

ROLE OF INSTITUTIONS IN FISCAL PERFORMANCE

BY

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DISSERTATION

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## Abstract

This dissertation examines the role of institutional features on fiscal outcomes: the level of hidden liabilities, credit spreads, and official government debt. We construct a country panel dataset and use quantile regression and error correction models for empirical analysis: quantile regression to verify how variables play different roles in explaining the level of hidden debt and credit spreads at each percentile of the conditional distribution and error correction model to investigate the role of institutional features on the long-term equilibrium level of government debt.

In Chapter 1, we discuss the roles of credibility and fiscal discipline on the level of government debt. Our findings are as follows: First, the bond issuance ceiling expands as a country builds up credibility because higher credibility reduces the concerns over repudiation of existing debt. Governments with weak policymaking institutions may want to fully utilize this favorable funding condition and end up with a relatively high level of government debt. Next, once a government reaches a sufficiently high level of credibility, the optimal choice of government debt becomes smaller because stronger fiscal institutions induce the government to borrow less.

In Chapter 2, we study which factors determine the government's tendency to resort to off-budget activities. First, factors that make public borrowing difficult such as larger official debt and higher borrowing cost induce politicians to resort to hiding debt. Second, certain institutional characteristics such as strong credibility and transparency in the government sector reduce the willingness of politicians to arrange hidden expenditures because it becomes more costly to hide debt. Third, the transition from the cash-based accounting method to the accrual-based one helps reduce hidden debt, but countries that are not credible may run hidden debt even under the accrual-based system.

In Chapter 3, we investigate the determinants of sovereign bond credit spreads in emerging market countries. First, the increases in government debt lead to a widening of the spreads because a higher debt level raises the concerns over default on sovereign debt. Second, we find that the market participants consider the role of fiscal institutions when pricing the risk premia of sovereign bonds. Better fiscal institutions tend to mitigate the widening of credit spreads from increases in debt. Furthermore, the negative impact of additional borrowing on spreads will be negligible if a country has good fiscal institutions. Lastly, the socio-political characteristics of a country such as contract reliability and observance of law also play important roles in determining the level of sovereign bond spreads.

*To my parents and family*

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## **CHAPTER 1**

### **The Determinants of Public Debt: Role of Fiscal Discipline and Political Institution**

#### **1.1 Introduction**

This study analyzes the determinants of public debt and offers an explanation for the variation of public debt among countries. Traditional government debt theory explains that governments issue sovereign bonds to smooth the consumption path. If government expenditures have stochastic streams, then it is optimal for the government to maximize the utility of household issues or pay back government bonds to smooth consumption (Barro, 1979). However, it is difficult to explain why countries respond to expenditure shock in different ways that lead to the huge cross-country variation in the level of debt according to the traditional view. Even the debt levels among European countries that may have experienced similar expenditure shock turn out to be quite different (Alesina and Perotti, 1994). It raises the question of why do we observe the large debt in certain countries but not in others, and what factors drive this different fiscal outcome.

We also need to think about how the public debt is seen by the financial market participants. One may believe that carrying high levels of public debt is considered as a potential source of macroeconomic instability. Large accumulations of public debt makes the country more vulnerable to external shocks and increases the default risk on existing debt. However, alternatively, one may view those high debt levels as a sign of creditworthiness and the confidence of capital markets in the sustainability of fiscal policies. Once a country is considered as credible in repaying its debt, international lenders may want to loan out money to this country. Under this favorable funding condition, some countries decide to fully utilize this position and other countries may keep fiscal discipline. We suspect that not only economic factors but also politico-institutional factors can play crucial roles in understanding different behaviors of governments.

In the following analysis, we start with an extended version of tax-smoothing theory and the possibility of default and varying degrees of institutional mechanisms for internal discipline. In the model, we try to show that the credibility of a country expands a country's borrowing limit and then we investigate how the optimal choice of debt level is affected by credibility. Next, we test the model using a panel dataset of 61 countries and regress the estimated fixed effect on fiscal discipline.

The key finding of this study is that the high debts are likely to be due to a combination of factors. Specifically, there are some weaknesses in the policymaking institutions of countries that lead to relatively high demand for public debt. However, those institutions are sufficiently strong to provide moderately high rates of credibility in world capital markets. This raises their debt ceilings and allows them to borrow relatively more than many other countries. The implication of this finding is that fiscal risks may be reasonable if one assumes that the current conditions would continue.

The rest of this study is organized as follows. Section 1.2 offers a review of existing literature on the determinants of public debt and fiscal policy. Section 1.3 develops a simple model of fiscal policy that highlights the role of institutional mechanisms in determining public debt with and without borrowing constraints. It describes the empirical implementation of the model and discusses the data, and particularly the construction of a fiscal discipline index. The results of the model's estimates are discussed in section 1.4 and 1.5. Then the conclusions of the study are presented in section 1.6.

## **1.2 Existing Literature**

Systematic efforts to explain fiscal policy started in the 1970s with two different approaches: neoclassical and institutional. The neoclassical approach emphasized the inter-temporal choices of the government treating decision-makers as a single actor that maximize some sort of social welfare. The institutional approach focused on the role of structural interaction among multiple decision-makers in the process of budget formation. In recent years, the two approaches have come together in dynamic models of interaction among policy makers. Over time, the original neoclassical model has become a benchmark against which the efficiency of fiscal outcomes under various institutional scenarios is assessed. In this section, we summarize the existing literature using these approaches and discuss their implications for our analysis.

The neoclassical theory of fiscal policy is based on the idea that the government uses budget deficits as “tax smoothing” to minimize the distortionary burden caused by passing taxes. According to Barro’s (1979) theory, the optimal fiscal policy must equate the marginal distortionary effects of the government sector over time. Barro treats fiscal expenditures as given and shows that tax rates should remain constant over time to minimize the excess burden of taxation. Lucas and Stocky (1983) show that extending the theory to stochastic environments does not change its main implications.

For the institutional approach to the analysis of fiscal policy, the starting point has been the “common pool” problem (von Hagen, 1992; Alesina et al., 1999; Poterba and von Hagen, 1999). The

basic idea of this approach is that when many interest groups participate in the budget process, they may not fully internalize the cost of the public expenditures. It leads to inefficiently high expenditures and borrowing and as a result, the size of the government debt and budget deficit may be larger than what is optimal from the viewpoint of the economy as a whole. According to common pool theory, we can expect that the structure of the political system matters a lot in determining the size of the government spending. Roubini and Sachs (1989) analyze the OECD data and find that coalition and minority governments are subject to larger fiscal deficits than the majority governments. Alesina and Perotti (1995) examine the episodes of fiscal adjustment in OECD countries and indicate that coalition governments succeed less frequently than majority governments in implementing adjustment policies. Kontopoulos and Perotti (1999) also find that the number of coalition partners in government and the number of spending ministers both positively correlate with spending and debt issuance.

