ESSAYS ON FINANCIAL DEVELOPMENT AND GROWTH

ALESSANDRA DAL COLLE

Thesis submitted for the degree of PhD in Finance & Management Studies

2012

Department of Financial & Management Studies

School of Oriental and African Studies

University of London

I, Alessandra Dal Colle, have read and understood regulation 17.9 of the Regulations for students of the School of Oriental and African Studies concerning plagiarism. I undertake that all the material presented for examination is my own work and has not been written for me, in whole or in part, by any other person. I also undertake that any quotation or paraphrase from the published or unpublished work of another person has been duly acknowledged in the work which I present for examination.

May 30th, 2012

Abstract

We discuss the links between the development of financial sector and economic growth in macroeconomic models, both from the theoretical and from the empirical point of view. Financial development is defined as the increase in number or scope of action of financial institutions, whose activity consists in taking deposits from savers and lending to entrepreneurs. In Chapter 1 we review the literature and, considering the width and time span covered by the so called finance-growth nexus, we concentrate on dynamic, non-stochastic models of real economies. In Chapter 2 we discuss financial openness as a form of financial development which changes the structure of costs of financial intermediation. We obtain the conditions under which cross border trade in financial services and commercial presence are growth-enhancing with respect to financial autarky. In Chapter 3 we present a model to study how financial intermediation, or lack thereof, influences the two-way relationship between income inequality and growth. We obtain that although in the steady state income inequality growth is unaffected by the presence of financial intermediation or lack thereof, financial intermediation accelerates growth of income inequality during transition. Also, economic growth reduces inequality if it allows poor individuals to overcome minimum investment requirements, which cut them off from accumulation. In Chapter 4 we consider a time series model, providing a framework for testing causality in the finance-growth nexus. We employ a newly developed technique to detect and estimate outliers, allowing the empirical analysis of country cases characterized by frequent and/or violent policy shocks. We obtain that in most cases financial development stimulates economic growth.

Acknowledgements

I will always be grateful to Luca G. Deidda (Università di Sassari, Italy), Pasquale Scaramozzino (CEFiMS, SOAS, University of London, UK) and Stefano Zamagni (Università di Bologna, Italy), for their guidance and encouragement during all these years.

I would also like to thank all staff at World Institute for Development Economic Research (WIDER) for the privileged research environment I could enjoy. Financial support, through WIDER PhD Internship Programme, is also gratefully acknowledged. Heino Bohn Nielsen (University of Copenhagen, Denmark) and Tommaso Proietti (University of Sydney, Australia) were very helpful in providing insights to apply cointegration techniques to my data.

Special thanks go to Nicola C. Williams, for her hospitality and her sharp analytical mind, feeding endless conversations since our Cambridge days and to Virginia Tirri, who has always upheld the value of research and made my efforts seem worthwhile in the difficult days.

Thanks to all my friends and relatives, who had to endure me all the way and often had to make up for my research time.

Finally, thanks to my husband, Ettore, without whose love, trust and firm support this work would have never been started, and to my daughter Bezawit, without whose arrival this work would have never been finished. Ettore and Bezawit this is dedicated to you.

Contents

List of Figures

List of Tables

Chapter 1

Overview

1.1 Introduction

"Consider Fred, who has just developed a design for a new truck that extracts rocks from a quarry better than existing trucks. His idea for manufacturing trucks requires an intricate assembly line with specialized labor and capital. Highly specialized production processes would be difficult without a medium of exchange. He would find it prohibitively costly to pay his workers and suppliers using barter exchange. Financial instruments and markets that facilitate transactions will allow and promote specialization and thereby permit him to organize his truck assembly line. Moreover, the increased specialization induced by easier transactions may foster learning-by-doing and innovation by the workers specializing on their individual tasks.

Production requires capital. Even if Fred had the savings, he would not wish to put all of his savings in one risky investment. Also, he wants ready access to savings for unplanned events; he is reluctant to tie up his savings in the truck project, which will not yield profits, if it does yield profits, for a long time. His distaste for risk and desire for liquidity create incentives for him to (a) diversify the family's investments and (b) not commit too much of his savings to an illiquid project, like producing a new truck. In fact, if Fred must invest disproportionately in his illiquid truck project, he may forgo his plan. Without a mechanism for managing risk, the project may die. Thus, liquidity, risk pooling, and diversification will help him start his innovative project.

Moreover, Fred will require outside funding if he has insufficient savings to initiate his truck project. There are problems, however, in mobilizing savings for Fred's truck company. First, it is very costly and time consuming to collect savings from individual savers. Fred does not have the time, connections, and information to collect savings from everyone in his town and neighboring communities even though his idea is sound. Banks and investment banks, however,can mobilize savings more cheaply than Fred due to economies of scale, economies of scope, and experience. Thus, Fred may seek the help of a financial intermediary to mobilize savings for his new truck plant." [Levine (1997) p. 701-702]

This parable successfully summarizes what will be referred to as the "finance-growth nnexus" in the history of economics. It shows the enrichment in terms of meaning, giving way to linkages and connections across economic categories. Walter Bagehot in the late XIX century was one of the first and most eminent scholars supporting a link between financial intermediation and growth arguing that it played a critical role in igniting industrialization in England by facilitating the mobilization of capital for "immense works." [Levine (1997) p. 688]. In more recent times John Hicks took up the same argument situating financial intermediation outside the Arrow-Debreu framework. In this context, financial development can be defined as an improvement in information asymmetries and/or reduction in transactions costs reached by any coalition of agents (intermediaries), institutions (markets) or contracts (instruments) which facilitates the working of linkages between the real and the financial sector. The latter can be identified in:

1. mobilization and transfer savings;
2. allocation of resources;
3. monitoring of managers' performance once outsiders have founded a firm;
4. facilitation of risk management practices both across different firms and/or across time;
5. facilitation of production and trading of goods, services and contracts.

All these channels of transmission are supposed to have a positive effect on growth by facilitating capital accumulation. In the late 1990s however, growth accounting literature underlined that physical capital accumulation *per se* did not manage to account for much of cross-country differences in economic growth rates and this put the finance-growth nexus under scrutiny as a facilitator of economic growth. It was also observed that the strengthening of a channel, say a wider mobilization of savings, might have an ambiguous effect on aggregate savings and hence on growth. More specifically, a wider mobilization of savings might increase aggregate savings as a result of the substitution effect, but it might reduce them as well, via the income effect.

The 1990s also saw some reaction to find a new role for the financial sector in economic growth. First of all, this particular branch of financial macroeconomics took endogenous growth on board with Bencivenga and Smith (1991), also economies of scale in overcoming asymmetric information in the credit market and the endogenous formation of financial intermediaries were seen as the main driving forces of the financial development process.

More specifically, Greenwood and Jovanovic (1990), and Acemoglu and Zilibotti (1997), endogenize the joint process of formation and evolution of the financial structure and economic development. In the former model the existence of non-convex costs associated with financial transactions, coupled with the crucial assumption of heterogeneity of savers with respect to endowments, implies that savers participate to the financial coalition (which operates as an intermediary) depending on the level of economic development. At early stage of economic and financial development few people can be entrepreneurs, then economic growth makeS this opportunity available to a wider share of the population, with a positive effect on aggregate economic growth. The distributional effect of financial deepening is thus adverse for poor individuals at early stages, and become positive in the mature stages of development. The mechanics are based on the cost of gathering information and obtaining organizational capital. Intermediaries, whose role is to gather information and channel the resources to higher returns, form endogenously only in developed economies and financial development follows Kuznets' hypothesis. In early stages of economic development financial intermediaries are virtually non existent and growth is slow, in the intermediate stage of growth financial intermediaries start to function, the saving rate increases, growth accelerates but inequality widens. In the final stage of growth financial intermediation is fully functioning, saving rates fall and the economy growth rate converges to a higher level than that prevailing in the early stage of development.

In Acemoglu and Zilibotti (1997), growth-inducing risky projects are not funded at early stages of economic development because, being indivisible, they expose entrepreneurs to too much risk. Since the relative size of indivisibilities diminishes with economic development, these projects might become economically viable at some later stage of development. These models shed light on potential reasons why the effects of financial institutions on growth might vary with the stage of economic development. The intuition is that the performance of the financial sector is related to the conditions of the real sector of the economy.

On the empirical side the research on finance and growth broadly suggests that countries with better functioning banks and markets grow faster and that a better functioning financial system eases the financing constraints firms face, allowing a thicker flow of investments and hence faster growth. However, a general critique of empirical studies on financial development and growth is that these are not in a position to support or disprove theoretical models as they do not manage to measure the concepts emerging from theoretical models. In their benchmark study King and Levine (1993) try to mitigate this problem by using several measures of financial development and find that financial development does predict growth in the long run.

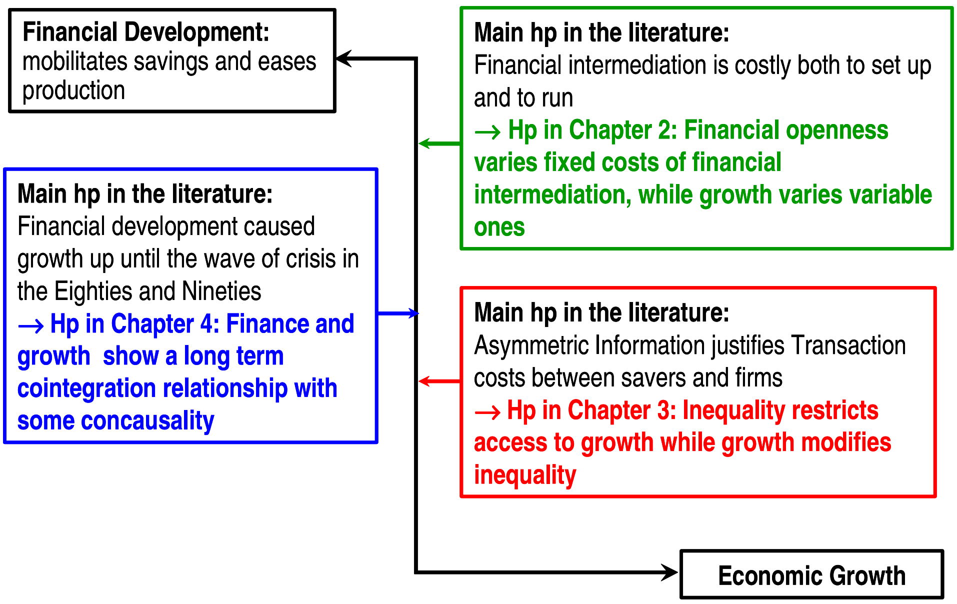
After more than a decade, however, Rousseau and Wachtel (2005) call for caution on the robustness of some classic findings on the cross-country relationship between financial development and economic growth. More precisely, they conclude that "Our findings are in some ways reminiscent of Robert Lucas's famous critique of econometric policy evaluation advanced nearly three decades ago. In Lucas the focus was on the now-obvious misuse of the Phillips curve in formulating policy prescriptions, but the basic lesson may apply in our application as well. In particular, policies that have promoted and/or forced increases in financial depth over the past two decades, perhaps in response to the prevailing Washington consensus, may well have altered the basic structural relationship between finance and growth. It would then be inappropriate to use the coefficients on finance obtained with data before 1990 (i.e., prior to the widespread acceptance of the finance-growth relationship) to estimate the impact of future policy initiatives aimed at spurring growth through increasing the size of a country's financial sector."

Finally, this Chapter, and the whole work that follows, focus only on purely real economies and ignore work on finance and growth in monetary economies, including work on the real effects of monetary policy via the credit channel of transmission. Also, the institutional framework made by the legal, regulatory and tax environment will only be touched upon. This is not to say that the topic is not important for understanding the numerous and varied links between financial development and growth, but this work, will mainly concentrate on the channel of transmission regarding the mobilization of savings. The legal, regulatory and tax environment will hence be taken as given and their changes as exogenous to the models in presented in the models in the following Chapters. More specifically, in Chapter 2 the legal and regulatory framework will exogenously go from financial autarky to financial intermediation and in Chapter 3 from financial autarky to international financial openness.

Models presented in the following Chapters are all based on a dynamic setting within the overlapping generations (OLG) framework where at each time t at least 2 types of agents are present: young and old. They are also set in a non Arrow-Debreu framework and, although uncertainty and/or asymmetric information are not made explicit, non linearities will be assumed to be the optimal response to such environment, while the models rest in a deterministic environment.

To summarize, the structure of this work is illustrated in Figure 1.1. The following three Chapters are set in the theoretical framework that assumes a non Arrow-Debreu framework where costly financial intermediation is the efficient answer to an asymmetric information problem. Such solution justifies the presence of financial intermediaries as specialized subjects who play the main roles of mobilizing savings and facilitating production - i.e. only points 1 and 5 of the list in par. 1.1 - and thereby have an effect on growth. More specifically, the aim in Chapter 2 is to explain how different modes of financial liberalization have an effect on the cost structure of financial intermediation and hence on growth. In Chapter 3 transaction costs between savers and investors take the extreme form of exclusion of some savers from productive investment because of their low income. Should financial intermediation be introduced, a virtuous cycle sets off, namely financial development sustains growth that makes financial intermediation more accessible to a larger share of the population further supporting growth. Chapter 4 is a time series studies on the causality - or lack thereof - between financial development and economic growth and results mostrly confrim the existence of a causal link from financial development to economic growth, while bi-directional causality is less frequent an outcome.

Figure 1.1: Financial Development and Growth - Aim of Resesarch



In order to address these issues, in Section 1.2 and in Section 1.3 we examine the finance - growth literature with special reference to financial openness and to income inequality respectively. In Section 1.4 we attempt a review of the empirical literature with special reference to time series studies. In Section 1.5 we introduce the topics that we intend to analyze in the thesis and we discuss how they are related to the literature reviewed. In the following Chapters financial intermediation will mostly identify with the deposit-taking and credit-granting functions. More specifically, in Chapter 2 financial development will be modelled as a deepening of the operations of financial sector and not, as it is traditionally, as the transition from a stage where individuals finance themselves only from own savings to that where a third party - i.e. the financial intermediary - emerges as a specialized subject. In Chapter 3 financial development comes as a widening of the availability of financial services to the population as a whole.

1.2 The role of Financial Openness

As effectively reviewed in Andersen and Tarp (2003), from 1950 onwards conventional policy advice has held that governments in developing countries should actively promote development through massive restrictive interventions in the financial sector. By the early 1970s, this "financial repression" policy came under severe criticism and in the 1980s research on the effects of financial openness on economic growth was mainly favorable to large scale liberalizations. The commonly held view, identified with the so called "Washington Consensus", called for liberalization of capital flows and deregulation in the recipient financial system, saving prudential regulation, as this would stimulate a sizeable flow of investments from rich countries to poor ones and could accelerate development in the latter countries. This view was endorsed among others by preeminent policy institutions such as the International Monetary Fund, the World Bank and the U.S. Treasury Department. Unfortunately these institutions, together with the supporting researchers, later took the blame when some Latin American countries, that had actually implemented those policy recommendations, were hit by yet another bout of crisis in the 1990s[1]. Among the theoretical critics of the Washington Consensus, Krugman (1993) maintained that financial integration could not be a major engine of economic development. To the already mentioned view that capital was not accountable for cross-country differences in economic growth rates, Krugman added that no historical evidence suggested that liberalizing policies were followed by large flows of capital from rich to poor countries.

By the end of the 1990s new impulse for the research on financial openness - growth nexus came with the result that Total Factor Productivity - i.e. that part of growth not accounted for by factor accumulation - explains the bulk of differences in the growth rates across countries and it receives a positive causal impact from the domestic financial system, as thoroughly reviewed in Levine (1997). The line of argument linking financial openness and economic growth runs as follows: if financial openness, as a form of liberalization, tends to enhance the functioning of the domestic financial system, then it can be maintained that financial openness has positive effects on the growth rate of the liberalizing country. One way in which financial openness has an impact on economic growth is by modifying the competitive framework of the financial system in a formerly financially closed country. However, there is not a widely shared agreement in the literature on the direction of the impact. On one hand, assuming relationship banking as the standard mode of operations for the financial sector, a more competitive environment may induce to channel less financing to firms because there is less incentive in establishing a close relationship with them. This implies that competition in financial markets is detrimental to the establishment of specific, long-lasting relations between

[1] Caprio and Honohan (1999) report that the average cost of 59 banking crashes in developing countries during the period 1976–96 was 9% of GDP.

a bank and a firm, that form the basis to overcome problems of asymmetric information.

On the other hand, competition in the credit sector, as in any other industry, implies the supply of a broader range of better-quality financial services at a lower costs and therefore has a positive effect on economic growth. Also, with more competition, financially dependent firms have less of an holdup problem, as they can easily break form a lending relationship without providing an adverse signal of their own quality. A more competitive financial system therefore supports more active demand for loans and hence higher growth. The conventional view, as expressed in Pagano (1993) among others, is that the second effects prevail and therefore a more competitive financial sector is growth-enhancing.

Cetorelli (1997) challenges this view by introducing in a dynamic model different types of entrepreneurs who require costly screening activities, so that banks can lend only to the more productive type. Supposing that competitive banks cannot establish an exclusive lending relationship with the high-quality borrower, as free riding makes the type of entrepreneur publicly known, the author finds that although a monopolist bank may lower the equilibrium quantity of credit, it allows a better allocation of credit supply thanks to screening. When the screening technology is very expensive then monopoly power by the banks has an overall negative effect on growth. Policy-wise Cetorelli (1997) arguments that monopoly power in the credit market could be especially beneficial in developing countries which are characterized by major difficulties for contract writing and enforceability - hence higher costs - and lower average quality of productive capital.

Always on the role of financial openness in shaping the competition regime of domestic banking, Claessens (2006) in his review of the policy oriented literature suggests that cross-border banking supports the development of an efficient and stable financial system that offers a wide access to quality financial services at low cost for the host country. However, while access to foreign capital is surely enhanced for some borrowers and lenders by the presence of foreign banks, better access to domestic capital is left in doubt. On this point Detragiache, Poonam and Tressel (2006) find that foreign banks presence in low-income countries leads to a reduction in credit and higher operating costs. Kono and Shuknecht (1998) as well warn against cross-border supply of financial services for weak financial systems and Tamirisa et al. (2000) specifically point out that "the liberalization of commercial presence (...) raises questions about strategic and cultural implications of foreign ownership in the financial sector, financial stability and cherry-picking. Cross-border trade liberalization presents additional challenges relating to the increased mobility of portfolio and other capital" [p. 25]. These works, however, although analytical, do not employ an economic growth framework leaving a gap in the analysis of the potential gains rather than dangers of an integrated financial intermediation. In a dynamic framework Detragiache (1999), although focusing on banking fragility as a consequence of financial openness, concludes that international integration of financial markets makes crises more likely. She also finds that even when there are higher returns on foreign assets from international integration the gains are asymmetrically distributed and they will ultimately hurt the domestic business sector.

As far as the empirical support is concerned Levine (2001) concludes that foreign bank presence tends to enhance the efficiency of the domestic banking system. In turn, better-developed banks spur economic growth primarily by accelerating productivity growth. Thus international financial integration can indeed promote economic development by encouraging improvements in the domestic financial system. Also Claessens and Laeven (2005) find that sectors dependent on external finance grow faster in more competitive banking system, so there is no support for the view that market power is good for access to financing and the degree of competition is indeed an important aspect of financial development and, in turn, of growth.

In conclusion, although the influence on the competition regime in the domestic financial sector is recognized as the main determinant of the effects of financial liberalization on growth rate there is no widespread agreement on the direction of the actual consequences. Chapter 2 will present an attempt to isolate aspects of the competition regime in order to underline specific channels of transmission to economic growth.

1.3 The role of Income Inequality

The research on the effects of income distribution on growth reached its zenith within the realm of the Keynesian tradition during the 1950s and the 1960s. In his article in the American Economic Review in 1955 Kuznets maintained that inequality in the distribution of income would increase in the early stage of economic development, then it would slow down and pick up again in fully developed economies, thereby introducing the famous "inverted U" thesis on the relationship between income distribution and economic development. The consequent conclusion, that wealth inequality is beneficial especially in low income countries, is based on Kaldor's hypothesis that the marginal propensity to save is higher for wealthy agents than for poor ones. If economic growth is directly related to the proportion on the national income that is saved, more unequal economies are bound to grow faster than more egalitarian ones.

Also, if investment projects involve large sunk cost, say for setting up new industries or the implementation of innovation, and equity market is not well functioning, then only wealthy agents are able to cover such large costs and thereby initiate a new business[2].

In the 1990s however, as reviewed in Levine (2006), the relationship between growth and income distribution started to be investigated together with its links to finance and both theory and empirical evidence, beginning with Perotti (1992), emphasized credit constraints as the channel through which inequality has a depressing effect on growth. The mechanics are based on the influence of financial development on saving decisions and the allocation of resources. Because of the existence of informational asymmetries, which are costly to overcome, and/or credit constraints not each individual may be equal before the economic system. More specifically, Galor and Zeira (1993) and Aghion and Bolton (1997) underline that these information costs may be prohibitive for some agents, who do not have either own resources to invest or collateral to access credit, hence they cannot contribute to growth. In such a case aggregate growth may slow due to the fact that these potential entrepreneurs are denied funding. Aghion, Caroli and Garcìa Peñalosa (1999) emphasize capital market imperfections discard the concept of aggregate production function because when a bank refuses to lend funds, it does so to a specific agent with a project, then he is cut off both from individual, and necessarily from aggregate, production possibilities.

In such an environment financial development reduces information costs, grants access to finance to more entrepreneurs, improves the allocation of capital and ultimately stimulates growth with the largest benefit to poor individuals[3]. Giné and Townsend (2003) too base their analysis on how capital market

[2] There is also a third line of research in the inequality and growth nexus which relates to redistribution. The core relationship studied in the literature is a trade-off since redistribution decreases income inequality and hence increases growth. But redistribution is usually financed through an income tax that dimishes the incentive to accumulate wealth. As this will not be included in the model in Chapter 3 relevant literature of this topic has not been reviewed here. Interested readers should refer to Aghion, Caroli and Garcìa Peñalosa (1999).

[3] It is also worth mentioning that some political economy theories suggest that financial

imperfections restrain investment in human capital and find that financial liberalization does indeed bring welfare gains and losses to different subsets of the population. Primary winners are talented would-be entrepreneurs who lack credit and cannot otherwise go into business (or, if they do, they invest too little capital). It is worth mentioning that the adjustment mechanism in this family of models - which also includes Cagetti and De Nardi (2003) and Ghatak, Morelli and Slöström (2002) - is based on occupational choice and wage differential rather than returns on savings as such. Financial intermediation modifies the impact of inequality on growth as it changes the partition of occupational choice among financially unconstrained firms, constrained firms and workers in equilibrium. Within this framework, Galor and Moav (2004) argues that it is the replacement of physical capital accumulation by human capital accumulation as a prime engine of growth that alters the qualitative impact of inequality on growth. More specifically, as long as credit constraints are binding, the higher the relative return to human capital, the more adverse is the effect of inequality on growth. As a consequence, the presence of international capital inflows reduces the impact of inequality by slackening the credit constraint.

Following the reverse relationship, namely the one that leads from growth to inequality, Matsuyama (2000) introduces a static model with endogenous interest rate determination. The author finds that under some values for the parameters his model predicts permanent separation of the population between wealthy and poor individuals and that wealthy individuals are able to maintain a high level of wealth partially because of the presence of poor ones. Under

development cannot be beneficial to the poor as it is primarily the rich and politically connected who benefit of the services of the financial sector, at least in the early stages of development. As a consequence, financial development can result in channelling more capital to a selected few, further increasing inequality. For a review of the relevant literature interested readers should refer to Levine (2006).

other valorizations of parameters wealth trickles down from wealthy individuals to poor ones and the former group pull the latter out of their relatively disadvantaged state, eliminating inequality in the long run.

The two-way relationship between financial development and growth was pioneered, as already mentioned, by Greenwood - Jovanovich (1990). In their model on one hand, financial intermediaries foster growth via better allocation of resources, even if there is a cost to joining them. On the other hand, economic growth makes joining financial intermediation relatively cheaper and more agents can afford to join thereby creating positive second order effects on growth. In addition to that, this seminal paper is particularly relevant for this work as it introduces a role for income distribution in the nexus between financial development and growth. More specifically, adjustment comes via both the quantity of savings available for investments and its returns. In fact the development of financial intermediation allows a higher return to be earned on capital invested that, in turn, feeds back on economic growth.

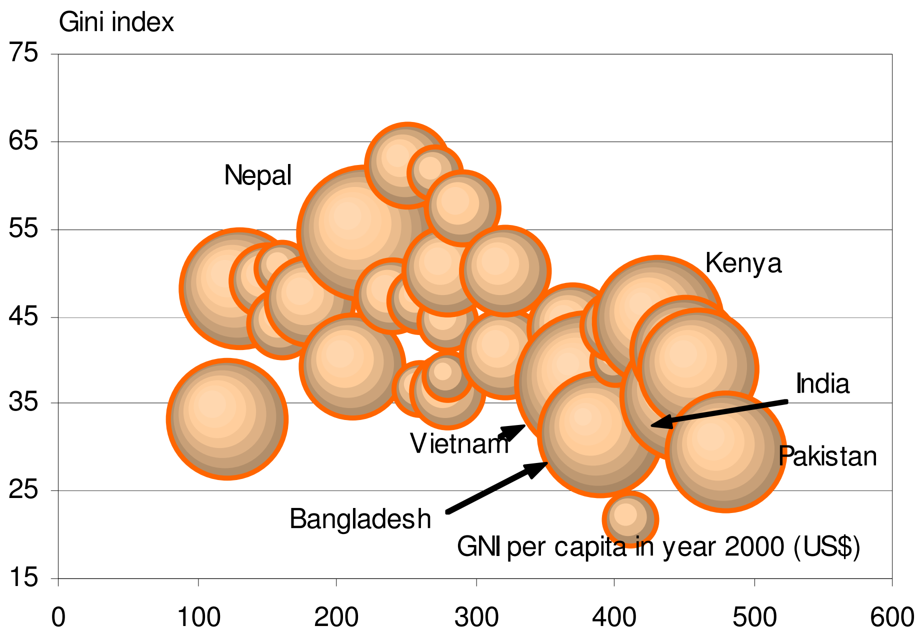
All in all, despite the relationship between income inequality and growth is not as firmly established as the date of the milestone article by Kuznets might suggest. The role of financial development within the above nexus is similarly far from definite. More specifically, although it is considered almost common knowledge that financial intermediation, being costly, can affect and be affected by inequality, a full rounded picture of the three-party relationships is missing. In addition to that, data do not seem to confirm the "inverted U" hypothesis fully.

Figures 1.2 to 1.5[4] show snapshots of the Kuznets curve for the countries where data for the distribution of income for year 2000 were available. Together with the relationship between inequality and growth, as measured by the gross

[4] Data sources: UNU-WIDER World Inequality Map, World Bank (2006).

national income per capita in US$, the diameter of each point is proportional to financial development as measured by the credit to private sector as a % of GDP.

Figure 1.2: Kuznets' curve and Financial Development - Low GNI per capita

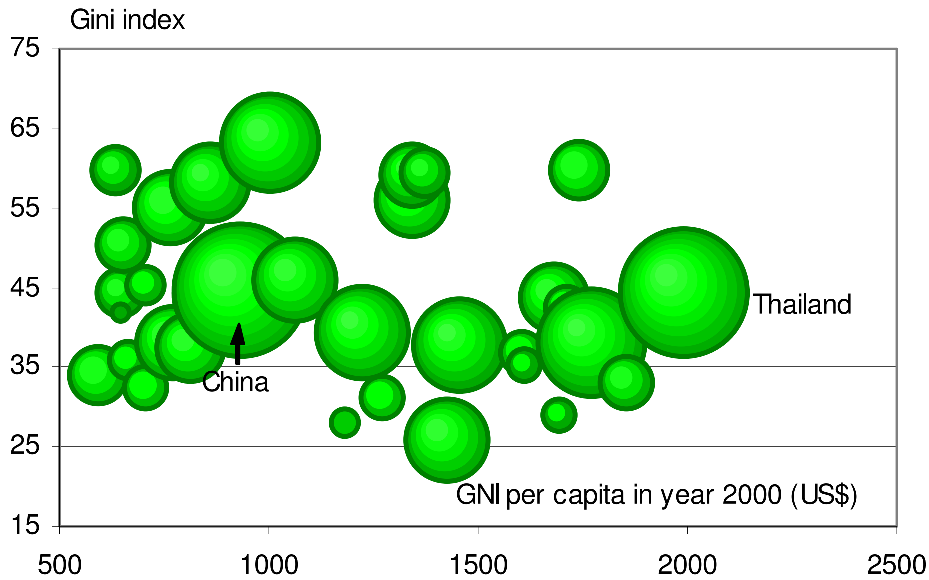


Diameter of the circumferences proportional to financial development, as measured by the Domestic credit to private sector (% of GDP)

More specifically, in Low and High GNI countries there seem to be a tendency for a decreasing inequality with respect to increasing level of income. Financial development seems quite independent from the Gini index as relatively highly financially developed countries are both in the upper part of the figures - Nepal and Kenya among Low GNI countries and the United States in the High GNI countries - and in the lower part, Vietnam, India and Denmark and Switzerland respectively.

In Lower middle GNI countries the Kuzents curve still shows a decreasing relationship, although less well defined than among Low GNI countries. In

Figure 1.3: Kuznets' curve and Financial Development - Lower middle GNI per capita

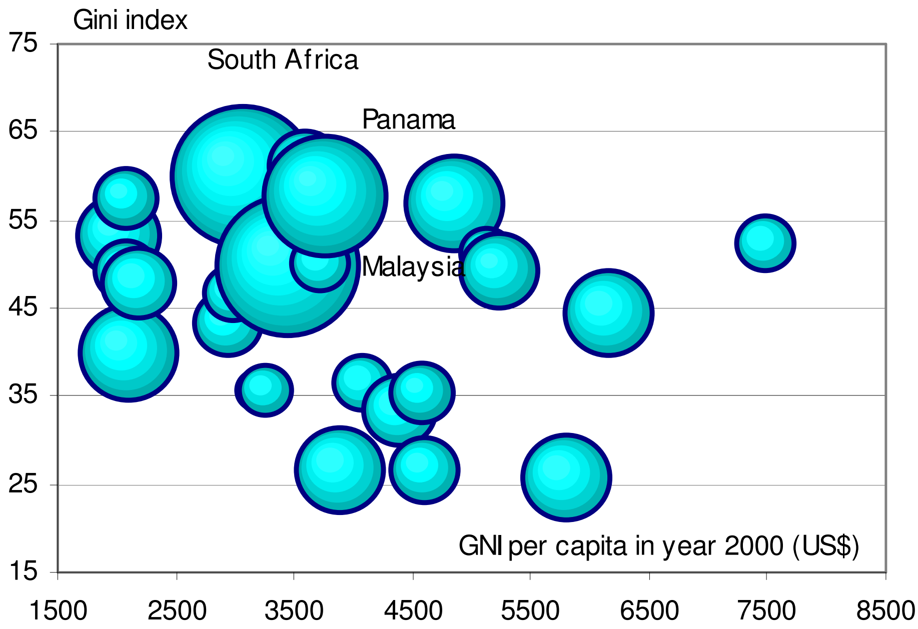


Diameter of the circumferences proportional to financial development, as measured by the Domestic credit to private sector (% of GDP)

the Upper middle GNI countries there is a slight tendency to an increasing inequality with income: comparatively financially developed countries, such as South Africa and Panama, are among the less egalitarian countries.

Finally, empirical evidence on the relationship between financial development, income inequality and economic growth is not very rich. Among the few examples, Azariadis and de la Croix (2003), using a calibration exercise to fit the long run economic performance of a panel of developing countries in the 1960s, find that abolishing credit constraints does indeed increase long term growth, even if it decreases household savings and raises income inequality permanently. Basically, the short-run and the long run effects of financial liberalization go in opposite directions and, depending on the level of total factor

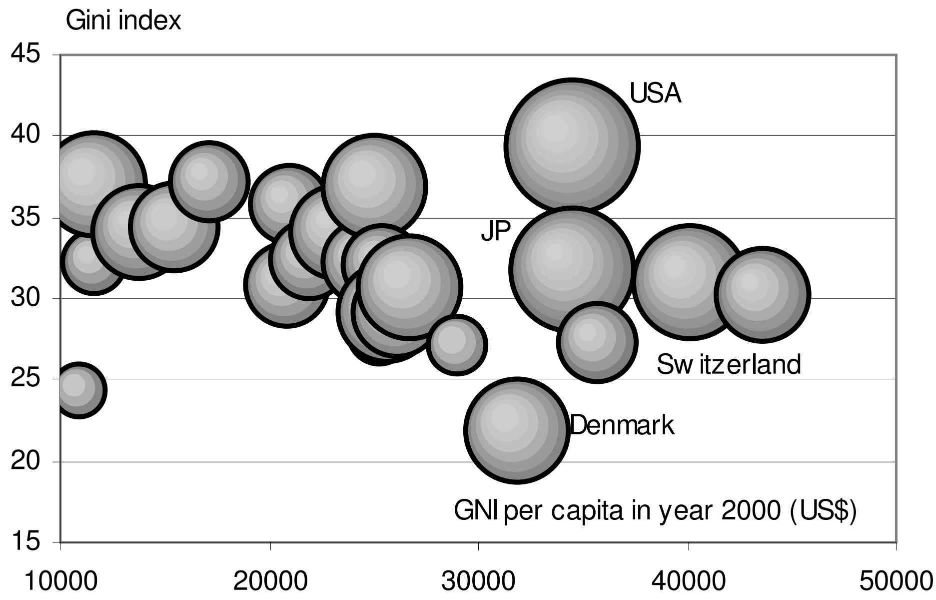
Figure 1.4: Kuznets' curve and Financial Development - Upper middle GNI per capita



Diameter of the circumferences proportional to financial development, as measured by the Domestic credit to private sector (% of GDP)

productivity and capital labour elasticity of substitution, financial liberalization effects may "trickle-down" to the population as a whole or relegate the economy to a poverty trap equilibrium. Also Beck, Demirgüç-Kunt and Levine (2004) give evidence to support the view that financial development boosts the income of the poor and reduce income inequality. In their cross-country study they look at how financial development influences (i) the growth rate of Gini coefficients of income inequality, (ii) the growth rate of the income of the poorest 20% of society and (iii) the fraction of the population living in poverty and they indeed find that financial development disproportionately lifts the poor out of their state and hence reduces income inequality. Their results also hold when using instrumental variables to control for the endogenous determina-

Figure 1.5: Kuznets' curve and Financial Development - High GNI per capita



Diameter of the circumferences proportional to financial development, as measured by the Domestic credit to private sector (% of GDP)

tion of financial development and changes in income distribution and poverty alleviation.

In conclusion, the role of financial intermediation in the relationship between income inequality and growth is is far from being defined. Research built up from Kuznets' article has underlined that the contribution of financial development to the inequality-growth nexus is not a static feature but it is path-dependent. Financial intermediation should favor accumulation by wealthy individuals in low income countries, to accelerate growth, and enlarge its scope on the whole population as a country develops and moves along the GNI line.

1.4 Empirical Evidence on Financial Development and Economic Growth

The empirical literature on the links between financial development and economic growth is wide and very differentiated and there is no single way to classify it. As surveyed in Levine (2006), the almost unique regularity reported consistently across studies and estimation techniques is that the link between theory and measurement is at best ambiguous.

A cornerstone of empirical studies is King and Levine (1993) who tried to mitigate the measurement problem by examining a variety of alternatives. They used four measures. Two of these measures are intended to gauge the dimension of the financial sector: liquid liabilities of the financial system as a fraction of GDP and the quantity of credit provided to private enterprises, by both private-sector banks and the central bank, as a fraction of GDP. The authors also used two measures of the efficiency of the financial system. The first measured the share of total credit actually provided by private-sector banks instead of the central bank. The second measured the share of total credit allocated to private non financial firms. Implicit in the use of these two measures is the belief that an economy with more lending by private-sector banks and more lending to private firms will have a more efficient allocation of external finance. A private-sector bank, seeking to maximize profits, is more likely to fund worthwhile investment projects than is a government lender, that may have to follow other criteria for loan evaluation. With a panel of 77 countries over the period 1960-1989, the authors find that the level of financial depth at the beginning of the sample does predict economic growth in the long run.

Beck, Levine and Loayza (2000) in their panel studies from 1960 to 1995 confirm an economically large and statistically significant relationship between financial development and both real per capita GDP growth and total factor productivity growth. In their study the positive link between financial intermediary development and both physical capital accumulation and private savings rates is however ambiguous since it is not robust to alterations in estimation techniques and to measures of financial intermediary development.

Harrison, Sussman and Zeira (1999), using a panel of data for 48 US states from 1982-1994, find a feedback effect between the real and the financial sector that helps to explain intra-national differences in output per capita.

On the question of causality the state of the art is apparently that to "agree to disagree" as differences in long run relationship and short-run dynamics or in the non-linearity of the relationship itself, are frequently picked up in different studies and make it impossible to reach a definitive conclusion on the presence and direction of causality. In fact, Loayza and Ranciere (2002) with a regression on 17 countries find a positive long-run relationship between financial intermediation and output growth coexists with a, mostly, negative short-run relationship. Also, Deidda and Fattouh (2002) with a threshold regression find a positive relationship between the level of financial depth and economic growth for countries with high income per capita but no significant relationship for lower-income countries, which is consistent with the non monotonic relationship implied in the model.

The strongest critique to all these studies comes from Aretis and Demetriades (1997). The authors, using King and Levine's data show that the contemporaneous correlation between the main financial indicator and economic growth is much stronger than the correlation between lagged financial development and growth. In fact conditioning on contemporaneous financial development destroys the association between lagged financial development and economic growth completely. Thus, the authors underline that the question of causality cannot be satisfactorily addressed in a cross-section framework. Also, the cross-country regression approach can only refer to the "average effect" of a variable across countries. In the context of causality testing, this limitation is particularly severe, as the possibility of differences in causality patterns across countries is quite likely. Such differences are, in fact, detected by time-series studies. Using data on Germany and the United States, Aretis and Demetriades (1997) find that while in the former country causality runs form financial development to growth, in the latter countries it goes the other way round. In addition to the value of results *per se*, the study strongly supports the claim that differences in the links between finance and growth across countries are extremely relevant and, as a consequence, the "average" country concept on which cross-country studies are based is not adequate. On the other hand, it must be pointed out that Aretis and Demetriades (1997) use quarterly data form 1979Q2 to 1991Q1 and it is not clear whether the use of quarterly data and an error correction model fully abstracts from high frequency factors influencing the variables, allowing the correct representation of long-run relationships.

Rousseau and Sylla (2001) study seventeen countries over the period 1850-1997 and find evidence of a leading role for finance. The result is further supported by Rousseau and Wachtel (1998) who, examining the links between the financial and real sectors for five countries that underwent rapid industrialization over the 1870-1929 period, are able to confirm that financial intermediation Granger-cause real output, with little evidence of feedback from output to intermediation.

Luintel and Khan (1999) using cointegration technique on ten developing countries with yearly data from the 1950s to the mid-1990s find two long-run equilibrium relationships linking financial and economic development and bi-directional causality between them. It is also worth mentioning that consensus is not uniform among time series scholars. Demetriades and Hussein (1996) in their studies of 16 developing countries, with 30 to 40 yearly data from the 1960s on, find that in quite a few countries economic growth systematically causes financial development and in most countries evidence favours bi-directional causality, especially in Korea and Thailand which, up to the Asian crisis of the late 1990s were considered to be some of the most successful examples of financial reform.

Also Shan, Morris and Sun (2001), using quarterly data from the mid-1970s to end 1990s for nine OECD countries, find evidence of reverse causality, namely from growth to financial development, in some countries and bi-directional causality in others, but no evidence of one-way causality from financial development to growth.

Finally, the fact that many time-series studies yield unreliable results due to the short time spans of typical data sets cannot be ignored. For this reason Christopoulos and Tsionas (2004) resort to panel technique that increases sample size. With panel unit root tests and panel cointegration analyses the authors examine the relationship between financial development and economic growth in ten developing countries and perform causality inferences. They find strong evidence in favor of the hypothesis that long-run causality runs from financial development to growth and that there is no evidence of bi-directional causality. Furthermore, they find a unique cointegrating vector between growth and financial development, and emphasize the long-run nature of the relationship between finance and growth.

In conclusion, although empirical findings on the question of causality in the finance-growth nexus are far from conclusive, the critique from Aretsis and Demetriades (1997) cannot be ignored. This is the main reason why a time series approach has been chosen for Chapter 4.

1.5 Further steps in the research on Financial Development and Growth

1.5.1 About financially open economies

The literature reviewed in section 1.2 does not come to a clear-cut conclusion about the positive effects of financial openness on growth. All authors recognize the role of capital and portfolio movements and the variations in the competitive regime of the financial sector, once it has opened to international competition, as the main driving forces shaping the finance growth nexus. Conclusions, however, are not unanimous.

The core mechanism through which the effects of financial openness on growth will be studied in Chapter 2 will be the variation in the structure of costs of financial intermediation. In particular in Chapter 2 the framework features both fixed and variable costs: the former are per intermediary opened, while the latter are in the form of economies of specialization, thereby they decrease with the market share of the financial intermediary. This framework is hence very different from Levine (2001), where the way financial intermediation improve resource allocation is by permitting the exploitation of economies of scale within the financial sector itself.

If one assumes that fixed costs can also represent a minimum capital requirement, needed as a safety and soundness instrument in presence of risky lending, and that average variable costs increasing with market size stem from the possibility of establishing exclusive lending relationship only with a limited number of creditors, then the model in Chapter 2 can find some common areas with Cetorelli (1997). However, differently from Cetorelli (1997), the regime of competition of the credit market is not exogenous but it is the result of the interplay between the free entry condition and profit-maximizing choices by financial intermediaries.

With such a structure of costs, the question of openness is first of all tied to the competition regime via the variation, or lack thereof, of the equilibrium market share consequent to financial openness. Secondly, considering that the open economy operates like a customs union which hosts the whole population of the formerly autarkic countries and produces with the most efficient technology - investment is necessarily in the only available technology, so there is no role for portfolio movements.

This is the main reason why the results obtained in Chapter 2 are quite in contrast with those of Detragiache (1999). The latter work, as the author herself points out, rests on the hypothesis that the bank deposit market becomes internationally integrated faster than the loan market. Putting money into the foreign asset hence becomes more attractive. As mentioned, the model in Chapter 2 hosts a single asset class, so the lack of synchronization during financial openness plays no role. Also, in Detragiache (1999) domestic firms can only borrow from domestic banks and not from foreign banks as it is assumed that banking skills require knowledge of the local market conditions, local customs, law enforcement and long-term customer relationships. In section 2.5 of Chapter 2 a form of seclusion of deposit market is indeed introduced, but the lending market is always perfectly integrated under financial openness, hence the difference in results.

Finally the model in Chapter 2 results in a two-way mechanism: financial openness favours growth because it stimulates competition and efficiency in the financial sector with a positive effect on economic growth and growth accelerates financial development as it increases the number of operating intermediaries. The model in Blackburn and Hung (1998) contains a similar bi-directional link but the transmission mechanims is based on the reduction in the cost of project appraisal and ultimately of lending and the costs of establishing delegation.

1.5.2 About income inequality

The literature reviewed in section 1.3, although very comprehensive for the types of credit constraint analyzed and consequent different transition mechanisms, fails short of supplying a unique framework that can model both the effects of growth on inequality and the reverse relationship, as shaped from financial intermediation or lack thereof.

On the former issue, Chapter 3 is an attempt to take up Matsuyama (2000)'s crucial question "In a capitalistic society, do the rich maintain a high level of wealth at the expense of the poor? Or would an accumulation of the wealth by the rich eventually trickle down to the poor and pull the latter out of poverty?" within a dynamic structure. Matsuyama (2002) proposes a static model whose main hypotheses are that output, after a given minimum investment requirement, is linear in investment and individuals can borrow only up to a fraction of the actual value of the project output. The interest rate adjusts endogenously to maintain the balance between demand and supply of credit and rich individuals benefit when interest rate is low, due to the presence of poor individuals who have no option for their savings other than lending. In Matsuyama (2004) this basic framework is enriched with an overlapping generation dynamic structure featuring diminishing returns to scale and a multi-country setting in order to capture financial market globalization. Here as well the author finds the conditions under which globalization might change the endogenous distribution of income in the different countries, given that financial openness has no effects on the degree of credit market imperfection. In both works the role of financial intermediation coincides with interest rate adjustment. In

To study the effects of income inequality on growth Galor and Zeira (1993) use an adjustment mechanism where income inequality translates into a particular partition among agents. More specifically, the authors underline that the channel through which capital market imperfections have an impact on income distribution is by excluding some people from costly human capital accumulation - in so far as individuals cannot borrow to accumulate human capital -, thereby cutting them off from higher wage in the future. The authors confirm that under the exclusive effect of credit market imperfections initial wealth distribution converges to a unique ergodic distribution.

Galor and Moav (2004) further specify that the role of capital market imperfection is to magnify rather than drive the effects of inequality on growth. This differs from the traditional credit market imperfection framework, where the effects of income inequality on growth depends on the level on income *per se*. However, as income increases, credit constraints are no longer binding and the effect of initial income inequality on growth becomes irrelevant. So in order to obtain permanent effects of income inequality on growth Galor and Moav (2004) introduce a Kaldor Keynes utility function which makes wealthy individuals always more willing to save than poor ones.

So, in order to include most of the features presented in the literature in Chapter 3 an overlapping generations[5] setting will be adopted, containing both the Kaldor-Keynesian saving function, where bequest is an increasing function of wealth as in Galor and Moav (2004), and financial market imperfections in the form of non-linearities in the rates of return to savings. In fact production is characterized by a minimum capital requirement, as in Matsuyama's models. Differently from both approaches however, the adjustment mechanism will be based on different rate of returns on savings and not on higher wages

[5] The steady state in infinitely-lived representative agent models leave the distribution of income indeterminate and this makes this kind of models not particularly useful. See note 4 in Matsuyama (2004).

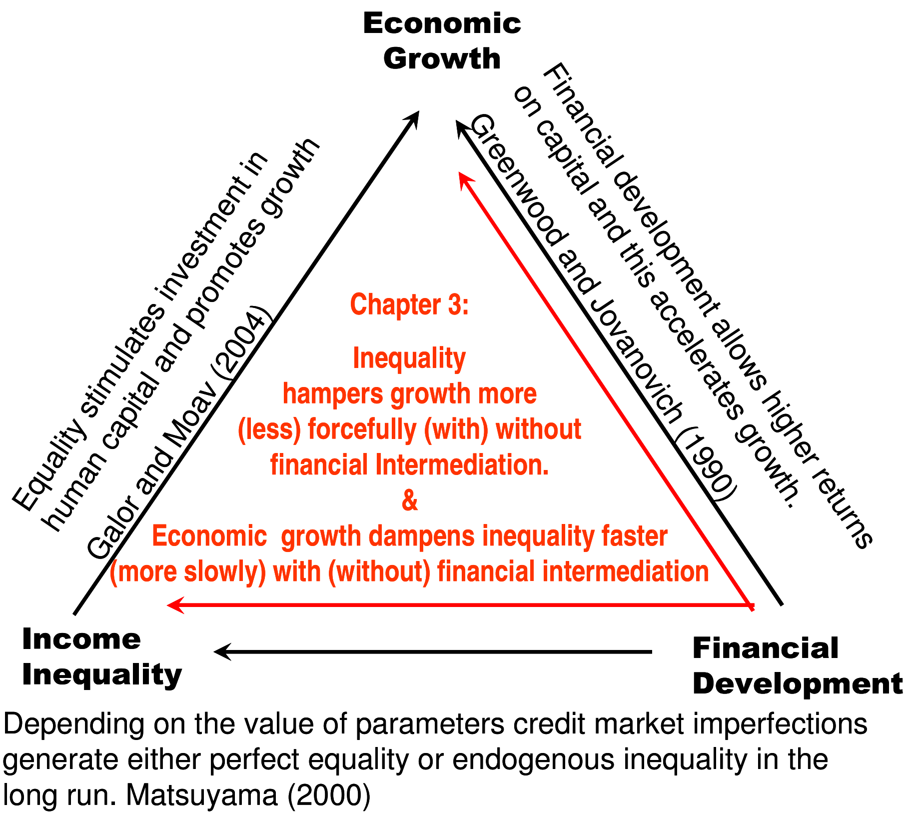
consequent to capital accumulation as in Galor and Moav (2004). Moving away from Matsuyama (2002) equilibrium interest rate will not adjust as the production function, hence the rate of return on capital, is characterized by an endogenous growth framework. Finally, as already mentioned, the relationships between income inequality and growth will be studied both in a financial autarky framework and under financial intermediation. While the former identifies with the full exclusion of poor agents from the production possibilities, leaving them no choice but to store their savings, the latter will smooth but not eliminate credit constraints for poor agents.

The resulting dynamics will present both the features of optimal bequest from the Kaldor-Keynesian saving function and those of the characterizing financial regime.

1.5.3 About empirical analysis with time series techniques

Arestis and Demetriades (1997) conclude that "We have warned against the over-simplified nature of results obtained from cross-country regressions in that they may not accurately reflect individual country circumstances such as the institutional structure of the financial system, the policy regime and the degree of effective governance. The econometric evidence we have reviewed using time-series estimations on individual countries suggests that the results exhibit substantial variation across countries, even when the same variables and estimation methods are used. Thus, the 'average' country for which cross-country regressions must, presumably, relate to may well not exist." (p. 796-797). A further warning for caution on the above statement is that, although the time series framework seems more appropriate to study the long run relationship between finance and growth than cross-section techniques, recent history of

Figure 1.6: Income Inequality and Growth as shaped by Financial Development



mismanaged financial opening, institutional changes and financial crises may have hit the relationship hard.

