Banco de México

Documentos de Investigación

Banco de México

Working Papers

N° 2008-13

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September 2008

Transparency and Numeric Rules in the Budgeting Process: Theory and Evidence[*]

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Abstract

In this paper I develop a simple dynamic agency model postulating that, among budgetary institutions, transparency of the budgeting process is the main driving force in explaining differences in fiscal outcomes and that budgetary numeric rules can be an active long-run constraint only if the budgeting process is transparent enough. The model does not only account for long-run differences where countries with better budgetary institutions will have more disciplined fiscal outcomes, but can rationalize situations where countries with relatively better budgetary institutions can have what would appear to be less disciplined fiscal outcomes in the short-run. Empirical tests corroborate some but not all of the model's predictions.

Keywords: Budgetary Institutions, Fiscal Outcomes, Transparency.
JEL Classification: H61, D70, E60.

Resumen

En este artículo se presenta un modelo de agencia dinámico en el cual se postula que la transparencia del proceso presupuestario es la principal causante de las diferencias en los resultados fiscales, y que las reglas numéricas sobre el presupuesto pueden ser una restricción activa en el largo plazo, únicamente si el proceso presupuestario es lo suficientemente transparente. El modelo puede explicar no solo diferencias en resultados fiscales en el largo plazo, dónde países con mejores instituciones siempre tendrán resultados fiscales más disciplinados, sino también racionalizar situaciones de corto plazo, donde países con relativamente mejores instituciones presupuestarias pueden presentar resultados fiscales que en apariencia son menos disciplinados. Los resultados empíricos del trabajo corroboran algunas de las predicciones del modelo.

Palabras Clave: Instituciones Presupuestarias, Resultados Fiscales, Transparencia.

1 Introduction

"Elected officials typically enjoy an immense informational advantage over the voters that limits how accountable such agents will be to the voters desires. This is a consequence of the complexity of modern government." (Ferejohn (1999)).

Budgetary Institutions are defined as the set of all the rules and regulations according to which budgets are prepared, approved and carried out (Alesina and Perotti (1999)). What is the role of budgetary institutions in shaping the size of the budget and, ultimately, the delivery of public goods? How independent are these institutions from each other and which ones, if any, are truly necessary to affect fiscal outcomes? This paper deals with these questions and explains how different countries that are supposed to obey the same set of rules, such as the members of the European Union and the Maastrich Treaty, can have dissimilar fiscal outcomes. In other words, it will provide an explanation of how and when these rules will be an active constraint on the government.

In this literature, stronger fiscal institutions are defined as those that provide more discipline in the budgeting process, reducing the margin for unproductive spending (Poterba and von Hagen (1999)). The implication is that, other things being equal, stronger institutions should cause, by means of stricter constraints, lower deficits and levels of debt for the same amount of public goods. The budgetary institutions that are analyzed in the present paper are the *transparency* of the budgetary process and the set of *numeric rules* imposed on the budget. Transparency of the budgetary process can be defined as the degree of openness towards the public at large about government structure and functions, fiscal policy intentions, public sector accounts, and projections (Kopits and Craig (1998)). Numeric rules imposed on the budget can take the form of specific limits to expenditures, debt and deficit, or restrictions to the flow of resources between and within programs, agencies and levels of government. These constraints could even be restrictions to the flow of resources between different fiscal periods.

To study these two budgetary institutions, in the first part of the paper I provide a career concern model in which the government has an agency relationship with their constituents and *might* enjoy some information advantages, depending on the degree of transparency of the budgetary process. Voters can try to discipline the incumbent through elections and by imposing numeric rules. The results of the model show that more transparency will increase fiscal discipline, while numeric budgetary rules will be effective only if the budgetary process is transparent enough.

This model was inspired by two well known pieces in the political economy literature: the political business cycle model with prospective voting (Rogoff and Siebert (1988), Rogoff (1990), Shi and Svensson (2001)), and the elections as a disciplining device model with retrospective voting (Ferejohn (1986)). To the best of my knowledge, no other

work –besides Milesi-Ferretti (2004)– provides a theoretical framework for the relationship between transparency and numeric constraints on the budgeting process and their implications over deficits or other fiscal variables. The novel characteristics of the model presented here are: First, the model is able to accommodate not only long-run results, where stronger institutions will always cause more constrained fiscal outcomes, but also short-run implications, where countries with relatively stronger institutions can be paired with relatively unconstrained outcomes. Second, the main claim of the model is that transparency is the major force for generating differences in the levels of debt, and that numeric constraints can have opposing effects for the same numeric rule, depending on the level of transparency.

The second part of the paper provides empirical evidence of the effects of budgetary institutions on fiscal outcomes. I exploit a new data set to construct measures of numerical constraints on the budget and the degree of budgetary transparency, and assess their influence on a series of fiscal outcomes. In particular, I test the two principal implications of the theoretical model: *(i)*, that more transparency will increase fiscal discipline and, *(ii)*, that numeric rules will increase fiscal discipline only if the budgetary process is transparent enough. The results of the regression analysis indicate that the only budgetary institution that appears to have an effect on fiscal outcomes is the transparency of the budgetary process. I do not find, however, an effect of numeric rules on fiscal outcomes conditional on the level of transparency.

The rest of the paper is organized as follows: In section 2 I review the literature. Section 3 presents the career concern model. Section 4 shows the empirical evidence and section 5 concludes.

2 Literature Review

The theoretical model presented in this work is related to the following literature. Shi and Svenson (2001) propose a moral hazard model of electoral competition to explain a set of empirical findings about the *size of electoral budget cycles*, and conclude that these depend on the rents of those remaining in power and the *share of informed voters*. Alt and Lassen (2003) slightly modify the Shi and Svenson model and reinterpret the share of informed voters as *transparency in the budgeting process*, and conclude that lower transparency produces higher levels of debt and larger deficits. The problem with these models is that in the absence of electoral cycles (i.e., if there were no elections or if elections occurred in every period), no debt or deficit could be generated. In other words, the Alt and Lassen model predicts that transparency affects fiscal outcomes *only* in the electoral year. In contrast, the model presented here builds on some of the structure of the Shi and Svenson model, but eliminates the political fiscal cycle motive by allowing elections to occur in every period. In spite of this change, the current model still generates an inverse relationship

between transparency and debt. This is relevant not only from a conceptual perspective, but also because the majority of empirical tests (Alesina et. al. (1998), Alt and Lassen (2003)) analyze the cross-sectional implications of transparency in fiscal outcomes and none of them show evidence that an election dummy is significant.

In a seminal paper, Ferejohn (1986), obtained optimal reelection rules when the incumbent's actions cannot be directly observed by retrospectively inferring these actions based on realized outcomes. This *pure outcome* evaluation can be interpreted in the context of the model presented here as a case of full opacity, where the signal drawn by the electorate is simply uninformative. Persson, Roland and Tabellini (1997) (PR&T), in a similar setup, also derive the case of full information, where voters can observe incumbent's actions, and show that even in this case the incumbent will extract rents from being in power. In terms of the present model this could be associated with a case of full transparency where the signal drawn from the private sector perfectly identifies the current shock. Whereas the structure for obtaining the optimal reelection rule is similar to these two previous works, there are some differences that are worth mentioning. Here, the *state of the world* is not only determined by an exogenous shock, but also by the history of policy decisions made by the incumbent. This feature allows situations where the incumbent will optimally choose to perform actions that are costly only to him and be reelected, even under the most adverse of shock realizations, provided he has enough fiscal resources, i.e. that issuing new debt is not too costly. A second difference between this model and those mentioned previously lies in the fact that I analyzed different degrees of informational asymmetry, and their relation to fiscal outcomes in addition to welfare.

The work that is most closely related to the model presented here is Milesi-Ferretti (2004) which is the first, and to the best of my knowledge, the only paper that looks at the effects of budgetary rules and budgetary transparency simultaneously on fiscal outcomes. In a two-period model, with heterogenous policymakers that seek to minimize an arbitrary loss function, Milesi-Ferretti shows that the extent to which a myopic ruler will engage in creative accounting (defined as deviations from a preestablished budgetary rule) depends negatively on the transparency of the budgetary process. There are two key differences between the two models. The first one is conceptual. The mechanics of Milesi-Feretti's model requires a numeric rule to be imposed in order to generate differences in fiscal outcomes. In other words, the same policymaker, if not faced with a numeric rule on the budget, will deliver the same fiscal outcome under two different transparency regimes. By the contrary, the model presented here postulates that policymakers facing different transparency regimes will deliver different fiscal outcomes even without the imposition of a numeric rule. The second important difference is that Milesi-Ferretti's model can only account or be interpreted for long-run results whereas my model also rationalizes short-run outcomes, as was already mentioned.

Several papers have empirically explored the question of whether budgetary institutions matter. In a series of papers, von Hagen (1992) and von Hagen and Harden (1994)

and (1996), study the effects of budgetary institutions as a whole. They combine in a single index elements that corresponds to transparency as well as to the voting procedure to pass the budget, classified in a hierarchical-collegiate spectrum. They find that more hierarchical and transparent budgetary institutions are associated with more fiscal discipline. Exploring further, von Hagen (1992) suggests that transparency comes second to hierarchical features in order of importance. De Haan et. al. (1999) use new information available to update von Hagen's index for an almost identical sample. These authors corroborate von Hagen's result that better budgetary institutions as a whole induce fiscal discipline. However, they conclude that although the results are statistically significant, these are not economically important as was previously claimed.

Alesina et. al. (1999) pursue a different strategy by constructing separate measures for every category of the budgeting process for a sample of twenty Latin American countries. Employing fiscal deficits as their fiscal outcome measure, these authors arrive at the conclusion that fiscal procedures matter for fiscal deficits among Latin American countries, but when they look at the disaggregated indexes, they find that numerical rules and hierarchical procedures matter but transparency does not. They do acknowledge, however, that the "results on transparency probably say more about the difficulty of measuring it, than about its effect on fiscal discipline" (Alesina and Perotti (1996) p.405). Filc and Scartascini (2004), employing a new data set that allows them to measure budgetary institutions ten years later, closely follow Alesina et. al. (1999), and perform the same exercise for a sample of eleven Latin American countries arriving, at the same conclusions.

Alt and Lassen (2003), using data from 19 OECD countries, concentrate exclusively on the effects of fiscal transparency on public debt and the central government expenditure. These authors make a successful attempt at providing guidance about what should contain a good measure of transparency. They find significant and economically important effects of transparency, especially for public debt.

3 A Career Concern Model

I consider an economy populated by a continuum of mass one of identical and infinitely lived individuals called *voters*. At every moment in time an *incumbent*, picked randomly from within the economy, is in charge of the government and will remain in power until he is voted out and replaced by an identical agent, who was a voter at the end of the last period, and who now becomes the new incumbent. The former incumbent returns to the population as a voter, and while nothing forbids him from being elected again, the probability of this event happening has measure zero.

In each period, voters obtains utility from a public good produced by the incumbent.

$$U_t^v = g_t, \tag{1}$$

where g represents per capita amounts of the public good. What is important to note about equation (1) is that voters know exactly how much of the public good they are consuming in each period.

The incumbent's period utility function is identical to that of voters, since the incumbent rose from within the population, but incorporates costs and benefits of being in office:

$$U_t^I = g_t + \chi - \phi(e_t), \tag{2}$$

where χ represents ego rents from being in office, charged every period t, and ϕ is the disutility function of the effort variable, e_t, which is the amount of effort measured in *dollars* that the incumbent devotes to public good production in the present period, and that is unobserved by voters. I assume that ϕ is twice continuously differentiable and strictly convex, which implies that the extra unit of effort is ever costlier. Both the incumbent and voters are assumed to maximize expected utility.

The production of the public good is described by the following equation:

$$g_t = \theta_t[d_t + e_t] - D(d_{t-1}), \tag{3}$$

where d_t is the per period government new debt maturing in the following period, and $D(d_{t-1})$ is the amount of debt plus interest payments maturing this period. Whereas d and e are choice variables for the government, θ_t represents an exogenous shock to the production of public goods. It can be thought of as an input shock summarizing the cost and composition of raw materials in the production of public goods. I assume that the set of possible values that θ can take is continuous, compact, time invariant, and common knowledge for voters and incumbent alike: everyone knows that $\theta_t \in [\underline{\theta}, \overline{\theta}]$. I further assume that θ is identically independent distributed (*iid*) over the mentioned set with $E(\theta) = 1$.

