was overvalued?
- And if so, why did you not close your position before?

Exchange Rate Management

Did you expect the central bank to intervene and contain the depreciation?

- If so at what level?
- Do you think the central bank was effective in containing the depreciation?
- If the central bank would not have had 200 billion forex reserves, would you have traded differently (speculated against the real)?

How do the operations of the central bank affect your trading decisions?

- Volatility vs. Trend?

How does the existence of an inflation target affect your trading strategy?

In your view, does the central bank in the floating exchange rate regime influence the exchange rate's value?

- And if so, how?
- Do you think the central bank was effective in containing the exchange rate trend?
- Do you think the reverse FX swap was effective in containing the inflation trend?
- How do you think the central bank could affect the real's value more effectively?

Would you want the central bank to defend a certain exchange rate value?

- Why?
- At certain times?

If the central bank decided to defend a certain exchange rate value, how could it make this strategy credible?

- Would a large level of foreign exchange reserves make it credible?
- Would a "sustainable" exchange rate value make it credible?
- What determines this "sustainable" exchange rate value?
- Where do you think would the sustainable value be?

Appendix 3c: Interview Sheet Offshore Banks

Notes: Questions underlined are core questions and where aimed at all interviewees; other questions were asked if time was available or if necessary for probing

Introductory Questions

What is your position in the institution?

How long have you worked for the institution?

Microstructure

What role does EMEFX trading play for your institution?

- How important is EME FX trading compared to other asset classes?
- Trend?
- When is EME FX most important?

How much of your trades client induced and how much proprietary?

- What determines the size of your proprietary budget?

Through what institutional channels and instruments do you trade EME assets (currencies and equities if so)?

- (When you invest in Brazil) do you prefer to trade on-shore or off-shore?
- If you trade off-shore what instruments do you use?

How would you compare Brazilian assets (currency) to other emerging market assets?

- Do you think the BRL is a commodity currency?
- What is the relationship between commodity prices and emerging market currencies?

How would you define liquidity? What contributes to the liquidity of an EME currency?

- For the carry, yield or liquidity more important?

Trading Strategy

What are your preferred trading strategies for emerging market assets (currencies)?

- Do you take structural (directional) positions?
- Do you use EME currencies to diversify?
- Flow Information?
- Which flows most important?
- Do you change your strategy? And if so when?

How would you compare EME currency trading with G7 currencies?

- What type of trading (long-term etc.) do you think is most prevalent in EME currencies?

In your opinion, what are the fundamentals of EME currencies?

- Does the nature of fundamentals change over time?

- Do you think there is a distinction between long and short-run fundamentals?
- How important are fundamentals to explain exchange rate movements?
- How important do you think is speculation for currency movements?

So what drives the exchange rate in EME?

What variables do you take into consideration when taking position in EME (currencies)?

- At different horizons?
- At different times?
- Other eme currencies?
- Other institutions?

What determines the timing and the size of the position you take?

- What determines your price and size limits?

How do returns on other assets (e.g. equities; domestic/international) affect your trading in currency?

What is the role of technical trading/momentum strategies for EME trading?

How does the notion of a long-run exchange rate value influence your trading?

- What determines this long-run value?

Financial Crisis

How did your trading strategies in EME assets (currencies) change during the international financial crisis?

- When did you reduce/close your long/opened short positions in EME in the international financial crisis?
- Why did you close your long positions?
- Losses of institution in other areas?
- Stop-loss orders?
- Herding?
- Credit crunch?
- Client Redemptions?
- Did you close your positions in different EME at different times? Why?

Do you think EME assets (currencies) were overvalued before the crisis?

- Why do you think it was overvalued?
- And if so, why did you not close your position before?
- Positioning?

Exchange Rate Management

How do the operations of central banks in EME affect your trading decisions? During the Crisis?

- Do you think the central bank was effective in containing the depreciation?

- If the central bank would not have had 200 billion forex reserves, would you have traded differently (speculated against the real)?

In normal times?

Existence of an inflation targeting regime

In your view, how can EME central banks manage the exchange rate value most effectively?

- Large level of reserves?
- Sustainable exchange rate value?

As a trader, do you prefer a managed or a floating exchange rate regime?

- At times, would you want the central bank to defend a certain exchange rate value?
- Would you want the central bank to contain an appreciation trend (do you prefer fast or slow appreciation)?
- How do you feel about capital controls?

Appendix 3d: Interview Sheet Offshore Funds

Notes: Questions underlined are core questions and where aimed at all interviewees; other questions were asked if time was available or if necessary for probing

Introductory Questions

What is your position in the institution?

(How long have you worked for the institution?)

Microstructure

What role does EM FX play for your institution?

- How important is FX compared to other asset classes?
- Are there times at which FX is particularly important?

Through what institutional channels and instruments do you trade EM currencies?

- (When you invest in Brazil) do you prefer to trade on-shore or off-shore?
- If you trade off-shore what instruments do you use?

Why is the Brazilian Real an attractive asset for you?

Trading Strategy

How would you compare EM currency trading with G7?

What are your preferred trading strategies for emerging market assets (currencies)?

