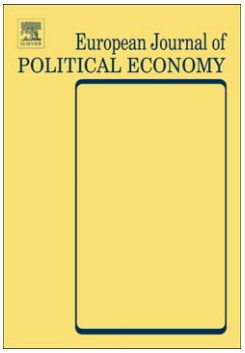

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Bureaucratic Corruption and the Dynamic Interaction between Monetary and Fiscal Policy

Ourania Dimakou*

Abstract

This paper analyses the dynamic interaction between monetary and fiscal policies in the presence of bureaucratic corruption. Corruption constrains the fiscal capacity to tax and increases the reliance on inflation (seigniorage). Given the restrictions that corruption imposes, a monetary reform strengthening central bank independence induces strategic debt accumulation; the government has the incentive to use debt and indirectly 'force' the central bank to pursue expansionary monetary policy. This result is augmented by the size of bureaucratic corruption, posing difficulties on the achievement of both a balanced debt process and price stability. The adverse implication of corruption on debt accumulation, given central bank independence, is supported in a large cross-sectional event study for developed and developing countries. Complementing the analysis with a measure for the level of independence each central bank reform enacted, the impact of corruption is greater, the higher the degree of independence granted. The results are also confirmed when accounting for countries that did not forego meaningful reforms and our findings are robust to different sub-samples, control variables and unobserved heterogeneity.

JEL Classification: E58, E61, E63, E52, D73

Keywords: Government Debt Accumulation, Central Bank Independence, Bureaucratic Corruption, Fiscal Leakages

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Introduction

Central bank independence (CBI) is widely accepted as the institutional remedy that contributes to price stability. Since 1990s the majority of statutes around the world have been rewritten, strengthening the central bank's political and economic autonomy. International organisations have promoted central bank reforms in emerging and developing countries and by 2007 about thirty countries have been operating under a highly autonomous inflation-targeting framework. However, despite the wide consensus and adoption of such an institutional reform, the monetary and fiscal performance of these countries has been diverse, especially across developed and developing countries. Several contributions suggest that the impact of reforms on inflation, inflation volatility and growth is sensitive to country and time samples, control variables and model specifications.[1] These mixed empirical results ultimately place the effectiveness of central bank reforms under uncertainty.

This wave of central bank reforms is closely related to the macroeconomic literature of monetary policy inconsistency and remedial institutional designs (Barro and Gordon (1983), Rogoff (1985)). In this context, a number of contributions (initiated by Sargent and Wallace (1981) and Alesina and Tabellini (1987)) have established the importance of fiscal policy in determining the inflation bias and thus the optimal monetary design. However, the relevance of the stance and quality of fiscal institutions to the optimal design has received less attention. Bureaucratic corruption, among other things, limits the fiscal capacity to tax and affects the government's fiscal decisions. Indeed, there is both theoretical and empirical evidence on the negative impact of corruption on tax revenues and the government's budget, strongly indicating the importance of incorporating such features in the analysis of monetary and fiscal policy interactions.

The aim of this paper is to reassess theoretically and empirically the optimality of central bank independence when active fiscal policy, debt dynamics and bureaucratic corruption are explicitly considered. At a theoretical level, we readdress the time-inconsistency problem of monetary policy focusing on the driving forces of monetary and fiscal policymaking when the economy is faced with suboptimal fiscal institutions, notably in the presence of a corrupt bureaucracy in the tax collection system. As such, we augment the framework of Alesina and Tabellini (1987) to include tax leakages due to corruption and focus on a two period model to allow for dynamic effects to take place. This way we highlight (i) the bearing of bureaucratic corruption in shaping and constraining fiscal policy and (ii) the role of debt policy and its impact on monetary outcomes and the optimal institutional design.

Our main theoretical finding suggests that in the presence of corruption price stability is undermined through the strategic use of debt. Even with central bank independence, the government may have the incentive to indirectly 'force' an expansionary monetary policy by accumulating debt. Intuitively, an independent central bank is overcorrecting for the inflation bias, delivering too little inflation (seigniorage) from the government's perspective. At the same time, high bureaucratic corruption is limiting fiscal tax revenues. As a result, the government

[1] See Berger, Haan, and Eijffinger (2001) for a survey on earlier cross-sectional studies. More recent contributions employ panel data analyses.

is induced to borrow more today in an attempt to increase future inflation. Hence, the level of bureaucratic corruption can restrict the effectiveness of a monetary institutional reform by 'altering' fiscal responses and constraining the extent of actual independence.

The theoretical implications provide potential interpretations for a set of empirical findings. First, they provide a reason for the observed diversity of performance of different countries that adopted similar central bank reforms. Second, they offer an explanation as to why many countries have experienced debt increases following important reforms.[2] They also give a rationale for the focus on debt ceilings. The explicit theoretical channel identified here gives emphasis to strategic borrowing due to the interplay between fiscal and monetary policy actions under central bank independency and suboptimal fiscal institutions. Consequently, our empirical analysis concentrates on the relationship between debt accumulation and bureaucratic corruption after central bank independence has been legislated.

In a cross-sectional event study setting, CBI is approximated by the timing of a significant central bank reform. The impact of corruption on debt evolution after that point (relative to before) is then examined. In addition, the analysis is complemented by a newly complied measure for the level of legal independence each reform provided. The sample covers 77 developed and developing countries and reforms span throughout 1990s and beginning of 2000s. Our main results are consistent with the theoretical implications and indicate that corruption plays a significant and negative role in debt accumulation. More importantly, the effect of corruption on debt accumulation is stronger, the higher the magnitude of the respective reform. We also investigate and confirm the impact of corruption on debt accumulation in a difference-in-differences setting, accounting for countries that did not forego meaningful reforms. The results prove to be robust to a set of sensitivity tests that allow for different subsamples, specifications, control variables and unobserved heterogeneity.

This work is linked to three literatures. The first one focuses on the role of debt within the monetary inconsistency game, as done for example by Beetsma and Bovenberg (1997a,b). The possibility of a (positive or negative) strategic use of debt also emerges in their work when governments are myopic or opportunistic. Here, we provide for an alternative reasoning; namely, due to corruption, fiscal institutions are suboptimal and that generates incentives for strategic public borrowing, when the monetary authority is 'too conservative'. The second strand concentrates on bureaucratic corruption. The macroeconomic literature on corruption mainly focuses on its consequences for economic growth, but it lacks systematic analysis of its impact on macroeconomic policymaking.[3] Huang and Wei (2006) are the first to incorporate bureaucratic corruption in the static Alesina and Tabellini (1987) framework, however the response and importance of debt policy is disregarded. The third refers to event studies in the empirical CBI literature, which have been recently growing.[4] These contributions predominantly concentrate on the impact of inflation targeting reforms on inflation and output. Here, the focus is on a broader concept of central bank reforms, while debt accumulation is the principal variable of

[2]See, for instance, Cabral and Ozkan (2008) and Daniel, Callen, Terrones, Debrun, and Allard (2003) for a discussion on public debt increases for emerging markets.

[3]Exceptions are, for example, Blackburn, Haque, and Neanidis (2008) who investigate the impact of corruption on seigniorage and through it on growth.

[4]For instance, Ball and Sheridan (2005), Daunfeldt and de Luna (2008) and Brito and Bystedt (2010).

interest. Hence, we explore the fiscal discipline effect of central bank independence, in relation to the level of corruption. A contribution closer to ours is Acemoglu, Johnson, Querubin, and Robinson (2008) who, using a generic politics redistributive approach, give theoretical and empirical support to the idea that reforms will be more successful at intermediate levels of constraints to politicians. They also provide preliminary support of a 'seesaw effect' on fiscal outcomes. Our work is similar in identifying the importance of institutional distortions in assessing the effectiveness of reforms, albeit the theoretical mechanisms and empirical strategies are distinct. We focus on a structural institutional distortion, namely, fiscal capacity to tax and within a standard macro-policy game we investigate the interactions between monetary and fiscal policy decisions. On the empirical side, we use a larger sample, but focus on the short-run debt response in relation to corruption, while they focus more on the long-run effect of the reform on inflation (and partially on government expenditure).

The remaining of the paper proceeds as follows. Section 2 presents the theoretical model. Section 3 determines the policy decisions and outcomes under the distinct institutional settings: commitment (second best), discretion, decentralisation of policies, focusing on central bank independence. The empirical analysis is conducted in Section 4. Section 5 concludes.

2 The Model

The model builds on the static Alesina and Tabellini (1987) and Huang and Wei (2006) frameworks while integrating the dynamic setting of Beetsma and Bovenberg (1997a). There are three main agents that live for two periods. The private sector consists of firms that determine output supply, and workers that provide labour and set inflation expectations. The government is responsible for the fiscal policy, setting government spending, distortionary taxes and debt, and the central bank controls monetary policy by setting inflation directly. In this setting we incorporate the analysis of bureaucratic corruption in a dynamic environment.[5]

2.1 Private Sector

The private sector is characterised by a continuum of firms that are both price and wage takers and seek to maximise their after-tax profits. The tax rate (τ_t) is incorporated as a fraction of revenues and thus distorts the behaviour of firms. Nominal wage contracts are negotiated before policies are set and hold fixed for one period. The labour market is competitive and the individuals seek to predict inflation expectations correctly. The aggregate supply of the economy is, then, given by a modified supply curve:

$$x_t = a(\pi_t - \pi_t^e) - b\tau_t \tag{1}$$

where x_t is the (log) output gap, and π_t, π_t^e are inflation and expected inflation respectively. a shows the ex ante unit impact of unanticipated monetary policy, and b the degree of distortionary taxation. In this simple model, we abstract from monopoly power is both goods and labour markets, since as Alesina and Tabellini (1987) show, distortionary taxation alone is responsible

[5]Our framework is based on a simple reduced-form model allowing us to derive and compare analytically policy outcomes under different institutional settings and systematic policy biases.

for the time inconsistent behaviour of policymaking. This simplification allows us to concentrate on the strategic interaction among the two 'big' players, the fiscal and monetary authorities. The private sector's market-determined output gap is distorted by taxation, $x_t = -b\tau_t$.

2.2 Fiscal Authority

The government provides public goods and services, having at its disposal taxation and/or borrowing.[6] The government's objective function is given by an augmented but otherwise conventional loss function. Benigno and Woodford (2004) justify this widely assumed specification by showing that, in a New-Keynesian framework, an approximation to the household's utility can match the loss function, given that the weights on inflation and output gap are appropriately set.

$$U^g = -\frac{1}{2}\sum_{t=1}^{2}\beta^{t-1}u_t = -\frac{1}{2}\sum_{t=1}^{2}\beta^{t-1}\left[(\pi_t - \tilde{\pi})^2 + \lambda_1(x_t - \tilde{x})^2 + \lambda_2(g_t - g^*)^2\right] \tag{2}$$

The objective function comprises of three arguments

(i) Inflation deviations from its bliss target, $\tilde{\pi}$. Despite the benefits of inflation on government revenues (seigniorage), the bliss inflation target corresponds to price stability, so $\tilde{\pi} = 0$.

(ii) Output gap deviations from its bliss target, $\tilde{x}$. The bliss output gap level is defined as the one that would prevail as a rational expectations equilibrium in the absence of any (tax or non-tax) distortions. With non-distortionary (i.e. lump-sum) taxes, this translates into $\tilde{x} = 0$. The difference among the output goals of the private sector ($-b\tau_t$) and the government (0) is the source of the time-inconsistency problem.

(iii) Government spending deviations from its bliss target, $g^* \in (0, 1)$. The bliss spending target, g^*, is the optimal share of non-distortionary output to be allocated on public goods, if lump-sum taxes were available. Alternatively, it could also reflect re-election or interest group motives.

Thus, $u_t = \pi_t^2 + \lambda_1 x_t^2 + \lambda_2(g_t - g^*)^2$ is the instantaneous loss function and $\lambda_i > 0$, for $i = 1, 2$ correspond to the weights relative to inflation the government puts on output and government spending gaps respectively.

The government budget constraint in nominal terms is given by:

$$P_tG_t = \phi\tau_tP_tY_t + M_t - M_{t-1} + P_tD_t - (1+\rho)P_tD_{t-1}$$

where Y_t, D_t, ρ and τ_t denote real output, debt, interest and tax rates, respectively. Debt is indexed, matures after one period and no borrowing can take place in period two.[7] Following Huang and Wei (2006), $0 \leq \phi \leq 1$ captures the degree of bureaucratic corruption in the tax collection mechanism and $\phi\tau_tP_tY_t$ is the effective tax revenue base. When $\phi = 0$ the whole revenue base is 'eaten up' and when $\phi = 1$ there is no corruption and all tax revenues accrue to

[6] The same key implications presented below (Propositions 1-4) can be drawn if we assume that part of government expenditure adds to the productive capacity of the economy. This extension is available from the Supplementary Material to the paper available from the author.