With respect to the cost of public debt, I follow the same assumptions as Shi and Svensson (2001) or Alt and Lassen (2003), where $D(d)$ is defined as a convex borrowing function. In particular, $D(0) = 0$, $D'(0) = 1$, and $D''(d) > 0$ for all $d > 0$. The convexity of D means that the marginal cost of borrowing is increasing in the amount of the principal, which can be linked to the country risk premium.

3.1   Transparency in the Budgeting Process

Transparency of the budgetary process is understood along the lines of Kopits and Craig (1998), who define transparency as openness towards the public at large about government structure and functions, fiscal policy intentions, public sector accounts, and projections.

Transparency involves ready access to reliable, comprehensive, timely, understandable, and internationally comparable information on government activities, so that the electorate and financial markets can accurately assess the government's financial position and the true cost and benefits of government activities, including their present and future economic and social implications.

Clearly, there is the question if transparency is always beneficial. As it has been argued (Prat, 2005), too much transparency on the agent's actions can lead to outcomes that are detrimental for the principal. In the context of the present paper, one could think of too much transparency generating a situation of sclerosis in policy implementation, perhaps due to conflict of interests between agents. This paper abstracts from this situation and it can be interpreted as looking only into the segment where more transparency always increases government efficiency.

Here, I condense this notion of transparency in the budgeting process as *the ability of voters to observe the true costs and composition of inputs involved in the production of the public good. That is, the potential to assess the true value of θ.* In this respect, I assume that only the incumbent can directly observe θ. On the other hand, voters obtain an *estimate*[1], $\tilde{\theta}$, of the true value of the shock, conditional on the degree of transparency and the actual realization of θ. For each level of g, the government will like voters to believe that θ was lower than the actual value and, consequently, make e appear to have been higher than the level exerted.

Some real world examples that help us understand this mechanism would be:

- Price of cement, steel, aluminum, etc: Voters can see new infrastructure but they can't know for sure what materials were used to build it. More importantly, without periodical revisions of the expending accounts, expenses at the end of the year can be justified claiming the material was purchased at the peak of the price within the year.

- Detail over contractors (suppliers): if payments to contractors are fully aggregated (low transparency), then it is easy to overstate costs. If on the contrary they are more disaggregated, this possibility is reduced.

To incorporate this idea in the model, I consider the *degree* of transparency of the budgetary process to be inversely related to a measure $\epsilon \in [0, \bar{\epsilon}]$, that is, more transparent regimes are associated with a lower value of ϵ. I treat ϵ as a parameter that is both exogenous and known to the incumbent and voters alike. The reason is that I am interested in the effect of transparency over fiscal outcomes rather than on the dynamic properties of transparency itself which, although a very interesting question, goes beyond the scope of

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[1]Also called *signal* throughout the paper.

this work. I then assume voters will draw a $\tilde{\theta}$ that depends on the given exogenous value of ϵ, the unobserved realization of θ, and its distribution $f(\theta)$. I treat $\tilde{\theta}$ as a continuous uniform random variable that can take any value over the *moving* interval $[\max(\underline{\theta}, \theta_t - \epsilon), \min(\overline{\theta}, \theta_t + \epsilon)]$.

The inference process about the true value of the shock is *informative* if it helps to further bound the set of possible θ. Depending on the level of transparency there are four possible information regions:

1. Full Transparency ($\epsilon = 0$): in this case $\tilde{\theta} = \theta$. This is the most informative case, where the signal *is* the shock.

2. High Transparency ($\epsilon \leq \frac{\overline{\theta} - \underline{\theta}}{2}$): in this case the inference process is always informative in the sense that the signal will give a range of the true value of the shock that is a subset of $[\underline{\theta}, \overline{\theta}]$: $\tilde{\theta} \Rightarrow \theta \in [\max(\tilde{\theta} - \epsilon, \underline{\theta}), \min(\tilde{\theta} + \epsilon, \overline{\theta})]$.

3. Low Transparency ($\frac{\overline{\theta} - \underline{\theta}}{2} < \epsilon < \overline{\theta} - \underline{\theta}$): in this range, depending on the realization of $\tilde{\theta}$, voters might not be able to reduce the set of possible realizations of θ.

4. Full Opacity ($\epsilon \geq \overline{\theta} - \underline{\theta}$): a case in which the inference process is simply not informative.

Given the voter's inference process and $\epsilon > 0$, the conditional expectation of θ on the estimated shock will be:[2]

$$E(\theta | \tilde{\theta}, \epsilon) = \int_{\max[\tilde{\theta} - \epsilon, \underline{\theta}]}^{\min[\tilde{\theta} + \epsilon, \overline{\theta}]} \theta f(\theta) d\theta \tag{4}$$

3.2   The Political Economy Equilibrium

This subsection describes the agency game in which voters and the incumbent engage to maximize their respective expected utilities.

The game is characterized by a succession of identical periods (see Figure 1). A period starts with an incumbent in office who observes θ and $\tilde{\theta}$. Meanwhile, voters can only observe $\tilde{\theta}$. Next, the incumbent decides fiscal policy: d_t and e_t. He repays principal and interests of outstanding debt, $D(d_{t-1})$, and produces the public good, g_t, that is consumed by voters and the incumbent. The period ends with the revelation of d_{t-1} and an election in which voters reappoint the incumbent only if the total utility they got in the period was *high enough*. Otherwise, a new government is put in place, the defeated politician returns to the population as a voter, and the game proceeds to the next period.

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[2]For $\epsilon = 0$, $E(\theta | \tilde{\theta}) = \tilde{\theta} = \theta$.

Figure 1: Timing of the Game.
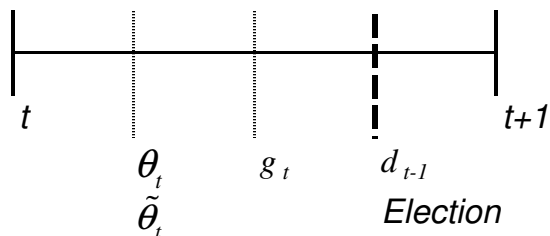
The only decision that voters face is how much to demand from the incumbent in each period, in other words, what is the *reelection rule* (See Ferejohn (1986) for a classical example).[3] On the agent side, the incumbent chooses fiscal policy, subject to the government budget constraint and to the reelection rule. In other words, every period the incumbent selects optimal policy under reelection and under *expropriation*. Expropriation is defined as a situation in which the incumbent optimally exerts the minimum level of effort given that he will not be reappointed next period. To select the optimal policy, the incumbent must take into account the endogenous probability of reelection, and then picks the one that yields the highest lifetime expected discounted utility. One can immediately see the tradeoff introduced by the reelection rule: in the long-run, higher reelection rules (the ones that demand higher utility levels) necessarily imply higher levels of effort, which in turn imply a non-decreasing probability of expropriation, and thus, when expropriation occurs, lower levels of the public good. On the other hand, lower reelection rules will perpetuate incumbents that put in little effort and thus deliver low levels of utility.[4]

Formally, the voter's problem is to:

$$\max_{\{\bar{U}(\tilde{\theta}_t|\epsilon)\}} E_t \sum_{t=1}^{\infty} \beta^{t-1} U_t^v \tag{5}$$

subject to

$$\max_{\{d_t, e_t|\bar{U}(\tilde{\theta}_t|\epsilon), \theta_t\}} E_t \sum_{t=1}^{\infty} \beta^{t-1} U_t^I \tag{6}$$

which in turn is subject to

$$g_t = \theta_t[d_t + e_t] + D(d_{t-1}),$$

where at the beginning of period t, $E_t U_t^v = [(p)(U_t^v \geq \bar{U}) + (1-p)(U_t^v < \bar{U})]$, and p is the

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[3]It is assumed that voters agree on the reelection rule, i.e. I ignore any coordination problem.
[4]The incumbent can use more debt to finance higher levels of public good, but only in the short-run since perpetual roll-over will violate a No Ponzi Game condition.

probability that the incumbent will choose to fulfill the reelection rule.

In order to obtain the solution to (5), I start by finding the solution to (6) for *any* $\bar{U}$. Define $V_t^I = U_t^I + \beta E_t V_{t+1}^I$ as the incumbent's expected present discounted value of being in office next period, which can be decomposed into his utility at t of providing $\bar{U}$, and the continuation value of holding office. In the same manner, define $V_t^o = U_t^o + \beta E_t V_{t+1}^v$ as the incumbent's expected present discounted value of being out of office next period, which is decomposed into his utility at t of reneging $\bar{U}$, and the continuation value of returning to the population as a voter. Suppose voters have instituted the reelection rule $\hat{U}$. Then, upon the realization of θ and $\tilde{\theta}$, the incumbent at time t will choose to deliver (at least) $\hat{U}$ *only if* it is *incentive compatible*, that is, only if:

$$U_t^I + \beta E_t V_{t+1}^I \geq U_t^o + \beta E_t V_{t+1}^v \tag{7}$$

The solution to (7) is not trivial: first, although it is clear that p affects V_{t+1}^I, equation (7) shows that due to the return of the incumbent to the voter pool, p also affects V_{t+1}^v. Second, it is easy to see that V_{t+1}^v is the solution to (5) at the optimum $\bar{U}^*$, for which (5) and (6) must be jointly solved.

In the remainder of this section the model is solved for three particular cases. First, I consider the *dictatorship*, an environment in which voters have no power to dethrone the incumbent and so, regardless on the transparency level, $\bar{U}$ plays no role. The dictatorship is not only the easiest case to solve, but a necessary first step in the solution of any democratic case: it provides us with U_t^o in (7). I then proceed to solve the polar cases of full transparency ($\epsilon = 0$), and full opacity ($\epsilon \geq \bar{\theta} - \underline{\theta}$).

3.3   No Elections: The Dictatorship

Assume a dictator is in power during period t and that, after observing the amount of debt outstanding from period $t - 1$ and the contemporaneous shock, decides his policy action for period t in order to maximize the present discounted value of his utility, knowing that he will remain in power forever. In other words, the dictator's maximization problem is:

$$\max_{(d_t, e_t)} E_t \sum_{t=1}^{\infty} \beta^{t-1} [g_t + \chi - \phi(e_t)], \tag{8}$$

subject to

$$g_t = \theta_t[d_t + e_t] + D(d_{t-1})$$

from which one can write the dynamic programming version of the problem as:

$$V_t^o(d_{t-1}, \theta_t) = \max\{g_t + \chi - \phi(e_t) + \beta E_t V_{t+1}^o(d_t, \theta_{t+1})\} \qquad (9)$$

subject to the government budget constraints.

The first order conditions to this problem are:

$$\theta_t + \beta E_t \frac{\partial V_{t+1}^o}{\partial d_t} = 0 \qquad (10)$$

$$\theta_t - \phi'(e_t) = 0 \qquad (11)$$

where the envelope condition is $\frac{\partial V_t^o}{\partial d_{t-1}} = -D'(d_{t-1})$. After updating, one gets the following set of equations:

$$\theta_t = \beta D'(d_t) \qquad (12)$$

$$\theta_t = \phi'(e_t) \qquad (13)$$

The first shows that it will be optimal to incur higher debt to produce the public good when it is relatively cheap to do so (θ is high); however, note that for β sufficiently high, there would be states for which debt will be zero. Also note that, given the assumption that θ is *iid*, optimal decision is not history dependent. The last optimality condition also exhibits a positive relationship between public good productivity and effort; whether effort would be positive or the condition would be always binding depends on ϕ and $\bar{\theta}$. I assume that no incumbent, whether dictator or not, will voluntarily exert any effort by imposing the following *No-Effort Condition*: $\bar{\theta} \leq \phi'(0)$.

