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Mercedes Haga

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ON CENTRAL BANK INDEPENDENCE AND POLITICAL CYCLES

Mercedes Haga*
Universidad Diego Portales

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Using a large panel data set, I find that political budget cycles are significantly smaller in countries with *de facto* central bank independence (CBI). To explain this result and its consequences in the economy, I develop an extended New Keynesian model that incorporates a political economy model of career concerns. I find that CBI mitigates the incumbent's fiscal decisions. Intuitively, since increases in the interest rate have a negative effect on the reelection probability due to consumption postponement, this discourages expansionary fiscal policies.

JEL classification codes: E52, E58, D72
Key words: political budget cycles, career concerns, New Keynesian models, central bank independence, optimal monetary policy

I. Introduction

An independent central bank is thought as an autonomous institution that ensures that its policies will not be politically influenced. The main achievement and desirability of central bank independence (CBI) is that it is considered to be a crucial factor in controlling inflation and bringing down stabilization costs putting therefore suitable foundations for sustainable, noninflationary economic growth. Political budget cycles are, on the other hand, driven by political interests that beyond sustainable, noninflationary economic growth, are aligned with a shorter

* Mercedes Haga: Escuela de Ingeniería Industrial, Universidad Diego Portales, Vergara 432, Santiago, Chile; e-mail: maria.haga@udp.cl. I am grateful to Rodrigo Cerda, Francisco Gallego, Francisco Rosende, Pablo Pincheira, Rodrigo Troncoso, and Rodrigo Vergara for encouragement and advice. For very helpful comments and suggestions, I want to thank the editor, Jorge Streb, and an anonymous referee. Any remaining errors are mine.

horizon objective: to remain in power. These two goals will generally be in conflict. This is why the institutional structure governing monetary decisions should not be indifferent to politicians and in particular, to those who care about the size of political budget cycles. As a matter of fact, any given country might be willing to rest on an independent central bank because, as Fisher (2008) states, it "protects a democratic government from its own worst instincts": inflationary bias and political budget cycles.

The CBI literature has tackled the existing relationship between CBI and inflation and its causality. While Eijffinger et al (1998) find that CBI lowers inflation in industrialized countries, Sturm and de Haan (2001) find no relationship between *de facto* CBI and inflation in developing countries, except when high-inflation countries are considered. Furthermore, Hayo (1998), Jácome and Vázquez (2005) and Hayo and Hefeker (2010) document the negative but not causal relationship between CBI and inflation.[1]

On the other hand, correlation between the size of political budget cycles (PBCs) and a country's institutional characteristics is empirically documented by the political economy literature. Gonzalez (2003) shows that PBCs in Mexico are bigger the higher the country's degree of democracy. Persson and Tabellini (2003) relate PBCs to different types of electoral rules and government forms. They find that PBCs are bigger in majoritarian countries and in parliamentary democracies. Shi and Svensson (2006) show that PBCs are positively related to politicians' rent of being in office and negatively related to the share of informed voters (voters that can distinguish politicians' competence level).

Furthermore, Drazen (2000 and 2001) argue that PBCs are not based on monetary surprises as the driving force but rather explained by a monetary policy that accommodates fiscal impulses in election years (active fiscal and passive monetary model). This paper is placed in an active fiscal and monetary environment due to a specific institutional characteristic, CBI. It tackles the issue of whether CBI affects or not PBCs and which is the mechanism underlying this effect.

[1] See Berger, de Haan and Eijffinger (2001) for a survey about theoretical foundations of CBI and empirical regularities.

The first part of the paper addresses the question of how CBI affects political budget cycles.[2] To that end, I use a large panel data set for 83 countries for the period 1970-2007 to show that even though legal CBI has no impact on fiscal decisions in election years, political budget cycles are significantly smaller in countries with *de facto* CBI. Results are robust to the inclusion of different control variables.

The second part of the paper is devoted to understanding how central bank behavior influences the government's incentives to set its policies. I propose an extended New Keynesian model in the spirit of Clarida, Galí and Gertler (1999) and incorporate a career concern model where a self-interested incumbent derives utility from its own consumption and therefore is concerned about reelection. I shall allow this government to face two different institutional settings. In particular, I am interested in determining optimal fiscal policy when the interest rate is decided by an independent central bank that minimizes a quadratic loss function and, on the other hand, when interest rate is subordinated to the incumbent's needs.

This general equilibrium model allows me to set a trade-off to the incumbent between its own preferences for consumption and its effect on the reelection probability that arises from the economy's performance. Under this setting, the interest rate emerges as the key variable because it affects not only present but also expected consumption which in turn affects the reelection probability. I find that CBI, through interest rate manipulation, mitigates fiscal expenditure decisions as the government is willing to offset the negative effect of a higher interest rate on the reelection probability. The intuition behind this result is that a self-interested incumbent will be eager to have an expansionary fiscal policy in order to increase its reelection probability but this will be diminished by the decrease in the reelection probability implied by the inflationary pressures generated by such a policy and the consistent reaction of the central bank that will force voters to postpone consumption. If, on the contrary, institutional factors are such that the central bank responds to the incumbent's requests, the interest rate will behave in the exact opposite way in order to compensate the negative impact of higher

[2] CBI is not only an institutional characteristic of industrialized countries. Up to December 2011, thirty two developed and developing countries adopted inflation targeting regimes, which implies that non-industrialized countries also have CBI.

inflation on the reelection probability and it therefore lowers the costs of an expansionary fiscal policy.

The paper is organized as follows. Section II presents empirical evidence of the significance of CBI in political budget cycles. Section III rationalizes these differences using an extended New Keynesian model and section IV obtains optimal fiscal policy under an independent and non-independent central bank. Finally, section V concludes.

II. Empirical Motivation

In this section I present the evidence found about the relationship between CBI, elections and government fiscal balance.

A. Data

Data was obtained from the 2009 IMF *International Financial Statistics*, the World Bank, the Penn World Tables, and the International Institute for Democracy and Electoral Assistance. I construct an unbalanced panel data set for 83 countries for the period 1970-2007.[3] I rely on Shi and Svensson's (2006) empirical specification of political budget cycles to evaluate the effect of CBI on the government's fiscal budget balance. I estimate two different specifications: one for the whole sample, and the second for two sub-samples of countries with independent and non-independent central banks. The equations to be estimated are as follows:

$$FB_{i,t} = \sum_{j=1}^{2} FB_{i,t-j} + \varkappa' \varpi_{i,t} + \beta_0 \, ELE_{i,t} + \beta_1 \, ELE_{i,t} * CBI_i + \zeta_i + \varepsilon_{i,t} \ , \tag{1}$$

$$FB_{i,t} = \sum_{j=1}^{2} FB_{i,t-j} + \varkappa' \varpi_{i,t} + \beta_0 \, ELE_{i,t} + \zeta_i + \varepsilon_{i,t} \ , \tag{2}$$

[3] There is missing data for some years in some countries.

where *FB* represents the government's fiscal balance as a percentage of *GDP*; ϖ is a group of control variables including real *GDP* per capita and the *GDP* growth rate; *ELE* is a dummy variable that takes the value one if there has been a presidential (or parliamentary if it is the prime minister who has budget power) election in that year and zero otherwise; *CBI* is a dummy variable that takes the value one if that country is considered to have an independent central bank and zero otherwise and finally, ζ is an unobserved country fixed effect.