- Do you take structural (directional) positions?
- How long do you keep positions?
- What determines the timing and the size of the position you take?
- Do you change your strategy and if so when? (Crisis?)

What type of trading strategies do you think is most prevalent in EM currencies?

Fundamentals

In your opinion, what are the fundamentals of EME currencies?

- Does the nature of fundamentals change over time?
- Do you think there is a distinction between long and short-run fundamentals?
- How important are fundamentals to explain exchange rate movements?
- Speculation?

What variables do you take into consideration when taking position in EME (currencies)?

- At different horizons?
- At different times?
- Other eme currencies?

- Other institutions

What drives EM currencies?

Which flows are particularly important for EM currencies?

How important is the carry trade for EM currencies? (for you?)

How important are stock prices?

What is the role of technical trading/momentum strategies for EME trading?

- Positioning?

How does the notion of a long-run exchange rate value/fair value influence your trading?

- What determines this long-run value?

Financial Crisis

How did your trading strategies in EME assets (currencies) change during the international financial crisis?

- When did you close your long/opened short positions in EME in the international financial crisis?
- Why did you close your long positions?
- Did you close your positions in different EME at different times? Why?

Do you think EME assets (currencies) were overvalued before the crisis?

- Why do you think it was overvalued?
- And if so, why did you not close your position before?
- Positioning?

Exchange Rate Management

How do the operations of central banks in EME affect your trading decisions? During the Crisis?

- Do you think the central bank was effective in containing the depreciation?
- If the central would not have had 200 billion forex reserves, would you have traded differently (speculated against the real)?

In normal times?

Existence of an inflation targeting regime

In your view, how can EME central banks manage the exchange rate value most effectively?

- Large level of reserves?
- Sustainable exchange rate value?

As a trader, do you prefer a managed or a floating exchange rate regime?

