On the Determinants of Hidden Public Debt

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Abstract

We study which factors determine the government’s tendency to resort to off-budget activities. We develop a model of hiding public debt and then estimate it using panels of cross-country data. We highlight the role of factors that make public borrowing difficult such as larger official debt and higher borrowing cost induce politicians to resort to hiding debt. We also show that certain institutional characteristics such as strong contract reliability and transparency in the government sector reduce the willingness of politicians to arrange hidden expenditures because they make it more costly to hide debt. Finally, we show that the transition from the cash-based accounting method to the accrual-based one helps reduce hidden debt, but countries that lack contract reliability may run hidden debt even under the accrual-based system.
1 Introduction

Governments often have financial commitments and contingent liabilities that do not receive explicit budgetary allocations or even official recognition. Such "hidden" liabilities can be a cause of concern for fiscal and macroeconomic stability (Polackova, 1998). Less transparent fiscal systems tend to produce more "surprise" liabilities of significant magnitude with destabilizing effects, as the recent economic crises in Europe and elsewhere have amply shown. Yet, governments seem to have an appetite for shifting liabilities off budget, especially as a means of avoiding badly needed fiscal adjustments (Easterly, 1999). The sudden realization of hidden liability can be a matter of not only contingent liability but also systematic factors that motivate policy makers to hide part of their expenditures. Despite the importance of the issue, there are very few studies of the forces at work and of why some governments tend to generate disguised spending much more than others do. This paper is an attempt to fill that gap by developing a simple model of hidden public debt and putting it to empirical test.

The main views of hidden public debt examined so far in the literature are developed in twofold. One group of researchers has investigated how the constraints on government fiscal activities affect the tendency of governments to resort to off-budget activities. Externally imposed constraints aimed at fiscal discipline are also common in international pacts and multilateral arrangements, as in the European Union's Maastricht Treaty and IMF conditionality. If such arrangements merely cause governments to shift their spending off-budget, then fiscal adjustment may be an illusion (Easterly, 1999). Empirical investigation among EU countries revealed that countries tried to bypass the Maastricht Treaty Rules by increasing off-budget activities (von Hagen and Wolff, 2006). Another grouping of the literature focuses on how off-budget activities are related to major economic events. Kharas and Mishra (2001) report that fiscal deficits that include hidden government activities are more relevant than official deficit figures in explaining the currency crisis of a country. Bernoth and Wolff (2008) claim that a government’s tendency to hide its liabilities from budget is perceived by financial market participants and financial markets penalize fiscal misreporting by charging higher spreads.

However, the existing literature is still quite limited and, in part, sketchy. In particular, there are no comprehensive studies that investigate what factors motivate the policymakers to hide part of the public expenditures and mitigate the adverse incentives of politicians. Country specific characteristics such as economic conditions and the design of its institutional features could induce the different behaviors in hiding expenditures. For example, governments with higher exposed debts may have greater incentives to keep their expenditures out of sight, and the borrowing cost of a country may raise the level of hidden activities too. On the other hand, if a country’s credibility is already high in the financial market
and it is enjoying favorable funding condition, then that country finds it more costly to repudiate its debt, which includes explicit and implicit ones, and it discourages the excess hidden spending.

The model developed in this paper provides a framework for the systematic analysis of the above issues and offers a number of new insights and hypotheses. We also adopted quantile regression for empirical analysis. Quantile regression is helpful in verifying how variables play different roles in explaining the level of hidden debt at each quantile of the conditional distribution. For example, the effect of official borrowing on the hidden debt might be small for some countries while dramatically increasing hidden debt for others. This is quite important because one country may have hidden assets, which is the opposite of hidden debt. The traditional least square method cannot separate these, but quantile analysis enables us to estimate the coefficients in different percentiles of distribution and we can separate this hidden asset case. Another issue in empirical analysis is the measurement of hidden debt, which is carried out in an indirect way because direct measures are nearly impossible to find. The indicator that we propose consists of the amount of net hidden public liabilities that become exposed each year. This variable can be measured by the change in public debt, adjusted for the declared budget deficit and base money expansion. We refer to this indicator as Stock-Flow Adjustment (SFA), \(^1\) which will be discussed in more detail later.

Using SFA may seem to have a drawback because it reflects both contingent liabilities and the hidden part of public expenditures. We may want to separate the observed hidden debt into two parts: one is the revealed contingent liabilities that the government had guaranteed explicitly or implicitly for its quasi-government agencies or financial institutions. The other part of SFA is the off-budget activities that the government made intentionally to increase public expenditures without public scrutiny. Even though those two are similar in the sense that they are hidden from the public, the realization process can be quite different. The exposure of contingent liabilities may be a random process in normal situations but also can be heavily influenced by external shocks such as a banking and sovereign debt crisis. Therefore, its revelation is quite difficult to expect beforehand. The hidden expenditure, on the other hand, may be revealed at a relatively consistent rate because the government needs to pay its maturing debt. While our study focuses on factors that influence the activities of hidden expenditure, carrying out the analysis through SFA reflects the combination of both contingent liabilities and hidden expenditures.

It should also be pointed out that SFA is likely to have other important applications, especially in the study of fiscal policy. Past research in that area has treated deficit figures based on budgetary data as

\(^1\) Stock-Flow Adjustment is a concept to measure the size of hidden debt and we will handle more details of this in section 2.4.1.
the direct measure of public deficit and has equated it with changes in the net amount of debt. That equation needs to be reexamined in light of the sizable values that $SFA$ seems to take.

In the rest of this paper, we first briefly review the existing literature on hidden public debt in section 2. The model that guides our work is developed in section 3. Section 4 discusses the empirical methodology and section 5 presents the econometric results. Section 6 concludes.

2 Hidden Fiscal Spending and Borrowing: A Review of Issues and Hypotheses

There is a large amount of literature, produced nowadays mostly by the International Monetary Fund (IMF) and the World Bank, that describes the variety of ways in which governments incur hidden liabilities. This literature also argues for fiscal transparency and calls for the inclusion of all government activities and liabilities in official budget accounts. Complete fiscal transparency, however, is largely an ideal. In reality, all governments have some sort of off-budget accounts and omit some of their liabilities and assets from official statistics, by design or by default. Parts of a government's de facto fiscal liabilities that do not show up as part of its official debt can be hidden in the accounts of lower level governments, special funds, public enterprises, or implicit or explicit commitments to the private sector. As a result, a key question is what factors can enable and motivate governments to make their budgets more comprehensive and transparent.

As pointed out above, external and domestic pressures to keep public debt low may give rise to the incentive to conceal expenditures and liabilities. However, it is natural to expect the effects to depend on the characteristics of those pressures and the conditions under which they are applied. Some pressures are political and electoral, while others are explicit rules that must be enforced through domestic checks and balances (such as balanced budget laws), and still others are external constraints imposed by financial markets or arranged by multilateral entities. When such constraints are not vigilantly enforced or when they focus on narrow fiscal measures, the government is more likely to find opportunities to undermine them through hidden debt techniques. But when the constraints are more comprehensive and there are influential agents inside and outside the government that are keen to enforce them, then there is less chance that the restrictions may be evaded. Especially when the constraints are long term, eventually they may become consequential as the government comes to deal with the expenditures that it manages to hide in the short-run.