The dummy variable *CBI* was defined based on the Crowe and Meade (2008) independence index. *De jure* independence is analyzed according to four aspects: (i) appointment procedures for the central bank governor; (ii) resolution of conflicts between the central bank and the executive; (iii) use of an explicit policy target and (iv) lending limits to the government. Crowe and Meade (2008) provide a legal independence index for different country samples. The first is *Dejure1*, which considers legal independence in 2003 for sixty-nine countries from Cukierman et al. (1992) plus twenty-seven countries not considered earlier. The second index is *Dejure2*, which considers the same seventy-three countries and the same 1980-1989 period as Cukierman et al. (1992), but instead of using their weights Crowe and Meade (2008) compute an unweighted index.

Also in line with Cukierman et al. (1992), Crowe and Meade (2008) measure *de facto* independence as the turnover rate of central bank governors assuming that a higher turnover rate would imply a lower level of central bank autonomy or even dependence. It might be argued that the turnover rate of central bank governors is an imperfect measure of *de facto* CBI as a low turnover rate may also indicate that the central bank governor behaves as the government prefers. However, the empirical literature consistently finds that a more rapid turnover of central bank governors indicates less CBI. For example, Vuletin and Zhu (2011) find that, compared to advanced countries, developing countries' turnover rate is significantly higher; its frequency of replacement is almost twice that of developed countries. Crowe and Meade (2008) obtain the index for two country samples: *Defacto1* computes the turnover rate for the period 1980-1989 for the Cukierman et al. (1992) sample and *Defacto2* does it for the 1995-2004 period for the Crowe and Meade (2008) sample (sixty-nine countries from Cukierman et al. 1992 plus twenty-seven new countries).

B. Findings

Given the dynamic nature of equations (1) and (2), I use the GMM estimator proposed by Arellano and Bond (1991). Table 1, columns 1 and 2, shows that for the two *de jure* indices, *CBI* is not significant in explaining fiscal decisions. That is to say, even though the budget balance does worsen in election years, the interaction term tells us that legal central bank independence has no impact; central bank independence does not affect political budget cycles.

A closer look to the data shows that legal independence might not reflect accurately how monetary policy is conducted in reality. As a matter of fact, countries like Argentina or Venezuela (which still have fair democratic elections) have almost the same independence index as Chile. Moreover, Argentina is an example of country where its central bank constitution stipulated independence from government's affairs, but this was not so in the everyday operation. This came clear when the Argentinean president removed the president of the central bank from office because he refused to lend the government more than six billion dollars from its reserves in January 2010. The *de facto* independence of the Argentinean Central Bank therefore turns to be incomparable to the Chilean Central Bank, which has proved to be making independent decisions over the past twenty years.

In this way, if I consider *de facto* independence, column 3 in Table 1 shows that the interaction term for election year and *CBI* is significant and of the expected sign. In other words, even though the fiscal balance tends to deteriorate in election years, this is offset by the presence of an independent central bank; CBI softens PBCs. Results are robust to different specifications of equations (1) and (2).[4] Columns 4 and 5 in Table 1 control for different institutional factors and included them into the group of control variables, $\varpi_{i,t}$. In particular, I considered OECD ($OECD = 1$) and non-OECD membership ($OECD = 0$). I also divided the countries according a financial development index The financial development index was obtained from the 2009 World Economic Forum Report which ranks developed and developing countries based on over 120 variables spanning institutional and business environments, financial stability, and size and depth of capital markets, among other factors. Scores go from 1 to 7 and I labeled as a *financially developed*

[4] Table 1 uses the *Defacto*2 index. Estimation results for *Defacto*1 and the split sample go in the same direction and are reported in the appendix.

country (*Finan_Dev* = 1) the one whose score was above the score mean and as a *financially developing country* (*Finan_Dev* = 0) the one whose score was equal or lower than the score mean. It is important to note that the World Economic Forum Report lists 55 developed and developing countries. In order to get robust estimates, I considered missing countries as not financially developed. Due to the lack of data, this is a shortcoming in the estimation. Table A4 in the appendix shows the country list considered as financially developing.

Table 1. Budget balance as a percentage of GDP, 1970–2007

	CBI Index							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	*Dejure*1	*Dejure*2	*DCBI*	*DCBI*	*DCBI*	*CCBI*	*CCBI*	*CCBI*
ELE	-0.62**	-0.68**	-1.12***	-1.09***	-2.17**	-5.92**	-4.31**	-4.51**
	(0.292)	(0.285)	(0.377)	(0.366)	(0.981)	(2.384)	(1.898)	(2.266)
*ELE*CBI*	0.08	-0.09	0.87**	0.85**	1.72**	25.62**	17.89**	18.91*
	(0.366)	(0.337)	(0.397)	(0.435)	(0.880)	(11.028)	(8.807)	(10.520)
$Budget_{t-1}$	0.51***	0.55***	0.633***	0.52***	0.31*	0.45**	-0.30	0.23
	(0.174)	(0.166)	(0.143)	(0.197)	(0.172)	(0.190)	(0.285)	(0.203)
$Budget_{t-2}$	0.39**	0.35*	-0.30	0.12	0.03	0.49**	0.11	0.63***
	(0.190)	(0.198)	(0.150)	(0.194)	(0.239)	(0.208)	(0.201)	(0.203)
Growth	-0.13**	-0.12**	-0.002	0.01	-0.04	-0.10	-0.09	-0.05
	(0.062)	(0.058)	(0.068)	(0.065)	(0.070)	(0.10)	(0.0754)	(0.093)
Ln(GDP)	1.74***	1.47**	1.39***	1.16	5.61**	0.84***	7.14***	1.37**
	(0.670)	(0.652)	(0.341)	(1.148)	(2.561)	(0.312)	(2.076)	(0.554)
OECD	-	-	-	0.36	-	-	-18.06***	-
				(2.838)			(5.915)	
Finan_Dev	-	-	-	-	-7.62**	-	-	-1.41*
					(3.456)			(0.835)
Sargan test	0,655	0.705	0.312	0.205	0.578	0.225	0.458	0.292
$P(\beta_0 + \beta_1 = 0)$	0,08	0.01	0.24	0.30	0.04	0.02	0.05	0.08
N° countries	55	49	65	65	65	65	65	65
N° obs.	1233	1111	1493	1493	1493	1493	1493	1493

Note: De facto independence measure: *Defacto2*. Estimation method: GMM. (*) Significant at 10% level. (**) Significant at 5% level. (***) Significant at 1% level. Standard errors in parenthesis.