Appendix 4: Residuals of the Basic VAR (2) Model

Figure A4.1: Exchange Rate

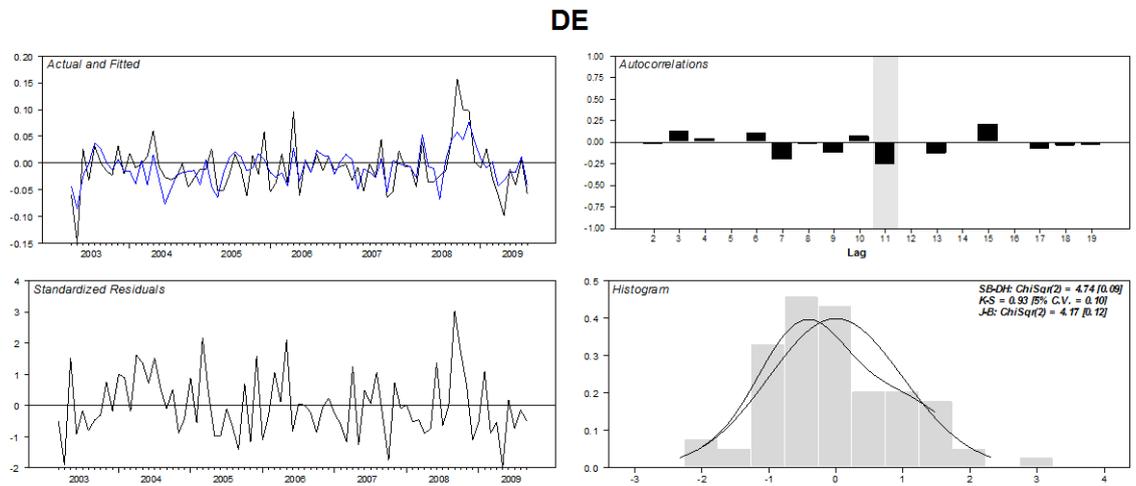


Figure A4.2: Expected Stock Prices

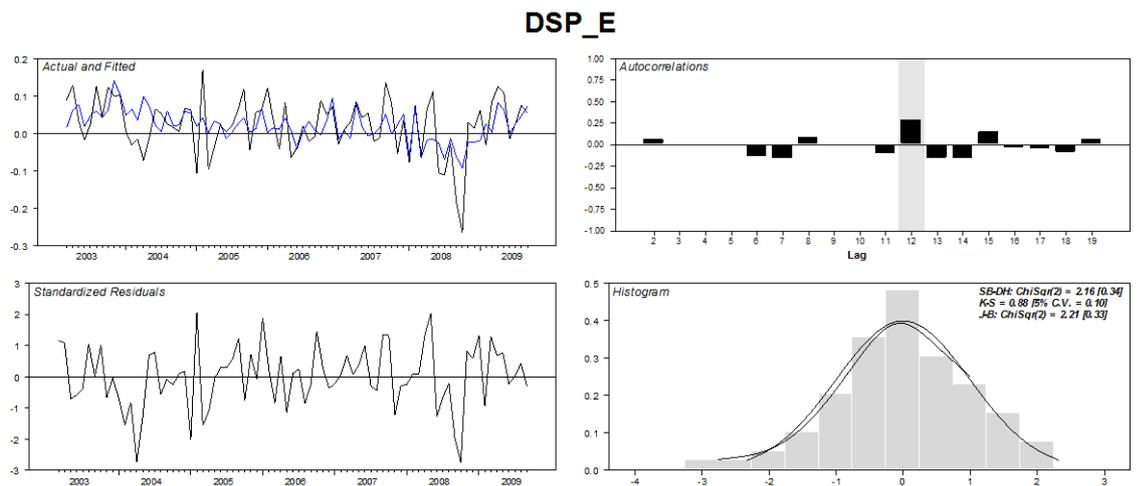


Figure A4.3: Expected Interest Rate