In order to perform comparisons of policy, fiscal outcomes and welfare across different degrees of transparency I simulate the proposed model, starting with a dictatorship but assuming the same functional forms and parameters for all scenarios. Table 1 presents the specific functional forms and parameters. These were arbitrarily chosen, since there is no intention of doing a calibration, but qualitatively the results are the same for a different parametrization. The solution is obtained by iterating over the value function until convergence is reached.

Table 1: Parameters and functional forms

parameters	functional forms
$\beta = .95$	$\phi(e) = \exp(1.2e) - 1$
$\chi = 3$	$D(d \geq 0) = d + d^2$
$\theta_t \in [0.8, 0.9, 1.0, 1.1, 1.2]$	

Figure 2 presents the dictator policy responses for 60 periods of the simulated model. I have transformed the continuous variable θ into a discrete one that can take any of five

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possible values with the same probability. The figure reflects the two optimality conditions, where effort is always zero, and debt responds positively with the contemporaneous shock, and is uniquely determined by it. Moreover, it shows the debt optimality condition binding at sufficiently low levels of θ, i.e. debt is zero for $\theta \leq 0.9$.

Figure 2: Shock and Policy in the Dictatorship.
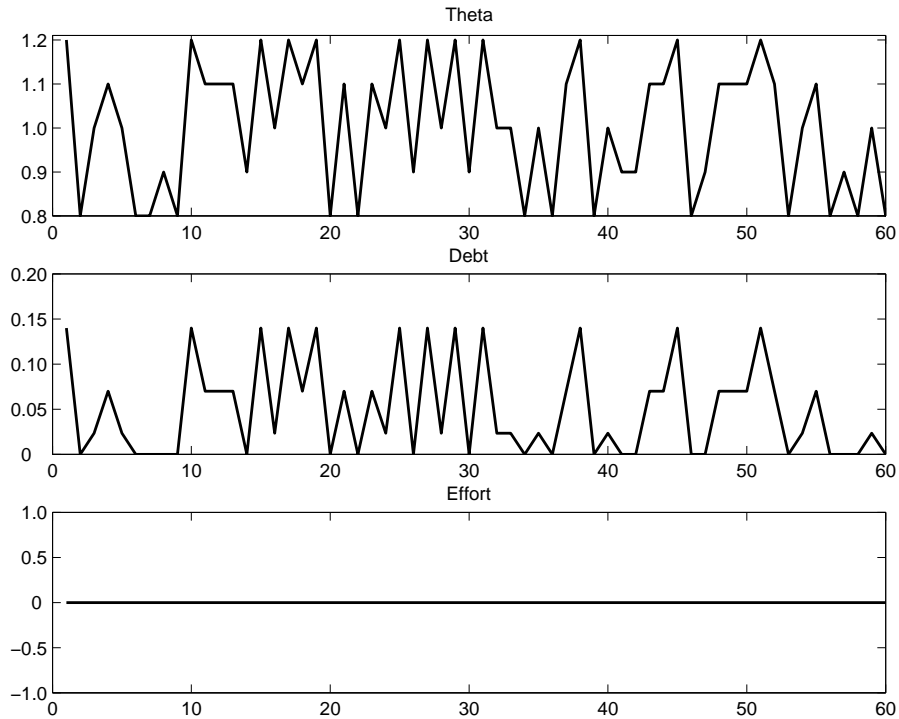
In terms of welfare, measured by V^I and V^v, while the dictator gets an expected PDV of 119.93, voters receive only 59.93. The difference is the PDV of ego rents for being in office, χ. Note that, for the parameters of the model, these two values are the boundaries of any solution of the democratic scenarios, for the incumbent and voters, respectively.

3.4 The Role of Elections as a Disciplining Device

Next I analyze a democratic environment under the polar cases of transparency, assuming that the unique instrument voters have to punish the incumbent is their ability to vote against him.

3.4.1 Full Transparency

Under full transparency, the observed signal is the true value of the shock. Both, the incumbent and voters, observe the same variables, and this is common knowledge. Thus,

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there are no informational asymmetries. Voters can exactly predict the incumbent's behavior for each reelection rule, and so, optimally they will propose a $\bar{U}$ schedule that maximizes their utilities by simultaneously providing enough incentives for the incumbent to ensure he never chooses to expropriate. I formalize this idea in two propositions:

Proposition 1. *Under full transparency the optimal rule is incentive compatible with equality and $p = 1$.*

To prove this, it is easy to see that among all $\bar{U}$ schedules associated with $p = 1$, the one that is incentive compatible, $\bar{U}^{ic}$ dominates the rest. Now, consider a new, higher schedule $\bar{U}^h = \bar{U}^{ic}$ for all $\theta \neq \hat{\theta}$ and $\bar{U}^h(\hat{\theta}) > \bar{U}^{ic}(\hat{\theta})$, making it a potential candidate for the optimal reelection rule. But $p(\hat{\theta}) = 0$ so $\bar{U}^h(\hat{\theta})$ is never delivered by any incumbent and thus $\bar{U}^h$ cannot dominate $\bar{U}^{ic}$.

Proposition 2. *Rent extraction is positive even if there are no information asymmetries.*

See proof in the appendix. Intuitively, and even if effort were to be observable and enforceable in the democratic setup, voters cannot extract all of the incumbent's ego rents for being in office since at this effort-level, the lifetime expected utility of voters and incumbent is identical, but the period utility of expropriation versus observation of the rule is higher. Therefore, the incumbent is always tempted to expropriate today and get voters' utility in the future. Under full transparency, ego rents will reach the minimum since voters can compute the incumbent's optimal policy for each contingent minimum utility level that voters demand in order to keep reappointing him.[5] The maximum per period level of effort that voters can demand is $e^* = \phi^{-1}(\beta\chi)$, which comes from the *no-expropriation-condition* $\chi - \phi(e)/1 - \beta \geq \chi$.

Figure 3 presents an extensive form of the game and helps to visualize the equilibrium concept. Each ending node shows the payoffs for Incumbent 1 and Voters, respectively. Voters move first by proposing the reelection rule $\bar{U}$. I have claimed that there exists only one reelection rule, $\bar{U}^*$ that solves the Full Transparency problem, which is IC. Suppose $\bar{U} > \bar{U}^*$ and that the equilibrium strategy for any incumbent is to Fulfill $\bar{U}$. Then, given that Incumbent 2 should Fulfill, Incumbent 1 has incentives to deviate and choose to Expropriate. Thus, Fulfill cannot be an equilibrium. If, on the other hand, voters demand $\bar{U} < \bar{U}^*$, the best response for any incumbent is to choose Fulfill, just as with $\bar{U}^*$, which is the only equilibrium.

To obtain the solution for any transparency level, I make a guess for $\bar{U}$, calculate V^I and V^v and check the IC constraint. A new $\bar{U}$ is proposed and the process repeated.

Figure 3: Full Transparency in Extensive Form.
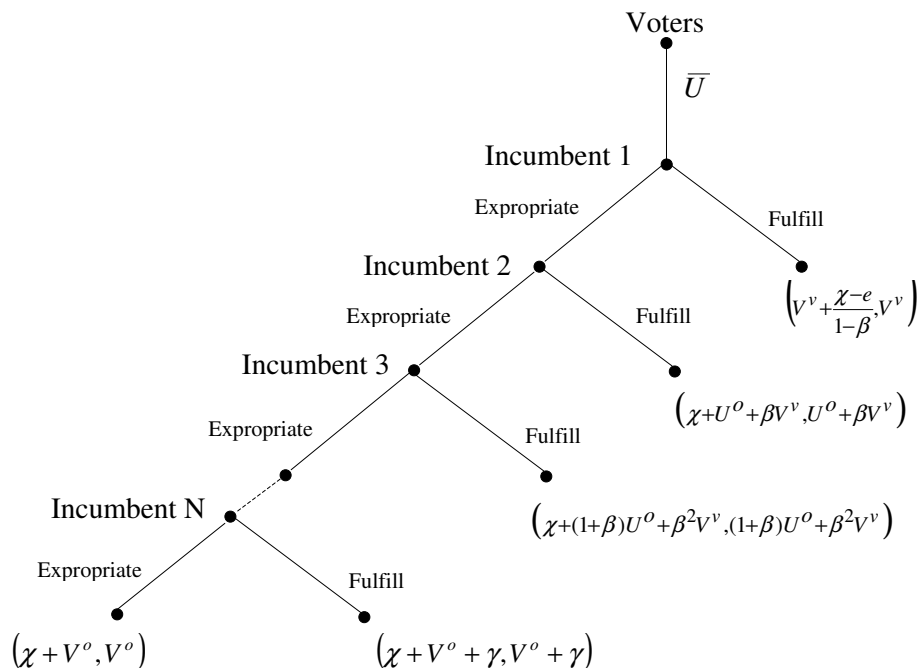
Both rules are compared and kept the one that renders the higher V^v. A new $\bar{U}$ is then proposed and the iteration continues until no $\bar{U}$ is beaten.

Figure 4 shows the policy path of the full transparency equilibrium, for the same stream of shocks as in Figure 2. In this case, the incumbent's effort is always positive and constant at the level of $e^* = \phi^{-1}(\beta\chi)$. For comparison purposes the figure also shows the Social Planner's levels of effort and debt. Under full transparency debt follows the exact same path as the dictator or the social planner if $\bar{U}$ can be written as a full contingency plan that states a different minimum level for every θ and d_{t-1}. If $\bar{U}$ can be written only conditional on θ, debt equals zero in equilibrium. I assume that it is too costly to write down a full contingency schedule and so $\bar{U}$ only specifies a minimum level for each θ.

At equilibrium, voters obtain an expected discounted utility of 82.47, contrasted with the 59.93 that they get in the dictatorship. In the Social Planner's benchmark case, where debt follows the optimal path and effort can be set at a no-rent-extraction level, voters and incumbent would have obtained 83.20. Fiscal outcomes are left for a subsection below where I compare them across transparency levels. I now turn to analyze the other polar case.

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[5]In a similar setup, Persson, Roland and Tabellini call it "rents of being in power".

Figure 4: Shock and Policy under Full Transparency and Social Planner.
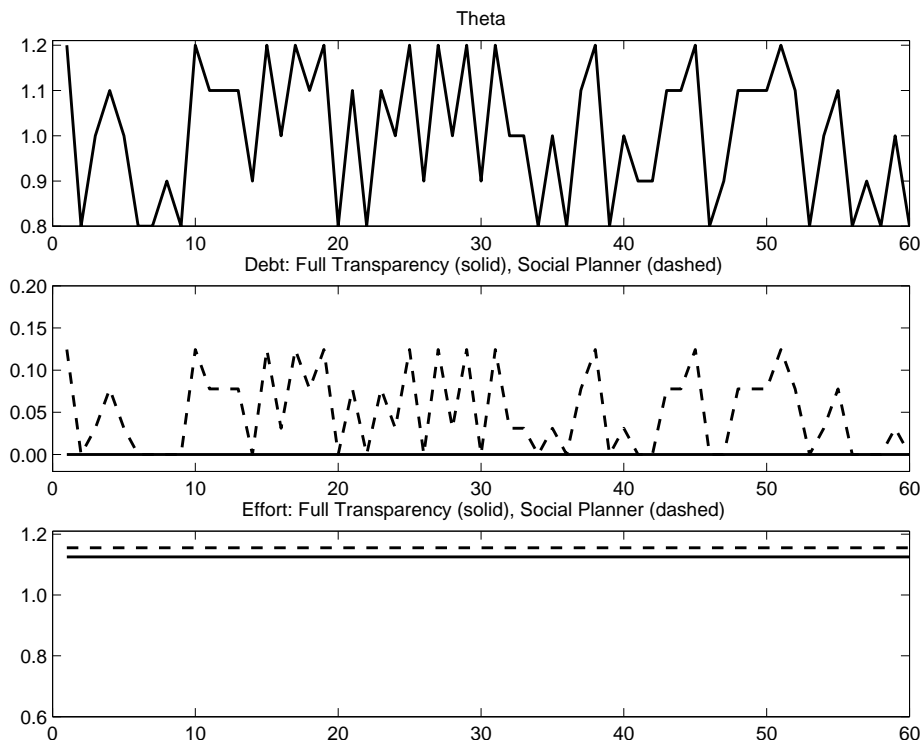
3.4.2 Full Opacity

Full opacity of the budgetary process is defined as the situation in which $\tilde{\theta}$, voters' estimate of the true fiscal shock, is not informative, meaning that the observation of any $\tilde{\theta}$ assigns the same probability of occurrence to an specific θ. In this case the type of solution of the model is similar to that of Ferejohn (1986), in which voters will ask for a time invariant minimum utility level and will keep reappointing the incumbent as long as he continues to fulfill this requirement. There is an important difference with the Ferejohn model though, which is that now the actual shock, θ, does not uniquely determine the policy outcome since debt carried from the last period will play a role.