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2 For a recent survey, see Polackova (1998). IMF’s website, www.imf.org, provides detailed discussions on fiscal transparency and a comprehensive list of references.
To understand the conditions under which fiscal constraints may breed hidden debt, it is useful to start with the motives for "overspending" against which the constraints are supposed to guard. A straightforward motive, well-known from the political economy literature, is that the politicians may value government expenditure more than the public because it provides them with greater political or economic advantages. The resources can be used for buying off key voters or satisfying influential constituencies and special interests. This motive is stronger when policymaking is uncoordinated and common pool problems arise over public resources (Alesina and Perroti, 1999). The reason is that in such situations each interest group represented in the policymaking process bears a small part of the cost of its preferred programs when they are funded out of public purse. As a result, there may be a divergence between the private and social costs of programs for each interest group, inducing overexploitation of fiscal resources, especially in the form of public debt that falls on the shoulders of future generations (Velasco, 1999).

To avoid inefficient fiscal outcomes, interest groups need to coordinate their actions and ensure that there are mechanisms in place that help everyone internalize the common pool externalities. But coordination possibilities depend on the structure of the polity. In particular, more fractionalized and more polarized polities face greater difficulties in coordinating action over fiscal policy (Roubini and Sachs, 1989). Such polities are more likely to resort to hidden debt.3

Crisis in the banking sector also contributes to SFA's (Weber, 2012). Significant signs of financial distress in the banking system such as bank runs, losses in the banking system, and/or bank liquidations can be considered a banking crisis. A trembling banking sector leads to output losses and increases the role of government during a financial crisis in response to significant losses in the banking system, which, after all, increase the liabilities of the government (Laeven and Valencia, 2008).

A crucial factor that is likely to facilitate the evasion of spending and deficit restrictions is extensive government intervention in markets. When the government uses market controls to reallocate and redistribute resources, it often puts pressure on some economic agents to give up their resources in exchange for promises of future compensation. Indeed, many government interventions, such as wage and

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3 Aside from the macro political institutions, the details of budgetary procedures should also matter for the extent of liabilities acquired off budget. *Ex ante* agreements on budget aggregates or their delegation to a central budget authority have been found to help increase fiscal discipline as far as explicit government accounts are concerned (Poterba and von Hagen, 1999). Thus, one might expect such mechanisms to reduce the demand for hidden debt as well. We do not examine this issue in this paper because there is little data on such factors for the countries and the time span of our sample.
price controls, implicitly create an obligation for the government to rescue the affected parties in case of adverse shocks. For example, between 1997 and 1999, the government of Korea had to commit large amounts of public funds to save the country's banking system from devastation by the foreign currency crisis. Though the banks and financial institutions were private firms, the government had to bail them out because it had intervened in the financial system for a long time and had used it for channeling credit to selected industries and enterprises. The incident made the government's debt jump even though the history of its low budget deficits seemed to indicate dutiful discipline. Similar cases can be found in European Countries. In Germany, the debt level increased by more than 6% of GDP in addition to the deficit in 1995, when the German federal government officially assumed the debt previously hidden in the Treuhandanstalt, the holding company of former East German industries. In Greece, debt level increased by almost 19% in addition to the deficit in 1994, when the debt of the Greek government at the Bank of Greece was officially recorded as public debt (Von Hagen and Wolff, 2006). Examples of this kind abound in other countries. More extensive interventions make it easier for the government to use the private economy as a means of accomplishing its policy objectives, but they also entail potential financial liabilities outside the normal budgetary channels.

One form of intervention that is often identified as a source of hidden liability is government ownership of firms. The common view is that when a government owns enterprises, it can direct the managers to use the resources and the borrowing capacity of those firms to pay for tasks that are essentially fiscal functions. For example, the United States government created FICO (The Financing Corporation) in 1987 and authorized it to borrow $10.8 billion to be used for deposit insurance purposes, without appropriating any funds to deal with the contingent liabilities of such an operation (Joulfaian and Marlow, 1991). Another example is the French government's takeover of the pension liabilities of France Telecom in 1997 in exchange for a budgetary receipt from the company amounting to about 0.5 percent of GDP (Easterly, 1999). All such activities create commitments that can impose large burdens on the government at later dates in a contingent or more predictable fashion. A prominent example of realization of large contingencies is the 1982 Brazilian debt crisis in which large sums borrowed by public enterprises had to be assumed by the federal government, with major adverse effects on the economy (Coes, 1995: 62-65). Of course, public enterprises also have assets that may produce occasional capital gains in the form of privatization proceeds or enhanced financial returns. Public enterprises may not be operating efficiently, but their net assets are not necessarily negative and the liabilities that they pass on to the government do not always exceed the capital gains that they offer. Indeed, some observers have criticized privatization in countries under fiscal stress as short-term palliatives that may cause more long-term problems due to asset depletion (Easterly, 1999).

Public enterprises can be seen as a special form of extra-budgetary funds that governments use to make their fiscal conditions look sounder. Another major example is pension funds. Many countries have
pay-as-you-go pension systems that accumulate surpluses in their early stages. Commonly, governments borrow the surplus of pension funds in these stages at low interest rates or keep their own contributions low, thus maintaining their explicit budget deficits low for a while. However, this practice eventually leads to shortages of funds needed for pension payments in later periods. It is not difficult to find pension funds whose present values are negative, with the government ultimately being forced to cover the shortage, which is in fact its own hidden debt.

Other economic characteristics of the country such as openness and vulnerability to internal and external volatility are also likely to be relevant for the calculus of hidden liabilities. Greater openness is likely to increase the demand for expenditures on social insurance for the households exposed to risk (Rodrik, 1998). In particular, this tends to raise the contingent liabilities of the government, which are typically off budget. It also indirectly encourages policymakers to resort to more hidden borrowing to keep the official accounts look healthy despite the increased fiscal burden.

There are also several segments of the literature that deal with the empirical side of hidden debt. Von Hagen and Wolff (2006) study how governments behave when external fiscal rules are imposed to constrain the government deficit in EU countries. They provide empirical evidence of creative accounting in the European Union. In other words, the EU imposes fiscal constraints such as a 3% deficit limit, and then these rules have induced governments to use SFAs, a form of creative accounting, to hide deficits. The tendency to substitute SFAs for budget deficits is especially strong for the cyclical component of the deficit, for in times of recession the cost of reducing the deficit is particularly large.

Kharas and Mishra (2001) point out the problem of using conventional deficit measures to explain currency crises and provide an alternative way to measure the hidden budget deficit. Instead of using the conventional budget deficit reported by the government, they devise actual deficit as the difference between the change in government debt and the change in money supply. They finally define the hidden debt as the gap between actual deficit and conventional deficit. They demonstrate that there is a close link between the number of currency crises and hidden and actuarial deficits. This link is nonexistent if one uses conventional deficits in place of actuarial deficits.

Weber (2012) notices the existence of large and persistent discrepancies, so called stock flow adjustments, between the annual change in public debt and the budget and investigates the relationship between fiscal transparency and the discrepancies. Weber finds that the more fiscally transparent the countries, the smaller these SFAs tend to be. The contribution of SFAs to increases in debt is likewise smaller in countries with above average fiscal transparency.