Some researchers investigate the role of budget institution. The size of public spending can decrease close to the optimal level through political institution of a country. Past research suggests that the most effective mechanism to achieve coordination in budget systems is the delegation of control over budget aggregates to a responsible office with incentives to pursue broad interests (Gleich, 2003; von Hagen, 2002). This office can be the Minister of Finance or a similar entity that sets the initial ceilings on the total spending and deficit and is in a position to constrain changes to those levels in the approval and implementation process. Gleich (2003) develops the indexes summarize institutional characteristics of the budget processes which classifies the incentives to internalize the fiscal implications of their actions. The empirical results suggest that the design of budget processes has a strong impact on the average size of budget deficits and average public debt levels. It implies that the countries with high level of index are more tend to have less debt in Eastern and Central Europe. Hallerberg and Wolff (2008) investigate the effect of fiscal institutions such as the strength of the Finance minister in the budget process and deficits on interest spreads contained in bond yields of the countries now belonging to the Eurozone.

This “common pool” approach implicitly assumes that an economy can borrow as much as it wants. However in reality, governments cannot run budget deficits if they cannot borrow. An economy that generated overspending in a “tragedy-of-the-commons” is in need of financing it by issuing bonds. If the repayment of its sovereign obligations is in doubt, then this economy may face binding constraints in issuing bonds and cannot enjoy overspending as much as it may wish to.

The pioneering work of Eaton and Gersovitz (1981) related the issue of sovereign default with the reputation. If a country defaults on its debt, then this country will lose access to the capital markets. It makes a country unable to smooth the consumption path by issuing bonds and creates disutility from

repudiating obligations and provides incentives to repay its debt. Lenders set credit ceilings based on the perceived borrower's disutility and decide not to allow borrowing more than this limit. It provides a theoretical background of an endogenous debt ceiling and defaults. English (1996) investigates the default history of the U.S. states in the 1840's and finds that most states repaid their debts, in spite of a lack of sanctions. English claims that the states repaid to maintain access to capital markets, which again supports the reputational models of sovereign debt.

Cole and Kehoe (1996) model the sovereign debts as a self-fulfilling debt crisis. In their model, there is a crucial interval of debt for which the government, although finding it optimal to repay old debt if it can sell new debt, finds it better to default if it cannot sell new debt. If government debt is in this interval, which we call the crisis zone, then the default on existing debts depends on the realization of a stochastic sunspot variable.

Arellano (2008) analyzes the relationship between sovereign default and output fluctuation and finds that default is more likely in recessions because it is more costly for a risk averse borrower to repay debt. In the study, Arellano provides a model that has 3 intervals. If a country's bond level is in the safe zone, there is no default risk and this country can issue additional bonds without lowering the price of bonds. But above this level, the default risk increases as the country issues more bonds and the price of bonds falls. Finally, there is a certain level where the country cannot generate positive revenue by issuing additional bonds above this level.

Hallerberg and Wolff (2008) extend the sovereign defaults onto financial markets and connect the issue of credibility over repaying debt to budget institutions. They find that sovereign bond credit spreads rise as deficits increase because financial market players know that the persistent budget deficits will increase the default risk of sovereign debt. But such concerns can be mitigated by good fiscal institutions. Financial markets will affect less sensitively to the budget deficit of a country with good institutions because financial market players know that the budget deficits will not last longer.

However, the existing literature on budget institutions views that countries with stronger discipline mechanisms maintain lower spending and debt levels. But as we show in this study, this need not be the case when a government faces a binding credit constraint. In that situation, an increase in the ability of the government to ensure discipline may raise its credibility and borrowing limit, inducing a positive relationship between institutional capabilities and observed debt levels. This effect is particularly important in the case of developing countries and plays a central issue in the present study. Taking account of the interactions between institutions and borrowing constraints is critical to understanding the role of fiscal institutions in the developing world.

### 1.3 A Simple Model of Government Debt

#### 1.3.1 The Structure of the Model

Consider an economy with discrete times and infinite horizon that has three players: A representative household, international bankers, and a government.

*The household:* The representative household receives a fixed endowment,  $y$ , of a consumption good every period. For its survival, the household also needs government services that have a time-varying stochastic cost,  $g_t$ , with the cumulative distribution function  $F(g_t)$  and density function  $f(g_t)$  defined over the compact and bounded set  $G \subset \mathbb{R}_+$ . In each given period  $t$ , this cost may be covered through a contemporaneous tax,  $\tau_t$ , or through borrowing from international bankers. The household is risk averse and its utility in each period is a concave function of its after-tax endowment in that period,  $u(y - \tau_t)$ , where  $u' > 0$  and  $u'' < 0$ . The household maximizes its long-run utility,  $E_s \sum_{t=s}^{\infty} \beta^t u(y - \tau_t)$ , where  $E_s$  is the expectation operator in period  $s$  and  $\beta$  is the discount factor.

*International bankers:* There is a continuum of identical and risk neutral international bankers, each of whom wants to maximize its expected profits from bond purchases. The bankers discount factor is the same as that of the households,  $\beta$ . Given the price of government sold in period  $t$ ,  $q_t$ , bankers will be willing to buy bonds as long as  $\beta(1 - \delta_t) - q_t \geq 0$ , where  $\delta$  is the probability that the government defaults on its debt next period. The default probability may depend on the amount of bond sold on the market,  $B_t$ . Therefore, the bond price threshold above which bankers refuse to purchase government debt can be expressed as:

$$(1.1) \quad q(B_t) = \beta[1 - \delta(B_t)]$$

*The Government:* The government's preference may deviate from that of the household. In our model, government can borrow from the banker and these trades are based on bankers' trust that the government will repay its debts in future period. However, default implies that the government breaks the previous commitment and it will damage government reputation. We assumed, therefore, that the government gains implicit benefit,  $\alpha$ , by honoring debt. We will discuss the value function of government in detail in next section. The government finances its expenditure,  $g_t$ , by collecting taxes or by issuing bonds. Since there are many competing bankers who are willing to purchase government debt at  $q(B_t)$ , the government can realize this price on its bonds. Therefore, its budget constraint can be expressed as:

$$(1.2) \quad g_t = \tau_t + q(B_t)B_t - B_{t-1}$$

### 1.3.2 Recursive Equilibrium

The value function of the government in period  $t$  when it chooses to pay back its past debt and remain in the credit market is:

$$(1.3) \quad V^c(B_{t-1}, g_t, \alpha_t) = \max_{B_t} \{u(y - g_t + q(B_t)B_t - B_{t-1} + \alpha_t) + \beta E_t V^o(B_t, g_{t+1}, \alpha_{t+1})\}$$

where  $V^o(B_t, g_{t+1}, \alpha_t)$  is the government's maximum payoff in period  $t + 1$  if it has not defaulted in the past and  $\alpha_t$  is the implicit gains from honoring debt for example inflow of foreign investment, maintaining political stability and reputational gains in period  $t$ . If the government chooses to default and withdraw from the credit market forever, then its value function would be given by:

$$(1.4) \quad V^d(g_t) = u(y - g_t) + \beta E_t V^d(g_{t+1})$$

Note that

$$(1.5) \quad V^o(B_t, g_{t+1}, \alpha_t) = \max\{V^c(B_t, g_{t+1}, \alpha_t), V^d(g_{t+1})\}$$

To characterize the government's strategy, we first examine the feasible range of net borrowing,  $q(B_t)B_t - B_{t-1}$ , given the realization of government expenditure in period  $t$ ,  $g_t$ . To this end, we first define the default set,  $D(B_{t-1}, \alpha_t)$ , i.e., the set of expenditure realizations in period  $t$  for which default occurs given the initial debt in period  $t$ ,  $B_{t-1}$ :

$$(1.6) \quad D(B_{t-1}, \alpha_t) = \{g_t \in G : V^c(B_{t-1}, g_t, \alpha_t) < V^d(g_t)\}$$

The following proposition shows that if  $g_t$  is in this set (i.e., the government prefers to default), then there is no feasible borrowing that the nets benefits from borrowing is positive. i.e.,  $q(B_t)B_t - B_{t-1} + \alpha_t \leq 0$ . This result, though rather trivial, is helpful in proofs of other propositions.

**Proposition 1:** If  $D(B_{t-1}, \alpha_t) \neq \emptyset$  and the realization of government expenditure in period  $t$  is  $g_t \in D(B_{t-1}, \alpha_t)$ , then there is no  $B_t$  for which  $q(B_t)B_t - B_{t-1} + \alpha_t > 0$

**Proof.** We prove this proposition by way of contradiction. Suppose there exists a  $B_t$  for which  $q(B_t)B_t - B_{t-1} + \alpha_t > 0$  Then,

$$(1.7) \quad u(y - g_t + q(B_t)B_t - B_{t-1} + \alpha_t) > u(y - g_t)$$

Since  $V^o(B_t, g_{t+1}, \alpha_{t+1}) \geq V^d(g_{t+1})$ , then adding the two inequalities, for this given  $B_t$  we must have:

$$(1.8) \quad u(y - g_t + q(B_t)B_t - B_{t-1} + \alpha_t) + \beta E_t V^o(B_t, g_{t+1}, \alpha_{t+1}) > u(y - g_t) + \beta E_t V^d(g_{t+1})$$

which suggests that there is a  $B_t$  such that  $V^c(B_t, g_t, \alpha_t) > V^d(g_t)$ , thus contradicting the assumption that  $g_t \in D(B_{t-1}, \alpha_t)$ . ■

In our next step, we show that the government always chooses to default in period  $t$  if the realization of expenditure is above some threshold,  $\bar{g}(B_{t-1})$ , and honors its debt otherwise.

**Proposition 2:** If  $D(B_{t-1}, \alpha_t) \neq \emptyset$  and  $\bar{g}_t \in D(B_{t-1}, \alpha_t)$ , then  $g_t \in D(B_{t-1}, \alpha_t)$  for all  $g_t > \bar{g}_t$ .

**Proof.** Let  $\bar{B}^* = \operatorname{argmax}_{B_t} \{u(y - \bar{g}_t + q(B_t)B_t - B_{t-1} + \alpha_t) + \beta E_t V^o(B_t, g_{t+1})\}$  and let  $B^*$  be similarly defined for  $g_t$ . If  $\bar{g}_t \in D(B_{t-1}, \alpha_t)$ , then

$$(1.9) \quad u(y - \bar{g}_t) + \beta E_t V^d(g_{t+1}) > u(y - \bar{g}_t + q(\bar{B}^*)\bar{B}^* - B_{t-1} + \alpha_t) + \beta E_t V^o(\bar{B}^*, g_{t+1}, \alpha_{t+1})$$

Now if we show that

$$(1.10) \quad u(y - \bar{g}_t + q(\bar{B}^*)\bar{B}^* - B_{t-1} + \alpha_t) + \beta E_t V^o(\bar{B}^*, g_{t+1}, \alpha_{t+1}) - \{u(y - g_t + q(B^*)B^* - B_{t-1} + \alpha_t) + \beta E_t V^o(B^*, g_{t+1}, \alpha_{t+1})\} > u(y - \bar{g}_t) + \beta E_t V^d(g_{t+1}) - \{u(y - g_t) + \beta E_t V^d(g_{t+1})\}$$

then summing up (1.9) and (1.10) yields an inequality that implies  $g_t \in D(B_{t-1}, \alpha_t)$ , thus prove the proposition. To show (1.10), we rearrange its terms to get

$$(1.11) \quad u(y - \bar{g}_t + q(\bar{B}^*)\bar{B}^* - B_{t-1} + \alpha_t) + \beta E_t V^o(\bar{B}^*, g_{t+1}, \alpha_{t+1}) - \{u(y - g_t + q(B^*)B^* - B_{t-1} + \alpha_t) + \beta E_t V^o(B^*, g_{t+1}, \alpha_{t+1})\} > u(y - \bar{g}_t) - u(y - g_t)$$

Since  $\bar{B}^*$  is the optimal choice under  $(B_{t-1}, \bar{g}_t, \alpha_t)$ ,

$$(1.12) \quad u(y - \bar{g}_t + q(\bar{B}^*)\bar{B}^* - B_{t-1} + \alpha_t) + \beta E_t V^o(\bar{B}^*, g_{t+1}, \alpha_t) \\ \geq u(y - \bar{g}_t + q(B^*)B^* - B_{t-1} + \alpha_t) + \beta E_t V^o(B^*, g_{t+1}, \alpha_{t+1})$$