[7] Debt indexation excludes the use of surprise inflation in reducing the real value of outstanding debt. See Beetsma and Bovenberg (1997b) for an analysis that includes this incentive.

the Treasury. There is a strand of the literature (initiated by Leff (1964)) that conceptualises corruption as the 'helping hand' in improving rigid regulation and red tape. Here, we model a very specific form of bureaucratic corruption that focuses on the tax collection mechanism. Bureaucratic corruption, as in Blackburn et al. (2008) or Ghosh and Neanidis (2010), is captured in the simple form of embezzlement of public funds. Corrupt bureaucrats either grab tax revenues or artificially inflate the costs of tax collection. Within our macro-game model, we are predominantly interested in the impact of existing corruption on monetary and fiscal interactions. Thus, without explicitly modeling bureaucratic corruption, we account for its effects on limiting tax revenues. Indeed, there is ample empirical evidence on the constraints corruption imposes on tax revenues and the government budget. Tanzi and Davoodi (2001) provide evidence on the negative association between corruption and collection of tax revenues, as well as composition of taxation, for a large sample of about 90 countries, while Ghura (1998) and Imam and Jacobs (2007) concentrate on Sub-Saharan Africa and the Middle East, respectively.[8]

In real terms the budget reads[9]

$$g_t = \pi_t + \phi\tau_t + d_t - (1+\rho)d_{t-1} \quad \text{for} \quad t = 1, 2 \tag{3}$$

where g_t, d_t, d_{t-1} are expressed as shares of a non-distortionary level output.

2.3 Monetary Authority

The central bank is responsible for monetary policy and controls inflation perfectly. The monetary authority is subject to time-inconsistency problems, since from equation (1) it can use surprise inflation to stimulate output, which is considered 'too low' due to distortionary taxation. The objective function of the central bank shares the same arguments and goals as the government.

$$V^{cb} = -\frac{1}{2}\sum_{t=1}^{2}\beta^{t-1}v_t = -\frac{1}{2}\sum_{t=1}^{2}\beta^{t-1}[(\pi_t - \tilde{\pi})^2 + \xi_1(x_t - \tilde{x})^2 + \xi_2(g_t - g^*)^2] \tag{4}$$

where $\tilde{\pi} = \tilde{x} = 0$ and $\xi_i > 0$ for $i = 1, 2$ represent the central bank's relative weights on output and spending gaps.

With $\xi_i = \lambda_i, i = 1, 2$ a centralised authority (government) is responsible for both monetary and fiscal policies. Under this setting, the policymaker faces the optimal policy mix and there is no disagreement regarding the conflicting objectives. In the case where $\xi_i < \lambda_i$ for $i = 1, 2$ monetary policy is delegated to a weight-conservative (Rogoff-type) central bank that is more inflation averse relative to the government. With the explicit incorporation of fiscal policy, ξ_2 represents the degree of fiscal independence and thus the extent to which the appointed central bank takes fiscal considerations into account when setting inflation. The case where $\xi_2 = 0$ may be interpreted as the appointment of a purely independent central bank.

[8] Friedman, Johnson, Kaufmann, and Ziodo-Lobaton (2000) also suggest a negative relationship between corruption and tax revenues, as the former induces firms to go 'underground', which in turn erodes the tax base.

[9] Beetsma and Bovenberg (1997a) provide a derivation.

3 Regimes

As standard in the literature, we start our analysis from the second best (commitment) regime, since it serves as the basis of comparison for different institutional settings. However, with no available policy pre-commitment only the discretionary regime is feasible. Finally, the core of our theoretical findings lie in exploring improvements upon the discretionary outcome when fiscal and monetary policies are decentralised and the latter delegated to a weight-conservative and/or independent central bank. The focus here is on the role and interplay between bureaucratic corruption and debt dynamics.

3.1 Second Best

The infeasible first best outcome would result in all policy targets being met, as there are no distortions in the economy. Taxes and debt, since both non-distortionary, can be used interchangeably. The second best (SB) outcome of the model is derived from a centralised authority that is able to commit in the presence of distortionary taxes. Under the commitment outcome, the centralised authority maximises its intertemporal objective function with respect to all policy variables at the beginning of period one.

$$\begin{aligned}
\max_{\tau_t,\pi_t,d_t} \quad &= \quad -\frac{1}{2}\sum_{t=1}^{2} u_t = -\frac{1}{2}\sum_{t=1}^{2} \beta^{t-1}\left[\pi_t^2 + \lambda_1 x_t^2 + \lambda_2 (g_t - g^*)^2\right] \\
\text{Subject to} \quad & \pi_t^e = \pi_t \quad \text{for} \quad t = 1, 2 \\
& x_t = -b\tau_t \\
& g_t - g^* = \pi_t + \phi\tau_t + d_t - F_t; \quad \text{where} \quad F_t = (1+\rho)d_{t-1} + g^*
\end{aligned}$$

Solving this gives all first and second period policies and outcomes as a function of the structural parameters of the model, $\mathfrak{z} = \{a, b, \phi, \lambda_1, \lambda_2, g^*\}$ as can be seen in Appendix A.1. Both Alesina and Tabellini's (1987) ($\phi = 1$) and Huang and Wei's (2006) ($\phi < 1$) models are nested as special static cases of our framework.

Optimal debt issuance under the second best institutional arrangement, d_1^{SB}, is independent of all structural parameters of the model and driven solely from society's degree of impatience ($1/\beta$) relative to the rate of return to assets, $(1+\rho)$, and past debt.

$$d_1^{SB} = \frac{(1+\rho)d_0 + (1-\beta(1+\rho))g^*}{1+\beta(1+\rho)^2}. \tag{5}$$

Most importantly, bureaucratic corruption is not affecting the amount of borrowing under the commitment regime. Although debt impacts both first and second period policies, by reallocating the burden of raising revenues across time, it cannot affect future expectations. At the same time, the size of ϕ is only affecting the shares of seigniorage and taxes in meeting the government's financial requirement in each period, not the intertemporal allocation of the two.[10]

All other policy variables, however, depend on the prevailing level of fiscal corruption. The

[10] If corruption were time-variant, then optimal debt would depend on ϕ_t, see for example Dimakou (2013). However, in this two period model we assume that ϕ is time-invariant reflecting that corruption levels change very sluggishly over time.

effect of corruption on taxation is non-monotonic. There is a critical level of corruption above which the centralised authority shifts away from taxation. That is, when the incidence of corruption is relatively severe, a further leakage in tax revenues makes the collection of more taxes unwarranted in terms of foregone output. Second best inflation is negatively related to the degree of corruption; higher bureaucratic corruption always erodes the effective tax revenue base ($\phi\tau^{\text{SB}}$), requiring greater reliance on inflation tax revenues. Finally, a higher scale of bureaucratic corruption unambiguously results in lower government spending and lower overall social welfare.[11]

3.2 Centralised Economic Policy without Commitment

When the centralised authority is unable to pre-commit, policy decisions are made sequentially and monetary policymaking is subject to the well-known time-inconsistency problem. We proceed to analyse the discretionary regime, verifying, apart from the standard inflationary bias, all other policy biases that arise relative to commitment within a dynamic model with an explicit fiscal authority that suffers from bureaucratic corruption. The model is solved backwards. In period two the centralised authority sets fiscal and monetary policies according to

$$\begin{aligned}
\max_{\tau_2,\pi_2} -\frac{1}{2}u_2 \quad &= \quad -\frac{1}{2}\left[\pi_2^2 + \lambda_1 x_2^2 + \lambda_2 (g_2 - g^*)^2\right] \\
\text{Subject to:} \quad & x_2 = a(\pi_2 - \pi_2^e) - b\tau_2 \\
& g_2 - g^* = \pi_2 + \phi_2\tau_2 - F_2\,; \quad \text{where} \quad F_2 = (1+\rho)d_1 + g^* \\
& \text{with} \quad \pi_2^e, d_1 \quad \text{given.}
\end{aligned}$$

Subsequently individual agents form their expectations and period two finishes. In period one, the government chooses its policy instruments taking people's expectations and optimal period two policies as given.

$$\begin{aligned}
\max_{\tau_1,\pi_1,d_1} U \quad &= \quad -\frac{1}{2}\Big[u_1 + \beta u_2^{*,\text{DIS}}(d_1;\mathfrak{z})\Big] = -\frac{1}{2}\left[\pi_1^2 + \lambda_1 x_1^2 + \lambda_2(g_1 - g^*)^2 + \beta u_2^{*,\text{DIS}}(d_1;\mathfrak{z})\right] \\
\text{Subject to:} \quad & x_1 = a(\pi_1 - \pi_1^e) - b(\phi)\tau_1 \quad \text{with} \quad \pi_1^e \quad \text{given} \\
& g_1 - g^* = \pi_1 + \phi_1\tau_1 + d_1 - (F_1 - d_1)\,; \quad \text{where} \quad F_1 = (1+\rho)d_0 + g^*
\end{aligned}$$

Individuals form their first period expectations based on these policy decisions, and period 1 ends. Optimal discretionary debt depends on society's time preference ($1/\beta$) relative to not only the rate of returns on assets ($1+\rho$) but also intratemporal forces, as reflected in K below.

$$d_1^{\text{DIS}} = \frac{(1+\rho)d_0 + (1 - \beta(1+\rho)K)g^*}{1 + \beta(1+\rho)^2 K}, \quad \text{where} \quad K = \frac{[b + a\phi]^2\lambda_1\lambda_2 + \phi^2\lambda_2 + b^2\lambda_1}{b[b + a\phi]\lambda_1\lambda_2 + \phi^2\lambda_2 + b^2\lambda_1} > 1 \quad \forall\, \phi.$$

Under discretion, the effective discount factor ($\beta(1+\rho)K$) is greater relative to commitment ($\beta(1+\rho)$). Thus, the centralised authority issues less debt, $d_1^{\text{DIS}} < d_1^{SB}$. The observed disaccumulation of discretionary debt stems from intratemporal biases and the inability to commit or what Beetsma and Bovenberg term the *credibility effect*.[12] In a static setting, discretion

[11] For more details, refer to the Supplementary Material to the paper.

[12] See for example Beetsma and Bovenberg (1997a), but also Jensen (1994).

results in both the well-known inflation bias (Barro and Gordon (1983)) and an 'under-tax bias' due to active fiscal policy (Alesina and Tabellini, 1987). In addition, the inflation bias is now endogenous, directly related to the amount of taxation. Thus, the government is collecting too much revenue in the form of inflation and too little in the form of taxation. Notice that the government also overspends relative to the commitment outcome.[13] In a dynamic setting, discretionary debt can affect these intratemporal imbalances. The government has the incentive to disaccumulate debt (relative to commitment) to gain on second period credibility, by constraining second period inflation expectations and ultimately inflation. While responding to these intratemporal forces, discretionary policies result in both intratemporal and intertemporal imbalances compared to the second best.

Under a discretionary institutional setting all policy decisions and outcomes depend on the level of bureaucratic corruption non-monotonically. At an intratemporal level, while the impact of corruption on taxation follows the same non-linear pattern as in the second best, this is not the case for inflation. Discretionary inflation is driven by an additional force, namely the endogenous source of the inflation bias ($\frac{ab\lambda_1}{1+\lambda_2}\tau^{\text{DIS}}$). At higher corruption levels, this source is lowered (as the government moves away from taxation) and that may drive discretionary inflation down.[14] In the same vein, the impact of corruption on discretionary debt, and hence on the degree of debt disaccumulation relative to commitment, will depend on the response of intratemporal biases, as reflected in the sensitivity of the credibility effect ($\partial K/\partial\phi$).

$$\frac{\partial d_1^{\text{DIS}}}{\partial \phi} = \frac{\partial d_1^{\text{DIS}}}{\partial K}\frac{\partial K}{\partial \phi} \quad \text{where} \quad \frac{\partial d_1^{\text{DIS}}}{\partial K} < 0 \quad \forall \phi$$

For $a^2\lambda_1 > 1, \frac{\partial K}{\partial \phi} > 0$ implying that more corruption weakens the credibility effect and the degree of debt disaccumulation. Whenever $a^2\lambda_1 < 1$, there is a critical value of ϕ above which, more corruption strengthens the credibility effect. In other words, in most cases, higher institutional quality translates into higher debt disaccumulation; albeit this result may be overstated since reputational issues and private sector's strategic behaviour are ignored. However, when the structural parameters are such that the ex ante impact of surprise monetary policy is small (low a) or the government is quite inflation averse (low λ_1), then the intratemporal biases are not so big, and at low corruption discretionary debt gets closer to the commitment one.

3.3 Decentralisation of monetary policy: Central Bank Independence

Given the intra and intertemporal biases that arise under the discretionary regime, we now analyse the improvements that can be achieved by delegating monetary policy to a more conservative central bank à la Rogoff (1985). Under this institutional design monetary policy is delegated to a central bank that attaches lower weights on the output and government spending arguments relative to inflation (i.e. $\xi_i < \lambda_i$, $i = 1, 2$). A lower ξ_1 implies the central bank is more inflation averse relative to output or, in other words, it represents the primacy of price stability. A lower ξ_2 implies that monetary policy making is less considerate of fiscal budgetary

[13] This is what Adam and Billi (2014) call a 'government spending bias'.

[14] Detailed exposition can be found on the Supplementary Material to the paper available from the author. See also discussion in Huang and Wei (2006) p. 244-245.

requirements.[15] Indeed, central bank reforms towards increased autonomy, in both dimensions, have been undertaken in many countries in the past couple of decades.