Even though much of the literature did pioneering work in studying the existence of hidden debt and the characteristics of it, there are some limitations of the previous research. First, there is no
theoretical model able to explain the size of hidden debt and under what situations government prefers to pursue hidden spending. Previous literature has tried to capture the importance of hidden debt in explaining certain behaviors such as fiscal rule and transparency but do not provide the comprehensive and theoretical model for explaining the size of hidden debt. Furthermore, previous papers have not studied the role of institutional background in determining the size of hidden debt. Sizes of hidden debt vary quite a bit across the countries and this country specific characteristic may be determined by the socio-economic structure of these countries. Also, previous literature did not try to separate the revelation mechanism between contingent liabilities and the hidden part of public expenditure. Even though those two are similar in the sense that they are hidden from the public, the realization process can be quite different. The exposure of contingent liabilities may be heavily influenced by external shocks such as banking and sovereign debt crisis, and, therefore, its revelation is quite difficult to expect beforehand. The hidden expenditure, on the other hand, may be revealed at a relatively consistent rate because the government needs to pay its maturing debt. The observed SFA data contains both types and it is, practically speaking, quite difficult to evaluate these two different types respectively. However, it is possible that the change in one factor such as revelation of contingent claim may affect the other, which are the activities of hidden expenditure.

The above discussion suggests a variety of variables to be considered in the empirical analysis of hidden debt. In the next section, we develop a model that places these variables in a unified framework, takes account of the key effects involved in the process, and yields a set of testable hypotheses.

3 A Simple Model of Hidden Debt

3.1 The Structure of the Model

Consider a two-period economy with a continuum of citizens of size one. In period 1, the government incurs expenditures that may take four different forms. The first is an explicit public expenditure, $x$, and the second is an implicit or hidden expenditure, $h$. The difference between the two is that the former is announced at the start of the period and the government explicitly borrows to cover any deficit that it causes, while no information about the total value of the latter is revealed until the end of the period. The government arranges its hidden expenditure by making promises to service suppliers or the beneficiaries, or by imposing the expenses on some firms or individuals. These arrangements are costly and, as a result, each dollar of hidden expenditure yields the same benefit that $\beta$ dollars of explicit expenditure does, where $\beta < 1$. We assume that the total value of the two types of expenditure to the government is diminishing in its size and can be specified as $\alpha(x + \beta h)^\gamma$, where $\alpha > 0$ and $0 < \gamma < 1$. 

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The third type of expenditure is the repayment of an existing debt, $b_1$. Finally, the fourth type of expenditure is a contingent liability, $l$, that is realized at the end of the period. $l$ is a random variable distributed according to a function, $F$. $F(\cdot)$ is publicly known. The realized value of the liabilities could be positive or negative, with $E(l) = 0$.

The payments for both $b_1$ and $x$ are arranged at the start of the period and financed by a tax, $t_1$, or by explicit borrowing in the credit market. However, the financing of $h$ and $l$ is less voluntary and the creditors are either coerced to lend or learn about the expenses imposed on them after the fact.

Letting the rate of interest for all borrowing be $r$, the total debt at the start of period 2 will be:

$$b_2 = (1 + r)[b_1 + x - t_1 + h + l].$$

In period 2, the government collects tax, $t_2$, to repay its debt. However, $t_2$ has an upper limit, $\bar{t}$. As a result,

$$t_2 = \min\{\bar{t}, b_2\}$$

Given the limit on repayment, the explicit creditors in period 1 would lend only up to a level that they can count on to get back with interest from the government. We assume that such lenders have seniority in the repayment of debt by the government. As a result, the government’s total explicit borrowing in period 1, $b_1 + x - t_1$, is constrained by:

$$b_1 + x - t_1 \leq \frac{\bar{t}}{1 + r} \tag{1}$$

If $b_2 \leq \bar{t}$, then all lenders, both explicit and implicit, will get their money back. But if $b_2 > \bar{t}$, then the implicit lenders will end up with the residual after the explicit lenders have been paid, $\bar{t} - (1 + r)[b_1 + x - t_1]$. In this case, the government suffers a cost that is an increasing function of the excess debt, $\theta c(b_2 - \bar{t})$, where $c' > 0$, $c'' > 0$, and $\theta > 0$ is a parameter that reflects the government’s credibility. A government with a higher credibility, indexed by $\theta$, enjoys more favorable borrowing conditions because it faces higher costs of repudiating its debt.

The probability that the government will not default on its debt is:

$$\Pr(b_2 \leq \bar{t}) = \Pr\left[ l \leq \frac{\bar{t}}{(1 + r)} - (b_1 + x - t_1 + h) \right] = F\left[ \frac{\bar{t}}{(1 + r)} - (b_1 + x - t_1 + h) \right]$$

$$\iff G(b) = \Pr(b_2 \leq b) = F\left[ \frac{b}{(1 + r)} - (b_1 + x - t_1 + h) \right]$$

Taxes are distortionary and cause the economy’s total income to decline at an increasing rate. Let the economy’s output in period $i$, $i = 1, 2$, be denoted as $y_i(t_i)$, where $y_i' < 0$ and $y_i'' < 0$. Taxes are less than the corresponding output; i.e., $t_i < y_i(t_i)$. We also assume $y'_i(t_i) \to 0$ as $t_i \to 0$. This assumption
helps rule out corner solutions that complicate the analysis without changing the main insights of the model.

The objective function of the government, which is based on the citizens’ welfare function, is:

(3) \[ w(x, h, t_1; b_1) = \alpha(x + \beta h)^\gamma + y_1(t_1) - t_1 + \delta v(b_1 + x - t_1 + h) \]

where \(\delta\) is the discount factor for period 2 output and \(v(b_1 + x - t_1 + h)\) is the expected utility of the government in period 2:

(4) \[ v(b_1 + x - t_1 + h) = \int_0^\bar{t} [y_2(b) - b] f \left( \frac{b}{1 + r} - (b_1 + x - t_1 + h) \right) \frac{db}{1 + r} \]
\[ + \int_{\bar{t}}^\infty [y_2(\bar{t}) - \bar{t} - \theta c(\bar{t})] f \left( \frac{b}{1 + r} - (b_1 + x - t_1 + h) \right) \frac{db}{1 + r} \]

First, consider the case where the government’s borrowing constraint in (1) is not binding. In this situation, the government’s optimal fiscal plan, \((x^*, h^*, t_1^*; b_1)\), solves the Lagrangian in (5) and its first order conditions can be described as (6)-(8):

(5) \[ w(x, h, t_1; b_1) + \lambda \left[ b_1 + x - t_1 - \frac{\bar{t}}{1 + r} \right] + \mu h, \]

(6) \[ \frac{\partial w}{\partial t_1} = y_1'(t_1) - 1 - \delta v'(b_1 + x - t_1 + h) - \lambda = 0, \]

(7) \[ \frac{\partial w}{\partial x} = \gamma \alpha(x + \beta h)^{\gamma - 1} + \delta v'(b_1 + x - t_1 + h) + \lambda = 0, \]

(8) \[ \frac{\partial w}{\partial h} = \beta \gamma \alpha(x + \beta h)^{\gamma - 1} + \delta v'(b_1 + x - t_1 + h) + \mu = 0 \]

A quick comparison of (7) and (8) shows that if constraint (1) is not binding and (7) holds, the first term on the left-hand side of (8) must be negative, which means that \(\mu > 0\). In this case, we must have \(h^* = 0\) and \(x\) and \(t_1\) will be determined by (6) and (7). The interpretation of the above finding is quite straightforward. If a government’s expenditure is small enough and below its borrowing limit, then the government does not have any incentive to hide its expenditure because the marginal benefit from hiding the expenditure is smaller than making it explicit. Now, let the solution be \(t^*\) and \(x^*\). Then we have:

(9) \[ \gamma \alpha(x^*)^{\gamma - 1} = 1 - y_1'(t^*) = -\delta v'(b_1 + x^* - t^*) \]
It implies that the government sets its marginal benefit from explicit expenditure, \( y \alpha(x^*) r^{-1} \), equal to its marginal cost in period 1, \( 1 - y'_1(t^*) \), and the marginal benefit from optimal expenditure should also be equal to the discounted present value of the marginal disutility of taxes in period 2 to pay back its debts either partly or fully, \(-\delta v' (b_1 + x^* - t^*)\). Any factor that raises the marginal value of expenditure will raise the government’s preferred spending, \( x^* \), and taxes in period 1, \( t^* \), and borrowings in period 1, \( b_1 + x^* - t^* \).