Working with economies subject to external, as well as internal, shocks is particularly problematic with time series. Often, the volatility around shocks causes autocorrelation in the residuals to which the Johansen procedure - on which the determination of the cointegration rank that identifies the number of long run relationships among endogenous variables is based - is very sensitive. The introduction or the omission of dummy variables, which is the standard technical instrument to whiten residuals, has to be done carefully in a cointegration framework as a dummy may influence several variables similarly, such that the effect cancels in a linear combination of them, and no dummy is needed. Alternatively, a dummy variable may only affect a subset of the variables (or several, but asymmetrically), and the effect will not disappear in the linear combination of the variable which constitutes the cointegration relation, so a dummy must be included. Furthermore, the properties of the resulting formulation may prove undesirable with respect to the objective of the estimation as parameter inference, policy simulations, and forecasting are much more sensitive to the specification of the deterministic than the stochastic components of the VAR model[6].

The above mentioned problems with outliers in cointegrating framework have found a technical solution in Bohn-Nielsen (2004) which was systematically applied on all the sample countries analyzed in Chapter 4. This allowed for meaningful results to be found even for dummy-laden countries such as the Central African Republic and Ghana.

Finally, following Andersen and Tarp (2003) in Chapter 4 causality is tested according to the concept of absence of weak exogeneity. The authors maintain that the possibility to use these tests makes time series studies particularly sensitive in distinguishing between different causal patterns in the countries studied. This is desirable since the functioning of the financial system is particularly contingent upon the institutional setting. Results in Chapter 4 show the presence of countries where financial development causes economic growth as well as cases of bi-directional causality.

[6] This non technical discussion of the problems relating to the use of dummy variables within a cointegration framework are taken by Hendry and Juselius (1999b). Readers interested in a more technical discussion should refer to Doornik, Hendry, and Nielsen (1998). On the excessive use of dummies Clements and Sensier (2003) provides useful insights.

Chapter 2

Financial Development and Growth in Financially Open Economies

2.1 Introduction

As reviewed in the previous Chapter, economics scholars and policy makers have offered only discontinuous support to the liberalization of financial flows across countries, i.e. financial openness. This Chapter aims to contribute to the debate of how financial liberalization does increase economic growth and it presents a dynamic model which offer an analytical framework to identify the contribution of efficiency and competition in the financial sector to economic growth. Financial liberalization and financial openness will hence be used as synonyms in what follows.

The model features two countries each operating in an overlapping generation framework where individuals share their income between consumption and savings, which are deposited with financial intermediaries. They hence borrow from savers and lends to firms - which produce according to a constant return technology only if externally funded - through a technology involving economies of scale and of specialization.

Under Financial Autarky (FA from now on) in each country domestic savers lend only to domestic firms. When the financial sector is opened, deposits of the two formerly financially autarkic countries may (in the Commercial Presence mode of financial liberalization) or may not (in the Cross Border mode of financial liberalization) be pooled to finance investments in the open economy. Fixed costs of financial intermediation change depending on which mode of operation is chosen to obtain financial openness.

The main contribution of the Chapter is the identification of the ratio between productivity and the fixed costs of financial intermediation as the driving force which determines whether financial liberalization promotes faster growth in the open economy as opposed to a single country in financial autarky: the higher the ratio, the faster is growth in the financially open economy, as opposed to financial autarky. The ratio between productivity and the fixed costs of financial intermediation also determines a threshold of economic development above which the financial sector operates in monopolistic competition, sustaining an accelerating rate of growth. The higher the ratio, the lower the level of development needed to sustain monopolistic competition in the financial sector as an equilibrium outcome. This is to say that below the threshold the dynamics of growth mainly sustain financial development, while above the threshold a bi-directional, self-reinforcing link is envisaged. Financial liberalization decreases this threshold level of development and this is in line with Pagano (1999) and Classens (2006) who showed that opening a sector usually brings more competition. Therefore, should a country under financial autarky have a higher ratio between productivity and the fixed costs of financial intermediation than under financial openness, competition in the financial sector will decrease the threshold level of development sustaining competition and this will, in turn, spur faster growth for a high level of development, despite the higher ratio in fundamentals under financial autarky.

Finally, the model finds that among different modes of financial openness, that with the lowest fixed costs of financial intermediation per capita ensures a faster growth.

The change in fixed costs in the different modes of financial openness and the interplay between financial openness and the regime of competition in the financial sector are the main features of all the results in the model and as strategic behavior by competing financial intermediaries permanently lowers the number of financial intermediaries operating in equilibrium, hence it decreases the pace of growth with respect to a scenario where such behavior is not present.

Section 2 will introduce the framework of financial autarky. In section 3 two different modes of financial liberalization will be sketched out, namely Commercial Presence and Cross Border mode of operations; they will be subsequently embodied in formal models in sections 4 and 5 respectively.

2.2 The economy under Financial Autarky (FA)

Under FA in each country capital accumulation can only be financed out of domestic savings. In this framework the traditional overlapping generations model, used among others by Deidda (2006), will be expanded in three main ways. First of all, it will not be applied to a single financially autarkic economy but to two economies $i = H$ for the Home country and $i = F$ for the Foreign country. Each economy will be composed of a continuum of size i of individuals, modelled as a standard 2-period OLG structure.

Secondly, it is assumed that the financial sector has developed in each country, i.e. that there is no alternative way to invest savings in equilibrium. Considering that the finance sector is characterized by fixed capital costs, the latter assumption is equivalent to saying that the level of development in each country is such that there is enough capital for at least one financial intermediary in each country to operate. Finally, the model allows for strategic interaction among intermediaries.

2.2.1 Agents' behavior

Households

Individuals inelastically supply labor during the first period of life and receive a salary w_t which is partly saved and partly consumed according to

$$U(c_{1t,}c_{2t+1}) = \lg c_{1t} + \frac{1}{1+\rho} \lg c_{2t+1}$$

subject to

$$c_{1t} = w_t - d_t \text{ and } c_{2t+1} = R_t^d d_t$$

where c_{1t} is the consumption of the presently young generation, d_t is young people's saving that is entirely deposited, c_{2t+1} is their consumption of the same people when old at $t+1$, ρ is the discount rate and R_t^d is the gross return on deposits from t to $t+1$. This framework results in optimal savings which are a constant fraction of wage as

$$d_t = (2+\rho)^{-1} w_t = s w_t \tag{2.1}$$

Firms

Firms have no initial endowment. They operate if and only if they are externally funded. It is also assumed that they are price takers and demand loans at the lowest rate, being indifferent across intermediaries for all other aspects of the lending contract. The production function for the firm operating in country i is

$$Y_t^i = jA_t K_t^{\beta} l_t^{1-\beta} \tag{2.2}$$

where j is the exogenous productivity coefficient in country i and $j = h$ for country H and $j = f$ for country F, l_t is labor; K_t is capital, $A_t = k_t^{1-\beta}$, with $k_t = \frac{K_t}{l_t}$, and $\frac{1}{2} > \beta > 1$ is an externality effect associated with capital accumulation.

The two countries H and F differ in the level of the exogenous productivity in per capita terms j - and it is assumed that H is the high productivity country as $h > f$ - and in the dimension of the two economies, as the number of operating firms is H and F for the two countries respectively.

The representative firm's demand for loans stems from the production function as

$$b_t^i \Big|_{R_t^{l,i} = \frac{\partial Y_{t+1}^i}{\partial K_{t+1}}} = \left(\frac{R_{t+1}^{l,i}}{\beta j A_{t+1}} \right)^{\frac{1}{\beta-1}} \tag{2.3}$$

where $R^{l,i}$ is the return on lending in country i when full capital depreciation is assumed. Equation (2.3) formalizes the assumption that the only variable relevant to firms *vis-à-vis* financial intermediaries is the cost of the loan, i.e. $R^{l,i}$.

In equilibrium the price of the factors of production will be

$$w_t^i = (1-\beta) jA_t K_t^{\beta} l_t^{\beta} = (1-\beta) jk_t \tag{2.4}$$

and

$$R_t^{l,i} = \beta j A_t k_t^{\beta-1} = \beta j \tag{2.5}$$

in the market for labor and capital respectively. The constant rate of return on capital in equilibrium implies constant returns to scale in the cumulable factor, which is the distinguishing feature of endogenous growth.

2.2.2 Credit market

In this framework financial intermediation will consist of the activities of deposit-taking and lending. Deposit-taking requires the establishment of an intermediary in the territory where savers are resident. This is not necessarily the case for lending. The latter activity will be characterized by both economies of scale and of specialization. Economies of scale stem from the assumption that a fixed amount of real resources E^i has to be invested each period in order to establish a financial intermediary. Such assumption is widely supported by the literature[1,2].

Similarly to Sussman (1993), financial intermediaries also face a marginal cost which is increasing in the market share because of the economies of specialization. It is in fact assumed that more customers imply a wider variety and hence increasing costs for evaluating them, i.e. lower economies of specialization. The simultaneous presence of economies of scale and specialization in financial intermediation is also supported by Berger (2004). The author underlines that lending technologies can be described along a continuum ranging from those that are primarily based on "hard" quantitative data – such as financial statement lending, asset-based lending, and credit scoring systems – to relationship-based lending, which, in contrast, is based in large part on "soft" information, such as the character and reliability of the firm's owner, his specific experience in the sector, the history of the firm's relationships with its suppliers, and the business prospects in the market in which the firm operates.

[1] Freixas and Rochet (2008) offer an updated review of the role of economies of scale in financial intermediation in para 2.1.2. These authors summarize their position citing Benston and Smith (1976) stating "The *raison d'être* for this industry is the existence of transaction costs." (page 215).

[2] Were such economies of scale not present, then any single lender would have to bear the fixed costs with inefficient duplications across the economy and direct lending by individuals could be sustained as an equilibrium solution. Greenwood and Jovanovich (1990), among others, justify the existence of institutions, as opposed to direct lending, because of their ability to pool resources among individuals, to take up information gathering and contract-writing efficiently and to diversify risk.

Information used in a quantitative, data-based lending technology is generally relatively transparent, easily observable and verified at the time of the credit origination. Technology to access, store and operate this information is based on computer systems and databases and originates economies of scale, as its capacity limits are quite large. On the other hand, in relationship-based lending information is generally gathered through contact over time by the bank loan officer with the firm, its owner, its suppliers and its outlet market on a variety of dimensions. In lending practice, analysis at credit origination is carried out using both techniques in a complementary fashion. Only when quantitative data are not available or not of a good quality, is lending actually carried out purely on "soft" information. The larger is the share of borrowing firms evaluated on "soft" information only in the financial intermediary's market share, the lower will be the exploitation of economies of specialization.

In this Chapter, financial intermediaries fund themselves by issuing deposit contracts to households and they consume real resources for a fixed amount E^i each period and for $\int_0^{z_t^i} q(z)dz$ per unit of lending to individual firms, where z_t^i is the mass of funded firms. The consumption of real resources in the lending activity is motivated by the just described need to set up technology to carry out quantitative credit analysis as well as by delegation of lending to financial intermediaries for the fixed part E^i, and by heterogeneity across firms, and hence the cost of gathering "soft" information for the variable part. More precisely, z_t^i financed firms generate costs equal to

$$q\left(z_t^i\right) = qz_t^i + \overline{q} \tag{2.6}$$

where $0 < q < 1$ and $\lim_{z \to 0} q(z) = \overline{q} > 0$. The lending technology hence involves the consumption of a fraction q per unit of allocated loan to the individual firm. q is the constant marginal effect of specialization, hence a low z_t^i decreases total costs. Also, the minimal market share involves positive costs. In fact, credit analysis must be carried out for every single potential customer at credit origination before a loan is granted, i.e. before the potential borrower becomes an actual client, hence when $z_t^i \longrightarrow 0$.

In this setting total variable costs are

$$Q\left(z_t^i\right) = \int_0^{z_t^i} q\left(z\right) dz = \frac{q}{2}\left(z_t^i\right)^2 + \overline{q} z_t^i \tag{2.7}$$

and average variable costs are

$$\frac{Q\left(z_t^i\right)}{z_t^i} = \frac{q}{2} z_t^i + \overline{q} \tag{2.8}$$

For any given z, marginal costs are higher than the average variable cost, formally $q\left(z\right) > \frac{Q(z)}{z}$. So a marginal increase in the market size z will raise average variable costs by dampening the working of the economies of specialization.

The balance sheet of the representative financial intermediary originating in country i can be thought of as

$$D_t^i = z_t^i b_t^i + \int_0^{z_t^i} q(z) b_t^i dz + E^i = \left(1 + \frac{Q\left(z_t^i\right)}{z_t^i}\right) z_t^i b_t^i + E^i \tag{2.9}$$

where D_t^i are deposits originated in country i and b_t^i is the amount of loans per firm.

Using (2.6) and (2.9) the profit of the n-th financial intermediary operating in country i can be written as

$$\pi_t^{n,i} = R_t^l b_t^i z_t^i - R_t^d \left[z_t^i b_t^i \left(1 + \frac{Q\left(z_t^i\right)}{z_t^i}\right) + E^i \right] \tag{2.10}$$

where $R_t^{u,i}$with $u = l, d$ are returns on loans or deposits respectively. Hence profit is the difference between revenues $R_t^{l,i} b_t^i z_t^i$ and all the resources needed to cover loans (i.e. $b_t^i z_t^i$), variable costs $\left(\frac{Q(z_t^i)}{z_t^i} b_t^i z_t^i\right)$ and fixed ones (E^i) times the cost of funding $R_t^{d,i}$.

Regime of Competition in the Credit Market

Competition in the credit market is characterized by lenders who choose prices and the market share they wish to serve to maximize their profits and by firms which, given the price of loans, demand a quantity of credit to maximize their profits. More precisely, it is assumed that:

1. financial intermediaries act as price takers in the market for deposits. In the market for loans each intermediary sets the interest rate $R_t^{l,i}$ as well as its market share z_t^i in order to maximize (2.10), given the optimal behavior by competitors. Financial intermediaries do not to discriminate across borrowers and charge the same interest rate to all clients;

2. there is free entry in the credit market. The number of financial intermediaries operating in economy i is n_t^i and it is taken as given by each single intermediary;

3. firms are price-takers in the market for loans and they demand as much credit as they need to maximize their profits to the lowest rate available on the credit market.

Focus is on symmetric equilibria where all intermediaries set the same interest rate and serve the same market share. Equilibrium is defined as a set of values $\left(R^{l,i^*}; z^{i^*}; n^{i^*}\right)$ for a given rate of return on deposits R^{d,i^*} such that:

- each intermediary offers a rate R^{l,i^*} and serves a market share z^{i^*} which is the best response to competitors' offers;

- n^{i^*} is such that profits of each operating financial intermediary is zero;

- firms demand the profit maximizing quantity of credit.

In what follows the number of operating intermediaries in equilibrium $n_t^{FE,i}$ given $R_t^{l,i}$ and z_t^i will be determined first, and hence the equilibrium values $\left(R^{l,i^*}; z^{i^*}\right)$ will be calculated to establish n^{i^*}.

Number of financial intermediaries operating in equilibrium

The assumption of free entry in the credit market and the existence of fixed costs imply an imperfectly competitive market where as many intermediaries will operate until the profit for each of them drops to zero.

Setting (2.10) to zero and substituting b_t^i with the mass of loans actually serviced by an intermediary, i.e. the ratio of total investments ik_{t+1} to the aggregate of market shares of operating intermediaries $n_t^i z_t^i$, gives

$$\left[R_t^{l,i} - R_t^{d,i}\left(1 + \frac{Q\left(z_t^i\right)}{z_t^i}\right)\right]\frac{i}{n_t^i}k_{t+1} = R_t^{d,i}E^i \qquad (2.11)$$

The equilibrium value of k_{t+1} is hence determined by the equality of the aggregate supply of funds and the demand for funds in

$$is(1-\beta)jk_t = \left[n_t^i z_t^i + n_t^i Q(z_t^i)\right] b_t^i + n_t^i E^i \qquad (2.12)$$

where the LHS defines aggregate deposits as the product of individual deposits - themselves a constant fraction of wage from (2.4) - multiplied by the size of the economy and the RHS sums resources needed for lending activities and those used to cover fixed and variable costs of financial intermediation for all the n_t^i operating financial intermediaries. So, further substituting $b_t^i = \frac{ik_{t+1}}{n_t^i z_t^i}$ in (2.12), the accumulation equation can be written as

$$k_{t+1} = \frac{s(1-\beta)jk_t - n_t^i \frac{E^i}{i}}{\left(1 + \frac{Q(z_t^i)}{z_t^i}\right)} \tag{2.13}$$

The accumulation equation is the ratio of individual savings $s(1-\beta)jk_t$ (net of per capita fixed cost for financial intermediation $n_t^i \frac{E^i}{i}$) to variable resources for financial intermediation, which are the sum of actual loans and average variable costs $\frac{Q(z_t^i)}{z_t^i}$.

And finally, substituting (2.13) in (2.11) one obtains

$$n_t^{FE,i} = \frac{is(1-\beta)jk_t}{E^i} \left[1 - \frac{R_t^{d,i}\left(1 + \frac{Q(z_t^i)}{z_t^i}\right)}{R_t^{l,i}} \right] \tag{2.14}$$

As a consequence, for any given k_t, $n_t^{FE,i}$ intermediaries are operating. Hence each of them cannot have more than $\frac{i}{n_t^{FE,i}}$ market share as a potential customer base, as i is the number of operating firms in the economy.

Local Monopoly Symmetric Equilibrium

In local monopoly equilibrium each intermediary sets the interest rate on loans and the market share so as to maximize (2.10). First the profit-maximizing interest rate and market share for the intermediaries will be calculated and then the conditions for these values to be sustained as an equilibrium will be verified.

Omitting FA for simplicity, first order conditions from (2.10) are

$$\frac{\partial \pi_t^{n,i}}{\partial R_t^{l,i}} = \frac{1}{\beta - 1} \frac{b_t^i}{R_t^l} \left\{ R_t^{l,i} - R_t^{d,i} \right\} z_t^i + b_t^i z_t^i - \frac{1}{\beta - 1} \frac{b_t}{R_t^l} R_t^{d,i} z_t^i \frac{Q\left(z_t^i\right)}{z_t^i} = 0 \tag{2.15}$$

$$\frac{\partial \pi_t^{n,i}}{\partial z_t^i} = \left(R_t^{l,i} - R_t^{d,i} \left(1 + \frac{Q\left(z_t^i\right)}{z_t^i} \right) \right) b_t^i - R_t^{d,i} b_t^i z_t^i \frac{q}{2} = 0 \tag{2.16}$$

From (2.15) the optimal rate of returns on loans is

$$R^{l,FAm} = R_t^{d,FAm} \frac{1}{\beta} \left(1 + \frac{Q\left(z_m\right)}{z_m} \right) \tag{2.17}$$

and substituting $R^{l,FAm}$ in (2.16) one obtains

$$z^{FAm} = \frac{1}{\Gamma s \left(1 - \beta\right)^2} \tag{2.18}$$

with $\frac{1}{2} < \beta < 1$ and $\Gamma = \frac{q(2\beta-1)}{2(1+\overline{q})s(1-\beta)^3}$.

Finally substituting (2.17) and (2.18) in (2.14) one obtains

$$n^{FAi,m} = \frac{is(1-\beta)^2 jk_t}{E^i} \tag{2.19}$$

Result 1. A local monopoly symmetric equilibrium exists if and only if the mass of firms which are actually served by all intermediaries is lower than the total market i, i.e. if $n^{FAi,m} z^{FAm} \leq i$.

Proof. Given z^{FAm} from (2.18), $n^{FAi,m} z^{FAm} \leq i$ is verified for $n^{FAi,m} \leq \widehat{n}^{FAi} = \Gamma si(1-\beta)^2$ and, as $n^{FAi,m}$ depends on k_t, $n^{FAi,m} \leq \widehat{n}^{FAi}$ implies that $k_t \leq \widehat{k}^{FAi} = \frac{\Gamma}{\frac{j}{E^i}}$ hence a threshold level of capital $\widehat{k}^{FAi}$ exists below which $n^{FAi,m} z^{FAm} \leq i$ is verified. The margin on the z^{FAm}-th customer can be calculated as $\left(R_t^{l,i} - R_t^{d,i} \left(1 + q\left(z^{FAm}\right)\right)\right) b_t^i$, which at $R_t^{l,i}$ from (2.17), equals zero. The values of $R_t^{l,i}$ from (2.17), z_t^i from (2.18) and n_t^i from (2.14) can be considered an equilibrium for $k_t \leq \widehat{k}^{FAi}$ as intermediaries are not incentived to compete by undercutting on the price of loans as $n^{FAi,m} z^{FAm} \leq i$ ensures their market shares are not conflicting.

When $k_t > \widehat{k}^{FAi}$, $n_t^i z_t^i$ is no longer lower than i and the margin on the z_t^i-th customer calculated at $R_t^{l,i}$ from (2.17) would be positive for any $z_t^i < \frac{1}{\Gamma s(1-\beta)^2}$.

As a result, market shares would be conflicting and the profit-maximizing behavior of financial intermediaries would drive them to undercut the price. Consequently, $R_t^{l,i}$ from (2.17), z_t^i from (2.18) and n_t^i from (2.14) cannot be considered an equilibrium for $k_t > \widehat{k}^{FAi}$. ■

$\widehat{k}^{FAi}$ is the level of development below which the capital available to set up financial intermediaries is limited relative to the number of borrowing firms i and it is so low that the resulting market shares for operating intermediaries cannot conflict and they will operate like local monopolists.

In essence, when the country is not sufficiently developed, i.e. $k_t \leq \widehat{k}^{FAi}$, the number of financial intermediaries operating in equilibrium as determined by the free entry condition are too few, i.e. $n^{FAi,m} \leq \widehat{n}^{FAi}$. Hence, each intermediary has a potential market share larger than the profit maximizing one, i.e. z_t^{FAm}; as a consequence each can offer a monopoly rate $R^{l,FAm}$ with no danger of competitors' undercutting them, as no one has an interest in lowering profit to gain a market share that is larger than the profit maximizing one.

$R^{l,FAm}$ and $z^{l,FAm}$ are constant and independent of the level of development k_t or the size of the economy i and in this equilibrium in the aggregate not all demand for loans is satisfied, i.e. $b_t^{FAim} = \frac{ik_{t+1}}{n_t^{FAi,m} z_t^{FAM}} < 1$.

Monopolistic Competition Symmetric Equilibrium

Eventually, economic growth will make the level of capital per capita grow above $\widehat{k}^{FAi}$, as a consequence the number of operating intermediaries will increase above $\widehat{n}^{FAi}$. Should financial intermediaries behave like under monopolistic competition, market share would be conflicting in equilibrium, making equilibrium untenable.

In such an environment, equilibrium has to sustain a market share potentially available to a single intermediary of $\frac{i}{n_t^{FAi,mc}}$ as i is the number of operating firms in the economy. With such a market share and a rate of return from

(2.15) each intermediary would earn an extra-profit, as he would be able to reap a monopoly price from a market share that is actually smaller than the profit maximizing one in monopoly. As a consequence, each intermediary, by lowering the rate he charges in equilibrium by $\varepsilon \to 0$, could earn an additional market share of $\left(z_t^{FAm} - \frac{i}{n_t^{FAi,mc}}\right)$ with a drop in revenues of $\varepsilon \frac{i}{n_t^{FAi,mc}} \to 0$. This will start a process of undercutting by intermediaries until the possibility of extra profits drops to zero, i.e.

$$R_t^{l,FAimc} = R_t^{d,FAimc} \left(1 + q\left(\frac{i}{n_t^{FAi,mc}}\right)\right) \tag{2.20}$$

Finally, substituting (2.20) and $z_t = \frac{i}{n_t^{FAi,mc}}$ in (2.14) one obtains

$$n_t^{FAi,mc} = \frac{is(1-\beta)jk_t}{E^i}\left(1 - \eta_t^{FAi}\right) \text{ with } \eta_t^{FAi} = \frac{\left(1 + \frac{Q\left(z_t^{FAi,mc}\right)}{z_t^{FAi,mc}}\right)}{\left(1 + q\left(z_t^{FAi,mc}\right)\right)} < 1 \tag{2.21}$$

Result 2. A monopolistic competition symmetric equilibrium exists if and only if the mass of firms which are actually served by all intermediaries is such that $n_t^{FAi,mc} z_t^{FAi,mc} > i$.

Proof. Should $k_t \leq \widehat{k}^{FAi}$, there would be no monopolistic competition symmetric equilibrium as Result 1 would apply. Should $k_t > \widehat{k}^{FAi}$, Result 1 would not apply, and the monopolistic competition symmetric equilibrium would have to be such as there is no incentive for intermediaries to deviate from it and no alternative equilibrium with $z_t = \frac{i}{n_t^{FAi,mc}}$ and R_t^l different from (2.20) can be calculated.

A necessary condition for $\left(R_t^{l,FAimc}; \frac{i}{n_t^{FAi,mc}}\right)$ to be an equilibrium is that no possible gain is obtainable by deviating from such equilibrium, given the competitors' best response. The increase in profit for the marginal client for a single intermediary can be proxied by the product of the derivative of profit with respect to market share and a finite variation in market size. If $R_t^l = R_t^{l,FAimc}$, $\frac{\partial \pi_t^i}{\partial z_t^i}\Delta z_t^i = 0 \ \forall \Delta z_t^i \lesseqgtr 0$[3], hence neither an increase nor a decrease in market size can increase profit for the intermediary who has therefore no incentive to deviate from $\left(R_t^{l,FAimc}; \frac{i}{n_t^{FAi,mc}}\right)$.

A sufficient condition for $\left(R_t^{l,FAimc}; \frac{i}{n_t^{FAi,mc}}\right)$ to be an equilibrium is that no alternative $\left(R_t^l; \frac{i}{n_t^i}\right)$ can be considered an equilibrium. Suppose an intermediary were to lower his lending rate at $R_t^l = R_t^{l,FAimc} - \varepsilon$ with $\varepsilon \to 0$. Should competitors leave their rate unchanged, the deviating intermediary could gain a market share of $\left(z_t^{FAm} - \frac{i}{n_t^{FAi,mc}}\right)$, but as he is earning zero on the $\frac{i}{n_t^i}$-th client, he has no incentive in lowering the interest rate so that he has losses on inframarginal client to increase his market share.

Suppose an intermediary were to increase his lending rate at $R_t^l = R_t^{l,FAimc} + \varepsilon$ with $\varepsilon \to 0$. Should competitors leave their rate unchanged, the deviating intermediary would receive no demand from any firm, as they demand the lowest rate on the market. His market share would go to zero and his profit would become negative. ■

Hence $\left(R_t^{l,FAimc}; z_t^{FAi,mc} = \frac{i}{n_t^{FAi,mc}}; n_t^{FAi,mc}\right)$ can be sustained as an equilibrium in monopolistic competition. All the borrowing firms are served, i.e. $b_t^i = k_{t+1}$, and the equilibrium variables are sensitive to the level of development as the credit market has reached its efficiency limit and only economic growth can actually enlarge it.

Also, in order to assess the effects of strategic interaction among intermediaries, the difference between the number of operating intermediaries in an equilibrium where no undercutting behavior is present[4] and (2.21) can be calculated as $\frac{is(1-\beta)jk_t\left(\beta-\eta_t^i\right)}{E^i}$, which, given that $\lim\limits_{k_t\to\infty} \eta_t^i = 1$, decreases without

[3] $\frac{\partial \pi_t^{n,i}}{\partial z_t^i}\Delta z_t^i = \left[\left(R_t^{l,i} - R_t^{d,i}\left(1+q\left(z_t^i\right)\right)\right)\right] b_t^i \Delta z_t^i = 0 \ \text{ if } R_t^{l,i} = R_t^{d,i}\left(1+q\left(z_t^i\right)\right)$

[4] This is the case when the mass of borrowing firms is large enough. For further details see note 7 on page 236 of Deidda (2006).

limits. This is to say, that the more growth increases the number of operating intermediaries in equilibrium, the less strategic interaction will slow this entry with respect to a scenario where it were was present. The difference in equilibrium market shares will disappear as $k_t \to \infty$, while the return on loans would have been permanently higher, were strategic interaction not operating.

2.2.3 Equilibrium growth under Financial Autarky

Financial Autarky is defined as the mode of operation whereby the amount of investments in a country is funded exclusively by savings of resident individuals. It will also be assumed that each country is initially endowed with sufficient capital to develop financial intermediation[5].

As detailed in the previous paragraph, the interplay between the regime of competition in the financial sector, as determined by the free entry condition, and profit-maximizing choices by the financial intermediaries determines two possible equilibria for country i in Financial Autarky depending on the level of economic development k_t. More precisely, by substituting (2.19) or (2.21) in (2.13) one obtains the equilibrium growth rate as:

$$g_{t+1}^{FAi} = \frac{k_{t+1}}{k_t} - 1 = \begin{cases} g_{t+1}^{FAim} = \frac{s\beta(1-\beta)j}{\left(1+\frac{Q\left(z_t^{FAm}\right)}{z_t^{FAm}}\right)} - 1 \text{ for } k_t \leq \widehat{k}^{FAi} \\ g_{t+1}^{FAi,mc} = \frac{s(1-\beta)jk_t}{\left(1+q\left(z_t^{FAimc}\right)\right)} - 1 \text{ for } k_t > \widehat{k}^{FAi} \end{cases} \tag{2.22}$$

The equilibrium growth rate of the economy allows to specify the different contributions of structural and financial factors to economic growth. More precisely, the higher are the saving rate s, exogenous productivity j and capital share in the economy β, the faster is growth, independently of the competition

[5] i.e. $k_{i,t=0} > \frac{E^i}{ijs(1-\beta)^2}$.

regime in the financial sector. On the other hand, the higher are variable costs of financial intermediation, the slower is growth.

When the country is not developed, i.e. $k_t \leq \widehat{k}^{FAi}$ its demand for investment is not fully funded and the country will grow at a constant rate which will be lower the larger is z_t^{FAm}. In essence, a vicious cycle sets in: the less a country is developed, the fewer the operating intermediaries in equilibrium, the larger z_t^{FAm}. As a consequence, a less developed country grows more slowly also because its financial sector is not efficient, given that it uses too many resources to cover its costs via $\left(1+\frac{Q\left(z_t^{FAm}\right)}{z_t^{FAm}}\right)$. When the country is developed, i.e. $k_t > \widehat{k}^{FAi}$ its financial sector is competitive, then growth will be self-feeding. In fact an accelerating rate of growth will be fed by the increasing number of operating intermediaries that will in turn decrease the available market share $z_t^{i,mc}$[6] and support growth. This is a consequence of the economies of specialization as the smaller is z, the lower are marginal costs $q(z_t^{i,mc})$, since a smaller market share supports the functioning of the economies of specialization. Hence, the link between financial development and economic growth is bi-directional when intermediaries compete, i.e. $k_t > \widehat{k}^{FAi}$ - as financial development lowers $z_t^{i,mc}$ and boosts growth, which in turn increases k_t and n_t further squeezing $z_t^{i,mc}$ - while it goes from economic growth to financial development when financial intermediaries act as monopolists in their own market share, i.e. $k_t < \widehat{k}^{FAi}$, as $z^{i,m}$ is constant.

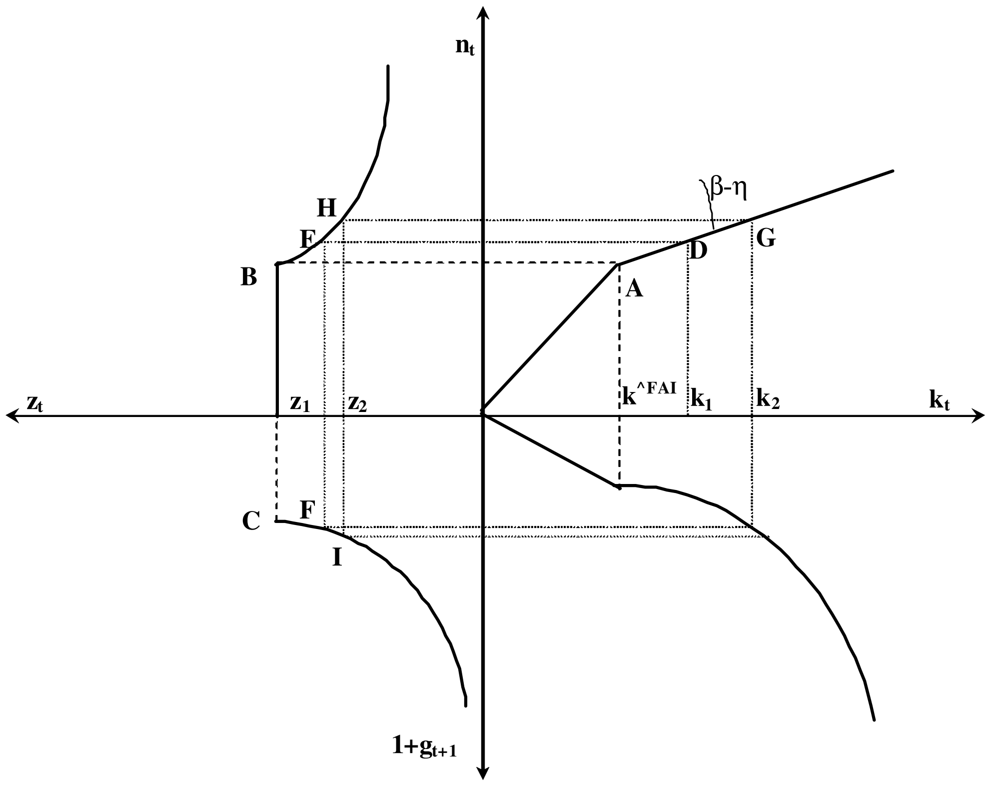
The development threshold $\widehat{k}^{FAi}$, above which competition in the financial sector accelerates growth, is higher the more costly is to set up a financial intermediary, either because fixed costs are high (high E^i) or because the economy is not very productive (low j). High fixed costs imply more resources are needed just to enter financial sector, let alone operate in it, hence local

[6] Formally $g_{t+1}^{i,mc}$ will increase as $\frac{\partial g_{t+1}^{i,mc}}{\partial z_t^{i,mc}} = -\frac{q}{2}\frac{s(1-\beta)j}{\left(1+q\left(z_t^{i,mc}\right)\right)} < 0$

monopoly as an equilibrium outcome becomes more probable, leading to a constant rate of growth for the economy.

The overall mechanics of the model in the FA mode, that will remain unchanged in the mode of operations in the open economy, are illustrated in figure 2.1. The level of development of a country and the free entry condition determine the number of operating financial intermediaries (top right quadrant). This together with their profit-maximizing behavior generate a market share z_t^i (top left quadrant) which, via average or marginal costs, in turn results in g_{t+1}^i calculated in (2.22) (bottom left quadrant). The resulting capital per capita is the new initial level of development for the mechanism to start again (bottom right quadrant).

Figure 2.1: Financial Autarky - Mechanics



$\widehat{k}^{FAi}$, $\widehat{n}^{FAi}$ and g_{t+1}^{FAim} in (2.22) are represented by letters A, B and C. More precisely, when $k_t \leq \widehat{k}^{FAi}$, the number of operating intermediaries increases, the market share results in z^m (letter B in the top left quadrant) and the growth rate is constant as represented by the point C in the bottom left quadrant.

Starting from a level k_1 of development, the dynamics of the system follow $\left(R_t^{l,FAimc}; z_t^{FAi,mc}; n_t^{FAi,mc}\right)$ and g_{t+1}^{FAimc} in (2.22) where the number of operating intermediaries in equilibrium (D) originates a market share at E in the top left quadrant and a growth rate at F in the bottom left quadrant, finally leading onto a new level of development k_2.

Changes in the regime of competition are visible in all the represented functions; in particular the break at point A in the top right quadrant shows the difference in the steepness of the two segments $(\beta - \eta)$ which represents the effects of strategic interaction. As detailed in the previous paragraph, because each intermediary takes into consideration the impact of competitors' choices, strategic interaction puts a lower ceiling on revenues in equilibrium. The main consequence is that for $k_t > \widehat{k}^{FAi}$, the number of operating financial intermediaries who gain market access via the free entry condition is permanently lower than would have been without strategic interaction and hence the pace at which competition further reduces the available market share in equilibrium slows down and consequently decelerates growth. Starting from k_1 the dynamics of the system without strategic interaction would have brought the number of intermediaries operating in equilibrium above D, with a consequently stronger impact on the functions in the other quadrants.

As far as out-of-equilibrium behavior is concerned, rewriting (2.12) gives $is(1-\beta)jk_t > n_t^i \left[\left(1 + \frac{Q(z_t^i)}{z_t^i}\right) z_t^i b_t^i + E^i\right]$. As long as savings (LHS) exceed the demand for funds (RHS) more financial intermediaries will be created via the free entry condition (2.11). For a low level of development n_t^i is low and new entrants will not bite into the incumbents' market shares; in other words, excess savings will mainly raise n_t^i as long as profit maximizing behavior of financial intermediaries generates non conflicting market shares. But as the economy keeps growing market shares will end up conflicting and competition will kick in. So, if there is an excess of savings over demand for funds, it will be again employed covering fixed costs - i.e. increasing n_t^i - but this will now further lower $z_t^{i,mc}$, hence boosting growth.

Finally, as income per capita is a linear function of k_t - and individuals optimally save and consume a constant fraction of their income - (2.22) is also the growth rate of income per capita and consumption. In fact this model has no transition dynamics.

Suppose now that in two countries, which differs by size $i = F, H$ (and $\bar{i} = H, F$), productivity $j = f, h$ (and $\bar{j} = h, f$) with $f < h$, and fixed costs in the financial sector E^i, financial intermediaries operate in Financial Autarky; then the following proposition holds.

Proposition 2.1 *Given two countries H and F whose financial sector operates under the FA mode, country i will grow faster than country $\bar{i}$ if:*

1. *its absolute productivity is higher and $k_t \leq \widehat{k}^{FAi}$*
2. *its squared productivity to fixed cost ratio, $\frac{j^2}{\frac{E^i}{\left(1-\eta_t^i\right)}} > \frac{\bar{j}^2}{\frac{E^{\bar{i}}}{\left(1-\eta_t^{\bar{i}}\right)}}$ is higher and $k_t > \widehat{k}^{FAi}$.*

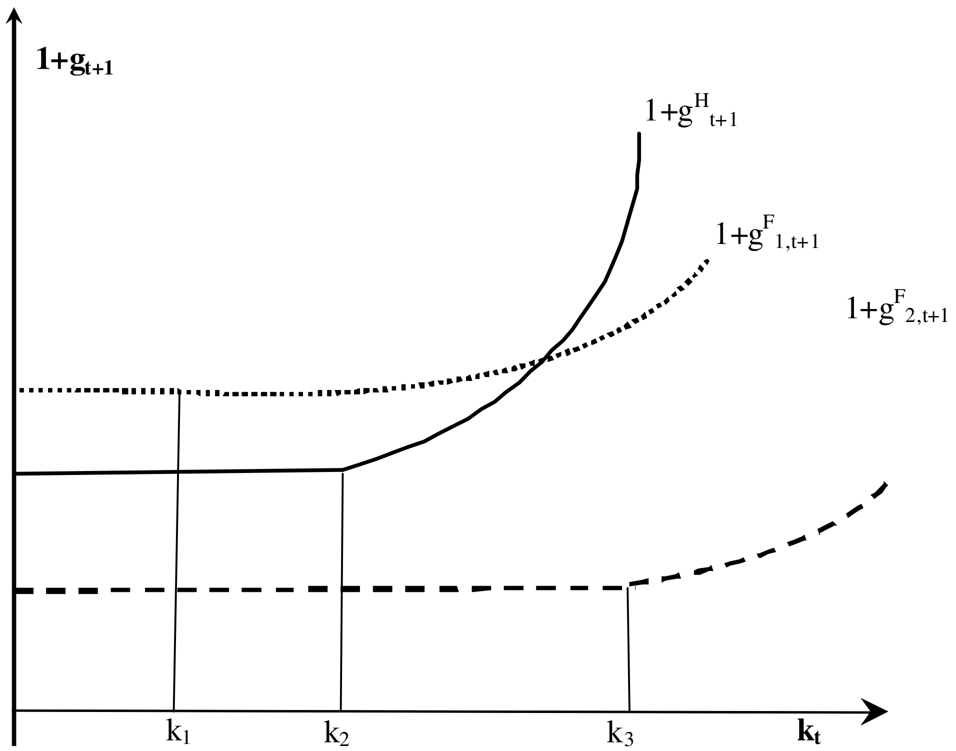
The Proposition is proved in Appendix 2.7.2.

Discussion. Proposition 2.1 compares the growth rates between countries in the FA mode. The intuition for the results rests on the role of productivity and fixed costs of financial intermediation. From (2.13) the growth rate is the ratio between aggregate savings, net of fixed costs of financial intermediation and average variable costs.

Hence, for low levels of development, the profit maximizing behavior of intermediaries drives the economy to E_m^{FAi}, and productivity j has a positive effect on the numerator of the ratio determining the growth rate as it enlarges the pool of savings. Financial intermediation seems to play no apparent role in the comparison of growth rates. This is because at any given $k_t \leq \widehat{k}^{FAi}$ accumulation changes neither the market share of active intermediaries nor variable costs of the financial sector. This case is shown in figure 2.2 for levels of development below $\widehat{k}_1$.

For higher levels of development, j has a positive effect both on the numerator and on the denominator of the ratio determining the economy's growth rate. More specifically, higher productivity maintains the growth-boosting property of enlarging the pool of savings to invest but it also restricts the market share available to each financial intermediary via n_t^{FAimc}, thereby lowering costs of financial intermediation. In fact, the higher the total productivity to fixed cost ratio $\frac{j}{E^i}$, the smaller is the market share, hence the lower average variable costs for financial intermediaries and the higher growth. Hence j has a positive and quadratic effect on growth. So, given two countries with the same level of development measured by k_t, the country with the highest productivity to fixed cost ratio will grow faster along the whole of the growth path. The continuos line in figure 2.2 represents $\left(1 + g_{t+1}^H\right)$ and the dashed line represents $\left(1 + g_{2,t+1}^F\right)$. Should country H be absolutely more productive than F (i.e. $h > f$) but not relatively to the fixed costs of financial intermediation E^i (i.e. $\frac{h}{E^H} < \frac{f}{E^F}$), then for low k_t country H will grow more slowly because of the larger E^H that delays competition. Eventually the growth in n_t^i will pace up and $z_t^{H,mc}$ will fasten its decline. In country F, starting with a smaller pool of savings because it is absolutely less productive, growth in the number of financial intermediaries n_t will slow as the pool of savings is smaller, as shown in the dotted lines representing $\left(1 + g_{1,t+1}^F\right)$. Hence $z_t^{F,mc}$ will decline more slowly, pushing the rate of growth below that in country H.

Figure 2.2: Financial Autarky - Economic Growth and Competition in the Financial Sector



2.3 Modes of Financial Service Liberalization

Liberalization of trade in financial services (or financial liberalization) may have different implications on economic growth depending on the way liberalization actually interacts with the competitive setting of the financial sector. The literature on the relationship between financial openness as a form of financial development and economic growth is quite wide[7]. Broadly defined "financial liberalization" can imply very different flows of funds (loans and/or

[7] Tornell and Westerman (2004) and Baltagi et al. (2009), together with their contribution to the debate, offer very updated reviews of the literature both on the theoretical and on the empirical side.

Foreign Direct Investments) depending on the source of funding for the loans. With reference to the traditional commercial banking activity, table 2.1 specifies that in the "Commercial Presence" (CP) mode of operation a foreign entrant financial intermediary needs either to acquire a domestic subsidiary or to establish a branch network in the host country, but gains access to foreign funding through deposit-taking activities from foreign savers. In this mode of operation a firm can arrange a loan with a foreign financial intermediary locally. By contrast, in the "Cross Border" (CB) mode of operation foreign entrant financial intermediaries effectively channel home-country deposits to finance host-country loans without sustaining further costs to set up a "foreign" branch network. In this mode of operation a firm can arrange a loan with a foreign financial intermediary abroad via telephone or some other way of communication. This is usually the case when the host country retail market receives protection as a "strategic infant industry".

Table 2.1: Modes of financial liberalisation

Loan provided by $\longrightarrow$	Domestic Supplier	Foreign supplier abroad	Foreing supplier established in the country
Modes of operation $\longrightarrow$	DOMESTIC FINANCIAL INTERMEDIATION	CROSS BORDER MODE: Financial Services trade only	COMMERCIAL PRESENCE: Financial Services trade + Foreign Direct Investments to "set up shop"

Adapted from Kono - Schuknecht (1998)

The sample of developing countries in table 2.2 shows that according to columns showing the level of commitments, liberalization under CP mode is the most frequent outcome (when the indicator is equal to -2) while liberalization under the CB mode (when the indicator is equal to 2) is both less frequent an outcome and, if present, it is carried out along with the CP mode.

This might be due to several reasons such as the fear of excessive competition in the sector and the fear of crises - such as in Ecuador and Peru -, or a tradition of directed lending and the desire of the authorities to keep strict control on lending by foreign intermediaries, thereby requiring physical presence in the country via CP mode. Political economy factors such as the weight of incumbents within each national financial sector - as remarked by Baltagi et al. (2009) among others - or bargaining power within WTO might also play a role in the actual scope of commitments.

Table 2.2: Assessment of Financial Services Commitments in the GATS, Selected Developing Countries

Country	**Level of Commitments** 1/		**Indicator of**		**Restrictions on practices by foreign establishments**				**Restrictive-ness for foreign establish-ments** 4/ (3)	**Combined indicator** (1)+(2)+(3)
	Coss-border supply	Com-mercial presence	**modal "bias"** 2/ (1)	**lending bias** 3/ (2)	Domestic funding	Retail operations	Equity limits	New licenses		
Chile	0	-1	-1	0	Yes	Some	Some	Some	2.5	1.5
Ecuador	2	-2	0	0	Yes	Yes	Yes	Yes	4.0	4.0
Ghana	2	-2	0	0	No	No	No	No	0.0	0.0
India	0	-1	-1	0	Yes	Yes	Yes	Some	3.5	2.5
Kenya	2	-2	0	0	No	No	No	No	0.0	0.0
Morocco	0	-2	-2	2	No	No	Some	No	0.5	0.5
Pakistan	0	-1	-1	0	Yes	Yes	Yes	Some	3.5	2.5
Peru	0	-2	-2	2	Some	Yes	No	No	1.5	1.5
Venezuela	0	-1	-1	2	Yes	Yes	Yes	Yes	4.0	3.0

Source: Kono Schuknecht (1998) for Chile, Ghana, India, Morocco and Venezuela. Author's calculation according to the most recent GATS schedules for Central African Republic, Ecuador, Kenya, Pakistan and Peru

1/ 0 = unbound (=no commitment taken) or non-member, 1/-1 = commitments to partial liberalization, 2/-2 = commitment to full liberalization.

2/ Indicator is nominal difference between previous columns. It ranges from -2 to 2; -2 would imply full commitments under Commercial Presence mode and unbound/non-member under Cross Border mode; 2 would imply full commitments under Cross Border mode and unbound/non-member under Commercial Presence mode.

3/ 0 means equal commitments for lending and securities or more liberal commitments for securities; 2 and 4 mean weak/strong bias in favour of lending liberalization.

4/ Indicator ranges from 0 to 4; 0 implies no restrictions on business practices in the four categories assessed, 4 implies important restrictions in all four areas. "Yes" in previous columns is quantified as 1, "Some" as 0.5, "No" as 0.

The actual grouping of countries under a "prevalent" mode of liberalization in financial services is, however, not unquestionable as it emerges from the comparison of first two columns of table 2.2 with the last one. In particular Ecuador, despite full commitment to liberalization in both modes of operations, imposes several restrictions in actual operations of foreign establishments nearly vanishing the effects of full commitments to liberalization. This is not the case for similarly committed Ghana and Kenya, with no restrictions at all, or CP-mode champion Morocco. This is one of the main reasons why in Chapter 4 the empirical test of openness will be done using a *de facto* indicator of openness instead of *de jure* criteria such as those illustrated in table 2.2.

In this Chapter the implementation of these modes of operation of trade in financial services in a two-economy setting will be reflected in modifications of (2.12) both on the demand for funds for financial intermediation and on the supply of funds. More precisely:

- the CP mode of operations will imply a full integration of both the lending market and the deposit market. As a consequence both (2.9) and (2.12) will be changed to the sum of the respective functions in the two countries. Because of the need to open or buy a local network, fixed cost of financial intermediation will change to E^{CP}, irrespective of the origin of the entrant financial intermediary;

- the CB mode of operations will imply a full integration in the lending markets and a perfect separation of deposit markets. As a consequence, only (2.9) will be changed to the sum of the respective functions across the two countries.

In this frictionless two-country world the liberalization of the financial sector follows the liberalization of the real side of the economy. In particular it will be assumed that financial liberalization comes after the open economy has adopted the more efficient production technology, namely that of country H, following liberalization of trade in technology. This assumption has the advantage of providing a motive for investments by the firms, namely to produce with the more efficient technology, for firms based in both formerly autarkic countries. This condition can be seen also as a result of an equilibrium choice in favor of trade openness that for the less productive country F is based on reaching a higher productivity and for H is based on getting access to a wider market. This is the case of countries moving from a customs union, as far as the trade in goods is concerned, to further liberalization in services aiming towards a common market. In line with the pioneering work of Corden (1972) "When the union is formed, one of the two producers, say country A's, will capture the whole union market, the other going out of business. Hence the average costs of country A's producer fall. Total costs of producing the product in the union thus decline because of specialization". Baltagi et al. (2009), among others, provide empirical support to the contribution of trade and financial openness to financial development and Tornell and Westerman (2004), in a model describing the effects of financial liberalization on the tradable and the non tradable sector, envisage a similar scenario expressing the results in terms of productivity and economic growth.