As mentioned before, *CBI* is a dummy variable that takes the value one if the Crowe and Meade (2008) independence index is above the average value for the whole sample and zero otherwise. However, the former criterion is arbitrary resulting in the possibility of two countries with very similar independence index but belonging to opposite categories. To avoid this scenario and in order to use all the available information, columns 6 to 8 in Table 1 report the former results using *CBI* as a continuous variable (note that *DCBI* stands for *discrete CBI* and *CCBI* stands for *continuous CBI*).[5] Conclusions do not change; even though magnitudes are not comparable, it is still true that the size of PBCs is significantly smaller the more independent the central bank is.

Finally, if I split the sample between countries with independent and non-independent central banks (equation 2), results go in the same direction as the former and were therefore left in the appendix. It is worth noting that even though significantly smaller in countries with more independent central banks, PBCs are still present in countries with autonomous monetary authorities. However, if I restrict estimations to countries with the highest independence index (countries with a turnover rate between 0.00 and 0.30 out of a range between 0.00 and 1.00), PBCs turn out to be not statistically significant.

III. The model

In order to rationalize the previous findings, I propose a New Keynesian general equilibrium model composed by four types of agents: consumers, firms, central bank and the government. Behavior of the first three is taken from standard New Keynesian models that accounts for inflationary inertia in the spirit of Galí and Gertler (1999), whereas government is assumed to behave as in the moral hazard model proposed by Shi and Svensson (2006). The aim of this model is to derive the optimal path of fiscal expenditure when the government is constrained by an independent central bank and when it is not (when the incumbent is free to decide fiscal and monetary policy). This section describes the decision problem for each building block (derivations are in the online appendix).

[5] Note that *CCBI* is a continuous variable not because it changes over time, but because it differs across countries. *CBI* takes a fixed value for each country over the period under consideration.

If monetary policy is set independently from the government, the timing of the events is as follows: first, the government sets its expected consumption level and, as a residual from its budget constraint, the tax rate needed to get a balanced budget, then the central bank minimizes its loss function by choosing the nominal interest rate.[6] The third players are firms which decide the optimal price level from which inflation can be obtained. Finally, consumers determine their optimal levels of private consumption, labor and bond holdings. Solving backwards, I first present consumers' utility maximization, which gives us the private side of aggregate demand. Second, firms maximize profits subject to consumers' optimal choice and obtain the aggregate supply curve; the Hybrid New Keynesian Phillips Curve (HNKPC). Third, the central bank solves its problem subject to the demand and the supply side of the economy and finally, the government will maximize its own utility subject to the reelection probability and the central bank behavior because it understands that fiscal decisions will affect consumers' and firms' behavior and therefore inflation and the output gap, which in turn will cause the central bank to react and, by this channel, it will affect the incumbent's reelection probability.

If on the other hand, the government decides fiscal and monetary policy, the timing will not be altered and the central bank will simply disappear. The government will maximize its utility choosing fiscal expenditure and the interest rate subject to the demand and supply side of the economy.

A. Households

Households are defined over a continuum of infinitely lived agents who drive utility from consumption and leisure. Consumption is provided either by the public sector in a proportion α of total government's expenditure, or by the private sector. Individuals have the same preferences over the public good, the composite consumption good and labor. However, they differ over idiosyncratic preferences

[6] The government does not issue public debt, so it does not affect the economy's interest rate through this channel. Assuming the opposite would imply the central bank to lose control of monetary policy as the government's debt decisions would also affect the interest rate. Under such scenario, this paper would not deal with optimal monetary policy of an independent central bank that faces a self-interested government; but about interest rate determination in a non-cooperative game between the government and the central bank.

concerning candidates' other policies (besides fiscal ones). These idiosyncratic preferences are captured by the parameter θ^s assumed to be uniformly distributed on $\left[-\frac{1}{2},\frac{1}{2}\right]$. The government is headed by one of the two existing political parties, a or b; A_t is a binary variable that equals -1/2 if party a is elected and equals 1/2 if b is elected. I assume an additive CRRA function. Finally, households are the owners of the firms from which they receive profits Π_t and hold one-period riskless nominal bonds issued by the central bank, B_t, which pay the nominal interest rate i_t. Let β be the private sector discount factor and P_t the general price level in period t; so, the consumer problem for citizen s is given by:

$$\max_{C_t,N_t,B_t} E_t \sum_{i=0}^{\infty} \beta^i \left[\frac{(\alpha G_{t+i})^{1-\sigma}}{1-\sigma} + \frac{C_{t+i}^{1-\sigma}}{1-\sigma} - \frac{\int_0^1 N_{jt+i}^{1+\eta}\, dj}{1+\eta} + \theta^s A_{t+i} \right]$$
$$s.t. \quad : \quad C_t + \frac{B_t}{P_t} = \frac{w_t \int_0^1 N_{jt} dj}{P_t} + (1+i_{t-1})\frac{B_{t-1}}{P_t} + \Pi_t \ , \tag{3}$$

where G_t is the level of a Dixit-Stiglitz aggregate of public good; C_t is also a Dixit-Stiglitz aggregate of private consumption of each of the continuum of differentiated goods; N_{jt} is the labor supply of the representative agent to sector j, for which she receives w_t and η is the corresponding elasticity.[7]

The Euler equation for the optimal intertemporal private consumption, the labor supply and the transversality condition are given by:

$$C_t^{-\sigma} = \beta(1+i_t)E_t \frac{P_t}{P_{t+1}} C_{t+1}^{-\sigma} \ , \tag{4}$$

$$\frac{N_{jt}^{\eta}}{C_t^{-\sigma}} = \frac{w_t}{P_t} \ , \tag{5}$$

$$\lim_{T\to\infty} R_T B_T = 0 \ , \tag{6}$$

where $R_T \equiv \prod_{j=0}^{T} \frac{1}{(1+i_{t+j})}$.

[7] Note that $w_{jt} = w_t \ \forall j$,, this means perfect labor mobility among sectors.