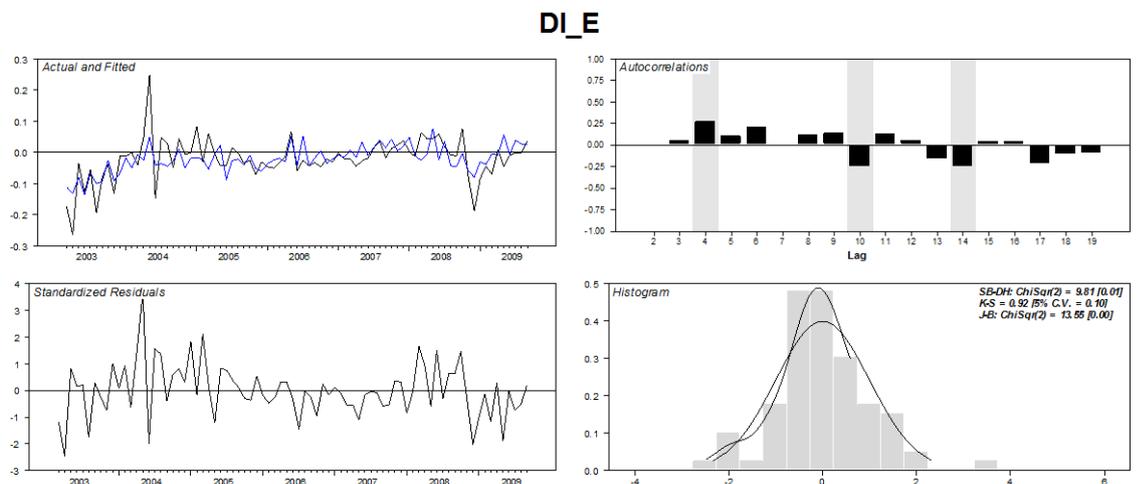


Figure A4.4: Equity Flows

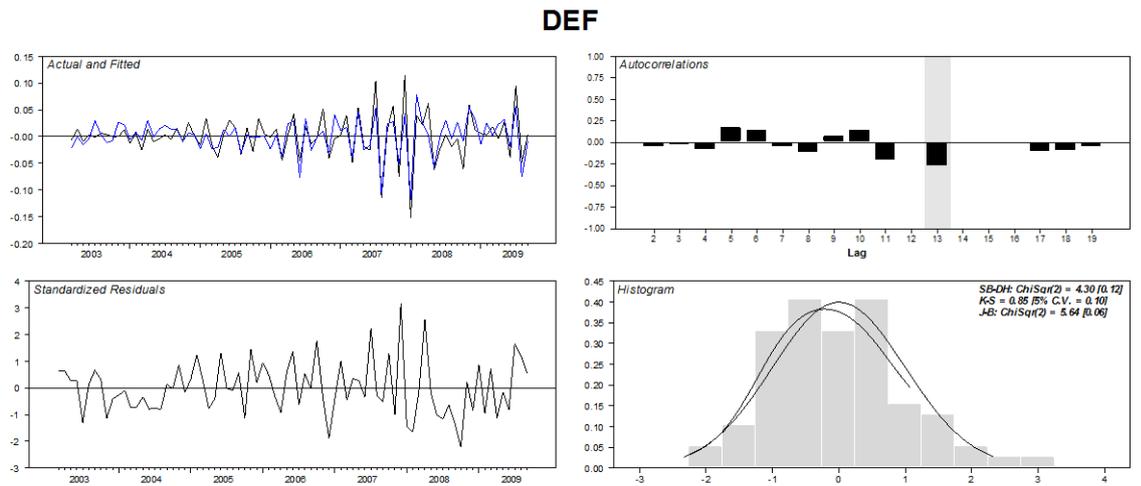


Figure A4.5: Debt Flows

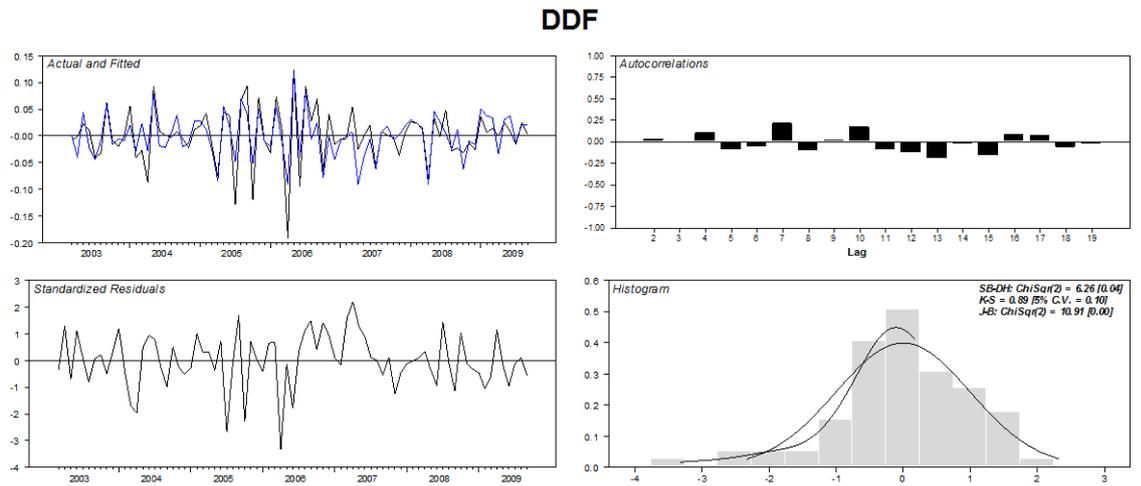
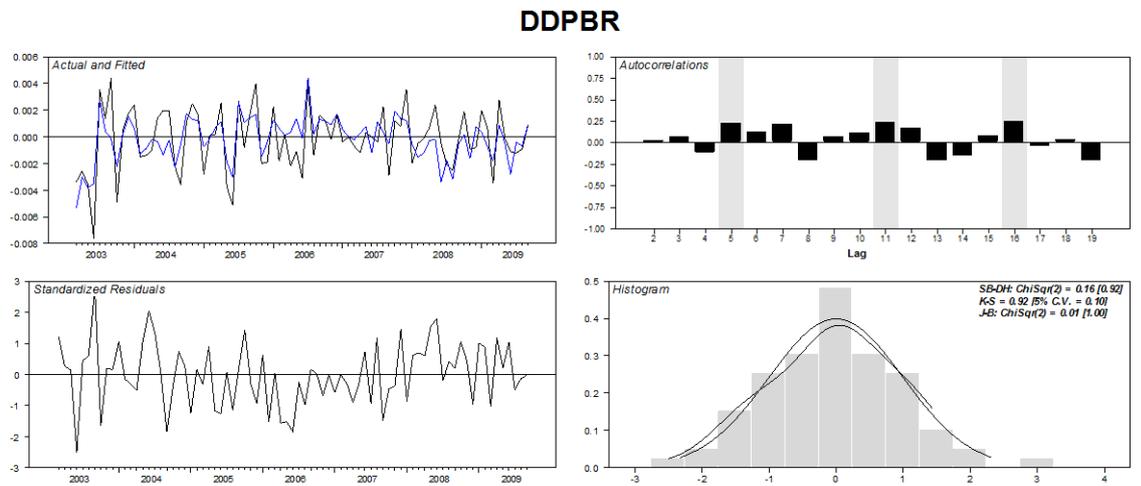