In particular, one of the most important provisions in central bank reforms is the ultimate prohibition of debt monetisation and direct credit to the government. This translates into a purely independent central bank, $\xi_2 = 0$. A vast amount of work on both the optimality of central bank independence (with exogenous or passive fiscal policy), the formulation of a such a regime and its implications empirically has developed, although empirical findings are still mixed. We now proceed to analyse the main policy outcomes under this institutional setting, which form the core of our empirical analysis in the following section.

Central bank independence (CBI) implies that the monetary authority is not fiscally dominated, achieving its monetary target without taking the government's budgetary needs into account. The solution to the CBI regime is obtained backwards and summarised in Appendix A.2. In the second period, the government and the central bank maximise their objective functions with respect to τ_2 and π_2 respectively,

$$\max_{\tau_2} u_2 = -\frac{1}{2}\left[\pi_2^2 + \lambda_1 x_2^2 + \lambda_2 (g_2 - g^*)^2\right] \quad and \quad \max_{\pi_2} v_2 = -\frac{1}{2}\left[\pi_2^2 + \xi_1 x_2^2\right]$$
$$\text{Subject to} \quad x_2 = a(\pi_2 - \pi_2^e) - b\tau_2\,;$$
$$g_2 - g^* = \pi_2 + \phi\tau_2 - F_2\,; \qquad F_2 = (1+\rho)d_1 + g^* \quad \text{and} \quad d_1,\, \pi_2^e \quad \text{given.}$$

Subsequently, second period expectations are formed and optimal policies obtained. Similarly, in the first period the fiscal and monetary authorities maximise their objective functions respectively, taking first period inflation expectations and optimal second period policies as given. Note that only the fiscal authority can affect second period expectations and policy outcomes (through d_1). Debt policy under this regime is given by

$$d_1^{\text{ICB}} = \frac{(1+\rho)d_0 + (1 - \beta(1+\rho)N)g^*}{1 + \beta(1+\rho)^2 N} \tag{6}$$

$$\text{where} \quad N = \frac{(ab\xi_1\lambda_2\phi)^2 + b^2\lambda_1\lambda_2(\phi^2\lambda_2 + b^2\lambda_1)}{b^2\lambda_1\lambda_2[ab\xi_1\lambda_2\phi + \phi^2\lambda_2 + b^2\lambda_1]}.$$

The optimal delegation parameter on inflation aversion is derived by maximising society's optimal (with respect to policy decisions) welfare under decentralisation, $\max_{\xi_1} -\frac{1}{2}[u_1^{*,\text{ICB}}(\xi_1;\mathfrak{z}) + \beta u_2^{*,\text{ICB}}(\xi_1;\mathfrak{z})]$, which yields the following optimality condition

$$\xi_1^{\text{opt}} = \frac{b}{a}\frac{1}{\phi}\lambda_1. \tag{7}$$

The size of ξ_1^{opt} depends positively on the degree of distortionary taxation (b), the government's weight on output gap (λ_1), the level of corruption ($1/\phi$) and negatively on the ex ante output boost channel (a). It will be greater than λ_1 whenever $b \geq a$ or $b > a\phi, \phi < \frac{b}{a}$. That is, except for potentially very low levels of corruption ($\phi > \frac{b}{a}$, if $a > b$), the commitment outcome can only be attained with a *less* conservative than society central bank.[16] A budgetary independent

[15] Within the literature with explicit fiscal policy (e.g. Eijffinger and Hoeberichts (2008)), ξ_1 corresponds to the *degree of conservativeness* of the central bank and ξ_2 to the *degree of independence*.

[16] When $a = b$ as in Alesina and Tabellini (1987) or Beetsma and Bovenberg (1997a), $\xi_1 > \lambda_1\, \forall \phi < 1$. The same

central bank is ignoring not only the government's financial requirements, but also the capability of the tax-collection mechanism. In other words, it is not taking into account that a lower ϕ implies a more costly tax system, with negative spillovers on both government's spending and output gaps, and a higher reliance on inflation tax from the perspective of the government.

Hence, with the explicit incorporation of fiscal policy the optimal institutional design may be 'altered'. In the presence of bureaucratic corruption, the trade-off between conservatism and independence entails a purely independent central bank should be *less* inflation averse. However, this is rarely observed in practice and never prescribed in policy/ academic circles. As part of universally promoted central bank reforms, the primacy of price stability and commitment to inflation averse functioning are top in the agenda. The appointment, hence, of such a less conservative central bank may not be feasible for political or credibility reasons. Hence, ξ_1 will be bounded in the proximity of λ_1.

Whenever an independent central bank with $\xi_2 = 0$ and $\xi_1 \leq \frac{b}{a\phi}\lambda_1$ is legislatively constituted, a new aspect emerges in a dynamic environment. The government faces the incentive to use debt strategically to influence second period monetary setting. This gives rise to the proposition below.

Proposition 1. *For $\xi_1 < \frac{b}{a\phi}\lambda_1$ delegation of monetary policy to a purely independent central bank results in higher debt relative to both commitment and discretionary settings. Thus, $d_1^{\text{ICB}} > d_1^{\text{SB}} > d_1^{\text{DIS}}$.*

Proof

Suffice to compare the effective discount factors under the three regimes, since they determine the intertemporal cost of servicing debt. The effective discount factor of the government under CBI, $\beta(1+\rho)N$, is smaller compared to the second best ($\beta(1+\rho)$) since,

$$N = \frac{[ab\xi_1\lambda_2\phi]^2 + b^2\lambda_1\lambda_2(\phi^2\lambda_2 + b^2\lambda_1)}{b^2\lambda_1\lambda_2\left[ab\xi_1\lambda_2\phi + \phi^2\lambda_2 + b^2\lambda_1\right]} < 1, \quad \text{when} \quad \xi_1 < \frac{b}{a\phi}\lambda_1$$

Thus, the government intertemporally shifts its financial requirements away from the first and towards the second period, by issuing more debt. Similarly, under CBI the effective discount factor is even lower relative to discretion's, $\beta(1+\rho)K$, since $K > 1$ (see section 3.2).

□

With central bank independence more debt is accumulated relative to both the commitment and the discretionary regimes, for a given level of bureaucratic corruption. Despite independence, the government uses debt policy in order to affect second period inflation because monetary policy is considered too conservative from the ex ante perspective of the government, delivering too little inflation in both periods. More precisely, the government strategically accumulates debt so as to increase second period taxes, which in turn distort output further and hence induce the central bank to increase second period inflation. The channel through which the *strategic effect of debt* affects second period inflation is indirectly via the independent central bank's consideration for period two output gap (ξ_1) and it is different from the discretionary case ($\xi_2 = \lambda_2$),

holds in an extension to the model where the government provides public goods that directly enhance private output in equation (1). See Supplementary Material to the paper available from the author.

where d_1 affects π_2^e (and hence π_2) directly, presented in Section 3.2. The strategic debt accumulation proposition can provide an explanation for the mixed results regarding the effectiveness of central bank independence on inflation performance, particularly among developing countries or emerging economies. Strategic borrowing may also generate adverse effects on both output and spending gaps due to higher taxation and a bigger debt burden, worsened by corruption. Strategic use of debt (positive or negative) can arise under different frameworks, as in Beetsma and Bovenberg (1997a) or Cabral and Ozkan (2008), that abstract from fiscal corruption. In the former, this can be due to political distortions (myopic or opportunistic governments, whereby β, λ_i differ from society's). In both works, the result depends on a velocity of money term ($k\pi_t$ - seigniorage). Here, we look explicitly at a structural institutional distortion on the fiscal capacity to tax, which in turn produces the need for further seigniorage. Most importantly, we elaborate on the impact that different levels of corruption (ϕ) and price stability primacy (ξ_1) have on the debt process. This yields the following three propositions, which are then tested empirically.

Proposition 2. *For values of ξ_1 in the range $\widetilde{\xi_1} < \xi_1 < \frac{b}{a\phi}\lambda_1$ and given ϕ, a bigger reform towards price stability (lower ξ_1) induces the government to strategically accumulate more debt. The opposite occurs when $\xi_1 < \widetilde{\xi_1}$.*

Proof
See Appendix A.3 for the proof and analytic definition for $\widetilde{\xi_1}$.

□

For relatively moderate values of $\xi_1 \in (\widetilde{\xi_1}, \frac{b}{a\phi}\lambda_1)$, increasing the degree of the central banks's inflation aversion decreases the effective discount factor. Thus, a bigger reform towards price stability induces the government to strategically borrow more. The cost of increased borrowing is lower than the benefit of higher future inflation, as the central bank cares enough about output distortions so as to respond by delivering higher future inflation. The opposite occurs for relatively small values of $\xi_1 \in (0, \widetilde{\xi_1})$. In this case the government knows that the delegated central bank (being very inflation averse) will barely raise inflation in response to higher debt repayment in the second period and refrains from issuing debt.[17]

Proposition 3. *For values of ϕ in the range $\widetilde{\phi} < \phi < 1$ and given $\xi_1 < \frac{b}{a\phi}\lambda_1$, more bureaucratic corruption induces the government to accumulate more debt. The opposite holds for $\phi < \widetilde{\phi}$.*

Proof
See Appendix A.3 for the proof and analytic definition of $\widetilde{\phi}$.

□

For corruption levels in the range $\phi > \widetilde{\phi}$, more fiscal corruption reduces the effective discount factor and increases borrowing. Within this range, more corruption implies a very restrictive monetary policy and the strategic debt accumulation channel is boosted, in an attempt to increase future inflation. This result suggests we would expect economies with higher levels of bureaucratic corruption to exhibit increasing and higher public debt levels with the introduction

[17] In the extreme case where $\xi_1 \to 0$ the central bank operates as an 'inflation nutter' and the strategic debt mechanism vanishes.

of central bank independence, compared to economies that have better fiscal institutions. For relatively severe values of corruption, $\phi \in (0, \widetilde{\phi})$, a further reduction in ϕ does not induce the government to accumulate borrowing. A lower ϕ is making the tax-system overly inefficient such that overall revenues get smaller due to the negative impact of tax revenues. Consequently, the potential mechanism the government has in affecting second period monetary policy gets prohibitively costly.

Proposition 4. *For values of* (ξ_1, ϕ) *such that* $\frac{\partial N}{\partial \xi_1} > 0$*, it holds that* $\frac{\partial N^2}{\partial \xi_1 \partial \phi} > 0$*. Thus, as* ϕ *(*ξ_1*) decreases the impact of* ξ_1 *(*ϕ*) on debt accumulation is enhanced.*

Proof

See Appendix A.3 for the proof.

□

The last proposition stresses the interactions among the size of the reform and fiscal inefficiencies and the possibility of non-linearities. Concentrating on values of (ξ_1, ϕ) such that $\frac{\partial N}{\partial \xi_1} > 0$, as the degree of inflation aversion of the central bank is increased, the impact of corruption on debt accumulation is strengthened. That is, the negative effect of corruption on debt accumulation is higher, when the monetary reform towards price stability is higher. Similarly, when corruption is higher, the impact of a more conservative central bank on debt is stronger.

Note that Acemoglu et al. (2008) develop a simplified politics redistribution model to explain under what conditions a central bank reform will succeed in reducing inflation, while also affecting other policy dimensions ('seesaw' effect). Although both contributions highlight the importance of institutional factors, the mechanisms and results are different. In their approach, inflation and government expenditure are viewed as redistributions to interest groups and the extent of their prevalence depends on the degree of control on politicians. They suggest that at high levels of checks and balances, the political equilibrium will entail a non-distortionary outcome (low inflation) irrespective of reform, while at high levels of politicians' unaccountability, the distortionary outcome may prevail even if the reform makes it costlier, as politicians can extract higher 'transfers' from the lobby in exchange for higher inflation. Thus, it is at intermediate levels of constraints to the executive that the reform will be more effective. For those cases, the success of the monetary reform, may lead to deterioration in fiscal outcomes, as the lobby can be compensated for the loss of inflation with more government expenditure. Thus, the source of the inflationary bias is very different from our model, which builds on the time-inconsistency literature. In the same lines, the mechanisms are distinct. Here, within a strategic macro game with a newly appointed monetary authority, the government is benevolent, but attempts to 'undermine' the central bank's effort due to corruption and its subsequent fiscal leakages. Monetary and fiscal policies interact such fiscal outcomes deteriorate (debt accumulation), decreasing the effectiveness of a central bank reform. Under CBI, more corruption induces the government to use debt even more in order to stimulate an expansionary monetary policy. Also, the bigger the reform, the greater the impact that corruption has on the strategic use of debt. Our framework also points to the direction of 'inverted' responses, in that at extreme levels of corruption or conservativeness, either the tax collection system is not functioning or the independent central bank is not responding to output distortions ('inflation nutter') and

consequently the strategic debt channel cannot pass through. However, for values of (ξ_1, ϕ) within plausible and realistic ranges, strategic borrowing succeeds and is negatively affected by fiscal corruption. We now look at whether these comparative static implications are supported empirically.

4 Empirical Analysis

Our empirical analysis explores the impact of corruption on fiscal policy (debt accumulation) given an important reform towards central bank independence. This way, we attempt to provide an explanation for the poorer inflation performance and the diverse empirical evidence on the link between central bank independence and inflation for developing and emerging economies. We follow two main empirical approaches in order to investigate whether a set of our theoretical predictions are consistent with evidence from the data; an event-study approach in which we focus only on countries that did undertake legal central bank reforms, and a difference-in-differences (DID) approach in which we control for countries that did not forego significant reforms. As a last step, we also provide estimates in a panel data setting.