Table 2 describes the full opacity equilibrium. If voters were to demand 3.70 as the cutoff rule for reelection, the incumbent will always choose to follow the rule, that is, the probability of expropriation is zero. The PDV for incumbent and voter are 93.64 and 74.29 respectively.

Raising the bar to 3.80 per period makes no difference in the decision of the incumbent with respect to expropriation; even when there are some possible states of the world in which the incumbent should choose to expropriate, namely a combination of a bad shock

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($\theta = .8$) and a very high level of outstanding debt, these states have a zero probability of occurrence.[6] Accordingly, the PDV for incumbent and voter under a rule of 3.80 are 87.09 and 76.29, respectively.

Going beyond 3.80 progressively increases the probability of expropriation, but this does not necessarily mean that V^v will be lower since at first the marginal gains for demanding a higher $\bar{U}$ will dominate the losses in case of expropriation, given that $1-p$ is very low. As $\bar{U}$ is increased, the second effect gains in importance over the first, reaching equilibrium at the point where they equal each other. The maximum is attained at $\bar{U}^* = 3.830$ with a probability of expropriation of .018 and expected PDV for incumbent and voter equal to 85.54 and 76.61, respectively.

Table 2: Full Opacity Equilibrium Rule.

| $\bar{U}$	*3.700*	*3.800*	*3.810*	*3.820*	***3.830***	*3.840*	*3.850*
1-p	0.000	0.000	0.006	0.016	**0.018**	0.036	0.052
V^v	74.29	76.29	76.37	76.39	**76.61**	76.42	76.35
V^I	93.64	87.09	86.49	86.19	**85.54**	85.47	85.31

Figure 5 depicts policy paths under full opacity. Debt is more volatile and average debt is higher than in the dictatorship. Moreover, the incumbent incurs in higher levels of debt when θ is low and less productive, to help him fulfill the reelection rule. The correlation between d and θ is -0.83. In contrast to the other two cases, effort shows variability and can even be higher, in some periods, than in the full transparent case, although average effort is, of course, lower. Similarly to debt, the incumbent chooses higher levels of effort for lower levels of θ, being their correlations -0.87. In the figure we can see an expropriation period (and therefore a change of ruler) when effort reaches zero. In this case, expropriation occurs after a second consecutive *worst* shock.

3.4.3 The Intermediate cases: High Transparency, Low Transparency, and High Opacity

Consider the intermediate cases. Here, I am introducing a third *de facto* state variable: $\tilde{\theta}$. Voters now condition the reelection rule on the observed signal. I explore three distinct cases. High Transparency, a situation in which the signal is always informative; Low Transparency, a case where *sometimes* the signal is informative and; High Opacity, a circumstance in which the signal is *almost never* informative, and so it resembles Full

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[6]Unless, of course, those are the initial conditions, but even in such case this can only happen for the first government since the outstanding debt for the next government following expropriation will never be high enough.

Figure 5: Shock and Policy under Full Opacity.
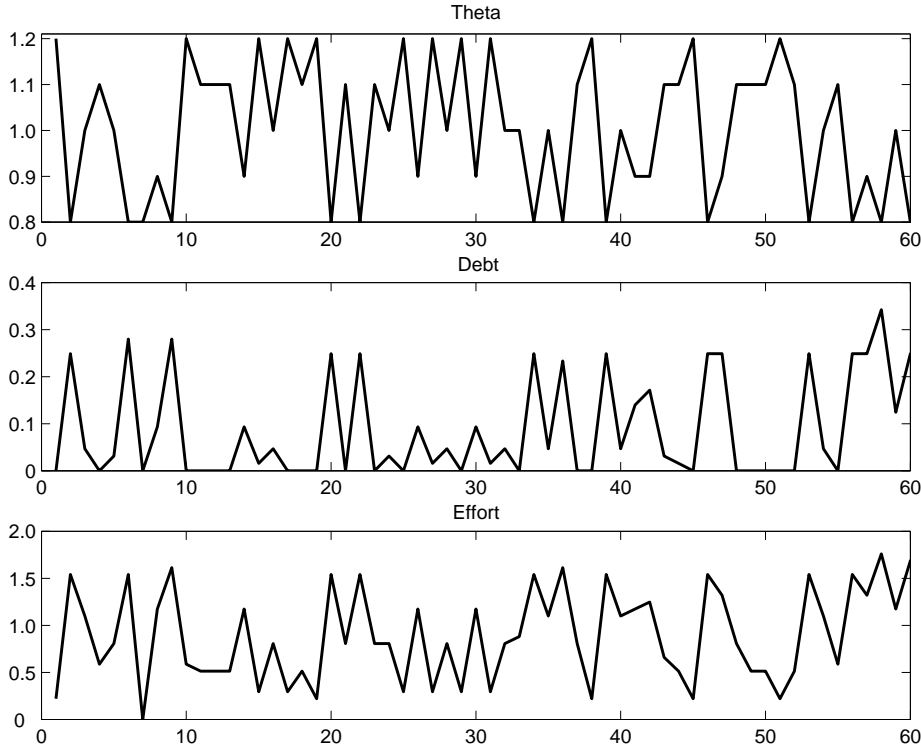
Opacity. Figure 11 (see Appendix 2) shows how θ and $\tilde{\theta}$ relate to each other depending on ϵ.

In the top panel of figures 6 and 7 it can be seen how θ and $\tilde{\theta}$ move together across time. Although $\tilde{\theta}$ is a good approximation of θ with $\epsilon = .1$ and a bad one when $\epsilon = .3$. By moving towards more opaque scenarios, these figures illustrate how debt and effort are progressively employed only to salvage office, rather than for efficiency reasons, which are measured by the contemporaneous correlations of e and d with θ (look at the bottom of top panel in table 3).

Figure 7 shows two periods of expropriation. The first episode coincides with the one obtained under full opacity. This episode would have being avoided if at least one of the signals had coincided with the true shock. The second episode is the consequence of two consecutive very uninformative signals, that make voters demand too much from the incumbent.

Figure 6: Shock and Policy under High Transparency.
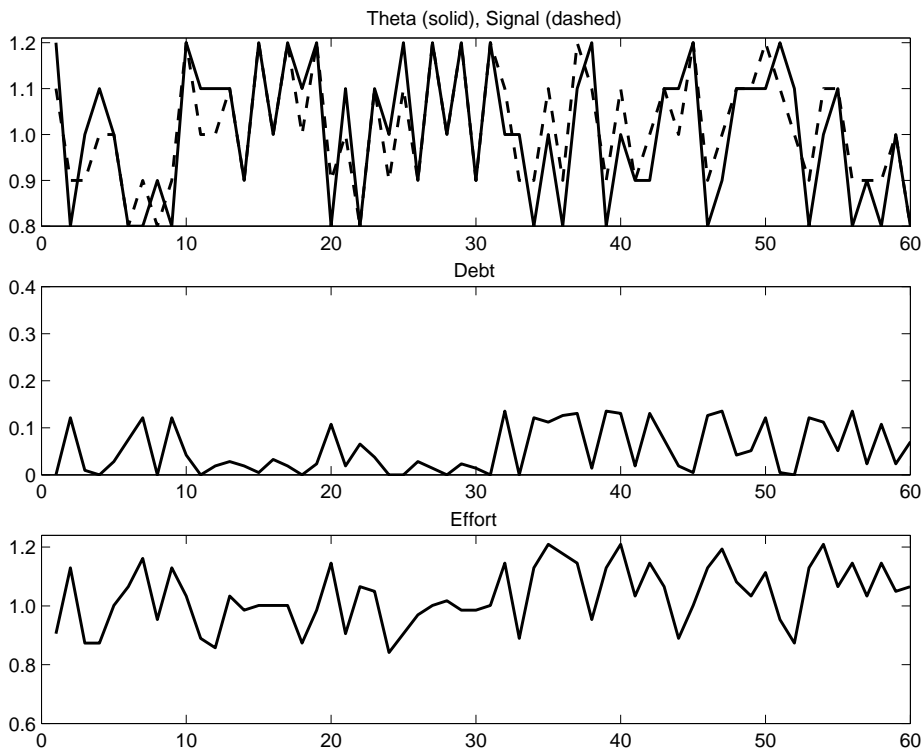
3.5 Numeric Constraints

Transparency in the budgetary process is by no means the only force that conditions the realization of fiscal outcomes. In fact, the institutional arrangement that seems to capture most of the attention in the literature is the set of numeric rules that the executive has to face at the moment of elaboration, approval and execution of the budget. These numeric constraints can take the form of specific limits to expenditures, debt and deficit, or restrictions to the flow of resources between and within programs, agencies and levels of government. The constraints could even be restrictions to the flow of resources between different fiscal periods. The most extended use of a numeric constraint is an explicit cap on the budget deficit.

To incorporate this set of restrictions into the model, I condense them into a single *de jure* budgetary rule. This allows me to evaluate, in the simplest manner, the effect these rules can have when there are asymmetries in the information that players are receiving, and thus address the possibility that the government can escape legal consequences by exploiting financial loopholes. Specifically, I introduce a *no-additional-debt* rule that has to be observed by the incumbent with the same consequences as the minimum utility rule already imposed. That is, if the incumbent fails to fulfill it, he will be voted out of office in

Figure 7: Shock and Policy under High Opacity.
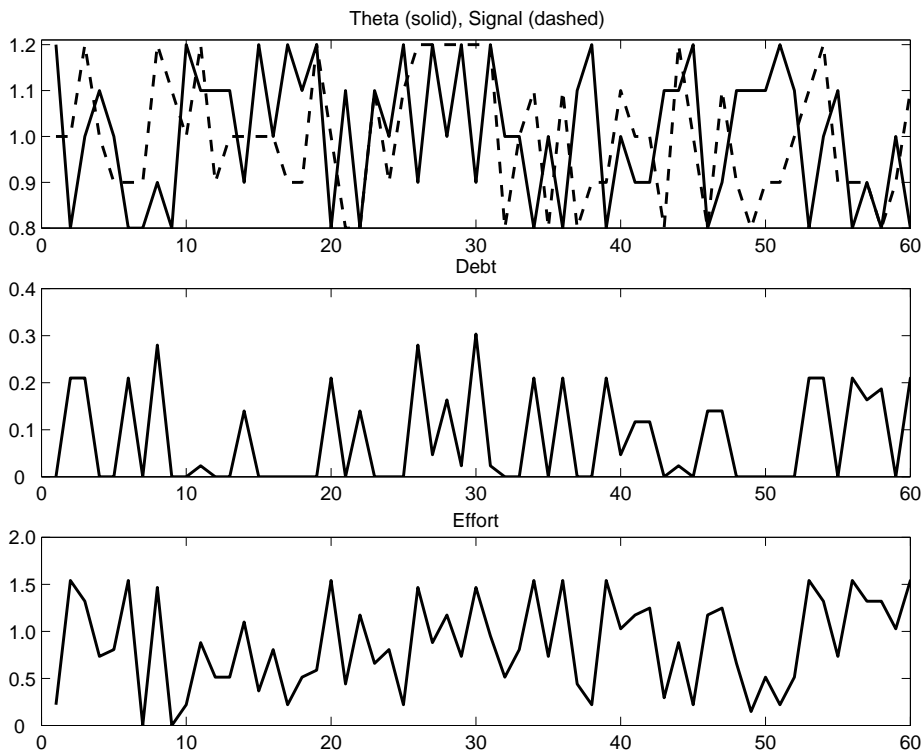
the following election. The problem with this rule, in contrast to the minimum utility rule, is that voters cannot directly observe the actual level of debt, but rather, they can only observe the reported level by the incumbent. Henceforth, I will call any deviation of the reported level from the actual level *creative accounting*. The extent to which the incumbent can use creative accounting as an instrument will be determined by the transparency level of the economy.