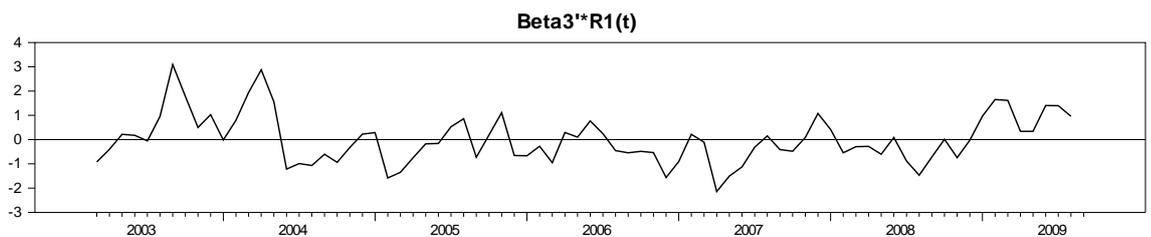
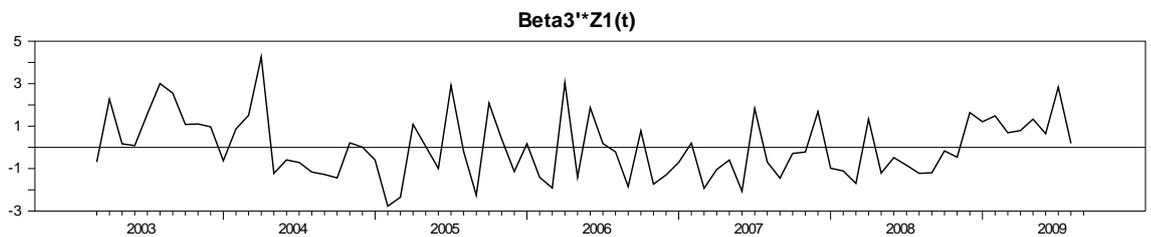
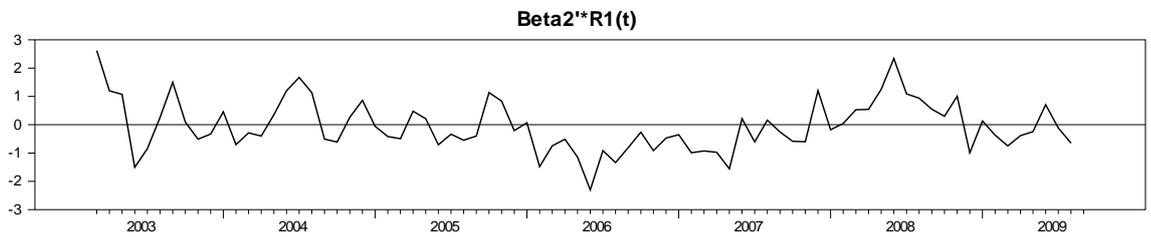
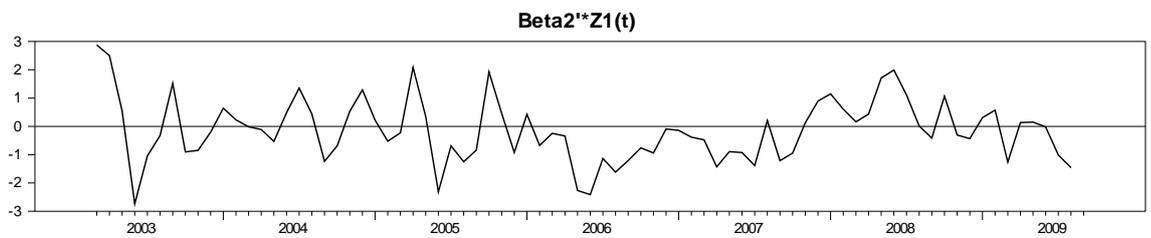
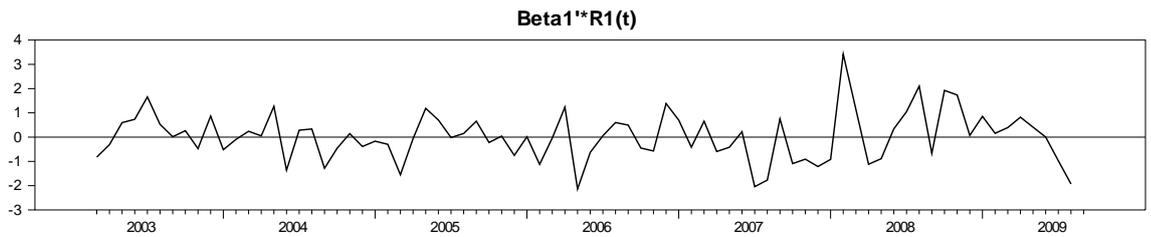
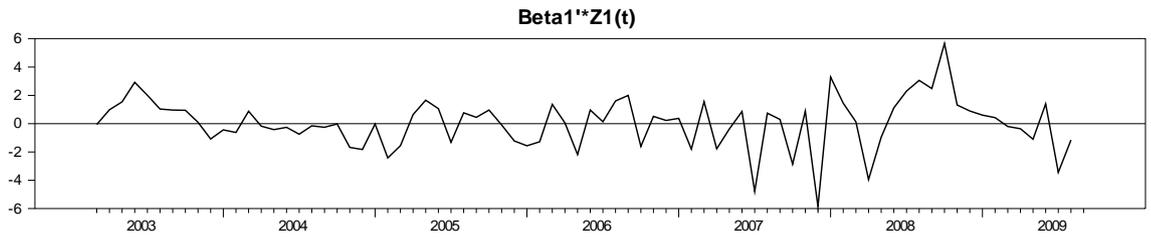