Next, consider the case where the constraint in (1) binds, then the explicit deficit in period 1, \( d = x - t_1 \), is such that \( x^* - t^* \geq d \equiv \bar{d} \). In this case, \( \lambda > 0 \) and \( x - t_1 \) must equal \( \bar{d} \). Then the welfare function in (3) can be written:

\[
(10) \quad w(t_1 + d, h, t_1; b_1) = \alpha(t_1 + d + \beta h) r^{-1} + y_1(t_1) - t_1 + \delta v \left( \frac{\bar{d}}{1+r} + h \right)
\]

The government’s most preferred fiscal plan under constraint can be summarized as \( (h^*, t_1^*; b_1) \), which solves the following FOCs:

\[
(11) \quad \frac{\partial w}{\partial t_1} = y \alpha(t_1 + d + \beta h) r^{-1} + y'_1(t_1) - 1 = 0,
\]

\[
(12) \quad \frac{\partial w}{\partial h} = y \beta \alpha(t_1 + d + \beta h) r^{-1} + \delta v' \left( \frac{\bar{d}}{1+r} + h \right) = 0
\]

Unlike the previous case, the government has an incentive to hide some of its expenditure, \( h > 0 \). This change is because formal borrowing is not possible anymore and explicit spending is already bounded. Under this circumstance the government needs to look for other means of spending that used to be ignored because it provides less marginal utility than an explicit one. In particular, the government may make an attempt to induce some agents to lend in a way that is not listed on the budget in period 1 and may not be fully paid back in period 2 if the realization of contingent claim, \( l \), is large enough.

Second order conditions under constraint can be also described as follows:

\[
(13) \quad \frac{\partial^2 w}{\partial t_1^2} = k + y''_1(t_1) < 0,
\]

\[
(14) \quad \frac{\partial^2 w}{\partial h^2} = \beta^2 k + \delta v'' \left( \frac{\bar{d}}{1+r} + h \right) < 0,
\]

\[
(15) \quad S = \frac{\partial^2 w}{\partial t_1^2} \frac{\partial^2 w}{\partial h^2} - \left( \frac{\partial^2 w}{\partial h \partial t_1} \right)^2 = k \delta v'' \left( \frac{\bar{d}}{1+r} + h \right) + y''_1(t_1) \beta^2 k + y''_1(t_1) \delta v'' \left( \frac{\bar{d}}{1+r} + h \right) > 0,
\]
where $k = \gamma (y - 1)\alpha(t_1 + \bar{d} + \beta h)^{y-2} < 0$.

### 3.2 Comparative Statics

In the following, we investigate the characteristics of the equilibrium hidden debt creation when government official borrowing is constrained. Let us begin our comparative statics analysis with respect to the initial debt, $b_1$. By differentiating FOCs in (11) and (12) with respect to $b_1$, we get:

\begin{align}
(16) \quad k \left( \frac{\partial t_1}{\partial b_1} - 1 + \beta \frac{\partial h}{\partial b_1} \right) + y''_1(t_1) \frac{\partial t_1}{\partial b_1} &= 0 \\
(17) \quad \beta k \left( \frac{\partial t_1}{\partial b_1} - 1 + \beta \frac{\partial h}{\partial b_1} \right) + \partial\nu'' \left( \frac{\bar{t}}{1 + r} + h \right) \frac{\partial h}{\partial b_1} &= 0
\end{align}

Solve (16) and (17) for $\frac{\partial h}{\partial b_1}$, then we can get:

\begin{align}
(18) \quad \frac{\partial h}{\partial b_1} &= \frac{y''_1(t_1) \beta k}{S} > 0.
\end{align}

The positive sign of $\frac{\partial h}{\partial b_1}$ follows from the fact that $y''_1(t_1) < 0$, $\beta > 0$, $k < 0$, and $S > 0$. We also know that the denominator is bigger than 0 from SOC in (16). Therefore, hidden debt increases when the government starts with larger inherited debt, $\frac{\partial h}{\partial b_1} > 0$. The interpretation of this finding is quite straightforward. If a government has large pre-existing debt, it needs to spend more resources for the repayment of existing debt, $b_1$ rather than making explicit expenditures, which increases government payoff. Therefore, a government’s willingness to arrange hidden expenditures increases as existing debt increases.\(^4\)

Now, consider how changes in borrowing cost, $(1 + r)$, affect the hidden debt. Differentiate FOCs with respect to $(1 + r)$:

\begin{align}
(19) \quad k \left( \frac{\partial t_1}{\partial (1 + r)} - \frac{\bar{t}}{(1 + r)^2} + \beta \frac{\partial h}{\partial (1 + r)} \right) + y''_1(t_1) \frac{\partial t_1}{\partial (1 + r)} &= 0 \\
(20) \quad \beta k \left( \frac{\partial t_1}{\partial (1 + r)} - \frac{\bar{t}}{(1 + r)^2} + \beta \frac{\partial h}{\partial (1 + r)} \right) + \partial\nu'' \left( \frac{\bar{t}}{1 + r} + h \right) \left( - \frac{\bar{t}}{(1 + r)^2} + \frac{\partial h}{\partial (1 + r)} \right) &= 0
\end{align}

\(^4\) Even though it is widely believed that the government is more likely to borrow implicitly when it cannot borrow explicitly, our analysis reveals that this switching does not happen when utility function is linear. Conditions such as substitutability between explicit and implicit spending and diminishing returns are required in order to show that the government hides its debt.
From (19) and (20), we can get the following:

\[
\frac{\partial h}{\partial (1+r)} = \frac{S + (1 - \beta) y'_1(t_1) \beta k}{S} \cdot \frac{\tilde{e}}{(1 + r)^2} > 0
\]

\[
\frac{\partial h}{\partial (1+r)}
\]

has a positive sign because of the fact that \(y'_1(t_1) < 0, 0 < \beta > 1, k < 0, \) and \(S > 0.\) We also know that the denominator is bigger than 0 from SOC in (16). The positive sign \(\frac{\partial h}{\partial (1+r)}\) implies that explicit deficit ceiling, \(\tilde{t} \equiv \frac{\tilde{e}}{1+r} - b_1,\) becomes tighter as the interest rate goes up and the explicit spending should decrease accordingly. This mechanism makes the government seek more hidden expenditure.