Hence, in what follows, in order to outline the consequences of liberalization to trade in financial services, a perfectly integrated loan market is set up in a customs union economy with a population $(H + F)$ and with the higher productivity h. With respect to single countries in the FA mode, this implies a per capita productivity shock in region F of size $(h - f)$. In this scenario optimal per capita savings will not change in the higher productivity region, i.e. in formerly autarkic country H, while they will increase in F due to the productivity shock. As far as costs of financial intermediation are concerned, the structure of variable costs of financial intermediation will remain unchanged while fixed costs of financial intermediation will change only in the CP mode as the integration of deposit market is allowed following higher setup cost. This can be justified not only by the need to have premises and staff *in loco*, but also by the need of upgrading in systems and procedures to operate in the new environment and/or comply with restrictions on foreign establishments as detailed in the previous paragraph.

Finally, the choice of the CB or CP mode of financial service liberalization is made by the regulators, and optimizing financial intermediaries take this choice as given. The possibility that one country opens in the CB mode and the other one in the CP mode is ruled out by assuming the principle of reciprocity, as it is often the case with international trade agreements.

2.4 Financial liberalization under Commercial Presence or "Set up shop" abroad (CP)

In the Commercial Presence (CP) mode both the loan and the deposit markets are perfectly integrated. Provided that financial intermediaries of whatever origin are willing to pay E^{CP} to participate in the CP market, they can borrow from and lend to whomever in the open economy. In this environment a financial intermediary's profit as shown in (2.10) is modified as revenues in the enlarged market are $R_t^{l,CP} b_t^{CP} z_t^{CP}$, where b_t^{CP} is the amount of loans actually serviced by an intermediary, and $\frac{Q(z_t^{CP})}{z_t^{CP}} b_t^{CP} z_t^{CP}$ and E^{CP} are respectively variable and fixed cost of financial intermediation. In this setting, for any given k_t, the maximum potential market share available to a single financial intermediary is now the ratio of the total number of firms in the open economy $(H+F)$ to the number of financial intermediaries n_t^{CP}.

Number of financial intermediaries operating in equilibrium under Commercial Presence

The open economy setting does alter the consumer problem as the whole territory has now a productivity of h. Hence the pool of deposits equals the sum of savings in previously financially autarkic countries at the new exogenous productivity level h i. e.

$$S_t = Hs(1-\beta)hk_t + Fs(1-\beta)hk_t = (H+F)\,s(1-\beta)hk_t \tag{2.23}$$

The resources used for loans and consumed by the financial sector as operating in the open economy are increased with respect to the FA case for two reasons. Firstly, the demand for loans is increased by the larger size of the economy and secondly, the fixed costs of financial intermediation increase to E^{CP}. So the equilibrium is described by

$$(H+F)\,s(1-\beta)hk_t = n_t^{CP}\left[\left(1+\frac{Q(z_t^{CP})}{z_t^{CP}}\right)z_t^{CP}b_t^{CP} + E^{CP}\right] \tag{2.24}$$

which, substituting $b_t^{CP} = \frac{(H+F)k_{t+1}}{n_t^{CP}z_t^{CP}}$, generates the accumulation equation of the form

$$k_{t+1} = \frac{s(1-\beta)hk_t - \frac{n_t^{CP}E^{CP}}{(H+F)}}{\left(1+\frac{Q(z_t^{CP})}{z_t^{CP}}\right)} \tag{2.25}$$

The optimal number of financial intermediaries is found by imposing a free entry condition similar to (2.11) i. e. $\left[R_t^l - R_t^d\left(1+\frac{Q(z_t^{CP})}{z_t^{CP}}\right)\right]\frac{(H+F)}{n_t^{CP}}k_{t+1} = R_t^d E^{CP}$. Substituting (2.25) one obtains

$$n_t^{CP} = \frac{(H+F)\,s(1-\beta)hk_t}{E^{CP}}\left(1-\frac{R_t^d\left(1+\frac{Q(z_t^{CP})}{z_t^{CP}}\right)}{R_t^l}\right) \tag{2.26}$$

Therefore, for any given k_t, n_t^{CP} intermediaries will be operating in the open economy with an available market share no larger than $\frac{H+F}{n_t^{CP}}$ each as a potential customer base, as $(H+F)$ is the number of operating firms in the economy. If the representative financial intermediary has to serve $\frac{H+F}{n_t^{CP}}$ customers in equilibrium, market shares of single lenders will conflict and strategic interaction will occur among competing intermediaries. Should this not be the case, each intermediary will operate as a local monopolist.

2.4.1 Symmetric Equilibrium under Commercial Presence

Along the same lines of the Financial Autarky mode of operations the interplay between the free entry condition and the optimizing behavior of intermediaries in the Commercial Presence mode results in $\left(R^{l,CPm}; z^{CPm}; n_t^{CPm}\right)$ equal to

$$\left(R^{d,CPm}\frac{1}{\beta}\left(1+\frac{Q\left(z^{CPm}\right)}{z^{CPm}}\right)\frac{1}{\Gamma s\left(1-\beta\right)^2}; \frac{(H+F)\,s(1-\beta)^2 hk_t}{E^{CP}}\right) \tag{2.27}$$

with $\frac{1}{2} < \beta < 1$ when $k_t \leq \widehat{k}^{CP} = \frac{\Gamma}{\frac{h}{E^{CP}}}$[8], i.e. when the single financial intermediary may operate as a monopolist, and in $\left(R^{l,CPmc}; z^{CPmc}; n_t^{CPmc}\right)$ equal to

$$\left(R_t^{d,CPmc}\left(1+q\left(z_t^{CPmc}\right)\right); \frac{H+F}{n_t^{CPmc}}; \frac{(H+F)\,s(1-\beta)hk_t}{E^{CP}}\left(1-\eta_t^{CP}\right)\right) \tag{2.28}$$

with $\eta_t^{CP} = \left[1-\frac{\left(1+\frac{Q\left(z_t^{CPmc}\right)}{z\left(z_t^{CPmc}\right)}\right)}{\left(1+Q'\left(z_t^{CPmc}\right)\right)}\right]$ when they cannot, i.e. $k_t > \widehat{k}^{CP}$.

Substituting n_t^{CP} from (2.27) or (2.28) in (2.25) one obtains the growth rate as:

[8]As $n_t^{CPm} z^{CPm} \leq (H+F)$ for $k_t \leq \widehat{k}^{CP}$

$$g_{t+1}^{CP} = \frac{k_{t+1}}{k_t} - 1 = \begin{cases} \frac{s\beta(1-\beta)hk_t}{1+\frac{Q(z_t^{CP})}{z_t^{CP}}} - 1 \text{ for } k_t \leq \widehat{k}^{CP} \\ \frac{s(1-\beta)hk_t}{1+Q'(z_t^{CP})} - 1 \text{ for } k_t > \widehat{k}^{CP} \end{cases} \tag{2.29}$$

$\widehat{k}^{CP} \gtreqless \widehat{k}^{FAi}$ if $\frac{h}{E^{CP}} \lesseqgtr \frac{j}{E^i}$ so one of the first effects of financial openness under the CP mode vs. FA is to anticipate (delay) the level of economic development needed for the financial sector to contribute to an accelerating growth if the productivity to fixed costs ratio is lower (higher). Also, the number of financial intermediaries has increased or decreased relative to financial autarky in proportion to the ratio of productivity relative to per capita fixed costs of financial intermediation i.e. $n_t^{CP} \lesseqgtr \sum_i n_t^{FAi}$ if $\frac{\frac{h}{E^{CP}}}{(H+F)\left(1-\eta_t^{CP}\right)} \lesseqgtr \sum_i \frac{\frac{j}{E^i}}{i\left(1-\eta_t^{FAi}\right)}$. This is to say that liberalization stimulates financial intermediation, by increasing the number of operating intermediaries, if the productivity to fixed costs ratio in per capita terms in the open economy is larger than the sum of the corresponding ratios in the two formerly autarkic countries.

The question whether the new mode of financial operation is growth-enhancing for the new open economy vs. financial autarky mode is examined in the next proposition.

Proposition 2.2 *An open economy whose financial sector operates under the CP mode will grow faster than a high (low) productivity country i ($\bar{i}$) operating in the FA mode if:*

1. its absolute productivity is higher and $k_t \leq \widehat{k}^{CP}$

2. its squared productivity to fixed cost ratio, $j\left(\frac{j}{E^{CP}}\right) > \bar{j}\left(\frac{\bar{j}}{E^{\bar{j}}}\right)$ is higher and $k_t > \widehat{k}^{CP}$.

The Proposition is proved in Appendix 2.7.3.

Discussion. The intuition behind Proposition 2.2 lies again in the interaction between productivity and the fixed costs of financial intermediation which do vary in the CP mode, due to the need to "set up shop abroad". If the country was not developed in FA and if the productivity to fixed cost ratio is more favorable in the CP mode, i.e. if $k_t < \widehat{k}^{CP} < \widehat{k}^{FAi}$, then only absolute productivity matter for growth. As a consequence the CP mode cannot be beneficial relative to the FAi mode for both formerly autarkic countries but only for the less productive one.

Similarly, if the country was developed in FA mode and still is after opening under the CP mode, i.e. if $k < \widehat{k}_t^{FAi} < \widehat{k}^{CP}$, and if it were the more productive country, then the only different factor is the fixed cost of financial intermediation as there is no productivity shock in per capita terms. With respect to the less productive country F , the growth rate in the open economy under the CP mode offers both an absolute productivity benefit on the net savings (j) and an increase of the productivity to fixed cost ratio $\left(\frac{h}{E^{CP}}\right)$. The increase in savings originated by the productivity shock in the open economy is partly used to finance higher set up costs, which have therefore an inverse relationship to the growth rate, and partly to increase growth.

Of particular interest for the dynamics of the rate of growth are the cases which combine openness and switch in the competition regime of the financial sector due to impact of E^{CP} on the free entry condition. In particular there might be cases where:

- $\widehat{k}^{CP} < k_t < \widehat{k}^{FAi}$: in this case the intermediaries of country i were operating as monopolist in FA and, because with financial openness the cost of "setting up shop" in the open economy has decreased, they now start to compete and set off an accelerating rate of growth. In the case of European Union this might be exemplified by countries whose financial sector was protected against foreign competition by national legislation, causing high E^{FAi} relative to productivity. The access to the Union has called for liberalization, which has decreased fixed costs. Financial intermediaries can thus compete on a level with the other European partners;

- $\widehat{k}^{FAi} < k_t < \widehat{k}^{CP}$: in this case the intermediaries of country i were competing in FA and with financial openness the cost of "setting up shop" in the open economy has increased. This slows down the rate of growth. In the case of European Union this might be exemplified by countries which were actually "financial centres" taking the benefit of a very low level of regulation, hence a low E^{FAi} relative to productivity. Access to the Union in this case has called for more regulation and barriers to entry in the financial sector have relatively increased E^{CP} with respect to E^{FAi}, with adverse effects on competition.

2.5 Financial liberalization under Cross-Border trade in Financial Services (CB)

In the Cross Border (CB) mode of operation, financial intermediaries face the larger open-economy demand for loans but cannot access the deposit taking activity in the other region of the open economy. This is because while lending activity can be organized with ways of communication - such as telephone, and/or internet - which do not require physical presence, this is not the case for deposit taking. On the other hand, this mode of operations has the advantage of not requiring higher fixed costs, as is the case in the CP mode of operation.

The main consequence of the seclusion of saving pools is that in each of the two regions of the open economy - i.e. formerly autarkic countries - only those intermediaries will operate, that the own pool of saving can support.

Formally, in the open economy a financial intermediary's profit as presented in (2.10) is modified for financial intermediaries originating in each single region i. More precisely, the demand for loans b_t^{CBi} is the ratio between the total demand for loans in the open economy $(H+F)k_{t+1}$ and the aggregate share served by financial intermediaries originated in i, i.e. $z_t^{CBi}n_t^{CBi}$. Also the maximum potential market share available to a single financial intermediary originating in any region is now the ratio of the total number of firms, i.e. $(H+F)$, to the total number of financial intermediaries actually operating in the open economy, i.e. $\sum_{i=F,H} n^{CBi}$.

Number of financial intermediaries operating in equilibrium under Cross-Border trade in Financial Services

As in equilibrium the supply of funds must equal the demand for funds in each single region of the open economy, taking into account that the whole territory has now a productivity of h yields

$$is(1-\beta)hk_t = n_t^i \left[z_t \left(1 + \frac{Q(z)}{z} \right) b_t^{CB,i} + E^i \right] \qquad i = F, H \tag{2.30}$$

where

$$b_t^{CB,i} = \frac{(H+F)k_{t+1}}{z_t n_t^i} \tag{2.31}$$

On the right hand side of (2.30), the demand for loans is the total amount of resources needed and consumed for lending activities by financial intermediaries originating in region i plus the sum of fixed costs $n_t^i E^i$. The resulting accumulation functions are

$$k_{t+1} = \frac{is(1-\beta)hk_t - n_t^i E^i}{(H+F)\left(1+\frac{Q(z)}{z}\right)} \qquad i = F, H \tag{2.32}$$

The optimal number of financial intermediaries is found by imposing two free entry conditions, one for each region i, i. e. $\left[R_t^{l,i} - R_t^{d,i}\left(1+\frac{Q(z_t)}{z_t}\right)\right] b_t^{CB,i} k_{t+1} = R_t^d E^i$ $i = F, H$ which result in

$$n_t^i = \frac{is(1-\beta)hk_t}{E^i}\left(1 - \frac{R_t^{d,i}\left(1+\frac{Q(z)}{z}\right)}{R_t^{l,i}}\right) \qquad i = F, H \tag{2.33}$$

In addition to that, as the market for loans is unique in the CB mode equilibrium must also hold at open economy level, hence adding up (2.30) across regions of the open economy one obtains

$$(H+F)s(1-\beta)hk_t = \left(1+\frac{Q(z)}{z}\right)(H+F)\,k_{t+1} + \sum_{i=F,H} n_t^i E^i \tag{2.34}$$

By summing up equations (2.30) across countries on the left-hand side one obtains the same supply of saving as in the CP mode[9], i.e. the left-hand side of (2.34). This is further evidence that the size of the financial market in the CB mode is the same as in the CP and that the modes of operation differ only by the internal distribution of market shares. The aggregate accumulation function is hence

$$k_{t+1} = \frac{s(1-\beta)hk_t - \frac{\sum_i n_t^i E^i}{(H+F)}}{\left(1+\frac{Q(z)}{z}\right)} = \frac{s(1-\beta)hk_t\left[1 - \frac{\sum_i i\left(1-\frac{R_t^{d,i}\left(1+\frac{Q(z)}{z}\right)}{R_t^{l,i}}\right)}{(H+F)}\right]}{\left(1+\frac{Q(z)}{z}\right)} \tag{2.35}$$

Summarizing, in terms of definition of regime of competition in the financial sector the CB mode of operation fares midway between the FA and the CP mode of operations. Similarly to financial autarky, $\sum_i n_t^{CBi}$ financial interme-

[9]It is easy to verify that $b_t^{CP} = \sum\limits_{i=F,H} b_t^{CB,i} = \frac{(H+F)k_{t+1}}{z_t \sum\limits_{i=F,H} n_t^i}$

diaries will be active in the whole open economy, with $\sum_i n_t^{CBi} > \sum_i n_t^{FAi}$ as more financial intermediaries from the less productive formerly autarkic country F are now able to operate, following the positive productivity shock to this region in the open economy environment. Similarly to the CP mode, for any given k_t, each intermediaries will be operating in the open economy with $(H+F)$ potentially borrowing firms and $\frac{H+F}{\sum_i n_t^{CBi}}$ each as a potential market share. If the representative intermediary has to serve these customers in equilibrium, market shares of single intermediaries will conflict and strategic interaction will occur among competing intermediaries. Should this not be the case, each lender will operate as a local monopolist.

2.5.1 Symmetric Equilibrium under Cross Border trade in Financial Services

Similarly to the previously analyzed modes of operation the interplay between the free entry condition and the profit maximizing behavior of intermediaries in the Cross Border mode results in $\left(R^{l,CBm}; z^{CBm}; \sum_i n_t^{CBim}\right)$ equal to

$$\left(R^{d,CBm}\frac{1}{\beta}\left(1+\frac{Q\left(z^{CBm}\right)}{z^{CPm}}\right); \frac{1}{\Gamma s\left(1-\beta\right)^2}; s(1-\beta)^2 hk_t \sum_i \frac{i}{E^i}\right) \tag{2.36}$$

with $\frac{1}{2} < \beta < 1$ if the single financial intermediary can operate as a local monopolist , i.e. for $k_t \leq \widehat{k}^{CB} = \frac{\Gamma}{\frac{h\sum_i \frac{i}{E^i}}{(H+F)}}$[10], and in $\left(R_t^{l,CBmc}; z_t^{CBmc}; \sum_i n_t^{CBimc}\right)$

[10] As $z^{CBm}\sum_i n_t^{CBim} \leq (H+F)$ for $k_t \leq \widehat{k}^{CB}$

$$\left(R_t^{d,CBmc}\left(1+q\left(z_t^{CBmc}\right)\right); \frac{H+F}{\sum_i n_t^{CBimc}}; s(1-\beta)hk_t\left(1-\eta_t^{CB}\right)\sum_i \frac{i}{E^i} \right) \tag{2.37}$$

with $\eta_t^{CB} = \left[1 - \frac{\left(1+\frac{Q\left(z_t^{CBmc}\right)}{z\left(z_t^{CPmc}\right)}\right)}{\left(1+Q'\left(z_t^{CBmc}\right)\right)} \right]$ if they do, i.e. $k_t > \widehat{k}^{CB}$.

Substituting $\sum_i n_t^{CBi}$ from (2.36) or (2.37) in (2.35) one obtains a growth rate of

$$g_{t+1}^{CP} = \frac{k_{t+1}}{k_t} - 1 = \begin{cases} \frac{s\beta(1-\beta)hk_t}{\left(1+\frac{Q(z)}{z}\right)} - 1 \text{ for } k_t \leq \widehat{k}^{CB} \\ \frac{s\eta_t^{CB}(1-\beta)hk_t}{\left(1+\frac{Q(z)}{z}\right)} - 1 \text{ for } k_t > \widehat{k}^{CB} \end{cases} \tag{2.38}$$

$\widehat{k}^{CB} \gtreqless \widehat{k}^{FAi}$ if $\frac{h\sum_i \frac{i}{E^i}}{(H+F)} \lesseqgtr \frac{j}{E^i}$ so one of the first effects of financial openness under the CP mode vs. FA is to anticipate (delay) the level of economic development needed for the financial sector to contribute to an accelerating growth if the productivity to fixed costs ratio is lower (higher).

The next proposition examines whether the new mode of financial operation is growth-enhancing for the new open economy vs. financial autarky.

Proposition 2.3 *An open economy whose financial sector operates under the CB mode will grow faster than a high (low) productivity country i ($\bar{i}$) operating in the FA mode if:*

1. *its absolute productivity is higher and $k_t \leq \widehat{k}^{CB}$*
2. *its squared productivity to fixed cost ratio, $h\left(\frac{h}{E^H}\right) > f\left(\frac{f(H+F)}{HE^F+FE^H}\right)$ is higher and $k_t > \widehat{k}^{CB}$*

The Proposition is proved in Appendix 2.7.4.

Discussion. The comparisons in Proposition 2.3 rely on the same mechanics of the open economy as in Proposition 2.2 with the only difference represented by fixed costs. If $k_t < \widehat{k}^{CB} < \widehat{k}^{FAi}$, then only absolute productivity matters for growth. The CB mode too cannot be beneficial with respect to the FAi mode for both formerly autarkic countries, but only for the less productive one.

The relevant fixed costs in per capita terms are a weighted average of those for the two types of financial intermediaries originating in the two countries namely $\frac{\left(HE^F+FE^H\right)}{(H+F)}$. As a consequence, for formerly autarkic country H, which by assumption does not benefit from any productivity shocks when joining the open economy, what matters is the absolute level of the partner country fixed costs. Should the latter be lower than its own in autarky, then the growth rate for the region in the open economy would be higher. This is because the (weighed) average quantity of capital used to cover fixed cost with financial intermediaries originating from both countries H and F is lower in per capita terms than that needed to set up the whole financial sector with representative financial intermediaries from formerly autarkic country H only.

As in the CP mode, the comparative advantage for country F to enter as a region in the open economy rather than remaining financially autarkic under the FA mode depends on both productivity and fixed costs. If the squared productivity to fixed cost ratio is more favorable in the partner country, then the weighted average of fixed costs for financial intermediation will be lower and it will be advantageous for country F to join the Cross Border mode of operations. Should this not be the case, higher growth will be reached by region F in the Cross Border mode only for high level of development.

The introduction of interbank bilateral agreements for the supply of savings could make the analysis of the CB mode redundant as national deposit markets would no longer be segregated. This development, however, is not considered here as this Chapter focuses on direct links between financial development and growth.

2.6 Discussion

The models presented in this paper establish a direct link between financial development and economic growth, which is essentially shaped by the costs of financial intermediation and the regime of competition in the financial sector. From the comparisons of the dynamics of the finance - growth relationship across countries under Financial Autarky it becomes apparent that differences in the growth performance can be explained by dissimilarities of the absolute level of fixed costs of financial intermediation or its ratio to productivity.

When the same analysis is applied to a single open economy under Financial Autarky vs. being a member of a custom union with has also liberalized trade in financial services, the model offer a multifaceted answer to the question whether financial liberalization is actually growth-enhancing. In line with the relevant literature, Cetorelli (1997), Tornell and Westermann (2004) and Claessens (2006) among others, the channels of transmission of the effects of financial liberalization on economic growth are identified with the change in the costs of financial intermediation, and eventually of the regime of competition in the financial sector, and the increase in the economy's productivity.

More specifically, when the lending technology is characterized by both economies of scale and specialization, financial openness does increase economic growth for both formerly autarkic countries only if:

- the level of fixed costs of financial intermediation in financial openness is lower than that under financial autarky in the more productive country H;
- the productivity-to-fixed cost ratio in financial openness is more favorable than that under financial autarky for the less productive country F.

Should formerly autarkic country F be less productive than partner country

H in absolute terms, but not relatively to the costs of financial intermediation, then it would still be growth enhancing for country F to open financially but only when a high level development is reached. This is because for country F the effect of joining the open economy is ambiguous as an increase in fixed costs with respect to Financial Autarky reduces the number of financial intermediaries, potentially hindering the functioning of the economies of specialization, but the increase in productivity counterbalances this effect.

The empirical evidence in Chapter 4 broadly supports these theoretical results as it identifies one equilibrium relationship between financial and economic development with mostly a positive effect of the level of development, openness and real interest rates. Financially open sample countries show higher values for the effect of openness on financial development, underlining the different effects that financial openness may activate on the traditional links between economic growth and financial development. In particular, within financially open sample countries Morocco's value estimates for the effect of openness on financial development is definitely larger than that of Ecuador, which shares a similar end-of-sample level of openness and level of economic development (both are Lower-Middle income countries according to the World Bank classification). Morocco - which in table 2.2 is indicated as committed to liberalization under the Commercial Presence mode - might constitute an example where the fixed costs to productivity ratio relative to the rest of the world was higher before liberalization. On the other hand in Ecuador the restrictions on practices by foreign establishments might have played a role despite the country's full commitment to liberalization both under CP and the CB modes.

As far as causality is concerned, the empirical findings in Chapter 4 mostly indicate that financial development causes economic growth.

Whether the largest gain in growth for a country in financial autarky is reached within an open economy operating either under the CB or the CP mode, it depends on the mode of operation with the lowest fixed costs of financial intermediation per capita. If there is no absolute costs advantage, then the growth-enhancing properties of the different modes of financial openness depend on the level of development and show path-dependency. An immediate policy implication is that a low productivity country might not find it rational to open financially under the CP mode if fixed costs E^{CP} are too high, but it might find some advantage if the financial sector is opened under the CB mode.

Finally, regarding the question of the regime of competition in the financial sector of the open economy, the thresholds in the level of development measured by k leading to monopolistic competition decrease with respect to those in the FAi mode. So it might be the case that, following liberalization in the financial sector, the credit market in one country goes from local monopoly under FA to monopolistic competition in the open economy. This is consistent with the view that opening a sector usually brings more competition, as underlined in Pagano (1993) and Claessens (2006) among others.

The main implication in terms of policy recommendation is the desirability to stimulate competition in the financial sector by lowering barriers to entry in the form of fixed costs. Such conclusion must however by circumstantiated by allowing for the fact that the model does not allow for macroeconomic or idiosyncratic risk, hence fixed costs in the form of capital requirements do not depend on past lending performance, i.e. financial intermediaries' capital cannot be used as a buffer against clients' defaults or cyclical movements in the economy.

The current framework relies on technology assumptions that are undoubtedly restrictive both for the analysis of financial autarky and of financial openness. A deterministic production function for a representative firm cannot allow for the impact of monitoring costs in the financial sector nor for crises via macroeconomic shocks. Similarly liberalization of the financial sector in a one-country, one-good environment does not allow for the analysis of portfolio flows and risk diversification. However, as the main focus of the paper is the study of the effects of different modes of financial liberalization on the real economy via the credit channel, these simplifying assumptions have been considered necessary in order to keep the model tractable while preserving the main features of the mechanism of transmission.

2.7 Appendices to Chapter 2

2.7.1 Proof of proposition 2.1

Proof. For $k_t \leq \widehat{k}^{FAi}$ $g_t^{FAH,m} > g_t^{FAF,m}$ if $\frac{s\beta(1-\beta)h}{\left(1+\frac{Q(z_m)}{z_m}\right)} - 1 > \frac{s\beta(1-\beta)f}{\left(1+\frac{Q(z_m)}{z_m}\right)} - 1$

hence if $h > f$

For $k_t > \widehat{k}^{FAi}$ $g_t^{FAH,mc} > g_t^{FAF,mc}$ if $\frac{s(1-\beta)h}{\left(1+q\left(z_t^{FAH,mc}\right)\right)} - 1 > \frac{s(1-\beta)f}{\left(1+q\left(z_t^{FAF,mc}\right)\right)} - 1$

hence if $\frac{h}{f} > \frac{\left(1+q\left(z_t^{FAH,mc}\right)\right)}{\left(1+q\left(z_t^{FAF,mc}\right)\right)}$

and then substituting z_t^{FAi} from (2.18) one obtains

$g_t^{FAH,mc} > g_t^{FAF,mc}$ if

$k_t > k^{FA^*} = \frac{q}{s(1-\beta)(h-f)(1+\overline{q})} \frac{E^{FAH}E^{FAF}}{fh\left(1-\eta_{FAH}\right)\left(1-\eta_{FAF}\right)} \left(\frac{f^2\left(1-\eta_{FAF}\right)}{E^{FAF}} - \frac{h^2\left(1-\eta_{FAH}\right)}{E^{FAH}}\right)$

$k^{FA^*} = \frac{q}{s(1-\beta)(h-f)(1+\overline{q})} \frac{1}{\left(1-\eta_{FAH}\right)\left(1-\eta_{FAF}\right)fh} \left(\frac{\left(1-\eta_{FAF}\right)E^{FAH}}{h^2} - \frac{\left(1-\eta_{FAH}\right)E^{FAF}}{f^2}\right)$

$k^{FA^*} > 0$ if $\frac{f^2\left(1-\eta_{FAF}\right)}{E^{FAF}} > \frac{h^2\left(1-\eta_{FAH}\right)}{E^{FAH}}$

Instead if $k^{FA^*} < 0$ i.e.$\frac{f^2\left(1-\eta_{FAF}\right)}{E^{FAF}} < \frac{h^2\left(1-\eta_{FAH}\right)}{E^{FAH}}$ then $g_t^{FAH,mc} > g_t^{FAF,mc}$ $\forall k_t$ ■

2.7.2 Proof of proposition 2.2

Proof. For $k_t \leq \widehat{k}^{CP}$ $g_t^{CP,m} = g_t^{FAH,m}$ $\forall k_t$; $g_t^{CP,m} > g_t^{FAF,m}$ $\forall k_t$ as $h > f$

For $k_t > \widehat{k}^{CP}$ $g_t^{CP,mc} > g_t^{FAi,mc}$ if $\frac{s(1-\beta)h}{\left(1+q\left(z_t^{CP,mc}\right)\right)} - 1 > \frac{s(1-\beta)j}{\left(1+q\left(z_t^{FAimc}\right)\right)} - 1$ hence if $\frac{h}{j} > \frac{\left(1+q\left(z_t^{CP,mc}\right)\right)}{\left(1+q\left(z_t^{FAi,mc}\right)\right)}$

If $i = H$ $g_t^{CP,mc} > g_t^{FAH,mc}$ if $z_t^{CP,mc} < z_t^{FAH,mc}$ hence if $E^H\left(1 - \eta_t^{FAH}\right) > \left(1 - \eta_t^{CP}\right) E^{CP}$

If $i = F$ $g_t^{CP,mc} > g_t^{FAF,mc}$ if

$k_t > k^{CP^*} = \frac{q}{s(1-\beta)(h-f)(1+\overline{q})} \frac{E^{CP} E^{FAF}}{hf\left(1-\eta_{CP}\right)\left(1-\eta_{FAF}\right)} \left(\frac{f^2\left(1-\eta_{FAF}\right)}{E^{FAF}} - \frac{h^2\left(1-\eta_{CP}\right)}{E^{CP}} \right)$

$k^{CP^*} > 0$ if $\frac{f^2\left(1-\eta_{FAF}\right)}{E^{FAF}} > \frac{h^2\left(1-\eta_{CP}\right)}{E^{CP}}$

Instead if

if $k^{CP^*} < 0$ i.e. $\frac{f^2\left(1-\eta_{FAF}\right)}{E^{FAF}} < \frac{h^2\left(1-\eta_{CP}\right)}{E^{CP}}$ then $g_t^{CP,mc} > g_t^{FAF,mc}$ $\quad \forall k_t$ ∎

2.7.3 Proof of proposition 2.3

Proof. For $k_t \leq \widehat{k}^{CB}$ $g_t^{CB,m} = g_t^{FAH,m}$ $\forall k_t$; $g_t^{CB,m} > g_t^{FAF,m}$ $\forall k_t$ as $h > f$

For $k_t > \widehat{k}^{CB}$ $g_t^{CB,mc} > g_t^{FAi,mc}$ if $\frac{s(1-\beta)h}{\left(1+q\left(z_t^{CB,mc}\right)\right)} - 1 > \frac{s(1-\beta)j}{\left(1+q\left(z_t^{FAIimc}\right)\right)} - 1$ hence if $\frac{h}{j} > \frac{\left(1+q\left(z_t^{CB,mc}\right)\right)}{\left(1+q\left(z_t^{FAIimc}\right)\right)}$

If $i = H$ $g_t^{CB,mc} > g_t^{FAH,mc}$ if $z_t^{CB,mc} < z_t^{FAH,mc}$ hence if

$\left(1 - \eta_t^{FAH}\right) E^F < \frac{FE^H + HE^F}{(H+F)} \left(1 - \eta_t^{CB}\right)$

If $i = F$ $g_t^{CP,mc} > g_t^{FAF,mc}$ if

$k_t > k^{CB^*} = \frac{qE^F E^H}{s(1-\beta)(h-f)(1+\overline{q})hf\left(1-\eta_{FAF}\right)\left(1-\eta_t^{CB}\right)} \left(\frac{f^2\left(1-\eta_{FAF}\right)}{\frac{FE^H+HE^F}{H+F}} - \frac{h^2\left(1-\eta_t^{CB}\right)}{E^H} \right)$

$k^{CB^*} > 0$ if $\frac{f^2\left(1-\eta_{FAF}\right)}{\frac{FE^H+HE^F}{H+F}} > \frac{h^2\left(1-\eta_t^{CB}\right)}{E^H}$

Instead if

if $k^{CB^*} < 0$ i.e. $\frac{f^2\left(1-\eta_{FAF}\right)}{\frac{FE^H+HE^F}{H+F}} < \frac{h^2\left(1-\eta_t^{CB}\right)}{E^H}$ then $g_t^{CB,mc} > g_t^{FAF,mc}$ $\quad \forall k_t$ ∎

Chapter 3

Financial Development, Income Inequality and Economic Growth

3.1 Introduction

In Chapter 2 we discussed the effects of financial openness on the link between financial development and economic growth. Here we try to model one additional force shaping this relationship, namely income distribution.

Income distribution does not perhaps top the "most wanted" list of offenders when thinking out loud about the good and evil effects of financial development on economic growth. However, if business is risky and information asymmetric, the debtor can hide true profits from his creditor and resort to default instead of paying back loans. If such opportunity for moral hazard is common, it can be difficult for the creditor to lend money in the first place. The traditional answer to this problem has been to grant loans only against collateral, more frequently in the form of properties through mortgages, but also in terms of personal guarantees on the future flows of income resulting from investments.

In this Chapter financial intermediation will shape the link between income inequality and growth. More specifically, since the financial system is assumed to ask for guarantees because of asymmetric information, its impact on economic growth will be influenced by inequality in income distribution. Also the working of the financial system, or its lack thereof, will generate different returns to different individuals and so it will affect aggregate growth and inequality in income distribution. All models in this Chapter are built on individual non-homothetic, altruistic, preferences on the consumption side, according to a Kaldor-Keynes utility function as in Galor and Moav (2004), and non-linearities on the investment side. Timewise, individuals work only when young and receive a salary which they fully save. When they are old they consume and leave a bequest to their child. Production technology necessitates a minimum investment to be productive[1]. Should this be unavailable to some subjects that an alternative storage technology can be used instead.

Financial markets, when present, are imperfect as lending is not available against the initial investment; therefore only those who can supply the initial investment out of personal wealth (old Wealthy) may actually be entrepreneur and employ young workers. Those who do not reach this wealth threshold (old Poor) can only store their income in financial autarky or lend it, if financial exchange is developed. Differently from the literature reviewed in Aghion, Caroli and Garcìa Peñalosa (1999) the effects of growth on inequality are based on differential returns on capital rather than on wage differentials. The framework is also distinct from Galor and Moav (2004), as there is a single aggregate notion of capital, and, because of imperfect capital markets, savings from poor and wealthy people have different returns.

As in is a driver of the effects of inequality on growth both with and without financial intermediation. As a consequence, during transition Poor agents may not fully contribute to accumulation and see an increase in the return on their

[1] For a non technincal discussion of outside funding in the presence of minimum investment requirement see the section G "A Parable" in Levine (1997).

savings.

Models are set in a dynamic framework characterized by endogenous growth that describes both the effects of income distribution on growth and the reverse relationship and where the two-way link passes through financial intermediation.

The main contribution of the Chapter is twofold: the representation of the relationship between economic growth and inequality as bi-directional and the study of the effects of Financial Intermediation (or lack thereof) on it.

As far as the effects of inequality on growth are concerned, the models in the chapter show that inequality slows growth down in transition stages, as some proportion of the population is cut off from accumulation. Under financial intermediation the slowdown in growth is smaller than under financial autarky. This is because financial intermediation allows an earlier participation of Poor agents in the accumulation process. In the steady state, as the population is no longer partitioned and credit constraints are no longer binding, growth is maximized and it is independent of a functioning financial system or lack thereof. Should the minimum investment requirement evolve with technology, as it is in section 5, then the effects of inequality on growth can be permanent.

As far as the effects of growth on inequality are concerned, inequality is at its maximum at the beginning of transition and growth reduces inequality through a "trickle down" mechanism that transfers the possibility to accumulate and get access to a more productive technology from Wealty to Poor individuals. Transition stages are shorter when financial intermediation operates rather than under financial autarky. In the steady state the growth rate of inequality is the same across financial autarky and financial intermediation and it shows the minimum value. The mitigating effects of growth and financial development on inequality are diminished when technological progress is capital-deepening. In this case permanently increasing inequality can result in the steady state.

In order to emphasize the role of financial development, in section 3 the equilibrium and the development path will be studied in a financial autarky regime, whereby old Wealthy individuals can only invest their own resources; while in section 4 old Poor individuals will be able to lend to old Wealthy individuals, side-stepping non-linearity in production and possibly accelerating growth. Finally in section 5 a model with a capital-deepening minimum investment requirement will be attempted.

3.2 Model Specification

The economy is composed by a continuum of individuals of size L. There are two categories of individuals Wealthy and Poor $i = P, W$. All individuals are born equal in terms of preferences[2], but they differ in terms of bequest received. Therefore, each income group can be represented by a single agent. Each individual of type i has one parent and one child and there is no population growth.

The time line follows a standard 2-period OLG dynamic framework where in the first period of life any individual of type i born in period t is endowed with one unit of labour and receives a bequest (if any). In the second period he consumes and leaves a bequest (if he can afford it) out of his savings.

Utility is log-linear and it features the traditional "warm-glow" form of altruism

$$u_{i,t} = (1-\beta)\lg c_{i,t+1} + \beta \lg \left(\overline{\zeta} + b_{i,t+1}\right) \tag{3.1}$$

where $\beta \in (0,1)$, $\overline{\zeta} > 0$, $c_{i,t+1}$ is consumption when old and $b_{i,t+1}$ is bequest left to offsprings of generation t. Equation (3.1) justifies two motives for saving:

[2] Among other things such feature assumes away the problem of intra-generation income distribution of Jappelli-Pagano (1994) and Bhattacharya (1998).

a selfish and an altruistic one. In fact, an individual will give up consumption when young to finance both his own consumption when old and to leave bequest to his child.

Therefore his income at time t is

$$I_{i,t} = (b_{i,t} + w_t) \tag{3.2}$$

whereas, in the second period of life, his income is generated exclusively by the return on savings i.e.

$$I_{i,t+1} = R_{i,t+1}I_{i,t} = (1 + r_{i,t+1} - \delta)I_{i,t} \tag{3.3}$$

where $r_{i,t+1}$ is the return on savings available to agent i. It will be assumed that capital fully depreciates within one year, hence $R_{i,t+1} = r_{i,t+1}$.

A single good used both for consumption and for investment purposes is produced through a technology yielding

$$Y_t = AB_tK_t^{\alpha}L^{1-\alpha} \tag{3.4}$$

where A is a technological parameter, $B_t = \overline{k}_t^{1-\alpha}$ is the function of the average capital labour ratio $\overline{k}$ that reflects externalities, K_t is aggregate capital, L is labour, which needs q units of capital to be productive. If an individual's wealth is higher than this minimum requirement, he may choose to be an entrepreneur or to store his income; whereas if an individual cannot satisfy this minimum requirement, he has to store his income. In the latter case, a storage technology with no minimum capital requirement is available in the form of

$$Z_t = R_{P,t}K_t = \rho K_t \tag{3.5}$$

In what follows these two technologies will determine the equilibrium return on investments for the type of agent who can actually afford to run them.

3.2.1 Static optimization

At each time t optimal consumption is the solution to (3.1) subject to the lifetime income constraint

$$R_{i,t+1}I_{i,t} = c_{i,t+1} + b_{i,t+1} \tag{3.6}$$

the result is

$$\begin{cases} c_{i,t+1} = (1-\beta)R_{i,t+1}I_{i,t} + \beta\zeta \\ b_{i,t+1} = \max\left\{0; \beta\left(R_{i,t+1}I_{i,t} - \zeta\right)\right\} \end{cases} \tag{3.7}$$

for $i \in (P, R)$ where $I_{i,t}$ is (3.2) and $\beta\zeta = (1-\beta)\overline{\zeta}$. While optimal consumption is always positive, being the sum of $\zeta > 0$ and a fraction of income $R_{i,t+1}I_{i,t}$, bequest is positive only if income is sufficient to fill the optimal consumption share, and null otherwise. More specifically, the level of income below which an individual will not leave any bequest is

$$\underline{I}_{i,t} < \frac{\zeta}{R_{i,t+1}} \tag{3.8}$$

$\underline{I}_{i,t}$ can be identified with the present value of the utility threshold ζ and it is decreasing in the return on savings $R_{i,t+1}$.

On the investment side, optimal investment K_{t+1} will be the result of the maximization of

$$\max_{K_{t+1},L} F = AB_{t+1}K_{t+1}^{\alpha}L^{1-\alpha} - w_{t+1}L - R_{W,t+1}K_{t+1} \tag{3.9}$$

The return on investments is $R_{W,t+1}$ accruing only to Wealthy individual. Poor individuals are, by definition, those whose income is below the threshold q and therefore can neither access production via (3.4) nor enjoy its returns $R_{W,t+1}$.

FOCs imply that

$$w_{t+1} = (1-\alpha) A\overline{k}_{t+1}^{1-\alpha} \left(\frac{K_{t+1}}{L}\right)^{-\alpha} \tag{3.10}$$

and

$$R_{W,t+1} = \alpha A\overline{k}_{t+1}^{1-\alpha} \left(\frac{K_{t+1}}{L}\right)^{\alpha-1} \tag{3.11}$$

3.2.2 Macroeconomic equilibrium

In equilibrium as all firms are equal $\overline{k}_{t+1} = \frac{K_t}{L} = K_t$ hence

$$w_{t+1} = (1-\alpha) Ak_{t+1} = \Gamma k_{t+1} \tag{3.12}$$

where k is the capital labour ratio and $\Gamma = (1-\alpha) A$ is labour productivity and

$$R_{W,t} = \alpha A\overline{k}_{t}^{1-\alpha} \left(\frac{K_t}{L}\right)^{\alpha-1} = \alpha A \tag{3.13}$$

Assuming $\alpha A > \rho$ implies that in equilibrium any agent whose income is higher than q will choose to produce. Should this not be the case, then for some individual i it must be that optimal utility $u^*_{i,t}$ is such that

$$u^*_{i,t} \mid_{R_{i,t+1}=\rho} > u^*_{i,t} \mid_{R_{i,t+1}=\alpha A} \tag{3.14}$$

But as optimal utility is increasing in $R_{i,t+1}$[3] then

[3] $\frac{\partial u^*_{i,t}}{\partial R_{i,t+1}} = \frac{(1-\beta)^2 I_{i,t}}{[(1-\beta)R_{i,t+1}I_{i,t}+\beta\zeta]}$ if $b^*_{i,t+1} = 0$ and $\frac{\partial u^*_{i,t}}{\partial R_{i,t+1}} = \frac{(1-\beta)^2 I_{i,t}}{[(1-\beta)R_{i,t+1}I_{i,t}+\beta\zeta]} +$

$$\alpha A > \rho \rightarrow u^*_{i,t} \mid_{R_{i,t+1}=\rho} < u^*_{i,t} \mid_{R_{i,t+1}=\alpha A} \tag{3.15}$$

implying that any agent, having the opportunity to do so, will definitely become an entrepreneur and earn $R_{W,t}$.

Recalling the hypothesis of full depreciation, in equilibrium returns become

$$R_i = \begin{cases} R_P = \rho \text{ if } 0 < I_{i,t} < q \\ R_W = \alpha A \text{ if } I_{i,t} > q \end{cases} \tag{3.16}$$

Returns are hence piece-wise defined, i.e. non linear, with respect to income.

Consequently, optimal bequest behavior will change according to (3.8) and become

$$\underline{I}_{i,t} = \begin{cases} \frac{\zeta}{R_P} \text{ if } 0 < I_{i,t} < q \\ \frac{\zeta}{R_W} \text{ if } I_{i,t} > q \end{cases} \tag{3.17}$$

3.3 Growth and inequality in financial autarky

Under financial autarky external funding is not available so Wealthy individuals can only invest their own savings but cannot borrow. Poor individuals ones can only store their savings until their income does not overtake the threshold q.

Suppose that the economy starts with $(1-\lambda)$ Wealthy individuals with a level of income such that $\frac{\zeta}{R_W} < q < I_{W,0}$ and λ Poor individuals with a level of income $I_{P,0} < \frac{\zeta}{R_P} < q$. This means that as long as individuals can be defined as Wealthy they will always have enough money both to leave a bequest and to invest with the productive technology. These opportunities will

$\frac{\beta^2 I_{i,t}}{\frac{\beta^2\zeta}{(1-\beta)}+\beta R_{i,t+1} I_{i,t}}$ if $b^*_{i,t+1} > 0$ and $\frac{\partial u^*_{i,t}}{\partial R_{i,t+1}} > 0$ as all elements of the sum are positve be gained by Poor individuals sequentially - positive bequest first and access to the productive technology after - once their income grows. Positive aggregate accumulation of capital is always possible via Wealthy individuals' bequest, who are so defined as their income is higher than the minimum investment requirement q. The unequal distribution of income also shapes the aggregate accumulation function. More precisely, the latter can be described by

$$k_{W,t+1} = \begin{cases} (1-\lambda)\left(w_t + b_{W,t}\right) \text{ if } I_{W,t} > \frac{\zeta}{R_W}; I_{P,t} < q \\ (1-\lambda)\left(w_t + b_{W,t}\right) + \lambda\left(w_t + b_{P,t}\right) \text{ if } I_{W,t} > \frac{\zeta}{R_W}; I_{P,t} > q \end{cases} \tag{3.18}$$

Because of the features of preferences embodied in the static equilibrium - implying that all young people work and save all their income - dynamics in (3.18) are driven both by labour productivity and by bequest.

As to optimal bequest, following (3.7), (3.16) and the above mentioned initial conditions, Wealthy individuals would always be in a position to leave a bequest, as $I_{W,0} > \frac{\zeta}{R_W}$, and to invest it in production, as $I_{W,0} > q$. On the other hand, by hypothesis Poor individuals cannot afford any bequest at the beginning. Should their income grow they will eventually be able to leave a bequest and store it together with their wage, and finally, once their income reaches the threshold q, they will have access to investment implying higher equilibrium return on savings and contribution to aggregate accumulation.

The full path of development of the economy is divided in stages delimited by thresholds for the income of the Poor individuals in (3.17). The stages feature different combinations of aggregate accumulation from (3.18) and optimal bequest by different groups of individuals, and specifically

Stage	Time	$I_{P,t}$	Dynamics
$j=1$	$(0;\underline{t})$	$I_{P,t} < \frac{\zeta}{R_P}$	$\begin{cases} k_{W,t+1} = (1-\lambda)\left(\Gamma k_{W,t} + b_{W,t}\right) \\ b_{W,t+1} = \beta\left[R_W\left(\Gamma k_{W,t} + b_{W,t}\right) - \zeta\right] \\ b_{P,t+1} = 0 \end{cases}$
$j=2$	$\left[\underline{t}+1;\overline{t}\right)$	$\frac{\zeta}{R_P} < I_{P,t} < q$	$\begin{cases} k_{W,t+1} = (1-\lambda)\left(\Gamma k_{W,t} + b_{W,t}\right) \\ b_{W,t+1} = \beta\left[R_W\left(\Gamma k_{W,t} + b_{W,t}\right) - \zeta\right] \\ b_{P,t+1} = \beta\left[R_P\left(\Gamma k_{W,t} + b_{P,t}\right) - \zeta\right] \end{cases}$
$j=3$	$\left[\overline{t}+1;\infty\right)$	$I_{P,t} > q$	$\begin{cases} k_{W,t+1} = \Gamma k_{W,t} + (1-\lambda)\, b_{W,t} + \lambda b_{P,t} \\ b_{W,t+1} = \beta\left[R_W\left(\Gamma k_{W,t} + b_{W,t}\right) - \zeta\right] \\ b_{P,t+1} = \beta\left[R_W\left(\Gamma k_{W,t} + b_{P,t}\right) - \zeta\right] \end{cases}$

(3.19)

More precisely:

- in the first stage only Wealthy individuals can afford a bequest hence aggregate accumulation is fed only by all the savings of the $(1-\lambda)$ Wealthy individuals, which are made up by wages and bequest. Poor individuals' savings are exclusively made up by wages as they cannot afford any bequest. Also their savings have to be stored so they do not feed aggregate accumulation. This stage lasts up to time $\underline{t}$ defined as $\underline{t} : I_{P,\underline{t}+1} > \frac{\zeta}{R_P}$;

- from $\underline{t}+1$ Poor individuals can afford a bequest hence the amount they store grows with respect to the previous stage. However, such amount cannot yet be invested as it is still below the minimum investment requirement. Wealthy individuals' bequest and aggregate capital accumulation maintain the same dynamics as in the previous stage. This stage lasts up to time $\overline{t}$ defined as $\overline{t} : I_{P,\overline{t}+1} > q$;

- from $\overline{t}+1$ Poor individuals can invest and therefore by (3.16) they give up storing and receive the same return on their savings as initially Wealthy individuals. Consequently in this stage all agents contribute to aggregate accumulation.

3.3.1 The dynamics in financial autarky

Each stage j in (3.19) is represented by a non-homogeneous system of first-order differential equations and, as shown in Appendix 3.7.1, it is solved by

Stage	Growth rates
$j=1$	$\begin{cases} g_{\widehat{k}_{R,t}} = (1-\lambda)\Gamma + \beta R_W - 1 \\ g_{\widehat{b}_{R,t}} = (1-\lambda)\Gamma + \beta R_W - 1 \\ g_{\widehat{b}_{P,t}} = 0 \end{cases}$
$j=2$	$\begin{cases} g_{\widehat{k}_{R,t}} = (1-\lambda)\Gamma + \beta R_W - 1 \\ g_{\widehat{b}_{R,t}} = (1-\lambda)\Gamma + \beta R_W - 1 \\ g_{\widehat{b}_{P,t}} = \varpi_{\widehat{b}_P\|j=2}(\beta R_P) + \left(1-\varpi_{\widehat{b}_P\|j=2}\right)((1-\lambda)\Gamma + \beta R_W) - 1 \end{cases}$
$j=3$	$\begin{cases} g_{\widehat{k}_{R,t}} = \Gamma + \beta R_W - 1 \\ g_{\widehat{b}_{R,t}} = \varpi_{\widehat{b}_R\|j=3}(\beta R_W) + \left(1-\varpi_{\widehat{b}_R\|j=3}\right)[\Gamma + \beta R_W] - 1 \\ g_{\widehat{b}_{P,t}} = \varpi_{\widehat{b}_P\|j=3}(\beta R_W) + \left(1-\varpi_{\widehat{b}_P\|j=3}\right)[\Gamma + \beta R_W] - 1 \end{cases}$

(3.20)

where $g_{\widehat{x}_t}$ is the growth rate of the normalized variable $\widehat{x}_t = x_t - x^*$, with x^* being the long run equilibrium value of the variable x_t, and $\varpi_{\widehat{x}_l|j}$ are weights[4] defined in Appendix 3.7.1.