Formally, the no-additional-debt rule means that the incumbent would be reelected if, in addition to delivering $\bar{U}$, he also fulfils:

$$d_t \leq D(d_{t-1}) \tag{14}$$

At this point it is necessary to introduce more structure about how *creative accounting* can take place in the model. Following Milesi-Ferretti (2004) I assume that the extent of creative accounting is inversely related to the degree of transparency, but I do not attempt to derive it from within the model. This ad-hoc formulation is made for convenience. Otherwise, one would have to introduce more structure about effort which would be as arbitrary as directly modelling creative accounting. In particular, the game is modified by assuming that after the delivery of the public good, the government reports the amount

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of debt that accrued during its production, $\tilde{d}_t$.

Figure 8: Timing of the Game.
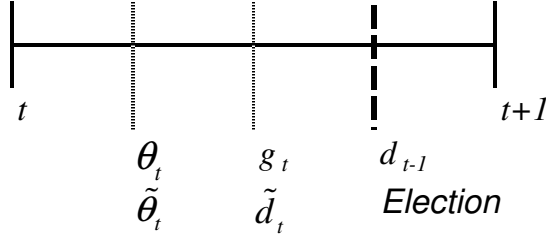
Any deviation from the true value of debt, that is if $\tilde{d}_t \neq d_t$, will be considered creative accounting. To simplify, I assume that the government's maximum amount of creative accounting without being caught is: $d_t \pm \epsilon d_t$, but that any attempt to engage in creative accounting outside this interval will be detected by voters with probability one. For example, $\epsilon = .1$ means that the government can falsely report up to 10 per cent of the period's debt without being caught.

In terms of the model I then introduce the *enforceable* no-additional-debt rule:

$$\tilde{d}_t - err = (1 - \epsilon)d_t - err \leq D(d_{t-1}) \tag{15}$$

For all positive d_{t-1} the maximum amount of possible diversion increases with ϵ. The term err, used for errors and omissions, is assumed to be constant across transparency and is needed in order to avoid a zero-debt trap: without err, once d_{t-1} reaches zero the maximum amount of diversion is zero independently of the degree of transparency, something that would trivialize the solution. In any case, err is set to the minimum.[7]

Figure 8 shows how the rule affects policy decision. After observing g_t and $\tilde{d}_t$, voters learn if $\bar{U}$ was satisfied and they have a rough idea of how much debt was utilized. After the (audited) value of d_{t-1} is released voters also learn if the enforceable rule was satisfied. In this game, a government is voted out for three possible reasons: If $\bar{U}$ is not satisfied, if creative accounting is detected ($\tilde{d}_t < (1 - \epsilon)d_t$), or if the enforceable no-additional-debt rule is violated.

Even when the ad-hoc rule obviously makes it easier for opaque regimes to engage in creative accounting, it does not trivialize the outcome since the rule will be binding for some states in all regimes. That is to say, it imposes an effective cap on the per period

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[7]The minimum err depends on how fine the discrete state space is; the finer the grid the smaller err will be, defined such that, if the d state space consists of n points and we index d by n where $d(1) = 0$, $d(n) = d_{max}$, then $err = d(2)$. In other words, if $d_{t-1} = 0$, d_t can take the first positive value.

debt. This can be seen in figures 9 and 10. The imposition of this numeric rule modifies the government's choice of optimal debt: even when debt moves in the same direction as in the unconstrained case—this is more pronounced as opacity increases—debt volatility is significantly reduced. In the constrained case debt is almost never as high as in the unconstrained case, but it is never as low either, reaching levels of zero debt only in the expropriation periods. Therefore, even when one should never expect to see debt levels as high as in the unconstrained case, this does not imply that average debt will be lower. The government finds it optimal to carry positive amounts of debt from period to period, since this gives it bigger room for engaging in creative accounting in order to smooth effort. In particular, in scenarios where there is no full transparency, the incumbent uses debt to fulfill the requirements and be reappointed, precisely in bad states of the world, when he is demanded relatively high levels of public good. But now the amount of debt that can be issued will be constrained by the amount outstanding last period, giving him the incentive to always carry over positive amounts of debt. This incentive will be enhanced as opacity increases.

Figure 9: Policy Comparison under High Transparency.
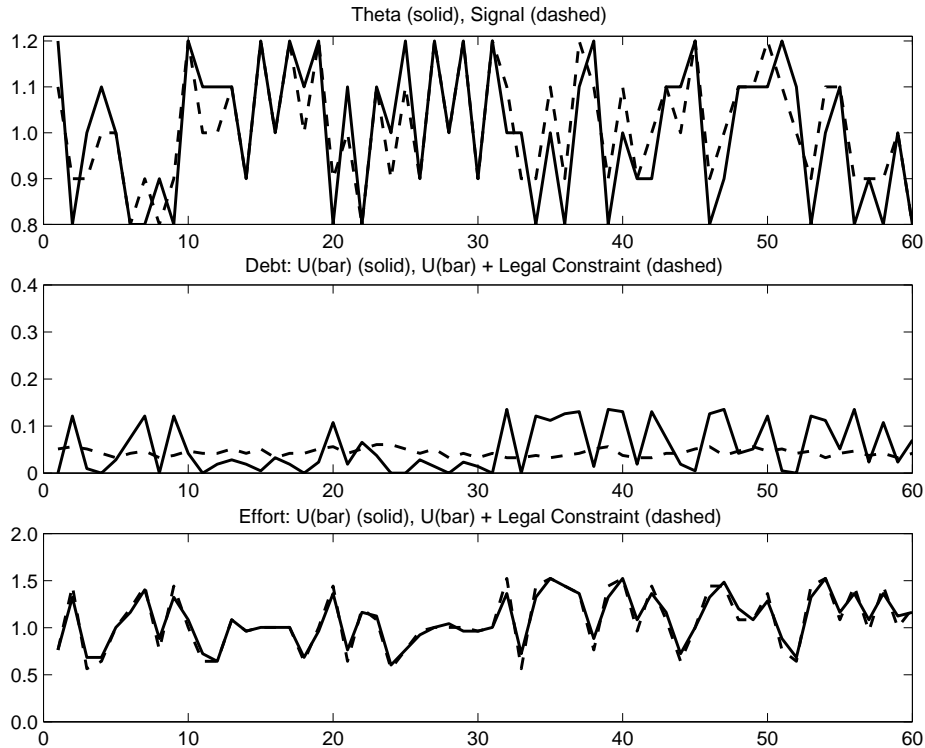
Figure 10: Policy Comparison under High Opacity.
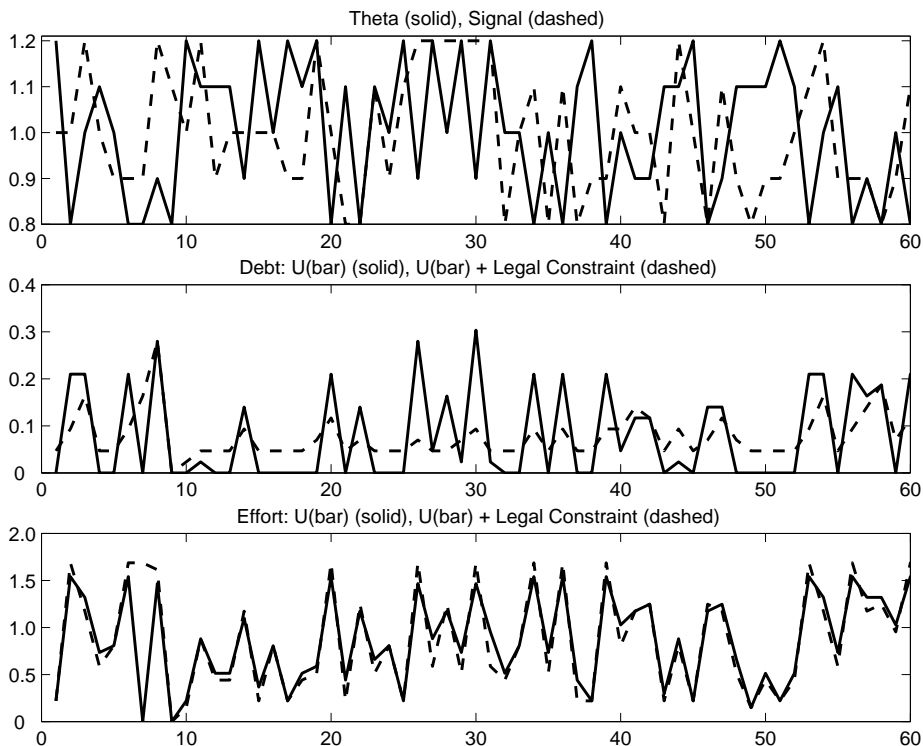
3.6 The Effects of Transparency and Numeric Rules: Welfare, Public Good, and Debt

The top panel of table 3 compares welfare, the average level of debt, and the average levels of public good, for the different degrees of transparency when no numeric rule is imposed. The bottom panel 3 does the same but including the no-additional-debt rule.

This exercises show, as in Ferejohn (1986), that more transparency is associated with an increase in welfare, driven by the average level of public good. The value added of the present setup is that is has been linked to public debt. Whereas in the long-run more transparency is always associated with lower levels of debt, in the short-run this is not always the case. For instance, by comparing Figures 6 and 7, it can be seen that between periods 10 and 20 the high transparency regime shows many periods with higher equilibrium debt than in the high opacity regime, for the same stream of shocks.

Contrasting the top and bottom panels of table 3, it can be seen that the the addition of the no-additional-debt rule does not necessarily imply a lower average debt across all regimes. In particular, whereas the highly transparent regime does reduce its average debt, the more opaque regimes increase average debt by non-insignificant magnitudes. Moreover, aside from the social planner case where it is obvious that debt and welfare has to decline,

the introduction of the numerical rule improves voter's welfare in the highly transparent scenario and worsens it in the more opaque ones.

Table 3: Welfare, Public Goods, and Debt.

Descriptive Statistics: Only Transparency							
Regime	Dictator	Social Planner	Full Transparency	High Transparency	Low Transparency	High Opacity	Full Opacity
V^v	59.93	83.20	82.47	80.71	78.11	77.01	76.61
g_{mean}	2.92	4.18	4.12	4.05	3.97	3.89	3.89
d_{mean}	0.047	0.047	0.00	0.050	0.065	0.072	0.087
e_{mean}	0.00	1.155	1.125	1.058	0.973	0.925	0.906
$corr(e,\theta)$	—	—	—	-0.39	-0.63	-0.75	-0.87
$corr(d,\theta)$	0.96	0.96	—	-0.48	-0.64	-0.74	-0.83
Descriptive Statistics: Transparency and No-Additional-Debt Rule							
Regime	Dictator	Social Planner	Full Transparency	High Transparency	Low Transparency	High Opacity	Full Opacity
V^v	—	83.11	82.47	80.82	77.39	76.08	75.54
g_{mean}	—	4.17	4.12	4.06	4.00	3.91	3.91
d_{mean}	—	0.000	0.000	0.044	0.072	0.083	0.102
e_{mean}	—	1.155	1.125	1.061	0.956	0.921	0.931
$corr(e,\theta)$	—	—	—	-0.43	-0.71	-0.80	-0.93
$corr(d,\theta)$	—	—	—	0.07	-0.44	-0.54	-0.66

4 Empirical Evidence

The model presented in the first part of the paper has clear predictions about the amount of public goods produced and the level of debt incurred, for different degrees of budgetary transparency and the inclusion of numeric rules. While it would be very difficult to measure the delivery of public goods across countries, the data on public debt is readily available. For this simple reason, in this section I test the predictions of the model only on measures of debt. Additionally, measures of fiscal balance are also employed as dependent variable, since the level of public debt is reflecting the accumulation of deficits across time.