Therefore if

$$(1.13) \quad u(y - \bar{g}_t + q(B^*)B^* - B_{t-1} + \alpha_t) + \beta E_t V^o(B^*, g_{t+1}, \alpha_{t+1}) - \\ \{u(y - g_t + q(B^*)B^* - B_{t-1} + \alpha_t) + \beta E_t V^o(B^*, g_{t+1}, \alpha_{t+1})\} > u(y - \bar{g}_t) - u(y - g_t)$$

holds, then through transitivity, we can find that equation (1.11) holds. By rearranging the terms in (1.13) we get

$$(1.14) \quad u(y - \bar{g}_t + q(B^*)B^* - B_{t-1} + \alpha_t) - u(y - g_t + q(B^*)B^* - B_{t-1} + \alpha_t) > u(y - \bar{g}_t) - u(y - g_t)$$

Since  $\bar{g}_t \in D(B_{t-1}, \alpha_t)$ , Proposition 1 implies that  $q(B^*)B^* - B_{t-1} + \alpha_t < 0$  for all available  $\{B^*, q(B^*)\}$ . Considering that the utility function is strictly concave, (1.14) must hold, which in turn implies that (1.10) must hold. Thus, if  $\bar{g}_t \in D(B_{t-1}, \alpha_t)$ , then  $g_t \in D(B_{t-1}, \alpha_t)$  for all  $g_t > \bar{g}_t$ . ■

Default probability in period  $t + 1$ ,  $\delta(B_t)$ , can be expressed by using a set of government expenditures where default,  $D(B_t, h)$ , is preferred given bond level.

$$(1.15) \quad \delta(B_t) = \int_{D(B_t, \alpha_{t+1})} f(g_{t+1}) dg$$

In (1.15), we assumed the Markov transition of government expenditure. Since default happens when government expenditure shock,  $g_{t+1}$ , is bigger than a threshold,  $\bar{g}$ , Default probability  $\delta(B_t, \alpha_{t+1})$  can also be written:

$$(1.16) \quad \delta(B_t, \alpha_{t+1}) = \int_{D(B_t, \alpha_{t+1})} f(g_{t+1}) dg = 1 - F(\bar{g}(B_t, \alpha_{t+1}))$$

In the following proposition, we show that the default set in each period is non-contracting in the initial bond level. In other words, if it is optimal for the government to default with a small amount of inherited debt, then default is also the optimal strategy with all larger debt levels.

**Proposition 3:** If default is optimal for  $B^1$  in some realization of  $g_{t+1}$ , then default is also optimal for  $B^2$  for the same  $g_{t+1}$  for all  $B^1 \leq B^2$ .

**Proof :**  $g_{t+1} \in D(B^1, \alpha_{t+1})$  implies that

$$(1.17) \quad u(y - g_{t+1}) + \beta E_{t+1} V^d(g_{t+2}) \geq u(y - g_{t+1} + q(B_{t+1})B_{t+1} - B^1 + \alpha_{t+1}) + \beta E_{t+1} V^o(B_{t+1}, g_{t+2}, \alpha_{t+2})$$

Since  $B^1 \leq B^2$ , the right-hand side of this inequality must be greater than  $u(y - g_{t+1} + q(B_{t+1})B_{t+1} - B^2 + \alpha_{t+1})$ . Then, by transitivity,

$$(1.18) \quad u(y - g_{t+1}) + \beta E_{t+1} V^d(g_{t+2}) \geq u(y - g_{t+1} + q(B_{t+1})B_{t+1} - B^2 + \alpha_{t+1}) + \beta E_{t+1} V^o(B_{t+1}, g_{t+2}, \alpha_{t+2})$$

Hence  $g_{t+1} \in D(B^2, \alpha_{t+1})$ . ■

Now, we will show that the default set in each period is non-increasing in the indirect benefits from honoring contract.

**Proposition 4:** If default is optimal for  $\alpha_{t+1}^1$  in some realization of  $g_{t+1}$ , then default is also optimal for  $\alpha_{t+1}^2$  for the same  $g_{t+1}$  for all  $\alpha_{t+1}^2 \leq \alpha_{t+1}^1$ .

**Proof :**  $g_{t+1} \in D(B_t, \alpha_{t+1}^1)$  implies that

$$(1.19) \quad u(y - g_{t+1}) + \beta E_{t+1} V^d(g_{t+2}) \\ \geq u(y - g_{t+1} + q(B_{t+1})B_{t+1} - B_t + \alpha_{t+1}^1) + \beta E_{t+1} V^o(B_{t+1}, g_{t+2}, \alpha_{t+2})$$

Since  $\alpha_{t+1}^2 \leq \alpha_{t+1}^1$ , the right-hand side of this inequality must be larger than  $u(y - g_{t+1} + q(B_{t+1})B_{t+1} - B_t + \alpha_{t+1}^2) + \beta E_{t+1} V^o(B_{t+1}, g_{t+2}, \alpha_{t+2})$ . Then, by transitivity,

$$(1.20) \quad u(y - g_{t+1}) + \beta E_{t+1} V^d(g_{t+2}) \\ \geq u(y - g_{t+1} + q(B_{t+1})B_{t+1} - B_t + \alpha_{t+1}^2) + \beta E_{t+1} V^o(B_{t+1}, g_{t+2}, \alpha_{t+2})$$

Hence  $g_{t+1} \in D(B_t, \alpha_{t+1}^2)$ . ■

Using the properties of default set, we can characterize the bond level as default risk changes. First, there is a level of bond,  $\underline{B}(\alpha_{t+1}) \geq 0$ , at which the default set is empty. i.e., whatever the realization of expenditure,  $g_{t+1}$ , is, the government will not choose to default in period  $t + 1$ . Note that if  $G$  includes sufficiently large expenditure levels, we may have  $\underline{B}(\alpha_{t+1}) = 0$ . Also, there exists a bond level,  $\overline{B}(\alpha_{t+1})$ , at which the government always prefers to default in period  $t + 1$  regardless of  $g_{t+1}$ .

$$(1.21) \quad \underline{B}(\alpha_{t+1}) = \sup\{B_t : D(B_t, \alpha_{t+1}) = \emptyset\}$$

$$(1.22) \quad \overline{B}(\alpha_{t+1}) = \inf\{B_t : D(B_t, \alpha_{t+1}) = G\}$$