Should $(1-\lambda)\Gamma + \beta R_W > 1$, then the long run equilibrium for variables in level is unstable, as expected in a endogenous growth framework, and growth pulls the economy through all the stages of development.

(3.20) firstly shows that accumulation and the distribution of income through

[4] As shown in the Appendix they are actually function of time but t in $\varpi_{\widehat{x}_l,t|j}$ has been left out for simplicity.

bequest follow paths that are not always perfectly related. This is due to one of the core features of the model, namely that capital accumulation has 2 regimes due to the non-linearity represented by q, while bequest behavior follow the 3 regimes corresponding to Poor individuals' bequest thresholds. These are the result of optimizing choices within the combined influence of non-linear optimal bequest, via the utility threshold $\overline{\zeta}$, and non linearity in returns.

Secondly, the rate of accumulation $g_{\widehat{k}_{R,t|j}}$ is constant and it is the sum of the aggregate savings of wealthy young individuals - the Γ-term - and return on old individual's saving, i.e. bequest, represented by the βR_W-term. While all of the bequest that is accumulated contributes to growth, not all of young individuals' saving does. In fact the Γ-term is scaled down by $(1-\lambda) < 1$ as the λ share, i.e. savings from young poor agents, has to be stored during transition. In the steady state accumulation accelerates precisely because the share of savings by young individuals is equal to unity. In other words the presence of minimum capital requirements hampers growth by excluding some individuals from accumulation in so far as $g_{k_{R,j=1}} < g_{k_{R,j=3}}$ precisely because $\lambda > 0$.

Finally, as shown in Appendix 3.7.1, Wealthy individuals' bequest grows at the same rate as the economy - although only asymptotically so in the steady state - while Poor individuals' bequest, if positive, grows faster than g_{k_R} during transition and in the steady state. More precisely, in stage 2 it is true that Poors' savings receive a lower return, but the mere fact to have a positive rather than zero bequest allows them to benefit from the "trickle down" effect in the words Matsuyama (2000), i.e. the gain in wage accruing from accumulation fuelled by Wealthy individuals' bequests. In the steady state bequest by Poor individuals grows more than that of Wealthy ones, although it does not manage to make up for the lost ground during transition if $R_W > \frac{1}{\beta}$. Formally, defining inequality as the difference in optimal bequests, given that the wage part of income is equal across individuals, one obtains

$$
\begin{array}{|c|c|}
\hline
\text{Stage} & \text{Inequality Dynamics } g_{\widehat{\delta}_t} = \frac{\widehat{b}_{W,t} - \widehat{b}_{P,t}}{\widehat{b}_{W,t-1} - \widehat{b}_{P,t-1}} - 1 \ t > 1 \\
\hline
j = 1 & \Gamma(1-\lambda) + \beta R_W - 1 \\
\hline
j = 2 & \varpi_{\widehat{\delta}_{j=2}} \beta R_P + \left(1 - \varpi_{\widehat{\delta}_{j=2}}\right)(\Gamma(1-\lambda) + \beta R_W) - 1 \\
\hline
j = 3 & \beta R_W - 1 \\
\hline
\end{array}
\tag{3.21}
$$

where $0 < \varpi_{\widehat{\delta}|j=2} < 1$ is defined in Appendix 3.7.1.

As shown in Appendix 3.7.1 inequality persists both in transition and in the steady state, although at a declining pace. In the first stage inequality grows at the same rate as the economy, $\beta\zeta$ excludes Poor individuals from bequeathing their children. In the second stage storage makes up for some of the difference in bequests and, as mentioned, positive bequests by Poor individuals allow them to benefit from the "trickle down" effect of Wealthy individuals' accumulation. However, because of lower returns, Poor individuals' income does not manage to keep pace with that of Wealthy individuals and inequality keeps on growing, albeit at slower rate than in the previous stage.

Finally, in the steady state inequality grows at a minimum rate βR_W which represents the loss in terms of higher returns suffered by the Poor during transition. The model is hence consistent with Kutznets' "inverted U" hypotheses of decelerating inequality along with development.

3.4 Growth and inequality in financial intermediation

Suppose that, giving up a constant fraction $0 < \varepsilon < 1$ of the returns in order to make up for transaction costs, it were possible to transfer savings of some group of population to investments of some other group. Should this be the case, and should $\rho < \alpha A(1-\varepsilon)$, Poor lenders can enjoy higher returns with respect to financial autarky, even with an income below the minimum investment requirement. In such environment equilibrium returns (3.16) becomes

$$R_i' = \begin{cases} R_P' = \alpha A(1-\varepsilon) \text{ if } 0 < I_{i,t} < q \\ R_W = \alpha A \text{ if } I_{i,t} > q \end{cases} \tag{3.22}$$

Financial intermediation changes the framework of the model in other two important ways. First of all, assuming that intermediation costs are fully born by Poor individuals - who are savers until their income overtakes q - implies that in equilibrium the return to Wealthy individuals is unchanged with respect to Financial Autarky, so they will decide to invest and be entrepreneurs rather than save and lend.

Secondly, as it is assumed that $\rho < \alpha A(1-\varepsilon)$, Financial Intermediation dominates storage in equilibrium and thereby increases the capital stock available for investments with respect of financial autarky. Therefore (3.18) changes into

$$k_{W,t+1} = w_t + (1-\lambda) b_{W,t} + \lambda b_{P,t} \ \forall I_{P,t}, I_{R,t} \tag{3.23}$$

Under Financial Intermediation anybody has always access to borrowing or lending and (3.23) describe accumulation throughout all the stages of development. As demand for borrowing by Wealthy individuals increases with k_t, while supply of funds is constrained to savings from Poor individuals, the return on borrowing should increase in stage 2 and in stage 3, where everyone would choose to be a borrower. As a consequence, a non competitive market may arise with changes in the equilibrium return on savings. Here a perfectly elastic source of funding outside exogenous to the model is assumed. Access to the international capital markets as a price-taker can provide a real world example of such assumption.

Also, $R'_P > R_P$ implies that the cut-off income level in (3.17) is lower, i.e. the no-bequest stage of economic growth is shorter here than in financial autarky environment, hence

$$\underline{I}_{i,t} = \begin{cases} \frac{\zeta}{R'_P} < \frac{\zeta}{R_P} \text{ if } 0 < I_{i,t} < q \\ \frac{\zeta}{R_W} \text{ if } I_{i,t} > q \end{cases} \tag{3.24}$$

Summarizing, the sequence of the 3 stages of development in financial intermediation is

Stage	$I_{P,t}$	Dynamics
$j = 1$	$I_{P,t} < \frac{\zeta}{R'_P}$	$\begin{cases} k_{W,t+1} = \Gamma k_{W,t} + (1-\lambda) b_{W,t} + \lambda b_{P,t} \\ b_{W,t+1} = \beta \left[R_W \left(\Gamma k_{W,t} + b_{W,t} \right) - \zeta \right] \\ b_{P,t+1} = 0 \end{cases}$
$j = 2$	$\frac{\zeta}{R'_P} < I_{P,t} < q$	$\begin{cases} k_{W,t+1} = \Gamma k_{W,t} + (1-\lambda) b_{W,t} + \lambda b_{P,t} \\ b_{W,t+1} = \beta \left[R_W \left(\Gamma k_{W,t} + b_{W,t} \right) - \zeta \right] \\ b_{P,t+1} = \beta \left[R'_P \left(\Gamma k_{W,t} + b_{P,t} \right) - \zeta \right] \end{cases}$
$j = 3$	$I_{P,t} > q$	$\begin{cases} k_{W,t+1} = \Gamma k_{W,t} + (1-\lambda) b_{W,t} + \lambda b_{P,t} \\ b_{W,t+1} = \beta \left[R_W \left(\Gamma k_{W,t} + b_{W,t} \right) - \zeta \right] \\ b_{P,t+1} = \beta \left[R_W \left(\Gamma k_{W,t} + b_{P,t} \right) - \zeta \right] \end{cases}$

(3.25)

The main difference with (3.19) is that all young people - irrespective whether they are Wealthy or Poor - fuel accumulation with their saving behavior in any stage. The threshold q, however, has still its *raison d'être* in so far as the return on savings is still lower for a given k for savers whose income is below q, as they have to bear the full cost of financial intermediation.

The dynamics in (3.25) are solved by

Stage	Growth rates
$j=1$	$\begin{cases} g_{\widehat{k}_{R,t}} = z_{2\vert j=1}\varpi_{\widehat{k}_R\vert j=1} + z_{3\vert j=1}\left(1-\varpi_{\widehat{k}_R\vert j=1}\right)-1 \\ g_{\widehat{b}_{R,t}} = z_{2\vert j=1}\varpi_{\widehat{b}_R\vert j=1} + z_{3\vert j=1}\left(1-\varpi_{\widehat{b}_R\vert j=1}\right)-1 \\ g_{\widehat{b}_{P,t}} = 0 \end{cases}$
$j=2$	$\begin{cases} g_{\widehat{k}_{R,t}} = z_{2\vert j=2}\varpi_{\widehat{k}_R\vert j=2} + z_{3\vert j=2}\left(1-\varpi_{\widehat{k}_R\vert j=2}\right)-1 \\ g_{\widehat{b}_{R,t}} = z_{2\vert j=2}\varpi_{\widehat{b}_R\vert j=2} + z_{3\vert j=2}\left(1-\varpi_{\widehat{b}_R\vert j=2}\right)-1 \\ g_{\widehat{b}_{P,t}} = z_{2\vert j=2}\varpi_{\widehat{b}_P\vert j=2} + z_{3\vert j=2}\left(1-\varpi_{\widehat{b}_P\vert j=2}\right)-1 \end{cases}$
$j=3$	$\begin{cases} g_{\widehat{k}_{R,t}} = z_{3\vert j=3}-1 \\ \widehat{b}_{R,t} = \varpi_{\widehat{b}_R\vert j=3} z_{2\vert j=3} + z_{3\vert j=3}\left(1-\varpi_{\widehat{b}_R\vert j=3}\right)-1 \\ \widehat{b}_{P,t} = \varpi_{\widehat{b}_P\vert j=3} z_{2\vert j=3} + z_{3\vert j=3}\left(1-\varpi_{\widehat{b}_P\vert j=3}\right)-1 \end{cases}$

(3.26)

where $z_{s|j}$ $s=1,2,3$ and $\varpi_{\widehat{x}_l|j}$ are defined in Appendix 3.7.2.

$g_{\widehat{x}_{l|j}} = z_{3|j} - \varpi_{\widehat{x}_l|j}$ multiplies a constant for $\widehat{x}_{l|j} = \widehat{b}_P, \widehat{b}_R, \widehat{k}_R$ and $j = 1,2$. Hence, as long as $z^{FI}_{3|j=1,2} > z^{FA}_{3|j=1,2}$, where the superscript FA stands for Financial Autarky and the superscript FI stands for Financial Intermediation, growth will be higher under Financial Intermediation during transition stages at least asymptotically.

(A3.3) in Appendix 3.7.2 shows that this is the case for $\widehat{x}_l = \widehat{b}_R, \widehat{k}_R$ in stage 1 and in stage 2. $g^{FI}_{\widehat{k}_{R,t|j=1,j=2}} > g^{FA}_{\widehat{k}_{R,t|j=1,j=2}} > 1$ also implies that as under Financial Autarky, in Financial Intermediation the economy will go through all three stages of development with an accelerating pace and because of the threshold in the utility function, excluding Poors from bequest in the first stage of development, inequality has still an effect on growth as $g^{FI}_{\widehat{k}_{R|j=1}} < g^{FI}_{\widehat{k}_{R|j=3}}$. This is because Financial Intermediation cannot counteract the effect of the Kaldor Keynes saving function for Poor individuals who receive no bequest.

In the steady state $g^{FI}_{\widehat{k}_{R,t|j=3}} \sim g^{FA}_{\widehat{k}_{R,t|j=3}}$ as it has been assumed that all agents can borrow as price-takers and with no transaction costs on the international financial market.

As a consequence inequality evolves with

$$
\begin{array}{|c|c|}
\hline
\text{Stage} & \text{Inequality Dynamics } g_{\widehat{\delta}_t} = \frac{\widehat{b}_{W,t}-\widehat{b}_{P,t}}{\widehat{b}_{W,t-1}-\widehat{b}_{P,t-1}} - 1 \\
\hline
j=1 & g_{\widehat{b}_{W|j=1}} \\
\hline
j=2 & \varpi_{\widehat{\delta}|j=2} z_{2,j=2} + (1-\varpi_{\widehat{\delta}|j=2}) z_{3,j=2} - 1 \\
\hline
j=3 & \beta R_W - 1 \\
\hline
\end{array}
\tag{3.27}
$$

where $\varpi_{\widehat{\delta}|j=2}$ is defined in (A3.9) in Appendix 3.7.2

(3.27) shows that inequality grows at rates that are asymptotic to the growth rate of the economy and $g_{\widehat{k}^{FI}_{W,t|j=1,2}} > g_{\widehat{k}^{FA}_{W,t|j=1,2}}$ implies that during transition inequality grows faster under Financial Intermediation than under Financial Autarky, i.e. $g_{\widehat{\delta}^{FI}_{t|j=1,2}} > g_{\widehat{\delta}^{FA}_{t|j=1,2}}$. This is because during transition costs are born by Poor individuals. In the steady state Financial Intermediation has no differential impact on inequality when compared to Financial Autarky.

Summarizing, with respect to Financial Autarky, Financial Intermediation represents a first best scenario as it shortens stage one, allowing initially Poor individuals to afford a bequest sooner than under Financial Autarky. Given $R'_P > R_P$, Financial Intermediation grants initially Poor individuals higher returns on their savings decreasing inequality, although at a slower pace than under FA. On the other hand, during transition inequality decreases more slowly than under Financial Autarky as transaction costs drag down lenders', i.e. Poor agents', returns. This result is in line with the prediction that financial development may accelerate the path of an economy along the inverted U shape which links economic growth and inequality but at the cost of having higher inequality during transition.

3.5 Growth and inequality in financial autarky with capital-deepening initial investment

Suppose that technological progress is capital deepening, i.e. that the minimum capital requirement to make technology productive increases with the level of development as measured by capital per capita under

$$q_{t+1} = mk_t + nq_t \tag{3.28}$$

with $m > 0$ and $0 < n < \beta R_W + \Gamma(1 - \lambda)$. This assumption, coupled with $I_{W,0} > q_0$, guarantees that Wealthy individuals' income cannot fall below q_t at any t, hence implying a "once Wealthy, always Wealthy" path of growth.

Equation (3.28) aims to capture the fact that the minimum investment requirement threshold evolves both endogenously through n and it is also driven by the aggregate notion of capital per capita k. So if an economy can be assimilated to a large-scale productive unit, say because of technology or sector specialization, it will have even higher q in the future and at the same time the more an economy accumulates, as capital is abundant, it will probably specialize in large-scale capital intensive technologies[5].

If equilibrium returns remain unchanged from (3.17), Wealthy individuals' level of income is $\frac{\zeta}{R_W} < q_0 < I_{W,0}$ and λ is the number of initially Poor, then

[5]The ongoing decline in the relative prices of new capital goods, such as computers and semiconductors, can be taken as current evidence for capital-augmenting technological change. However, defining the nature of technological progress goes beyond the scope of this Chapter and iterested readers shoudl refer to Jalava, Pohjola, Ripatti, Vilmunen (2005).

aggregate accumulation can be described by

$$k_{W,t+1} = \begin{cases} (1-\lambda)(w_t + b_{W,t}) \text{ if } I_{W,t} > q_t; 0 < I_{P,t} < q_t \\ (w_t + b_{W,t}) \text{ if } I_{W,t} > q_t; I_{P,t} > q_t \end{cases} \tag{3.29}$$

Similarly to the dynamics in the fixed q model the 3 stages of economic growth can be defined by

Stage	$I_{P,t}$	Dynamics
$j=1$	$I_{P,t} < \frac{\zeta}{R_P}$	$\begin{cases} k_{W,t+1} = (1-\lambda)(\Gamma k_{W,t} + b_{W,t}) \\ b_{W,t+1} = \beta[R_W(\Gamma k_{W,t} + b_{W,t}) - \zeta] \\ b_{P,t+1} = 0 \\ q_{t+1} = mk_t + nq_t \end{cases}$
$j=2$	$\frac{\zeta}{R_P} < I_{P,t} < q_t$	$\begin{cases} k_{W,t+1} = (1-\lambda)(\Gamma k_{W,t} + b_{W,t}) \\ b_{W,t+1} = \beta[R_W(\Gamma k_{W,t} + b_{W,t}) - \zeta] \\ b_{P,t+1} = \beta[R_P(\Gamma k_{W,t} + b_{P,t}) - \zeta] \\ q_{t+1} = mk_t + nq_t \end{cases}$
$j=3$	$I_{P,t} > q_t$	$\begin{cases} k_{W,t+1} = \Gamma k_{R,t} + (1-\lambda) b_{W,t} + \lambda b_{R,t} \\ b_{W,t+1} = \beta[R_W(\Gamma k_{R,t} + b_{W,t}) - \zeta] \\ b_{P,t+1} = \beta[R_W(\Gamma k_{R,t} + b_{P,t}) - \zeta] \\ q_{t+1} = mk_t + nq_t \end{cases}$

(3.30)

By construction (3.28) does not have any feedback on other variables so, technically although the system in each stage of development has 4 variables, the dynamics of $\widehat{k}_{R,t}, \widehat{b}_{R,t}$ and $\widehat{b}_{P,t}$ remain independent of those of $\widehat{q}_t$. In fact the dynamics in (3.30) are solved by

Stage	Growth rates
$j=1$	$\begin{cases} g_{\widehat{k}_{W,t}} = \beta R_W + \Gamma(1-\lambda) - 1 \\ g_{\widehat{b}_{W,t}} = \beta R_W + \Gamma(1-\lambda) - 1 \\ g_{\widehat{b}_{P,t}} = 0 \\ g_{\widehat{q}_t} = \varpi_{\widehat{q}\vert j=1}\left(\beta R_W + \Gamma(1-\lambda)\right) + \left(1 - \varpi_{\widehat{q},\vert j=1}\right) n - 1 \end{cases}$
$j=2$	$\begin{cases} g_{\widehat{k}_{W,t}} = \beta R_W + \Gamma(1-\lambda) - 1 \\ g_{\widehat{b}_{W,t}} = \beta R_W + \Gamma(1-\lambda) - 1 \\ g_{\widehat{b}_{P,t}} = \varpi_{\widehat{b}_P\vert j=2}\left(\beta R_W + \Gamma(1-\lambda)\right) + \left(1 - \varpi_{\widehat{b}_P\vert j=2}\right) \beta R_P - 1 \\ g_{\widehat{q}_t} = \varpi_{\widehat{q},\vert j=2}\left(\beta R_W + \Gamma(1-\lambda)\right) + \left(1 - \varpi_{\widehat{q}\vert j=2}\right) n - 1 \end{cases}$
$j=3$	$\begin{cases} g_{\widehat{k}_{W,t}} = \Gamma + \beta R_W - 1 \\ g_{\widehat{b}_{R,t}} = \varpi_{\widehat{b}_{W,}\vert j=3}\left(\Gamma + \beta R_W\right) + \left(1 - \varpi_{\widehat{b}_{R,}\vert j=3}\right) \beta R_W - 1 \\ g_{\widehat{b}_{P,t}} = \varpi_{\widehat{b}_{P,}\vert j=3}\left(\Gamma + \beta R_W\right) + \left(1 - \varpi_{\widehat{b}_{P,}\vert j=3}\right) \beta R_W - 1 \\ g_{\widehat{q}_t} = \varpi_{\widehat{q}\vert j=3}\left(\beta R_W + \Gamma\right) + \left(1 - \varpi_{\widehat{q}\vert j=3}\right) n - 1 \end{cases}$

(3.31)

and $\varpi_{l|j}$ with $l = \widehat{b}_P, \widehat{b}_R, \widehat{q}$ are constant weights similar to those in Financial Autarky.

The evolution of the minimum investment threshold q_t is a weighted average between the growth rate of the economy and that of technology and the latter does not influence any of the equilibrium growth rates of the other variables. As a consequence, inequality will evolve in the same way as in the model with a fixed q, namely with a decreasing rate during transition reaching the minimum in the steady state.

Stage	Inequality Dynamics $g_{\widehat{\delta}_t^{CD}} = \frac{\widehat{\delta}_t^{CD}}{\widehat{\delta}_{t-1}^{CD}} - 1$
$j = 1$	$g_{\widehat{b}_W}$
$j = 2$	$\varpi_{\delta\mid j=2} z_{2j\mid=2} + \left(1 - \varpi_{\delta\mid j=2}\right) z_{3\mid j=2} - 1$
$j = 3$	$\beta R_W - 1$

(3.32)

where $\varpi_{\delta|j=2}$ is defined in Appendix 3.7.3.

Therefore the main conclusions remain the same as the model with a fixed q, however if

$$\nexists t^* : \widehat{b}_{P,t^*} + \Gamma \widehat{k}_{W,t^*} > \widehat{q}_{t^*} \tag{3.33}$$

then Poor individuals' income will never be able to overtake q_t hence they will never have access to higher returns as Wealthy individuals have. In such a case, credit market imperfections will have a long-lasting effects on growth, given that $g_{\widehat{k}_{W,t}}$ will permanently increase at the lower rate $(\beta R_W + (1 - \lambda) \Gamma)$, instead of reaching the higher path characterized by $(\beta R_W + \Gamma)$ growth rate. This is because initially Poor will be cut off form higher returns and from accumulation for ever.

Galor and Moav (2004) maintain that the importance of inequality for physical capital accumulation would raise, if non convexities in production of physical capital were introduced, and that the latter might also increase the likelihood of poverty traps and persistent inequality. The case where equation (3.33) is verified can be thought of as an example of such occurrence.

3.6 Discussion

This paper presents a unified approach for the dynamic implications of financial development on growth and income distribution. The framework of analysis is characterized by constant return to scales in production, a Kaldor-Keynes utility function and non linearities in financial intermediation. A core feature of the model is that the combination of optimal savings, which are increasing in individual wealth, and non linearities in the functioning of the financial sector generates threshold levels both in access to production and in returns on savings.

More specifically, initially Wealthy agents are assumed to be always in a position to save and leave a bequest to the next generation, while initially Poor individuals' income is assumed to be below the bequest threshold. Consequently while aggregate accumulation is characterized by 2 stages of development, depending on the share of the population having access to accumulation, the distribution of income features 3 different stages according to optimal savings by Poor individuals.

The main result of the Chapter is the identification of a bi-directional link between economic growth and inequality which is shaped by the functioning of the financial sector.

As to the effects of growth on inequality, under Financial Autarky inequality grows as much as the economy in the first stage of development, given that the Poor cannot afford any bequest. Subsequently, inequality growth slows down, as the effects of Wealthy agents' accumulation "trickle down" to Poor agents and pull initially Poor individuals out of their relative scarcity state. A steady state is then reached where inequality grows at a minimum rate. The working of the "trickle down" is ensured by the fact that Wealthy individuals are always in a position to leave a bequest and, the model being constant return to scale and deterministic, this implies a "once wealthy, always wealthy" path of development. This mechanism of adjustment is different from Matsuyama (2000), whose model is based on the endogenous interest rates as lenders benefit from the presence of the Poor agents who cannot do anything but lend and this keeps interest rate low. In the models presented here the interest rate is results from the endogenous growth framework. When Financial Intermediation is introduced, it is assumed that financial transaction costs are fully born by Poor agents. This is an example of the formalization of the "Wealthy get richer at the expense of the Poor" view of Matsuyama (2000). As a consequence inequality grows faster in the transitions stages in Financial Intermediation than in Financial Autarky. At the steady state stage, this model agrees with the commonly held expectation that more financial development leads to faster growth and more equality. As to the effects of inequality on growth, in the models in this Chapter inequality lowers growth by excluding some share of the population from higher returns and contribution to aggregate capital accumulation during transition. Financial Intermediation dampens this effect giving way to earlier participation of Poor workers to the accumulation process.

Summarizing, the mechanics of the models in this Chapter are determined by the combination of a minimum investment requirement and financial intermediation (or lack thereof) operating in an asymmetric information environment, which is implicitly assumed. This framework has a pervasive impact: in financial autarky it generates returns on savings that are piece-wise defined with respect to income and it *de facto* excludes Poor agents from contributing to aggregate capital accumulation and in financial intermediation it brings about credit exclusion, i.e. no individual is ever able to borrow q, as well as extra costs for savers, i.e. Poor agents. The models lead to conclude that financial intermediation does bring benefits vs. financial autarky first of all by shortening the first stage of development where Poor agents cannot afford a bequest due to the Kaldor-Keynes utility function, and secondly by accelerating growth with respect to financial autarky if a perfectly elastic supply of funds, say from international capital markets, is assumed. However, a trade off in terms of a faster growth of inequality during transition will emerge. The steady state under both financial regimes does bring the growth rate of inequality to a minimum. Should technological progress be of a capital-deepening sort, then financial market imperfections will have a permanent impact both on growth and on inequality. More precisely the economy will grow at a slower pace and Poor individuals will never be able to access the high returns production technology and the economy will evolve with persistent inequality.

Finally, it may be unsettling to some readers that the main policy recommendation emerging from a *prima facie* view of this model may hint at supporting the *laissez-faire* view as the best recipe for lifting Poor individuals out of their state. Distortionary tax or regulatory changes favouring the remuneration of savings of Wealthy individuals, even in spite of that of Poor ones, would further accelerate these positive results. However, a not much more in depth analysis of this work should also point out that policies aiming at lifting the threshold q - say by offering government guarantees to initial loans to Poor people or promoting microcredit lenders - would still be a first best with respect to *laissez-faire*.

3.7 Appendices to Chapter 3

3.7.1 Financial Autarky

(3.19) encompasses 3 linear non homogeneous systems of differential equations describing the dynamics of the variables $k_{W,t}$, $b_{W,t}$ and $b_{P,t}$ in the three different stages of development $j = 1, 2, 3$.

For each stage j the general solution for the single $x_{l,t} = \{k_{W,t}, b_{W,t}, b_{P,t}\}$ variable is[6]

[6] See Chiang (1974) from p. 603.

$$x^*_{l,t} = x^*_l + \sum_{v=1}^{V} h_{l,v} s_v \left(z_v\right)^t \qquad \text{(A3.1)}$$

where x^*_l is the long run equilibrium level of x_l, z are the solutions of the characteristic equation of the system, so called characteristic roots, $h_{l,v}$, s_v are constants derived from initial or boundary conditions and V is the number of solutions [7].

Defining a normalized variable as $\widehat{x}_{l,t} = x_{l,t} - x^*_l$, one can write its (normalized) growth rate $g_{\widehat{x}_l}$ [8] as

$$1 + g_{\widehat{x}_l} = \sum_{v=1}^{V} z_v \varpi_{l,v,t} \qquad \text{(A3.2)}$$

where $\varpi_{l,v,t} = \frac{h_{l,v} s_v (z_v)^{t-1}}{\sum_{v=1}^{V} h_{l,v} s_v (z_v)^{t-1}}$ with $\sum_{v=1}^{V} \varpi_{l,v,t} = 1$ and for $1 < \overline{v} < V$

Weights $\varpi_{l,v,t}$ are actually function of time, however to simplify notation t will be dropped from now on. In fact given eigenvalue $\overline{v}$ it is easy to show that

$$\frac{\partial \varpi_{l,\overline{v}}}{\partial t} = \frac{h_{l,\overline{v}} s_{\overline{v}} (z_{\overline{v}})^{t-1} \ln(z_{\overline{v}}) \left(\sum_{v=1}^{V} h_{l,v} s_v (z_v)^{t-1} \right) - h_{l,\overline{v}} s_{\overline{v}} (z_{\overline{v}})^{t-1} \left(\sum_{v=1}^{V} h_{l,v} s_v (z_v)^{t-1} \ln(z_v) \right)}{\left(\sum_{v=1}^{V} h_{l,v} s_v (z_v)^{t-1} \right)^2} >$$

0 if

$$h_{l,\overline{v}} s_{\overline{v}} \left(z_{\overline{v}}\right)^{t-1} \gtrless 0 \text{ and } \left(\sum_{v=1}^{V} h_{l,v} s_v \left(z_v\right)^{t-1} \left(\ln\left(z_{\overline{v}}\right) - \ln\left(z_v\right)\right) \right)$$

So the normalized growth rate of variable $\widehat{x}_l$ $g_{\widehat{x}_l}$ is a weighted sum of the

[7] Writing the system in matrix notation as $x_{t+1} = A_j x_t + d_1$ it is immediate to verify that V is the rank of the matrix of coefficients A_j, z are its eigenvalues and $h_{l,v} s_v$ are elements obtained by pre- and postmultiplying the matrix of eigenvalues by the matrix of correspondent eigenvectors and its inverse. See Chang (1974) from p. 605.

[8] $\frac{x^*_t - x^*_l}{x^*_{l,t-1} - x^*_l} = \frac{\sum_{v=1}^{V} h_{l,v} s_v (z_v)^t}{\sum_{v=1}^{V} h_{l,v} s_v (z_v)^{t-1}} = z_1 \frac{h_{l,v} s_1 (z_1)^{t-1}}{\sum_{v=1}^{V} h_{l,v} s_v (z_v)^{t-1}} + z_2 \frac{h_{l,v} s_2 (z_2)^{t-1}}{\sum_{v=1}^{V} h_{l,v} s_v (z_v)^{t-1}} + \ldots + z_V \frac{h_{l,V} s_V (z_V)^{t-1}}{\sum_{v=1}^{V} h_{l,v} s_v (z_v)^{t-1}} = z_1 \varpi_{l,1} + z_2 \varpi_{l,2} + \ldots + z_V \varpi_{l,V}$

common characteristic roots z_v where the weights $\varpi_{l,v}$ are ratios of exponential functions that sum up to 1[9].

By construction the weight associated with the largest eigenvalue will tend to one when t goes to infinity i.e.

$\lim_{t\to\infty}\varpi_{l,V} = \lim_{t\to\infty}\frac{h_{l,V}s_V(z_V)^{t-1}}{\sum_{v=1}^{V}h_{l,v}s_v(z_v)^{t-1}} \sim \frac{(z_V)^{t-1}}{(z_V)^{t-1}} \sim 1$ where $|z_1| < |z_2| < |z_3| < ... < |z_V|$

and the weights associated with smaller eigenvalues will tend to zero, i.e.

$\lim_{t\to\infty}\varpi_{l,v} = \lim_{t\to\infty}\frac{h_{l,v}s_v(z_v)^{t-1}}{\sum_{v=1}^{V}h_{l,v}s_v(z_v)^{t-1}} = 0^+$ if $h_{l,v}s_v \gtreqless 0$ and $\sum_{v=1}^{V}h_{l,v}s_v \gtreqless 0$ and $\lim_{t\to\infty}\varpi_{l,v} = 0^-$ otherwise

Also $\forall v$

$\lim_{t\to 1}\varpi_{l,v} = \frac{h_{l,v}s_v}{\sum_{v=1}^{V}h_{l,v}s_v} > 0$ if $h_{l,v}s_v \gtreqless 0$ and $\sum_{v=1}^{V}h_{l,v}s_v \gtreqless 0$

Hence in any stage j for any pair of variables $\widehat{x}_l, \widehat{x}_m$ $g_{\widehat{x}_l|j} > g_{\widehat{x}_m|j}$ if

[9] It is also easy to verify that the gross growth rates for the original variable $x_{i,t}$ and for the normalized one are asymptotic. In fact $x_{l,t} = x_l^* + \sum_{v=1}^{V}h_{l,v}s_v(z_v)^t$ and $\frac{x_{l,t}}{x_{l,t-1}} = \frac{\sum_{v=1}^{V}h_{l,v}s_v(z_v)^t}{x_i^*+\sum_{v=1}^{V}h_l s_v(z_v)^{t-1}}$

whereas $\widehat{x}_{l,t} = x_{l,t} - x_l^*$ and $\frac{\widehat{x}_{l,t}}{\widehat{x}_{l,t-1}} = \frac{\sum_{v=1}^{V}h_{l,v}s_v(z_v)^t}{\sum_{v=1}^{V}h_{l,v}s_v(z_v)^{t-1}}$

and $\lim_{t\to\infty}\frac{x_{l,t}}{x_{l,t-1}} = \lim_{t\to\infty}\frac{\sum_{v=1}^{V}h_{l,v}s_v(z_v)^t}{x_l^*+\sum_{v=1}^{V}h_{l,v}s_v(z_v)^{t-1}} = \frac{h_{l,V}s_V\left(z_V\right)^t}{h_{l,V}s_V\left(z_V\right)^t-1} = z_V = \lim_{t\to\infty}\frac{\widehat{x}_{l,t}}{\widehat{x}_{l,t-1}} = \lim_{t\to\infty}\frac{\sum_{v=1}^{V}h_{l,v}s_v(z_v)^t}{\sum_{v=1}^{V}h_{l,v}s_v(z_v)^{t-1}}$
where $z_V = max(z_v)$.

$$\sum_{v=1}^{V} z_v \left(\varpi_{l,v} - \varpi_{m,v}\right) > 0$$

and similarly in any stages j, p for any variable $\widehat{x}_l$, $g_{\widehat{x}_l|j} > g_{\widehat{x}_l|p}$ if

$$\sum_{v=1}^{V|j} z_{v|j}\varpi_{l,v|j} > \sum_{v=1}^{V|p} z_{v|p}\varpi_{l,v|p}$$

Considering that under Financial Autarky two characteristic roots in stage 1 and one in stages 2 and 3 are equal to zero[10] the solutions of the reduced systems $j = 1, 2, 3$ are

	z_1	z_2	z_3
$j = 1$	0	0	$(\Gamma(1-\lambda) + \beta R_W)$
$j = 2$	0	βR_P	$(\Gamma(1-\lambda) + \beta R_W)$
$j = 3$	0	βR_W	$\Gamma + \beta R_W$

(A3.3)

while the full solutions of the systems are

Stage	Solutions
$j = 1$	$\begin{cases} \widehat{k}_{W,t} = \frac{s_{1,j=1}0^t + (1-\lambda)s_{3,j=1}(z_{3,j=1})^t}{(\Gamma(1-\lambda)+\beta R_W)} \\ \widehat{b}_{W,t} = \frac{-\Gamma s_{1,j=1}0^t + \beta R_W s_{3,j=1}(z_{3,j=1})^t}{(\Gamma(1-\lambda)+\beta R_W)} \\ \widehat{b}_{P,t} = 0 \end{cases}$
$j = 2$	$\begin{cases} \widehat{k}_{W,t} = \frac{\left[s_{1,j=2}0^t + (1-\lambda)s_{3,j=2}(z_{3,j=2})^t\right]}{(\Gamma(1-\lambda)+\beta R_W)} \\ \widehat{b}_{W,t} = \frac{\left[-\Gamma s_{1,j=2}0^t + \beta R_W s_{3,j=2}(z_{3,j=2})^t\right]}{(\Gamma(1-\lambda)+\beta R_W)} \\ \widehat{b}_{P,t} = \frac{-s_{1,j=2}0^t}{(\Gamma(1-\lambda)+\beta R_W)} - \frac{s_{2,j=2}(z_{2,j=2})^t}{(\beta(R_W - R_P)+\Gamma(1-\lambda))} + \frac{\Gamma(1-\lambda)\beta R_P s_{3,j=2}(z_{3,j=2})^t}{F_9} \end{cases}$
$j = 3$	$\begin{cases} \widehat{k}_{W,t} = \frac{s_{1,j=3}0^t + s_{3,j=3}\left(z_{3\|j=3}\right)^t}{(\Gamma+\beta R_W)} \\ \widehat{b}_{W,t} = -\frac{\Gamma s_{1,j=3}0^t}{\Gamma+\beta R_W} + \lambda s_{2,j=3}\left(z_{2,j=3}\right)^t + \frac{\beta R_W s_{3,j=3}\left(z_{3\|j=3}\right)^t}{\Gamma+\beta R_W} \\ \widehat{b}_{P,t} = -\frac{\Gamma s_{1,j=3}0^t}{\Gamma+\beta R_W} + (\lambda - 1)\, s_{2,j=3}\left(z_{2,j=3}\right)^t + \frac{\beta R_W s_{3,j=3}\left(z_{3\|j=3}\right)^t}{\Gamma+\beta R_W} \end{cases}$

(A3.4)

[10] The rank of a matrix is the number of linearly independent rows or columns and rank($A_{j=1}$) = 1 and rank($A_{j=2}$) =rank($A_{j=3}$) = 2. The eigenvalues corresponding to a linear combination of independent rows or columns are zero.

where and $s_{l,j}$ $l = 1,2,3$ are constants to be determined and

$\digamma_9 = (\Gamma(1-\lambda) + \beta R_W)(\beta(R_W - R_P) + \Gamma(1-\lambda))$.

$\varpi_{\widehat{b}_P|j=2} = \frac{-s_{2,j=2}(z_{2,j=2})^{t-1}\digamma_9}{-s_{2,j=2}(z_{2,j=2})^{t-1}\digamma_9+(\beta(R_W-R_P)+\Gamma(1-\lambda))\Gamma(1-\lambda)\beta R_P s_{3,j=2}(z_{3,j=2})^{t-1}}$

$\varpi_{\widehat{b}_P|j=3} = \frac{(\Gamma+\beta R_W)(\lambda-1)s_{2,j=3}(z_{2,j=3})^{t-1}}{(\Gamma+\beta R_W)(\lambda-1)s_{2,j=3}(z_{2,j=3})^{t-1}+\beta R_W s_{3,j=3}\left(z_{3|j=3}\right)^{t-1}}$

$\varpi_{\widehat{b}_W|j=2} = \frac{(\Gamma+\beta R_W)(\lambda-1)s_{2,j=3}(z_{2,j=3})^{t-1}}{(\lambda-1)s_{2,j=3}(z_{2,j=3})^{t}(\Gamma+\beta R_W)+\beta R_W s_{3,j=3}\left(z_{3|j=3}\right)^{t}}$

Further supposing continuity, i.e. that the value of each variable at the end of each stage is equal to the value of the same variable at the beginning of the next stage of development, and setting initial conditions from (A3.4) one obtains

Stage	Conditions
$x^0_{j=1}$	$\begin{cases} s_{1,j=1} = (1-\lambda)(\beta R_W - 1)\widehat{k}_{R,0} > 0 \text{ if } \beta R_W > 1 \\ s_{3,j=1} = \widehat{b}_{W,0}((1-\lambda)\Gamma + 1) > 0 \\ \widehat{b}_{P,0} = 0 \end{cases}$
$x^t_{j=1} = x^0_{j=2}$	$\begin{cases} s_{1,j=2} = 0 \\ s_{2,j=2} = \frac{\Gamma\beta R_P(1-\lambda)}{((1-\lambda)\Gamma+\beta R_W)} s_{3,j=1}\left(z_{3\|j=1}\right)^{\underline{t}} > 0 \\ s_{3,j=2} = s_{3,j=1}\left(z_{3\|j=1}\right)^{\underline{t}} > 0 \end{cases}$
$x^{\bar{t}}_{j=1} = x^0_{j=3}$	$\begin{cases} s_{3,j=3} = \frac{(\beta R_W+\Gamma)(1-\lambda)}{((1-\lambda)\Gamma+\beta R_W)} s_{3,j=1}\left(z_{3\|j=1}\right)^{\underline{t}}\left(z_{2\|j=2}\right)^{\underline{t}} > 0 \\ s_{2,j=3} = \frac{\Gamma}{((1-\lambda)\Gamma+\beta R_W)} s_{3,j=1}\left(z_{3\|j=1}\right)^{\underline{t}}\left(z_{2\|j=2}\right)^{\underline{t}} > 0 \\ 0 = s_{1,j=3} \end{cases}$

(A3.5)

which make the growth rates those in (3.20) with

$\varpi_{\widehat{b}_P|j=2} = \frac{-(z_{2,j=2})^{t-1}}{-(z_{2,j=2})^{t-1}+(z_{3,j=2})^{t-1}} < 0$

$\varpi_{\widehat{b}_P|j=3} = \frac{-\Gamma(\beta R_W)^{t-1}}{-\Gamma\left(z_{2|j=3}\right)^{t-1}+\beta R_W\left(z_{3|j=3}\right)^{t-1}} < 0$

$0 < \varpi_{\widehat{b}_R|j=3} = \frac{\lambda\Gamma\left(z_{2|j=3}\right)^{t-1}}{\lambda\Gamma\left(z_{2|j=3}\right)^{t-1}+\beta R_W(1-\lambda)\left(z_{3|j=3}\right)^{t-1}} < 1$

so

Proof. $g_{\widehat{k}_{R|j=2}} < g_{\widehat{b}_{P|j=2}}$ as

$\varpi_{\widehat{b}_P|j=2}\left(\left(1-\lambda\right)\Gamma+\beta R_W\right) < \varpi_{\widehat{b}_P|j=2}\left(\beta R_P\right)$

since $\varpi_{\widehat{b}_P|j=2} < 0$

$\left(\left(1-\lambda\right)\Gamma+\beta R_W\right) > \left(\beta R_P\right)$ ■

Proof. $g_{\widehat{b}_{R|j=3}} < g_{\widehat{b}_{P|j=3}}$ as

$\left(\varpi_{\widehat{b}_R|j=3}-\varpi_{\widehat{b}_P|j=3}\right)\left(\beta R_W\right) < \left(\varpi_{\widehat{b}_R|j=3}-\varpi_{\widehat{b}_P|j=3}\right)\left(\Gamma+\beta R_W\right)$

since $\varpi_{\widehat{b}_R|j=3} > 0$ and $\varpi_{\widehat{b}_P|j=3} < 0$ hence $\left(\varpi_{\widehat{b}_R|j=3}-\varpi_{\widehat{b}_P|j=3}\right) > 0$

$0 < \Gamma$ ■

Proof. $g_{\widehat{k}_{R|j=3}} < g_{\widehat{b}_{P|j=3}}$ as

$\varpi_{\widehat{b}_P|j=3}\left(\Gamma+\beta R_W\right) < \varpi_{\widehat{b}_P|j=3}\left(\beta R_W\right)$

since $\varpi_{\widehat{b}_P|j=3} < 0$ hence

$\Gamma > 0$ ■

Proof. $g_{\widehat{k}_{R|j=3}} > g_{\widehat{b}_{R|j=3}}$ as

$\left(\Gamma+\beta R_W\right)\varpi_{\widehat{b}_R|j=3} > \varpi_{\widehat{b}_R|j=3}\left(\beta R_W\right)$

since $\varpi_{\widehat{b}_R|j=3} > 0$ hence

$\Gamma > 0.$ ■

Inequality and its dynamics

Equation (3.21) yields

Stage	Inequality $\widehat{\delta}_t=\widehat{b}_{W,t}-\widehat{b}_{P,t}\ t>1$
$j=1$	$\frac{\beta R_W s_{3,j=1}\left(z_{3,j=1}\right)^t}{\left(\Gamma(1-\lambda)+\beta R_W\right)}$
$j=2$	$\varpi_{\widehat{\delta}_t\|j=2}\left(z_{2,j=2}\right)^t+\left(1-\varpi_{\widehat{\delta}_t\|j=2}\right)\left(z_{3,j=2}\right)^t$
$j=3$	$s_{2,j=3}\left(z_{2,j=3}\right)^t$

(A3.6)

with $0<\varpi_{\widehat{\delta}_t|j=2}=\frac{\Gamma\beta R_P(1-\lambda)\left(z_{2,j=2}\right)^{t-1}}{\Gamma\beta R_P(1-\lambda)\left(z_{2,j=2}\right)^{t-1}+\beta(R_W-R_P)((1-\lambda)\Gamma+\beta R_W)\left(z_{3,j=2}\right)^{t-1}}<1$

as both the numerator and the denominator are positive and

$\lim\limits_{t\to\infty} \varpi_{\widehat{\delta}_t|j=2} = \frac{1}{(z_{3,j=2})^{\infty}} = 0$

Proof. $g_{\widehat{\delta}_t|j=1} > g_{\widehat{\delta}_t|j=2}$ as

$0 > \varpi_{\widehat{\delta}_{j=2}} (\beta (R_P - R_W) - \Gamma (1 - \lambda_0))$

which is always true as $R_P < R_W$ as detailed in para. 3.2.2. and $\varpi_{\widehat{\delta}_{j=2}} > 0$ hence LHS<0 ■

Proof. $g_{\widehat{\delta}_t|j=2} > g_{\widehat{\delta}_t|j=3}$ if

$\frac{\Gamma(1-\lambda)}{\beta(R_W - R_P)} > \frac{\varpi_{\widehat{\delta}_{j=2}}}{\left(1-\varpi_{\widehat{\delta}_{j=2}}\right)}$

as $\lim\limits_{t\to\infty} \varpi_{\widehat{\delta}_t|j=2} = 0$ then $\lim\limits_{t\to\infty} RHS = 0$ and $g_{\widehat{\delta}_t|j=2} > g_{\widehat{\delta}_t|j=3}$ ■

3.7.2 Financial intermediation

(3.30) encompasses 3 linear non homogeneous systems of differential equations describing the dynamics of the variables $k_{W,t}, b_{W,t}$ and $b_{P,t}$. Under Financial Intermediation the solutions of the reduced systems $j = 1, 2, 3$ are

	z_1	z_2	z_3
$j = 1$	0	$\frac{1}{2}(\Gamma + \beta R_W - F_1)$	$\frac{1}{2}(\Gamma + \beta R_W + F_1)$
$j = 2$	0	$\frac{1}{2}(\Gamma + \beta R_W(2-\varepsilon) - F_2)$	$\frac{1}{2}(\Gamma + \beta R_W(2-\varepsilon) + F_2)$
$j = 3$	0	βR_W	$\Gamma + \beta R_W$

(A3.7)

where $F_1 = \sqrt{(\Gamma + \beta R_W)^2 - 4\lambda\Gamma\beta R_W}$ with $(\Gamma + \beta R_W)^2 > 4\lambda\Gamma\beta R_W$ and $F_2 = \sqrt{(-\Gamma - \beta R_W \varepsilon)^2 - 4\lambda\Gamma\beta R_W\varepsilon}$ with $(-\Gamma - \beta R_W\varepsilon)^2 > 4\lambda\Gamma\beta R_W\varepsilon$ by hypothesis.