Now consider the role of credibility, \(\theta,\) which measures contract reliability in our model. Differentiate FOCs with respect to \(\theta:\)

\[
k \left( \frac{\partial t_1}{\partial \theta} + \beta \frac{\partial h}{\partial \theta} \right) + y''_1(t_1) \frac{\partial t_1}{\partial \theta} = 0
\]

\[
\beta k \left( \frac{\partial t_1}{\partial \theta} + \beta \frac{\partial h}{\partial \theta} \right) + \delta' v' \left( \frac{\tilde{e}}{1+r} + h \right) \frac{\partial h}{\partial \theta} + \delta \frac{\partial v'}{\partial \theta} = 0
\]

where \(\frac{\partial v'}{\partial \theta} = \int_\xi^\infty c(b - \tilde{e})f' \left[ \frac{b}{1+r} - \frac{\tilde{e}}{1+r} - h \right] \frac{db}{(1+r)}\)

From (22) and (23), we can get:

\[
\frac{\partial h}{\partial \theta} = - \frac{\{y''_1(t_1) + k\} \delta \frac{\partial v'}{\partial \theta}}{S} < 0
\]

Since \(\delta > 0, \) \(y''_1(t_1) + k < 0\) and \(S > 0,\) \(\frac{\partial h}{\partial \theta}\) will have the same sign as \(\frac{\partial v'}{\partial \theta}.\) In order to investigate the sign of \(\frac{\partial v'}{\partial \theta},\) let \(f[\cdot]\) be a bell-shaped symmetrical distribution. Then, it is easy to show that \(\frac{\partial v'}{\partial \theta} < 0.\)

\[
\frac{\partial h}{\partial \theta} < 0
\]

Since \(f[\cdot]\) is symmetric, we know that the value of \(f'[\cdot]\) on the right hand side of \(\mu\) has a negative sign while it has a positive sign on the left hand side of \(\mu\) with the same absolute values. First, consider the case where \(\tilde{e} > \mu.\) Then \(c(b - \tilde{e}) > 0\) holds by the construction \(f'[\cdot] < 0.\) Therefore, \(\frac{\partial v'}{\partial \theta}\) has a negative value. Next, suppose that \(\tilde{e} < \mu.\) Since the cost of repudiate is an increasing function of the excess debt, i.e., \(c'(b - \tilde{e}) > 0,\) we can find:

\[
\left| \int_{\mu}^{\mu+\varphi} c(b - \tilde{e})f' \left[ \frac{b}{1+r} - \frac{\tilde{e}}{1+r} - h \right] \frac{db}{(1+r)} \right| < \left| \int_{\mu}^{\mu+\varphi} c(b - \tilde{e})f' \left[ \frac{b}{1+r} - \frac{\tilde{e}}{1+r} - h \right] \frac{db}{(1+r)} \right|
\]
The interpretation of $\frac{\partial \nu'}{\partial \theta} < 0$ is quite straightforward. Considering that $\nu$ is the expected utility of the government in period 2, this expected utility will decrease as the government suffers from more severe costs when it repudiates debt. Finally, we can show that higher credibility reduces incentives to arrange hidden expenditures, i.e., $\frac{\partial h}{\partial \theta} < 0$.

4 Empirical Methodology

For empirical assessment of the issues related to hidden debt, we build and analyze a country panel dataset during 1970 and 2010. This section describes the variables and the details of the empirical methodology.

4.1 The Measurement of Hidden Borrowing

An important part of this methodology is the measurement of hidden debt, which is carried out in an indirect way because the nature of hidden public debt makes its direct measurement very difficult. In fact, absence of direct measures seems to have been the main impediment for the study of the phenomenon in the past. The indicator that we propose consists of the amount of net hidden public liabilities that become exposed each year, which is “Stock-Flow Adjustment” (SFA). The conventional deficit financing equation can be summarized by the following:

$$Deficit_{it} = \Delta Debt_{it} + \Delta Money_{it}$$

where $Debt_{it}$ is the country's exposed debt at the end of year $t$, $Deficit_{it}$ is the gross deficit (primary deficit plus interest payments) during year $t$ and $Money_{it}$ is the outstanding amount of primary money at the end of year $t$. This equation implies that the budget deficit in this period $t$ should be financed by issuing new debt and printing new money in period $t$. This traditional assumption simply states that the government needs to either borrow money from the public or create seigniorage benefits by printing base money. Many empirical data, however, show that this rarely holds and the right hand side of the equation is usually greater than the left hand side. It implies that the government finances more resources than the

Therefore, we can show that

$$\frac{\partial \nu'}{\partial \theta} = f_{\mu - \psi = c}(b - \bar{\tau})f^{b} \left[ \frac{1 + r}{1 + r} - h \right] db \frac{d b}{(1 + r)} + f^{\mu + \psi}(b - \bar{\tau}) f^{b} \left[ \frac{b + \bar{\tau} - h}{1 + r} \right] db < 0$$
amount needed for its explicit deficit financing on the budget and the discrepancy needs to be adjusted by some factor, $SFA_t$, as follows:

$$\text{Deficit}_t + SFA_t = \Delta \text{Debt}_t + \Delta \text{Money}_t$$

We can assume that this additional financing is used to pay for the extra-budgetary spending that has been hidden from the budget but eventually revealed in year $t$. To some extent, such liabilities are natural because it is difficult to predict all contingencies in the budget process, and once they occur, it may be easier to just add them to the stock of debt rather than integrating them into the budget. The interesting issue is whether the politicians' incentives also play systematic roles in creating or curbing the situations that lead to off-budget debt creation.

Finally we can derive the revealed hidden debt, which is the net amount of debt revealed each year from the stock of hidden government liabilities, as the following:

$$SFA_{it} = \Delta \text{Debt}_{it} + \Delta \text{Money}_{it} - \text{Deficit}_{it}$$

where $SFA_{it}$ is the country's revealed hidden debt during year $t$. Using $SFA$ may seem to have a drawback because it reflects the underlying net hidden debt as well as the rate at which such debt is exposed. But the combination is an important variable in itself because a critical concern is the destabilizing effects of sharp movements in the government's explicit debt exposure. While our study focuses on factors that influence the stock of hidden debt, carrying out the analysis through $SFA$ reflects the extent to which those factors ultimately affect changes in explicit debt exposure outside the normal budget process. It should be pointed out that $SFA$ is likely to have other important applications, especially in the study of fiscal policy. Past research in that area has treated deficit figures based on budgetary data as the direct measure of public deficit and has equated it with changes in the net amount of debt. That equation needs to be reexamined in light of the sizable values that $SFA$ seems to take.

4.2 Overall Behavior of Revealed Hidden Debt

We measured $SFA$ using the data from the International Monetary Fund’s International Financial Statistics (IFS) or the International Monetary Fund’s Government Finance Statistics (GFS)\(^6\).

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\(^6\) These datasets are the most common and reliable resources for obtaining cross-country panel data. These datasets, however, suffer from inconsistency when comparing before and after the change of accounting method. IMF revised its Government Finance Statistics Manual (GFSM) in 2001. After that, only a limited number of countries, which are mainly the advanced countries, reported their debt data according to the new method and the debt data of the rest of the countries are treated as missing variables in the new GFS dataset. We will discuss more details in the empirical analysis section.
The data show that the average $SFA$ has been positive both in the advanced and the developing countries between 1970 and 2010. We can find that the average $SFA$ of developing countries is larger than that of advanced economies throughout most of the time period (Figure 1). It is quite expected considering that the developing countries have more incentives to hide debt because of their lack of ability to borrow money in the formal financial market and also because of their weak institutional features. In general, $SFA$ of both groups moves in the same direction, but the magnitude is different. Figure 1 also shows that the $SFA$ of the advanced economies sharply increased in 2008 and dropped back again after 2009. Considering that major advanced economies have suffered from financial crisis since 2008, we can infer that the recent increase in $SFA$ resulted from the extensive support to their financial sectors during the crisis. This kind of support cannot be predicted when the budget is prepared and hence it drives up the discrepancy between debt and budget deficit and finally leads to an increase in $SFA$ in advanced economies.