Proposition 3 implies that if  $B_t \leq \underline{B}(\alpha_{t+1})$ , then there is no risk of default in period  $t + 1$  and the government should be able to issue  $B_t$  at price  $\beta$  in period  $t$ . If  $\underline{B}(\alpha_{t+1}) < B_t \leq \overline{B}(\alpha_{t+1})$ , then a default might happen in period  $t + 1$  for some  $g_{t+1}$ . Considering that the price of bonds issued in period  $t$  is  $\beta[1 - \delta(B_t, \alpha_{t+1})]$  and  $\delta(B_t)$  is increasing in  $B_t$ , the government should be able to issue  $B_t$  at the price of  $\beta[1 - \delta(B_t)] < \beta$ , which is decreasing in  $B_t$ . The definition of  $\overline{B}(\alpha_{t+1})$  in (1.22) implies that the government cannot issue new bonds more than or equal to  $\overline{B}(\alpha_{t+1})$  in period  $t$ . Even though the government wishes to issue some  $B_t \geq \overline{B}(\alpha_{t+1})$ , bankers know that the government will not pay these bonds back and will default in period  $t + 1$ . Therefore, they do not buy the government bonds in period  $t$

at any positive price. Proposition 4 below shows that the maximum amount of riskless bond issue,  $\underline{B}(\alpha_{t+1})$ , and the bond purchase ceiling,  $\overline{B}(\alpha_{t+1})$ , are both increasing in benefit from honoring debt,  $\alpha$ .

**Proposition 4:**  $\underline{B}(\alpha_{t+1})$  and  $\overline{B}(\alpha_{t+1})$  are both increasing in  $\alpha_{t+1}$ .

**Proof :** From Proposition 3, we know that the government with higher gains from keeping contract,  $\alpha_{t+1}^H$ , has lower probability of default in  $t + 1$  than the government with low gains,  $\alpha_{t+1}^L$ . Since realization of expenditure,  $g_{t+1}$ , is independent of  $\alpha_{t+1}$ , decreasing  $\delta(B_t, \alpha_{t+1})$  with respect to  $\alpha_{t+1}$  implies that default set,  $D(B_t, \alpha_{t+1})$ , is also decreasing in  $\alpha_{t+1}$ . Therefore

$$(1.23) \quad D(B_t, \alpha_{t+1}^H) \subset D(B_t, \alpha_{t+1}^L).$$

Assume that for certain bond level  $\underline{B}(\alpha_{t+1}^L)$ , default set is empty for the country with low gains from keeping contract. i.e.,  $D(\underline{B}(\alpha_{t+1}^L), \alpha_{t+1}^L) = \emptyset$ . Then by (1.23), it is also optimal for high credibility country to pay the bond back. i.e.,  $D(\underline{B}(\alpha_{t+1}^L), \alpha_{t+1}^H) = \emptyset$ .

Also, assume that for certain bond level  $\overline{B}(\alpha_{t+1}^H)$ , it is optimal for the high credibility government to default always in period  $t + 1$ . i.e.,  $D(\overline{B}(\alpha_{t+1}^H), \alpha_{t+1}^H) = G$ . Then, again by (1.23), it is also optimal for low credibility government to default. i.e.,  $D(\overline{B}(\alpha_{t+1}^H), \alpha_{t+1}^L) = G$ . ■

Figure 1.1 summarizes the finding from previous propositions. Figure 1.1 illustrates that the revenue curve from issuing bond,  $q(B_t)B_t$ , extends to the right hand side as credibility goes up. Regarding the shape of the curve, bond price  $q(B_t)$  is  $\beta$  until  $B_t$  reaches  $\underline{B}(h)$ . Therefore,  $q(B_t)B_t$  is increasing and has a slope  $\beta$  up to  $\underline{B}(\alpha_{t+1})$ . If  $\underline{B}(\alpha_{t+1}) < B_t < \overline{B}(\alpha_{t+1})$ , then  $q(B_t)$  is decreasing in  $B_t$  and  $q(B_t)B_t$  will have an inverse U shape. Define  $\hat{B}_t(\alpha_{t+1})$  be the bond issued in period  $t$  such that maximizes  $q(B_t)B_t$ . It is easy to verify that  $\hat{B}_t(\alpha_{t+1})$  satisfies:

$$(1.24) \quad \hat{B}_t(\alpha_{t+1}) = -\frac{q(B_t)}{\frac{\partial q(B_t)}{\partial B_t}}$$

Then, Risky borrowing region is between  $\underline{B}(\alpha_{t+1})$  and  $\hat{B}_t(\alpha_{t+1})$  because the government will not choose to issue bonds above  $\hat{B}_t(\alpha_{t+1})$ .

### 1.3.3 Optimal policy

In this section, we will derive the optimal bond issue in period  $t$ ,  $B_t$ , of government. In previous chapter, we showed that if default cost increases, the borrowing limit of the government increases. It can be

interpreted as the expansion of government budget set. However, is this constraint really binds? In other words, will the government issues bonds up to its ceiling? To examine this, we need to characterize the optimal behavior of the government.

First, consider the case where the government issues bond in no default region. i.e., optimal bond issue in period  $t$ ,  $B_t^*(\alpha_{t+1}) \in [0, \underline{B}(\alpha_{t+1})]$ . In this region, price of bond,  $q(B_t)$ , is indifferent of  $B_t$ . Then it is easy to verify that the government issues the maximum amount of bond that can be issued without default risk. i.e., the government issues bond up to  $\underline{B}(\alpha_{t+1})$ . This outcome is quite intuitive. Since there is no cost of issuing additional bond such as increasing default risk or bond price falling, the government has an incentive to issue bond up to  $\underline{B}(\alpha_{t+1})$ .

Next, consider the case where the government issues bond between  $\underline{B}(\alpha_{t+1})$  and  $\bar{B}(\alpha_{t+1})$ . In this case, we find that the government with high default cost will issue less government bond.