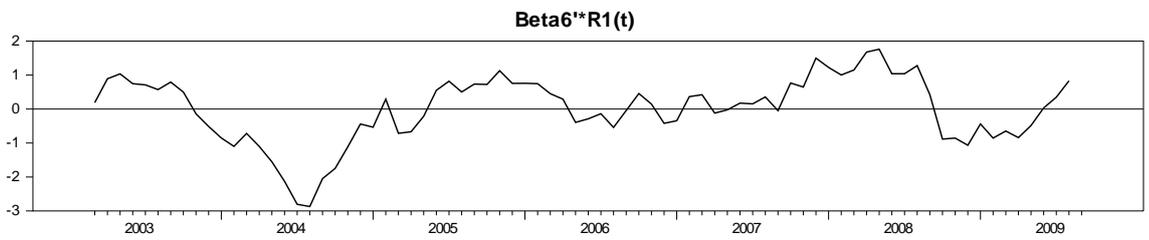
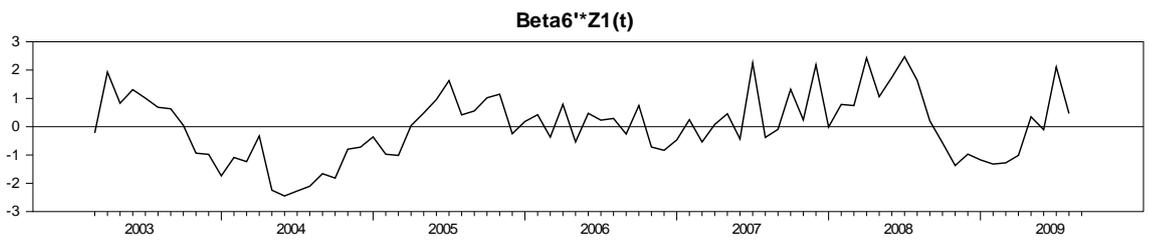
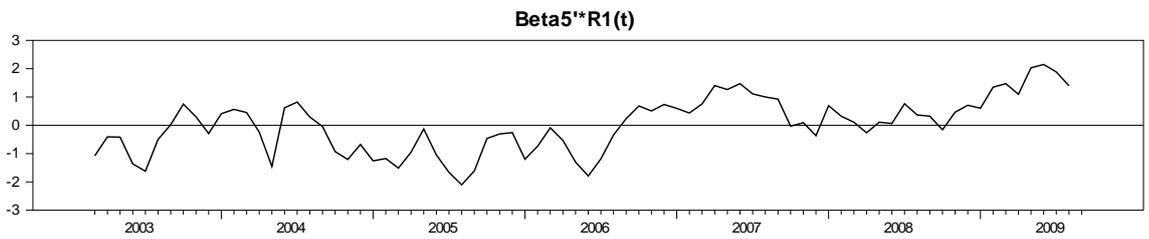
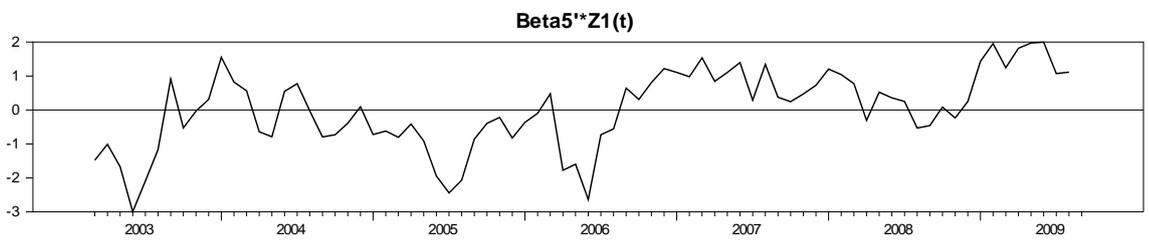
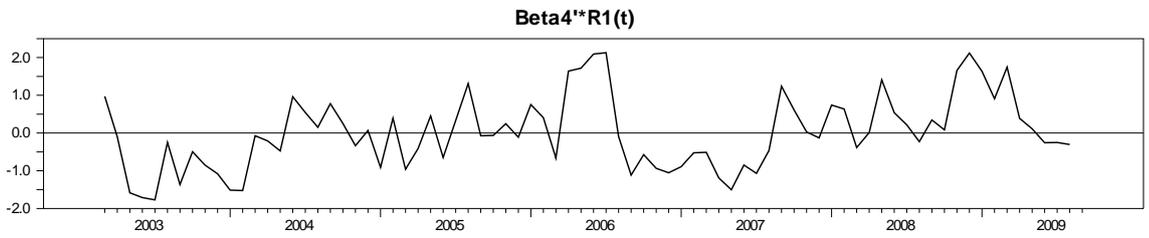
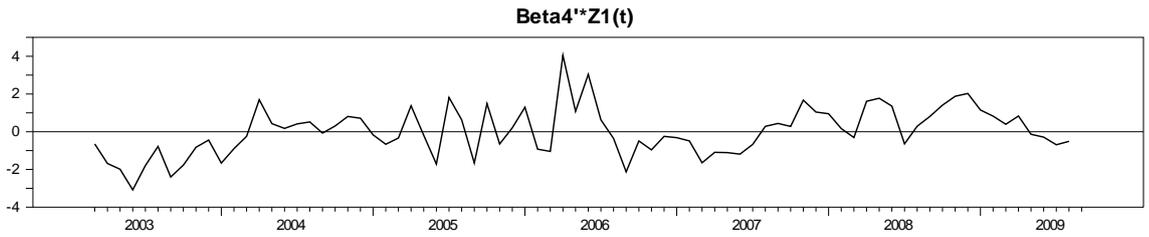