**Figure 1 Stock-Flow Adjustment of Advanced and Developing Economies**

![Graph showing Stock-Flow Adjustment of Advanced and Developing Economies](image)

Source: Calculated based on IMF GFS data.

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7 The classification of advanced countries has been adopted from IMF. IMF categories the following countries as advanced economies: Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovenia, Spain, Australia, Canada, Hong Kong, Denmark, Iceland, Israel, Japan, Korea, New Zealand, Norway, San Marino, Singapore, Sweden, Switzerland, United Kingdom, United States. We consider the rest of the countries as developing countries.
Table 1 shows the overall distribution of SFA as a share of GDP between 1970 and 2010. Our dataset contains 1,577 hidden debt observations from 82 countries. Out of 1,577 total observations, 719 observations are from the 29 advanced countries while 856 observations are from the 53 developing countries. Table 1 verifies that the average SFA of developing countries, 6.18% of GDP, is larger than that of advanced countries, 3.90% of GDP. Also, the mean of SFA is larger than the median both in advanced and developing countries. It supports the existence of large outliers in the dataset. Some countries have negative hidden debt, which can be interpreted as hidden assets in lower percentiles such as the 10% percentile. SFA can be negative because governments have assets as well as debts that are not reflected in their accounts. Such assets can generate revenues or sales proceeds that help retire explicit debt without entering the budget process.

Table 1 The Distribution of Stock-Flow Adjustment, 1970–2010
(as % of GDP)

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean (St.dev)</th>
<th>Percentile</th>
<th># of Obs</th>
<th># of Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>10%</td>
<td>25%</td>
<td>50% (Median)</td>
</tr>
<tr>
<td>All Countries</td>
<td>5.1413 (7.7023)</td>
<td>-.938</td>
<td>.880</td>
<td>3.392</td>
</tr>
<tr>
<td>Advanced Countries</td>
<td>3.9013 (6.8413)</td>
<td>-1.135</td>
<td>.372</td>
<td>2.162</td>
</tr>
<tr>
<td>Developing Countries</td>
<td>6.1804 (8.2167)</td>
<td>-.551</td>
<td>1.642</td>
<td>4.566</td>
</tr>
</tbody>
</table>

Source: Calculated based on IMF GFS data. Several observations in which SFA is larger than 60% of GDP are excluded from the calculations.

Figure 2 presents the distribution of SFA over time for our (panel) sample. Note that Figure 2 shows that the variance of SFA has clearly increased since the mid-1980s. This seems to reflect the increased uncertainty in the world economic environment associated with globalization. It should be pointed out that the data shown in Figure 2 excludes several observations, mostly from Israel during 1977 and 1985, which were 1-4 times bigger than GDP and seemed to be clear outliers. However, we do not exclude those observations from our analysis because the variables may contain country specific issues and the econometric method, “quantile” regression, is robust to the outliers.
To further examine the properties of SFA, in Figures 3 and 4 we present its scatter diagrams against the logs of per capita GDP and 1+debt/GDP. Figure 3 shows that there is some tendency for lower income countries to have larger SFA. However, the tendency is weak and, in fact, econometrically undetectable once we control for the factors identified by the theoretical model. Figure 4 shows that there is a wider dispersion of SFA as debt-GDP ratio goes up. We will discuss the relationship between SFA and debt-GDP ratio by using model and econometric work.
Figure 3 Revealed Hidden Debt vs. Real Per Capita GDP

Figure 4 Revealed Hidden Debt vs. Debt-GDP Ratio

Source: Calculated based on IMF GFS data.
To be able to use the model of section 3 for analyzing \( SFA \), we need to make some assumptions about the rate at which hidden debt becomes exposed. If the rate of revelation were independent of the determinants of the stock of hidden debt, then we could ignore that factor altogether. However, this is unlikely to be the case. In fact, it is likely that the factors that raise hidden debt tend to slow down its revelation as well. To overcome the consequences of this problem, we assume that the effects of the determinants of the stock of hidden debt on the revelation rate of the debt do not completely counteract the effects of those determinants on the stock itself. In other words, we assume that the net effects of those factors on \( SFA \) are in the same direction as the ones on the stock of debt. This allows us to proceed with the examination of the determinants of \( SFA \) based on the theoretical insights of section 3. Since the variations in the rate of revelation are likely to dampen the effects on the stock, if empirical results from the study of \( SFA \) agree with our hypotheses concerning the stock of hidden debt, we can interpret them as strongly favorable evidence. In the rest of this section, we lay out our empirical methodology for testing the model based on this approach. To ensure that \( SFA \) is comparable across countries, we scale it by its corresponding GDP.

### 4.3 The Explanatory Variables and Operational Hypotheses

To test the results obtained in section 3, we need to specify the actual variables that can proxy for the parameters of the model and, then, examine their relationships with \( SFA \). Let us start with the proxies for the cost of default, \( \theta \). Considering that the countries with strong credibility are more likely to experience bigger costs when they repudiate their debt, \( \theta \) can also be interpreted as the index for the credibility. The variable that we consider for this purpose is the "contract viability" and “contract repudiation” indexes available from the *International Country Risk Guide* (ICRG) dataset (see Knack and Keefer, 1995). These indexes measures risks of modification in contracts in the form of cancellation or outright expropriation. Since ICRG provides "contract viability" from 2001, we used “contract repudiation” for the previous years and rescale the range between 0 and 10, with higher scores indicating lower risks which translate into higher levels of \( \theta \). To reflect the improvement in institutional quality associated with higher values of this index, we will refer to it as *contract reliability*. Our hypothesis is that the *contract reliability* is negatively related to \( SFA \). It is possible that lacking credibility in contracting may also raise the cost of arranging hidden debt and result in the opposite effect. However, the *contract reliability*

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8 The ICRG dataset is available from the early 1980s. To take advantage of a longer time span, we extrapolated this data to the early 1970s with the help of another data set, BERI, which offers similar indicators, though for a more limited number of countries.
reliability index reflects situations concerning formal and explicit contracts, while disguised debt deals are often arranged through informal relationships, which seem to be more readily available in environments where formal contracts are less reliable. For this reason, we expect the stated hypothesis to hold. In any event, if the impact of contract reliability on the cost of hidden loans is in fact large and the data still shows a negative relationship between that variable and SFA, the result should be taken as even a stronger support for the hypothesis concerning the role of factors that tighten the explicit borrowing constraint by lowering the borrowing limit.

Now consider the variables that affect the tightness of the constraint on explicit borrowing, $\bar{d}$. The initial level of exposed public debt as a percentage of GDP, $b_1$, should reduce $\bar{d}$. Other things being equal, a more indebted government is likely to have less to offer by way of debt repayment in the future and, thus, face a tighter debt limit in the formal credit markets. This should increase the politicians' incentive to seek hidden debt. Therefore, $SFA$ is expected to be positively related to the debt-GDP ratio. In the regression, we used the lagged value of debt-GDP ratio.

The interest rate may also affect the level of hidden debt, however, its effect is ambiguous according to our model. First, as the interest rate goes up, the governments need to spend a larger portion of their borrowing for repaying debt, reducing resources available for explicit government spending. On the other hand, if the interest rate goes up, the government needs to pay higher interest both on explicit and implicit loans eventually, and it may give incentive to reduce government expenditures, including hidden ones. Finally, the net effect of the interest rate on hidden debt is determined by the magnitude of the above two different forces. As an instrument for the interest rate, we use the deposit interest rate from WDI.