Proof. $z^{FI}_{3|j=1} > z^{FA}_{3|j=1}$

$\frac{1}{2}(\Gamma + \beta R_W + F_1) > (1-\lambda)\Gamma + \beta R_W$ if

$F_1 > (1-2\lambda)\Gamma + \beta R_W$

$0 > 4\lambda\left[\lambda - 1\right]\Gamma^2$

which is always verified as RHS is always negative for $0 < \lambda < 1$ ∎

Proof. $z^{FI}_{3|j=2} > z^{FA}_{3|j=2}$

$\frac{1}{2}\left(\Gamma + \beta R_W\left(2 - \varepsilon\right) + F_2\right) > \left(1 - \lambda\right)\Gamma + \beta R_W$

$0 > -4\lambda\left[1 - \lambda\right]\Gamma^2$

which is always verified as RHS is always negative for $0 < \lambda < 1$ ∎

Proof. $z^{FI}_{3|j=1} < z^{FI}_{3|j=3}$ $i = 2, 3$

$\frac{1}{2}\left(\Gamma + \beta R_W + F_1\right) < \Gamma + \beta R_W$

if $-4\lambda\Gamma\beta R_W < 0$

which is always verified as LHS is always negative ∎

Proof. $z^{FI}_{3|j=1} < z^{FI}_{3|j=2}$

$\frac{1}{2}\left(\Gamma + \beta R_W + F_1\right) < \frac{1}{2}\left(\Gamma + \beta R_W\left(2 - \varepsilon\right) + F_2\right)$

if $4\lambda\Gamma^2\left[\lambda - 1\right] < 0$

which is always verified as LHS is always negative ∎

The full solutions are

Solutions
Stage $j = 1$
$\widehat{k}_{R,t} = -\frac{s_{1,j=1}}{\Gamma}0^t + \frac{(-\Gamma+\beta R_W+\digamma_1)s_{2,j=1}(z_{2,j=1})^t}{2\digamma_1} + \frac{(-\Gamma+\beta R_W-\digamma_1)s_{3,j=1}(z_{3,j=1})^t}{2\digamma_1}$
$\widehat{b}_{R,t} = s_{1,j=1}0^t - \frac{\Gamma\beta R_W s_{2,j=1}(z_{2,j=1})^t}{\digamma_1} - \frac{\beta R_W \Gamma s_{3,j=1}(z_{3,j=1})^t}{\digamma_1}$
$\widehat{b}_{P,t} = 0$
Stage $j = 2$
$\widehat{k}_{R,t} = s_{1,j=2}0^t + \frac{\left((-\Gamma-\beta R_W\varepsilon+\digamma_2)s_{2,j=2}(z_{2,j=2})^t-(-\Gamma-\beta R_W\varepsilon-\digamma_2)s_{3,j=2}(z_{3,j=2})^t\right)}{2\digamma_2(-\Gamma-\beta R_W(1-\varepsilon)+\digamma_2)}$
$\widehat{b}_{R,t} = -s_{1,j=2}0^t+\digamma_3\left(\frac{(\Gamma+\beta R_W\varepsilon-\digamma_2)s_{2,j=2}(z_{2,j=2})^t}{(-\Gamma+\beta R_W\varepsilon+\digamma_2)} + \frac{(-\Gamma+\beta R_W\varepsilon+\digamma_2)s_{3,j=2}(z_{3,j=2})^t}{(\Gamma+\beta R_W(1-\varepsilon)-\digamma_2)}\right)$
$\widehat{b}_{P,t} = -s_{1,j=2}0^t - \frac{\Gamma\beta R_W(1-\varepsilon)\left(s_{2,j=2}(z_{2,j=2})^t-s_{3,j=2}(z_{3,j=2})^t\right)}{\digamma_2(-\Gamma-\beta R_W(1-\varepsilon)+\digamma_2)}$
Stage $j = 3$
$\widehat{k}_{R,t} = \frac{s_{1,j=3}0^t}{\Gamma+\beta R_W} + \frac{s_{3,j=3}}{\Gamma+\beta R_W}\left(\Gamma+\beta R_W\right)^t$
$\widehat{b}_{R,t} = -\frac{\Gamma s_{1,j=3}0^t}{\Gamma+\beta R_W} + \lambda s_{2,j=3}\beta R_W + \frac{\beta R_W s_{3,j=3}(\Gamma+\beta R_W)^t}{\Gamma+\beta R_W}$
$\widehat{b}_{P,t} = -\frac{\Gamma s_{1,j=3}0^t}{\Gamma+\beta R_W} + (\lambda-1)\, s_{2,j=3}\beta R_W + \frac{\beta R_W s_{3,j=3}(\Gamma+\beta R_W)^t}{\Gamma+\beta R_W}$

(A3.8)

where $s_{v,j}$ $v = 1, 2, 3$ are constants depending on initial and continuity conditions and could be made explicit along the lines of (A3.5), $z_{v,j}$ are from (A3.3), $\digamma_3 = \frac{\Gamma\beta R_W}{\digamma_2(-\Gamma-\beta R_W(1-\varepsilon)+\digamma_2)}$ and

$\digamma_6 = (\Gamma + \beta R_W\varepsilon - \digamma_2)(-\Gamma - \beta R_W(1-\varepsilon) + \digamma_2)$

	Weights
$\varpi_{\widehat{k}_{W,j=1}}$	$\frac{(-\Gamma+\beta R_W+\digamma_1)s_{2,j=1}(z_{2,j=1})^{t-1}}{(-\Gamma+\beta R_W+\digamma_1)s_{2,j=1}(z_{2,j=1})^{t-1}+(-\Gamma+\beta R_W-\digamma_1)s_{3,j=1}(z_{3,j=1})^{t-1}}$
$\varpi_{\widehat{k}_{W,j=2}}$	$\frac{(-\Gamma-\beta R_W\varepsilon+\digamma_2)s_{2,j=2}(z_{2,j=2})^{t-1}}{\left((-\Gamma-\beta R_W\varepsilon+\digamma_2)s_{2,j=2}(z_{2,j=2})^{t-1}-(-\Gamma-\beta R_W\varepsilon-\digamma_2)s_{3,j=2}(z_{3,j=2})^{t-1}\right)}$
$\varpi_{\widehat{b}_{W,j=1}}$	$\frac{s_{2,j=1}(z_{2,j=1})^{t-1}}{s_{2,j=1}(z_{2,j=1})^{t-1}-s_{3,j=1}(z_{3,j=1})^{t-1}}$
$\varpi_{\widehat{b}_{W,j=2}}$	$\frac{\digamma_6 s_{2,j=2}(z_{2,j=2})^{t-1}}{\digamma_6 s_{2,j=2}(z_{2,j=2})^{t-1}+\left(-\Gamma^2+(\beta R_W\varepsilon+\digamma_2)^2\right)s_{3,j=2}(z_{3,j=2})^{t-1}}$
$\varpi_{\widehat{b}_{W,j=3}}$	$\frac{\lambda(\Gamma+\beta R_W)s_{2,j=3}(z_{2,j=3})^{t-1}}{\left(\lambda(\Gamma+\beta R_W)s_{2,j=3}(z_{2,j=3})^{t-1}+\beta R_W s_{3,j=3}(z_{3,j=3})^{t-1}\right)}$
$\varpi_{\widehat{b}_{P,j=2}}$	$\frac{\Gamma\beta R_W(1-\varepsilon)s_{2,j=2}(z_{2,j=2})^{t-1}}{\Gamma\beta R_W(1-\varepsilon)\left(s_{2,j=2}(z_{2,j=2})^{t-1}-s_{3,j=2}(z_{3,j=2})^{t-1}\right)}$
$\varpi_{\widehat{b}_{P,j=3}}$	$\frac{-(1-\lambda)(\Gamma+\beta R_W)s_{2,j=3}(z_{2,j=3})^{t-1}}{-(1-\lambda)(\Gamma+\beta R_W)s_{2,j=3}(z_{2,j=3})^{t-1}+\beta R_W s_{3,j=3}(z_{3,j=3})^{t-1}}$
$\varpi_{\widehat{\delta}\|j=2}$	$\frac{\digamma_4 s_{2,j=2}(z_{2,j=2})^{t-1}}{\digamma_4 s_{2,j=2}(z_{2,j=2})^{t-1}+\digamma_5 s_{3,j=2}(z_{3,j=2})^{t-1}}$

(A3.9)

3.7.3 Financial autarky with capital-deepening initial investment

(3.25) encompasses 3 linear non homogeneous systems of differential equations describing the dynamics of the variables $k_{W,t}, b_{W,t}, b_{P,t}$ and q_t. Under capital-deepening initial investment the solutions of the reduced systems $j = 1, 2, 3$ are

	z_1	z_2	z_3	z_4
$j = 1$	0	0	$(\Gamma(1-\lambda)+\beta R_W)$	n
$j = 2$	0	βR_P	$(\Gamma(1-\lambda)+\beta R_W)$	n
$j = 3$	0	βR_W	$\Gamma+\beta R_W$	n

(A3.10)

The full solutions are

Stage	Solutions
$j=1$	$\widehat{k}_{W,t} = s_{1,j=1}0^t - (1-\lambda)\digamma_7 s_{3,j=1} z^t_{3\vert j=1}$ $\widehat{b}_{W,t} = -\Gamma s_{1,j=1}0^t + \beta R_W \digamma_7 s_{3,j=1} z^t_{3\vert j=1}$ $\widehat{b}_{P,t} = 0^t h_{3,1}$ $\widehat{q}_t = \frac{m}{n} s_{1,j=1}0^t - m(1-\lambda) s_{3,j=1} z^t_{3\vert j=1} + s_{4,j=1} z^t_{4\vert j=1}$
$j=2$	$\widehat{k}_{W,t} = s_{1,j=2}0^t - (1-\lambda)\digamma_7 s_{3,j=2} z^t_{3\vert j=2}$ $\widehat{b}_{W,t} = -\Gamma s_{1,j=2}0^t + \beta R_W \digamma_7 s_{3,j=2} z^t_{3j\vert =2}$ $\widehat{b}_{P,t} = -\Gamma s_{1,j=2}0^t + s_{2,j=2} z^t_{2j\vert =2} + \beta R_P \Gamma (1-\lambda)\digamma_7 s_{3,j=2} z^t_{3j\vert =2}$ $\widehat{q}_t = -\frac{m}{n}0^t - m(1-\lambda) s_{3,j=2} z^t_{3j\vert =2} + s_{4,j=2} z^t_{4j\vert =2}$
$j=3$	$\widehat{k}_{W,t} = s_{1,j=3}0^t - \digamma_8 s_{3,j=3} z^t_{3j\vert =3}$ $\widehat{b}_{W,t} = -\Gamma s_{1,j=3}0^t + \lambda s_{2,j=3} z^t_{2j\vert =3} + \beta R_W \digamma_8 s_{3,j=3} z^t_{3j\vert =3}$ $\widehat{b}_{P,t} = -\Gamma s_{1,j=3}0^t + (\lambda-1) s_{2,j=3} z^t_{2j\vert =3} + \beta R_W \digamma_8 s_{3,j=3} z^t_{3j\vert =3}$ $\widehat{q}_t = -\frac{m}{n} s_{1,j=3}0^t - m s_{3,j=3} z^t_{3j\vert =3} + s_{4,j=3} z^t_{4j\vert =3}$

(A3.11)

where $s_{v,j}$ $v = 1, 2, 3, 4$ are constants depending on initial and continuity conditions and could be made explicit along the lines of (A3.5), $z_{v,j}$ are from (A3.7), $\digamma_7 = (\Gamma(1-\lambda) + \beta R_W - n)$ and $\digamma_8 = (\Gamma + \beta R_W - n)$.

Weights are

Stage	Weights
$j=1$	$\varpi_{\widehat{q}} = \frac{m(1-\lambda)s_{3,j=1}z_{3\|j=1}^{t-1}}{m(1-\lambda)s_{3,j=1}z_{3\|j=1}^{t-1}+s_{4,j=1}z_{4\|j=1}^{t-1}}$
$j=2$	$\varpi_{\widehat{b}_P} = \frac{s_{2,j=2}z_{2j\|=2}^{t-1}}{s_{2,j=2}z_{2\|j=2}^{t-1}+\Gamma\beta R_P(1-\lambda)(\Gamma(1-\lambda)+\beta R_W-n)s_{3,j=2}z_{3\|j=2}^{t-1}}$ $\varpi_{\widehat{q}} = \frac{-m(1-\lambda)s_{3,j=2}z_{3j\|=2}^{t-1}}{-m(1-\lambda)s_{3,j=2}z_{3\|j=2}^{t-1}+s_{4,j=2}z_{4\|j=2}^{t-1}}$ $\varpi_{\delta\|j=2} = \frac{-s_{2,j=2}z_{2\|j=2}^{t-1}}{\beta(R_W-R_P\Gamma(1-\lambda))F_7 s_{3,j=2}z_{3\|j=2}^{t-1}-s_{2,j=2}z_{2\|j=2}^{t-1}}$
$j=3$	$\varpi_{\widehat{b}_W} = \frac{\lambda s_{2,j=3}z_{2\|j=3}^{t-1}}{\lambda s_{2,j=3}z_{2\|j=3}^{t-1}+\beta R_W(\Gamma+\beta R_W-n)s_{3,j=3}z_{3\|j=3}^{t-1}}$ $\varpi_{\widehat{b}_P} = \frac{-(1-\lambda)s_{2,j=3}z_{2\|j=3}^{t-1}}{-(1-\lambda)s_{2,j=3}z_{2\|j=3}^{t-1}+\beta R_W(\Gamma+\beta R_W-n)s_{3,j=3}z_{3\|j=3}^{t-1}}$ $\varpi_{\widehat{q}} = \frac{-ms_{3,j=3}z_{3j\|=3}^{t-1}}{-ms_{3,j=3}z_{3\|j=3}^{t-1}+s_{4,j=3}z_{4\|j=3}^{t-1}}$

(A3.12)

Chapter 4

Finance-Growth Nexus in economies with outliers

4.1 Introduction

In Chapters 2 and 3 we have investigated the influence of financial openness and income distribution respectively on the relationship between financial and economic development. In both Chapters the theoretical framework has rested on a causality assumption according to which financial development, whether in the form of financial openness or financial intermediation as opposed to financial autarky, would stimulate economic development. This Chapter aims at providing empirical evidence for such a relationship through a two-step process: identifying a long run equilibrium relationship between financial and economic development - with an explicit role for openness - and then assessing the direction of causality. Causality will hence be studied in a cointegration setting as a long run phenomenon, i.e. testing significance of loading factors.

This topic has been quite deeply researched by several prominent scholars, Luintel and Khan (1999) and Demetriades and Hussein (1996) among others. More recently, Rousseau and Wachtel (2005) studied the relationship between financial and economic development with cross section and panel techniques where the dependent variable is the percentage growth of real per capita GDP.

The authors use data on 84 countries – among which all those included in the present Chapter – to find that causality from finance to growth is not strongly persistent when data after the 1990s are used for estimations.

One of the main motivations for the present study is to investigate the existence and direction of causality between financial and economic development with data extending well after the 1990s - up to 2006 in fact - with time series techniques. In line with the empirical literature on financial and economic development, private credit as a percentage of GDP is used as a financial development indicator. Also, given the volatility of variables for the sample countries and the consequent need of dummies, a newly developed technique for the detection and estimation of outliers is implemented.

The main result of the paper is that, contrary to Rousseau and Wachtel (2005), a long run equilibrium relationship between financial and economic development is identified with time series running well into the 21st century and even in countries whose history is characterized by numerous years of high inflation, policy shocks and/or other structural changes. Two cointegrating vectors are mostly found in open economies which also show parameter estimates in line with the thesis of Chapter 2, namely that openness has a positive effect on financial development. For closed economies a model with one cointegrating vector is the most frequent outcome and the relevance of openness is much toned down, in line with the model design which reserves a specific role for openness. Causality mostly runs along what is predicted by the model in Chapter 2, namely that financial development causes economic development. What is worth underlining is that for both the explanation of country differences in estimated values of single parameters and the direction of causality *de jure* classification of openness used in Chapter 2 is needed along with the operational definition of *de facto* openness, actually used as endogenous variable in this Chapter and also inequality in the distribution of income plays a role in line with what is described in Chapter 3.

In what follows section 2 will briefly describe the data and the identification and estimation techniques for outliers observations and section 3 will present the outlier detection and estimation procedure. Cointegration estimations and causality tests will be shown in section 4. Section 5 will discuss the results.

4.2 Data Description

The VAR model consists of five variables: financial development as measured by credit to the private sector as a percentage of GDP (FD), the logarithm of real income per capita (YP), the logarithm of real capital per capita (KP), openness as measured by gross trade as a percentage of GDP (OP) and real interest rate (RR). Data frequency is annual and FD, YP, trade, investment and inflation data have been obtained from 2009 World Development Indicators [WDI09 from now on]. Nominal interest rates have mostly been obtained from various issues of the International Financial Statistics published by the International Monetary Fund[1]. Countries have been chosen mostly among developing economies trying to capture different geographical origin (4 African, 2 Asian, 4 Latin American and 2 European countries), level of economic development (4 Low income countries, 3 Lower Middle income ones, 3 Upper Middle income ones and 2 High income countries) and average level of financial openness. Data availability - i.e. at least 35 years of data for all the time series - has been the main driver in the choice of sample countries.

FD underpins a view of financial development mainly related to the function of credit as a stimulus of economic growth, rather than as financial development as a result of accumulation of savings. This is in accordance with

[1] Details on sources and calculations for endogenous variables in each country are detailed in table 4.1 in the Appendices.

the McKinnon/Shaw view of inside money, namely that the supply of credit is ultimately responsible for the quantity and quality of investment. FD has been preferred to other frequently used measures of financial development such as M2 as a percentage of GDP, which are nearer to the role of money as a facilitator of exchange, rather than a facilitator of investment. In fact, in case of "liquidity trap", i.e. availability of money which is not invested in production but treasured, M2 as a percentage of GDP would increase but this would have only marginal effects on aggregate demand and economic growth and hence on the long run relationship between financial and economic development, which is the aim of the research in this Chapter. Deposit/GDP ratio has not been used as a financial development measure as it underpins a supply side view, assuming most economic agents earn more than what they are willing to consume and financial intermediaries are developed enough to be able to gather a sizable part of that savings. Also credit-based measures of financial intermediation are readily available and with longer time series from WDI09 and they provide a better fit with the model developed in Chapter 2, hence the preference for FD as a measure of financial development. A word of caution must be spent on the fact that FD includes credit from government banks to the private sector which may allocate credit according to criteria which differ, sometimes markedly so, from profit maximization and this may weaken the expected relationship between financial and economic development.

Empirical work on financial openness is always confronted with the choice of the right indicator for such multifaceted phenomenon. The main alternatives can be classified under two headers: *de jure* indicators and *de facto* indicators. The first group of measures of financial openness mainly rests on combinations of discrete variables that aim at codifying legal restrictions on cross-border financial transactions; the resulting indicators try to gauge how much financial flows are allowed by international treaties and agreements to go in and out of a selected country. Chinn and Ito (2006) provide one of the most recently calculated examples of a *de jure* financial openness indicator. While better grounded theoretically and potentially rid of exogenous components, *de jure* measures of openness might be more liable to the influence of interest group politics. They may also overstate true openness due to enforcement issues, as the lifting of capital account restrictions need not always translate into greater capital account openness, especially if the right to engage in international financial transactions is not fully enforced. Furthermore, as these indicators mainly originate from discrete variables, they offer a relatively low explanatory power within a integrated time series framework. The *de facto* family of measures of financial openness is instead based on actual flows of funds crossing a selected country's borders as payments of international transactions. Baltagi et al. (2009) maintain that elements that reflect historical, geographical and international political factors, which are normally outside the control of domestic policy makers make *de facto* openness more in line with the actual state of affairs in a country and more suitable for empirical testing. The main problem with this type of indicator lies the quality of data. More specifically, while methodologies of data collecting and standardization are quite established as far as international trade movements are concerned, quality on financial flows data is much less consistent.

In this Chapter, a *de facto* measure of financial openness - and namely gross trade openness as a percentage of GPD (OP) - has been preferred to *de jure* measures, as it is considered more suitable to test whether countries that happen (not necessarily choose) to be more open to trade and capital flows are also more financially developed. Data quality issues have also contributed to drive the choice towards such an indicator. Support on the use of trade openness as a proxy of financial openness comes from several sources. Baltagi et al. (2009) who, using yearly data and dynamic panel estimation techniques, find that both trade and financial openness are statistically significant determinants of banking sector development. Along the same lines, Chinn and Ito (2006) further maintain that the opening of trade in goods is a precondition for financial opening and that an increase in trade openness is a prolog to financial openness and thence to financial development. Tornell and Westermann (2004) find that while trade liberalization Granger-causes financial liberalization, the test for reverse causation is rejected. The authors justify this finding mainly by observing that exporters and importers need access to international financial markets and since capital is fungible, it is difficult to insulate those financial flows which are exclusively associated with trade transactions. In other words an open trade regime is usually sustained by an open financial regime. On the theoretical side Aizenman and Noy (2009) support these findings with a theoretical model that shows that *de facto* financial openness depends positively on lagged trade openness. For a sample of developing countries the authors find that a one standard deviation increase in the commercial openness index is associated with a 9.5% increase in *de facto* financial openness.

OP has hence been selected as a proxy of financial openness among *de facto* measures of financial openness. The limited availability of sufficiently long time series of financial openness measures[2] required for cointegration analysis also played a role. In table 4.2 the main data on financial and economic development in each country are summarized: financial development is represented through its initial level (IFD), end level ($ENDFD$) and average growth rate DFD while economic development is represented by Gross National Income

[2] Ranciere, Tornell and Westermann (2006) calculate *de facto* financial openness by computing cumulative net capital inflows - including FDI, portfolio flows and bank flows - sent by nonresidents from the International Monetary Fund's International Financial Statistics. For some countries, when the three series are not available, they use inflows to the banking system only. Unfortunately these data start with 1980, making time series too short for a cointegration exercise. The alternative of using FDI data is not recommended by the same authors, who maintain that FDIs do not obviate the need for risky international bank flows. The latter are essential to finance the non-tradable sector and hence to evaluate the full benefit of openness on both tradable and non tradable sectors.

(GNI) per capita in 2008 and average yearly growth rate of real per capita income (DYP). Average openness (AOP) is also shown with values ranging from just above 18% to nearly 60%; so according to a simple ordering Chile, India, Italy, Pakistan, Peru and Venezuela will be considered as (relatively) financially closed with a value below 50% (Financially Closed from now on) while the Central African Republic, Ecuador, Finland, Ghana, Kenya and Morocco will be considered (relatively) financially open (Financially Open from now on). This classification overlaps only partially with that in table 2.2 of Chapter 2 as India, Pakistan and Venezuela can be considered financially closed, given the low level of commitment to liberalization and, symmetrically, Ecuador, Ghana and Kenya, together with Finland, being a EMU and OECD member country, can be considered financially open given their liberal regime. Chile, Morocco and Peru, which are *de facto* financially open countries, constitute borderline cases, given their limited commitment to *de jure* openness. The reverse is true for Italy which, despite being a EMU and OECD member country, i.e. being *de jure* financially open, will be defined as financially closed.

FC countries are all Middle Income countries with the exception of Italy (a High Income country) and Pakistan (Low Income country), and as a group they show an average GNI which is 8% higher than that of FO countries and they end the sample period with a $ENDFD$ over 30% higher than that of FO countries. They are symmetrically spread across the distribution of income spectrum with 3 countries, namely India, Italy and Pakistan showing a Gini index in year 2000 below 40, and three with a more concentrated distribution of income.

FO countries are all Low and Lower Middle Income countries with the exception of Finland and show a slower financial and economic development. They are also symmetrically spread across the distribution of income spectrum and they show a lower average level of inequality as a group and a less pronounced trend in increasing inequality, once the Central African Republic is excluded, than FO countries. 2 countries, namely Kenya and Morocco, even show decreasing inequality.

Across groups, both economic and financial development exhibit signs of non-linearity and geographical connotation. African countries show the lowest growth rate in real per capita income and financial openness and the second lowest in financial development. By contrast, Asian countries come out top in all three dimensions.

Table 4.2 also shows that the contemporaneous correlations between FD and the levels of real income and openness. Both are always positive with the exception of the correlation between FD and openness in Kenya and Venezuela. The correlation between income growth and financial development $C(DY, FD)$ is mixed with negative signs (Ecuador, Finland, Italy, Kenya and Venezuela) that are less prevalent than in Luintel and Khan (1999) and nearly zero values in Morocco, Pakistan and Peru. Correlation between openness growth and financial development $C(DOP, FD)$ is similarly of mixed sign with values close to zero in Ecuador, Finland and Kenya. The overall evidence from table 4.2 seems to suggest that FC countries are more developed both economically and financially than FO countries. FC countries show a pattern of correlations between financial and economic development more in line with what is suggested by the theory, whereas for FO countries the same is true with reference to the patterns of correlation between openness and financial development.

Unit root test results on level variables and on first differences of the same variables are given in tables 4.3 and 4.4. The presence of a unit root is found for all level variables by both ADF and KPSS procedures in the Central African Republic, and at least one of the 2 tests also indicates the presence of a unit root in all variables in Ghana, India, Italy, Morocco and Pakistan. All variables can be considered I(1) with the exception of RR in Chile, Ecuador, Finland, Peru and Venezuela. In Kenya all variables except OP can be considered I(1) according to at least one test. The I(0) variables will still be included in the study as literature suggests that treating I(0) variables as weakly exogenous does not offer substantial differences in terms of interpretation of results (see Luintel and Khan (1999)).

Also, either the ADF or the KPSS test provide evidence in support of the possibility of some variables being I(2) for several countries. However, only in Ecuador, Ghana, India, Italy, Kenya and Venezuela the identification of KP as an I(2) series is robust to both unit root test. It must be said, however, that the compounding formula used in the perpetual inventory methodology[3] implies a smoothing of the investment series, hence the underlying properties of the investment series, among which economic theory suggests integration of order one, should be those of the respective investment series, save a higher persistence. Also Johansen (1995) maintains that if the number of cointegrating relations exceeds the number of I(2) common trends - and this is the case for Ghana, Italy, Kenya and Morocco with 2 cointegrating relations and one I(2) series, as shown in tables 4.5 and 4.6 - the combinations of the cointe-

[3]Specifically, let $K(t)$ equal the real capital stock in period t. Let $I(t)$ equal the real investment rate in period t. Let d equal the depreciation rate, which we assume equals 0.07. Thus, the capital accumulation equations states that $K(t+1) = (1-d)K(t) + I(t)$. To make an initial estimate of the capital stock, the country is assumed to be at its steady-state capital-output ratio. Thus, in terms of steady-state value, let $k = K/Y$, let $g =$ the growth rate of real output, let $i = I/Y$ where Y is GDP. Then, from the capital accumulation equation plus the assumption that the country is at its steady-state, it must be that $k = i/[g+d]$. Thus, a reasonable estimate of the steady-state values of i, g, and d, is obtained.

To make the initial estimate of k, the steady state capital output ratio for each individual country, d is set at 0.07, g − the steady-state growth rate − is a weighted averaged of the countries average growth rate during the first ten years for which there are output and investment data. The world growth rate is computed as 0.0423 and, based on Easterly et al. (1993, Journal of Monetary Economics), a weight of 0.75 is given to the world growth rate. i is then computed as the average investment rate during the first ten years for which there are data. To reduce the influence of business-cycles in making the estimate of $Y(initial)$, the average real output value between 1960-1969 is used as an estimate of initial output. Thus, the capital stock in 1960 is given as $Y(initial) * k$. Given depreciation, the guess at the initial capital stock becomes relatively unimportant decades later. For further details see Easterly and Levine (2001).

grating variables in such setting can be stationary by themselves. Because of a stronger economic interpretation of integration of capital stock series and of the support of the literature all the sample countries and all the series will be included in this study. India, where YP, KP and OP might be considered I(2) and Ecuador and Venezuela, where KP can be considered I(2) and Johansen's cointegration test identifies only one cointegrating relation, might be considered borderline cases.

ADF and KPSS tests, however, do not take into consideration the possibility of breaks in the series. For this reason their results must be taken with caution in such an uneven environment as that represented in figures 4.1 and 4.2 for the time span considered. The Sequential Break test[4] in columns 6 and 7 of tables 4.3 and 4.4 shows that the null of no break unit root cannot be rejected in any of the series with the exception of RR in the Central African Republic, Chile, India, Peru and Venezuela and of YP in Ecuador, Finland and Kenya, all the other series can hence be considered I(1) and they will be tested under the Johansen's procedure.

Finally, the trace tests in tables 4.5 and 4.6 indicate a rank equal to 2 in 8 countries with 5% significance and this is confirmed by the maximum eigenvalue statistic for Chile, Italy, Kenya and Peru. Results are not so clear-cut for the Central African Republic and India, where the maximum eigenvalue statistic is valid only at 10% significance, and for Morocco and Ghana, where the maximum eigenvalue statistic suggests a rank of one. Following Luintel and Khan (1999), however, the trace test is considered as more robust than maximal eigenvalue statistics, so in what follows the Central African Republic,

[4] From Perron (1997) the unit root test for the innovational model is performed estimating by OLS the regression: $y_t = \mu + \theta DU_t + \beta t + \delta D(T_b)_t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t$ where $DU_t = 1(t > T_b)$ and $D(T_b)_t = 1(t = T_b + 1)$ and k is the lag parameter then obtaining the t-statistic for testing $\alpha = 1$. The break date is selected as the value which minimizes $t_a^* = Min_{T_b \in (k+1,T)} t_{\widehat{\alpha}}(T_b, k)$

Ghana, India and Morocco will be considered with the rank set at 2 as well. For Ecuador, Finland, Pakistan and Venezuela the rank will be set at 1 in accordance with the results presented in the in tables 4.5 and 4.6.

4.3 The need of proper consideration for dummy variables

Considering that the minimum time span in each sample country covers at least 35 years of deep structural changes, economic transition, financial liberalization and other policy shocks, episodes of boom and bust may not be infrequent. On this theme Loayza and Ranciere (2002) find that, in the case of countries subject to the effects of financial crises longer than the average economic cycle, *ad hoc* dummy variables are essential in order to obtain meaningful estimation results. They observe that "in the case of private credit its correlation with growth is strongly negative prior to the crisis, and it becomes close to neutral in the aftermath".

Generally speaking, volatility around shocks causes autocorrelation in residuals which might influence the determination of the cointegration rank as well as parameter inference. As reviewed in para 1.5.3, the usual practice to limit those effects is to detect outliers from the estimated residuals in cointegrated VAR and to include unrestricted dummies to whiten residuals. This practice, however, has no sound justification in theory.

Also, in a cointegrating framework, shocks may influence several endogenous variables similarly, such that the effects cancel out in a linear combination, or they may only affect a subset of endogenous variables, so that the effects will not cancel themselves out and dummy variable(s) will have to be included in estimations.

In order to outline formally the above difference, define a p-dimensional cointegrated VAR model of rank $r \leq p$, $H^*(r)$ as

$$\Delta Y_t = ab'Y_{t-1} + \sum_{i=1}^{k-1} Q_i \Delta Y_{t-i} + m_0 + ab'_{p+1}t + \varepsilon_t \tag{4.1}$$

where Y_t is the vector of the p endogenous variables in levels, a is the vector of adjustment parameters, b is the vector of parameters specifying the long term or equilibrium cointegration relationship, k is the number of the lags (of the unrestricted, i.e. level, model) and $Q_i ... Q_{k-1}$ the matrices of the remaining autoregressive parameters, each of dimension pxp. The above specification contains an unrestricted constant m_0 and a restricted linear drift term $ab'_{p+1}t$, allowing for a linear trend both in the stationary and non-stationary combinations of the data.

The usual way to add dummy variables is to insert an additional deterministic function μ_t containing indicator variables such as $\mu_t = m\mathbf{D}_t$ where $\mathbf{D}_t$ is an n-dimensional vector of dummy variables and m is a $p \times n$ matrix of unrestricted coefficients. D_t dummy variables are of the type

$$D_t(T_0) = 1\{t = T_0\} \text{ and } d_t(T_0) = \Delta D_t(T_0) \tag{4.2}$$

where $1\{.\}$ is the indicator function equal to one if the expression in curly brackets is true.

In the terminology of Nielsen (2004) [HBN04 from now on], this will transform (4.1) in the innovational model $H_I^*(r)$ which can be represented as

$$\Delta Y_t = ab'Y_{t-1} + \sum_{i=1}^{k-1} Q_i \Delta Y_{t-i} + m_0 + ab'_{p+1}t + m\mathbf{D}_t + \varepsilon_t \tag{4.3}$$

In such a framework the event at $t = T_0$ represented by $D_t(T_0)$ is to all effects treated as a large innovation to the system and it is also furthermore implicitly assumed that the transmission mechanism of this extreme shock within the system is identical to that of normal innovations ε_t. This means that the events represented by $\mathbf{D}_t$, although they do not modify the equilibrium relationship $ab'Y_{t-1}$, do modify the modelling of the behavior of the p-th variable by m_p; in other words should the estimated weights in m_p result positive (negative) this would mean that the events in $\mathbf{D}_t$ have increased (lowered) the level at which $ab'Y_{t-1}$ is perched in the p-th equation.

On the other hand, there might be such events as to affect the equilibrating forces of the dynamic system through institutional changes related to the shocks themselves. In these occurrences the transmission mechanism is different from the usual one: wars with prolonged periods of rationing and price controls provide an example[5]. In such a case "extreme value" observations, i.e. outliers, are bound to be related to individual time series and not to the dynamic model as such. As a consequence, the DGP could be written as an unobserved components model in the form $Y_t = X_t + \theta\mathbf{D}_t$ where X_t are the unobserved variables that obey a cointegrated VAR model, θ is a $p \times n$ matrix of unrestricted coefficients and $\mathbf{D}_t$ an n-dimensional vector of dummy variables and the representation in the additive model $H_A^*(r)$ could be specified as[6]

$$\begin{aligned}(\Delta Y_t - \theta_i \Delta\mathbf{D}_t) &= a\,(b'Y_{t-1} - b_1'\mathbf{D}_{t-1}) + \\ &+ \left(\sum_{i=1}^{k-1} Q_i \Delta Y_{t-i} - \sum_{i=1}^{k-1} \theta_i \Delta\mathbf{D}_{t-i}\right) + m_0 + ab_{p+1}'t + \varepsilon_t\end{aligned} \tag{4.4}$$

[5]Isolated measurement errors in single time series, unfortunately, cause the same disruptive effect on the transmission mechanims of dynamic systems.

[6]Were the restrictions on θ_i not imposed, the dynamics of the dummies would be approximated be the k free parameters $\theta, \theta_1, ..., \theta_{k-1}$ which would bring the model close to the specification used by Johansen et al. (2000) for broken levels and linear trends. Such a specification, however, is very costly in terms of degrees of freedom for the case of isolated outliers.

$$\text{subject to} \begin{cases} b_1 = \theta' b \\ \theta_i = -Q_i \theta \quad \text{for } i = 1, ..., k-1 \end{cases}$$

Amending the single time series with the additive dummy and the estimated parameter θ is equivalent to interpolate the single "extreme value" data point using the information available from the rest of the sample. In this case the events in $\mathbf{D}_t$ are such that they modify the equilibrium relationship itself as a result of the amendment(s) to the cointegrating series $ab' \left(Y_{t-1} - \theta' \mathbf{D}_{t-1}\right)$. In such a framework a counterfactual event study could be performed, confronting the estimates of ab' and those of ab from (4.1), i.e. using the unadjusted series which represent the counterfactual situation that the "extreme value" had not actually occurred[7].

Also the specification in (4.4), differently from (4.3), makes the value of the likelihood function invariant to the "extreme" observation in the single time series, because it is replaced by an interpolated value.

Within this framework, rather than including innovational dummy variables in presence of large residuals, HBN04 suggests estimating both the innovational model $H_I^*(r)$ in (4.3) and the additive model $H_A^*(r)$ in (4.4) for a given dummy variable $\mathbf{D}_t = D_t(T_0)$ and then base the chosen specification on a test criterion. As both models nest the basic model (4.1) the author suggest testing $H^*(r) \subset H_I^*(r)$ and $H^*(r) \subset H_A^*(r)$ with the LR test statistic

$$\tau_j = -2 \log Q \left(H^*(r) \mid H_j^*(r)\right) = -T \log \left|\widehat{\Omega}^{-1} \widehat{\Omega}_j\right| \quad j = I, A \tag{4.5}$$

where $\widehat{\Omega}$ and $\widehat{\Omega}_j$ denote the estimated covariance matrices under $H^*(r)$ and $H_j^*(r)$ respectively. The test will be compared to a critical value τ^c calculated

[7] No such study will be performed here as no significative results are obtained for countries showing additive outliers. Interested readers should refer to Nielsen (2007).

according to the Bonferroni inequality $\delta^{max} = 1 - (1 - \delta)^{1/T}$ and used in a $\chi^2(p)$-based test[8], where p is the number of endogenous variables in the model, to ensure an overall Type I error probability below $\delta = 5\%$. The final specification of the model will hence include as many dummy variables of the type for which the test is larger and it is above the critical value. The above outlined procedure is based on Gaussian likelihood function, hence it differs from the pseudo-maximum-likelihood (PML) approach to cointegration analysis which is based on a fat tail distribution for the error term. Although the two techniques may yield similar results in the case of IO-only dummy specification, the HBN04 technique is considered better in so far the Gaussian maximum likelihood approach offers an easier rank determination framework[9].

As to the question of rank specification for testing, HBN04 underlines that "in the case of a fixed number of outliers asymptotic inference in the cointegration model is unchanged, in the sense that the asymptotic distributions are unaffected. But the distortionary effects could be important in finite samples". More precisely, while ignoring innovational outliers has only minor consequences for small sample inference on the cointegration rank of a VAR process, additive outliers may bias inference towards the finding of stationarity or cointegration. Therefore, forcing the unjustified introduction of additive outliers can manipulate the cointegration rank. To this effect HBN04 suggests

[8] $\chi^2(5)$ threshold values span from 19.94 for countries with 40 yearly observations to 20.31 for countries with 47 yearly observations as detailed in the notes of tables 4.7 and 4.8.

[9] Intuitively, considering that the PML estimation based on a multivariate student-t distribution corresponds to a "weighted" Gaussian, where the weights involve a Generalised Least Square (GLS)-type transformation, the GLS transformation automatically gives lower weight in the likelihood function to large residuals. Therefore the leptokurtic error distribution will by construction give more robustness to IOs. However, the PML is not automatically robust to AOs as AOs are related to a particular time series and not to the model and to innovations and the PML does not take this into account. Furthermore the pseudo-LR test for rank determination in the PML approach necessitates the use of simulated distributions instead of the asymptotic table of the Gaussian approach. This brief outline of the preference for the Gaussian approach aims at justifying the use of this technique intuitively and it should not be considered exhaustive. Interested readers should refer to para. 5.3 of Nielsen (2004).

that "a pretest for the cointegration rank can be applied, and the search for outliers can be made conditional on that estimated rank, $\widehat{r_0}$ [and] ... there might be a gain in the outlier detection from using a rank, r_0, close to the true rank, r". According to HBN04 the alternative procedure of using a stationary model (i.e. rank $r = 5$ in our case) for the detection of outliers may create difficulties in distinguishing the type of error, i.e. IO *vs.* AO, in small samples.

In the light of all the above considerations, the outlier detection and estimation procedure by Nielsen (2004) will be applied to each country in the sample with the rank specified in tables 4.5 and 4.6.

4.3.1 Outlier Detection & Estimation

The results of the Detection & Estimation procedure, described in the previous paragraph, are presented[10] in tables 4.7 and 4.8 where:

- the first section shows n residuals from the estimation of $H^*(\widehat{r_0})$ - where $\widehat{r_0}$ results from Johansen's cointegration test reported in tables 4.5 and 4.6 - that are higher than twice the standard deviation

- the section headed Iteration 0 shows the likelihood ratio tests $\tau_{j,i} = -T\log\left|\widehat{\Omega}^{-1}\widehat{\Omega}_{j,i}\right|$ for $j = IO, AO$ and $i = 1, ..., n$ where $\widehat{\Omega}$ and $\widehat{\Omega}_{j,i}$ represent covariance matrices of $H^*(\widehat{r_0})$ and $H^*_{j,i}(\widehat{r_0})$ models respectively. More precisely, in $H^*_{IO,i}(\widehat{r_0})$ $\mu_t = mD_i$ and $H^*_{AO,i}(\widehat{r_0})$ tests $(\Delta Y_t - \theta_i d_i)$

- in the section headed Iteration 1, observation i_1 has been chosen as the first component of $\mathbf{D}_i$ for the outlier type j_1 such that for $j = j_1$ and $i = i_1$ $\tau^*_{j_1,i_1} = \max_{j=IO,AO;\ i=[1,n]} \tau_{j,i} > \tau^c$. The section shows the likelihood ratio tests $\tau_{j,i} = -T\log\left|\widehat{\Omega_1}^{-1}\widehat{\Omega}_{j,i}\right|$ for $j = IO, AO$ and $i = 2, ..., n$ where

[10] All calculations have been conducted in EViews 7 ®. See Appendix 4.6.3 for a sample routine.

$\widehat{\Omega_1}$ and $\widehat{\Omega}_{j,i}$ represent covariance matrices of $H^*_{j_1,i_1}(\widehat{r_0})$ and $H^*_{j,i|(j_1;i_1)}(\widehat{r_0})$ models respectively

- in the sections headed Iteration s, observation i_s has been chosen as the s-th component of $\mathbf{D}_i$ for the outlier type j_s such that for $j = j_s$ and $i = i_s$ $\tau^*_{j_s,i_s} = \max_{j=IO,AO;\ i=[1,n]} \tau_{j,i} > \tau^c$. The section shows the likelihood ratio tests $\tau_{j,i} = -T \log \left| \widehat{\Omega_s}^{-1} \widehat{\Omega}_{j,i} \right|$ for $j = IO, AO$ and $i = s+1, ..., n$ where $\widehat{\Omega_s}$ and $\widehat{\Omega}_{j,i}$ represent covariance matrices of $H^*_{j_s,i_s}(\widehat{r_0})$ and $H^*_{j,i|(j_1,...,j_s;i_1,...i_s)}(\widehat{r_0})$ models respectively.

For all countries the maximum number of dummies has been limited to 7, i.e. from 15% to 18% of observations for single endogenous variables in the sample countries, in order to preserve degrees of freedom. Only 50% of countries end up with the maximum number of dummies; in all cases, however, the number of estimated dummies is less than the number of yearly observations showing excess standard deviation in iteration 0 of the Detection & Estimation procedure. In all countries with the exception of Italy, the procedure does not detect any additive outliers, which are usually associated with data errors in time series. This reinforces the claim that the cointegration rank from tables 4.5 and 4.6 is the true cointegration rank and it should guarantee a good quality of estimates, sometimes doubted when time series from non-OECD countries are used. For Italy, the procedure detects an AO-type for year 1970 for YP series[11]: hence, following HBN04, data for that year are interpolated in levels[12]. Amended data are checked again with Johansen's cointegration test

[11] Values of parameter θ and p-value of student t distribution for significance are reported here

	CR	YP	KP	OP	RR
θ	-0.0106	0.0051	0.0045	-0.2638	0.1629 .
(p-value)	67%	0%	81%	92%	11%

[12] This is the reason why no dummies of the additive type appear in the cointegrating vector, as it would be expected from equation 4.4. On the opportunity of using linear interpolation of data in the presence of additive outliers, see Model M5 on page 265 of Nielsen

which confirms a rank of 2.

Despite its being iterative, i.e. taking into account all previously found outliers when testing for the next one, the procedure finds contiguous outliers in 6 out of 12 countries, a sign that the effects of structural changes and other policy shocks on financial development and economic growth are frequently longer than a yearly cycle[13]. All outliers with a Chi-square test higher than the critical value will be used for estimating cointegrating vectors.

Finally, the value added of the HBN04 procedure can also be seen in the very small overlap between the breaks endogenously identified by the Structural Break tests in the single series and presented in tables 4.3 and 4.4 and those identified by the procedure. This is a piece of supportive evidence towards the fact that the multivariate nature of the VAR model does modify the relative relevance of breaks with respect to testing single time series and the heavy presence of outliers may help explain the contrasting results of the stationarity tests. Also, in most cases, the timing of the break dates identified by the Nielsen (2004) procedure corresponds to important events in the countries, as illustrated in tables 4.9 and 4.10.

4.4 Model Identification

Similarly to Luintel and Khan (1999) for countries with cointegration rank equal to 2 the normalization restrictions are chosen with reference to FD and YP (formally $b_{1,1} = 1$ and $b_{2,2} = 1$) in order to obtain a financial depth relationship (FD cointegration vector) and an (aggregate) production function

(2004). In this model $YP_{1970}^{original} - (YP_{1969}^{original} + YP_{1971}^{original})$ is not significatively different from $\theta_2 D_{70}$, confirming the equivalence of linear interpolation and HBN04 estimation.

[13] Arghyrou and Luintel (2007) among others face the same problem. The authors define a period of three years as the neighbourhood of a break and represent it by a single shift, identifying the exact break date as the one that produces the highest Chi-square statistic in the sequential tests.

(Output cointegration vector). The other over-identifying restrictions are:

1. the coefficient of the per capita capital in the FD cointegrating relationship is zero ($b_{1,3} = 0$), since capital has no direct effect on the economy's supply of credit to the private sector;

2. the coefficient of FD in the Output vector is zero ($b_{2,1} = 0$), as economic theory suggests that financial development has no direct effect on the economy's production function;

3. the coefficient of OP is non negative in at least one of the two cointegrating relationships (either $b_{1,4} \geq 0$ or $b_{2,4} \geq 0$). The restriction $b_{1,4} > 0$ captures the positive effects of financial openness on financial development. Following Chinn and Ito (2006), capital account liberalization can lead to the development of financial systems through several channels. First, financial liberalization may mitigate financial repression in protected financial markets by allowing the real interest rate to rise to its competitive market equilibrium. Second, removing capital controls allows domestic and foreign investors to engage in more effective portfolio diversification. Third, but not least, the liberalization process usually increases the efficiency level of the financial system by weeding out inefficient financial intermediaries and by creating greater pressure for a reform of the financial infrastructure. The restriction $b_{2,4} > 0$ captures the real effects of the increased availability of credit, following financial openness. It also aims to capture the economies of scale in the distribution of funds that the domestic economy reaches once it opens financially as described in Chapter 2. Tornell and Westermann (2004) maintain that while trade liberalization promotes efficiency and growth mainly in the tradables sector, financial liberalization adds even more to growth because it eases financing constraints, leading to an increase in investment

by financially constrained firms, most of which are in the nontradables sector;

4. the coefficient on RR is non negative in at least one of the two cointegrating relationships (either $b_{1,5} \geq 0$ or $b_{2,5} \geq 0$). The restriction $b_{1,5} > 0$ captures profit for financial intermediaries, which is one of the main drivers of financial development. As in Luintel and Khan (1999), the restriction $b_{2,5} > 0$ can be interpreted as a proxy for technological progress.

For countries with cointegration rank equal to 1, only a FD cointegrating relationship will be identified with the additional restriction that $b_{1,3} = 0$.

Considering all the above restrictions, equations (4.3) and (4.4) can be written in estimable form and they would result in:

$$\begin{aligned} \Delta Y_t \; = \; & a_{1,p}(b_{1,1}FD_t + b_{1,2}YP_t + b_{1,3}KP_t + b_{1,4}OP_t + b_{1,5}RR_t + \\ & + b_{1,6}t + b_{1,0}) + a_{2,p}(b_{2,1}FD_t + b_{2,2}YP_t + b_{2,3}KP_t + b_{2,4}OP_t + b_{2,5}RR_t + \\ & + b_{2,6}t + b_{2,0}) + m_0 + m\mathbf{D}_t + \sum_{i=1}^{k-1} Q_i \Delta Y_{t-i} + \varepsilon_t \end{aligned} \tag{4.6}$$

$$\text{subject to restrictions} \left\{ \begin{array}{c} b_{1,1} = b_{2,2} = 1 \\ b_{1,3} = 0 \\ b_{2,1} = 0 \\ (b_{1,4} \geq 0) \cup (b_{2,4} \geq 0) \\ (b_{1,5} \geq 0) \cup (b_{2,5} \geq 0) \end{array} \right. \quad \text{if } r = 2 \text{ or}$$

$$\begin{aligned} \Delta Y_t \; = \; & a_{1,p}(b_{1,1}FD_t + b_{1,2}YP_t + b_{1,3}KP_t + b_{1,4}OP_t + b_{1,5}RR_t + \\ & + b_{1,6}t + b_{1,0}) + m_0 + m\mathbf{D}_t + \sum_{i=1}^{k-1} Q_i \Delta Y_{t-i} + \varepsilon_t \end{aligned} \tag{4.7}$$

subject to restrictions $\begin{cases} b_{1,1} = 1 \\ b_{1,3} = 0 \end{cases}$ if $r = 1$ and

$$\begin{aligned} \widetilde{\Delta Y}_t &= a_{1,p}(b_{1,1}\widetilde{FD}_t + b_{1,2}\widetilde{YP}_t + b_{1,3}\widetilde{KP}_t + b_{1,4}\widetilde{OP}_t + b_{1,5}\widetilde{RR}_t + \\ &\quad + b_{1,6}t + b_{1,0}) + a_{2,p}(b_{2,1}\widetilde{FD}_t + b_{2,2}\widetilde{YP}_t + b_{2,3}\widetilde{KP}_t + b_{2,4}\widetilde{OP}_t + b_{2,5}\widetilde{RR}_t + \\ &\quad + b_{2,6}t + b_{2,0}) + m_0 + \sum_{i=1}^{k-1} Q_i \widetilde{\Delta Y_{t-i}} + \varepsilon_t \end{aligned} \tag{4.8}$$

subject to restrictions $\begin{cases} b_{1,1} = b_{2,2} = 1 \\ b_{1,3} = 0 \\ b_{2,1} = 0 \\ (b_{1,4} \geq 0) \cup (b_{2,4} \geq 0) \\ (b_{1,5} \geq 0) \cup (b_{2,5} \geq 0) \end{cases}$ if $r = 2$

where $\widetilde{Y}_t' = \begin{bmatrix} \widetilde{FD}_t \\ \widetilde{YP}_t \\ \widetilde{KP}_t \\ \widetilde{OP}_t \\ \widetilde{RR}_t \end{bmatrix} = Y_t' - \theta \mathbf{D}_t = \begin{bmatrix} FD_t \\ YP_t \\ KP_t \\ OP_t \\ RR_t \end{bmatrix} - \begin{bmatrix} \theta_{1,1} & ... & \theta_{1,n} \\ \theta_{2,1} & ... & \theta_{2,n} \\ \theta_{3,1} & ... & \theta_{3,n} \\ \theta_{4,1} & ... & \theta_{4,n} \\ \theta_{5,1} & ... & \theta_{5,n} \end{bmatrix} \begin{bmatrix} D_{1,t} \\ .. \\ D_{n,t} \end{bmatrix}'$

with $D_{i,t} = 1\{t = i\}$ or

$$\begin{aligned} \widetilde{\Delta Y}_t &= a_{1,p}(b_{1,1}\widetilde{FD}_t + b_{1,2}\widetilde{YP}_t + b_{1,3}\widetilde{KP}_t + b_{1,4}\widetilde{OP}_t + b_{1,5}\widetilde{RR}_t + \\ &\quad + b_{1,6}t + b_{1,0}) + m_0 + \sum_{i=1}^{k-1} Q_i \widetilde{\Delta Y_{t-i}} + \varepsilon_t \end{aligned} \tag{4.9}$$

subject to restrictions $\begin{cases} b_{1,1} = 1 \\ b_{1,3} = 0 \end{cases}$ if $r = 1$.

4.4.1 Estimation results

The results in table 4.11 show for each country the identified cointegrating vectors and the overidentifying restriction test which follows a $\chi^2(1)$ probability distribution.

It should be noted that in Chile, Italy, Pakistan and Peru the results of the weak exogeneity test show no evidence of causality. As in Demetriades and Hussein (1996) this contradicts the representation theorem of Engle and Granger, thereby casting some doubt on the cointegration results for these countries, which will therefore be excluded from the subsequent analysis.

In the other countries a number of common elements seem to emerge. First, the detection and estimation technique helps in identifying a long run relationship between financial and economic development for high-inflation countries, namely Ecuador (16 years of yearly price growth above 25%, the threshold chosen by Rjoja and Valev (2004)), Ghana (22 years) and Venezuela (14 years). This goes against Rjoja and Valev (2004) who maintain that high inflation leads not only to an underdeveloped financial system but also to a breakdown of the finance-growth nexus.

Secondly, in all countries a Financial Development cointegrating vector is identified with a positive coefficient for YP, with the exception of the Central African Republic, India and Morocco. In particular the negative estimated value for India may be explained by domestic financial repression. The latter phenomenon is well described in Demetriades and Luintel (1996) who maintain that in the 1960s the government of India tightened its controls over the financial system introducing liquidity requirements and lending rate controls; domestic financial repression stepped up in 1969 with the nationalization of the 14 largest commercial banks and was further extended in 1980. Domestic financial liberalization followed only in 1990 with the end of directed credit and concessionary lending. So a relationship showing that the more income per capita increases, the more financial development decreases, being maimed in its function of channelling savings to productive investments by domestic repression, is consistent with data. Also, the presence of I(2) series in India must not be underestimated.