Figure A4.6: Inflation Rate



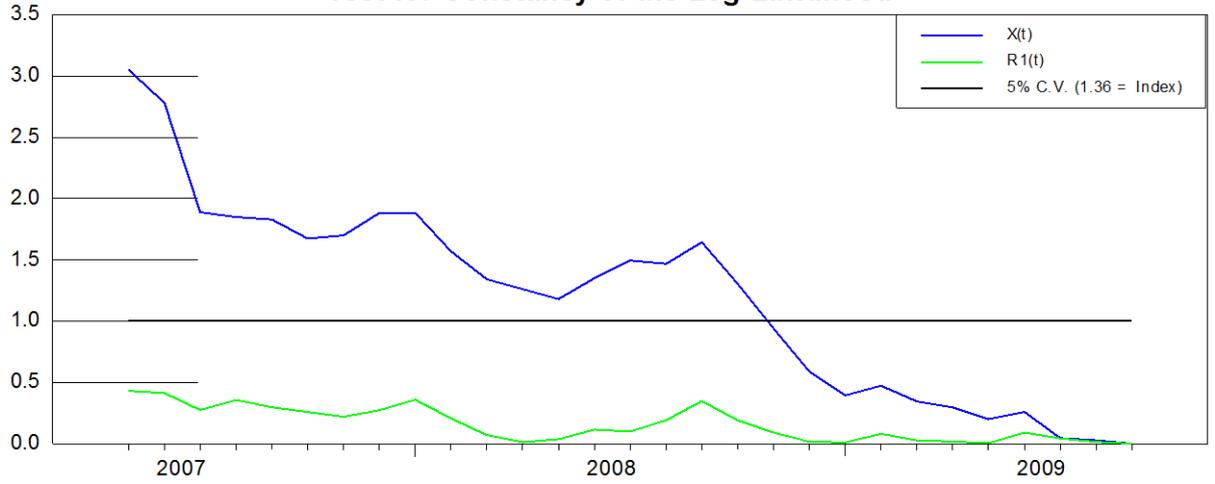
Appendix 5: Cointegration Relations



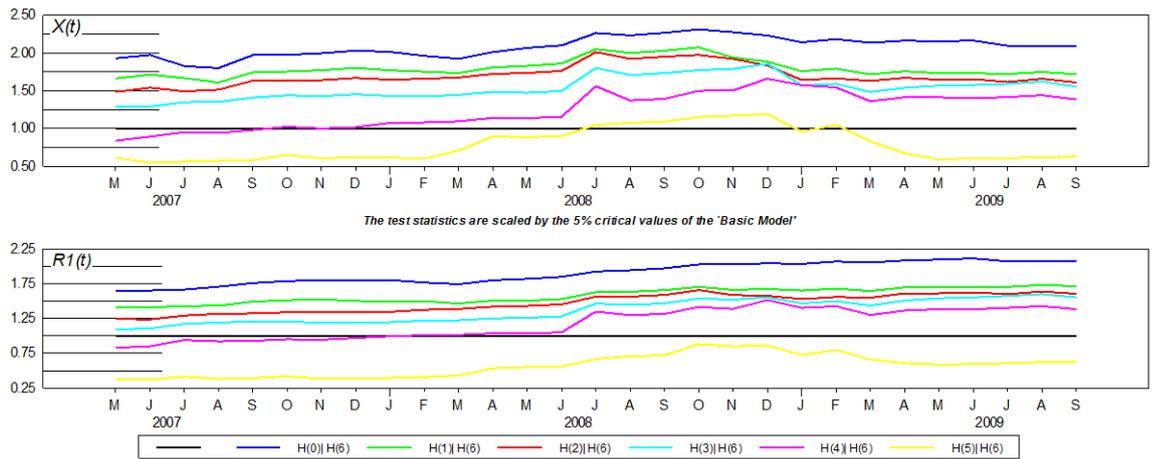


Appendix 6: Parameter Constancy Tests

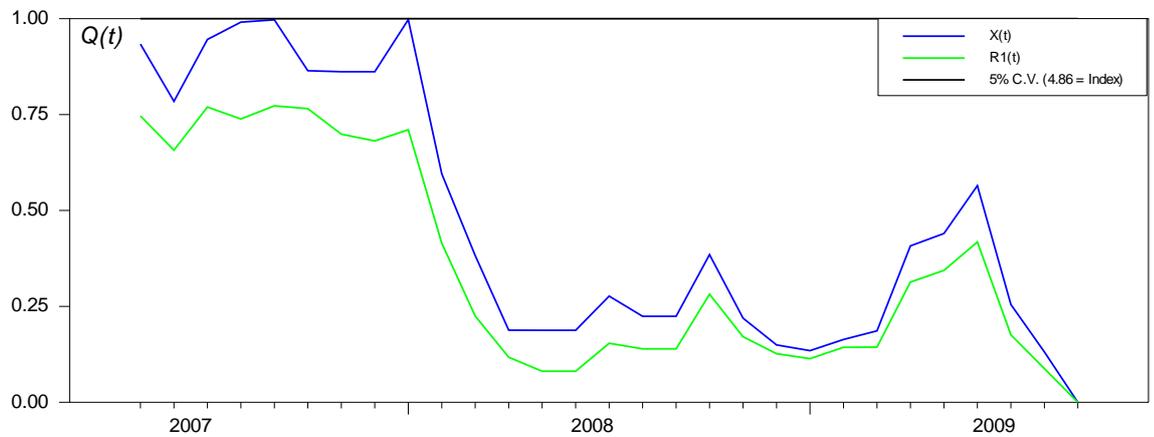
Test for Constancy of the Log-Likelihood