A banking crisis may affect the probability of realization of contingent liability, $F[\cdot]$, and eventually change the size of $SFA$. Laeven and Valencia (2012) constructed a database that includes all banking crisis dates, costs, and policy responses during the period 1970-2010. Based on this information, we create a dummy which is equal to 1 if the country is under a banking crisis. We can assume that the country under a banking crisis experiences difficulties in financing resources by issuing bonds due to the freezing of the financial system. If a banking crisis hits the economy, then it shifts the probability of sudden realization of contingent liability and we should observe $SFA$ rising during a banking crisis.

Now consider the variables that represent the value of public expenditure, $\alpha$. Though it is not easy to find measures across countries, the degree of openness that affects the demand for public expenditure as a source of social insurance can be used as a proxy (Rodrik, 1998). If this is indeed the
case, openness should be positively related to SFA. We measure openness by the share of imports plus exports in GDP from the WDI database. Proportional Representative Systems (PR), in the electoral rule, may also affect the demand for public expenditure. There is a wide consensus that PR is likely to increase government spending and run larger deficits compared to plurality states because PR systems often lead to coalition governments among several minor parties, and governments are less decisive to discourage the demands of extreme parties (Roubini and Sachs 1989; Alesina and Tabellini 1990; Hallerberg and Von Hagen, 1999). We acquire proportional representative information from DBPI. The proportional representative system dummy has a value of 1 if politicians are elected based on the percent of votes received by their party.

Transparency in the government sector may affect the level of hidden expenditure. It is generally believed that the cost of arranging disguised expenditure increases as the government becomes more transparent. However, for empirical analysis, acquiring data sources that provide the long run trend of transparency is difficult. Several institutions have investigated the transparency level of a country, but they measure the transparency only one time or only across a very limited time period. To detect the latent characteristics of transparency, we use the data missing patterns in the World Bank's World Development Indicators (WDI). WDI provides various country level statistics but one can easily notice that some countries have more missing points than others across a wide range of indicators and that some indicators tend to be missing more so than other indicators across country-years. The missing values in WDI indicate that the government was either unable or unwilling to provide reliable information on the state of the country. Therefore, we can assume that a larger number of empty values means a lower level of transparency (Kim, 2008; Rosendorff and Vreeland, 2006). For our analysis, the number of missing values is calculated similarly to Kim (2008).

Finally, we also added a measure of inflation, though there is no clear theory of the effect of inflation on hidden debt. If a country can generate inflation, it decreases the value of existing liability and also possibly reduces the incentive for the politicians to hide debt. We adopted Consumer Price Indexes (CPI) from WDI for the analysis.

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9 It is possible that the greater access to international capital markets in more open economies may lead to less need for hidden debt. This effect would tend to dampen the positive impact of openness on hiding debt through increased demand for public expenditure. Thus, if we observe a significant positive coefficient for openness, it would confirm the strength of the latter effect.
5 Empirical Results

5.1 The Econometric Model

To test empirically the above hypotheses, we used regression with country fixed effects and time fixed effects. As we already saw in Figure 1, there are time-varying biases in SFA and time-fixed effects have been added to control for any time-varying biases that are common across all countries. The structure of the model is the following:

\[ H_{it} = X'_{it} \cdot \alpha(\tau) + \eta_i(\tau) + \theta_t(\tau) + \varepsilon_{it}(\tau) \]

where \( X'_{it} \) is the set of determinants of hidden debt (discussed in the previous subsection), \( \alpha(\tau) \) is the vector of coefficients at \( \tau \)th percentile of distribution, \( \eta_i(\tau) \) is a country fixed effect and \( \theta_t(\tau) \) is a time fixed effect. \( \varepsilon_{it}(\tau) \) is a random variable whose \( \tau \)th quantile is zero: \( Q_\varepsilon(\tau) = 0 \). The bootstrapping method has been applied to calculate standard errors. Since the introduction of a large number of fixed effects can inflate the variability of estimates of other covariate effects, these individual effects have been penalized by shrinking toward zero, a method proposed by Koenker (2004)\(^\text{10}\).

The econometric method that we use for estimating (25) is a quantile regression with fixed effects for panel dataset (Koenker, 2004). Quantile regression has several advantages in analyzing the determinants of SFA. Quantile regression is a statistical technique intended to estimate, and conduct inferences about, the conditional median or other percentiles of the response variable while classical linear regression methods are based on minimizing sums of squared residuals. Owing to this nature of quantile regression, we can investigate how explanatory variables differently influence the SFA at each quantile of the conditional distribution. For example, it is possible to estimate whether debt to GDP alters the hidden debt of a country with a high level in the same way that the country under a low level of hidden debt is affected. It turns out to be a huge advantage considering that the classical least square method assumes that covariate effects shift the entire distribution by a fixed amount in all regions. Another advantage is that the quantile regression estimates are more robust against outliers in the response measurements than ordinary least square regression. Some SFA observations calculated by using the GFM dataset show unreasonably large values, and this may be caused by the lack of accounting techniques or unknown country specific issues. Therefore, it may be misleading to drop outliers just because of their largeness. However, once they are included in the least square regression, the regression estimates can be heavily affected by the outliers. Quantile regression can reduce the outlier problem

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\(^{10}\) For statistical analysis of quantile regression for panel data, R package “rqpd” has been employed.
because it cares about the rank of the observation, not the values of the observation itself, so we can add the outliers into our regression with fewer concerns about robustness issues.

5.2 Summary of Empirical Analysis

Figure 5 reports our main results. The first column in Figure 5 shows the outcome of quantile regression estimation of equation (25) with respect to cash based SFA. The next column shows the regression outcomes of accrual based SFA. For all regressions, a country fixed effect and year fixed effect have been introduced to control the country characteristics and year trends. A quick comparison of the two columns shows that addressing simultaneity and measurement matters for the size of the estimated coefficients and their significance levels.

First, let us consider the cash based hidden debt case. Theory predicts that the debt-GDP ratio is positively related to SFA, and the empirical analysis supports this prediction. The coefficient of lagged debt-GDP ratio has a positive sign and its magnitude becomes stronger as it moves toward the upper end of distribution. It indicates that the countries in the upper tail of distribution, i.e., countries already having a large stock of hidden debt, are likely to incur larger hidden debt when debt-GDP ratio increases.

Let us now consider the indexes related to $\alpha$, which is the value of public expenditure. Our explanation for this effect is that openness raises the demand for public expenditure as a means of social insurance. Lagged openness of the economy pushes up the level of hidden debt and the magnitude of openness on the level of hidden debt is larger when the country has more hidden debt.

The estimated coefficients for the contract reliability, which is a proxy for the ability to ensure the payment of explicit debt, have a negative sign. It implies that the countries with low risk of ex-post modification in government contracts can access credit markets easily and have less incentive to seek hidden debt. Therefore, the sign of the index is expected to be negative. The regression outcome shows that the coefficient of the lagged contract reliability index is significantly negative in general. Furthermore, the absolute value of the coefficients gets bigger as one moves to the upper end of distribution. It indicates that contract reliability has more power to decrease the level of hidden debt, especially in the countries that have a larger level of hidden debt.

It turns out that a proportional representative system induces more hidden debt. It is quite expected considering that a proportional representative system increases the possibility of the emergence of minor parties and a coalition government and possibly increases the size of government expenditure.

Regression also shows that the cost of funds also matters in determining the level of hidden debt. As the interest rate goes up, the countries are more likely to hide debt. Furthermore, if the country has more hidden debt, then hidden debt increases more sharply as the interest rate increases.
Inflation has exactly the opposite effect. It seems to reduce the hidden debt. A possible explanation is that countries that are able to create inflation do not need to hide debt. Inflation reduces the cost of borrowing and countries do not need to hide their debt.