**Proposition 5:** Optimal bond issue in period  $t$ ,  $B_t^*$ , is decrease in contract credibility  $\alpha_{t+1}$ .

$$(1.25) \quad V^c(B_{t-1}, g_t, \alpha_t) = \max_{B_t} \{u(y - g_t + q(B_t)B_t - B_{t-1} + \alpha_t) + \beta E_t V^o(B_t, g_{t+1}, \alpha_{t+1})\}$$

**Proof :** The government chooses  $B_t$  such that maximize (1.25). From FOC condition,  $\frac{\partial V^c(B_{t-1}, g_t, h)}{\partial B_t} = 0$ , we get

$$(1.26) \quad \frac{\partial u(y - \tau_t + \alpha_t)}{\partial (y - \tau_t + \alpha_t)} \frac{\partial (y - g_t + q(B_t)B_t - B_{t-1} + \alpha_t)}{\partial B_t} + \beta E_t \frac{\partial V^o(B_t, g_{t+1}, \alpha_{t+1})}{\partial B_t} = 0$$

By expanding (1.26),

$$(1.27) \quad \frac{\partial u(y - \tau_t + \alpha_t)}{\partial (y - \tau_t + \alpha_t)} \left\{ \frac{\partial q_t(B_t)}{\partial B_t} B_t + q_t(B_t) \right\} \\ + \beta E_t \left[ F(\bar{g}(B_t, \alpha_{t+1})) \frac{\partial V^c(B_t, g_{t+1}, \alpha_{t+1})}{\partial B_t} + \frac{\partial F(\bar{g}(B_t, \alpha_{t+1}))}{\partial B_t} V^c(B_t, g_{t+1}, \alpha_{t+1}) \right] \\ + \beta E_t \left[ (1 - F(\bar{g}(B_t, \alpha_{t+1}))) \frac{\partial V^d(g_{t+1})}{\partial B_t} + \frac{\partial (1 - F(\bar{g}(B_t, \alpha_{t+1})))}{\partial B_t} V^d(g_{t+1}) \right] = 0$$

Since  $V^d(g_{t+1})$  is independent of maturing bonds,  $B_t$ , in period  $t + 1$ ,  $\frac{\partial V^d(g_{t+1}, \alpha_{t+1})}{\partial B_t} = 0$ . Using envelope condition,  $\frac{\partial V^c(B_t, g_{t+1}, \alpha_{t+1})}{\partial B_t} = - \frac{\partial u(y - g_{t+1} + q(B_{t+1})B_{t+1} - B_t + \alpha_t)}{\partial (y - \tau_{t+1})}$ . Now rewrite (1.27),

then we get

$$(1.28) \quad \frac{\partial u(y - \tau_t + \alpha_t)}{\partial (y - \tau_t + \alpha_t)} \left\{ \frac{\partial q_t(B_t)}{\partial B_t} B_t + q_t(B_t) \right\}$$

$$\begin{aligned}
& + \beta E_t \left[ -F(\bar{g}(B_t, \alpha_{t+1})) \frac{\partial u(y-\tau_{t+1}+\alpha_t)}{\partial (y-\tau_{t+1}+\alpha_t)} + f(\bar{g}(B_t, h)) \frac{\partial \bar{g}(B_t, \alpha_{t+1})}{\partial B_t} V^c(B_t, g_{t+1}, \alpha_{t+1}) \right] \\
& + \beta E_t \left[ -f(\bar{g}(B_t, \alpha_{t+1})) \frac{\partial \bar{g}(B_t, \alpha_{t+1})}{\partial B_t} V^d(g_{t+1}) \right] = 0
\end{aligned}$$

Again rearranging (1.28), we get

$$\begin{aligned}
(1.29) \quad & \frac{\partial u(y-\tau_t+\alpha_t)}{\partial (y-\tau_t+\alpha_t)} \left\{ \frac{\partial q_t(B_t)}{\partial B_t} B_t + q_t(B_t) \right\} \\
& = \beta E_t \left[ F(\bar{g}(B_t, \alpha_{t+1})) \frac{\partial u(y-\tau_{t+1}+\alpha_t)}{\partial (y-\tau_{t+1}+\alpha_t)} - f(\bar{g}(B_t, \alpha_{t+1})) \frac{\partial \bar{g}(B_t, \alpha_{t+1})}{\partial B_t} \{V^c(\cdot, \alpha_{t+1}) - V^d(\cdot)\} \right]
\end{aligned}$$

Finally optimal  $B_t^*$  is

$$(1.30) \quad B_t^* = -\frac{q(B_t)}{\frac{\partial q(B_t)}{\partial B_t}} + \frac{\beta}{\frac{\partial q(B_t)}{\partial B_t} \frac{\partial u(y-\tau_t+\alpha_t)}{\partial (y-\tau_t+\alpha_t)}} E_t \left[ F(\bar{g}) \frac{\partial u(y-\tau_{t+1})}{\partial (y-\tau_{t+1})} - f(\bar{g}) \frac{\partial \bar{g}(B_t, \alpha_{t+1})}{\partial B_t} \{V^c(\cdot, \alpha_{t+1}) - V^d(\cdot)\} \right]$$

We know that price of bond is decreasing in  $B_t$ . i.e.,  $\frac{\partial q(B_t)}{\partial B_t} < 0$  and threshold  $\bar{g}$  is decreasing in  $B_t$ . i.e.,  $\frac{\partial \bar{g}(B_t, h)}{\partial B_t} < 0$ . It implies as the difference between  $V^c(\cdot, \alpha_{t+1})$  and  $V^d(\cdot)$  increases, optimal bond issue in period  $t$ ,  $B_t^*$ , decreases. Also, note that  $V^c(\cdot, \alpha_{t+1}) - V^d(\cdot)$  is larger when  $\alpha_{t+1}$  increases. Therefore, the government with higher credibility,  $\alpha_{t+1}$ , issue less bond,  $B_t^*$ . ■

## 1.4 Empirical Data and Estimation

### 1.4.1 Overview of the Data

In this section, we present a general description regarding government debt-GDP ratio in different credibility groups. Standard and Poor's (S&P), the bond rating company, provides country ratings for international investors in 21 categories from AAA to D and update country ratings when major credit events happen. This index is the country's ability to pay its existing debts and can be understood as a broad measure of credibility. We observe the debt to GDP ratio in 5 different levels of S&P credit ratings.

It is easy to find that the debt level shows a "U shape curve". We can summarize the table in the following way: both most credible and least credible groups have a large level of debt to GDP but moderate credit groups (Single A and Double B countries) have a relatively low level of debt. The interpretation is quite interesting. The advanced countries can issue higher levels of debt because these countries have higher credibility and their debt ceilings are higher than other countries. For the low credibility group, their debts are increasing in a steep way. It can be inferred from our theory that these

countries reach close to their debt ceilings and some countries may fall into the default zone. But for the countries with moderate credibility, debt levels are contained at a low level though they have relatively better credibility. It implies that institutional features in those developing countries deter the requests for increases in debt issuance from political pressures though they have higher debt ceilings compared to the low credibility group. Later in this study, we will see how the institutional features affect the debt levels of developing countries. Taking account of the interactions between institutions and borrowing constraints is critical to understanding the role of fiscal institutions in the developing world.