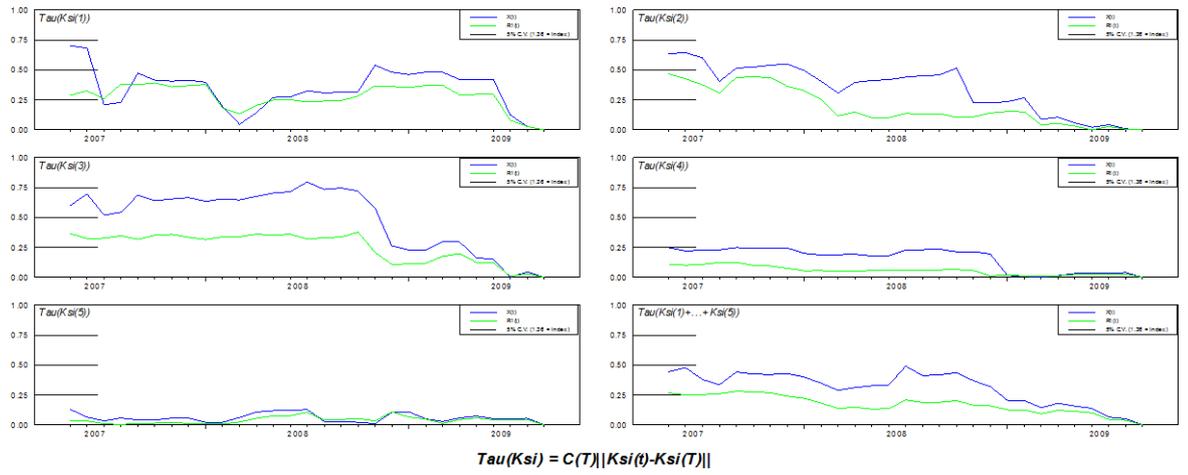
Trace Test Statistics



Test of Beta Constancy



Eigenvalue Fluctuation Test



Appendix 7: Engle Two-Step DCC Model

Table A7.1: DCC Model for all six Currencies

DCC	01/01/03-01/06/10		01/04/05-01/06/10	
	Coefficient	T-Statistic	Coefficient	T-Statistic
ω_B	***0.010	5.35	***0.012	4.91
ω_A	***0.007	5.90	***0.008	5.11
ω_N	***0.006	5.00	***0.007	3.90
ω_Z	***0.011	2.90	***0.011	2.74
ω_T	***0.018	7.54	***0.013	5.51
ω_M	***0.002	3.17	**0.002	2.45
α_B	***0.104	13.57	***0.098	12.00
α_A	***0.052	14.12	***0.067	11.73
α_N	***0.042	12.27	***0.047	9.39
α_Z	***0.054	12.25	***0.057	11.17
α_T	***0.118	17.34	***0.100	16.05
α_M	***0.082	13.59	***0.086	11.81
β_B	***0.890	120.59	***0.897	112.16
β_A	***0.942	237.06	***0.930	167.50
β_N	***0.955	278.63	***0.951	207.04
β_Z	***0.940	154.96	***0.938	140.53
β_T	***0.865	118.57	***0.890	130.99
β_M	***0.920	158.83	***0.919	138.55
λ	***0.015	13.50	***0.016	11.29
μ	***0.981	650.74	***0.980	498.02
	T-Statistic	P-Value	T-Statistic	P-Value
MVQ	*406.11	0.05	*402.02	0.06
MVQ-SQ	***3139.92	0.00	***2345.86	0.00

Notes: *, **, *** indicates significance at 10%, 5% and 1% standard normal level respectively; given missing data for Turkey the model is only estimated from 2003-2010; the crisis period is not considered due to the small sample; the model has been estimated with the BHH algorithm.

Table A7.2: DCC Model for BRL-AUSD-NZLD-ZAR

DCC	01/07/99-01/06/10		01/01/03-01/06/10		01/04/05-01/06/10	
	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
ω_B	***0.013	6.45	***0.013	5.02	***0.019	5.10
ω_A	***0.006	6.49	***0.007	5.87	***0.009	5.27
ω_N	***0.006	6.16	***0.006	5.14	***0.008	4.21
ω_Z	***0.007	5.52	***0.014	2.79	***0.014	4.21
α_B	***0.145	16.69	***0.122	12.10	***0.123	10.91
α_A	***0.047	17.37	***0.051	15.18	***0.067	12.64
α_N	***0.037	14.34	***0.042	12.35	***0.048	9.73
α_Z	***0.080	15.68	***0.058	10.84	***0.062	9.56
β_B	***0.848	103.16	***0.870	91.86	***0.866	80.84
β_A	***0.946	280.18	***0.942	232.86	***0.927	161.41
β_N	***0.957	333.73	***0.954	272.43	***0.948	202.67
β_Z	***0.919	189.93	***0.934	123.73	***0.931	102.63
λ	***0.014	11.44	***0.016	9.58	***0.017	7.96
μ	***0.983	618.09	***0.980	450.26	***0.979	338.07
	T-Statistic	P-Value	T-Statistic	P-Value	T-Statistic	P-Value
MVQ	*187.68	0.07	*185.97	0.08	170.84	0.26
MVQ-SQ	150.93	0.68	158.614	0.52	180.98	0.12

Notes: *, **, *** indicates significance at 10%, 5% and 1% standard normal level respectively; the crisis period is not considered due to the small sample; the model has been estimated with the BHH algorithm