B. Firms

There is also a continuum of profit-maximizing firms of measure one that operates under monopolistic competition. The technology available is a *CRS* function with no capital and a productivity shock Z_t. The only thing that distinguishes one firm from another (besides its output) is that they adjust their prices in different dates. Therefore, output j is of the form:

$$y_{jt} = Z_t N_{jt}; \qquad Z_t \sim \text{i. i. d.}\,(1, \sigma_Z^2) \quad ,$$

and aggregate output is defined as:

$$Y_t \equiv \int_0^1 \frac{p_{jt}}{P_t} y_{jt} dj \quad ,$$

where p_{jt} is the price set for good j in period t. Prices are staggered à la Calvo (1983); every period, only a fraction $1-\omega$ of all firms adjust prices. In this way, it can be shown that P_t is a convex combination between the lagged price level P_{t-1} and the optimal price set by adjusting firms, p_t^*:[8]

$$P_t^{1-\zeta} = \omega P_{t-1}^{1-\zeta} + (1-\omega)\,(p_t^*)^{1-\zeta}\,.$$

Inflation persistence is introduced by a fraction $(1-\Theta)$ of adjusting firms that set prices in a forward-looking way such that they maximize the expected discounted value of current and future profits; and the remaining fraction Θ set prices in a backward-looking way. That is to say:

$$p_t^* = (1-\Theta)\, p_t^{fo} + \Theta\, p_t^{ba} \quad , \tag{7}$$

where p_t^{fo} is the price set by a forward-looking firm and p_t^{ba} is the price set by a backward-looking firm.

[8] See Galí and Gertler (1999).

Finally, let τ_t be the income tax rate paid the firms. A forward-looking firm will choose p_t^{fo} to solve:

$$\max_{p_t^{fo}} E_t \sum_{i=0}^{\infty} \omega^i \Delta_{i,t+i} \left[\left(\frac{p_{jt}^{fo}}{P_{t+i}} \right)^{1-\zeta} (1-\tau_{t+i}) - \phi_{t+i} \left(\frac{p_{jt}^{fo}}{P_{t+i}} \right)^{-\zeta} \right] C_{t+i}^T \quad ,$$

where ω^i is the probability of not adjusting price between t and $t+i$; $\Delta_{i,t+i}$ is the subjective discount factor and $\emptyset_t$ is the firm's real marginal cost. Finally, C_t^T is total consumption of composite good (private C_t and public G_t).

I will assume backward-looking firms set their price equal to the optimal price set by adjusting firms the period before; i.e.:[9]

$$p_t^{ba} = p_{t-1}^* \, . \tag{8}$$

Therefore, adjusting forward-looking firms will set their price according to:

$$\frac{p_t^{fo}}{P_t} = \frac{\zeta}{\zeta - 1} \, \frac{E_t \sum_{i=0}^{\infty} \omega^i \beta^i C_{t+i}^{-\sigma} (C_{t+i} + G_{t+i}) \phi_{t+i} \left(\frac{P_{t+i}}{P_t} \right)^{\zeta}}{E_t \sum_{i=0}^{\infty} \omega^i \beta^i C_{t+i}^{-\sigma} (C_{t+i} + G_{t+i})(1-\tau_{t+i}) \left(\frac{P_{t+i}}{P_t} \right)^{\zeta-1}} \, . \tag{9}$$

Let $\hat{a}_t$ denote the percentage change of a variable A_t around its steady state level A. Assuming the steady state involves a zero inflation rate, (9) can be linearized to obtain aggregate inflation as:

$$\pi_t = \Lambda_1 \hat{\tau}_t + \Lambda_2 E_t \pi_{t+1} + \Lambda_3 \pi_{t-1} + \Lambda_4 \hat{\phi}_t \tag{10}$$

[9] Even though this very simple rule says that backward-looking firms are completely short-sighted, they are actually incorporating information about future expectations as p_{t-1}^* has a forward-looking part, p_{t-1}^{fo}. So, backward-looking firms are somehow naive, but not that much.

where the coefficients Λs are defined in the online appendix, are all positive and for the special case of pure forward-looking firms scenario, it is true that $\Lambda_2 = \beta$; $\Lambda_3 = 0$ and $\Lambda_4 = \frac{1-\omega}{\omega}(1-\beta\omega)$ as in the traditional New Keynesian Phillips Curve.[10]

Equation (10) is known as the HNKPC: inflation is forward-looking, it has an inertial component and real marginal cost is a determinant of the inflation rate. The inflation rate does not directly depend on the output gap, but it can be related to deviations of real marginal cost:

$$\hat{\phi}_t = \frac{\theta_P \eta + \sigma}{\theta_P}\left(\hat{y}_t - \hat{y}_t^f\right) - \frac{\sigma\theta_G}{\theta_P}\left(\hat{g}_t - \hat{g}_t^f\right) \ , \tag{11}$$

where the superscript *f* denotes the flexible price equilibrium (i.e., $\omega = 0$) and θ_P is the private participation in total consumption, with $\theta_P + \theta_G = 1$..

The explicit consideration of government fiscal expenditure as one of the same nature as private expenditure has a direct implication on the inflation rate not only because higher taxes generate higher prices but also because it affects real marginal costs. The real marginal cost deviation is a weighted average of the output gap and the "public gap". Note that $\hat{y}_t$ equals $\theta_P \hat{c}_t + \theta_G \hat{g}_t$ in equilibrium.

Then, equation (11) says that deviations of public consumption have a lower weight in real marginal cost than deviations of private consumption. The reason behind this result is a *labor supply effect* present in private but not in public consumption. If private consumption rises, it expands aggregate demand and therefore equilibrium output must also rise. A higher output level moves the labor demand to the right causing real wage and consequently real marginal cost to rise. Additionally, higher private consumption moves the labor supply curve to the left which strengthens the real marginal cost rise. If fiscal expenditure rises, the labor demand effect will still be present but not the labor supply effect and that is why public expenditure enters into the real marginal cost equation in a weaker way.

[10] Equation (10) is in line with the one found by Benigno and Woodford (2006) for the case of distortionary sales taxes.

C. Central bank

The central bank, if independent, is concerned with individuals' welfare and minimizes a quadratic loss function that considers deviations of inflation from its steady state value and output deviations from its potential value.[11] I work with an independent central bank with commitment that chooses the whole path for inflation, the output gap and the nominal interest rate and is constrained by the demand and supply side of the economy. The central bank's problem is then:

$$\min_{\pi_{t+i}, x_{t+i}, i_{t+i}} E_t \sum_{i=0}^{\infty} \beta^i \left(\frac{1}{2}\pi_{t+i}^2 + \frac{\lambda}{2} x_{t+i}^2 \right)$$

$$s.t.: \quad x_t = E_t x_{t+1} + \frac{\theta_P}{\sigma} E_t \pi_{t+1} - \frac{\theta_P \beta i}{\sigma}\, \hat{\imath}_t + u_t \,,$$

$$\pi_t = \Lambda_1 \hat{\tau}_t + \Lambda_2 E_t \pi_{t+1} + \Lambda_3 \pi_{t-1} + \Lambda_4 \hat{\phi}_t \,,$$

$$\hat{\phi}_t = \frac{\theta_P \eta + \sigma}{\theta_P}\, x_t - \frac{\sigma \theta_G}{\theta_P} \left(\hat{g}_t - \hat{g}_t^f \right),$$

where $u_t \equiv E_t \hat{y}_{t+1}^f - E_t \hat{y}_t^f$ is an exogenous disturbance.[12]
The best response function implies that:

$$E_t \pi_{t+1} = \frac{\lambda \theta_P}{\Lambda_4 (\theta_P \eta + \sigma)} \left(\frac{\Lambda_2}{\beta} x_t - E_t x_{t+1} + \beta \Lambda_3 E_t x_{t+2} \right). \tag{12}$$