4.1 Methodology and Data

In our methodology, central bank independence is primarily identified as a point in time, concentrating on the timing of an important central bank reform providing a decisive step towards independence and observe the evolution of debt accumulation from that point onwards compared to before. Event and DID studies in this area of economic literature have been limited, but are recently growing.[18] Although the timing of a reform is undoubtedly an objective measure of commitment to more independent monetary policymaking, the magnitude of such reform will inevitably differ from one country to another. Consequently, we complement our analysis with a CBI-index that measures the level of independent status each reform gave. Information on the level of CBI allows us to also carry out a DID estimation, whereby we identify a group of countries that either did not change their central bank Act or did not enact 'meaningful' legal reforms.

Our first empirical specification associates with the cross-sectional growth models that examine the existence of "β-convergence" (Barro, 1991). Our empirical investigation involves estimating the effect of bureaucratic corruption on debt accumulation after an important central bank reform in a cross-sectional setting. This is conducted as follows. Denoting τ as that point in time in which a country had a decisive reform, we calculate the average debt-to-GDP ratio of three years before and after the reformed date.[19]

$$DB = \frac{d_{\tau-3} + d_{\tau-2} + d_{\tau-1}}{3} \quad \text{and} \quad DA = \frac{d_{\tau} + d_{\tau+1} + d_{\tau+2}}{3}$$

where $d_t = D_t/GDP_t$ corresponds to the debt-to-GDP ratio. If the reform is enacted in the

[18] For instance, see Ball and Sheridan (2005), Daunfeldt and de Luna (2008), Goncalves and Salles (2008), Lin and Ye (2009), Brito and Bystedt (2010), Acemoglu et al. (2008), Crowe and Meade (2008) and Hielscher and Markwardt (2012).

[19] The choice of three years averaging was merely driven by debt data availability. Although not presented here, using four and five years averages does not qualitatively affect our results, but increases the number of cases with missing data, particularly for the pre-reform period.

first two quarters of year τ, then τ is included in the after period (as shown above). Otherwise, we start the after period in $(\tau + 1)$ to allow for the reform to be fully realised. Based on the theoretical implication that more corruption leads to more debt accumulation (Proposition 3), the first empirical specification employed is

$$GD_i = \alpha + \beta QUAL_i + \gamma X_i + \varepsilon_i \tag{8}$$

$GD = \frac{DA-DB}{DB} \times 100$ is the percentage change in the average three years before and after debt-to-GDP ratio.

$QUAL$ reflects the level of corruption (quality) of each country and X consists of a set of control variables (discussed below). Subscript i refers to each observation (country and reform) in our sample, thus countries with two central bank reforms are treated as different observations. CBI is implicitly identified as that point around which the dependent variable is centered, and hence, despite this being a snapshot analysis, there is a time-dimensional element (generated by DB_i). A caveat is in order. Given that GD internalises the adoption of a central bank reform and that such reforms are not randomly assigned, our estimation results are interpreted as robust correlations between corruption and debt accumulation, conditional on CBI being granted, and not as causal effects.

Our second empirical specification follows a DID approach in the spirit of Ball and Sheridan (2005), controlling for countries that did not forego important central bank reforms and ameliorating on the issue of endogeneity of reforms.

$$GD_i = \alpha + \beta_1 QUAL_i + \beta_2 CBR_i + \beta_3 QUAL_i \times CBR_i + \gamma X_i + \varepsilon_i \tag{9}$$

where CBR takes the value of 1 for those countries that enacted significant legal reforms (to be defined below), and zero otherwise. Here, we are predominantly interested in the interaction term, showing the impact that corruption may have on the effectiveness of the reform. Our approach bears some similarities with the timing approach to CBI within event and DID studies. The majority of these contributions concentrate on the effect of inflation-targeting (IT) adoption on inflation, output and/or their volatility and their results are mixed. Ball and Sheridan (2005) compare the effect of inflation targeting in 20 OECD countries in a cross-sectional difference-in-difference approach, and find no evidence of improvement in economic performance. For developing countries, Brito and Bystedt (2010) suggest that inflation targeting has a (negative but) mild impact on inflation and a negative impact on output growth. Lin and Ye (2009), using a propensity score matching approach, show that the treatment effect of inflation targeting in lowering inflation is large and significant, but at the same time they reveal that fiscal discipline is an important factor that determines the efficiency of inflation targeting.

However, our methodology and conceptualisation differs in many ways. We incorporate a broader concept of CBI looking at important central bank reforms (not restricted to, but also including IT). This is also the case for Acemoglu et al. (2008) and Crowe and Meade (2008), although our sample size is larger. More importantly, the focus here is on debt accumulation, and hence on the fiscal discipline effect. We first investigate the conditional relation between debt accumulation and bureaucratic corruption, given an important central bank reform towards

CBI.[20] Acemoglu et al.'s (2008) 'seesaw' effect bears some similarities with ours, as they investigate the impact of reforms on government spending, using a fixed-effects panel analysis and focusing on the longer-run. They conclude that further investigation is needed. In equation (8) we focus on the immediate response of debt to the reform in relation to fiscal corruption and in Section 4.3 fixed-effects panel estimations are undertaken both in the spirit of eq. (8) and in line with the empirical strategy of Acemoglu et al. (2008). In our DID specification (equation (9)), extending the IT literature, we control for countries that did not enact important reforms in their monetary policy making. This allows us to identify whether there is indeed a difference in debt-to-GDP evolution between control and treatment groups, and whether the constraints corruption imposes are stronger among the set of countries that significantly reformed their central banks, unlike Crowe and Meade (2008) and Hielscher and Markwardt (2012) who do not incorporate a control group.

Country Sample and Data

Our country sample for the event study specification consists of 77 countries, 23 advanced and 54 developing. In the DID specification the country sample in augmented to include 12 more countries. Central bank reform dates span from 1989 to 2002 and 29 countries had two reforms during the examined period which raises the number of observations in the model to 106. Developing countries come from all geo-economic regions and provide for a very diverse sample. Indeed, during the 1990s and beginning of 2000s the majority of central banks around the world enhanced their autonomous status. Apart from this universal trend towards increased independence, there is a number of regional and country specific factors that can explain the observed patterns towards CBI. The importance of creditworthiness, the break from past political activities and 'failed' policies (e.g. in Latin America), crises or collapse of previous institutions (East Asia, Latin America), aspiration of EU admission (Eastern Europe) constitute a few of such factors. Using the information from the updated CBI indices, we observe that advanced economies have attained the highest level of CBI, followed closely by Europe and Central Asia (ECA) and Latin America and the Caribbean (LAC). In many instances, those two groups rank higher than non-EU advanced economies, since many countries undertook very ambitious reforms. Countries in East Asia and Pacific (EAP), Subsaharan Africa (SSA) and Middle East and North Africa (MENA) regions have substantially lower degrees of CBI. In the last two groups the reforms are quite recent (beginning of 2000s) and small in magnitude.

Public debt data are taken from Jaimovich and Panizza (2006). Their debt database refers to central government debt (domestic and external) as a share of GDP. As a proxy for bureaucratic corruption (*QUAL*) we use two widely known indices; the Control of Corruption index from the Worldwide Governance Indicator (CC-WGI) (Kaufmann, Kraay, and Mastruzzi, 2009) and the the Corruption Perception Index of Transparency International (CPI-TI). The CC-WGI index is available bi-annually since 1996 and annually after 2002. We use the average for the 1996-2005 period for each country, since this is the only available period that is included in the time span of reforms. For robustness purposes, we also employ individual years of the CC-WGI index, as well as the CPI-TI as of 2005. Both indices are transformed and range from 0 to 10, increasing

[20] Al-Marhubi (2000) empirically confirms the adverse impact of corruption on inflation.

in institutional quality.

Data on central bank reform dates have been collected from official Central Bank websites, legal databases and various reference papers.[21] Inflation Targeting (IT) adoption dates are also treated as central bank reforms.[22] The timing of reforms is complemented by a newly compiled CBI-index capturing the level of independence each reform gave. This is a highly relevant distinction, since reforms resulted in quite distinct levels of monetary policy autonomy. We use the widely used Grilli, Masciandaro, and Tabellini (1991) index (thereafter GMT), which assesses the degree of autonomy based on a set of legal criteria in the Central Bank Act. We employ updates of the GMT-index from other studies and own calculations.[23] The degree of CBI is introduced in a categorical (dummy) variable format, as shown below. This reduces the subjectivity biases that arise from the combination of various sources, as some variation in legal CBI levels could be due to different interpretations of researchers. Additionally, there is evidence that a dummy variable specification is preferred, without loss in predictive power (Cargill, 2013; Parkin, 2013).

Our CBI-index variable is grouped into four categories for high, upper medium, lower medium and low independence. The GMT-index is measured in a 0 (no CBI) to 16 (full CBI) scale, by adding up its two components (political and economic autonomy). The categorisation of the countries into the four classes is based on deriving somehow equal sized groups, while keeping the level of CBI as coherent as possible (Appendix B.1). There is no country with a 0 score (the least independent is Qatar with a score of 3) nor with 16. More precisely,

$$IHIGH = \begin{cases} 1 & \text{if CBI} \geq 13 \\ 0 & \text{otherwise} \end{cases} \qquad IUMED = \begin{cases} 1 & \text{if } 11 \leq \text{CBI} \leq 12 \\ 0 & \text{otherwise} \end{cases}$$

$$ILMED = \begin{cases} 1 & \text{if } 8 \leq \text{CBI} \leq 10 \\ 0 & \text{otherwise} \end{cases} \qquad ILOW = \begin{cases} 1 & \text{if CBI} \leq 7 \\ 0 & \text{otherwise.} \end{cases}$$

Based on this information we construct a control (non-reform) group for the difference-in-differences estimation as follows. All countries with a CBI level less than 9 points are identified as very small, and hence not meaningful reforms. In addition, we use data from Polillo and Guillén (2005) and identify 12 more countries for which the CUK independence index (Cukierman et al., 1992) did not change throughout 1990s.

The control variables in vector X are depicted in Table 1. Variations in GDP ($GRGDP$) could be affecting the dependent variable (as a share of GDP) negatively, while the impact of variations in inflation (INF) is unclear. Some countries have indexed debt, though for others with non-indexed debt we would expect variations in inflation to affect debt negatively. Further, we control for the exchange rate regime of each country, since the more rigid the system, the less scope for discretionary monetary policy. Financial or currency crises are also accounted for, as they can have sizeable effects on debt accumulation. For instance, the Asian financial crisis of 1997 caused Indonesia's debt-to-GDP to increase by 235% between 1997-1998. The crisis dummy ($CRISIS_i$) captures all the major crises that occurred during the 1990s and the beginning of 2000s. $HIGHDB$ controls for those countries that are highly indebted before the

[21] Indicatively, Arnone, Laurens, and Segalotto (2006), Maliszewski (2000), Jácome and Vázquez (2005), Roger and Stone (2005) and Cukierman, Miller, and Neyapti (2002).

[22] IT adoption represents a highly credible and 'non-reversible' regime shift (Samarina and Sturm, 2014).

[23] See Dimakou (2010) for details on sources, reformed Central Bank Acts, dates and the GMT-index scores.

Table 1: Control Variables

Variable	Description	Source
$GRGDP$	Percentage change of annual average real GDP between three years before and after the reform. In the panel estimations we use real GDP per capita data	PWT8.0
INF	Percentage change of annual average Consumer Price Index (CPI) between three years before and after the reform	IFS - IMF
EX_j	*De facto* classification of regimes into fixed ($EXFIX$), intermediate ($EXINTER$) and floating ($EXFLOAT$)	Bubula and Ötker Robe (2002)
$CRISIS$	Dummy variable that takes value 1 for those countries that experienced a financial or currency crises during the years of interest; 0 otherwise. In panel regressions we also employ a debt restructuring ($DEBTRESTR$) dummy variable.	Reinhart and Rogoff (2008), Valencia and Laeven (2008)
$HIGHDB$	Dummy variable that takes value 1 for those countries that average debt-to-GDP ratio before the reform exceeds 80%; 0 otherwise	
$HIPC$	Dummy variable that takes value 1 for those countries that had their decision or completion points under the Heavily Indebted Poor Countries (HIPC)-initiative included in the period examined	www.worldbank.org/hipc
$PRES, PAR$	Dummy variables identifying whether the political system in each country is presidential or parliamentary (relative to assembly-elected president),	DPI - World Bank
$DSYS$	and whether there was a change in the system during the reform period	
$FRAC$	Degree of fractionalisation in the legislature (probability that two legislators selected at random are from the same party)	DPI - WB
$POLAR$	Degree of political polarisation (difference among the ideological position of the government and opposition)	DPI - WB
$LIEC$	Legislative index of electoral competition	DPI -WB

See Table B.2 in the Appendix for country classification in each control dummy. Summary statistics are provided from the Supplementary Material to the paper available from the author.

reform. Countries with excessive debt-to-GDP ratios face a set of different challenges. Due to credit or other constraints, they might not be able to issue more debt, but at the same time it could be difficult to implement a drastic debt disaccumulation policy. Overall, countries with high starting debt/GDP levels experienced small decreases after the reforms. A similar control variable accounts for the HIPC-initiatives, initiated in 1996 and further enhanced in 1999 by the WB and IMF, as schemes of debt relief for poor countries. Finally, we control for a set of political economy variables that could be responsible for cross-country variation in debt evolution. Using data from the Database of Political Institutions (Beck et al., 2001), we first account for the type and differences in the political system; presidential, parliamentary and assembly-elected president. The last category is associated with a lower level of democracy and elections competitiveness. We also control for the degree of fractionalisation and political polarisation. Various political economy theories suggest that parliamentary systems, and more fragmented and polarised legislatures may exhibit increased debt levels. However, note that these theoretical predictions refer to longer time frames, particularly among democracies and focus on debt-to-GDP levels (rather than short period growth rates).