In concrete, the models' predictions I want to test are:

• Countries with higher degree of budgetary transparency should exhibit lower levels of public debt and fiscal deficits.

• Numeric rules should induce lower levels of public debt and fiscal deficits only if budgetary transparency is sufficiently high.

To assess the effect of numerical rules and budgetary transparency on fiscal outcomes, I construct several indices of these budgetary institutions and then regress a series of fiscal outcome variables on these indices and other controls.

4.1   Measuring Transparency and Numerical Rules

The data for the construction of the indices was obtained from the OECD/World Bank *Survey of Budget Practices and Procedures (2003)*. The database contains more that 350 questions covering all sorts of issues about the budgeting process for 38 countries.[8] I started by selecting those questions that were directly related to transparency and numerical rules. From that set, I eliminated questions that were too similar—after corroborating that answers were the same—and I eliminated questions with ambiguous interpretations. At the end I ended up with 11 questions that were relevant to numerical rules and 14 questions for transparency.

To construct each index, every answer was given a value that ranged between zero and one, where higher values reflected institutions that should enhance fiscal discipline. Since, in general, questions had more than two answers, partial weights were proportionately distributed, following the method of Alesina et. al. (1999). Finally, the two indices were standardized so that each ranges from zero to one, which eased comparisons between them.

4.1.1   Transparency

How can one budgetary process be defined to be more transparent than other? Transparency is not a unidimensional concept; the literature contains many definitions that agree on the central issues of transparency, but authors assign different weights to its components, and omit others.

Based on the many definitions of transparency in the literature, Alt and Lassen (2003) try to rationalize and provide guidance of what a good measure of budgetary transparency would be. For this purpose they identify four main characteristics of transparency. First, more transparent procedures should process *more information*, and other things being equal, use *fewer documents*. This speaks to openness and ease of access and monitoring. Second, transparency is increased by the possibility of *independent verification*, which has been experimentally shown to be a key feature in making communication persuasive and credible. Third, there should be a commitment to *non-arbitrary language*: words and classifications should have clear, shared, unequivocal meanings. Finally, the presence of ex-ante *more justification* increases transparency, reducing the possibility of ex-post strategic justification.

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[8]For the list of countries, see Table 9 in Appendix 2

To construct the transparency index, the following questions were employed, shown under the Alt and Lassen (2003) classification:

- More information, other things equal, in fewer documents

    - Does the annual central government budget documentation submitted to the legislature/parliament contain multi-year expenditure estimates?
    - At what interval is information on the in-year budget implementation released?
    - Are the following accounts (assets, liabilities, government equity, revenues, expenses) integrated into the accounting system to facilitate the preparation of financial statements?

- Independent verification

    - Does the government announce the release dates for information on the in-year budget implementation in advance?
    - Are economic assumptions available for scrutiny?
    - Is this information audited?
    - Are audited final accounts published and available publicly?
    - Are internal audit procedures clear and subject to effective process review by external auditors?
    - Are the findings of the National Audit Body available to the public?
    - Are government entities subject to financial audits by an external auditor?

- Non-arbitrary language

    - Does the government uses accrual accounting in its financial statements?
    - Is there a unified accounting and budgeting classification system?

- More justification

    - Does the budget documentation contain a discussion of what impact variations in the key economic assumptions (sensitivity analysis) would have on the budget outturn?
    - Does the published information have a comparison between actual and planned spending for the period covered?

The main transparency index has more weight on the verification side and in the type of information presented, and less on the amount of information per se. It seems more important to have fewer pieces of transcendental, bottom-lined and audited information at the relevant time than large amounts of data that might confuse rather than clarify the government objectives.

4.1.2   Numerical Rules

The possibility of running larger deficits or increasing the level of expenditures is, in principle, established in the legislation. Other things being equal, one should observe higher fiscal deficits or debt levels the less constrained is the budgetary process. Note, however, that the model presented in the first part of the paper establishes that the effects of numerical rules on fiscal outcomes depend on the level of transparency.

Ideally it would be possible to distinguish between restrictions to the overall budget and to the composition of it and, presumably, only the first type should affect aggregate fiscal outcomes. In practice, such separation might not exist; budgetary processes that allow inter program transfers, for instance, can create a bigger budget by ex-ante inflating accounts or programs that are not so carefully watched in comparison to others and then making ex-post transfers. If this type of connection is of true importance or just a second order effect is a question that I try to answer here. For this reason, the questions used to construct the numerical constraint index were separated in three categories: those that refer to direct restrictions to the overall budget, those that refer to transfers within the fiscal budget, and those that refer to transfers between different budgetary years.

- Direct Restrictions

    - In developing the budget, are there fiscal rules placing limits on Executive fiscal policy discretion?
    - Can you change expenditures outside the budget process?

- Between Restrictions

    - Is it possible to carry-over unused appropriations for operating costs (salaries, etc.) from one year to another?
    - Is it possible to carry-over unused appropriations for investments (building construction, etc.) from one year to another?
    - Is it possible to carry-over unused appropriations for transfer programs from one year to another?
    - Is it possible for managers of ministries/government organizations to borrow against future appropriations for operating costs (salaries, etc.)?
    - Is it possible to borrow against future appropriations for investments (building construction, etc.)?

- Within Restrictions

    - Are there laws, regulations or policies that define the permitted uses of the budget reserves and the decision-making authorities for approving allocations from the reserves?

- Are government organizations allowed to transfer funds between operating expenditures, investments and program funds?

- Can appropriations be reallocated from one program to another?

- More generally, are transfers permitted between capital investments or transfer programs (social security pensions, etc.) and operating expenditures?

I compute three main numerical constraints indices. The first one assigns equal weight to each question which implicitly gives more importance to *within* and *between* constraints since both represent nine out of eleven questions. Two additional measures are then computed to tackle this problem. The second index gives half the weight to *direct* restrictions and the other half to the within and between constraints. The third index disregards the within and between effects concentrating only on direct constraints.

4.2 The Effects of Budgetary Institutions on Fiscal Outcomes.

This section presents a series of econometric models that try to answer the question of how different budgetary institutions, in the form of the constructed indices, affect fiscal outcomes across countries. First, I introduce the benchmark model, which controls for economic and demographic variables that has been shown to affect fiscal outcomes. Second, I study possible differences in the estimated parameters, depending on the degree of development of the countries in the sample. Finally, I add to the model a series of political variables that can also affect fiscal outcomes.

4.2.1 Data and the Benchmark Model

Fiscal outcomes variables come from the *World Economic Outlook* (WEO), produced by the International Monetary Fund, and were constructed as averages of the period 1999-2003. All the remaining economic and population variables are directly extracted, or constructed from, the World Development Indicators (WDI). The political variables are from the *Database of Political Institutions* (DPI2004) by Philip Keefer (*District Magnitude* and *Number of Effective Parliamentary Parties*), and from The Economist (*Cabinet Size*).

The empirical strategy is to fit the following benchmark model:

$$FO = \beta_0 + \beta_1 Transparency + \beta_2 Numerical Rules + \beta_3 Hierarchical + \vec{\beta'}X + \epsilon, \quad (16)$$

where FO, that stands for *Fiscal Outcomes*, can alternatively take the form of *General Balance, Central Balance, General Net Debt,* and *General Gross Debt*, all expressed as ratios

to GDP and, as was mentioned earlier, averaged over the 1999-2003 period. *Transparency* and *NumericalRules* are the computed institutional indexes that were described in the previous subsection. *Hierarchical* is an index trying to measure the third budgetary institution recognized in the literature, *procedural rules*, and was constructed in a similar way as the other two indexes.[9] X is a vector of economic and demographic control variables that can potentially influence fiscal outcomes. The controls are, first, the average growth of GDP for the 1990-2003 period (*Avg. Growth*) which is believed to be directly related to revenues due to the progressivity of the tax structure and higher tax revenues from job creation, and inversely (or neutrally) related to expenditures, due to lower unemployment benefits paid by the state. Added together, these should have a positive effect on fiscal balances and a negative effect on public debt. Second, the *Dependency Ratio*, defined as the sum of population under 12 and over 65, divided by total population and averaged over the 1999-2003 period, is expected to have the opposite effects to *Avg. Growth* on fiscal outcomes since a higher dependency ratio represents a lower taxable base on one hand, and higher expenditure on education and in the pension system, other things being equal. The third variable (*Wagner*) is the average GDP per capita over the 1999-2003 period, measured in dollars and adjusted by PPP, that is used as a proxy for the country's development level. This variable controls for Wagner's law, the prediction of a positive correlation between the development level of an economy and it's share of public expenditure to GDP. It is important to note that this variable may be correlated with budgetary institutions. However, all the results that are reported below are robust to the exclusion of the *Wagner* variable from the benchmark model. Additionally, I have conducted another exercise splitting the sample according to the development level of countries, in order to account for this potential source of bias. The last control is the degree of openness of an economy, defined as the ratio of the sum of total exports and total imports to GDP (*Openness*). This variable is included to account for the empirical finding (Rodrik (1996)) that more open economies tend to have larger levels of government. I have also included the value of the dependent variable in 1990 as a control for the evolution of the analyzed fiscal outcome during the last decade.

There are two potential problems with the econometric specification. The first one is endogeneity: In the literature, and this work is no exception, budgetary institutions are

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[9]*Procedural rules* dictate the timing and mechanisms by which the executive drafts the budget, it's discussion and approval in the legislature, and its posterior implementation. These procedural rules determine the relative strength of the players involved in the budgeting process within the executive and between the executive and the legislature. In this literature, procedural rules are classified on a *hierarchical-collegial* spectrum. At the stage of budgeting drafting, hierarchical rules are those that tilt the balance of power in favor of the finance minister, who faces the whole government budget constraint, and in detriment of spending ministers, who care almost exclusively about their own portfolio. On the contrary, collegial rules are those in which the role of the finance minister is more passive and limited. At the approval stage, hierarchical rules are those that impose more constraints on the legislature's ability to modify the budget proposed by the executive, and in particular, on its ability to increase the size of the budget or the deficit. At the execution stage, hierarchical rules are those that limit the possibility of the legislature to increase the budget once it has been approved.

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treated as being exogenous, while it is also recognized that they are indeed endogenous, particularly to past fiscal outcomes. The justification to this treatment is that, at least in the short run, institutions are reasonably difficult to change, and therefore are changed relatively infrequently. Since it is costly and complex to change institutions, the existing ones have to be very unsatisfactory before it is worth changing them; as a result, there is a strong "status quo" bias in institutional reform. Therefore, at least up to a point, one can use institutional features as explanatory variables (Alesina and Perotti (1999)). The second problem is the potential correlation between the budgetary institutional variables. Indeed, while the simple correlation between transparency and the other two measures of budgetary institutions is not different from zero, the *Hierarchical* and *Numerical Rules* variables are positively correlated. I used different definitions for *Numerical Rules* and also drop the *Hierarchical* variable to account for this problem, and the results remain qualitatively the same.

The benchmark results for *Central Balance*, *General Balance*, *General Net Debt*, and *General Gross Debt* are presented in table 4. For each fiscal outcome, the model with only the economic controls, is reported on the left columns, and the economic controls and budgetary institutions on the columns of the right.

Looking at the models with the economic controls alone, there are two aspects that are worth mentioning. First, in none of the four fiscal outcomes analyzed are all of the economic controls significant at the same time but, nevertheless, we can confidently reject the null of all coefficients being jointly equal to zero. Moreover, every economic control enters significantly in at least half of the fiscal outcomes analyzed. Second, all the economic controls that enter significantly in each equation, does it with the expected sign, although some of them lose significance once the budgetary variables are included in.[10]

Looking at the columns on the right in table 4 for each fiscal outcome, it can be seen that budgetary transparency helps to explain the cross-country differences of all fiscal outcomes, although the effect seems to be stronger for the debt variables than for the fiscal balance variables. At the same time, it can also be seen that numerical rules do not enter significantly in any of the regressions. These results are congruent with the model presented in the previous section.