When optimizing, the central bank understands that: (i) an increase in the output gap raises real marginal cost and therefore current inflation. Because of price stickiness, prices today do not rise as much as all firms are willing to. Consequently, inflation tomorrow is expected to increase due to the current output

[11] Even though this is an ad hoc loss function, Woodford (2003) shows that minimization of such an expression is consistent with the maximization of the consumers' utility function. For a formal derivation, see Benigno and Woodford (2003) or Woodford (2003), chapter 4.
[12] Due to the fact that the former loss function is aligned with the consumers' utility function, the discount rate should not be different from the one considered in the households' maximization problem.

gap increase; (ii) there is a trade-off between inflation and the output gap and (iii) if the output gap is expected to increase next period, it will cause next period's expected inflation to rise. However, as it is known that inflation has an inertial component, that rise is anticipated and makes inflation increase today.

To obtain the optimal interest rate rule let me first put forward, as a benchmark, the standard case where there is no inflation inertia. If Θ equals zero then Λ_4 equals β and Λ_3 equals zero so that equation (12) can be rewritten as:

$$x_t - E_t x_{t+1} = \frac{\Lambda_4(\theta_P \eta + \sigma)}{\lambda \theta_P} E_t \pi_{t+1} .$$

Substituting this into the aggregate demand, optimal interest rate behaves as follows:

$$\hat{\imath}_t = \frac{1}{\beta i}\left[\left(1 - \frac{\sigma \Lambda_4(\theta_P \eta + \sigma)}{\lambda \theta_P^2}\right) E_t \pi_{t+1} + \frac{\sigma \theta_G}{\theta_P}(\hat{g}_t - E_t\, \hat{g}_{t+1})\right]. \tag{13}$$

The coefficient associated with expected inflation is positive and greater than one; that is to say, it is optimal for the central bank to overreact when expected inflation rises above its target. Nevertheless, the effect of expected inflation is attenuated due to the fact that the central bank can effectively affect expectations; it will not need huge movements in the interest rate to align expectations back.[13] Additionally, equation (13) also states that the central bank will tighten its policy in response to changes in the government's public gap because it generates inflationary pressures as shown in the HNKPC. Furthermore, this reaction will be more important the bigger is the public sector relative to the private one.

In the more general case with $\Theta > 0$, optimal interest rate rule change is given by:

$$\hat{\imath}_t = \frac{1}{\beta i}\left[\left(1 - \frac{\beta \sigma \Lambda_4(\theta_P \eta + \sigma)}{\lambda \theta_P^2 \Lambda_2}\right) E_t \pi_{t+1} - \frac{\sigma}{\theta_P}\left(\frac{\beta}{\Lambda_2} - 1\right) E_t x_{t+1} + \right.$$
$$\left. \frac{\sigma \Lambda_3}{\theta_P \Lambda_2} E_t x_{t+2} + \frac{\theta_G \sigma}{\theta_P}(\hat{g}_t - E_t\, \hat{g}_{t+1})\right]. \tag{14}$$

[13] Clarida, Galí and Gertler (1999) also find this attenuation effect under commitment.

The presence of backward-looking firms makes the optimal interest rate rule change in three aspects. First, while the interest rate still reacts in a positive way to expected inflation, this reaction is even less severe than in equation (13). Intuitively, $\beta > \Lambda_2$ means that inflationary inertia causes the central bank to care less for expected inflation than otherwise as it generates less uncertainty about the future in the sense that it can be affected by today's actions. In this way, persistence calls for a slight movement in the policy instrument to bring current inflation down because it also brings down expected inflation. Second, a high expected output gap for next period makes the central bank willing to decrease today's interest rate in order to stimulate households to transfer future consumption to the present. Finally, an expected output gap in period $t + 2$ induces a rise in expected inflation in that period but because of the inertia it generates inflationary pressures also in the previous periods calling for a rise in the interest rate today.

If, by the contrary, the central bank is not independent, monetary policy is in charge of the executive branch of the government. In this case, it is the incumbent who makes interest rate decisions, therefore, inflation and the output gap will be the consequence of those decisions plus consumers' and firms' best responses.

D. Government

Regardless of the ruling party, government is in charge of a self-interested politician that likes to consume for its own satisfaction the same type of goods as households. The government can appropriate from the remaining $(1 - \alpha)$ fraction of fiscal expenditure as long as it stays in power. Consumers will replace the incumbent for the challenger unless they expect it will do better next period in terms of fiscal expenditure, consumption and hours worked. While voters can infer nothing about the challenger, they can partially infer the incumbent's competence from this period's economic performance. That is to say, economic performance signals the incumbent's competence and voters reward competence with reappointment.

To have a better understanding of the election process and government's behavior, I will break down these items into three topics: competence, government's utility function and reelection probability. The incumbent's problem will be presented in the next section.

Competence

I assume that terms last only one period (one can think of it as a four-year or six-year term). Elections take place at the end of every period t with the following available information: at the beginning of any period every agent solve their respective problem from where the government sets its expected level of fiscal expenditure; during period t two shocks occur: a productivity shock Z_t already introduced and a government's competence shock $\rho_t^j (j = a, b)$, which is not revealed to voters. Competence is a time persistent variant process of the form:

$$\rho_t^j = \mu_t^j + \mu_{t-1}^j; \quad j = a, b,$$

where μ_t^j and μ_{t-1}^j are i.i.d. random variables with zero mean, known variance, distribution function $F(\mu)$ and density function $f(\mu)$. Given the realization of the competence shock, the government's budget constraint must be satisfied (as in every other period t); so the incumbent charges the tax rate needed to finance his effective level of public expenditure. These effects along with its consequences in inflation, consumption and labor are available information for the voters who use it before deciding to reappoint the incumbent or not.[14] That is to say, the incumbent sets fiscal expenditure under uncertainty. Shocks can make actual expenditure be higher than expected.

Incumbent's utility function

Politicians are drawn randomly from the citizenry. Therefore, their preferences are isomorphic to the ones presented in the consumers' problem, except that instead of private consumption, the incumbent can take over the fraction of fiscal expenditure that is not returned to households and in exchange the policymaker is asked to work a fixed amount of time $\overline{N}$. Finally, I assume that if the incumbent does not hold office, it implies zero utility. The incumbent's utility function is,

[14] This is the same extraction problem voters face in Lohmann (1998). As voters cannot directly observe the incumbent's competence level, they must infer it from economic outcomes and compare this estimation to that for the challenger. If economic outcomes are favorable, voters will reappoint the incumbent.

$$V_t = \sum_{i=0}^{\infty} \beta^i \left[\frac{\left((1-\alpha)G_{t+i}\right)^{1-\sigma}}{1-\sigma} - \frac{\bar{N}^{1+\eta}}{1+\eta} \right] d_i \,,$$

where d_i is an indicator function that equals 1 if the politician is in power in period t and zero otherwise; with $d_0 = 1$.