4.2 Estimation Results

Table 2 presents the estimation results for equation (8). Overall, the effect of *QUAL* is significant at the 1% level and ranges between 3.6 and 5.6%. This implies that a decrease in institutional quality (more corruption) is associated with an increase in the rate of growth of (3-years average) debt-to-GDP ratio of approximately four percentage points. Given that average *GD* in our sample is 10.1%, the impact of corruption on debt accumulation is sizeable.

Table 2: Estimation Results for equation (8) (No. of observations 106)

	(1)	*(2)*	*(3)*	*(4)*†	*(5)*†	*(6)*‡
Const.	45.928	44.708	51.310	42.758	41.869	54.215
	(4.637)***	(4.266)***	(5.041)***	(4.585)***	(4.492)***	(3.045)***
QUAL	-4.170	-4.656	-3.846	-3.798	-3.579	-5.601
	(-3.473)***	(-3.411)***	(-3.340)***	(-3.331)***	(-3.168)***	(-3.094)
GRGDP	-0.816	-0.837	-0.832	-0.744	-0.803	-1.160
	(-2.218)**	(-2.137)**	(-2.211)**	(-2.088)**	(-2.212)**	(-4.084)***
INF	-0.122	-0.118	-0.110	-0.127	-0.126	-0.032
	(-5.093)***	(-4.540)***	(-4.646)***	(-8.208)***	(-7.940)***	(-0.436)
HIGHDB	-19.152	-18.450		-18.204	-17.818	-21.609
	(-3.899)***	(-3.393)***		(-3.810)***	(-3.789)***	(-4.134)***
CRISIS	42.573	40.886	40.716	35.942	32.962	35.952
	(4.905)***	(5.083)***	(4.576)***	(4.547)***	(4.235)***	(4.107)***
HIPC	-10.202	-12.287	-8.442	-10.174	-9.421	-3.297
	(-1.197)	(-1.410)	(-0.935)	(-1.210)	(-1.118)	(-0.351)
DB			-0.196			
			(-2.678)***			
EXINTER		0.658				
		(0.108)				
EXFLOAT		8.696				
		(1.458)				
PRES						-16.986
						(-1.217)
PAR						0.663
						(0.045)
DSYS						-12.636
						(-0.846)
FRAC						19.263
						(1.259)
POLAR						-3.919
						(-1.009)
R-square	*0.487*	*0.502*	*0.487*	*0.569*	*0.587*	*0.547*
Adj. R-square	*0.456*	*0.461*	*0.456*	*0.533*	*0.549*	*0.490*
SER	*24.358*	*24.249*	*24.362*	*22.570*	*22.195*	*22.989*
F-stat (p)	*15.683 (0.00)*	*12.228 (0.00)*	*12.228 (0.00)*	*15.986 (0.00)*	*15.173 (0.00)*	*9.751 (0.00)*

Note: OLS estimation with Heteroskedasticity-Consistent Standard Errors and Covariance. *t*-ratios in parentheses; * = 10%, ** = 5%, and *** = 1% levels of significance. † In columns *(4)* and *(5)* we control for three outlier countries. Although not reported, the dummy variables for Turkey, Indonesia and Kyrgyz are high significant. ‡ In column *(6)*, due to unavailability of polarisation data, the sample size reduces to 101.

GRGDP and *INF* have a negative impact on *GD*, albeit quantitatively small, while exchange rate regimes are found to be insignificant (Column *(2)*). The *HIPC* dummy variable is negative, but insignificant in most specifications. *HIGHDB*, *CRISIS* are always significant both statistically and quantitatively. Their sizeable effects are attributable to the inclusion of countries with very different debt processes compared to the average. In most countries hit by a crisis, there were marked increases in their debt-to-GDP ratios; in others where *GD* was not largely affected the impact of the crisis is noticed in either their GDP growth or inflation. Highly indebted countries are experiencing debt decreases after the reforms.

In column *(3)* we follow the growth Barro-type specification more closely using the 'initial' debt-to-GDP ratio as one of the regressors. The impact of the before the reform debt-to-GDP is significant and the importance of institutional quality prevails. In columns *(4)* and *(5)* we control for some outlier countries, as a means of confirming that the results are not driven by exceptional cases. These are: Indonesia and Turkey that show their debt-to-GDP ratios increase substantially in the midst of their financial crises; and Kyrgyz Republic (1997) that also experienced a big increase in GD due to the negative spill-over of the Russian crisis. Results remain robust with the impact of *QUAL* in the same range as before. In column (6) we control for political factors, which are however found to be insignificant.

Results in Table 2 are consistent with the main statement of Proposition 3; more corruption is associated with higher debt-to-GDP accumulation given a reform. However, our proposition also suggests that at severe levels of corruption, the strategic effect of debt might get 'reversed'. We check this by adding an interaction term ($QUAL \times LOWQUAL$), but find little support for the 'reversal'.[24] This might imply that either our sample does not contain countries with such characteristics, or the impact is not easily identified because we neglected the size of the reform.

Results for different levels of Central Bank Independence

Our empirical investigation in equation (8) does not account for the level of independence that may well differ from one reform to another. Our comparative-static predictions (indicated by Proposition 4) suggest that we would expect the effect of fiscal institutional quality to be stronger when high levels of CBI are legislated, rather than when a monetary policy regime shift is only limited. We account for this feature empirically by interacting corruption with a CBI-dummy variable, reflecting the level of independence the central bank reform in question gave. This proposition is further explored in a DID estimation. Note that Crowe and Meade (2008), using updated data for the CUK CBI-index[25] for 56 countries, formulate a first difference specification in which the difference in inflation is explained by the difference in this de jure measure of independence. However, the timing of each reform in question is ignored, as all countries are grouped into the initial (1987-91) and the current (2002-06) periods. Here, due to unavailability of data we incorporate only the level of the CBI after the reform, but we do account for the timing. Results for the following regression are presented in Table 3.

$$GD_i = \alpha + \sum_{k=1}^{4} \beta_k CBI_{ki} QUAL_i + \gamma X_i + \varepsilon_i \tag{10}$$

where $CBI_k, k = 1, ..., 4$ stands for the four (high, upper and lower medium, low) categories of independence levels.

Our empirical results provide evidence of a non-linear effect of corruption on *GD*. The impact of institutional quality on debt-to-GDP accumulation is the highest for the countries that shifted to very high levels of CBI, and gradually decreases as the level of CBI introduced

[24] $LOWQUAL$ takes value 1 for countries with very low quality scores. When the cutoff point is set very low, the coefficient of the interaction term is positive, as we expect, but highly insignificant. Results do not improve if we include more countries in the dummy, increasing the cutoff point.

[25] The CUK index was initially constructed using Acts in effect as of 1991. Crowe and Meade (2008) update the data looking at current central bank Acts as of 2003.

by the reform lessens. The interaction variables of quality with high, upper medium and low CBI are significant under all specifications. According to Table 3 (column *(1)*), within the reforms that resulted in a high degree of independence, a unit rise in corruption (lower *QUAL*) is associated with increases in the debt/GDP ratio of 4.6 percentage points; this is then dropped to about 4.3 points for the *UMED* group, and to around 2.9 point for those countries that only established very limited independence. However, the interaction variable *QUAL*ILMED* turns out to be insignificant, and this is further explored in Columns *(2)* and *(3)* of Table 3.[26]

The two clusters that incorporate the smallest reforms are quite diverse in terms of both timing of reforms and geo-economic regions. They also include the majority of low-income countries, as well as all the Asian crisis-hit and HIPC countries.[27] We follow two lines of investigation. First, we investigate the relative level of independence granted in the two clusters. The *ILMED* group is characterised overall by low political autonomy and its main improvements compared to *ILOW* come from economic autonomy aspects. Considering that a certain level of political autonomy is also required for economic autonomy to be more relevant, those two groups that exhibit lower levels of CBI do not differ systematically. Integrating the two clusters (column *(2)*) results in a significant and reform-size ascending relation between corruption and debt accumulation.

Second, we examine closely the composition of countries in the *ILMED* group. It is the group with the lowest standard deviation in institutional quality, driven by the lack of high quality countries. Within the group, two of the countries with the highest *QUAL* scores, Australia (1993) and Malta (1994) experienced sizeable increases in their debt-to-GDP ratios after the Central Bank reforms, due to severe recessions.[28] Controlling for both cases (Column *(3)*) shows the effect of institutional quality within the *ILMED* without them. Column *(5)* additionally controls for Nicaragua (1992), Sierra Leone (2000) (both in the *ILMED* group), as well as Kyrgyz, Turkey and Indonesia. Finally, we include a set of political variables, which are again found to be insignificant. Interestingly, their inclusion makes the non-linear impact of corruption under all four categories stronger both quantitatively and statistically.

The results of Table 3 suggest the presence of non-linearities in the conditional correlation between bureaucratic corruption and debt at different levels of CBI. In testing the significance of these non-linearities we perform a set of coefficient restriction tests (Wald test) and factor breakpoint tests. The results are mixed. In all specifications, the significant difference among the coefficient of *IHIGH* and *ILOW* is confirmed. Further, when Nicaragua, Sierra Leone and Kyrgyz are excluded, the factor breakpoint tests suggest that the breaks, as identified by the four independence clusters, are all significant. Finally, we check for the presence of a 'reversal' effect, while conditioning for the magnitude of the reform. Our results provide some evidence for the *IUMED* group of reforms; at severely low levels of corruption, the strategic debt effect becomes negative (asset accumulation).[29]

[26] This result may also suggest some evidence of a 'reversal' in the relationship in question.

[27] Bolivia is an exception; although classified as HIPC, the magnitude of the 1995 reform was such that it is placed in the high CBI (*IHIGH*) group.

[28] A widely accepted view in the case of Australia (e.g. Macfarlane (1998) is that the recession was responsible for the drop of inflation and hence for the success of the IT regime which followed. Also note that both countries have been identified as outliers when employing the influence statistics techniques.

[29] The coefficient is positive, albeit insignificant for the *IHIGH* group as well. Results are available through the

Table 3: Estimation Results for GD using CBI levels (No. of observations 106)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*†	*(6)*‡
Const.	42.612	43.151	45.357	50.090	39.918	47.803
	(4.204)***	(4.320)***	(4.618)***	(4.969)***	(4.305)***	(2.508)**
GRGDP	-0.780	-0.793	-0.847	-0.860	-0.805	-1.042
	(-2.174)**	(-2.210)**	(-2.309)**	(-2.303)**	(-2.260)	(-3.557)***
INF	-0.121	-0.121	-0.121	-0.110	-0.129	-0.035
	(-4.719)***	(-4.735)***	(-4.633)***	(-4.247)***	(-8.244)***	(-0.490)
HIGHDB	-21.190	-21.345	-19.975		-19.876	-23.731
	(-4.143)***	(-4.145)***	(-3.790)***		(-3.901)***	(-4.442)***
CRISIS	43.173	43.277	43.861	42.219	34.667	36.356
	(5.015)***	(5.139)***	(5.128)***	(4.788)***	(4.567)***	(4.331)***
HIPC	-10.413	-9.897	-9.564	-8.259	-2.936	-5.487
	(-1.280)	(-1.220)	(-1.149)	(-0.910)	(-0.384)	(-0.614)
QUAL*IHIGH	-4.600	-4.651	-4.887	-4.540	-4.255	-7.113
	(-3.712)***	(-3.837)***	(-4.069)***	(-3.970)***	(-3.697)***	(-3.482)***
QUAL*IUMED	-4.310	-4.383	-4.680	-4.218	-3.919	-6.693
	(-2.973)***	(-3.082)***	(-3.306)***	(-3.151)***	(-2.964)***	(-3.252)***
QUAL*ILMED	-2.470		-3.757	-3.525	-2.853	-4.554
	(-1.465)		(-2.622)**	(-2.494)**	(-2.055)**	(-2.275)**
QUAL*ILOW	-2.980		-3.331	-2.924	-2.535	-4.915
	(-2.310)**	-2.822571	(-2.678)***	(-2.266)**	(-2.142)**	(-2.621)**
QUAL*ILMED+ QUAL*ILOW		(-2.183)**				
DB				-0.192		
				(-2.477)**		
AUS			53.091	48.905	50.142	
			(6.160)***	(5.310)***	(5.884)***	
MLT1			37.154	36.815	35.980	
			(5.203)***	(5.145)***	(5.113)***	
PRES						-14.850
						(-1.020)
PAR						4.366
						(0.280)
DSYS						-11.055
						(-0.709)
FRAC						22.930
						(1.494)
POLAR						-0.865
						(-0.228)
R-square	*0.514*	*0.513*	*0.544*	*0.538*	*0.659*	*0.583*
Adj. R-square	*0.469*	*0.473*	*0.491*	*0.484*	*0.598*	*0.515*
SER	*24.077*	*23.978*	*23.566*	*23.729*	*20.950*	*22.437*
F-stat (Prob)	*11.292 (0.0)*	*12.782 (0.0)*	*10.208 (0.0)*	*9.952 (0.0)*	*10.752 (0.0)*	*8.573 (0.0)*

Note: OLS estimation with Heteroskedasticity-Consistent Standard Errors and Covariance. t-ratios in parentheses; * = 10%, ** = 5%, and *** = 1% levels of significance. †In column *(5)* the controls for NIC1, SLE, KGZ, TUR and IDN are all significant, although not reported. ‡Number of observations in column *(6)* is 101 due to non-available polarisation data.