The banking crisis dummies also play an important role in determining the level of hidden debt. These dummies reflect an unexpected government spending increase or the sudden realization of implicit guarantees by the government on financial sectors. For the first year of a banking sector crisis, the banking crisis dummy basically influences the upper end of the distribution. When the country has a banking crisis, it typically pushes up the level of hidden debt at the upper end of distribution. By the nature of crisis, a banking crisis causes the revelation of a great deal of hidden debt. One interesting observation is about the years after the first year. In the following years, there is a correction of the sudden revelation of hidden debt in the first year and hidden debt levels become lower or negative hidden debt.

Opaqueness of a country, which is measured by the missing values in WDI, turns out to be positively correlated to hidden debt. This relationship indicates that the countries with a lower level of transparency in their government system are more likely to pursue hidden debt.

Now let us consider the determinants of hidden debt under accrual accounting. The general result is that for the countries with accrual accounting, the effect of several determinants becomes milder and less significant. Variables such as inflation, openness, and opaqueness do not turn out to be significant in explaining the behavior of accrual based hidden debt.

The debt-GDP ratio pushes up the hidden debt at the upper percentile of distribution. One interesting observation is that debt-GDP ratio has a negative impact on hidden debt in the lower tail of distribution. Considering that hidden debt in the lower-end usually has a negative sign, which means hidden assets, we may explain that countries sell their assets and the revenues from sales of these assets reduce the liabilities. We may expect that this money movement is captured more easily under accrual bases.

Deposit interest rate basically does not have much impact on the level of hidden debt, but it has a possibly positive relationship with hidden debt at the higher end of distribution. Proportional representation system has a positive sign at the upper tail of distribution but its significance is only visible in the middle range. Banking sector crisis again increases the level of hidden debt during the first year and has a negative effect in the following years for all corresponding quantile.
6 Conclusion

Government budgets are highly complex and difficult to track. Politicians are also often reluctant to make government accounts transparent, either because it is difficult for them to do so or because they prefer to shield part of their activities from public scrutiny. These factors give rise to hidden liabilities that sometimes come to undermine fiscal and macroeconomic performance. Understanding the factors that increase or decrease off-budget liabilities or their exposure rates is important for designing preventive measures and for enhancing transparency and predictability in government finances around the world. The theoretical and empirical analysis of this paper offers important insights in this regard.

Our results show that stock-flow adjustment (SFA) is not just a simple random element but, rather, systematically related to the country specific institutional and economic conditions. Factors that make public borrowing difficult, such as a larger debt level and higher borrowing cost or an increase in the demand for public spending such as through vulnerability to external shock, induce politicians to resort to hiding debt. If a country has a weak institution, a politician’s desires are easy to implement, and it allows politicians to use hidden debt more easily. Our regression, however, finds that certain institutional characteristics discourage politicians’ willingness to arrange for hidden expenditures because it becomes more costly to hide the debt. Credibility measured by the contract reliability index, opaqueness in the government sector, and the structure of the legislative body significantly influences the size of SFA under cash based accounting. The switch to accrual accounting from cash based accounting has helped reduce SFA and most factors have milder effects in explaining the SFA under accrual accounting. Changes in accounting method, however, do not remove all the adverse effects of a weak institution. Contract reliability turns out to have a consistently significant effect on hidden debt both in cash and accrual based accounting. We can see a very stable relationship that shows that improvement in contract reliability reduces the level of hidden debt and that this effect becomes stronger in the upper tail of distribution. Considering that other variables become less significant in accrual base, the level of hidden debt largely boils down to the credibility issue. Overall, accrual based accounting seems to be helpful in reducing hidden debt, but countries that are not reliable in keeping contracts may run hidden debts even under accrual based accounting.

In terms of econometric method we adopt the quantile regression method to help us verify how explanatory variables differently alter the hidden debt of a country with a high level of hidden debt in the same way that the country with a low level of hidden debt is affected. We can verify that the magnitude of variables on hidden debt is different based on the existing level of hidden debt. For example, contract reliability has a small impact on the lower end of distribution, but it becomes larger in the upper percentiles. Furthermore, we can separate the effect of explanatory variables where a country has hidden
assets, which means a negative value of $SFA$. For example, the coefficient of debt to GDP ratio has a negative sign in the lower percentile of distribution when we measure the $SFA$ using accrual basis. We might be able to say that the country may sell assets when it has hidden assets.

Lastly, it is worth noting that the conformity of the various effects derived from our theoretical framework with the estimation results offers support for the usefulness of $SFA$ as a proxy for hidden public spending. The regressions show that this indicator is capable of generating meaningful results that help disentangle a variety of effects on hidden debt. The concept can also be useful for improving research on fiscal policy by highlighting the difference between the budgetary deficit and the actual deficit that a government runs. However, more work needs to be done to separate the hidden expenditure out from $SFA$, which includes both hidden expenditures and contingent liability. There is also a clear need to collect information about the specifics of budget procedures that influence the costs and benefits of hidden debt. Identifying such factors and documenting their roles can play an important part in offering lessons for practical policy steps that help improve budget discipline.
Figure 5 Quantile Regression Plots

(Dependent Variable) Stock Flow Adjustment to GDP, %

<table>
<thead>
<tr>
<th>Figure</th>
<th>(1) Cash based Accounts</th>
<th>(2) Accrual based Accounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.a.</td>
<td><img src="image1.png" alt="" /></td>
<td><img src="image2.png" alt="" /></td>
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<tr>
<td>5.b.</td>
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<tr>
<td>5.c.</td>
<td><img src="image5.png" alt="" /></td>
<td><img src="image6.png" alt="" /></td>
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</table>
Figure 5 (cont.)

<table>
<thead>
<tr>
<th></th>
<th>(1) Cash based Accounts</th>
<th>(2) Accrual based Accounts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Figure 5.d. Lagged Contract Reliability</strong></td>
<td><img src="image1" alt="Graph" /></td>
<td><img src="image2" alt="Graph" /></td>
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<tr>
<td><strong>Figure 5.e. Proportional Representative System</strong></td>
<td><img src="image3" alt="Graph" /></td>
<td><img src="image4" alt="Graph" /></td>
</tr>
<tr>
<td><strong>Figure 5.f. Opaqueness (Missing Values in WDI)</strong></td>
<td><img src="image5" alt="Graph" /></td>
<td><img src="image6" alt="Graph" /></td>
</tr>
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</table>
Figure 5 (cont.)

(1) Cash based Accounts

(2) Accrual based Accounts

List of Countries: Cash base (54): Argentina, Australia, Austria, Bahamas, Bahrain, Bangladesh, Belarus, Bolivia, Brazil, Cameroon, Canada, Chile, Costa Rica, Cote d'Ivoire, Cyprus, Czech Republic, Denmark, Dominican Republic, Ethiopia, Germany, Greece, Hungary, Iceland, Indonesia, Israel, Jamaica, Japan, Jordan, Korea, Madagascar, Malaysia, Malta, Mexico, Moldova, Mongolia, Morocco, New Zealand, Norway, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Singapore, Sweden, Switzerland, Thailand, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, Uruguay, Venezuela, Zimbabwe.

Non-Cash base (36): Australia, Austria, Belgium, Brazil, Canada, Colombia, Cote d'Ivoire, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Lithuania, Madagascar, Malta, Morocco, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Slovak, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom.
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