The government finances its expenditure by setting the tax rate according to its desired expenditure level. That is to say, the government's budget constraint that holds in every period is given by:

$$G_t = \tau_t Y_t + \rho_t \,.$$

Rearranging the previous equation, once the government decides its consumption level, the tax rate is such that:

$$\tau_t = \frac{G_t}{Y_t} - \frac{\rho_t}{Y_t} \,. \tag{15}$$

Given equation (15), I will redefine a competent government as one that for a given expenditure level sets a lower tax rate which implies lower inflationary pressures. In other words, a competent government is competent not only from the individuals' point of view (lower tax rate without resigning fiscal expenditure); but also from the economy's point of view because he releases inflationary pressures.

At the beginning of period t, μ_{t-1} is observed. From the government's budget constraint voters can deduce government's current competence partially. However, competence is not fully revealed because at the end of period t when voters observe effective levels of fiscal expenditure and tax rate, they are not able to distinguish between the portion of tax due to the productivity shock and the portion due to the competence shock μ_t. That is to say, a low level of τ_t can be the consequence of a high productivity shock (high output level) or a high competence shock. This is the core confusion that may mislead individuals' perception and that the incumbent is eager to take advantage of.

Reelection probability

Suppose party a is in power in period t; then voter i will reelect the incumbent if

$$E_t[U_a(t+1)] - E_t[U_b(t+1)] - \theta^i \geq 0\,.$$

The expected share of votes (ESV) can be expressed as:

$$ESV = Pr(\theta^i \leq E_t[U_a(t+1)] - E_t[U_b(t+1)])\,.$$

The incumbent will be reappointed if it receives at least 50% of the votes; using steady state relations, the probability of reelection Γ is:

$$\Gamma = Pr(ESV \geq 1/2) = Pr\left[\mu_t^a \geq -G\left(E_t\hat{\tau}_{t+1}^a - E_t\hat{\tau}_{t+1}^b\right) + \Gamma_\pi\left(E_t\pi_{t+1}^a - E_t\pi_{t+1}^b\right)\right]$$
$$= 1 - F\left[-\mathrm{G}\left(E_t\hat{\tau}_{t+1}^a - E_t\hat{\tau}_{t+1}^b\right) + \Gamma_\pi'\left(E_t\pi_{t+1}^a - E_t\pi_{t+1}^b\right)\right].$$

In a more intuitive way:

$$\Gamma = 1 - F\left[-\Gamma_G\left(E_t\hat{g}_{t+1}^a - E_t\hat{g}_{t+1}^b\right) + \Gamma_\pi\left(E_t\pi_{t+1}^a - E_t\pi_{t+1}^b\right) - \Gamma_\mu E_t\mu_t^a\right] \qquad (16)$$

where $\Gamma_G \equiv G\theta_p$, $\Gamma_\pi' \equiv \frac{(\alpha G)^{1-\sigma}}{\theta_n G}\left[\frac{(\alpha G)^{1-\sigma}}{\sigma} + \frac{C^{1-\sigma}}{\sigma} + \frac{N^{1+\eta}}{\eta}\right]$, $\Gamma_\pi \equiv \Gamma_\pi' + \frac{G\theta_p}{\sigma}$, and $\Gamma_\mu \equiv G^2$. The first thing to notice is that if voters expect taxes and inflation to be the same with the incumbent or with the challenger (i.e., $E_t\hat{\tau}_{t+1}^a - E_t\hat{\tau}_{t+1}^b = E_t\pi_{t+1}^a - E_t\pi_{t+1}^b = 0$), the incumbent wins; this is because voters can learn something about the incumbent but know nothing about the challenger. Also, expected fiscal expenditure raises the reelection probability and expected inflation decreases it. This is because a fraction α of G_t is returned to households and a higher inflation rate tomorrow means lower expected consumption. The former poses a trade-off to the incumbent because on one hand he will be eager to raise fiscal expenditure for the positive effect it has on the reelection probability (and also on its own utility) but, on the other hand it puts inflationary pressures to the economy through the HNKPC and therefore induces the opposite and undesirable effect. Optimal fiscal expenditure will hence result from the equilibrium between these two factors.

IV. Optimal fiscal policy

This section solves the maximization problem for the incumbent when it is faced up to an independent central bank and when it is not.

A. Incumbent's maximization problem

To see the incumbent's maximization problem, note that it will have no incentives to manipulate expenditure to impress voters beyond period $t + 1$. This is because the probability of reelection at the end of $t + 1$, which determines period's $t + 2$ outcome, will be influenced by the incumbent's expected competence at $t + 2$ which is independent of current competence, because $E_t(\rho_{t+j}/\rho_t) = E_t(\rho_{t+j}) = 0\ \forall j \geq 2$. So, the incumbent will be interested in maximizing its total expected utility only over the next two periods. In this way, the incumbent faces a decomposable problem due to the informational structure of career concerns models.

B. Under central bank independence

A self interested incumbent will maximize its own utility subject to: (i) the central bank's best response function (which in turn incorporates the economy's behavior), (ii) the equilibrium market condition and, (iii) the reelection probability. Its budget constraint is as an equilibrium condition. The incumbent's maximization problem is then:

$$\max_{G_t} E_t \frac{[(1-\alpha)G_t]^{1-\sigma}}{1-\sigma} + \beta\Gamma E_t \frac{[(1-\alpha)G_{t+1}]^{1-\sigma}}{1-\sigma}$$

$$s.t.: E_t\pi_{t+1} = \frac{\lambda\theta_P}{\Lambda_4(\theta_P\eta+\sigma)}\left(\frac{\Lambda_2}{\beta}x_t - E_t x_{t+1} + \beta\Lambda_3 E_t x_{t+2}\right),$$

$$\hat{x}_t = \theta_P\hat{c}_t + \theta_G\hat{g}_t - \hat{y}_t^f,$$

$$\Gamma = 1 - F\left[-\Gamma_G(E_t\hat{g}_{t+1}^a - E_t\hat{g}_{t+1}^b) + \Gamma_\pi(E_t\pi_{t+1}^a - E_t\pi_{t+1}^b) - \Gamma_\mu E_t\mu_t^a\right],$$

and $G_t = \tau_t Y_t + \rho_t \quad \text{holds} \quad \forall t.$

The FOC associated to this problem is given by:

$$E_t G_t^{-\sigma} = \frac{f(\chi)\Gamma_\pi \lambda \theta_P \Lambda_2 \theta_G}{\Lambda_4(\theta_P \eta + \sigma)G(1-\sigma)} E_t G_{t+1}^{1-\sigma}\,, \tag{17}$$

where χ is defined in the online appendix. As expected, the incumbent will raise consumption until he equalizes its marginal benefit to its marginal cost. Marginal benefit is given by the higher utility level obtained from higher fiscal expenditure. Marginal cost is given by the level of fiscal expenditure it would be giving up if it is not reelected times the change in the reelection probability caused by the inflationary pressures generated by today's public consumption.