Results from difference-in-differences estimation

We now turn to estimate equation (9) and explore proposition 4 within a different empirical setting. We determine the control (non-reform) group by, first, augmenting our country sample. According to Polillo and Guillén (2005), there were 12 countries for which the CUK independence index did not change during 1990s. Apart from USA and the Bahamas, all other cases are

Supplementary Material.

developing countries with relatively high corruption incidence.[30] In addition, our control group includes all countries for which the CBI index is lower than or equal to 8. Thus, we identify this cluster of countries as not granting a significant degree of independence. Indeed, as discussed above, the majority of these reforms were only partial, providing very limited political autonomy to the central bank. This way, we have a control group of 46 and a treatment group of 72 countries. We use the average year of reforms among the treatment group (1996) as the start date for the 'after' period of the control group.[31]

Estimation results are presented in Table 4. Our interest lies on the impact of corruption of debt, and particularly the interaction term which shows whether corruption has an impact among the countries that did significant central bank reforms (relative to the ones that did not). That is,

$$\frac{\partial GD}{\partial QUAL} = \hat{\beta}_1 + \hat{\beta}_3 CBR, \quad \hat{\beta}_1, \hat{\beta}_3 < 0.$$

Although the direct negative relationship, given by $\hat{\beta}_1$, is insignificant, the impact of corruption on debt accumulation is significant and sizeable for those countries that foregone a meaningful reform towards CBI (coefficient of the interaction term, $\hat{\beta}_3$). This finding suggests that institutional quality constraints fiscal policies particularly when monetary policy is granted independence. In other words, bureaucratic corruption seems an important factor determining the effectiveness of central bank reforms. This result is consistent with the findings of Hielscher and Markwardt (2012), who employing the dataset and methodology of Crowe and Meade (2008), suggest that the effectiveness of central bank reforms depends on the quality of political institutions. They do not include a control group, however. In addition, the direct impact of a meaningful central bank reform increases debt accumulation; the coefficient of CBR is positive and significant, in line with the predictions of Proposition 1.

However, outliers are present in both in the non-reform and reform groups. In the next two columns we account for this, and show that results remain unchanged. In column *(2)* we control for Turkey, Indonesia and Australia, while in column *(3)* we exclude all observations for which residuals were above (below) 2 standard deviations from the regression line.

Another important consideration relates to inflation targeting reforms. Our non-reform group includes six countries[32] that moved to inflation targeting, and despite the fact that their CBI-index is low (< 8) such a monetary policy shift indicates a strong commitment towards price stability, independent from fiscal considerations. In column *(4)* of Table 4 we include these cases into the reform group and find that the interaction term between corruption and CBR becomes quantitatively stronger. Finally, in the last two columns, we control for political factors. Presidential systems exhibit a strong negative effect on debt accumulation, while the countries that experienced a political system shift also reduced their debt rates. However, political considerations are not robust and turn insignificant when controlling for outliers.

[30] In the estimations presented here, we always exclude Congo, DR as it turns out to be a strong outlier (with a hyperinflation of 2,962 % during the period of interest).

[31] We select the cut-off point (low GMT index) by trading off between identifying cases where reforms were small (granting limited autonomy) and generating an adequately sizeable control group. Setting the cut-off point to 9 or changing the average date of the reforms, is generally producing similar results. See Appendix B.3 and supplementary material.

[32] These are: N. Zealand (1990), Norway (2000), Sweden (1995), Israel (1997), S. Africa (2000) and Thailand (2000). In this specification, our sample size increases to 117 due to S. Africa.

Table 4: Estimation Results for equation (9)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Const.	25.318	24.942	21.523	19.949	63.127	45.619
	(2.090)**	(2.076)**	(2.345)**	(1.593)	(3.372)***	(2.309)**
QUAL	-1.229	-1.409	-1.382	0.166	-1.126	-0.298
	(-0.770)	(-0.878)	(-1.039)	(0.099)	(-0.629)	(-0.160)
CBR	30.616	26.465	22.496	36.731	37.322	42.473
	(2.408)**	(2.187)**	(2.413)**	(2.854)***	(2.815)***	(3.040)***
QUAL*CBR	-3.768	-3.338	-3.114	-5.157	-4.445	-5.843
	(-1.953)*	(-1.838)*	(-2.120)**	(-2.630)***	(-2.215)**	(-2.769)***
GRGDP	-0.848	-0.813	-0.921	-0.870	-1.243	-1.195
	(-3.225)***	(-3.098)***	(-4.317)***	(-3.395)***	(-5.929)***	(-5.278)***
DB	-0.125	-0.101	-0.065	-0.135	-0.142	-0.151
	(-2.002)**	(-1.709)*	(-1.316)	(-2.059)**	(-2.115)**	(-2.133)**
INF	-0.111	-0.116	-0.110	-0.114	-0.081	-0.083
	(-6.961)***	(-12.113)***	(-11.947)***	(-6.876)***	(-2.280)**	(-2.458)**
CRISIS	34.248	28.401	30.242	37.249	24.339	29.024
	(4.362)***	(4.154)***	(5.418)***	(4.420)***	(3.464)***	(3.620)***
HIPC	-15.068	-15.056	-12.165	-13.988	-7.825	-7.400
	(-1.762)*	(-1.904)*	(-1.791)*	(-1.594)	(-0.749)	(-0.719)
PRES					-1.638	4.775
					(-0.135)	(0.338)
PAR					-1.492	-2.265
					(-0.440)	(-0.611)
DSYS					-40.403	-29.926
					(-2.901)***	(-2.023)**
FRAC					-29.047	-15.548
					(-2.012)**	(-1.007)
POLAR					-39.596	-28.707
					(-2.701)***	(-1.878)*
R-square	*0.493*	*0.617*	*0.652*	*0.508*	*0.578*	*0.568*
Adj. R-square	*0.455*	*0.577*	*0.623*	*0.471*	*0.521*	*0.511*
SER	*22.865*	*20.157*	*14.287*	*23.273*	*20.918*	*21.902*
No of Observ.	*116*	*116*	*103*	*117*	*111*	*112*
F-stat	*13.024*	*15.252*	*22.027*	*13.834*	*10.199*	*9.924*
Prob(F-stat)	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*

Note: OLS estimation with Heteroskedasticity-Consistent Standard Errors and Covariance. *t*-ratios in parentheses; * = 10%, ** = 5%, and *** = 1% levels of significance. Our original specification has 116 observations, since Congo, DR is dropped and the second reform of S. Africa (IT adoption) is not applicable. The latter is included in columns *(4)* and *(6)*, when the six inflation targeters are moved to the reform group. In column *(2)*, although not reported, the dummies for Turkey, Indonesia and Australia are highly significant.

4.3 Robustness

A set of different robustness checks has been performed and selected results are displayed in Table B.3 of Appendix B. We perform the analysis for different model specifications, looking at both the level and the difference (gross measure for fiscal deficit) of debt-to-GDP ratios; we also confirm robustness of results when controlling for outliers, excluding observations with high standardised residuals, and under different sub-samples. Our results are also consistent when using other years of the CC-WGI corruption measure, as well as the one of Transparency International. We also try different parameterisations for the control and treatment groups (in terms of both countries and average reform date for the former group) in the DID estimations.[33]

We now analyse the robustness of our results employing two different estimation strategies in a panel data framework. First, we estimate an equivalent of equation (8) using a fixed effect

[33] All results of robustness tests are available from the author upon request.

panel analysis with $t = 2$, for the three-year averages of the pre and post reform dates (Table 5).[34] This way we can account for unobserved heterogeneity in our sample (time-invariant omitted variables) and ameliorate possible endogeneity issues with regards to bureaucratic corruption. In addition, in these estimations we can assess directly the effect of the central bank reform on debt.

Table 5: Panel Regressions on log($Debt$) - Fixed Effects with $t = 1$ (pre), 2 (post).

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Const.	18.938	18.896	18.548	18.118	18.048	17.753
	(4.287)***	(4.233)***	(4.074)***	(4.263)***	(4.179)***	(3.903)***
CBR	0.569	0.581	0.565	0.534	0.545	0.482
	(4.744)***	(4.522)***	(4.336)***	(4.453)***	(4.269)***	(0.105)***
CBR*QUAL	-0.047	-0.048	-0.047			
	(-3.631)***	(-3.532)***	(-3.173)***			
QUAL	0.017	0.027	0.032	0.023	0.029	-0.028
	(0.403)	(0.576)	(0.573)	(0.525)	(0.600)	(0.051)
Log(RGDP)	-1.226	-1.225	-1.203	-1.158	-0.053	-1.308
	(-3.285)***	(-3.228)***	(-3.128)***	(-3.220)***	(-3.777)***	(0.395)***
Log(PR)	-0.283	-0.292	-0.274	-0.283	-0.043	-0.201
	(-2.174)**	(-2.207)**	(-2.022)**	(-2.141)**	(-2.738)***	(0.094)**
HIGHDB	0.219	0.221	0.222	0.230	-0.034	0.245
	(3.928)***	(3.951)***	(3.859)***	(3.819)***	(-1.987)**	(0.060)***
CBR*QUAL*IHIGH				-0.052	-0.041	-0.048
				(-3.905)***	(-2.862)***	(0.013)***
CBR*QUAL*IUMED				-0.042	-1.152	-0.039
				(-2.773)***	(-3.139)***	(0.015)***
CBR*QUAL*ILMED				-0.032	-0.292	-0.031
				(-1.933)*	(-2.193)**	(0.017)*
CBR*QUAL*ILOW				-0.040	0.229	-0.036
				(-2.906)***	(3.844)***	(0.014)**

In columns *(1)* and *(4)* QUAL takes the CC-WGI value of 1996 for $t = 1$ and 2002 for $t = 2$. In columns *(2)* and *(5)* we use CC-WGI of 1998 and 2002 for the two time periods, while in columns *(3)* and *(6)* we use 2000 and 2005.

As can be seen from the first three columns in Table 5, the negative association between institutional quality and debt when moving towards increased CBI ($CBR*QUAL$) is confirmed. We also see that the impact of corruption in the central bank reform - debt nexus is increasing in the size of the reform (last three columns of Table 5). Both these findings are in line with the cross-sectional and difference-in-differences estimations of Tables 2 - 4. Furthermore, there is a positive correlation between the CBR event and debt accumulation. This result is consistent with Proposition 1 and findings in Table 4; for a given level of corruption, moving towards CBI increases debt accumulation. The direct impact of corruption is always found to be insignificant. This can be explained by the quantitatively small and statistically insignificant time variation in each country's level of corruption, as depicted by the available over time CC-WGI data.

Second, we follow closely the econometric strategy of Acemoglu et al. (2008), focusing on a slightly different question, while employing a longer annual panel data model.

$$logDebt_{it} = \rho logDebt_{it-1} + \gamma_1 HQUAL_i \times CBR_{it} + \gamma_2 MQUAL_i \times CBR_{it} + \gamma_3 LQUAL_i \times CBR_{it} + X_{it} + f_i + \varepsilon_{it} \quad (11)$$

[34]The Hausman test confirms that fixed effects is the preferred specification. $Debt$ is the debt-to-GDP ratio, PR the consumer price index, CBR takes value 1 in the post-reform period and $QUAL$ is the Control of Corruption index for various pairwise years.

where $t = 1986-2005$ and $i = 1, ...89$ and we have a highly unbalanced panel. *Debt* is the debt-to-GDP ratio, *CBR* is a dummy variable taking 1 after the reform, X is a vector of control variables as defined in Table 1, and *HQUAL, MQUAL, LQUAL* represent country groups according to their average level of corruption (CC-WGI) during 1996-2005. These are computed by using one and 0.8 standard deviations from the global CC-WGI average as cut-off points.