The interpretation of the point estimates of *Transparency* is that an increase in this variable of one standard deviation (0.12) from its midpoint (0.69) is associated with, relative to GDP, a fiscal stance improvement of 1.2 and 1.6 percent on Central and General Balance, and with a 10.4 and 12.4 percent reductions in General Net Debt and General Gross Debt, respectively. In terms of the explained cross country variation, the inclusion *Transparency* in the benchmark model improves considerably the R-squared of the

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[10]Dropping one control at a time did not change the significance level of any of the other variables. Their coefficient values never changed more than 5%. Since there are good theoretical motives to suspect that the non-significant controls truly affect fiscal outcomes they are left as part of the regression.

regressions.

Table 4: Benchmark Model.

	Central Balance		General Balance		General Net Debt		General Gross Debt	
Dep. Var. 1990	0.084	0.077	0.204**	0.242*	0.862***	0.912***	0.779***	0.753***
	(0.056)	(0.082)	(0.099)	(0.126)	(0.083)	(0.097)	(0.109)	(0.074)
Avg. Growth	0.007	0.006	0.005	-0.002	-0.123***	-0.093***	-0.122***	-0.098***
	(0.005)	(0.006)	(0.006)	(0.007)	(0.022)	(0.031)	(0.027)	(0.022)
Dependency Rat.	0.094	0.042	0.102 *	0.016	-2.364***	-1.472*	-1.718***	-1.150***
	(0.060)	(0.061)	(0.058)	(0.057)	(0.629)	(0.731)	(0.554)	(0.396)
Wagner	0.002***	0.002***	0.002 ***	0.002 ***	-0.002	-0.003	0.000	0.001
	(0.0005)	(0.0007)	(0.0006)	(0.0008)	(0.0036)	(0.0034)	(0.0028)	(0.0027)
Openness	0.023*	0.019	0.035**	0.041**	-0.194*	-0.188	-0.266*	-0.204*
	(0.013)	(0.014)	(0.016)	(0.018)	(0.106)	(0.110)	(0.130)	(0.100)
Transparency		0.106**		0.136*		-0.891***		-1.063***
		(0.050)		(0.068)		(0.272)		(0.315)
NumericalRules		0.025		0.056		-0.142		0.057
		(0.028)		(0.042)		(0.153)		(0.178)
Hierarchical		0.000		0.008		-0.083		-0.085
		(.029)		(0.037)		(0.161)		(0.156)
Constant	-0.123**	-0.173**	-0.140**	-0.216**	1.672***	1.896***	1.439***	1.826***
	(0.050)	(0.069)	(0.053)	(0.082)	(0.389)	(0.361)	(0.348)	(0.369)
R^2	0.46	0.57	0.50	0.63	0.88	0.93	0.74	0.86
No. of Observations	36	36	37	37	25	25	30	30

Robust standard errors in parenthesis.*** significant at 1%, ** significant at 5% and, * significant at 10%.

4.2.2 Different Specifications for Numerical Rules

As was already mentioned, one can immediately suspect a wrong specification of the numerical rules index employed above, since it gives the same weight to factors that directly constrain the size of government and deficits, and to those that can affect them indirectly. The other two proposed specifications for *Numerical Rules* are presented in table 5, where I have omitted to report the control variables. *NumericalRules 2* gives half of the weight to direct restrictions on the budget and the other half to between and within restrictions. *NumericalRules 3* takes into account only direct restrictions. As can be seen, the lack of significance of the numerical rules index is not due to its specification. In turn, the *Transparency* measure is not affected by these changes in the *NumericalRules* specification.

Table 5: Benchmark Model: Different Numerical Rules.

	Central Balance	General Balance	General Net Debt	General Gross Debt
Transparency	0.106**	0.132*	-0.833***	-1.078***
	(0.051)	(0.072)	(0.260)	(0.319)
NumericalRules 2	0.006	0.028	-0.027	0.016
	(0.024)	(0.036)	(0.129)	(0.127)
Hierarchical	0.010	0.018	-0.101	-0.073
	(0.028)	(0.037)	(0.171)	(0.145)
R^2	0.56	0.61	0.93	0.86
	Central Balance	General Balance	General Net Debt	General Gross Debt
Transparency	0.105**	0.127*	-0.818***	-1.085***
	(0.050)	(0.072)	(0.252)	(0.317)
NumericalRules 3	-0.011	-0.005	0.029	-0.005
	(0.017)	(0.022)	(0.088)	(0.089)
Hierarchical	0.022	0.037	-0.139	-0.065
	(0.030)	(0.040)	(0.179)	(0.136)
R^2	0.57	0.60	0.93	0.86

Robust standard errors in parenthesis.*** significant at 1%, ** significant at 5% and, * significant at 10%.

4.2.3 Budgetary Institutions and Development

In the benchmark model I have tried to account for all sources of heterogeneity, even the development level of a country. However if the degree of development is correlated with budgetary institutions but it is not—or in a different way—with the *measures* of budgetary institutions, the results obtained above will be inexorably biased. Suppose, for example, that the punishment for a policymaker that is caught cheating is more severe in a rich than in a poor country. Then, it will be expected that the same degree of transparency will exert a higher influence on fiscal outcomes in rich than in poor countries, something that the transparency index will not capture. In trying to account for this possibility I divided the data set into rich and poor countries, using the original OECD as rich countries, and ran the same set of regressions to see if the estimated parameters are stable to sample specification. The results, that are reported in table 6, should be taken with caution, since now each sub-sample is very small. Indeed, it is not even possible to run the General Net Debt regression for the poor countries sample.

In this exercise, the results that were obtained for the whole sample, are preserved in the sub-sample of rich countries, and all but disappear in the sub-sample of poor countries. This suggests that the result of *Transparency* being the only budgetary institution that matters in the whole sample, is basically driven by rich countries.

Table 6: Rich vs. Poor Countries.

Rich Countries	Central Balance	General Balance	General Net Debt	General Gross Debt
Transparency	0.184*	0.181*	-1.356***	-1.313**
	(0.087)	(0.095)	(0.301)	(0.518)
NumericalRules	-0.004	0.014	0.0419	0.096
	(0.053)	(0.054)	(0.220)	(0.369)
Hierarchical	0.068	0.070	-0.211	0.114
	(0.088)	(0.095)	(0.401)	(0.397)
R^2	0.64	0.57	0.95	0.86
No. of Observations	17	18	17	18
Poor Countries	Central Balance	General Balance	General Net Debt	General Gross Debt
Transparency	0.102	0.124	–	-0.581
	(0.084)	(0.114)		(0.377)
NumericalRules	0.051	0.117	–	0.930*
	(0.070)	(0.097)		(0.360)
Hierarchical	-0.016	-0.023	–	-0.526
	(0.046)	(0.052)		(0.333)
R^2	0.49	0.50	–	0.96
No. of Observations	19	19	9	12

Robust standard errors in parenthesis.*** significant at 1%, ** significant at 5% and, * significant at 10%.

An interesting result from this exercise is that in the Gross Debt specification for less developed countries, *NumericalRules* enters significantly but with the opposite sign of what is expected. Dropping one economic control at a time does not destroy this result except when growth is left out. A possible interpretation of this result is that less developed countries typically face credit constraints from the private sector which can be softened if balanced budget rules are in place. Of course, this or any other interpretation should be taken with caution given the small sample size, as was already mentioned.[11]

Given that I have controlled for economic differences across countries, that splitting an already small sample is very costly in terms of degrees of freedom, and that the inclusion of less developed countries in the analysis does not significantly affect the results when compared to the sub-sample of rich countries, I have chosen to continue with the whole sample. Nevertheless, the results presented so far in this section help to understand discrepancies in the literature of budgetary institutions and fiscal outcomes. For example, the Latin American experience, composed of all under-developed countries, was documented

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[11]I also employed the other two definitions of *NumericalRules* and while the results are preserved for the intermediate specification(*NumericalRules 2*), the coefficient losses all significance for the more strict one (*NumericalRules 3*).

by Alesina et. al. (1999), and Filc and Scartascini (2004) who found that only numerical constraints and hierarchical procedures motives are important in determining fiscal outcomes.

4.2.4 Political Controls

So far, I have analyzed the effects of budgetary institutions on fiscal outcomes taking into account economic variables that have been shown to influence fiscal policy. Here, I add to the model a variety of political variables that have also been shown to be correlated with fiscal outcomes. All of these political variables capture the idea of fragmented government. Government fragmentation arises when several agents or groups participate in the fiscal decision-making process, each with its own interest and constituencies to satisfy, and each with some weight in the final decision. To participate in the majority, each group demands a share in the budget; as all groups do this, the end result is a high level of expenditure or a large deficit (Kontopoulos and Perotti (1999)). In other words, fragmentation is an expression of a common pool problem.

First, I add to the model a measure of *district magnitude*, defined as the average number of representatives elected per district to the Lower House. Several theoretical and empirical studies show that, other things being equal, the degree of government fragmentation increases with the number of political parties. In turn, the number of political parties increases with district magnitude. Consequently, one should expect the common pool problem to be enhanced as average district magnitude augment.

The second variable of consideration is the *effective number of parliamentary or legislative parties*(ENPP), defined by the Laakso and Taagepera (1979) formula, $1/\sum s_i^2$, where s_i is the percentage of seats won by the ith party. While district magnitude is a direct characteristic of the electoral system, its effect on fiscal policy is expected to go through *outcomes* of the electoral system as, in this case, the ENPP. A larger ENPP represents a more fragmented government and thus, countries with a higher ENPP are expected to have larger governments, to be more indebted, and to run larger deficits.

Following Kontopoulos and Perotti (1999), the third variable under consideration is *cabinet size*, defined as the sum of all spending ministers. While this variable does not reflect government fragmentation per se, it is related to the idea of more decision-makers wanting to maximize their share of the budget; in this case, from the executive side of the budgeting process. In other words, it is expected that more numerous cabinets will tend to be associated with bigger governments and larger deficits.

Finally, I control for the degree of income inequality using the Gini coefficient.[12] The idea for including this variable is that, if agents are altruistic, they will care for their

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[12]Although inequality is not a political variable, it is not commonly used in the budgetary institutions literature so I decided to use it as an additional control rather than in the benchmark model.

descendants and thus the current generation of taxpayers will refrain from redistributing wealth from future generations of taxpayers by contracting public debt. Cuckierman and Meltzer (1989) as well as Tabellini (1991) have pointed out that this altruistic effect becomes weaker the higher the income inequality, and consequently higher levels of public debt should be expected.[13]

In table 7 I present the regression results of including these political controls. I first proceed to estimate each equation including all three budgetary institutions, but in no case were *NumericalRules* or *Hierarchical* significant. I re-estimated all regressions dropping these variables in order to gain degrees of freedom and to avoid a problem of possible multicollinearity since the *Hierarchical* index and the political variables are possibly capturing the same effect. Since none of the estimated coefficients changed qualitatively from one specification to the other, I report the latter, omitting once again the results of the other controls.

District Magnitude does not seem to affect fiscal outcomes. The lack of *District Magnitude*'s explanatory power is consistent with the results of Stein, Talvi and Grisanti (1999) on a sample of Latin American countries. The reason for this outcome, as mentioned above, could be due to *District Magnitude* affecting fiscal outcomes only indirectly, and that this effect is either too low or that it fails to show up in this short data set. However, the *Effective Number of Parliamentary Parties*, that is a direct measure of the common pool effect, only shows a significant effect for General Gross Debt. None of these two political variables alters in a significant way the effect of *Transparency* on fiscal outcomes.

Again, the *Cabinet Size* variable enters significantly only in the General Gross Debt regression. However, in this case the effect of *Transparency* on the Central and General Balance is not robust to the inclusion of *Cabinet Size*. This result is not driven by the countries included in the regression since re estimating the benchmark model using only the data points for which *Cabinet Size* is available, still yielded levels of significance equivalent to those when the full sample was employed. What drives this result is the fact that *Cabinet Size* and *Transparency* are highly and positively correlated (0.43) at a .02 significance level. This collinearity problem has the effect of dampening their significance levels when both variables are included. Why *Transparency* and *Cabinet Size* are correlated is a question that is not treated here but that surely needs further exploration; there is no a priori reason to think the former causes the first which would have resulted in *Cabinet Size* being the true underling force. For clarification purposes, it's worth mentioning that *Transparency* is not correlated with any of the other control variables.