Among FO countries only the Central African Republic shows a deeply negative estimate for parameter $b_{1,2}$. This might be due to the extreme financial underdevelopment of the country, which ends the sample period with a FD level which is lower than the initial level of financial development in any country with the exception of Ghana. Also the fact that inequality reaches the zenith in the Central African Republic might configure a case where growth is capital-deepening and, as described in para. 3.5 of Chapter 3, inequality seriously hampers accumulation and growth. The fact that the Central African Republic has the lowest capital-income ratio at the end of the sample period across all the sample countries provides further support to this claim.

Estimates for $b_{1,4}$ span from negative values (FO Finland and Kenya) to very positive values (FC India). For the FO countries might be the case that the marginal effect of increasing openness is low, while the large coefficient for India might indicate the sizable potential gains in financial development from openness, given the low level of actual openness of India, a *de facto* and *de jure* FC country. It should be noted that Morocco's end-of-sample level of *de facto* openness does not differ much from that of Ghana or Ecuador, but the value estimated for $b_{1,4}$ is definitely larger in the former country. *De jure* openness classification of table 2.2 of Chapter 2 indicates Morocco's commitment only under commercial presence mode, while Ghana and Ecuador are among countries showing full commitment to liberalization both under cross border mode and under commercial presence. The difference in the effect of financial openness on financial development might hence be explained by the difference in *de jure* openness and namely that the relatively *de jure* "closed" Morocco has succeeded in taking more advantage of openness than *de jure* "open" Ecuador and Ghana.

Finally, estimates for $b_{1,5}$ are mostly positive and they are much smaller than other coefficients. This outcome is in line with Arestis, Demetriades, Fattouh and Mouratidis (2002) as $b_{1,5} > 0$ can be interpreted as the return on financial intermediation. Again the distribution of countries between FC and FO groups proves helpful as $b_{1,5} < 0$ is more frequently observed in FC countries. Financial intermediation in FC countries is probably protected from international competition and subsidized by the government so profitability is not such an important driving force of financial development. Estimates for $b_{1,5}$ are lower than those for $b_{1,4}$ in most countries with exception of Ecuador and Finland; this may indicate that when financial openness operates, it is a stronger factor in financial development than return on financial intermediation. In Finland the loss of an independent monetary policy due to the introduction of the Euro has possibly had an impact in reducing the role of interest rates in financial development. By contrast, in Ecuador the low level of financial development could not benefit in full from openness, despite its fast dynamics. It is interesting to note that in FC India the estimate for $b_{1,4}$ is higher than that for $b_{1,5}$, suggesting that financial openness more than compensates the negative effects of low returns on financial intermediation in explaining financial development.

As far as the Output cointegrating vector is concerned, all countries exhibit a positive coefficient for $b_{2,3}$, in line with the interpretation that the second cointegrating vector represents a production function. The Central African Republic shows a value compatible with endogenous growth theory.

Values estimated for $b_{2,4}$ are mostly positive, in line with the prediction of the models in Chapter 2, and capture the real effects of the increased availability of credit, originating from improvements in financial infrastructure which alleviate information asymmetry, following financial openness. This is a sign that for nearly all the FO countries in this sample financial openness - as a form of financial liberalization - is positively related to economic growth. Exceptions on opposite fronts are Ghana and India. For Ghana, Chapter 2 may suggest that it is a case where financial openness has brought about an increase of financial costs relatively to productivity, thereby imposing a burden rather than stimulating economic development. The fact that the country is characterized by the second most dynamic openness and the bottom economic growth across sample countries might also play a role. For India, a high and positive estimated coefficient for $b_{2,4}$ can represent the potential gains in economic development from openness, given the low level of actual openness, which are higher than those from the effect of real interest rates, estimated by $b_{2,5}$.

Estimates for $b_{2,5}$ show positive values in all countries with the exception of India, as just discussed. The model of development of India, characterized until very recently by high labour intensity[14] and where technological progress played only a minor role, might be one of the reasons for the negative coefficient for $b_{2,5}$. Also, as described by Arestis and Demetriades (1997), India might be a case where the belief that "keeping down the cost of capital is good for the economy" by introducing financial repression measures, as it was the case in India, may not be an optimal answer to smooth out unintended consequences of financial liberalization. By contrast Morocco - a *de facto* open country but with low *de jure* commitment to financial openness - is the only country where estimates for $b_{2,5}$ are larger than those for $b_{2,4}$, this might be because low *de jure* commitment to financial openness actually weaken the effect of financial

[14] India has one of the lowest average capital income ratio among Low and Lower Middle income countries and it did nor reach a capital income ratio of 2 until the 1980s.

openness on economic development.

As far as causality is concerned, long run causality is found when weak exogeneity of a variable with respect to a single cointegrating vector is rejected. Hence, if $a_{1,2} = 0$ is rejected at the conventional significance level, one can conclude that the second cointegrating vector, which represents Economic Development, causes the first cointegrating vector, which represents Financial Development. Similarly, if $a_{2,1} = 0$ is rejected at the conventional significance level, one can conclude that financial development causes economic development. If both the hypotheses that $a_{1,2} = 0$ and $a_{2,1} = 0$ are rejected at the conventional significance level, then one concludes that there is bi-directional causality between economic and financial development in the long run. Table 4.11 shows that:

- Financial Development causes Economic Development in Ecuador, Finland, India, Kenya and Venezuela;
- Bi-directional causality between Economic Development and Financial Development in the Central African Republic, Ghana and Morocco.

All countries conform with the consensus view stating that financial development does cause economic development. Bi-directional causality is more frequently observed in countries that combine a more equal distribution of income (Ghana and Morocco), either with a robust economic growth (Morocco) or low level of financial development (Ghana).

On the other hand, financial development as a *primum movens* in the finance-growth nexus is associated either with an unequal distribution of income (for Ecuador, Kenya and Venezuela) or with increasing level of inequality (India and Finland). In Kenya, a Low Income, *FO* country showing robust growth in financial development and subdued economic growth, the substantial reduction in inequality form 1985 to 2000 has not been sufficient to kick in causality from economic growth to financial development as in Ghana. This may be a case where, as described in stage 1 of the models in Chapter 3, distribution of income is such that a sizable share of population cannot leave bequest, i.e. take part in the accumulation process and growth.

The fact that FC India does not support causality from economic development to growth as FO Morocco, a similar Lower Middle Income country showing robust growth in both financial and economic development, may be due to increasing trend in inequality, and this according to the models in Chapter 3 is not favorable to growth. Also, the seemingly counter-intuitive result that a FC country such as India may find in financial development a cause for economic development should consider that the financial openness is an important driving force for financial development, but by no means the only one; in India domestic financial liberalization of the 1990s might have played a similar "pull" role.

4.4.2 Quality of results and the role of outliers

In order to check for robustness of the estimations, the cointegrating vectors have been estimated with dynamic OLS (DOLS) as well with the same leads and lags as the order of differentiation of the variables in the Johansen's methodology and with the dummy variables as exogenous regressors. Results of DOLS estimation presented in table 4.13 show that parameter estimations are most similar to those obtained with Johansen's estimation technique in countries with a single cointegrating vector, possibly because in countries that are cointegrated of rank 2 Johansen's methodology seems to be more in a position to take full advantage of correlations across endogenous differentiated and lagged variables. With DOLS estimates for $b_{1,2}$ and $b_{1,4}$ would not be significative in India and Venezuela, $b_{1,5}$ would not be significative in the Central African Republic, Ghana and Kenya. $b_{2,3}$ and/or $b_{2,4}$ would not be significatively different from zero in Central African Republic, Ghana and Morocco. In Kenya and India $b_{2,5}$ would not result significative too.

Results of the Hansen's parameter instability test[15] on DOLS confirm the absence of parameter instability, further supporting the quality of the model estimations.

As to the usefulness of the outlier detection and estimation procedure, it can be directly assessed by the comparison of the results of the estimates obtained including dummy variables and excluding them, presented in table 4.12. First of all, without dummies residuals of the estimations would not be normally distributed in two thirds of the sample countries. Also, in Ghana and Morocco only one of the loading factors would be significant without dummies, none in the Central African Republic, Ecuador, Finland, India and Venezuela. Ecuador would not pass the overidentification test and Finland and Venezuela just barely so. Also $b_{1,2}$ would not be significantly different from zero in Ghana, Morocco and Venezuela and $b_{1,4}$ would not be significantly different from zero in Finland. It would be very difficult to have and economic interpretation for $b_{2,3}$ in the Central Africa Republic as well. Therefore it can be concluded that the use of the dummies does increase significance of the parameters' estimates,

[15]Hansen (1992) proposes the use of the LC test statistic, which arises from the theory of Lagrange Multiplier tests for parameter instability, to evaluate the stability of the parameters. The LC statistic examines time-variation in the scores from the estimated equation. Let $\widehat{s}_t$ be the vector of estimated individual score contributions from the estimated equation, and define the partial sums, $\widehat{S}_t = \sum_{\tau=1}^{t} \widehat{s}_\tau$ where $\widehat{S}_t = 0$ by construction. Then Hansen chooses a constant measure of the parameter instability $\widehat{G}$ and forms the statistic $LC = tr\left(\sum_{t=1}^{T} \widehat{S}_t' G^{-1} \widehat{S}_t\right)$. For DOLS $\widehat{S}_t$ is defined for the subset of original regressors, and G may be computed using the method employed in computing the original coefficient standard errors.

allowing for meaningful comparisons among countries and groups, and in the end improves the identification of the model. The use of the detection and estimation procedure also allows a parsimonious use of dummies with respect to the standard use of "rules of thumb" on observations showing excess standard deviation, which are frequently applied in practice. The procedure therefore saves degrees of freedom, which are precious in time series studies with low frequency data. In this study only in Ghana, out of all sample countries, the procedure identifies the same number of dummies as observations showing excess volatility while the number of dummies is lower for all other countries.

Ghana is also the only country with 1 observation (year 1982) where the outliers identified by the HBN04 Detection & Estimation procedure and those identified by the Structural Break test overlap. This reinforces the claim that cointegration does modify the relative relevance of breaks with respect to testing single time series and should be treated with a specific technique, as the one developed by Nielsen (2004). As an example it is useful to compare the first section of tables 4.7 and 4.8 - showing standard deviation in excess of 2 - with dummy coefficients at the bottom of tables 4.14 and 4.15. In the case of Finland the first section of table 4.8 shows that years 1974 and 1991 exhibit excess standard deviation for several endogenous variables and with opposite signs, while 1972 show excess standard deviation just for YP. In table 4.14 coefficients of d1 (year 1974) and d4 (1991) show 3 significative coefficients for the variables showing excess standard deviation in table 4.8 and with compatible signs. On the contrary, d3 (1972) shows 3 significative coefficients none of which in the equation describing the short-term behavior of YP, which showed excess standard deviation for that year, as indicated in table 4.8.

Figures 4.3 and 4.4 aim at representing the contribution of large innovation dummies in the first two estimated equations, namely financial development (ΔFD) and economic growth (ΔYP). The dark shaded area represents equations (4.6) or (4.7), depending on the rank used for estimation from tables 4.5 and 4.6, with the significative parameters reported in tables 4.14 and 4.15 net of the short term components $\sum_{i=1}^{k-1} Q_i \Delta Y_{t-i}$,while the lighter area represents only the equilibrium relationship(s) $\sum_{r=1}^{2} a_{r,p}(b_{r,1}FD_t + b_{r,2}YP_t + b_{r,3}KP_t + b_{r,4}OP_t + b_{r,5}RR_t + b_{r,6}t + b_{r,0})$. As the innovational model aims at capturing the role of large innovations to the system which do not modify its dynamic transmission mechanism, their result is a shift in the equilibrium relationships within equations describing endogenous variables. The relative importance of such shift is shown by the width of the darker shaded area and it essentially depends on the size of the deterministic component m_0, on the number of significative $\mathbf{D}_t$ dummies and on the size of the estimated parameter(s) m. Ghana, Kenya and Venezuela, which support a trend specification with no constant in the data but only in the cointegrating relationship(s), show a very narrow darker area representing the pure effect of $m\mathbf{D}_t$, while in other countries despite the "noise" represented by m_0 it is easier to recognize the changing width of the darker area depending on number and magnitude of significative dummies along the estimated equilibrium relationship. This "buffer" nature of dummies aims at smoothing the estimation results, dampening the effects of large innovations. Ecuador, with 2 significative dummies in both ΔFD and ΔYP equations, and India, with 1 significative dummy in ΔFD and 4 in ΔYP equations are examples of asymmetric impact of dummies in the different endogenous variables. In the former country the deterministic component is not significative in the ΔYP equation and in the latter country it is not significative in the ΔFD equation. So Ecuador is an example of the impact of m_0 as a magnifier of the effect of dummies in ΔFD as opposed to ΔYP, the reverse situation is true for India, a country whose ΔYP equation shows one of the higher number of significative dummies (4). According to table 4.14 the estimations say that while the debt crisis in the 1980s in Ecuador had a negative impact on financial development and a positive one on economic growth (while the year 2000 crisis had a negative one), the austerity program of 1988 had a positive impact on financial development and none on economic growth. As indicated in table 4.15, in India the early 1970s oil shock, as well as negative interest rates in the same decade and disorders following the assassination of Prime Minister Indira Ghandi in mid-1980s all have a negative impact on economic growth and only the expansionary monetary policy of the late 1980s has a positive impact on growth.

In no estimated equation the number of significative dummies is higher than five, i.e. between 10% and 13% of observations in the sample size, thereby limiting the risk of overfitting.

4.5 Discussion

The contribution that this paper aims to offer is a study of the link between financial and economic development within a time series framework with data extending over the Nineties and an explicit role for openness. On the one hand, the choice of time series analysis tries to address the concerns about structural homogeneity, i.e. parameter constancy, which has raised many reservations in the empirical literature based on cross-section techniques, as reviewed by Andersen and Tarp (2003). The time series approach allows the analysis on the finance-growth nexus to be carried out for each country singularly and therefore does not need instruments in order to take care of cross-country institutional heterogeneity or different levels of development, both economic and financial, as suggested by Arestis and Demetriades (1997) among others. On the other hand, the time span of the analysis (1961-2008) has been characterized by structural and policy changes calling for the use of dummy variables to obtain meaningful estimates. Hence a newly developed technique has been applied to detect and estimate outliers and create ad hoc dummies.

Sample countries are almost equally divided between cointegrating model of rank two and one; the single cointegrating vector model is relatively more frequent among Financially Closed countries. The study identifies a Financial Development cointegrating vector, with mostly a positive effect of income per capita, openness and real interest rates, as well as an Output vector, for the countries of rank two, with the positive effects of capital stock, openness and real interest rate expected in an aggregate production function augmented by the real effect of openness.

The estimated effect of the income per capita in the Financial Development cointegrating vector is more widely ranged in Financially Open countries, underlining the different effects that financial openness may activate on the traditional links between economic growth and financial development. Also, more than one third of the countries show a negative effect of income per capita on Financial Development, mainly due to financial repression or unequal income distribution.

The estimated effect of openness in the Financial Development cointegrating vector is broadly ranged with *de facto* financially open countries ranking among the highest values. Within FO countries the distinction between *de facto* and *de jure* open countries from Chapter 2 proves useful in explaining differences in estimations across countries. Also, in most countries the effect of openness in the Financial Development cointegrating vector is larger than that of the real interest rate, suggesting that once *de facto* openness operates, it is a stronger factor in financial development than return on financial intermediation *per se*.

A negative effect of real interest rate in the Financial Development cointegrating vector is more frequently observed in FC countries, possibly due to the protection from international competition and/or to government subsidies.

The economic development cointegrating vector, estimated only for countries supporting 2 cointegrating vectors, shows mostly positive coefficients, in line with the theory that capital per capita, availability of funds due to financial openness and the real interest rate play a positive role in economic development.

As far as causality is concerned, results in this Chapter are in line with the consensus view that financial development causes economic growth. The combination of openness and income distribution with dynamics of economic and financial development comes useful for the interpretation of differences in the direction of causality across countries sharing the same level of economic development.

One last word on the countries that were excluded from the analysis: the fact that they have all been grouped among FC countries and are Upper Middle or High income countries, is in itself telling about the need of further research in the relationship between financial development, openness (or, rather, lack thereof) and economic growth for developed economies. For Low-Income Pakistan the minor role played by the banking system in providing funds to the economy due to the extensive role of agricultural cooperatives and the informal financial market, as mentioned by Demetriades and Hussein (1996), might have played a major role in the exclusion.

Finally, one should underline that the sequential procedure to identify and estimate outliers is based on the initial estimation of the cointegration rank by Johansen's methodology. Therefore the criticism about the sensitivity of the latter methodology to VAR lag length by Andersen and Tarp (2003) does also apply here.

4.6 Appendices to Chapter 4

The Appendices cover three topics: data sources (App. 4.6.1), the outlier detection and estimation implementation sequence (App. 4.6.2) and a sample routine (App. 4.6.3) and diagnostic and estimation results (App. 4.6.4).

4.6.1 Data & Sources

Table 4.1: Variables and Sources

Variable	**Description**	**Source**
FD	Credit to private sector as a percentage of GDP	WDI (2009)
YP	(Log of) real income per capita in national currency calculated as ratio of real national GDP to population	Real GDP: WDI (2009) and Population: WDI (2009)
KP	(Log of) real capital stock per capita in national currency calculated with perpetual inventory formula from Easterly and Levine (2001)[16]gross capital formation data	Gross capital formation: WDI (2009)
OP	Gross trade openness as a percentage of GDP	Import, Exports and GDP: WDI (2009)
RR	Real interest rate = Discount rate net of inflation rate	Discount rate: IFS. Consumer price annual growth: WDI (2009)

Please note that:

- for **Central African Republic** and **Ghana** inflation is measured by the rate of growth of GDP deflator;
- for **Chile** nominal interest rates are measured by the rate on short term loans from the IFS. For 1961-1976 data have been supplied by the Central Bank of Chile;

- for **Finland** and **Italy** nominal interest rates are measured by the Eurosystem marginal lending facility rate from 1999 onwards;

- for **India** nominal interest rates are measured by bank rates from the International Financial Statistics (IFS);

- for **Kenya** nominal interest rates are measured by lending rates from the IFS;

- for **Morocco** nominal interest rate are measured by maximum export credit rates from the IFS from 1989 to 1997.

4.6.2 Sequential implementation of routines to obtain the HBN04 procedure in EViews 7®

This sequence assumes that diagnostic tests an the Johansen's cointegration test have given results supporting the hypothesis that the "true model" supports two cointegrating vectors.

1. Open program file **my0.prg** and fill in country code[17], lag length and trend specification[18]and run the programme. The program produces a vector - named **out** - of all observations where the residual is larger than twice the standard deviation;

2. Open program file **my1.prg,** fill in the usual data, add length of the outlier vector **out** and run the programme. The program produces the table **ioall_nod** with the t_{IO} test for all the observations in the vector **out;**

[17]It is a 2 character field with the first two letters of the international country code. So Ghana would have %co="gh".

[18]Trend specification is "b" or "c" or "d" as described in the notes at the bottom of tables 4.8 and 4.9. So Ghana would have %tr="b".

3. Open program file **my2.prg**, fill in the usual data, add length of the outlier vector **out** and run the programme. The program produces the table **aoall_nod** with the t_{AO} test and θ estimations for all the observations in the vector **out;**

4. If the largest value among t_{IO} and t_{AO} is t^*_{IO} , then open program file **my3.prg**, fill in the usual data, add length of the outlier vector **out** and position of observation corresponding to t^*_{IO} (say year yy) in the vector **out** and run the programme. The program produces the tables **ioalld1_yy** and **aoalld1_yy** with the t_{IO} and t_{AO} tests for all the observations in the vector **out** except observation (yy) and a vector **out1**[19] of all the remaining observations where the residual was originally larger than twice the standard deviation;

5. If the largest value among t_{IO} and t_{AO} is t^*_{AO} , then amend observation at year yy with the estimated θ or a linear interpolation of the previous and following observation and amend the original vector **out** taking away the year where the data correction has been made. Create manually a new (i.e. shorter) version of vector **out**. Then open program file **my3.prg**, fill in the usual data, add the length of the new outlier vector **out** and position of observation corresponding to the largest t^*_{IO} (say year yy) in the new vector **out** and run the programme on the amended data set. The program produces the tables **ioalld1_yy** and **aoalld1_yy** with the t_{IO} and t_{AO} tests for all the observations in the vector **out** except observation (yy) and a vector **out1** of all the remaining observations where the residual was originally larger than twice the standard deviation;

6. Run programs subsequently starting from **my4.prg**, filling in the usual

[19] As shown in table 4.11 yy for Ghana is year 2000 hence the first dummy is d1_00. Vector out1 for Ghana will include 1971, 1975, 1982, 1983, 1984 and 1993.

data, the length of the **out(n+1)** vector resulting from the previous routine and the position of the observation showing the largest t_{IO} or test the amended data if the largest statistic is of AO-type. Repeat this step until there are no more observations with significative test values[20] or until the number of dummy variables has reached 7.

After here continue with standard cointegration analysis and related tests.

4.6.3 Eviews 7® Program to detect and estimate the second Outlier for Ghana once an IO-type outlier has already been found for year 2000

```
'Estimate t_ao and theta values for observation in out1
    'Set country
    %co = "gh"
    'Set previous dummy
    %fi=@str(00)
    'set leg length
    !l =2
    %z=@str(!l)
    %b=@str(1)
    'if error correction set trend specification and rank
    %tr="b"
    !r =2
    %r=@str(!r)
    'set length of vector out1
    !e=6
    'set position of the dummy in vector out1
    !d =4
    %one =%co+"cr"
    %two =%co+"yc"
    %three = %co+"kc"
    %four= %co+"op"
    %five= %co+"rr"
    group gr %one %two %three %four %five
    '++++++++++++++++++++++++++++
```

[20] As shown in the final section of table 4.11, for Ghana all outliers are to be considered significative.

```
'STEP 1: calculate t0
smpl s1
%ob =@otod(out1(!d,1))
%it = "d2_" + @right(%ob,2)
series %it=0
smpl %ob %ob
series %it=1
smpl s1
%first="d1_"+%fi
var v1.ec(%tr, %r) %b %z gr @ %first %it
scalar llk%it = v1.@logl
'STEP 2: calculate t_io values
smpl s1
for !i = 1 to !d-1
%obs =@otod(out1(!i,1))
%name = @right(%obs, 2)
series d%name=0
smpl %obs %obs
series d%name=1
smpl s1
stom(d%name,x%name)
'io test for every observation
var v1.ec(%tr, %r) %b %z gr @ %first %it d%name
scalar llk%name = v1.@logl
table (!i+1,3) ioall%it
setcell (ioall%it,1,1,"out1")
setcell (ioall%it,1,2,"obs.")
setcell (ioall%it,1,3,"t_io")
setcell (ioall%it,!i+1,1,out1(!i))
setcell (ioall%it,!i+1,2,%obs)
setcell (ioall%it,!i+1,3,-2*(llk%it - llk%name))
delete v1
'++++++++++++++++++++++++++++++
'STEP 3: calculate theta and t_ao
'create a beginning for a counter of iterations starting at zero
%zero="_"+@str(0)
'convert endogenous variables to matrix endo0
stom(gr,endo0)
var ve0.ec(%tr, %r) %b %z gr @ %first %it
ve0.makeresids r_cr r_yc r_kc r_op r_rr
group res0 r_cr r_yc r_kc r_op r_rr
matrix err0=@convert(res0)
matrix omega0 = @cov(res0)
scalar llk%name%zero = ve0.@logl
'create a submatrix beta with cointegration parameters without1 constants
```

```
matrix betafull0
betafull0 = ve0.@cointvec
'_______
'rank is not relevant for matrix away with dimensions (endog+const; endog)
If %tr="d" then
matrix (5,7) away
away(1,1)=1
away(2,2) =1
away(3,3) =1
away(4,4) =1
away(5,5) =1
else
matrix (5,6) away
away(1,1)=1
away(2,2) =1
away(3,3) =1
away(4,4) =1
away(5,5) =1
endif
'______
matrix beta%name%zero = away*betafull0
matrix (5,%r) alpha%name%zero
matrix (5,5) gamma1%name%zero
matrix (5,5) gamma2%name%zero
matrix (5,5) gamma3%name%zero
matrix (5,5) gamma4%name%zero
'***
'!p, !q and !u are counters of endo variables
for !u =1 to 5
'!rp is a counter of the rank
for !rp =1 to !r
'create loading factor matrix alpha
alpha%name%zero(!u,!rp)=ve0.a(!u,!rp)
next
next
'***
'+++++++++++
if !l=1 then
for !p =1 to 5
for !q =1 to 5
gamma1%name%zero(!p,!q)= ve0.c(!p,!q)
next
next
endif
if !l=2 then
```

```
for !p =1 to 5
for !q =1 to 5
gamma1%name%zero(!p,(!q))= ve0.c(!p,!q*!l-1)
gamma2%name%zero(!p,!q)= ve0.c(!p,!q*!l)
next
next
endif
if !l=3 then
for !p =1 to 5
for !q =1 to 5
gamma1%name%zero(!p,!q)=ve0.c(!p,(!q*!l-2))
gamma2%name%zero(!p,!q)=ve0.c(!p,!q*!l-1)
gamma3%name%zero(!p,!q)=ve0.c(!p,!q*!l)
next
next
endif
if !l=4 then
for !p =1 to 5
for !q =1 to 5
gamma1%name%zero(!p,!q)=ve0.c(!p,(!q*!l-3))
gamma2%name%zero(!p,!q)=ve0.c(!p,(!q*!l-2))
gamma3%name%zero(!p,!q)=ve0.c(!p,(!q*!l-1))
gamma4%name%zero(!p,!q)=ve0.c(!p,(!q*!l))
next
next
endif
matrix hi0 =@identity(5)
matrix hj0 =-@identity(5)-alpha%name%zero*
*@transpose(beta%name%zero) -gamma1%name%zero
matrix hk0=gamma1%name%zero - gamma2%name%zero
matrix hw0=gamma2%name%zero - gamma3%name%zero
matrix hz0=gamma3%name%zero - gamma4%name%zero
matrix hy0=gamma4%name%zero
'create matrix H as sum of component matrices times covariance matrix
matrix hh0 =@transpose(hi0)*@inverse(omega0)*hi0+@transpose(hj0)*
*@inverse(omega0)*hj0+@transpose(hk0)*@inverse(omega0)*
*hk0+@transpose(hw0)*@inverse(omega0)*hw0+
+@transpose(hz0)*@inverse(omega0)*hz0+@transpose(hy0)*
*@inverse(omega0)*hy0
'multiply components of matrix H times lagged errors
'————————————-
If !l=1 then
matrix hv0 = @transpose(hi0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)-!l-1)))+@transpose(hj0)*@inverse(omega0)*
*@transpose(@rowextract(err0,(out1(!i,1)+1-!l-1)))+@transpose(hk0)*
```

```
*@inverse(omega0)*@transpose(@rowextract(err0,(out1(!i,1)+2-!l-1)))
endif
if !l =2 then
matrix hv0 = @transpose(hi0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1) -!l-1)))+@transpose(hj0)*@inverse(omega0)*
*@transpose(@rowextract(err0,(out1(!i,1)+1-!l-1)))+@transpose(hk0)*
*@inverse(omega0)*@transpose(@rowextract(err0,(out1(!i,1)+2-!l-1)))+
+ @transpose(hw0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+3-!l-1)))
endif
if !l =3 then
matrix hv0 = @transpose(hi0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1) -!l-1)))+@transpose(hj0)*@inverse(omega0)*
*@transpose(@rowextract(err0,(out1(!i,1)+1-!l-1)))+@transpose(hk0)*
*@inverse(omega0)*@transpose(@rowextract(err0,(out1(!i,1)+2-!l-1)))+
+ @transpose(hw0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+3-!l-1)))+@transpose(hz0)*
*@inverse(omega0)*@transpose(@rowextract(err0,(out1(!i,1)+4-!l-1)))
endif
if !l =4 then
matrix hv0 = @transpose(hi0)*
*@inverse(omega0)*@transpose(@rowextract(err0,(out1(!i,1)-!l-1)))+
+@transpose(hj0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+1-!l-1)))+
+@transpose(hk0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+2-!l-1)))+
@transpose(hw0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+3-!l-1)))+
+@transpose(hz0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+4-!l-1)))+
+@transpose(hy0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+5-!l-1)))
endif
'—————————-
'calculate theta for this iteration
matrix theta%name%zero=@inverse(hh0)*hv0
delete r_?

delete r_??
delete res0
delete ve0
delete betafull0
delete away
delete omega0
delete err0
```

```
delete h?0
'create table with position of observations of potential outliers, likelihood and t(AO)
table (!e+1,9) aoall%it
setcell (aoall%it, 1,1,"out1")
setcell (aoall%it, 1,2,"obs.")
setcell (aoall%it, 1,3,"t_AO")
setcell (aoall%it, 1,4,"theta_cr")
setcell (aoall%it, 1,5,"theta_yc")
setcell (aoall%it, 1,6,"theta_kc")
setcell (aoall%it, 1,7,"theta_op")
setcell (aoall%it, 1,8,"theta_rr")
setcell (aoall%it, 1,9,"llk")
'———-
'create iteration counter !s and convergence measure !t
!s=0
!t=100
while !s<999 and !t>0.0001
'—————-
'create labels to count iterations on the same dummy
%old="_"+@str(!s)
%new="_"+@str(!s+1)
'create new endogenous variable X(t) = Y(t) - theta*D
matrix endo%name%new = endo0-@transpose
(theta%name%old*@transpose(x%name))
delete alpha%name%old
delete beta%name%old
delete gamma?%name%old
'create label to count iterations on the same dummy
%c=%name+%new
'and move new endogenous variable to group gr%c
mtos(endo%name%new,gr%c)
'start new iteration to estimate theta
var v%c.ec(%tr, %r) %b %z gr%c @ %first %it
v%c.makeresids r_1 r_2 r_3 r_4 r_5
group res%c r_1 r_2 r_3 r_4 r_5
matrix err%c=@convert(res%c)
matrix omega%c = @cov(res%c)
scalar llk%c=v%c.@logl
delete ser??
matrix betafull%c
betafull%c = v%c.@cointvec
'**************
If %tr="d" then
matrix (5,7) away
```

```
away(1,1)=1
away(2,2) =1
away(3,3) =1
away(4,4) =1
away(5,5) =1
else
matrix (5,6) away
away(1,1)=1
away(2,2) =1
away(3,3) =1
away(4,4) =1
away(5,5) =1
endif
'______
matrix beta%c = away*betafull%c
matrix (5, %r) alpha%c
matrix (5,5) gamma1%c
matrix (5,5) gamma2%c
matrix (5,5) gamma3%c
matrix (5,5) gamma4%c
'***
for !u =1 to 5
for !rp =1 to !r
alpha%c(!u,!rp)=v%c.a(!u,!rp)
next
next
'***
'++++++++++++
if !l=1 then
for !p =1 to 5
for !q =1 to 5
gamma1%c (!p,!q)= v%c.c(!p,!q)
next
next
endif
if !l=2 then
for !p =1 to 5
for !q =1 to 5
gamma1%c (!p,(!q))= v%c.c(!p,!q*!l-1)
gamma2%c (!p,!q)= v%c.c(!p,!q*!l)
next
next
endif
if !l=3 then
for !p =1 to 5
```

```
for !q =1 to 5
gamma1%c (!p,!q)=v%c.c(!p,(!q*!l-2))
gamma2%c (!p,!q)=v%c.c(!p,!q*!l-1)
gamma3%c (!p,!q)=v%c.c(!p,!q*!l)
next
next
endif
if !l=4 then
for !p =1 to 5
for !q =1 to 5
gamma1%c (!p,!q)=v%c.c(!p,(!q*!l-3))
gamma2%c (!p,!q)=v%c.c(!p,(!q*!l-2))
gamma3%c (!p,!q)=v%c.c(!p,(!q*!l-1))
gamma4%c (!p,!q)=v%c.c(!p,(!q*!l))
next
next
endif
'+++++++++++++
matrix hi%c=@identity(5)
matrix hj%c=-@identity(5)-alpha%c*@transpose(beta%c)+
-alpha%c*@transpose(beta%c)-gamma1%c
matrix hk%c =gamma1%c- gamma2%c
matrix hw%c =gamma2%c - gamma3%c
matrix hz%c =gamma3%c - gamma4%c
matrix hy%c =gamma4%c
matrix hh%c =@transpose(hi%c)*@inverse(omega%c)*hi%c+
+@transpose(hj%c)*@inverse(omega%c)*hj%c+
+@transpose(hk%c)*@inverse(omega%c)*hk%c
'---------------
If !l=1 then
matrix hv%c = @transpose(hi%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)-!l-1)))+@transpose(hj%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+1-!l-1)))+
+@transpose(hk%c)*@inverse(omega%c)*
*@transpose(@rowextract(err%c,(out1(!i,1)+2-!l-1)))
endif
if !l =2 then
matrix hv%c = @transpose(hi%c)*@inverse(omega%c)*
*@transpose(@rowextract(err%c,(out1(!i,1)-!l-1)))+@transpose(hj%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+1-!l-1)))+
+@transpose(hk%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+2-!l-1)))+
+ @transpose(hw%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+3-!l-1)))
endif
```

```
if !l =3 then
matrix hv%c = @transpose(hi%c)*@inverse(omega%c)*
*@transpose(@rowextract(err%c,(out1(!i,1)-!l-1)))+@transpose(hj%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+1-!l-1)))+
+@transpose(hk%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+2-!l-1)))+@transpose(hw%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+3-!l-1)))+
+@transpose(hz%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+4-!l-1)))
endif
if !l =4 then
matrix hv%c = @transpose(hi%c)*@inverse(omega%c)*
@transpose(@rowextract(err%c,(out1(!i,1)-!l-1)))+
@transpose(hj%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+1-!l-1)))+@transpose(hk%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+2-!l-1)))+
@transpose(hw%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+3-!l-1)))+@transpose(hz%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+4-!l-1)))+
+@transpose(hy%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+5-!l-1)))
endif
'-------------
'calculate theta for this iteration
matrix th%c=@inverse(hh%c)*hv%c
matrix (5,1) theta%c
matplace(theta%c,th%c,1,1)
setcell (aoall%it, !i+1,1,out1(!i,1))
setcell (aoall%it, !i+1,2,@otod(out1(!i,1)))
setcell (aoall%it, !i+1,3,-2*(llk%it -llk%c))
setcell (aoall%it, !i+1,4,theta%c(1,1))
setcell (aoall%it, !i+1,5,theta%c(2,1))
setcell (aoall%it, !i+1,6,theta%c(3,1))
setcell (aoall%it, !i+1,7,theta%c(4,1))
setcell (aoall%it, !i+1,8,theta%c(5,1))
setcell (aoall%it, !i+1,9,llk%c)
'+++++++++
delete res%c
delete err%c
delete betafull%c
delete away
delete omega%c
delete v%c
delete gr%c
delete r_?
```

```
delete h?%c
'calculate the norm - i.e. is the largest column sum in a matrix and no
element in a matrix can exceed that of the norm - as the measure for
convergence of theta between the latest two iterations
scalar conv%c=@norm(theta%c-theta%name%old)
'set conv%c as a counter of convergence and step up iteration counter at
!s+1
'———
if -2*(llk%it-llk%c)<0 then
%prev="_"+@str(!s-1)
theta%c=theta%name%old
llk%c=llk%name%old
!s=999
else
'************
delete theta%name%old
!t= conv%c
!s=!s+1
endif
'———-
wend
delete conv????
delete conv?????
delete conv??????
delete conv???????
delete endo????
delete endo?????
delete endo??????
delete endo???????
delete alpha?????
delete alpha??????
delete alpha???????
delete alpha????????
delete beta?????
delete beta??????
delete beta???????
delete beta????????
delete gamma??????
delete gamma???????
delete gamma????????
delete gamma?????????
'delete the???
'——-
delete x%name
delete th?????
```

```
delete th??????
delete th???????
delete th????????
delete theta?????
delete theta??????
delete theta???????
delete theta????????
next
'STEP 4: repeat 2+3 for the second part of the out1 vector
smpl s1
'———
if !d+1>!e then
stop
else for !i =!d+1 to !e
endif
'———
%obs =@otod(out1(!i,1))
%name = @right(%obs, 2)
series d%name=0
smpl %obs %obs
series d%name=1
smpl s1
stom(d%name,x%name)
'io test for every observation
var v1.ec(%tr, %r) %b %z gr @ %first %it d%name
scalar llk%name = v1.@logl
table (!i+1,3) ioall%it
setcell (ioall%it,1,1,"out1")
setcell (ioall%it,1,2,"obs.")
setcell (ioall%it,1,3,"t_io")
setcell (ioall%it,!i+1,1,out1(!i))
setcell (ioall%it,!i+1,2,%obs)
setcell (ioall%it,!i+1,3,-2*(llk%it - llk%name))
delete v1
'delete llk??
'create a beginning for a counter of iterations starting at zero
%zero="_"+@str(0)
'convert endogenous variables to matrix endo0
stom(gr,endo0)
smpl s1
var ve0.ec(%tr, %r) %b %z gr @ %first %it
ve0.makeresids r_cr r_yc r_kc r_op r_rr
group res0 r_cr r_yc r_kc r_op r_rr
matrix err0=@convert(res0)
matrix omega0 = @cov(res0)
```

```
scalar llk%name%zero = ve0.@logl
'create a submatrix beta with cointegration parameters without constants
matrix betafull0
betafull0 = ve0.@cointvec
'________
'rank is not relevant for matrix away with dimensions (endog+const; endog)
If %tr="d" then
matrix (5,7) away
away(1,1)=1
away(2,2) =1
away(3,3) =1
away(4,4) =1
away(5,5) =1
else
matrix (5,6) away
away(1,1)=1
away(2,2) =1
away(3,3) =1
away(4,4) =1
away(5,5) =1
endif
'_______
matrix beta%name%zero = away*betafull0
matrix (5,%r) alpha%name%zero
matrix (5,5) gamma1%name%zero
matrix (5,5) gamma2%name%zero
matrix (5,5) gamma3%name%zero
matrix (5,5) gamma4%name%zero
'***
'!p, !q and !u are counters of endo variables
for !u =1 to 5
'!rp is a counter of the rank
for !rp =1 to !r
'create loading factor matrix alpha
alpha%name%zero(!u,!rp)=ve0.a(!u,!rp)
next
next
'***
'+++++++++++
if !l=1 then
for !p =1 to 5
for !q =1 to 5
gamma1%name%zero(!p,!q)= ve0.c(!p,!q)
next
next
```

```
endif
if !l=2 then
for !p =1 to 5
for !q =1 to 5
gamma1%name%zero(!p,(!q))= ve0.c(!p,!q*!l-1)
gamma2%name%zero(!p,!q)= ve0.c(!p,!q*!l)
next
next
endif
if !l=3 then
for !p =1 to 5
for !q =1 to 5
gamma1%name%zero(!p,!q)=ve0.c(!p,(!q*!l-2))
gamma2%name%zero(!p,!q)=ve0.c(!p,!q*!l-1)
gamma3%name%zero(!p,!q)=ve0.c(!p,!q*!l)
next
next
endif
if !l=4 then
for !p =1 to 5
for !q =1 to 5
gamma1%name%zero(!p,!q)=ve0.c(!p,(!q*!l-3))
gamma2%name%zero(!p,!q)=ve0.c(!p,(!q*!l-2))
gamma3%name%zero(!p,!q)=ve0.c(!p,(!q*!l-1))
gamma4%name%zero(!p,!q)=ve0.c(!p,(!q*!l))
next
next
endif
matrix hi0 =@identity(5)
matrix hj0 =-@identity(5)-alpha%name%zero*
*@transpose(beta%name%zero) -gamma1%name%zero
matrix hk0=gamma1%name%zero - gamma2%name%zero
matrix hw0=gamma2%name%zero - gamma3%name%zero
matrix hz0=gamma3%name%zero- gamma4%name%zero
matrix hy0=gamma4%name%zero
'create matrix H as sum of component matrices times covariance matrix
matrix hh0=@transpose(hi0)*@inverse(omega0)*hi0+@transpose(hj0)*
*@inverse(omega0)*hj0+@transpose(hk0)*@inverse(omega0)*hk0+
+@transpose(hw0)*@inverse(omega0)*hw0+@transpose(hz0)*
*@inverse(omega0)*hz0+@transpose(hy0)*@inverse(omega0)*hy0
'multiply components of matrix H times lagged errors
'—————————-
If !l=1 then
matrix hv0 =@transpose(hi0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)-!l-1)))+@transpose(hj0)*
```

```
*@inverse(omega0)*@transpose(@rowextract(err0,(out1(!i,1)+1-!l-1)))+
+@transpose(hk0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+2-!l-1)))
endif
if !l =2 then
matrix hv0=@transpose(hi0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)-!l-1)))+@transpose(hj0)*
*@inverse(omega0)*@transpose(@rowextract(err0,(out1(!i,1)+1-!l-1)))+
+@transpose(hk0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+2-!l-1)))+
+@transpose(hw0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+3-!l-1)))
endif
if !l =3 then
matrix hv0=@transpose(hi0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1) -!l-1)))+@transpose(hj0)*@inverse(omega0)*
*@transpose(@rowextract(err0,(out1(!i,1)+1-!l-1)))+@transpose(hk0)*
*@inverse(omega0)*@transpose(@rowextract(err0,(out1(!i,1)+2-!l-1)))+
+@transpose(hw0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+3-!l-1)))
+@transpose(hz0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+4-!l-1)))
endif
if !l =4 then
matrix hv0 =@transpose(hi0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1) -!l-1)))+@transpose(hj0)*@inverse(omega0)*
*@transpose(@rowextract(err0,(out1(!i,1)+1-!l-1)))+@transpose(hk0)*
*@inverse(omega0)*@transpose(@rowextract(err0,(out1(!i,1)+2-!l-1)))+
+@transpose(hw0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+3-!l-1)))+
+@transpose(hz0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+4-!l-1)))+
+@transpose(hy0)*@inverse(omega0)*@transpose
(@rowextract(err0,(out1(!i,1)+5-!l-1)))
endif
'——————-
'calculate theta for this iteration
matrix theta%name%zero=@inverse(hh0)*hv0
delete r_?
delete r_??
delete res0
delete ve0
delete betafull0
delete away
delete omega0
```

```
delete err0
delete h?0
'———-
'create iteration counter !s and convergence measure !t
!s=0
!t=100
while !s<999 and !t>0.0001
'—————-
'create labels to count iterations on the same dummy
%old="_"+@str(!s)
%new="_"+@str(!s+1)
'create new endogenous variable X(t) = Y(t) - theta*D
matrix endo%name%new = endo0-@transpose(theta%name%old*
*@transpose(x%name))
delete alpha%name%old
delete beta%name%old
delete gamma?%name%old
'create label to count iterations on the same dummy
%c=%name+%new
'and move new endogenous variable to group gr%c
mtos(endo%name%new,gr%c)
'start new iteration to estimate theta
var v%c.ec(%tr, %r) %b %z gr%c @ %first %it
v%c.makeresids r_1 r_2 r_3 r_4 r_5
group res%c r_1 r_2 r_3 r_4 r_5
matrix err%c=@convert(res%c)
matrix omega%c = @cov(res%c)
scalar llk%c=v%c.@logl
delete ser??
matrix betafull%c
betafull%c = v%c.@cointvec
'**************
If %tr="d" then
matrix (5,7) away
away(1,1)=1
away(2,2) =1
away(3,3) =1
away(4,4) =1
away(5,5) =1
else
matrix (5,6) away
away(1,1)=1
away(2,2) =1
away(3,3) =1
away(4,4) =1
```

```
away(5,5) =1
endif
'______
matrix beta%c = away*betafull%c
matrix (5,%r) alpha%c
matrix (5,5) gamma1%c
matrix (5,5) gamma2%c
matrix (5,5) gamma3%c
matrix (5,5) gamma4%c
'***
for !u =1 to 5
for !rp =1 to !r
alpha%c(!u,!rp)=v%c.a(!u,!rp)
next
next
'***
'+++++++++++
if !l=1 then
for !p =1 to 5
for !q =1 to 5
gamma1%c (!p,!q)= v%c.c(!p,!q)
next
next
endif
if !l=2 then
for !p =1 to 5
for !q =1 to 5
gamma1%c (!p,(!q))= v%c.c(!p,!q*!l-1)
gamma2%c (!p,!q)= v%c.c(!p,!q*!l)
next
next
endif
if !l=3 then
for !p =1 to 5
for !q =1 to 5
gamma1%c (!p,!q)=v%c.c(!p,(!q*!l-2))
gamma2%c (!p,!q)=v%c.c(!p,!q*!l-1)
gamma3%c (!p,!q)=v%c.c(!p,!q*!l)
next
next
endif
if !l=4 then
for !p =1 to 5
for !q =1 to 5
gamma1%c (!p,!q)=v%c.c(!p,(!q*!l-3))
```

```
gamma2%c (!p,!q)=v%c.c(!p,(!q*!l-2))
gamma3%c (!p,!q)=v%c.c(!p,(!q*!l-1))
gamma4%c (!p,!q)=v%c.c(!p,(!q*!l))
next
next
endif
'+++++++++++++
matrix hi%c=@identity(5)
matrix hj%c=-@identity(5)-alpha%c*@transpose(beta%c)-alpha%c*
*@transpose(beta%c)-gamma1%c
matrix hk%c =gamma1%c- gamma2%c
matrix hw%c =gamma2%c - gamma3%c
matrix hz%c =gamma3%c - gamma4%c
matrix hy%c =gamma4%c
matrix hh%c =@transpose(hi%c)*@inverse(omega%c)*hi%c+
+@transpose(hj%c)*@inverse(omega%c)*hj%c+
+@transpose(hk%c)*@inverse(omega%c)*hk%c
'------------------
If !l=1 then
matrix hv%c =@transpose(hi%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)-!l-1)))+@transpose(hj%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+1-!l-1)))+
+@transpose(hk%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+2-!l-1)))
endif
if !l =2 then
matrix hv%c = @transpose(hi%c)*@inverse(omega%c)*
*@transpose(@rowextract(err%c,(out1(!i,1)-!l-1)))+@transpose(hj%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+1-!l-1)))+
+@transpose(hk%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+2-!l-1)))+
+@transpose(hw%c)*@inverse(omega%c)*
*@transpose(@rowextract(err%c,(out1(!i,1)+3-!l-1)))
endif
if !l =3 then
matrix hv%c = @transpose(hi%c)*@inverse(omega%c)*
+@transpose(@rowextract(err%c,(out1(!i,1)-!l-1)))+
+@transpose(hj%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+1-!l-1)))+@transpose(hk%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+2-!l-1)))+
+@transpose(hw%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+3-!l-1)))+@transpose(hz%c)*@inverse(omega%c)*
*@transpose(@rowextract(err%c,(out1(!i,1)+4-!l-1)))
endif
if !l =4 then
```

```
matrix hv%c = @transpose(hi%c)*@inverse(omega%c)*
@transpose(@rowextract(err%c,(out1(!i,1)-!l-1)))+
+@transpose(hj%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+1-!l-1)))+@transpose(hk%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+2-!l-1)))+
+@transpose(hw%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+3-!l-1)))+@transpose(hz%c)*
*@inverse(omega%c)*@transpose(@rowextract(err%c,(out1(!i,1)+4-!l-1)))+
+@transpose(hy%c)*@inverse(omega%c)*@transpose
(@rowextract(err%c,(out1(!i,1)+5-!l-1)))
endif
'————————-
'calculate theta for this iteration
matrix th%c=@inverse(hh%c)*hv%c
matrix (5,1) theta%c
matplace(theta%c,th%c,1,1)
delete res%c
delete err%c
delete betafull%c
delete away
delete omega%c
delete v%c
delete gr%c
delete r_?
delete h?%c
'calculate the norm - i.e. is the largest column sum in a matrix and no element in a matrix can exceed that of the norm - as the measure for convergence of theta between the latest two iterations
scalar conv%c=@norm(theta%c-theta%name%old)
'set conv%c as a counter of convergence and step up iteration counter at !s+1
'————
if -2*(llk%it-llk%c)<0 then
%prev="_"+@str(!s-1)
theta%c=theta%name%old
llk%c=llk%name%old
!s=999
else
'************
delete theta%name%old
!t= conv%c
!s=!s+1
endif
'————-
wend
```

```
delete conv????
delete conv?????
delete conv??????
delete conv???????
delete endo????
delete endo?????
delete endo??????
delete endo???????
delete alpha????
delete alpha?????
delete alpha??????
delete alpha???????
delete alpha????????
delete beta????
delete beta?????
delete beta??????
delete beta???????
delete beta????????
delete gamma????
delete gamma?????
delete gamma??????
delete gamma???????
delete gamma????????
delete gamma?????????
'delete the???
'———-
'create table with position of observations of potential outliers, likelihood and t(AO)
table (!e+1,9) aoall%it
setcell (aoall%it, 1,1,"out1")
setcell (aoall%it, 1,2,"obs.")
setcell (aoall%it, 1,3,"t_AO")
setcell (aoall%it, 1,4,"theta_cr")
setcell (aoall%it, 1,5,"theta_yc")
setcell (aoall%it, 1,6,"theta_kc")
setcell (aoall%it, 1,7,"theta_op")
setcell (aoall%it, 1,8,"theta_rr")
setcell (aoall%it, 1,9,"llk")
setcell (aoall%it, !i+1,1,out1(!i,1))
setcell (aoall%it, !i+1,2,@otod(out1(!i,1)))
setcell (aoall%it, !i+1,3,-2*(llk%it-llk%c))
setcell (aoall%it, !i+1,4,theta%c(1,1))
setcell (aoall%it, !i+1,5,theta%c(2,1))
setcell (aoall%it, !i+1,6,theta%c(3,1))
setcell (aoall%it, !i+1,7,theta%c(4,1))
```

```
setcell (aoall%it, !i+1,8,theta%c(5,1))
setcell (aoall%it, !i+1,9,llk%c)
delete x%name
delete d%name
delete th????
delete th?????
delete th??????
delete th???????
delete th????????
delete theta?????
delete theta??????
delete theta???????
delete theta????????
next
'STEP 5: create new out2 vector
vector(!e-1) out2
for !i = 1 to !d-1
out2(!i)=out1(!i)
next
'______
if !d+1<!e then
for !i =!d+1 to !e
out2(!i-1)=out1(!i)
next
endif
delete llk????
delete llk?????
delete llk??????
delete llk???????
```

4.6.4 Diagnostic and estimation results

Table 4.2: Some Summary Statistics by Country

Country	GNI	WB Class.	IFD	ENDFD	DFD	DYP	AOP	Start	End	Obs	Gini 1985	Gini 2000	C(Y,FD)	C(DY,FD)	C(OP,FD)	C(DOP,FD)
Central Afr. Rep.	410	L	13.9	7.03	1.4%	-0.8%	51.90	1961	2008	47			0.85	0.13	0.89	-0.01
Chile	9,370	UM	8.66	88.53	4.4%	2.7%	48.25	1961	2007	46	54.91	56.90	0.75	0.17	0.84	-0.06
Ecuador	3,690	LM	18.1	27.12	4.0%	1.6%	51.80	1970	2008	38	44.40	56.00	0.35	-0.24	0.04	0.01
Finland	47,600	H	45.1	82.01	3.4%	3.0%	56.12	1961	2007	46	22.40	28.00	0.72	-0.46	0.39	0.08
Ghana	630	L	5.78	17.79	2.9%	0.3%	50.70	1961	2006	45	35.30	40.70	0.69	0.30	0.79	-0.12
India	1,040	LM	14.7	50.36	5.1%	3.0%	18.38	1963	2008	45	32.00	36.00	0.86	0.48	0.86	0.32
Italy	35,460	H	71.9	101.79	2.8%	2.5%	41.74	1965	2007	42	32.50	35.80	0.30	-0.20	0.43	0.25
Kenya	730	L	12.7	26.40	4.7%	1.3%	59.79	1967	2008	41	57.00	44.50	0.90	-0.26	-0.20	0.05
Morocco	2,520	LM	25.5	79.50	4.5%	2.2%	52.60	1961	2008	47	39.70	39.40	0.97	0.03	0.93	0.22
Pakistan	950	L	25.7	29.38	5.3%	2.5%	32.50	1967	2007	40	28.40	29.60	0.44	0.07	0.03	0.23
Peru	3,990	UM	16.6	25.09	3.6%	1.3%	35.94	1961	2008	47	42.70	49.33	0.34	0.03	0.17	0.16
Venezuela	9,230	UM	28.6	21.52	3.1%	0.4%	47.85	1962	2008	46	44.90	45.80	0.23	-0.18	-0.20	-0.02

NOTES

GNI = Real per capita Gross National Income in current US dollar (Atlas method) for the year 2008; obtained from World Development Report, 2009.