This specification provides information on whether the effect of a reform towards independence on debt-to-GDP is of different magnitude, depending on whether each country's institutional quality in high, medium or low. Table (11) presents results from difference-GMM estimations. According to our theoretical predictions and assuming the same size of reform for all countries[35] we would expect the positive effect of CBR on (log of) debt-to-GDP to be lower among countries with higher institutional quality, and then increase for medium to low levels of institutional quality. As shown in Table 6 and while focusing on short-run effects, we see a consistently statistically significant increase in debt-to-GDP among the medium quality group when moving towards CBI, in the range of 5.5-8.1 %. This effect is positive but smaller among the countries with high institutional quality, while it looses significance under some specifications. This result shows some consistency in the data in relation to our theoretical predictions. For the same level of reform, we would expect the response of debt-to-GDP to be small (or insignificant) for countries with very high institutional quality, relative to countries with lower institutional quality. However, the interaction term among countries suffering from high corruption levels is always found to be insignificant. This could be either an indication of the 'reversal' effect or, most probably, due to not considering the size of the reforms which, for the majority of this group were rather small, granting only limited independence to central banks. Nonetheless, we should notice that we have a proliferation of instruments problem and should treat these findings with caution.

[35]Due to the lack of dynamic CBI indices for our panel, the *CBR* event takes values 0 and 1 before and after each reform.

Table 6: Difference - GMM dynamic panel regressions - eq. (11)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Lag log(Debt)	0.794	0.758	0.794	0.857	0.784	0.798	0.733
	(12.302)***	(14.502)***	(12.230)***	(16.744)***	(12.854)***	(13.263)***	(11.911)***
DEBTRESTR	-0.182	-0.155	-0.186	-0.176	-0.180	-0.181	-0.160
	(-3.893)***	(-3.274)***	(-3.965)***	(-3.781)***	(-3.885)***	(-3.892)***	(-3.673)***
CRISIS	0.296	0.250	0.293	0.296	0.291	0.296	0.249
	(7.038)***	(6.625)***	(7.108)***	(6.300)***	(6.745)***	(7.181)***	(5.849)***
log (RGDPpc)	-0.277	-0.268	-0.287	-0.256	-0.284	-0.278	-0.284
	(-3.829)***	(-4.212)***	(-3.946)***	(-3.419)***	(-4.144)***	(-4.066)***	(-4.499)***
INF	0.00001	-0.00003	0.00001	-0.00004	-0.00000	0.00001	-0.00002
	(0.088)	(-0.380)	(0.128)	(-0.489)	(-0.006)	(0.098)	(-0.234)
FRAC	-0.052	-0.069	-0.057	-0.061	-0.035	-0.041	-0.035
	(-0.692)	(-0.997)	(-0.725)	(-0.521)	(-0.454)	(-0.547)	(-0.330)
POLAR	0.001	0.009	0.000	0.002	0.002	0.003	0.008
	(0.147)	(1.168)	(0.039)	(0.279)	(0.229)	(0.327)	(0.873)
LIEC	0.019	-0.005	0.018	0.009	0.018	0.020	0.023
	(0.630)	(-0.212)	(0.609)	(0.289)	(0.605)	(0.661)	(0.618)
HQUAL*CBR	0.073	0.061	0.072	0.031	0.044	0.071	0.059
	(1.795)*	(1.715)*	(1.616)	(0.996)	(1.456)	(1.791)*	(1.827)*
MQUAL*CBR	0.081	0.073	0.082	0.054	0.060	0.077	0.070
	(2.145)**	(1.985)**	(2.342)**	(1.782)*	(1.991)**	(2.151)**	(1.738)*
LQUAL*CBR	-0.002	-0.028	-0.067	0.046	0.059	-0.004	-0.013
	(-0.034)	(-0.488)	(-0.831)	(0.638)	(0.804)	(-0.059)	(-0.214)
HIGHDEBT		0.211					0.280
		(5.448)***					(4.181)***
		0.000					0.000
Obs	1054	1054	1054	1054	1054	1054	1054
Instruments	181	332	181	473	224	221	238
AR(1) test	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AR(2) test	0.75	0.56	0.79	0.77	0.74	0.75	0.50

In all columns except *(3)*, the grouping of countries is done by 0.8 standard deviations from the global mean of CC. Columns *(1)* - *(3)* assume CBR interaction terms as exogenous and give the one-step estimator. Columns *(4)* and *(5)* assume CBR to be predetermined, while the last two columns consider CBR endogenous. The Hansen J test for overidentifying restrictions is always approaching unity, indicating that we have an instrument proliferation problem.

5 Conclusion

We develop a two period model where fiscal policy is endogenised; the government provides public goods and is allowed to issue public debt. The capacity of the tax collection system is eroded by a corrupt bureaucracy. In this setting we explore the optimality of delegating monetary policy to an independent central bank. Our main finding suggests that price stability may be undermined due to strategic use of debt. Corruption and its subsequent fiscal leakages, restrict the government's ability to raise revenues through the formal tax system and a purely independent and conservative central bank is overly restricting seigniorage revenues. This may induce the government to strategically accumulated debt in order to increase second period inflation. Thus, despite the fact that the central bank is not fiscally dominated, the government can still exert upward pressure on long-run price stability, by increasing debt accumulation. This result may be worsened by the level of corruption.

Reforms towards central bank autonomy have been a general trend around the world in the past couple of decades. Those countries that are faced with high corruption indices and inefficient tax-collection systems, as is the problem with many developing and emerging economies, may have difficulties in achieving their targets. They could experience lower performances in terms

of controlling inflation compared to countries with high quality of fiscal institutions, due to the higher incentive of the government to rely on borrowing.

We empirically assess these theoretical findings using event study and DID specifications. In a cross-sectional large country sample, we provide evidence of a positive and significant correlation between corruption and debt accumulation, given an important central bank reform. Complementing the analysis with a newly compiled measure for the level of independence suggests that the effect of corruption may be non-linear; the impact of corruption is greater, the higher the degree of independence granted. More importantly, we also verify our results when accounting for countries that did not undertake meaningful central bank reforms.

Our findings can provide an explanation for the diverse performance of emerging market economies that have introduced inflation-targeting regimes or increased the independence status of their central banks. This is in line with a number of empirical studies suggesting that the negative relation between legal central bank independence and average inflation is not uniformly observed, especially among the developing countries. Finally, our results are pointing towards the importance of fiscal responses, and in particular debt, when analysing the monetary policy design. This is reflected in the continuously increased focus on debt ceilings (e.g. Growth and Stability Pact). However, the importance of the fiscal capacity to tax, and the factors that prevent it, remain vital and should not be neglected.

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A Appendix - Theoretical Model

A.1 Second Best - Equilibrium

$$
\begin{aligned}
\tau_1^{\mathrm{SB}} &= \frac{\phi\lambda_2}{D}\frac{\beta(1+\rho)^2}{(1+\beta(1+\rho)^2)}\mathrm{FR}; \qquad \tau_2^{\mathrm{SB}} = \frac{\phi\lambda_2}{D}\frac{(1+\rho)}{(1+\beta(1+\rho)^2)}\mathrm{FR}\\
\pi_1^{\mathrm{SB}} &= \frac{b^2\lambda_1\lambda_2}{D}\frac{\beta(1+\rho)^2}{(1+\beta(1+\rho)^2)}\mathrm{FR}; \quad \pi_2^{\mathrm{SB}} = \frac{b^2\lambda_1\lambda_2}{D}\frac{(1+\rho)}{(1+\beta(1+\rho)^2)}\mathrm{FR}\\
g_1^{\mathrm{SB}} - g^* &= -\frac{b^2\lambda_1}{D}\frac{\beta(1+\rho)^2}{(1+\beta(1+\rho)^2)}\mathrm{FR}; \quad g_2^{\mathrm{SB}} - g^* = -\frac{b^2\lambda_1}{D}\frac{(1+\rho)}{(1+\beta(1+\rho)^2)}\mathrm{FR}\\
x_1^{\mathrm{SB}} &= -b\tau_1^{\mathrm{SB}}; \quad x_2^{\mathrm{SB}} = -b\tau_2^{\mathrm{SB}}\\
d_1^{\mathrm{SB}} &= \frac{(1+\rho)d_0 + (1-\beta(1+\rho))g^*}{1+\beta(1+\rho)^2}\\
U^{*,\mathrm{SB}} &= u_1^{*,SB} + \beta u_2^{*,SB} = -\frac{1}{2}\frac{b^2\lambda_1\lambda_2}{D}\frac{\beta(1+\rho)^2}{1+\beta(1+\rho)^2}\mathrm{FR}^2\\
\text{where} \quad FR &= (1+\rho)d_0 + g^* + \frac{g^*}{1+\rho} \quad \textit{(Overall financial requirement)}\\
D &= b^2\lambda_1(1+\lambda_2) + \phi^2\lambda_2
\end{aligned}
$$

A.2 Delegation of Monetary Policy

$$
\begin{aligned}
\tau_1^{\mathrm{DMC}} &= \frac{\phi\lambda_2}{\Upsilon}\frac{\beta(1+\rho)^2M}{(1+\beta(1+\rho)^2M)}\mathrm{FR}; \quad \tau_2^{\mathrm{DMC}} = \frac{\phi\lambda_2}{\Upsilon}\frac{(1+\rho)}{(1+\beta(1+\rho)^2M)}\mathrm{FR}\\
\pi_1^{\mathrm{DMC}} &= \frac{b^2\lambda_1\xi_2 + ab\phi\xi_1\lambda_2}{\Upsilon}\frac{\beta(1+\rho)^2M}{(1+\beta(1+\rho)^2M)}\mathrm{FR};\\
\pi_2^{\mathrm{DMC}} &= \frac{b^2\lambda_1\xi_2 + ab\phi\xi_1\lambda_2}{\Upsilon}\frac{(1+\rho)}{(1+\beta(1+\rho)^2M)}\mathrm{FR}\\
g_1^{\mathrm{DMC}} - g^* &= -\frac{b^2\lambda_1}{\Upsilon}\frac{\beta(1+\rho)^2M}{(1+\beta(1+\rho)^2M)}\mathrm{FR}; \quad g_2^{\mathrm{DMC}} - g^* = -\frac{b^2\lambda_1}{\Upsilon}\frac{(1+\rho)}{(1+\beta(1+\rho)^2M)}\mathrm{FR}\\
x_1^{\mathrm{DMC}} &= -b\tau_1^{\mathrm{DMC}}; \qquad x_2^{\mathrm{DMC}} = -b\tau_2^{\mathrm{DMC}}\\
d_1^{\mathrm{DMC}} &= \frac{(1+\rho)d_0 + (1-\beta(1+\rho)M)g^*}{1+\beta(1+\rho)^2M}\\
U^{*,\mathrm{DMC}} &= u_1^{*,DMC} + \beta u_2^{*,DMC} = -\frac{1}{2}\frac{W}{\Upsilon^2}\frac{\beta(1+\rho)^2(1+\beta(1+\rho)^2M^2)}{(1+\beta(1+\rho)^2M)^2}\mathrm{FR}^2\\
\text{where} \quad \Upsilon &= b^2\lambda_1\xi_2 + ab\xi_1\lambda_2\phi + \phi^2\lambda_2 + b^2\lambda_1\\
W &= [b^2\lambda_1\xi_2 + ab\xi_1\lambda_2\phi]^2 + b^2\lambda_1\lambda_2[\phi^2\lambda_2 + b^2\lambda_1] \quad \text{and} \quad M = \frac{W}{b^2\lambda_1\lambda_2\Upsilon}
\end{aligned}
$$

1. $\xi_i = \lambda_i,\ i = 1, 2$: The solution in Table A.2 reduces to the outcome obtained under discretionary centralised policies (Section 3.2).

2. $\xi_i \leq \lambda_i,\ i = 1, 2$: Monetary policy is delegated to a more conservative central bank. With optimally delegated parameters in accordance to $b\lambda_1\xi_2 + a\xi_1\lambda_2\phi - b\lambda_1\lambda_2 = 0$ the commitment outcome is achieved.

3. $\xi_2 = 0$ & $\xi_1 \neq \lambda_1$: Monetary policy is set by a conservative and purely independent central bank. In this case, $M_{|\xi_2=0} = N < 1\ \forall\ \xi_1 < \frac{b}{a\phi}\lambda_1$, and thus $d^{\mathrm{ICB}} > d^{\mathrm{SB}}$.