C. Under no central bank independence

In this scenario there is no alteration of the timing of the events except that the government decides both public consumption and the interest rate. The incumbent internalizes consumers' and firms' responses to movements in fiscal expenditure and their effect on the reelection probability:

$$\max_{G_t, i_t} E_t \frac{[(1-\alpha)G_t]^{1-\sigma}}{1-\sigma} + \beta\Gamma E_t \frac{[(1-\alpha)G_{t+1}]^{1-\sigma}}{1-\sigma}$$

$$s.t.: x_t = E_t x_{t+1} + \frac{\theta_P}{\sigma} E_t \pi_{t+1} - \frac{\theta_P \beta i}{\sigma} \hat{\imath}_t + u_t\,,$$

$$\pi_t = \Lambda_1 \hat{\tau}_t + \Lambda_2 E_t \pi_{t+1} + \Lambda_3 \pi_{t-1} + \Lambda_4 \hat{\phi}_t\,,$$

$$\hat{\phi}_t = \frac{\theta_P \eta + \sigma}{\theta_P} x_t - \frac{\sigma \theta_G}{\theta_P}\left(\hat{g}_t - \hat{g}_t^f\right),$$

$$\Gamma = 1 - F\left[-\Gamma_G(E_t \hat{g}_{t+1}^a - E_t \hat{g}_{t+1}^b) + \Gamma_\pi(E_t \pi_{t+1}^a - E_t \pi_{t+1}^b) - \Gamma_\mu E_t \mu_t^a\right],$$

and $G_t = \tau_t Y_t + \rho_t \quad$ holds $\quad \forall t.$

The corresponding FOC states that:

$$E_t G_t^{-\sigma} = \frac{\beta f(\chi)\Gamma_\pi \Lambda_3 \Lambda_4 \eta \theta_G}{(1-\Lambda_3\Lambda_4)G(1-\sigma)} E_t G_{t+1}^{1-\sigma} \ . \tag{18}$$

As well as in the previous case, the government will raise fiscal expenditure until it equalizes its marginal benefit to its marginal cost which has the same intuition as in equation (17). Furthermore, different institutional setting entails different levels of public expenditures, not different growth rates. The latter, gives rise to different steady state fiscal expenditure values, which imply different public sector sizes.

To see under which environment a bigger steady state public sector is expected, I shall consider the calibration presented in Benigno and Woodford (2003) for US data, a value of seventy percent for the fraction of firms using the backward-looking rule; a relative low fraction of fiscal expenditure returned to households and a weight of thirty percent for the relative importance of the output gap in the central bank's loss function. In this way, the set of parameters to be used are: $\beta = 0.99$; $\omega = 0.3$; $\sigma = 0.157$; $\eta = 0.2$; $\Theta = 0.7$ and $\alpha = \frac{1}{3}$. Under this parameterization, it is always true that:

- For a given expected level of fiscal expenditure, today's public consumption is lower when there is an independent central bank than when not. That is to say, $E_t G_t^{ICB} < E_t G_t^{NICB}$ where *ICB* stands for "Independent Central Bank" and *NICB* stands for "Non Independent Central Bank"; or
- For a given level of today's fiscal expenditure, expected public consumption is lower under an independent central bank schedule than under a subordinated central bank schedule. That is to say, $E_t G_{t+1}^{ICB} < E_t G_{t+1}^{NICB}$.

The former implies that countries with non independent central banks should have, in steady state, a bigger size of public sector than countries with independent central banks.

Contrary to the case where the central bank minimizes a loss function based on the individuals' welfare, the interest rate behavior derived from government's manipulation of monetary and fiscal policy should not be called *optimal* as it responds to the incumbent's rather than the consumers' objectives. The interest rate behavior is obtained from the demand side of the economy as follows:

$$\hat{\imath}_t = \frac{1}{\beta i}\left[E_t\pi_{t+1} + \frac{\sigma}{\theta_P}(E_t x_{t+1} - x_t) - \frac{\theta_G}{\theta_P}E_t\hat{g}_{t+1}\right]. \quad (19)$$

Equation (19) is a best response function in a narrow sense. Its first two elements do not reflect the government's reaction to expected inflation, nor to the expected change in the output gap but they are both showing the interest rate's reaction to these variables determined by aggregate demand. Consequently, it says that if inflation is expected to rise, then consumers will call for a higher nominal interest rate in order to compensate for their assets' lower real value generated by higher inflation next period. The same logic applies to the second term, if consumers are offered a higher interest rate, tomorrow's output gap will be higher than today's. The third term, on the other hand, does represent the government's best response of interest rate to expected deviations of fiscal expenditure and it says (opposite to equation 14), that a higher level of fiscal expenditure tomorrow will induce the government to lower interest rate today and this negative relation will be stronger the bigger is the public relative to the private sector. The intuition behind this result is that positive deviations of expected public consumption have a direct and positive impact on the reelection probability, but they also have an indirect and negative effect in the same variable through expected inflation. Higher expected fiscal expenditure will induce higher expected inflation and this lowers the reelection probability because it lowers expected consumption. It is therefore the incumbent's best response to lower the interest rate as much as necessary in order to offset this effect and promote expected consumption.

V. Concluding remarks

This paper contributes to the monetary policy and political budget cycle literature in four ways. First, it provides empirical evidence of political budget cycles in countries with independent and non-independent central banks. I find that *de facto*, not *de jure*, central bank independence is relevant when identifying political budget cycles and that they are significantly larger the less independent the central bank is.

Second, I provide a theoretical model of political budget cycles with a self-interested incumbent that wants to manipulate fiscal expenditure because he can appropriate a fraction of it. The incumbent is constrained by the negative effect

his decisions may have on the reelection probability triggered by higher expected inflation.

Third, besides the relevance of central bank independence for controlling inflation and bring stabilization costs down, I find that this is a useful tool to moderate the government's instincts to raise public consumption because the central bank's reaction to the government's fiscal disarray does not favor reelection. An independent central bank acts as an *internalizing-externalities devise* for the government who will optimally set a lower expenditure level. In this way, the present model gives theoretical support to the political economy literature that states that the size of political budget cycles depends on institutional features of each country.

Finally, when the interest rate is subordinated to the executive's needs, it will be manipulated in a non-welfare-maximizing way (from the consumers' point of view) and households will end in a suboptimal consumption path.