WB Classification: The country groups by GNI are: Low income countries, (GNI of US$975 or less); Lower Middle income countries, (GNI between US$976 and US$3,885); Upper Middle income countries, (GNI between US$3,886 and $11,905); and High income countries (GNI above US$11,906).

IFD = financial development as measured by credit to the private sector as a percentage of GDP at the initial (i.e., first) year of the sample period.

ENDFD = financial development at the end (i.e. final) year of the sample period.

DFD = average annual percentage growth rate of financial development during the sample period.

DYP = average annual percentage growth rate of real per capita income during the sample period.

AOP = financial openness as measured by imports plus exports as a percentage of GDP average for the sample period.

Obs = number of annual observations.

Gini = coefficient that measures the area between the 45-degree line and the Lorenz curve, divided by 1/2, the total area under the 45-degree line. The Gini coefficient will be equal to 0 when the distribution is equal and equal to 100 when all the income is owned by a single person. Source UNU-WIDER.

C(Y, FD) = correlation between the level of financial development and the level of real per capita income.

C(DY,FD) = correlation between the level of financial development and the rate of growth of real per capita income.

C(OP, FD) = correlation between the level of financial openness and the level of real per capita income.

C(DY,FD) = correlation between the rate of growth of financial openness and level of financial development.

Figure 4.1: Financial Development and Openness - FC countries

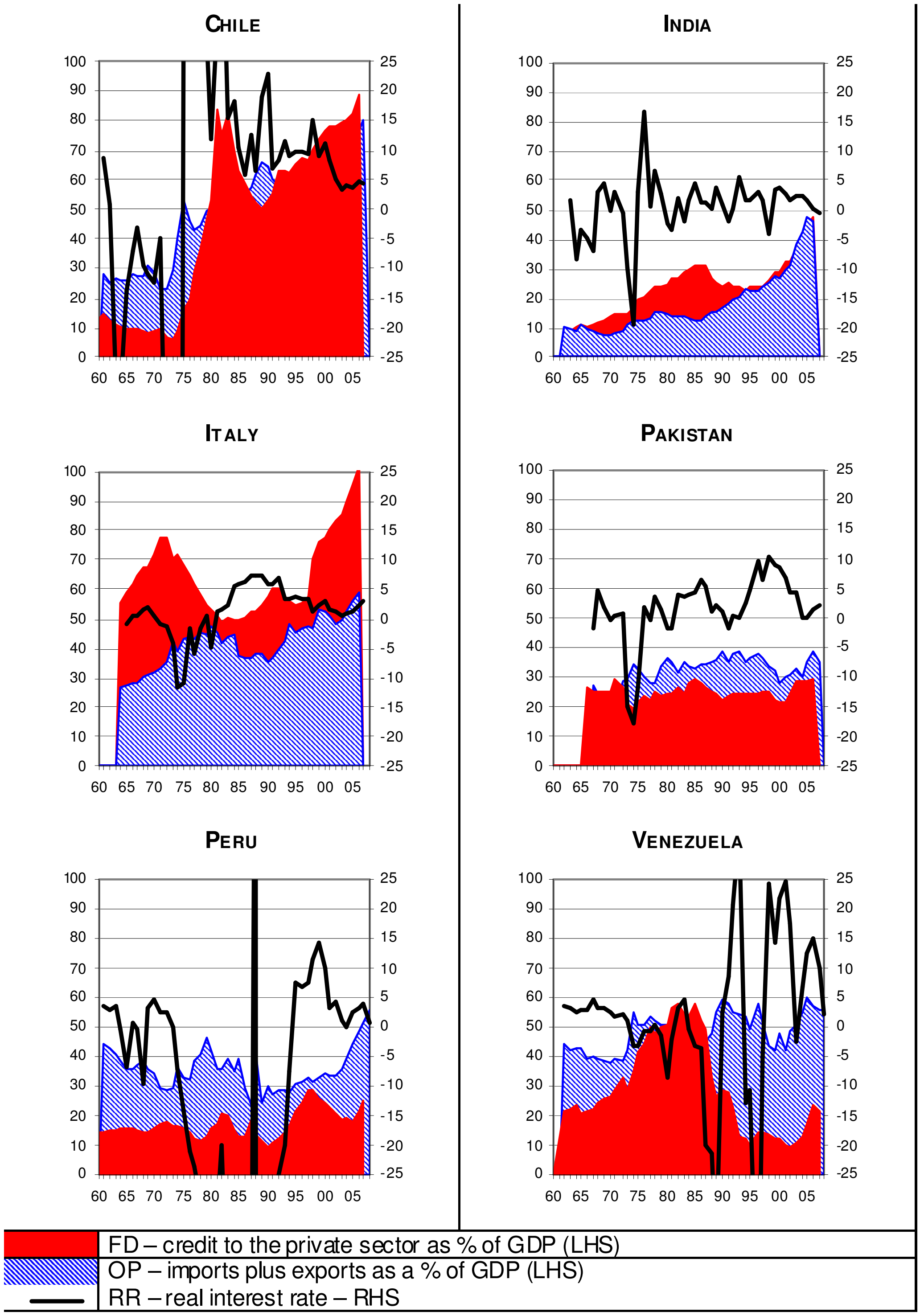


Figure 4.2: Financial Development and Openness - FO countries

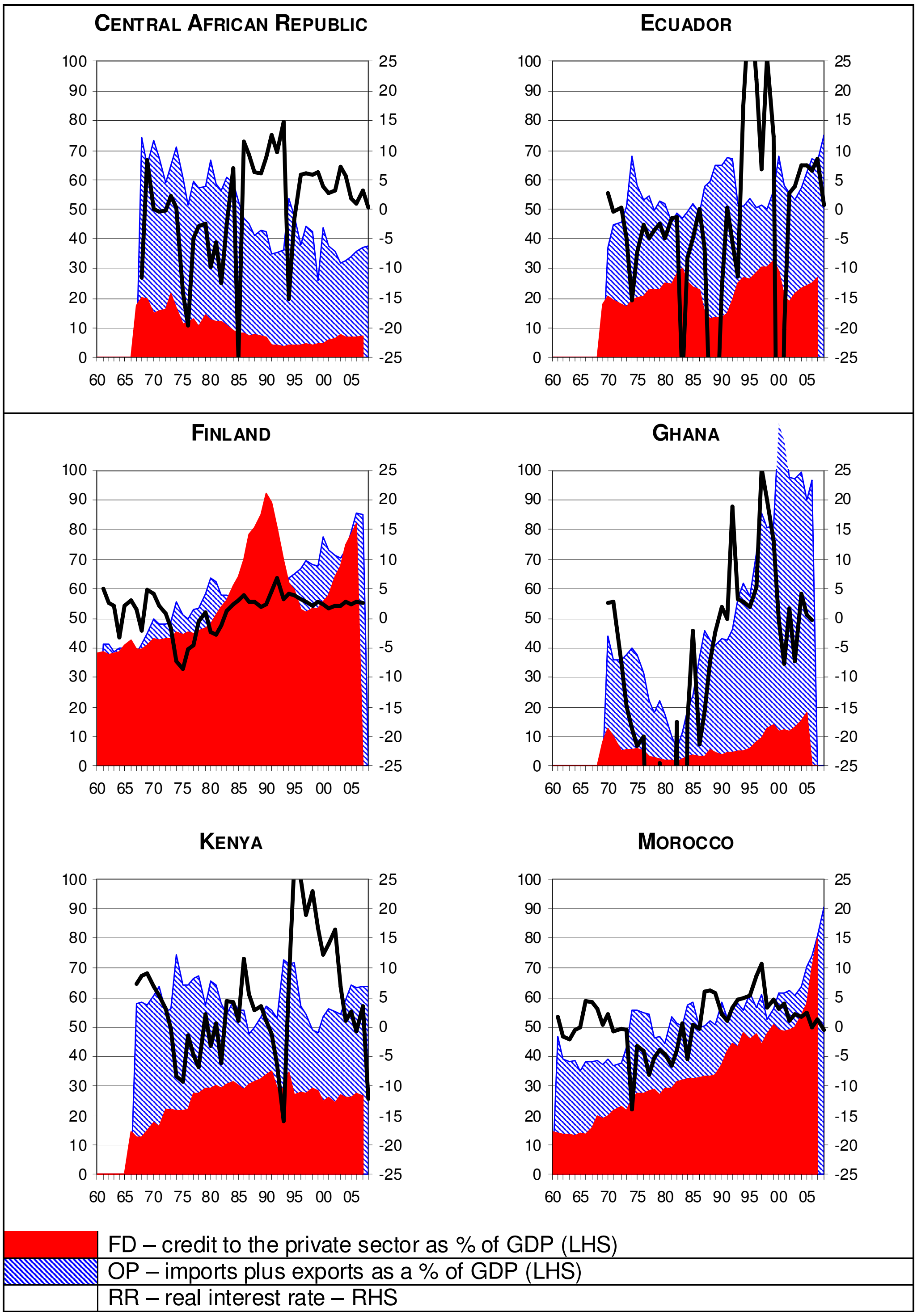


Table 4.3: Unit Root Test and Sequential Break Tests - FC countries

COUNTRY	Level Variables						Differentiated Variables		
	ADF(ii)		KPSS (iii)		SBT (iv)			ADF(ii)	KPSS
Variable	Lag (i)	Adj. t-stat	No. obs.	LM stat	t_a	T_b	Variable	Adj. t-stat	LM stat
CHILE									
FD	2	-1.18	47	0.76 **	-4.37	1977	**D(FD)**	-2.69 **	0.08
YP	2	0.66	47	0.82 **	-3.48	1970	**D(YP)**	-3.16 *	0.27
KP	2	0.46	47	0.83 **	-3.04	1990	**D(KP)**	-2.16	0.31
OP	2	-0.09	47	0.84 **	-3.42	1970	**D(OP)**	-4.43 *	0.16
RR	2	-2.93 *	47	0.19	-5.85	1972 *	**D(RR)**	-4.48 *	0.28
INDIA									
FD	3	0.24	44	0.71 **	-2.91	1987	**D(FD)**	-1.12	0.18
YP	3	3.02	44	0.81 **	-0.83	1970	**D(YP)**	-2.38	0.79 **
KP	3	1.92	44	0.84 **	-2.12	2003	**D(KP)**	1.24	0.78 **
OP	3	2.56	44	0.74 **	-1.82	2002	**D(OP)**	-0.44	0.57 **
RR	3	-4.72 *	44	0.36 *	-8.54	1973 *	**D(RR)**	-4.87 *	0.19
ITALY									
FD	2	0.00	43	0.26	-2.06	1997	**D(FD)**	-2.00	0.34
YP	2	-3.72 *	43	0.81 **	-2.76	2001	**D(YP)**	-2.69 **	0.75 **
KP	2	-4.12 *	43	0.79 **	-4.76	1971	**D(KP)**	-1.13	0.70 **
OP	2	-0.87	43	0.61 **	-4.41	1984	**D(OP)**	-3.26 *	0.11
RR	2	-1.40	43	0.30	-3.37	1979	**D(RR)**	-2.94 *	0.08
PAKISTAN									
FD	2	-2.39	41	0.11	-3.02	1971	**D(FD)**	-4.10 *	0.21
YP	2	-0.16	41	0.78 **	-3.14	1995	**D(YP)**	-2.81 **	0.09
KP	2	-0.11	41	0.78 **	-3.58	1977	**D(KP)**	-2.08	0.13
OP	2	-2.71 *	41	0.48 **	-4.59	1970	**D(OP)**	-4.29 *	0.13
RR	2	-2.52	41	0.38 *	-4.05	1976	**D(RR)**	-4.57 *	0.20
PERU									
FD	3	-1.69	48	0.40 *	-4.63	1994	**D(FD)**	-3.10 *	0.07
YP	3	-0.99	48	0.16	-3.32	1986	**D(YP)**	-3.50 *	0.20
KP	3	-1.41	48	0.64 **	-4.18	1987	**D(KP)**	-2.69 **	0.15
OP	3	-0.93	48	0.14	-2.31	2003	**D(OP)**	-3.17 *	0.39 *
RR	3	-3.11 *	48	0.13	-14.9	1991 *	**D(RR)**	-5.04 *	0.50 **
VENEZUELA									
FD	3	-1.20	47	0.26	-5.00	1987 *	**D(FD)**	-2.21	0.31
YP	3	-1.80	47	0.57 **	-3.07	1981	**D(YP)**	-2.57	0.16
KP	3	-2.08	47	0.21	-3.18	1987	**D(KP)**	-1.75	0.40 *
OP	3	-2.42	47	0.45 *	-4.24	1995	**D(OP)**	-3.15 *	0.04
RR	3	-4.30 *	47	0.17	-6.48	2000 *	**D(RR)**	-6.17 *	0.17

NOTES

(i) Lag is for variables in level.

(ii) H(0) for ADF test: Series has a unit root. ADF test is calculated with the lag set in coloumn 2.

(iii) H(0) for KPSS test: Series is stationary.

(iv) SBT is Sequential Break test for IO model 1 from Perron (1997) and the common lag. H(0) for SBT is no-break unit root. SBT critical value is: -5.23 (5% level).

** and * indicate rejection of H(0) at 10% and 5% significance level respectively.

Table 4.4: Unit Root Test and Sequential Break Tests - FO countries

COUNTRY	Level Variables						Differentiated Variables		
	ADF(ii)		KPSS (iii)		SBT (iv)			ADF(ii)	KPSS
Variable	Lag (i)	Adj. t-stat	No. obs.	LM stat	t_a	T_b	Variable	Adj. t-stat	LM stat
C. AFR. REP.									
FD	2	-2.20	41	0.68 **	-3.03	2000	**D(FD)**	-5.41 *	0.39 *
YP	2	-0.91	41	0.74 **	-3.48	1988	**D(YP)**	-3.73 *	0.11
KP	2	0.43	41	0.78 **	-4.41	1998	**D(KP)**	-2.95 *	0.31
OP	2	-1.67	41	0.74 **	-3.54	1985	**D(OP)**	-4.67 *	0.11
RR	2	-2.34	41	0.42 *	-5.45	1984 *	**D(RR)**	-5.56 *	0.23
ECUADOR									
FD	2	-2.39	39	0.19	-3.25	1986	**D(FD)**	-2.49	0.05
YP	2	-1.84	39	0.67 **	-5.24	2002 *	**D(YP)**	-2.70 **	0.17
KP	2	-2.47	39	0.72 **	-4.58	1973	**D(KP)**	-1.70	0.47 **
OP	2	-2.14	39	0.48 **	-3.06	1985	**D(OP)**	-3.21 *	0.07
RR	2	-2.92 *	39	0.12	-3.66	1992	**D(RR)**	-4.64 *	0.26
FINLAND									
FD	1	-1.60	47	0.58 **	-4.33	1990	**D(FD)**	-2.43	0.07
YP	1	-1.08	47	0.87 **	-5.83	1988 *	**D(YP)**	-4.41 *	0.15
KP	1	-1.49	47	0.82 **	-4.25	1989	**D(KP)**	-2.88 **	0.43 *
OP	1	-0.35	47	0.73 **	-3.89	1983	**D(OP)**	-4.80 *	0.14
RR	1	-2.64 *	47	0.30	-3.82	1981	**D(RR)**	-5.55 *	0.17
GHANA									
FD	2	0.34	46	0.28	-2.27	1970	**D(FD)**	-2.83 **	0.40 *
YP	2	-1.23	46	0.26	-2.92	1973	**D(YP)**	-3.14 *	0.38 *
KP	2	-1.21	46	0.20	-1.75	1974	**D(KP)**	-0.66	0.43 *
OP	2	0.08	46	0.50 **	-3.43	1974	**D(OP)**	-3.04 *	0.43 *
RR	2	-1.59	46	0.22	-4.49	1982	**D(RR)**	-5.01 *	0.05
KENYA									
FD	1	-2.57	42	0.42 *	-3.10	1976	**D(FD)**	-5.68 *	0.24
YP	1	-2.87 *	42	0.50 **	-7.20	1969 *	**D(YP)**	-4.35 *	0.31
KP	1	-3.30 *	42	0.62 **	-3.52	1990	**D(KP)**	-1.72	0.62 **
OP	1	-3.01 *	42	0.12	-3.51	1980	**D(OP)**	-5.64 *	0.14
RR	1	-2.39	42	0.20	-3.77	1992	**D(RR)**	-5.14 *	0.12
MOROCCO									
FD	3	1.43	48	0.91 **	-2.69	2005	**D(FD)**	-0.54	0.38 *
YP	3	-0.08	48	0.90 **	-3.76	1990	**D(YP)**	-4.14 *	0.09
KP	3	-1.53	48	0.87 **	-4.11	1972	**D(KP)**	-1.83	0.21
OP	3	0.48	48	0.82 **	-3.78	2005	**D(OP)**	-3.38 *	0.31
RR	3	-1.66	48	0.30	-3.31	1985	**D(RR)**	-3.53 *	0.09

NOTES

(i) Lag is for variables in level.

(ii) H(0) for ADF test: Series has a unit root. ADF test is calculated with the lag set in coloumn 2.

(iii) H(0) for KPSS test: Series is stationary.

(iv) SBT is Sequential Break test for IO model 1 from Perron (1997) and the common lag. H(0) for SBT is no-break unit root. SBT critical value is: -5.23 (5% level).

** and * indicate rejection of H(0) at 10% and 5% significance level respectively.

Table 4.5: Johansen's Cointegration Test - FC countries

COUNTRY Lag, trend (i)	Eigenv.	Trace Stat	p-val (ii)	Max Eigen	p-val (ii)	LM(iii) / JB(iv)	h+1 / df	p-val / p-val
CHILE	0.59	102.4	0% **	39.63	1% **			
2b	0.49	62.73	1% **	29.76	4% **	29.91	3	23%
	0.38	32.97	9% *	20.72	8% *	66.17	10	0%
	0.16	12.25	43%	7.86	56%			
	0.09	4.39	36%	4.39	36%			
INDIA	0.59	87.44	0% **	35.81	3% **			
3c	0.49	51.63	2% **	27.26	5.5% *	16.85	4	89%
	0.30	24.38	19%	14.45	33%	7.95	10	63%
	0.18	9.92	29%	7.99	38%			
	0.05	1.93	16%	1.93	16%			
ITALY	0.70	117.30	0% **	48.08	0% **			
2d	0.55	69.22	2% **	32.39	5% **	26.91	3	36%
	0.31	36.83	18%	14.97	64%	34.88	10	0%
	0.26	21.87	15%	12.27	39%			
	0.21	9.60	15%	9.60	15%			
PAKISTAN	0.77	115.80	0% **	55.23	0% **			
2d	0.48	60.57	9% *	25.18	28%	13.14	3	96%
	0.35	35.39	23%	16.61	49%	4.10	10	94%
	0.27	18.79	29%	11.93	42%			
	0.17	6.86	36%	6.86	36%			
PERU	0.80	127.44	0% **	69.79	0% **			
3b	0.59	57.65	2% **	38.83	0% **	33.36	4	12%
	0.24	18.82	80%	12.27	63%	8.62	10	57%
	0.11	6.56	92%	4.88	90%			
	0.04	1.67	84%	1.67	84%			
VENEZUELA	0.71	104.89	0% **	52.67	0% **			
3b	0.39	52.22	7% *	21.60	30%	18.16	4	84%
	0.32	30.62	14%	16.35	27%	20.84	10	2%
	0.20	14.27	27%	9.65	37%			
	0.10	4.61	33%	4.61	33%			

NOTES

(i) Lag is in VEC i.e. for differentiated variables. Trend assumptions:
b = No deterministic trend in the data, and an intercept but no trend in the cointegrating equation
c = Linear trend in the data, and an intercept but no trend in the cointegrating equation
d = Linear trend in the data, and both an intercept and a trend in the cointegrating equation
(ii) MacKinnon-Haug-Michelis (1999) p-values
(iii) VEC Residual Serial Correlation LM Test. H0: no residual autocorrelations at lag h+1 where (h+1) = lag((VEC) +1). Prob from chi-square with 25 df.
(iv) JB = Jarque Bera Test. H0: residuals are multivariate N.

Table 4.6: Johansen's Cointegration Test - FO countries

COUNTRY Lag, trend (i)	Eigenv.	Trace Stat	p-val (ii)		Max Eigen	p-val (ii)		LM(iii) / JB(iv)	h+1 / df	p-val / p-val
CEN. AF. REP.	0.65	102.4	0%	**	39.69	3%	**			
2d	0.55	62.75	4%	**	30.38	8%	*	19.19	3	79%
	0.38	32.37	37%		18.37	35%		10.90	10	37%
	0.24	14.01	66%		10.53	56%				
	0.09	3.48	82%		3.48	82%				
ECUADOR	0.72	107.3	0%	**	45.90	1%	**			
2d	0.59	61.39	8%	*	32.28	5.1%	*	15.86	3	92%
	0.27	29.11	56%		11.56	90%		24.50	10	1%
	0.26	17.54	38%		10.99	51%				
	0.17	6.55	39%		6.55	39%				
FINLAND	0.57	72.68	3%	**	37.55	2%	**			
1c	0.34	35.13	44%		18.97	42%		17.82	2	85%
	0.19	16.16	70%		9.75	77%		147.3	10	0%
	0.13	6.41	65%		6.12	60%				
	0.01	0.29	59%		0.29	59%				
GHANA	0.61	94.24	0%	**	40.30	1%	**			
2b	0.44	53.94	4.8%	**	24.75	14%		23.64	3	54%
	0.30	29.20	19%		15.64	32%		42.49	10	0%
	0.19	13.56	32%		9.06	43%				
	0.10	4.50	34%		4.50	34%				
KENYA	0.60	100.86	0%	**	36.22	3%	**			
1b	0.54	64.65	0%	**	31.40	2%	**	22.21	2	62%
	0.40	33.25	8%	*	20.74	8%	*	21.27	10	2%
	0.18	12.50	40%		8.11	53%				
	0.10	4.39	36%		4.39	36%				
MOROCCO	0.66	100.60	0%	**	47.70	0%	**			
3c	0.41	52.90	2%	**	23.55	15%		24.08	4	51%
	0.30	29.35	6%	*	15.44	26%		15.65	10	11%
	0.20	13.91	9%	*	9.65	24%				
	0.09	4.26	4%		4.26	4%				

NOTES

(i) Lag is in VEC i.e. for differentiated variables. Trend assumptions:
b = No deterministic trend in the data, and an intercept but no trend in the cointegrating equation
c = Linear trend in the data, and an intercept but no trend in the cointegrating equation
d = Linear trend in the data, and both an intercept and a trend in the cointegrating equation
(ii) MacKinnon-Haug-Michelis (1999) p-values
(iii) VEC Residual Serial Correlation LM Test. H0: no residual autocorrelations at lag h+1 where (h+1) = lag((VEC) +1). Prob from chi-square with 25 df.
(iv) JB = Jarque Bera Test. H0: residuals are multivariate N.

Table 4.7: Outlier Detetection and Estimation - FC countries

	Excess standard dev					Iteration 0		Iteration 1		Iteration 2		Iteration 3		Iteration 4		Iteration 5		Iteration 6		Total
Year	FD	YP	KP	OP	RR	IO	AO	IO	AO	IO	AO	IO	AO	IO	AO	IO	AO	IO	AO	
CHILE: (Rank = 2, Lag = 2, Trend = b)																				
1966		2.20				9.65	3.99	9.24	6.86	7.51	0.62	9.13	4.20	10.23	3.57					
1971				-2.54		22.74 *	10.46	14.67	21.96 *	14.89	23.24 *	17.25	23.15 *	19.07	19.73					
1973			-2.59		-4.56	67.60 *	2.10													d1_73
1978					2.46	27.18 *	5.46	22.59 *	3.95	25.77 *	0.07									d3_78
1982	3.89	-2.42				60.98 *	15.35	59.84 *	11.74											d2_82
1993			2.22			16.93	5.01	12.11	7.14	14.83	0.09	25.79 *	7.46							d4_93
1999			-2.14			7.91	0.59	9.08	8.38	15.14	5.94	16.67	4.94	16.93	3.44					
INDIA: (Rank = 2, Lag = 3, Trend = c)																				
1974					-3.38	37.35 *	3.18													d1_74
1976					2.11	23.92 *	6.66	32.01 *	7.36											d2_76
1978					2.14	15.78	5.71	19.62	12.19	16.53	4.91	15.80	13.01	13.49	5.36					
1984		-2.94				24.58 *	19.21	27.42 *	26.94 *	26.90 *	12.86	24.24 *	4.82							d4_84
1988		2.75				23.05 *	15.93	23.59 *	16.01	27.65 *	14.79									d3_88
1989	-2.36					21.43 *	3.70	22.82 *	4.03	23.92 *	3.60	22.20 *	2.82	14.96	1.94					
ITALY: (Rank = 2, Lag = 2, Trend = d)																				
1970		2.06				7.76	8.56	10.13	15.12	12.83	17.56	12.83	18.64	11.72	17.50	16.23	21.25 *			70_ yc
1973				-2.00		11.87	5.50	18.51	3.55	19.30	4.55	19.24	3.73	17.35	2.76	20.14 *	4.80	28.92 *	6.80	d6_73
1974			2.26		-2.67	39.27 *	7.29													d1_74
1981					2.75	20.39	8.99	15.20	5.08	15.62	1.60	17.55	5.55	22.28 *	10.12					d5_81
1986				-2.84		17.42	15.49	18.13	11.95	19.04	-5.87	21.30 *	0.23							d4_86
1993		-3.20	-2.46			28.10 *	5.84	30.79 *	7.84	26.76 *	4.19									d3_93
1999	3.59					32.33 *	12.17	35.28 *	12.32											d2_99
PAKISTAN: (Rank = 1, Lag=2, Trend =d)																				
1992			2.71			11.99	5.73	12.64	7.90											
1996					2.10	9.55	11.40	10.15	12.24											
1997			-2.16			9.68	6.77	11.66	0.27											
2004	2.29					25.36 *	8.64													d1_04
PERU: (Rank = 2, Lag = 3, Trend = b)																				
1970			-2.56			21.29 *	9.27	17.89	0.71	26.01 *	0.95	34.13 *	1.08							d4_70
1974		2.48	2.79	2.13		16.40	4.31	13.00	0.27	16.77	9.38	15.72	10.12	23.17 *	13.94	26.72 *	12.66			d6_74
1979				2.35		14.74	8.55	17.67	2.05	16.52	5.09	15.43	1.80	16.26	19.27	19.57	7.22	18.86	6.61	
1980		-2.50				14.35	8.83	18.65	6.99	11.91	9.88	18.88	9.85	23.33 *	10.82					d5_80
1984		2.07				35.23 *	7.37	29.95 *	9.72	29.06 *	6.87									d3_84
1988	2.17		2.17			43.54 *	0.74	51.47 *	0.93											d2_88
1989					-2.05	54.14 *	0.01													d1_89
1998				-2.27		19.85	5.67	20.06	5.45	22.32 *	5.81	22.19 *	8.35	22.38 *	9.59	21.13 *	7.15	19.74	6.78	
VENEZUELA: (Rank = 1, Lag = 3, Trend = b)																				
1974	-2.15			2.81		15.29	17.2	15.25	3.52	25.11 *	3.90	32.36 *	7.73							d4_74
1975					-2.20	25.83 *	2.86	20.33 *	0.77	19.16	0.15	21.21 *	0.01	24.86 *	1.00	23.59 *	0.92			d6_75
1983			-2.33	-2.97		35.10 *	23.89 *	35.14 *	18.08	34.95 *	17.08									d3_83
1989	-3.51	-3.36	-2.69			36.59 *	18.94	37.64 *	3.52											d2_89
1993					2.18	14.60	11.13	10.33	8.79	13.51	8.12	11.93	6.16	12.43	8.89	11.43	1.13	17.14	3.53	
1995				-2.32		13.62	11.76	16.49	9.08	15.31	12.10	15.06	11.90	35.40 *	21.13 *					d5_95
1996					-2.57	50.19 *	6.08													d1_96

NOTES

Lag is in VEC i.e. for differentiated variables. Trend assumptions: b = no deterministic trend in the data, and an intercept but no trend in the cointegrating equation; c = linear trend in the data, and an intercept but no trend in the cointegrating equation; d = linear trend in the data, and both an intercept and a trend in the cointegrating equation.

Chi. Sq = critical value calculated with the Bonferroni inequality to ensure an overall type I error probability below 5%.

IO (AO) = likelihood ratio test obtained by the ratio of the likelihood of the ECM model with all dummies detected up to iteration n and that at iteration n-1 or no dummies at the iteration 0.

* indicates 5% significance with respect to critical value ranging from 19.94 for Pakistan to 20.31 for Peru.

Table 4.8: Outlier Detetection and Estimation - FO countries

	Excess standard dev					Iteration 0		Iteration 1		Iteration 2		Iteration 3		Iteration 4		Iteration 5		Iteration 6		Total
Year	FD	YP	KP	OP	RR	IO	AO	IO	AO	IO	AO	IO	AO	IO	AO	IO	AO	IO	AO	
CEN. AF. REP.: (Rank = 2, Lag = 2, Trend = d)																				
1974	2.92					30.69 *	14.22	29.97 *	21.06 *											d2_74
1980	2.31		-2.15	2.25		21.04 *	2.07	19.31	8.81	31.61 *	8.49	25.97 *	11.41							d4_80
1983		-2.05				10.94	2.01	15.86	1.61	19.46	1.71	23.08 *	1.92	23.82 *	0.30	28.02 *	0.45			d6_83
1992		-2.08				10.73	6.97	7.91	5.47	8.08	12.73	9.21	0.03	11.55	4.09	11.17	4.03	13.59	4.66	
1994				2.75	-3.67	25.95 *	13.21	28.28 *	9.73	38.95 *	16.44									d3_94
1996			-2.47			31.13 *	27.13 *													d1_96
2000				2.32	-2.03	11.85	2.62	12.48	4.32	18.69	7.18	25.92 *	13.61	27.39 *	6.88					d5_00
2003		-2.24				9.30	6.54	11.43	4.56	17.36	5.45	15.35	7.09	20.29 *	7.06	24.78 *	9.85	32.61 *	11.79	d7_03
ECUADOR: (Rank = 1, Lag = 2, Trend = d)																				
1973					2.13	19.11	3.17	16.91	1.14	19.37	1.88	18.16	2.75	16.30	3.70	10.25	3.26			
1983	3.00					17.55	4.10	25.99 *	8.50	24.32 *	9.89									d3_83
1988	-2.58					29.54 *	12.09	40.94 *	10.82											d2_88
1993				-2.46		22.18 *	10.23	22.09 *	10.70	22.21 *	9.91	23.76 *	8.64	24.98 *	9.84					d5_93
1999		-3.11	-3.52			30.85 *	4.68	22.19 *	8.51	20.43 *	6.63	32.14 *	4.31							d4_99
2000					-3.15	61.23 *	10.55													d1_00
FINLAND: (Rank = 1, Lag = 1, Trend = c)																				
1964					-2.76	20.16	13.61	21.35 *	15.00	22.17 *	16.06	22.09 *	18.40	22.83 *	16.38					d5_64
1968					-2.16	8.65	7.84	9.87	7.96	11.47	3.46	13.60	3.54	12.90	3.13	21.52 *	6.59	20.14	4.66	
1969		2.70			2.47	23.81 *	6.70	24.42 *	8.77											d2_69
1972		2.99				19.17	12.46	19.60	2.83	28.46 *	4.88									d3_72
1974			3.15	2.58	-2.92	40.20 *	13.40													d1_74
1976			-2.09			12.56	3.24	12.79	6.45	13.81	5.51	14.38	7.36	14.94	7.56	14.25	6.84	14.62	7.29	
1986				-2.10		7.37	2.79	9.16	3.41	9.83	3.37	10.07	3.52	10.03	3.32	9.92	2.87	12.47	3.96	
1991	2.11	-3.28	-2.37			19.98	4.32	20.09	5.17	21.22 *	4.84	24.59 *	6.48							d4_91
2000				2.85		14.40	10.57	16.68	15.53	17.31	15.60	19.96	17.71	21.43 *	18.37	23.13 *	18.06			d6_00
2001				-2.03		7.76	3.23	9.88	3.63	9.11	3.17	10.84	3.00	10.76	3.35	9.45	2.11	11.12	3.55	
GHANA: (Rank = 2, Lag = 2, Trend = b)																				
1971	3.16					21.88 *	12.06	24.66 *	13.21	21.23 *	11.89	25.22 *	16.87	27.46 *	17.88					d5_71
1975		-2.65				15.99	5.63	15.13	4.77	14.71	4.11	19.62	6.28	20.91 *	9.40	21.85 *	8.84	25.52 *	8.63	d7_75
1982		-2.43				19.81	3.03	20.29 *	5.03	17.86	8.58	23.70 *	4.19	24.15 *	3.56	24.51 *	3.89			d6_82
1983		-2.12			-3.08	29.74 *	16.87	39.40 *	23.17 *											d2_83
1984			2.00		2.39	24.34 *	0.98	24.83 *	1.66	43.18 *	11.38									d3_84
1993			3.31			26.27 *	9.32	28.34 *	8.51	26.73 *	8.29	28.21 *	7.90							d4_93
2000				3.41		35.28 *	15.78													d1_00
KENYA: (Rank = 2, Lag = 1, Trend = b)																				
1970		-2.62				29.91 *	22.91 *	33.75 *	7.60											d2_70
1971		3.44	2.40			38.05 *	2.61													d1_71
1974				2.76		18.10	15.75	19.56	17.38	19.56	18.48	29.77 *	23.27 *							d4_74
1978	2.03		2.46			16.57	17.43	20.36 *	14.88	24.43 *	21.05 *	21.89 *	12.77	26.58 *	10.39					d5_78
1979			-2.31			10.90	6.45	7.73	4.26	11.49	6.97	15.35	8.33	12.40	8.45	10.67	7.48	13.93	9.60	
1983					2.04	9.06	9.08	8.82	11.19	10.07	10.87	8.80	9.58	9.68	11.42	10.13	15.28	9.78	8.77	
1985			2.09			8.50	6.07	12.92	7.11	13.16	6.52	14.60	7.08	13.50	11.58	20.40 *	16.41			d6_85
1993	-2.65			3.34		32.70 *	6.00	32.83 *	5.27	33.95 *	5.20									d3_93
MOROCCO: (Rank = 2, Lag = 3, Trend = c)																				
1967			2.13			8.74	3.15	8.22	3.39	7.89	2.29	19.03	0.40							
1970			2.47			20.19 *	6.12	18.88	3.21	20.66 *	0.00	18.63	7.62							
1974				3.30	-3.88	41.94 *	8.63													d1_74
1983			-2.16			10.99	1.78	14.45	2.55	15.04	2.25	14.78	0.20							
1994		2.45				25.86 *	5.37	25.46 *	4.07	31.66 *	5.39									d3_94
2004	-2.54					15.70	13.60	15.70	8.83	17.11	7.57	15.75	12.95							
2007	3.21					29.10 *		29.10 *												d2_07

NOTES

Lag is in VEC i.e. for differentiated variables. Trend assumptions: b = no deterministic trend in the data, and an intercept but no trend in the cointegrating equation; c = linear trend in the data, and an intercept but no trend in the cointegrating equation; d = linear trend in the data, and both an intercept and a trend in the cointegrating equation.

Chi. Sq = critical value calculated with the Bonferroni inequality to ensure an overall type I error probability below 5%.

IO (AO) = likelihood ratio test obtained by the ratio of the likelihood of the ECM model with all dummies detected up to iteration n and that at iteration n-1 or no dummies at the iteration 0.

Table 4.9: Detected outliers and events - FC Countries

COUNTRY	Year	CR	YP	KC	OP	RR	Event	Source
CHILE	1973			-2.59		-4.56	Coup d'etat	
	1978					2.46	6th year of double digit inflation. Labour law reform allowing dismissal "without cause"	
	1982	3.89	-2.42				Banking crisis (1982 -1985) and foreign currency bank debt default (1983-1990)	CK(2003), S&P(2002)
	1993			2.22			Slowdown in international trade. Elections	
INDIA	1974					-3.38	Oil shock. Double digit inflation and negative real interest rates	
	1976					2.11	Drop in inflation and negative interest rates	
	1984		-2.94				Religious riots. Assassination of Prime Minister I. Ghandi and Bhopal disaster	
	1988		2.75				Expansionary monetary policy	
ITALY	1970		2.06				End of "Autunno caldo": a period of strikes and social unrest	
	1973				-2.00		Oil shock. Double digit inflation and negative real interest rates	
	1974			2.26		-2.67		
	1981					2.75	Public finance reform takes interest rates back to positive values . Obligation for the Bak of Italy to buy public debt ends ("divorzio")	
	1986				-2.84		Slowdown in international trade	
	1993		-3.20	-2.46			During 1990–94, 58 banks (accounting for 11 percent of lending) were merged with other institutions.	CK(2003)
	1999	3.59					Financial liberalisation in preparation of access to euro	
PAKISTAN	2004	2.29					Expansionary monetary policy	
PERU	1970			-2.56			Import substitution + limits to foreing investments	
	1974		2.48	2.786	2.129		Oil shock. Double digit inflation and negative real interest rates	
	1980		-2.50				Slowdown in international trade	
	1984		2.072				Two large banks fails. Nationalization of the banking system in 1987. Debt crises (1983 - 1998)	CK(2003), LR(2002), MRS(2003)
	1988	2.17		2.172				
	1989					-2.05		
VENEZUELA	1974	-2.15			2.809		Major bank failures	CK(2003)
	1975					-2.20		
	1983			-2.33	-2.97		Banking crisis, foreign currency bond (1995-1997) and bank debt default (1983-1988, 1990)	MRS(2003), S&P(2002), LR(2002)
	1989	-3.51	-3.36	-2.69				
	1995				-2.32			
	1996					-2.57		

NOTES:
CK(2003): Caprio, G., Klingebiel, D., 2003.
DL(1997): Demetriades, P.O., Luintel, K., 1997.
LR(2002): Loayza, N., Ranciere, R., 2002.
MRS(2003): Manasse, P., Roubini, N., Schimmelpfennig A., 2003.
M(2003): Moody's, 2003
S&P(2002): Standard and Poor's, 2002.
YL (2010): Yong, C., Lee Nah, Q., 2010.

Table 4.10: Detected outliers and events - FO Countries

COUNTRY	Year	CR	YP	KC	OP	RR	Event	Source
CEN. AF. REP.	1974	2.92					Expansionary monetary policy	
	1980	2.31		-2.15	2.25		Transition year after Emperor Bokassa I is overthrown and "bloodless coup" against President David Dacko	
	1983		-2.05				Systemic banking crises. Foreign Currency Bank Debt Default (1983 - 2002)	LR(2002), S&P (2002)
	1994				2.75	-3.67		
	1996			-2.47				
	2000				2.32	-2.03		
	2003		-2.24					
ECUADOR	1973					2.13	Jump in trade due to oil exports. Inflation reach double digit and real interest rate turn negative	
	1983	3.00					Debt Crisis (1982 - 1996)	MRS(2003)
	1988	-2.58					End of free market FX system and austerity program	
	1999		-3.11	-3.52			Bank deposits frozen for 6 months. By January 2000, 16 financial institutions closed (12) or taken over (4) by the government. All deposits unfrozen by March 2000. Debt crisis (1999 - 2001)	CK(2003), LR(2002), MRS(2003)
	2000					-3.15		
FINLAND	1964					-2.76	Double digit inflation. Real interest rates turn negative	
	1968					-2.16		
	1969		2.70			2.47	Inflation falls. Positive real interest rates	
	1972		2.99				Oil shock. Double digit inflation and negative real interest rates	
	1974			3.15	2.58	-2.92		
	1991	2.11	-3.28	-2.37			Government takes control of 3 banks that together accounted for 31% of deposits	CK(2003), LR(2002)
	2000				2.85		Finland adopts Euro	
GHANA	1971	3.16					Coup d'etat	
	1975		-2.65				Drought + rejection of foreign debt payments	
	1982		-2.43				Stagnation + Banking crisis (1982-1989)	LR(2002); CK(2003)
	1983		-2.12			-3.08		
	1984			2.00		2.39		
	1993			3.31			4th Republic inaugurated. Boom year and start of high inflation cycle	
	2000				3.41		Elections. Boom year and start of high inflation	
KENYA	1970		-2.62				Boom bust cycle in agricoltural exports	
	1971		3.44	2.40				
	1974				2.76		Oil shock. Double digit inflation and negative real interest rates	
	1978	2.03		2.46			Coffee production boom	
	1985			2.09			Banking crises (1985 -1989) and (1993 - 1995).	CK(2003),
	1993	-2.65			3.34		Foreign Currency Bank Debt Default (1994-2003)	LR(2002),
MOROCCO	1974				3.30	-3.88	Oil shock. Double digit inflation and negative real interest rates	
	1994		2.452				Recovery after 2-year crisis	
	2007	3.21					Real interest rate turn positive + export led boom	

NOTES:
CK(2003): Caprio, G., Klingebiel, D., 2003.
DL(1997): Demetriades, P.O., Luintel, K., 1997.
LR(2002): Loayza, N., Ranciere, R., 2002.
MRS(2003): Manasse, P., Roubini, N., Schimmelpfennig A., 2003.
M(2003): Moody's, 2003
S&P(2002): Standard and Poor's, 2002.
YL (2010): Yong, C., Lee Nah, Q., 2010.

Table 4.11: Identified Cointegrating Vectors and Causality Tests

Country, VEC lag, Trend type	Financial Development Coint.Vect. (i)						Economic Development Coint. Vect. (i)						OR (ii)	IO dummies (iii)	W. Exog. (iv)	
	$FD=b_{1,0}+b_{1,2}YP+b_{1,4}OP+b_{1,5}RR+b_{1,6}t$						$YP = b_{2,0}+b_{2,3}KP+b_{2,4}OP+b_{2,5}RR+b_{2,6}t$								$a_{1,2}=0$ / $a_{2,1}=0$	
	$b_{1,0}$ p-val	$b_{1,2}$ p-val	$b_{1,4}$ p-val	$b_{1,5}$ p-val	$b_{1,6}$ p-val	$a_{1,1}$ p-val	$b_{2,0}$ p-val	$b_{2,3}$ p-val	$b_{2,4}$ p-val	$b_{2,5}$ p-val	$b_{2,6}$ p-val	$a_{2,2}$ p-val	$Chi^2(1)$ p-val		Chi^2	p-val
Cen. Af. Rep.	5.95	-0.57	0.022	0.017		-0.38	-5.07	1.16	0.031	0.022	0.032	-0.55	**0%**	d1_96 d2_74 d3_94 d4_80	19.07	0%
2d		0%	0%	0%		0%		0%		0%	0%	1%	**99%**	d5_00 d6_83 d7_03	0.73	8%
Chile	- 3.34	0.23	0.009	0.00		-0.25	-0.57	0.99		0.00		-0.28	**0.07**	d1_73 d2_82	1.01	60%
2b	0%	0%	0%	0%		0%	9%	0%		1%		1%	**79%**	d3_78 d4_93	0.95	62%
Ecuador	-5.62	0.82	0.003	0.006	-0.011	-0.12							**0.05**	d1_00 d2_88 d3_83 d4_99		
2d		0%	6%	0%	0%	0%							**82%**	d5_93	14.55	0%
Finland	-5.23	0.62	-0.006	0.050		-0.07							**2.26**	d1_74 d2_69 d3_72 d4_91		
1c		0%	1%	0%		8%							**13%**	d5_64 d6_00	13.64	0%
Ghana	-0.57	0.09	0.002	0.001		-0.22	2.2	0.61	-0.002	0.002		-0.60	**0.20**	d1_00 d2_83 d3_84 d4_93	8.97	1%
2b	0%	0%		1%		8%	0%	0%	0%	0%		0%	**66%**	d5_71 d6_82	5.96	5%
India	2.42	-0.30	0.037	-0.017		-0.11	3.96	0.46	0.047	-0.039		-0.23	**0.00**	d1_74 d2_76	0.00	100%
3c		3%	0%	1%		4%		0%		0%		0%	**98%**	d3_88 d4_84	17.91	0%
Italy	27.71	-3.12	0.011	0.042	0.111	-0.10	0.01	0.61	-0.002	-0.003	0.007	-0.39	**0.47**	d1_74 d2_99 d3_93 d4_86	0.17	92%
2d		0%		0%	0%	0%		0%	2%	3%	0%	0%	**49%**	d5_81 d6_73	3.81	15%
Kenya	-2.90	0.34	-0.006	-0.005		-0.34	4.2	0.52	0.005			-0.48	**0.09**	d1_71 d2_70 d3_93 d4_74	0.97	62%
1b	0%	0%	0%	0%		0%	0%	0%	0%			0%	**76%**	d5_78 d6_85	9.42	1%
Morocco	0.35	-0.08	0.014			-0.23	5.95	0.30	0.007	0.011		-0.58	**0.19**	d1_74 d2_07	40.54	0%
3c		1%				0%		0%	0%	0%		0%	**91%**	d3_94	8.47	4%
Pakistan	-1.75	0.27	-0.017	0.012	-0.007	-0.10							**0.10**	d1_04		
2d		9%	0%	0%	9%	1%							**75%**		2.15	34%
Peru	14.95	-1.97	0.052	0.000		-0.06	5.03	0.26	0.026	0.000		-0.42	**0.70**	d1_89 d2_88 d3_84 d4_70	0.05	98%
3b	0%	0%	0%	0%		1%	0%	0%	0%			0%	**40%**	d5_80 d6_74	0.47	79%
Venezuela	- 3.97	0.58		- 0.02		-0.06							**0.04**	d1_96 d2_89 d3_83 d4_74		
3b	3%	1%		0%		6%							**85%**	d5_95 d6_75	10.81	0%

NOTES

(i) Percentage figures below coefficients are marginal p-values i.e., marginal significance level of likelihood ratio tests under the null that the coefficient under consideration is zero; they are $Chi^2(1)$ distributed. a_{ij} are the associated loading factors.

(ii) OR are Over-identifying Restrictions which are Chi2(1) distributed. For Morocco OR Restrictions are Chi2(2) distributed.

(iii) dn_yy = dummy at year yy obtained at iteration n. dn_yy=0 t≠yy and dn_yy=1 t=yy.

(iv) Test is calculated as difference in loglikelihood functions without and with restriction on a(i,j)=0. The test is $Chi^2(2)$ distributed except for Morocco where it is $Chi^2(3)$ distributed. If the null a(i,j)=0 where i≠j is rejected, then the vector j causes variable i. Rejection of both a(i,j)=0 for each i≠j implies bi-directional causality between Financial and Economic Development.