A.3 Proofs to Propositions 2-4

Debt Dynamics under CBI

$$\frac{\partial d_1^{\text{ICB}}}{\partial \xi_1} = \frac{\partial d_1^{\text{ICB}}}{\partial N}\frac{\partial N}{\partial \xi_1}; \quad \frac{\partial d_1^{\text{ICB}}}{\partial \phi} = \frac{\partial d_1^{\text{ICB}}}{\partial N}\frac{\partial N}{\partial \phi}; \quad \text{and} \quad \frac{\partial d_1^{\text{ICB}}}{\partial N} = -\frac{\beta(1+\rho)\text{FR}}{(1+\beta(1+\rho)^2 N)^2} < 0$$

$$\frac{\partial N}{\partial \xi_1} = \frac{a\phi\lambda_2}{\lambda_1 \Psi^2}\left\{(b^2\lambda_1 + \phi^2\lambda_2)\,[\mathbf{v}] + a^2 b\xi_1^2\lambda_2\phi^2\right\} \tag{A.1}$$

$$\frac{\partial N}{\partial \phi} = \frac{ab\xi_1\lambda_2}{\lambda_1 \Psi^2}\left\{b\lambda_1\,[\mathbf{v}] + (a^2\xi_1^2 + \lambda_1)\phi^2\lambda_2\right\} \tag{A.2}$$

$$\frac{\partial N^2}{\partial \xi_1 \partial \phi} = \frac{ab\lambda_2}{\lambda_1 \Psi^3}\left\{a\xi_1\lambda_2\phi(\phi^2\lambda_2[\mathbf{v}] + a^2 b\xi_1^2\lambda_2\phi^2) + b^2\lambda_1(b\lambda_1[\mathbf{v}] + a^2\xi_1^2\lambda_2\phi^2) + \Xi\right\} \tag{A.3}$$

where $\mathbf{v} = [2a\phi\xi_1 - b\lambda_1]$, $\quad \Psi = ab\xi_1\lambda_2\phi + \phi^2\lambda_2 + b^2\lambda_1$

$\Xi = \left\{ab\xi_1\lambda_1\phi(2\Psi + b^2\lambda_1\lambda_2 + 2\phi^2\lambda_2) + (\phi^2\lambda_2)^2(a^2\xi_1^2 + \lambda_1)\right\}$

When (ξ_1, ϕ) are such that $\mathbf{v} > 0$, then both the direct and cross partial derivatives of ξ_1, ϕ on the effective discount factor are positive. Otherwise,

$$\frac{\partial N}{\partial \xi_1} = 0 \Rightarrow \widetilde{\xi}_1 = \frac{\left[B(B + b^2\lambda_1\lambda_2)\right]^{1/2} - B}{ab\lambda_2\phi}. \quad \text{For} \quad \xi_1 > \widetilde{\xi}_1,\ \frac{\partial N}{\partial \xi_1} > 0 \Rightarrow \frac{\partial d_1^{\text{ICB}}}{\partial \xi_1} < 0$$

$$\frac{\partial N}{\partial \phi} = 0 \Rightarrow \widetilde{\phi} = \frac{b\lambda_1\left[(X^2 + (X^2 + \lambda_1)\lambda_2)^{1/2} - X\right]}{(X^2 + \lambda_1)\lambda_2)}. \quad \text{For} \quad \phi > \widetilde{\phi},\ \frac{\partial N}{\partial \phi} > 0 \Rightarrow \frac{\partial d_1^{\text{ICB}}}{\partial \phi} < 0$$

with $\quad B = \phi^2\lambda_2 + b^2\lambda_1$ and $X = a\xi_1$

Also, it is straightforward to show that when (ξ_1, ϕ) are such that $\frac{\partial N}{\partial \xi_1} > 0$, this ensures that $\frac{\partial N}{\partial \phi} > 0$ and $\frac{\partial N^2}{\partial \xi_1 \partial \phi} > 0$. This proves Proposition 4.

Case 1 If $\mathbf{v} > 0 \Rightarrow \frac{\partial N}{\partial \xi_1} > 0$, $\frac{\partial N}{\partial \phi} > 0$ and $\frac{\partial N^2}{\partial \xi_1 \partial \phi} > 0$.

Case 2 If $\mathbf{v} < 0$, then let $2a\xi_1\phi - b\lambda_1 = -z$. And in $\frac{\partial N}{\partial \xi_1}$ as shown in equation (A.1) above, let $a^2 b\xi_1^2\lambda_2\phi^2 = \mathbf{s}$.

$$\text{If} \quad \frac{\partial N}{\partial \xi_1} > 0 \quad \text{then} \quad \mathbf{s} > b^2\lambda_1 z + \phi^2\lambda_2 z \tag{A.4}$$

For $\frac{\partial N}{\partial \phi} > 0$ (equation (A.2)) it is sufficient to show that $a^2\xi_1^2\lambda_2\phi^2 > b\lambda_1 z$ or

$$a^2 b\xi_1^2\lambda_2\phi_2 > b^2\lambda_1 z \Leftrightarrow \mathbf{s} > b^2\lambda_1 z \tag{A.5}$$

(A.5) always holds if condition (A.3) holds as $\phi^2\lambda_2 z > 0$. Thus, $\frac{\partial N}{\partial \xi_1} > 0 \Rightarrow \frac{\partial N}{\partial \phi} > 0$.

For $\frac{\partial N^2}{\partial \xi_1 \partial \phi} > 0$ it is sufficient that $a^2 b\xi_1^2\lambda_2\phi^2 - \phi^2\lambda_2 z > 0$, $a^2\xi_1^2\lambda_2\phi^2 - b\lambda_1 z > 0$ and $\Xi > 0$. Ξ as defined in the table above is always positive. For the first two terms,

$$a^2 b\xi_1^2\lambda_2\phi^2 - \phi^2\lambda_2^2 z > 0 \quad \text{and} \quad b(a^2\xi_1^2\lambda_2\phi^2) - b^2\lambda_1 z > 0$$
$$\mathbf{s} > \phi^2\lambda_2 z \quad \text{and} \quad \mathbf{s} > b^2\lambda_1 z \tag{A.6}$$

Conditions (A.6) are true as long as (A.3) holds. Thus, $\frac{\partial N}{\partial \xi_1} > 0 \Rightarrow \frac{\partial N}{\partial \phi} > 0$ and $\frac{\partial N^2}{\partial \xi_1 \partial \phi} > 0$.

B Appendix - Empirical Model

Table B.1: Classification of countries-reforms according their updated GMT-index

ihigh		*iumed*		*ilmed*		*ilow*	
COUNTRY -	YEAR	COUNTRY -	YEAR	COUNTRY -	YEAR	COUNTRY -	YEAR
Finland	1999	Iceland	2001	Australia	1993	New Zealand	1990
Sweden	1999	Denmark	1998	UK	1992	Singapore	1998
Switzerland	2000	Netherlands	1994	Canada	2001	Sweden	1995
Austria	1999	UK	1998	Malta	1994	Norway	2000
Netherlands	1999	Canada	1991	Uruguay	1995	Belgium	1993
Luxembourg	1999	France	1994	Cyprus	2002	Ireland	1989
Germany	1994	Spain	1994	Hungary	1991	Japan	1998
Germany	1999	Malta	2002	Hungary	1997	Barbados	1992
France	1999	Slovenia	1993	Greece	1994	Portugal	1995
Belgium	1999	Slovenia	2002	Slovak R.	1993	Israel	1997
Ireland	1999	Italy	1993	Slovak R.	2001	Oman	2001
Chile	1989	Tunisia	2000	Colombia	1993	Qatar	1997
Chile	2000	Czech R.	1993	Colombia	2000	Jordan	1992
Spain	1999	Costa Rica	1995	Trinidad & Tob.	1994	Malaysia	1994
Portugal	1999	El Salvador	1991	Brazil	1999	S. Korea	1998
Italy	1999	Latvia	1994	Poland	1992	S. Africa	1996
Czech R.	1998	Mexico	1999	China,P.R.	1995	S. Africa	2000
Greece	1998	Turkey	2001	Morocco	1993	Namibia	1998
El Salvador	1996	Poland	1998	Rwanda	1997	Thailand	2000
Latvia	1998	Moldova	1995	Honduras	1997	Ghana	2002
Mexico	1994	Ecuador	1992	Nicaragua	1992	Egypt	1998
Peru	1993	Ecuador	1998	Nicaragua	1999	Lesotho	2000
Peru	2002	Georgia	1996	Philippines	1993	Uganda	1993
Bolivia	1995	Venezuela, R. B.	1993	Philippines	2002	Burundi	1993
Kyrgyz R.	1997	Venezuela, R. B.	2001	Albania	1996	Ethiopia	1994
		Paraguay	1995	Russia	1995	Nigeria	1999
				Sierra Leone	2000		
				Indonesia	1999		
				Kenya	1997		

See Dimakou (2010) for detailed sources and scores.

Table B.2: Countries in each control dummy

	Empirical Specification: eq. (8)
HIPC	Ghana (2002), Rwanda (1997), Honduras (1997), Nicaragua (1999), Bolivia (1995), Sierra Leone (2000). *Source: www.worldbank.org/hipc*
HIGHDB	Belgium (1993 & 1999), Ireland (1989), Israel (1997), Jordan (1992), Italy (1993 & 1999), Greece (1994 & 1998), Ghana (2002), Egypt (1998), Poland (1992), Morocco (1993), Rwanda (1997), Honduras (1997), Nicaragua (1992 & 1999), Uganda (1993), Sierra Leone (2000), Burundi (1993), Ethiopia (1994), Hungary (1997), Peru (1993)
CRISIS	United Kingdom (1992), Germany (1994), France (1994), Spain (1994), Italy (1993), Korea (1998), Colombia (2000), Thailand (2000), Mexico (1994), Paraguay (1995), Turkey (2001), China, P.R. (1995), Moldova (1995), Ecuador (1998), Albania (1996), Russia (1995), Kyrgyz R. (1997), Indonesia (1999). *Source: Reinhart and Rogoff (2008).*
DSYS	Burundi (1993), Czech Rep. (1993), Ethiopia (1994), Hungary (1991), Israel (1997), Latvia (1994), Poland (1992), Rwanda (1997), Slovakia (1993), Slovenia (1993)
	Empirical Specification: eq. (9)
Control Group	Consists of all countries with $CBI \leq 8$, as well as: Bahamas, Belarus, Bulgaria, Congo, DR, India, Lebanon, Nepal, Pakistan, Panama, Ukraine, USA and Zambia

There are minor changes in the rest of the control groups. See supplementary material for more details.

The table below presents selected results of robustness tests. The first three columns refer to eq. (8). Columns *(1)* and *(2)* use the CC-WGI index as of 1996, while for the rest of the columns *QUAL* is measured by the corruption index of TI as of 2005. Column 3 excludes standardised residuals greater than 2 (in absolute value). The last three columns refer to the DID specification in which all inflation targeters are in the treatment group. Here, controlling for standardised residuals greater than 1.5, we report further results using the CC index and political variables from DPI. Finally, column *(7)* reports results where the cut-off point for the control group is raised to 9 (while accounting for outliers). Results remain overall robust.

Table B.3: Robustness Tests - Selected Regressions: Dependent variable - *GD*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Const.	45.047	42.553	36.043	19.480	19.911	32.693	22.978
	(4.886)***	(4.506)***	(5.592)***	(2.600)**	(2.146)**	(2.362)**	(3.320)***
QUAL	-4.019		-3.129	-0.062	-0.151	-0.532	-0.331
	(-3.596)***		(-3.471)***	(-0.050)	(-0.107)	(-0.381)	(-0.322)
GRGDP	-0.833	-0.794	-1.106	-1.020	-1.017	-1.062	-0.926
	(-2.428)**	(-2.319)**	(-4.924)***	(-4.784)***	(-4.773)***	(-5.662)***	(-4.791)***
INF	-0.122	-0.122	-0.128	-0.113	-0.109	-0.124	-0.169
	(-4.992)***	(-4.671)***	(-9.418)***	(-2.535)**	(-2.470)**	(-2.732)***	(-4.992)***
HIGHDB/DB	-18.866	-21.017	-15.055	-0.111	-0.113	-0.100	-0.111
	(-3.862)***	(-4.163)***	(-3.512)***	(-12.404)***	(-12.283)***	(-6.675)***	(-14.155)***
CRISIS	43.017	43.582	39.646	32.928	31.719	31.375	33.630
	(4.866)***	(4.967)***	(5.500)***	(5.484)***	(5.429)***	(5.239)***	(5.848)***
HIPC	-10.382	-10.839	-5.011	-7.234	-8.381	-6.347	-9.194
	(-1.229)	(-1.329)	(-0.632)	(-1.115)	(-1.294)	(-0.890)	(-1.461)
QUAL*IHIGH		-4.558					
		(-3.887)***					
QUAL*IUMED		-4.331					
		(-3.039)***					
QUAL*ILMED		-2.421					
		(-1.584)					
QUAL*ILOW		-3.012					
		(-2.634)**					
CBR				18.891	24.715	18.006	17.819
				(2.535)**	(2.541)**	(2.169)**	(2.556)**
QUAL*CBR				-3.344	-3.814	-3.239	-3.310
				(-2.472)**	(-2.466)**	(-2.163)**	(-2.796)***
PRES						-4.987	
						(-0.489)	
PAR						-4.151	
						(-0.415)	
DSYS						-3.770709	
						(-0.374)	
FRAC						-13.59066	
						(-1.081)	
POLAR						3.713	
						(1.766)*	
R-square	*0.486*	*0.511*	*0.594*	*0.682*	*0.686*	*0.691*	*0.718*
Adj. R-square	*0.454*	*0.465*	*0.566*	*0.654*	*0.658*	*0.642*	*0.692*
SER	*24.398*	*24.158*	*17.379*	*13.504*	*13.423*	*13.694*	*12.925*
No of Obs.	*106*	*106*	*95*	*99*	*99*	*96*	*97*
F-stat	*13.518*	*11.145*	*21.463*	*24.155*	*24.587*	*14.105*	*27.964*
Prob(F-stat)	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*

Note: t-ratios in parentheses; * = 10%, ** = 5%, and *** = 1% levels of significance

Highlights

- Interactions between monetary and fiscal policies in the presence of corruption
- Optimality of central bank independence is questioned and price stability uncertain
- Bureaucratic corruption induces the government to strategically accumulate debt
- Results are supported empirically in a cross-section event study and DID setting
- More corruption is associated with higher debt accumulation given central bank reforms