In terms of policy recommendations, this calls for stronger institutional arrangements in order to support an independent central bank able to confront, if necessary, the executive's demands. The key issue in this scenario is credibility; if the central bank is not credibly committed to its loss function, its interest rate movements might not be seen by the government as a threat, so the government will succumb to a looser fiscal policy and to higher budget deficits. In Streb and Torrens (2013), the credibility problems of fiscal policy in election years are alleviated by the presence of legislative veto players in the budget process. This paper shows that *de facto* CBI also mitigates political budget cycles, providing a credible commitment for monetary policy not to accommodate expansive fiscal policy in election years. This extends to political budget cycles the results in Keefer and Stasavage (2003), where credibility (empirically proxied by low inflation) and CBI (proxied by low turnover of central bank governors) are linked to political veto players.

Appendix

This appendix presents estimation results for the full and the split sample, which correspond to equations (1) and (2), for the different independence indices not reported in Table 1.

Using the *Defacto1* index in the estimations leads to the same conclusions as when using the *Defacto2* index; political budget cycles are smaller in the presence of an independent central bank. Moreover, Table A1 shows that this result holds

when CBI is considered as a dummy variable as well as a continuous one. Country-specific characteristics as OECD membership and financial development do not alter the outcomes.

Table A1. Budget balance as a percentage of GDP, 1970–2007

	CBI Index					
	DCBI	DCBI	DCBI	CCBI	CCBI	CCBI
ELE	-0.88**	-0.94***	-0.61**	-0.98***	-0.92***	-0.97***
	(0.281)	(0.273)	(0.252)	(0.291)	(0.261)	(0.279)
*ELE*CBI*	0.70*	0.74*	0.39*	1.80*	1.57*	1.79*
	(0.396)	(0.443)	(0.298)	(1.035)	(0.957)	(0.997)
$Budget_{t-1}$	-0.11	-0.22	0.47***	0.09	0.02	0.08
	(0.297)	(0.223)	(0.180)	(0.185)	(0.170)	(0.177)
$Budget_{t-2}$	0.31	0.47***	0.56**	0.59**	0.45*	0.51**
	(0.252)	(0.114)	(0.226)	(0.240)	(0.246)	(0.245)
Growth	-0.14	-0.13	0.58***	(0.02)	0.02	0.02
	(0.144)	(0.092)	(0.109)	(0.101)	(0.094)	(0.098)
Ln(GDP)	0.96***	7.00***	6.06***	1.21***	2.36***	2.63***
	(0.344)	(1.826)	(1.668)	(0.416)	(0.747)	(0.904)
OECD	-	-17.40***	-	-	-3.46***	-
		(5.564)			(1.113)	
Finan_Dev	-	-	-6.63***	-	-	-3.54***
			(1.880)			(1.268)
Sargan test	0.414	0.814	0.190	0.269	0.232	0.216
P($\beta_0 + \beta_1$=0)	0.45	0.54	0.31	0.93	0.68	0.42
N° countries	65	65	65	65	65	65
N° obs.	1493	1493	1493	1493	1493	1493

Note: De facto independence measure: *Defacto1*. Estimation method: GMM. (*) Significant at 10% level. (**) Significant at 5% level. (***) Significant at 1% level. Standard errors in parenthesis.

I first show the estimation results for equation (2) using the *de jure* measure and then the *de facto* measure of independence. When estimating the size of PBCs for independent versus non-independent central banks considering the *de jure* index, the difference between the coefficients of the election variable (*ELE*) is not

statistically significant in Table A2. That is to say, even though the fiscal balance does worsen in election years, it makes no difference whether the central bank is subordinated or not.

Table A2. Budget balance as a percentage of GDP, 1970–2007: Split sample one

	CBI Index			
	Dejure1 - independent	*Dejure1* - non-indep.	*Dejure2* – independent	*Dejure2* – non-indep.
ELE	-3.14***	-2.69***	-1.15***	-1.20**
	(0.989)	(0.741)	(0.227)	(0.554)
$Budget_{t-1}$	-1.01*	-0.75**	-0.31*	0.12
	(0.607)	(0.295)	(0.192)	(0.209)
$Budget_{t-2}$	0.17	-0.48**	-0.16	0.24
	(0.259)	(0.232)	(0.103)	(0.182)
Growth	0.61**	-0.03*	-0.02*	0.12**
	(0.284)	(0.019)	(0.012)	(0.061)
Ln(GDP)	16.39***	10.82***	11.86***	2.97*
	(5.213)	(2.650)	(2.120)	(1.757)
Sargan test	0.408	0.249	0.167	0.405
N° countries	28	27	24	25
N° obs.	683	550	503	608

Note: Estimation method: GMM. (*) Significant at 10% level. (**) Significant at 5% level. (***) Significant at 1% level. Standard errors in parenthesis.

With *de facto* independence, the results support the ones found for the full sample no matter the *de facto* indices considered. Focusing on the *Defacto*2 results in Table A3, the fiscal balance worsens almost 1% as percentage of GDP in an election year when the government faces an independent central bank, and more than 3% when the central bank is subordinated. This difference is statistically significant.

Table A3. Budget balance as a percentage of GDP, 1970–2007: Split sample two

	CBI Index			
	Defacto1 – independent	*Defacto1* – non-indep.	*Defacto2* – independent	*Defacto2* – non-indep.
ELE	-1.00***	-3.81**	-0.958***	-3.22**
	(0.252)	(1.681)	(0.228)	(1.429)
$Budget_{t-1}$	-0.51**	-0.23	-0.49*	-0.41
	(0.237)	(0.533)	(0.287)	(0.367)
$Budget_{t-2}$	-0.17	0.66	0.01	-1.00*
	(0.127)	(0.693)	(0.207)	(0.546)
Growth	-0.02	0.09*	-0.004	-0.10
	(0.014)	(0.058)	(0.012)	(0.115)
Ln(GDP)	8.98***	9.66**	6.82***	13.43**
	(2.204)	(4.032)	(1.557)	(4.032)
Sargan test	0.403	0.321	0.778	0.350
N° countries	32	33	43	22
N° obs.	706	787	1010	483

Note: Estimation method: GMM. (*) Significant at 10% level. (**) Significant at 5% level. (***) Significant at 1% level. Standard errors in parenthesis.

The contries classified as financially developing are listed in Table A4.

Table A4. Financially developing countries in full sample

Bahamas	Dominican Republic	Iran	Nepal	Togo
Barbados	Ecuador	Jamaica	Nicaragua	Trinidad & Tobago
Bolivia	El Salvador	Kenya	Papua New Guinea	Tunisia
Botswana	Fiji	Korea, Republic of	Paraguay	Uruguay
Burkina Faso	Ghana	Malawi	Romania	Zambia
Burundi	Greece	Maldives	SierraLeone	Zimbabwe
Chad	Guatemala	Mali	SriLanka	
Costa Rica	Guyana	Malta	Suriname	
Cyprus	Honduras	Mauritius	Syria	

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