Table 4.12: Comparison of Johansen's methodology Estimation Results: Models with dummies vs. without dummies

Country	Financial Development Cointegrating $FD=b_{1,0}+b_{1,2}YP+b_{1,4}OP+b_{1,5}RR+b_{1,6}t$						Economic Development Cointegrating $YP = b_{2,0}+b_{2,3}KP+b_{2,4}OP+b_{2,5}RR+b_{2,6}t$						OR	IO dummies	LM(i) h+1 Prob		
	$b_{1,0}$ p-val	$b_{1,2}$ p-val	$b_{1,4}$ p-val	$b_{1,5}$ p-val	$b_{1,6}$ p-val	$a_{1,1}$ p-val	$b_{2,0}$ p-val	$b_{2,3}$ p-val	$b_{2,4}$ p-val	$b_{2,5}$ p-val	$b_{2,6}$ p-val	$a_{2,2}$ p-val	$Chi^2(1)$ p-val		JB(ii)	df	Prob
Cen. Af. Rep.	5.95	-0.57	0.022	0.017		-0.38	-5.1	1.16	0.031	0.022	0.032	-0.55	**0.00**	d1_96 d2_74 d3_94 d4_80 d5_00 d6_83	20.7	3	71%
2d		0%	0%	0%		0%		0%		0%	0%	1%	**99%**	d7_03	10.7	10	38%
	3.48	-0.21	-0.012	-0.024	-0.008	-0.05	-184.2	14.38	0.031	-0.097	0.381	0.00	**0.47**		19.3	3	78%
		9.7%	0%	0%	2%	65%		0%		0%	0%	91%	**49%**		10.7	10	38%
Ecuador	-5.62	0.82	0.003	0.006	-0.011	-0.12							**0.05**	d1_00 d2_88 d3_83	26.8	3	37%
2d		0%	6%	0%	0%	0%							**82%**	d4_99 d5_93	10.5	10	40%
	8.22	-1.04	-0.019	-0.008	0.025	0.05							**12.95**		12.6	3	98%
		0%	0%	0%	0%	16%							**0%**		13.5	10	20%
Finland	-5.23	0.62	-0.006	0.050		-0.07							**2.26**	d1_74 d2_69 d3_72	25.2	2	45%
1c		0%	1%	0%		8%							**13%**	d4_91 d5_64 d6_00	11.6	10	31%
	-3.64	0.40	0.003	0.080		-0.02							**3.59**		19.0	2	80%
		2%	50%	0%		49%							**6%**		183.7	10	0%
Ghana	-0.57	0.09	0.002	0.001		-0.22	2.19	0.61	-0.002	0.002		-0.60	**0.20**	d1_00 d2_83 d3_84	27.9	3	31%
2b	0%	0%		1%		8%	0%	0%	0%	0%		0%	**66%**	d4_93 d5_71 d6_82	13.1	10	22%
	-0.12	0.02	0.002	0.002		0.01	2.44	0.57	-0.002	0.003		-0.64	**0.85**		21.8	3	65%
	69%	68%		0%		90%	0%	0%	0%	0%		0%	**36%**		47.8	10	0%
India	2.42	-0.30	0.037	-0.017		-0.11	3.96	0.46	0.047	-0.039		-0.23	**0.00**	d1_74 d2_76 d3_88	11.2	4	99%
3c		3%	0%	1%		4%		0%		0%		0%	**98%**	d4_84	17.8	10	6%
	-2.73	0.36	-0.028	0.022		-0.05	5.07	0.35	0.047	-0.034		0.08	**0.91**		16.5	4	90%
		0%	0%	0%		61%		0%		0%		44%	**34%**		6.9	10	74%
Kenya	-2.90	0.34	-0.006	-0.005		-0.34	4.19	0.52	0.005			-0.48	**0.09**	d1_71 d2_70 d3_93	23.8	2	53%
1b	0%	0%	0%	0%		0%	0%	0%	0%			0%	**76%**	d4_74 d5_78 d6_85	14.4	10	16%
	-2.99	0.35	-0.005	-0.002		-0.61	3.15	0.61	0.006			-0.73	**0.37**		21.0	2	69%
	0%	0%	0%	0%		0%	0%	0%	0%			0%	**54%**		21.8	10	2%
Morocco	0.35	-0.08	0.014			-0.23	5.95	0.30	0.007	0.011		-0.58	**0.19**	d1_74 d2_07 d3_94	15.2	4	94%
3c		1%				0%		0%	0%	0%		0%	**91%**		5.0	10	89%
	-0.08	-0.03	0.014			-0.18	5.61	0.34	0.005	0.012		-0.46	**0.52**		24.3	4	50%
		62%				13%		0%	1%	0%		5%	**77%**		17.0	10	7%
Venezuela	-3.97	0.58		-0.020		-0.06							**0.04**	d1_96 d2_89 d3_83	27.4	4	34%
3b	3%	1%		0%		6%							**85%**	d4_74 d5_95 d6_75	4.2	10	94%
	3.46	-0.36	-0.008	-0.026		-0.02							**3.07**		16.0	4	92%
	30%	41%	8%	0%		60%							**8%**		23.4	10	1%

NOTES

For every country indicated in the row heading the top set of results originates from the model with the dummies specified in the "IO dummies" column, while the second set originates from the model without dummies showing shaded area under the "IO dummies" column heading".

di_yy = dummy at year yy obtained at iteration i

(i) VEC Residual Serial Correlation LM Test. H0: no residual autocorrelations at lag h+1 where (h+1) = lag((VEC) +1). P-values from chi-square with 25

(ii) JB = Jarque Bera Test.H0: residuals are multivariate N.

Table 4.13: Comparison of DOLS and Johansen's methodology Estimation Results and Hansen's Instability Test

Country	Financial Development Cointegrating Vector							Economic Development Cointegrating Vector							OR
	$FD=b_{1,0}+b_{1,2}YP+b_{1,4}OP+b_{1,5}RR+b_{1,6}t$							$YP = b_{2,0}+b_{2,3}KP+b_{2,4}OP+b_{2,5}RR+b_{2,6}t$							
	$b_{1,0}$	$b_{1,2}$	$b_{1,4}$	$b_{1,5}$	$b_{1,6}$	$a_{1,1}$	Adj R^2	$b_{2,0}$	$b_{2,3}$	$b_{2,4}$	$b_{2,5}$	$b_{2,6}$	$a_{2,2}$	Adj R^2	$Chi^2(1)$
	p-val	p-val	p-val	p-val	p-val	p-val	LC	p-val	p-val	p-val	p-val	p-val	p-val	LC	p-val
Cen. Af. Rep.	5.95	-0.57	0.022	0.017		-0.38		-5.1	1.16	0.031	0.022	0.032	-0.55		**0.00**
2d		0%	0%	0%		0%			0%		0%	0%	1%		**99%**
	-6.15	0.48	0.005	0.003	0.008		0.82	18.7	-0.43	-0.008	-0.011			0.97	
	4%	5%	8%	27%	6%		0.03	13%	62%	33%	5%			0.04	
Ecuador	-5.62	0.82	0.003	0.006	-0.011	-0.12									**0.05**
2d		0%	6%	0%	0%	0%									**82%**
	-0.54	0.17	-0.009	0.001	0.002		0.84								
	50%	14%	0%	9%	7%		0.04								
Finland	-5.23	0.62	-0.006	0.050		-0.07									**2.26**
1c		0%	1%	0%		8%									**13%**
	-4.59	0.60	-0.012	0.013			0.90								
	0%	0%	0%	2%			0.04								
Ghana	-0.57	0.09	0.002	0.001		-0.22		2.19	0.61	-0.002	0.002		-0.60		**0.20**
2b	0%	0%		1%		8%		0%	0%	0%	0%		0%		**66%**
	-1.33	0.22	0.001	0.000			0.83	2.84	0.51	-0.001	0.004			0.92	
	0%	0%	0%	22%			0.04	0%	0%	44%	1%			0.03	
India	2.42	-0.30	0.037	-0.017		-0.11		3.96	0.46	0.047	-0.039		-0.23		**0.00**
3c		3%	0%	1%		4%			0%		0%		0%		**98%**
	0.60	-0.05	-0.001	0.038	0.000		0.52	2.52	0.68	0.017	-0.003			1.00	
	80%	86%	95%	2%	0%		0.02	0%	0%	0%	73%			0.02	
Kenya	-2.90	0.34	-0.006	-0.005		-0.34		4.19	0.52	0.005			-0.48		**0.09**
1b	0%	0%	0%	0%		0%		0%	0%	0%			0%		**76%**
	-4.14	0.44	-0.003	-0.001			0.83	2.85	0.64	0.005	0.000			0.90	
	0%	0%	1%	24%			0.06	0%	0%	2%	91%			0.09	
Morocco	0.35	-0.08	0.014			-0.23		5.95	0.30	0.007	0.011		-0.58		**0.19**
3c		1%				0%			0%	0%	0%		0%		**91%**
	-1.55	0.15	0.009	0.005	0.000		0.96	5.14	0.38	0.004	0.019			0.99	
	28%	39%	5%	2%	0%		0.02	0%	0%	29%	1%			0.03	
Venezuela	-3.97	0.58	-0.002	-0.020		-0.06									**0.04**
3b	3%	1%	53%	0%		6%									**85%**
	-4.03	0.57	0.000	-0.018	0.000		0.67								
	30%	22%	99%	0%	0%		0.02								

NOTES

For every country the first two rows indicate the results from Johansen's cointegration methology and the third and fourth line those from DOLS. DOLS have been estimated with the same leads and lags as those used in unit root tests and with all the dummies as deterministic regressors. Equations are:

$FD=b_{1,0}+b_{1,2}YP+b_{1,4}OP+b_{1,5}RR+b_{1,6}t+\cong_{j=-k}^{k}\cong(YP:OP:RR)+m\mathbf{D}_t+\cong_{1t}$

$YP=b_{2,0}+b_{2,3}KP+b_{2,4}OP+b_{2,5}RR+b_{2,6}t+\cong_{j=-k}^{k}\cong(KP:OP:RR)+m\mathbf{D}_t+\cong_{2t}$

Percentage figures below estimated coefficients are the marginal p-values i.e., marginal significance level of likelihood ratio tests under the null that the coefficient under consideration is zero; they are $Chi^2(1)$ distributed. a_{ij} are the associated loading factors. OR are Over-identifying Restrictions which are $Chi^2(1)$ distributed.

Percentage figures below estimated coefficients are the marginal p-values i.e., marginal significance level of t-student test under the null that the coefficient under consideration is zero. In DOLS regression leads and lags are simmetrical (r=q) and are the same as the lags used in the Johansen's cointegrated model.

LC is Hansen instability test. H0: cointegration. Rejection of H0 might indicate parameter instability. Hansen (1992) indicates that all p-values of LC statistic in the table are larger than 20%.

Table 4.14: Short-term dynamics: Central African Republic, Ecuador, Finland and Ghana

Lagged var. and dummies	Estim. coeff. (p-val)	Central Afr. Rep.					Ecuador					Finland					Ghana				
		D(FD)	D(YP)	D(KP)	D(OP)	D(RR)	D(FD)	D(YP)	D(KP)	D(OP)	D(RR)	D(FD)	D(YP)	D(KP)	D(OP)	D(RR)	D(FD)	D(YP)	D(KP)	D(OP)	D(RR)
	a(1,p)	-0.38	0.51			-105.2	-0.12	0.22			90.9	-0.07	0.07	0.03	9.58	10.45	-0.22	-0.64	-0.48		
	p-val	0%	4%			0%	0%	0%			0%	8%	0%	0%	3%	0%	8%	1%	0%		
	a(2,p)	0.29	-0.55			95.51											-0.18	-0.60	-0.04	-94.01	-123.7
	p-val	0%	1%			0%											2%	0%	63%	1%	6%
	m(0,p)	-0.02	-0.06	-0.01	-4.73		0.01					-0.02	0.02		2.61	1.07					
	p-val	0%	0%	0%	3%		2%					1%	0%		0%	1%					
D(CR)(-1)	q(1,1,p)		-0.90			138.9	0.32	0.45			190	0.48	0.21	0.15	31.14	20.04				-197.3	-269.3
	p-val		2%			2%	0%	4%			0%	0%	1%	0%	4%	3%				2%	8%
D(CR)(-2)	q(1,2,p)	-0.43		-0.23			-0.22			-54.9	-83.6						-0.36	0.62	0.36		
	p-val	0%		0%			1%			10.0%	9.9%						4%	10%	4%		
D(CR)(-3)	q(1,3,p)																				
	p-val																				
D(YC)(-1)	q(2,1,p)		0.28	0.14		-71.27		0.68		126	-128		0.94	0.39		24.20		0.41	0.12	106.0	136.0
	p-val		6%	0%		0%		0%		0%	5%		0%	0%		8%		0%	4%	0%	1%
D(YC)(-2)	q(2,2,p)		0.38	0.08		99.85	0.21	0.43	0.15									0.25		73.21	221.4
	p-val		1%	1%		0%	3%	3%	7%									9.7%		3%	0%
D(YC)(-3)	q(2,3,p)																				
	p-val																				
D(KC)(-1)	q(3,1,p)	-0.54	-1.00	0.37			-0.44	-1.18	0.50	-218	317	0.72	-1.17	0.31	-145.2	-79.6			0.62		
	p-val	2%	9.8%	0%			9.8%	3%	2%	3%	4%	10%	0%	0%	0%	0%			0%		
D(KC)(-2)	q(3,2,p)		-1.60	-0.24		-148.3		1.39		135.0								-0.95	-0.29		
	p-val		0%	1%		3%		0%		9.6%								1%	8%		
D(KC)(-3)	q(3,3,p)																				
	p-val																				
D(OP)(-1)	q(4,1,p)		-0.00	-0.00			-0.00								0.28	-0.14		-0.00			
	p-val		2%	0%			1%								3%	7%		6%			
D(OP)(-2)	q(4,2,p)		-0.00	-0.00				0.00											-0.00	-0.21	
	p-val		9%	1%				6%											0%	8%	
D(OP)(-3)	q(4,3,p)																				
	p-val																				
D(RR)(-1)	q(5,1,p)		-0.00	-0.00		-0.61	-0.00		-0.00						0.58			-0.00			-0.35
	p-val		3%	0%		0%	0%		4%						0%			0%			4%
D(RR)(-2)	q(5,2,p)	-0.00				-0.35		0.00										-0.00			-0.45
	p-val	5%				0%		5%										1%			0%
D(RR)(-3)	q(5,3,p)																				
	p-val																				
D1_yy	m(1,p)		-0.07	-0.05		9.58		-0.07	-0.05	10.11	-25.1			0.03	10.04	-5.67					-19.30
	p-val		7%	0%		7%		1%	0%	5%	0%			0%	0%	0%					10%
D2_yy	m(2,p)	0.10	0.09		14.57					17.76	-107		0.06	0.01		5.63		-0.09			-79.64
	p-val	0%	2%		1%					0%	0%		0%	7%		0%		0%			0%
D3_yy	m(3,p)	-0.02			17.91	-21.60	-0.07	0.11		12.41	-51.1		0.08	0.01	5.77		0.04		0.04	13.94	105
	p-val	9.9%			0%	0%	0%	0%		7%	0%		0%	8%	5%		5%		2%	9%	0%
D4_yy	m(4,p)	0.04	-0.07	-0.01	10.66		0.04				-35.5	0.05	-0.06	-0.01					0.06		
	p-val	0%	2%	6%	3%		2%				0%	7%	0%	2%					0%		
D5_yy	m(5,p)	0.02		-0.01	15.95	-12.67				-15.20						-6.66	0.04			-14.93	
	p-val	10%		4%	1%	2%				0%						0%	0%			1%	
D6_yy	m(6,p)		-0.15			8.16									9.94			-0.10			36.45
	p-val		0%			9%									0%			0%			0%
D7_yy	m(7,p)		-0.10	-0.02														-0.11			
	p-val		0%	0%														0%			

Table 4.15: Short-term dynamics: India, Kenya, Morocco and Venezuela

Lagged var. and dummies	Estim. coeff. (p-val)	India					Kenya					Morocco					Venezuela				
		D(FD)	D(YP)	D(KP)	D(OP)	D(RR)	D(FD)	D(YP)	D(KP)	D(OP)	D(RR)	D(FD)	D(YP)	D(KP)	D(OP)	D(RR)	D(FD)	D(YP)	D(KP)	D(OP)	D(RR)
	a(1,p)	- 0.11	0.19	0.07		30.53	- 0.34	- 0.35	- 0.16	- 81.7	- 95.1	- 0.23	0.37			-35.39	- 0.06	- 0.13	- 0.04		- 74.3
	p-val	4%	0%	8%		2%	0%	0%	1%	0%	1%	0%	1%			1%	6%	1%	2%		0%
	a(2,p)		- 0.23	- 0.06		-37.49		- 0.48			-187.2	0.48	- 0.58		88.66						
	p-val		0%	4%		0%		0%			0%	0%	0%		0%						
	m(0,p)		0.09	0.03		14.96						0.06	- 0.05		7.83	3.54					
	p-val		0%	2%		0%						0%	1%		0%	5%					
D(CR)(-1)	q(1,1,p)		- 0.36				- 0.23	0.36				0.69			69.01		0.60	0.56	0.21	- 57.9	
	p-val		7%				9%	3%				0%			3%		0%	7%	3%	0%	
D(CR)(-2)	q(1,2,p)		0.54	0.26								0.46	- 1.17				0.52				156.5
	p-val		1%	8%								0%	0%				2%				0%
D(CR)(-3)	q(1,3,p)												- 0.68								
	p-val												3%								
D(YC)(-1)	q(2,1,p)	- 0.32	0.35	0.23				0.68	0.17			- 0.20			-66.46			0.47			
	p-val	3%	2%	3%				0%	0%			4%			1%			5%			
D(YC)(-2)	q(2,2,p)		0.24	0.23		67.58						- 0.59	0.69		-74.93			- 0.43		- 31.1	
	p-val		8%	2%		4%						0%	0%		1%			8%		5%	
D(YC)(-3)	q(2,3,p)		0.30									- 0.15	0.48		-44.14					- 25.9	-81.06
	p-val		2%									4%	0%		2%					3%	0%
D(KC)(-1)	q(3,1,p)								0.43	-137.9	226.1			0.83				- 1.70	0.54		
	p-val								0%	0%	0%			0%				5%	4%		
D(KC)(-2)	q(3,2,p)		- 0.81			-231.1						0.49									
	p-val		5%			2%						4%									
D(KC)(-3)	q(3,3,p)	- 0.70										- 1.20	0.89		-128.3		0.79				
	p-val	7%										0%	6%		2%		10.0%				
D(OP)(-1)	q(4,1,p)	- 0.01	0.01	0.00								- 0.00	0.01			- 0.45	0.00	0.01		- 0.61	
	p-val	0%	2%	3%								2%	0%			2%	1%	2%		0%	
D(OP)(-2)	q(4,2,p)											- 0.00	0.01				0.00	0.01		0.10	0.92
	p-val											0%	0%				0%	0%		50%	1%
D(OP)(-3)	q(4,3,p)					- 1.56							0.00							0.47	
	p-val					5%							9%							0%	
D(RR)(-1)	q(5,1,p)		0.00				0.00		0.00	0.23					0.52	- 0.64				- 0.18	0.62
	p-val		1%				2%		0%	1%					4%	0%				0%	0%
D(RR)(-2)	q(5,2,p)		0.00												0.47	- 0.40	0.00	0.002			0.48
	p-val		0%												7%	5%	1%	2%			0%
D(RR)(-3)	q(5,3,p)	0.00				0.29						0.00			0.42			0.001		0.08	0.58
	p-val	2%				7%						0%			4%			9.6%		8%	0%
D1_yy	m(1,p)		- 0.04			-18.70		0.18	0.06	10.96	-25.53				13.94	-13.74	0.09				-51.06
	p-val		1%			0%		0%	0%	1%	0%				0%	0%	6%				0%
D2_yy	m(2,p)		- 0.06			21.40		- 0.11				0.06					- 0.14	- 0.16	- 0.04	7.72	-19.03
	p-val		1%			0%		0%				0%					0%	0%	0%	2%	1%
D3_yy	m(3,p)		0.05				- 0.06			16.43	-14.17	- 0.05	0.12						- 0.04	-15.71	
	p-val		0%				0%			0%	2%	0%	0%						1%	0%	
D4_yy	m(4,p)	0.03	- 0.05							20.76							- 0.10		- 0.03	15.99	
	p-val	3%	0%							0%							0%		8%	0%	
D5_yy	m(5,p)						0.04		0.04											-15.76	
	p-val						1%		0%											0%	
D6_yy	m(6,p)								0.03												-26.00
	p-val								0%												1%
D7_yy	m(7,p)																				
	p-val																				

Figure 4.3: Financial Development and Growth: Central African Republic, Ecuador, Finland and Ghana

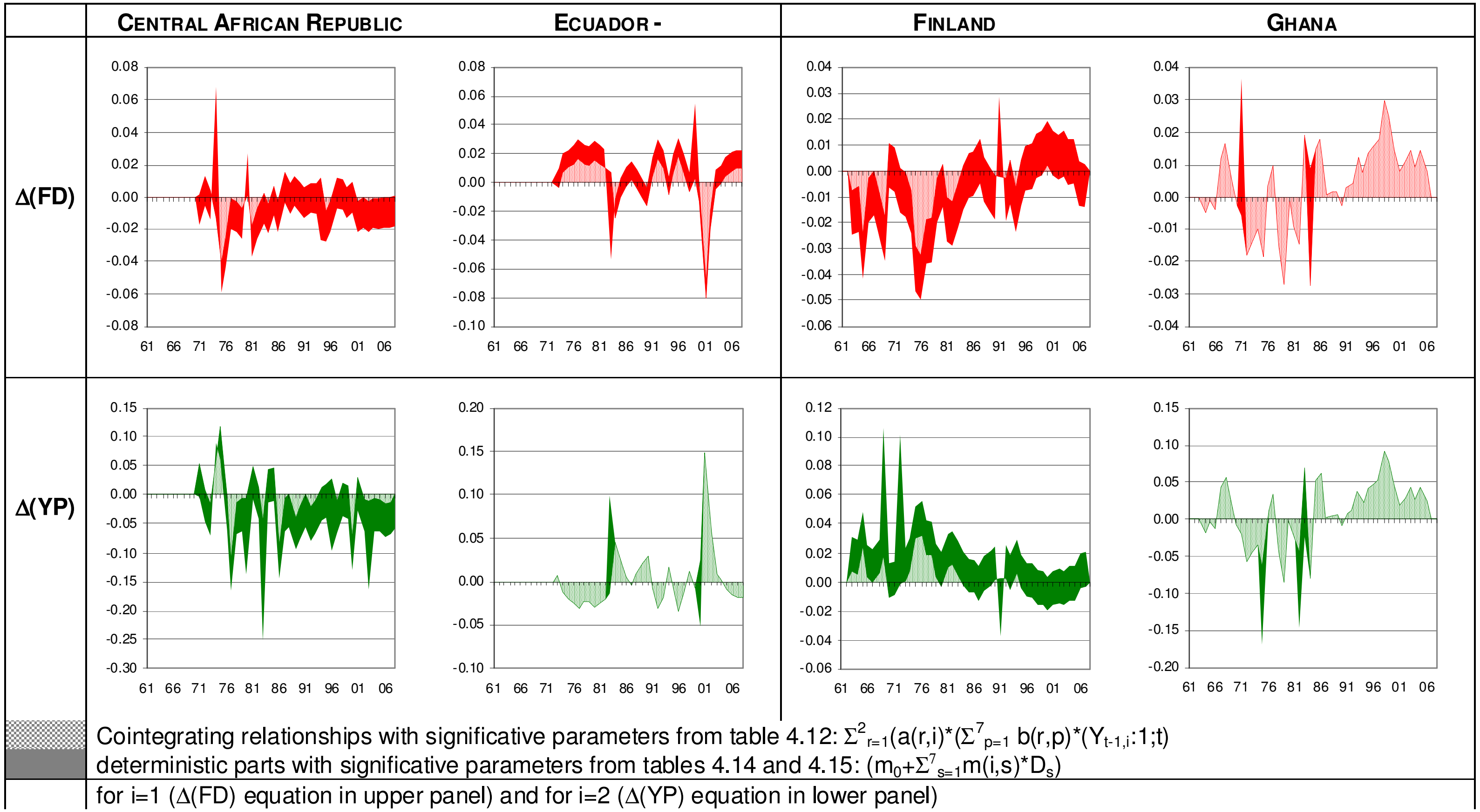
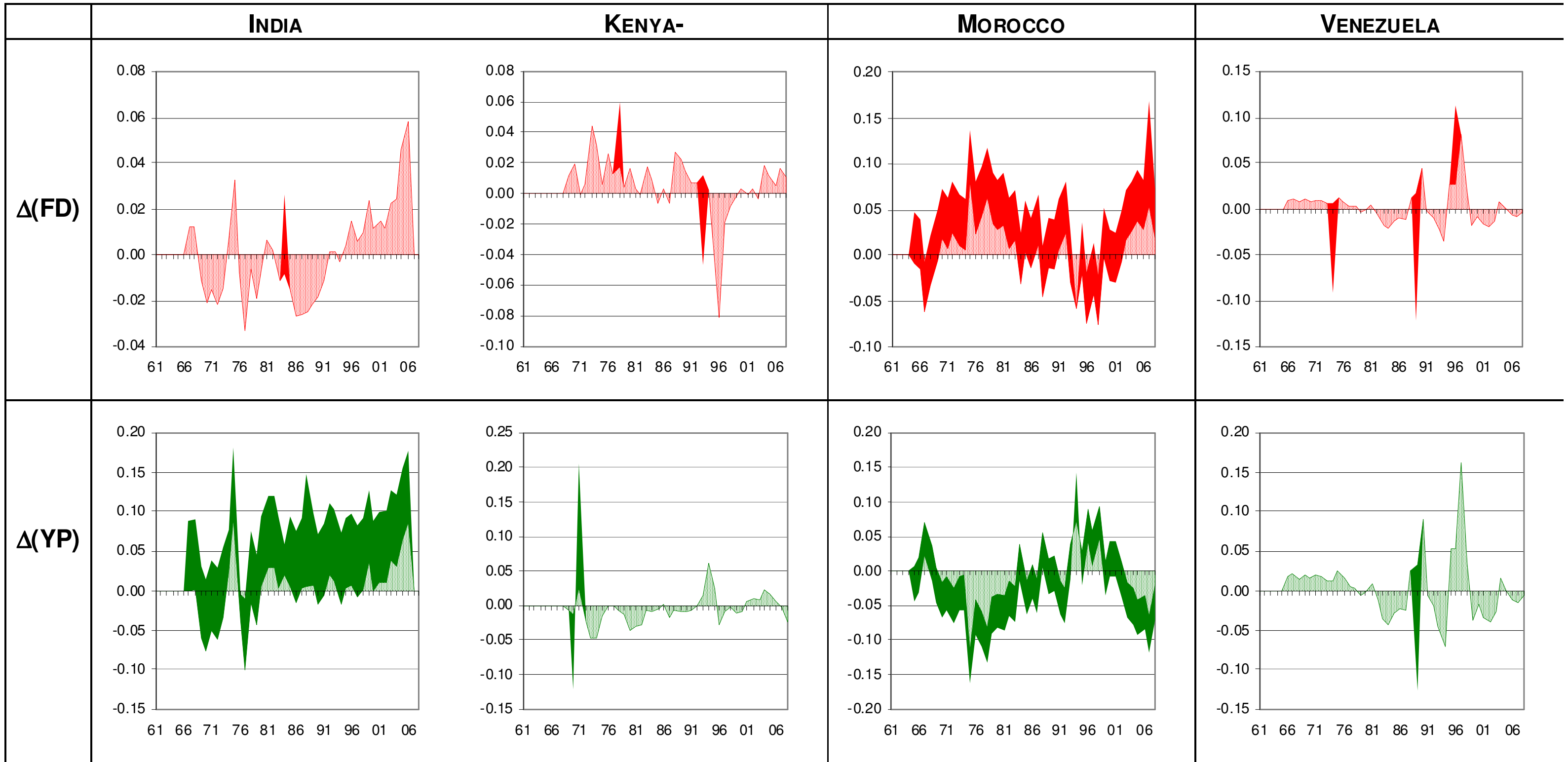


Figure 4.4: Financial Development and Growth: India, Kenya, Morocco and Venezuela



Cointegrating relationships with significative parameters from table 4.12: $\Sigma^2_{r=1}(a(r,i)*(\Sigma^7_{p=1} b(r,p)*(Y_{t-1,i}:1;t)$

deterministic parts with significative parameters from tables 4.14 and 4.15: $(m_0+\Sigma^7_{s=1}m(i,s)*D_s)$

for i=1 (Δ(FD) equation in upper panel) and for i=2 (Δ(YP) equation in lower panel)

Bibliography

[1] Acemoglu, D. , Zilibotti, F., 1997 Was Prometheus Unbound by Chance? Risk, Diversification, and Growth?, *Journal of Political Economy,* 105, 709-775.

[2] Aghion, P., Bolton, P., 1997. A Theory of Trickle-Down Growth and Development, *Review of Economic Studies*, 64, 151-172.

[3] Aghion, P., Caroli, E., García Peñalosa, C., 1999. Inequality and Economic Growth: The Perspective of New Growth Theories, *Journal of Economic Literature*, 37, 1615-1660.

[4] Aizenman, J., Noy, I., 2009. Endogenous Financial Trade Openness, *Re-*

view of Development Economics, 13(2), 175-189.

[5] Andersen, T. P., Tarp, F., 2003. Financial Liberalisation, Financial Development and Economic Growth in LDCs, *Journal of International Development*, 15, 189–209.

[6] Arestis, P., Demetriades, P., 1999. Financial liberalization: the experience of developing countries, *Eastern Economic Journal* 25, 4, 441–457.

[7] Arestis, P., Demetriades, P., 1997. Financial development and economic growth: assessing the evidence, *Economic Journal*, 107, 783-799.

[8] Arestis, P., Demetriades, P., and Fattouh, B., 2003. Financial Policies and the Aggregate Productivity of the Capital Stock: Evidence from Developed and Developing Economies. The Levy Economics Institute, *Working Paper* No. 362.

[9] Arestis, P., Demetriades, P., Fattouh, B., Mouratidis, K., 2002. The impact of financial liberalisation policies on financial development, evidence from developing economies, *International Journal of Finance and Economics*, 7, 109-121.

[10] Arghyrou, M.G., Luintel, K.B., 2007. Government solvency: revisiting some EMU countries, *Journal of Macroeconomics*, 29, 387-410.

[11] Azariadis, C., de la Croix, D., 2003. Growth or Equality? Losers and gainers from financial reform, *mimeo.*

[12] Baltagi, B.H., Demetriades, P.O., Hook Law, S., 2009. Financial Development and openness: Evidence from panel data, *Journal of Development Economics*, 89, 285-296.

[13] Bandiera, O., Caprio, G., Honohan, P., Schiantarelli, F., 2000. Does Financial Reform Raise or Reduce Saving?, *Review of Economics and Statistics*, 82, 2, 239-263.

[14] Barro, R.J., Sala-i-Martin X., 1998. Economic Growth, MIT Press, Cambridge, MA.

[15] Bebczuck, R. N., 2003. *Asymmetric Information in Financial Markets*, Cambridge University Press.

[16] Beck, T., Levine, R., Loayza, N., 2000. Finance and the sources of growth, *Journal of Financial Economics*, 58, 261-300.

[17] Beck, T., Demirgüç-Kunt, A., Levine, R., 2004. Finance, Inequality and Poverty: Cross-country Evidence, Carlson School of Management, University of Minnesota, *mimeo.*

[18] Bekaert G., Harvey C. R., 2001. Economic Growth and Financial Liberalisation, *mimeo.*

[19] Bencivenga, V.R., Smith, B.D., 1991. Financial Intermediation and Endogenous Growth, *Review of Economic Studies*, 58,195-209.

[20] Benston, G., Smith, C.W., 1976. A transaction cost approach to the theory of financial intermediation, *Journal of Finance*, 31, 215-231.

[21] Berger, A.N., 2004. Potential Competitive Effects of Basel II on Banks in SME Credit Markets in the United States, Board of Governors of the Federal Reserve System, *mimeo.*

[22] Bertola, G., Foellmi, R., Zweimüller, J., 2006. *Income distribution in macroeconomic models*, Princeton University Press.

[23] Bhattacharya J., 1998. Credit market imperfections, income distribution and capital accumulation, *Economic Theory*, 11, 171-200.

[24] Bhattacharya J., 2003. Monetary Policy and the Distribution of Income, Iowa State University, *Working Paper,* 03026, Department of Economics, December.

[25] Birdsall, N., (2005) The World is not Flat: Inequality and Injustice in our Global Economy, WIDER, *Annual Lecture*, 9.

[26] Blackburn, K., Hung V. T. Y., 1998. A Theory of Growth, Financial Development and Trade, *Economica*, 65, 257, 107-124.

[27] Blanchard, O.J., Fisher S., 1989. *Lectures on Macroeconomics*, MIT Press, Cambridge, MA.

[28] Bolton P., Freixas, X., 2000a. Corporate Finance and the Monetary Transmission Mechanism, *mimeo.*

[29] Bolton P., Freixas, X., 2000b. Equity, Bonds, and Bank Debt: Capital Structure and Financial Market Equilibrium under Asymmetric Information, *Journal of Political Economy*, 108(2), 324-351.

[30] Bolton P., Freixas, X., 1997. A Dilution Cost approach to Financial Intermediation and Securities Markets, *mimeo.*

[31] Boyd, J. H., Smith, B.D., 1995. The Co-Evolution of the Real and Financial Sectors in the Growth Process, Federal Reserve of Minneapolis, *Working Paper* 541.

[32] Buch, C.M., 2000. Information or regulation, What is Driving the International Activities of Commercial Banks, Kiel, *Working Paper,* 1011.

[33] Byrd, W., 1983. *China's Financial System, the Changing Role of Banks*, Westview, Colorado.

[34] Caprio G., Hohohan P., 1999. Restoring banking stability: beyond supervised capital requirements, *Journal of Economic Perspectives,* 13, 4, 43–64.

[35] Caprio, G., Klingebiel, D., 2003. Episodes of Systemic and Borderline Financial Crises, World Bank, *mimeo.*

[36] Cetorelli N., 1997. The Role of Credit Market Competition on Lending Strategies and on Capital Accumulation, Federal Reserve Bank of Chicago, *Working Papers Series*, Research Department WP 97, 14.

[37] Chiang, A. C., 1974. *Fundamental methods of mathematical economics*, McGraw Hilll, New York, 2nd ed.

[38] Chinn, M.D., Ito, H., 2006. What Matters for Financial Development?, Capital Controls, Institutions, and Interactions, *Journal of Development Economics*, 81, 163-192.

[39] Christopoulos, D. K., Tsionas, E. G., 2004. Financial Development and Economic Growth: Evidence from Panel Unit Root and Cointegration Tests, *Journal of Development Economics*, 73, 55-74.

[40] Chuhan, P., Sturzenegger, F., 2003. Default Episodes in the 1980s & 1990s, what have we learnt?, *mimeo.*

[41] Claessens, S., 2006, Competitive implications of Cross Border Banking, World Bank, *Policy Research Working Paper,* 3854.

[42] Claessens, S., Laeven, L., 2005, Financial Dependence, Banking Sector Competition, and Economic Growth, *Journal of the European Economic Association*, 3, 1, 79-207.

[43] Clarke, G.R.G., Xu L.C., Zou, H., 2006. Finance and Income Inequality: What Do the Data Tell Us?, *Southern Economic Journal*, 72, 578-596.

[44] Claus, I., Grimes, A., 2003. Asymmetric Information, Financial Intermediation and the Monetary Transmission Mechanism: A Critical Review, *Working Paper, 03/19*, New Zealand Treasury.

[45] Clements, M.P., Sensier, M., 2003. Asymmetric Output-Gap Effects in Phillips Curve and Mark up Pricing Models: Evidence for the US and the UK, *Scottish Journal of Political Economy*, 50, 4, 359-374.

[46] Corden, W. M., 1972. Economies of Scale and Customs Union Theory, *The Journal of Political Economy*, 80, 3, 465–475.

[47] Deidda, L., 2006. Interaction between Economic and Financial Development, *Journal of Monetary Economics*, 53, 233–248.

[48] Deidda, L., 2004. Risk Aversion, Financial Development and Growth, *Working Paper*, DeFiMs, SOAS, November.

[49] Deidda, L., Fattouh, B., 2002. Non linearity between finance and growth, *Economic Letters*, 74, 3, 339-345.

[50] Demetriades, P.O., Hussein, K.A., 1996. Does Financial Development cause Economic Growth? Time series evidence from 16 countries, *Journal of Development Economics*, 51, 387-411.

[51] Demetriades, P.O., Luintel, K., 1997. The direct costs of Financial Repression: evidence from India, *The Review of Economics and Statistics*, 311-320.

[52] Demetriades, P.O., Luintel, K., 1996. Financial Development, Economic Growth and Banking sector controls: evidence from India, *The Economic Journal*, 106, 359-374.

[53] Department of Statistics on Investment in Fixed Assets National Bureau of Statistics of China, 2002. *Statistics on Investment in Fixed assets of China 1950-2002*, Beijing, People's Republic of China.

[54] Detragiache, E., 1999. Bank Fragility and International Capital Mobility, IMF, *Working Paper,* WP/99/113.

[55] Detragiache, E., Tressel, T., Gupta P., 2006, Foreign Banks in Poor Countries: Theory and Evidence, IMF, *Working Paper.*

[56] Deveraux, M.B., Smith, G.B., 1991. International Risk Sharing and Economic Growth, Institute for Economic Research, Queen's University, Kingston Ontario, *Discussion Paper*, 829, August.

[57] Diamond, D.W., Rajan R.G., 2000. A Theory of Bank Capital, *Journal of Finance*, 55, 6, 2431-2465.

[58] Do Q., Levchenko, A.A., 2004. Trade and Financial Development,World Bank, *Policy Research Working Paper,* 3347.

[59] Doornik, J.A., 1998. Aproximations to the Asymptotic Distribution of Cointegration Tests, *Journal of Economic Surveys*, 12, 5, 573-593.

[60] Doornik, J.A., Hendry, D.F., Nielsen, B., 1998. Inference in Cointegrating Models: UK M1 Revisited, *Journal of Economic Surveys*, 12, 533-572.

[61] Dornbusch, R., Giavazzi, F., 1999. Heading Off China's Financial Crisis, Bocconi University, *mimeo*

[62] Easterly, W., Levine, R., 2001. It's not Factor Accumulation, Stylized Facts and Growth, World Bank, *mimeo.*

[63] Edison, H.J., Levine, R., Ricci, L., Sløk, T., 2002. International Financial Integration and economic growth, IMF, *mimeo.*

[64] *EViews* 7 ®, by Quantitative Micro Software.

[65] Fattouh, B., Scaramozzino, P., Harris, L., 2005. Capital structure in South Korea: a quantile regression approach, *Journal of Development Economics*, 76,1, 231-250.

[66] Feltenstein, A., Farhadian, Z., 1987. Fiscal Policy, Monetary Targets and Price Level in a Centrally Planned Economy, An Application to the Case of China, *Journal of Money, Credit and Banking*, 19, 2, 137-156.

[67] Fink, G., Haiss, P., Vuksic, G., 2009. Contribution of financial market segments at different stages of development: Transition, cohesion and mature economies compared, *Journal of Financial Stability*, 5, 4, 431-455.

[68] Fishman A., Simhon, A., 2002. The Division of Labor, Inequality and Growth, *Journal of Economic Growth*, 7, 117-136.

[69] Fitch Ratings, 2003. *Taiwanese Banks, 1H03 Results and the Outlook for 2002*, December.

[70] Freixas, X.J., Rochet, F., 2008. *Microeconomics of Banking,* MIT Press, Cambridge, MA.

[71] Galor, O., Moav, O., 2004. From Physical to Human Capital Accumulation: Inequality and the Process of Development, *Review of Economic Studies,* 71, 1001-1026.

[72] Galor, O., Zeira, J., 1993. Income Distribution and Macroeconomics, *Review of Economic Studies*, 60(1), 35-52.

[73] Gambacorta, L., Mistrulli, P.E., 2004. Does bank capital affect lending behavior? *Journal of Financial Intermediation*, 13, 436-457.

[74] Ghatak, M., Morelli, M., Slöström, T., 2002. Credit Rationing, Wealth Inequality and Allocation of Talent, *mimeo.*

[75] Giné, X., Townsend, R.M., 2003. Evaluation of Financial Liberalization: A general equilibrium model with Constrained occupation choice, *Working Paper*, 3014, World Bank, April.

[76] Greenwood, J., Jovanovich, B., 1990. Financial Development, Growth, and the Distribution of Income, *Journal of Political Economy*, 98, 5, 1, 1076-1107.

[77] Guzman, M.G. 2000a. The Economic Impact of Bank Structure, A Review of Recent Literature, *Economic and Financial Review*, 11-25.

[78] Guzman, M.G. 2000b. Bank structure, capital accumulation and growth, a simple macroeconomic model, *Economic Theory,* 16, 421-455.

[79] Hansen, H., Johansen, S., 1999. Some Tests for Parameter Constancy in Cointegrated VAR-models, *Econometrics Journal*, 2, 306-333.

[80] Harris, R., 1995. Using Cointegration Analysis in Econometric Modelling, Prentice Hall, Harlow, UK

[81] Harrison, P., Sussman, O., Zeira J., 1999. Finance and Growth, Theory and New Evidence, Federal Reserve Board, July, *mimeo.*

[82] Hendry, D.F., Juselius, K., 1999a. Explaining Cointegration Analysis, Part I, *mimeo.*

[83] Hendry, D.F., Juselius, K., 1999b. Explaining Cointegration Analysis, Part II, *mimeo.*

[84] Heston, A., Summers, R., Aten, B., 2001. *Penn World Tables Version 6.1*, Center for International Comparisons at the University of Pennsylvania, CICUP, December.

[85] Hsiao, K., 1984. *Money and banking in the Chinese Mainland*, Tzongshian Yu, Taiwan, Republic of China.

[86] Hsiao, K., 1971. *Money and Monetary Policy in Communist China*, Columbia University Press, NY.

[87] International Monetary Fund, International Financial Statistics, various years.

[88] Jacobson, T., Lindé, J., Roszbach, K., 2005. Exploring Interactions between Real Activity and the Financial Stance, Sveriges Riksbank, *Working Paper, 184*.

[89] Jalava, J., Pohjola, M., Ripatti A., Vilmunen J., 2005. Biased Technical Change and Capital-labour Substitution in Finland, 1902-2003, EU KLEMS Project, *Working Paper, 4*.

[90] Jappelli, T., Pagano, M., 1994. Saving, Growth, and Liquidity Constraints, *Quarterly Journal of Economics*, 109(1), 83-109.

[91] Johansen, J., 1995. A statistical analysis of Cointegration for I(2) variables, *Econometric Theory*, 11, 25-29.

[92] Johansen, S., Mosconi, R., Nielsen, B., 2000. Cointegration analysis in the presence of structural breaks in the deterministic trend, *Econometric Journal,* 3, 216-249.

[93] Juselius, K., 2002. The Cointegrated VAR model, Econometric Methodology and Macroeconomic Applications, *Lecture Notes*, CIdE, Bertinoro, Italy.

[94] Key, S.J., Scott, H. S., 1991. International Trade in Banking Services, a conceptual Framework, Group of Thirty, *Occasional Paper* 135, Washington DC.

[95] Khan, A., 2001. Financial Development and Economic Growth, *Macroeconomic Dynamics*, 5, 413-433.

[96] King, R. G., Levine, R., 1993. Finance and Growth: Schumpeter Might Be Right, *Quarterly Journal of Economics,* 108, 717-38.

[97] Kleff, V., Weber, M., 2008. How Do Banks Determine Capital? Evidence from Germany, *German Economic Review*, 9, 3, 354-372.

[98] Kono, M., Shuknecht, L., 1998. Financial Services Trade, Capital Flows and Financial Stability, WTO *Staff Working Papers* ERAD, 98, 12.

[99] Krugman, P., 1993. International Finance and Economic Development in Giovannini, A. (Eds), *Finance and development: issues and experience*, Cambridge University Press, Cambridge, (UK).

[100] Kuznets, S., 1955. Economic growth and Income Inequality, *American Economic Review*, 15, 1-28.

[101] Levine, R., 2006. Finance and Growth: Theory and Evidence, in *Handbook of Economic Growth*, Aghion, P. (Eds.), North Holland.

[102] Levine, R., 2001. International Financial Liberalisation and Economic Growth, *Review of International Economics,* 9, 4, 688-702.

[103] Levine, R., 1997. Financial Development and Economic Growth: Views and Agenda, *Journal of Economic Literature*, XXV, 688-726.

[104] Loayza, N., Ranciere, R., 2002. Financial Development, Financial Fragility, and Growth, Central Bank of Chile, *Working Paper,* 145.

[105] Luintel, K. B., Khan, M. 1999. A quantitative reassessment of the finance-growth nexus: evidence from a multivariate VAR, *Journal of Development Economics*, 60, 381-405.

[106] Maddison, A., 1998. *Chinese Economic Performance in the Long run*, OECD Development Centre, Paris.

[107] Manasse, P., Roubini, N., Schimmelpfennig, A., 2003. Predicting Sovereign Debt Crises, IMF, *Working Paper* 03/221.

[108] Manove, M., Padilla, J., Pagano, M., 2001. Collateral versus project screening: a model of lazy banks, *RAND Journal of Economics,* 32(4), 726-744.

[109] Matsuyama, K., 2004. Financial Market Globalisation, Symmetry Breaking and Endogenous Inequality on Nations, *Econometrica*, 72, 3, 853-884.

[110] Matsuyama, K., 2000. Endogenous Inequality, *Review of Economic Studies*, 67, 743-759.

[111] Mehran, H., Quintyn, M., Nordman, T., Laurens, B., 1996. Monetary and Exchange System Reforms in China, An Experiment in Gradualism, IMF, *Occasional Paper* 141, Washington DC.

[112] Moav, O., 2002. Income distribution and macroeconomics: the persistence of inequality in a convex technology framework, *Economic Letters,* 75, 187-192.

[113] Moody's Investors Service, 2003. *Sovereign Bond Defaults, Rating Transitions, and Recoveries 1985-2002.*

[114] Nielsen, H.B., 2004. Cointegration Analysis in the Presence of outliers, *The Econometrics Journal,* 7, 1, 249-271.

[115] Nielsen, H.B., 2007. UK money demand 1873-2001: a long-run time series analysis and event study, *Cliometrica,* 1, 45-61.

[116] Pagano, M., 1993. Financial Market and Growth. An Overview, *European Economic Review*, 37, 613-622.

[117] Panagariya, A., 2000. Preferential Trade Liberalization: The Traditional Theory and New Developments, *Journal of Economic Literature*, 38, 2, 287-331.

[118] Perotti, R., 1992. Fiscal Policy, Income Distribution, and Growth, Columbia University, *Working Paper, 636.*

[119] Perron, P., 1997. Further evidence on breaking trend functions in macroeconomic variables, *Journal of Econometrics*, 80, 355-385.

[120] Pesaran, M.H., 1999. On Aggregation of Linear Dynamic Models, University of Cambridge, *mimeo.*

[121] Ranciere, R., Tornell, A., Westermann, F., 2006. Decomposing the Effects of Financial Liberalization: Crises vs. Growth, *Journal of Banking & Finance*, 30, 3331–3348.

[122] Repullo R., Suarez, J., 1999. Entrepreneurial Moral Hazard and Bank Monitoring: a Model of the Credit Channel, CEPR, *Discussion Paper*, 2060.

[123] Robinson, J., 1952. "The Generalization of the General Theory," in *The rate of interest, and other essays*, Macmillan: London, pp. 67-142.

[124] Rioja, F., Valev, N., 2004. Does one size fit all? A re-examination of the finance and growth relationship, *Journal of Development Economics*, 74, 429-447.

[125] Rousseau, P.L., Sylla, R., 2001. Financial Systems, Economic Growth and Globalization, NBER, *Working Paper,* 8323.

[126] Rousseau, P.L., Wachtel, P., 2005. Economic Growth and Financial Depth. Is the Relationship Extinct Already? UNU-Wider, *Discussion Paper,* 2005/10.

[127] Rousseau, P.L., Wachtel, P., 1998. Financial Intermediation and Economic Performance: Historical Evidence from Five Industrialized Countries, *Journal of Money, Credit, and Banking,* 30, 4, 657-678.

[128] Shan, Z. J., Morris, A.G., Sun, F., 2001. Financial Development and Economic Growth: an Egg-and-Chicken Problem?, *Review of International Economics*, 9, 3, 443-454.

[129] Singh, R. J., 1997. Banks, Growth and Geography, UNCTAD, *Discussion Papers*, 127.

[130] Standard & Poor's, 2002. Sovereign Defaults, Moving Higher Again in 2003?, *Credit Week*, October.

[131] Sussman, O., 1993. A theory of financial development, in Giovannini, A. (Eds), *Finance and development: issues and experience*, Cambridge University Press, Cambridge, (UK).

[132] Tamirisa, N. T., Sorsa, P., Bannister, G. J., McDonald, B. J., Wieczorek, J., 2000. Trade Policy in Financial Services, IMF, *Working Paper,* WP/00/31.

[133] Toda H. Y., Phillips P. C. B., 1993. Vector Autoregression and Causality, Econometrica, 61, 6, 1367-1393.

[134] UNU-WIDER World Inequality Map, www.wider.unu.edu/wiid/wiid.htm.

[135] Tornell, A., Westermann, F., 2004. The Positive Link between Financial Liberalization, Growth and Crises, CESifo, *Working Paper,* 1165.

[136] World Bank (2009), World Development indicators ®.

[137] WTO, 2001. *Report on the Working Party on the Accession on the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu*, WT/ACC/TPKM/18/Add.2.

[138] WTO, 2002. *The People's Republic of China*, GATS/SC/135.

[139] www.goldcouncil.org

[140] www.parisclub.org