#### **1.4.2 Data Set and Key Variables**

This section describes the variables and the details of the empirical methodology. For empirical assessment, we build a country panel dataset during 1980 and 2010 for 60 developed and developing countries. The limit on the number of countries and observations is set by the availability of consistent data for the relevant variables, particularly information on fiscal performance. Data are obtained from *World Economic Outlook* (WEO), IMF<sup>1</sup> and the main measure of public debt used in this study, the government debt as a percentage of GDP.

For measuring credibility, I use the survey-based "contract viability" and "contract repudiation" indices available from the *International Country Risk Guide* (ICRG) dataset (see Knack and Keefer, 1995). These indices measure the 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. Our hypothesis is that the *contract reliability* is *positively* related to  $b_i$ . In other words, the government faces a loose credit constraint and can have access to credit markets easily if its credibility increases. Figure 1.2 graphs the data for the contract credibility index against debt to GDP rate and it shows the positive relationship between them.

The measurement of the discipline index requires a more detailed discussion because there is no single source with a consistent indicator covering a large number of countries. To ensure that the regressions are based on data with sufficient cross-country variation, I use the common denominator of all

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<sup>1</sup> After IMF's revision of its fiscal statistics reporting manual (Government Finance Statistics Manual, GFSM) from the cash-system to a format consistent with an accrual-basis (GFSM2001) in 2001, only a few member countries report their fiscal statistics according to GFSM2001. Many countries have stopped reporting their liabilities data to IMF and it leads to many missing values in debt statistics in GFS. Because of this missing value issue, we used the government statistics from World Economic Outlook which are basically estimates of IMF staffs.

available regional data on budget institutions to construct a common index for them. These studies and their regional focuses are as follows:

Central and Eastern Europe - Gleich (2003).

Western Europe - Hallerberg, Strauch, and von Hagen (2001).

Latin America - Alesina et al. (1999).

Middle East and North Africa - Esfahani (2001).

South and East Asia - Lao-Araya (1998).

Among these studies, the budget institutions index developed by Alesina et al. (1999) is based on the least amount of information, while the indices constructed by Esfahani (2001) and Hallerberg, Strauch, and von Hagen (2001) are the most data intensive. Lao-Araya (1998) and Gleich (2003) use simpler versions of the latter study's index. For building a broad cross-country index, I adopt the methodology of Alesina et al. (1999) and apply it to the countries covered by the other four studies. For some of these countries, the data provided by the studies needed to be supplemented by examining other sources, which was done by consulting the relevant IMF, World Bank, and other publications. This approach ensured the largest set of countries in the database. The more detailed methods adopted in the other studies yield indices that incorporate more information about fiscal policy institutions. However, the Alesina et al. method captures important elements of the information covered by all other studies; hence the rationale for adopting it.

The Alesina et al. method consists of ranking the answers to 10 questions, as presented in Appendix. The rankings of answers are reflected in the scores listed in the table, with higher scores reflecting greater opportunity for fiscal discipline.<sup>2</sup> Questions 1, 2, 3, 7 and 8 pertain to issues regarding "borrowing constraint." The first three questions ask about the existence of constitutional constraints on the deficit, the importance of a macroeconomic plan as a constraint to the budget process, and the existence of borrowing constraints on the central government. Questions 7 and 8 relate to whether the deficit constraints are binding *ex ante* or *ex post*. The average of the scores for these five questions yields a "borrowing constraint sub-index." Questions 4, 5 and 6 highlight "agenda setting" powers of the finance minister (or whichever office is responsible for the overall budget design). Question 4 deals with the role of the finance minister within the government in the budget design stage. Questions 5 and 6 capture the relative position of the government vis-à-vis the legislature in the approval stage. The average score for these three questions

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<sup>2</sup> In Alesina et al. (1999), the scores range from 0 to 10. Here, I have scaled the range from 0 to 1. The purpose of rescaling is to avoid the regression coefficients that are very small and require many digits after the decimal point.

forms the "agenda setting sub-index." Questions 9 and 10 are concerned with whether or not the budget of the central government can be subverted and "contaminated" by the borrowing practices of other public agencies. The less the central government has control, and the more other agencies can influence the budget balance, the less meaningful is the government's budget plan. The average of the scores for these two questions yields an "*ex post* control sub-index." Finally, to construct an overall "fiscal discipline index," we calculate the average of the three sub-indices. Note that all these indices range from 0 to 1, with higher values representing a greater ability to ensure discipline.

The index of fiscal discipline thus constructed yields data for 69 countries.<sup>3</sup> For most countries, the assessment of fiscal institutions is available for only one point in time. We use such observations for all years in our panel data because fiscal institutions do not change very often. We dot graphed the relationship between fiscal discipline and public debt in Figure 1.3 The scatter diagram shows that fiscal discipline is positively correlated to public debt and the dispersion of public debt becomes large where the countries have moderate fiscal discipline.

Figure 1.4 graphs the data for the *fiscal discipline index* against the *contract reliability index* during the 2000s decade. Graphically observing the relationship between two indexes in the overall region, we cannot see a clear positive correlation. However, the distribution shows quite different results when we look at the data of each region separately. In the Latin America and East, South-East Asia regions, there is a positive correlation between *contract reliability* and *fiscal discipline*. However, we cannot see a clear relationship between Europe and Middle East Asia. In those regions, there is a wide variance of fiscal discipline even though contract credibility is generally the same. Therefore, it seems natural to think how this variance affects fiscal outcomes. Once a country reaches a sufficiently high level of credibility, stronger fiscal institutions induce the government to borrow less. We can expect that the interaction term of budget institution and credibility has a negative sign.

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<sup>3</sup> These countries are: Algeria, Argentina, Austria, Bahamas, Bangladesh, Belgium, Bolivia, Brazil, Bulgaria, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Finland, France, Germany, Greece, Guatemala, Honduras, Hungary, India, Indonesia, Iran, Ireland, Italy, Jamaica, Jordan, Korea, Rep., Kuwait, Latvia, Lebanon, Lithuania, Luxembourg, Malaysia, Mexico, Morocco, Nepal, Netherlands, New Zealand, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Singapore, Slovak Republic, Slovenia, Spain, Sri Lanka, Sweden, Thailand, Trinidad and Tobago, Tunisia, Turkey, UAE, United Kingdom, USA, Uruguay, Venezuela, and Yemen.