The *Gini* coefficient enters significantly in the General Net Debt regressions. As mentioned above, the only implied relationship from theory was that more inequality should be paired with more indebtedness due to a decrease in the bequest motive of an altruistic agent. *Transparency* remains robust to the inclusion of this variable.

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[13]See Feld and Kirchgassner (1999) for a complete elaboration of this idea.

Table 7: Political Controls.

	Central Balance	General Balance	General Net Debt	General Gross Debt
Transparency	0.106**	0.124*	-0.807***	-1.071***
	(0.049)	(0.069)	(0.240)	(0.337)
District Magnitude	-0.000	-0.000	-0.006	-0.001
	(0.0001)	(0.0001)	(0.0004)	(0.0007)
R^2	0.56	0.59	0.93	0.87
No. of Observations	36	37	25	29
Transparency	0.118**	0.146*	-0.960***	-1.194***
	(0.055)	(0.079)	(0.192)	(0.338)
ENPP	-0.000	-0.000	0.020	0.034*
	(0.003)	(0.003)	(0.016)	(0.017)
R^2	0.57	0.60	0.94	0.87
No. of Observations	33	34	24	28
Transparency	0.098	0.129	-0.942***	-1.437***
	(0.086)	(0.111)	(0.245)	(0.299)
Cabinet Size	0.002	0.002	-0.007	0.020**
	(0.002)	(0.002)	(0.010)	(0.007)
R^2	0.57	0.60	0.94	0.88
No. of Observations	30	30	23	25
Transparency	0.126**	0.152*	-0.960**	-1.221***
	(0.054)	(0.079)	(0.177)	(0.305)
Gini Coefficient	-0.001	-0.000	0.008**	0.006
	(0.001)	(0.001)	(0.003)	(0.005)
R^2	0.58	0.61	0.95	0.87
No. of Observations	32	33	24	28

Robust standard errors in parenthesis.*** significant at 1%, ** significant at 5% and, * significant at 10%.

4.3 Testing for an Interaction Effect between Transparency and Numerical Rules

Lastly, I analyze the possibility of conditional numerical constraints. The consistent failure of finding any significant relationship between the different measures of numerical constraints and fiscal outcomes may be due to the impossibility of enforcing those constraints. Specifically, if the budgetary process is sufficiently opaque, it would be hard for the constituents to detect any deviation from the rule, and therefore the constraints might not bind. There are, at least, two empirical strategies to test for conditional numerical constraints. The first consists of dividing the data set between transparent and non transparent countries and running the same set of regressions in both sub-samples. One should expect to obtain a significant coefficient for *NumericalRules* in the transparent

sub sample and still a non-significant one for the opaque set of countries. The advantage of dividing the sample is a straightforward interpretation of the test since, provided that *Transparency* is exogenous and independent, one is comparing two sets of countries that will only differ in their transparency level. Of course this comes at the high cost of dropping many observations which in a small cross-section like this one might turn out to be prohibitive. I tried this strategy, separating the data set in two halves, but I did not find any significant coefficient for *NumericalRules* in any of its specifications, either in the high or low *Transparency* group.

The second strategy is to take advantage of the whole data set and test for an interaction effect between *Transparency* and *NumericalRules* directly. However, it is not clear that an interacted variable, such as the one constructed by multiplying *Transparency* and *NumericalRules*, will capture the true relationship between these variables. The interaction assumes a continuous relationship between the two constituent variables, though it is plausible that a minimum level of transparency is required for numerical constraints to become binding. This effect might not be captured by a standard interaction model. To investigate this possibility I followed two approaches: First, I evaluated a standard interaction model and, second, I multiplied the *NumericalRules* measures with a dummy variable that separates countries by their *Transparency* level (I used the top half and top third most transparent countries) with the aim of capturing any discontinuity in this interaction. Again, I did not find robust evidence of any sort of interaction effect within this sample of countries.

It is possible that the failure of numeric constraints of showing any type of effect over fiscal outcomes may be due to the short sample of countries surveyed. More data would be needed to answer this question in a definite manner.

5   Concluding Remarks

In a simple model in which voters can coordinate perfectly to demand results from the policymaker in charge of the government (who typically will enjoy an informational advantage about the true actions taken in the production of public goods), the model shows that the best way to curtail the government's unproductive activities and curb a tendency to incur greater debt is by reducing the informational advantage directly. That is, by increasing the level of transparency of the whole budgetary process. On the contrary, according to the model presented in this paper, if voters' strategy is to impose numeric constraints over imperfectly observed fiscal outcomes, these will have the desired effect only if the level of transparency is sufficiently high. When transparency is very low, the imposition of a numeric constraint could even carry the contrary effect, that is, higher average debt and lower expected welfare.

I use a new survey on budgetary practices, with the broadest country coverage so far, to construct several measures of numerical constraints and transparency and test the predictions of the model. The results for the whole sample of countries indicate that only the level of transparency shows a significant and economically important effect on Central and General Deficits, as well as on General Net and Gross Debts. On the contrary, numerical rules failed to show any significant effect on fiscal outcomes. These results conform with the predictions of the theoretical model. On the other hand, however, contrary to what was obtained in the model, for this sample of countries there does not seem to exist an interaction effect between transparency and numerical constraints.

Appendix 1

PROOF OF PROPOSITION 2: To prove it, consider a regime which differs considerably from a democracy, in which a contract to run the government forever in a fully transparent world is auctioned among the population. The contract is enforced by killing the incumbent in case he does not respect it. A first citizen will place a bid that consists of a constant per period effort level, and debt satisfying (2.14). If no other citizen places a higher bid the game ends and payoffs to the ruler and citizen are distributed according to V^I and V^v, respectively. The unique equilibrium of this game is $e^* = \phi^{-1}(\chi)$ or *zero-rent-extraction*: no citizen will offer a higher bid since his payoff as a ruler will be lower than as a citizen; on the other side, any outstanding bid $\hat{e} \in [0, \phi^{-1}(\chi))$ will not survive in the game since it is a dominant strategy for the bidding citizen to play e^* and get $V^I(e^*) = V^v(e^*) > V^v(\hat{e})$. I call the solution to this game the *social planner solution* and denote its expected discounted utility as V^{sp}.

The social planner problem is solved following the same method outlined in the dictatorship. The idea is to choose only d conditional on θ since $e = e^*$. The two first order conditions look exactly the same as in the case of the dictatorship, i.e.

$$V^{sp}(e^*) = V^v(e = 0) + \frac{e^*}{(1 - \beta)} < V^o = V^v(e = 0) + \frac{\chi}{(1 - \beta)}$$

In other words $U_t^{sp} < U_t^o$ for all θ by the amount $\chi - \theta e^*$. Finally, note that proposition 2 is equivalent to stating that no social planner solution can be achieved. To see this, let me assume a social planner solution can be achieved. By proposition 1 the solution has to be *IC*, thus

$$
\begin{aligned}
V_t^{sp} = U_t^{sp} + \beta E V_{t+1}^{sp} &= U_t^o + \beta E V_{t+1}^v \\
\Rightarrow \qquad U_t^{sp} &= U_t^o
\end{aligned}
$$

since $V_t^{sp} = V_t^v$, which is a contradiction.

Appendix 2

Figure 11: Co-movement of θ and $\tilde{\theta}$ conditional on ϵ.

Full Trasnparency $\varepsilon = 0.0$

Shock	Signal 0.8	Signal 0.9	Signal 1.0	Signal 1.1	Signal 1.2	Pr. of Shock
0.8	1.000	0.000	0.000	0.000	0.000	0.200
0.9	0.000	1.000	0.000	0.000	0.000	0.200
1.0	0.000	0.000	1.000	0.000	0.000	0.200
1.1	0.000	0.000	0.000	1.000	0.000	0.200
1.2	0.000	0.000	0.000	0.000	1.000	0.200
Pr. of seen Signal	0.200	0.200	0.200	0.200	0.200	

High Trasnparency $\varepsilon = 0.1$

Shock	Signal 0.8	Signal 0.9	Signal 1.0	Signal 1.1	Signal 1.2	Pr. of Shock
0.8	0.500	0.500	0.000	0.000	0.000	0.200
0.9	0.333	0.333	0.333	0.000	0.000	0.200
1.0	0.000	0.333	0.333	0.333	0.000	0.200
1.1	0.000	0.000	0.333	0.333	0.333	0.200
1.2	0.000	0.000	0.000	0.500	0.500	0.200
Pr. of seen Signal	0.167	0.233	0.200	0.233	0.167	

Low Transparency $\varepsilon = 0.2$

Shock	Signal 0.8	Signal 0.9	Signal 1.0	Signal 1.1	Signal 1.2	Pr. of Shock
0.8	0.333	0.333	0.333	0.000	0.000	0.200
0.9	0.250	0.250	0.250	0.250	0.000	0.200
1.0	0.200	0.200	0.200	0.200	0.200	0.200
1.1	0.000	0.250	0.250	0.250	0.250	0.200
1.2	0.000	0.000	0.333	0.333	0.333	0.200
Pr. of seen Signal	0.157	0.207	0.273	0.207	0.157	

High Opacity $\varepsilon = 0.3$

Shock	Signal 0.8	Signal 0.9	Signal 1.0	Signal 1.1	Signal 1.2	Pr. of Shock
0.8	0.250	0.250	0.250	0.250	0.000	0.200
0.9	0.200	0.200	0.200	0.200	0.200	0.200
1.0	0.200	0.200	0.200	0.200	0.200	0.200
1.1	0.200	0.200	0.200	0.200	0.200	0.200
1.2	0.000	0.250	0.250	0.250	0.250	0.200
Pr. of seen Signal	0.170	0.220	0.220	0.220	0.170	

Full Opacity $\varepsilon = 0.4$

Shock	Signal 0.8	Signal 0.9	Signal 1.0	Signal 1.1	Signal 1.2	Pr. of Shock
0.8	0.200	0.200	0.200	0.200	0.200	0.200
0.9	0.200	0.200	0.200	0.200	0.200	0.200
1.0	0.200	0.200	0.200	0.200	0.200	0.200
1.1	0.200	0.200	0.200	0.200	0.200	0.200
1.2	0.200	0.200	0.200	0.200	0.200	0.200
Pr. of seen Signal	0.200	0.200	0.200	0.200	0.200	

Table 8: Data Availability.

Country	Central Balance	General Balance	General Net Debt	General Gross Debt
Argentina	Y	Y	No	No
Australia	Y	Y	Y	Y
Austria	Y	Y	Y	Y
Belgium	Y	Y	Y	Y
Bolivia	No	Y	No	No
Canada	Y	Y	Y	Y
Chile	Y	Y	Y	Y
Colombia	Y	Y	No	No
Czech Republic	Y	Y	No	No
Denmark	Y	Y	Y	Y
Finland	Y	Y	Y	Y
France	Y	Y	Y	Y
Germany	Y	Y	Y	Y
Greece	Y	Y	Y	Y
Hungary	Y	Y	Y	No
Iceland	Y	Y	Y	Y
Ireland	Y	Y	Y	Y
Israel	Y	Y	Y	Y
Italy	Y	Y	Y	Y
Japan	Y	Y	Y	Y
Jordan	Y	Y	No	No
Kenya	Y	Y	No	No
Korea, Republic	Y	No	No	No
Mexico	Y	Y	Y	Y
Morocco	Y	Y	Y	Y
Netherlands	Y	Y	Y	Y
New Zealand	Y	Y	Y	Y
Norway	Y	Y	Y	Y
Portugal	Y	Y	No	Y
Slovak Republic	Y	Y	No	Y
Slovenia	Y	Y	No	Y
South Africa	Y	Y	Y	Y
Spain	Y	Y	Y	Y
Sweden	No	Y	No	Y
Turkey	Y	Y	No	No
United Kingdom	Y	Y	Y	Y
United States	Y	Y	Y	Y
Uruguay	Y	Y	No	Y

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