### 1.4.3 Other Explanatory Variables

In the empirical work presented here, we use a typical set of variables to control for effects that are not (or should not) be captured by the variables representing *Credibility* and *Fiscal Discipline*. This set consists of the devaluation of currency, interest rate, unemployment rate, legislative effectiveness, rule of law, openness, demographic composition, ethno-linguistic fractionalization and history of banking sector crisis.

*Fluctuation of foreign exchange rate* affects the value of foreign currency denoted borrowing in terms of local currency. For example, currency depreciation increases the value of foreign currency borrowing and it leads to the increase in deficit in local currency. Annual exchange rate data are obtained from *Penn World Table*.

*Interest rate* debt servicing costs may affect the deficit but its net impact is not clear *a priori*. An increase in interest rate raise the borrowing cost and the country may want to borrow less during this period. It may work as a factor that decreases the deficit. However, in the case of refinancing the existing debt by issuing new bonds, the government needs to borrow regardless of interest rate and it leads to a larger deficit during a high interest period. Hallerberg et al. (2007) examine the development of fiscal rules and budget procedures in EU countries and find that the interest rate is positively correlated to the level of debt. For our regression, we use the real interest rate data from *World Development Indicator (WDI)*.

*Unemployment rate* that reflects the economic situation of a country is also a potential determinant of budget deficit. In general, a higher unemployment rate is expected to result in larger deficits because the government makes counter-cyclical fiscal policies during economic recession. *Unemployment rate* data is taken from *WDI*.

We consider the political system of a country. One can expect that the well-developed checks and balances system between executive and the legislative body boosts up the cost of arranging hidden debt and eventually decreases hidden debt. *Legislative effectiveness* available from *Cross-National Time-Series Data Archive (CNTS)* by Arthur S. Banks has been employed to measure this institutional feature. This index takes a value between 0 and 3. A score of 0 implies that no legislature exists. A score of 1 refers to an ineffective legislative body. A score of 2 means a partially effective legislature. In other words, the executive's effectiveness substantially outweighs, but does not completely dominate that of the legislature. A score of 3 implies that the legislative body is fully effective and has substantial autonomy in taxation

and disbursement. Higher level of legislative effectiveness leads to strong checks and we can expect that *Legislative effectiveness* is negatively related to public debt.

*Rule of law* variables provided by *ICRG* may affect the fiscal output as well. The rule of law measures the impartiality of the legal system and the observance of the law of a country. The scores range from 0 to 6, and higher scores indicate better institutions.

We get *openness* index from *Pen World Table*. *Openness* is obtained by dividing the sum of exports and imports by current gross domestic product. Greater openness is likely to increase the demand for expenditures on social insurance of the households exposed to risk (Rodrik, 1998).

It is also believed that ethnic, linguistic, and religious heterogeneity lead to political instability and poor economic performance. In a cross-country setting, Easterly and Levine (1997) have shown that per capita GDP growth is inversely related to ethno-linguistic fractionalization in a large sample of countries. Alesina et al. (2003) develop the previous measures of ethnic, linguistic and religious fractionalization and construct more comprehensive measures of about 190 countries. They use the following formula to compute fractionalization:

$$(1.31) \quad \text{Frac}_j = 1 - \sum_{i=1}^N S_{ij}^2$$

where  $S_{ij}$  is the share of group  $i$  ( $i = 1 \dots N$ ) in country  $j$ . Therefore, it ranges from zero to one and a higher value implies that the country is more ethno-linguistically fractionalized. Though heterogeneity is believed to hamper coordination and make it difficult to implement efficient policies, its effect can be quite complex in the case of public debt policies. One reason is that while the lack of coordination may raise the demand for borrowing, credibility may also suffer and the supply of funds may not be forthcoming. Another complication is that heterogeneity may have different roles in different environments. For example, it may enhance the competitiveness of the political and economic system in democracies, while leading to greater exclusiveness under dictatorships.

The *Banking Sector Crisis* has been added to control the sudden changes in government spending. Laeven and Valencia (2012) construct the database that includes all banking crises dates and costs, and policy responses during 1970-2010. Based on this, we create a dummy that is equal to 1 if the country is under a banking crisis. Crisis in the banking sector also contributes to stock-flow adjustments (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 as a banking crisis. Laeven and Valencia (2008) show that a trembling banking sector leads to output losses and increases the role of government

during financial crisis in response to significant losses in the banking systems that, after all, increase the liabilities of government.

We also added variables for measuring demographic composition. *The share of population above 65 years out of total population* may correlate with fiscal policy (Persson and Tabellini, 2004). A society with a larger elderly group may increase its public spending for welfare programs and it leads to an increase in public debt. The share of population above 65 years used here is available from *WDI*.

There may be many other possible determinants of public debt. Some such variables have been used in the empirical literature on public debt, though the theoretical foundations for experiments have not been developed. I also experimented with several indicators of this type. But no significant result emerged and, therefore, I will not dwell on them in the rest of this study.

We experimented with the GDP growth rate as a potential determinant of supply and demand for borrowing. In particular, one may expect faster growing countries have both greater credibility and greater demand for borrowing and, thus, end up running higher debt-GDP ratios.

Corruption level of a country may also affect fiscal outcome. Tanzi and Davoodi (1997) address the possibility that corruption is likely to increase the number of projects undertaken in a country, and to change the design of these projects by enlarging their sizes and complexity. Some recent analyses show that the presence of corruption can cause significant government borrowing and lead to larger public debt (Grechyna, 2011). To measure the corruption level of a country, we use *corruption* index from *International Country Risk Guide* (ICRG). This index assesses the corruption level within the political system, and ranges from 0 to 6. The higher scores indicate a lower corruption level. Our empirical finding shows that this index is negatively correlated with public debt. In other words, the countries with low corruption level are likely to be lower in debt level and corruption increases the public debt.

The *Database of Political Institutions* (DBPI) consists of various data and ranks on political and bureaucratic characteristics of most countries in the world. District magnitude and government orientation index are from this dataset. *District magnitude* is the average number of representatives elected per electoral district. If the legislature is composed of lower and upper houses, our measure is the average of the two houses weighted by the numbers of each house's seats. In case no competitive election for the legislature exists, we give the value of zero to this variable. It is because the information we want to obtain from district magnitude is the probability of one-party majority government. As discussed above, this probability gets higher as district magnitude decreases. Since one-party majority government is always guaranteed in case no competitive election exists, we give a number less than one for the completeness of

our dataset. *Government orientation* has a value of 1 if the chief executive is from a conservative or right-wing party, and -1 if from a liberal or left-wing party. For the definitions of conservative and liberal party, we use the ones given by DBPI. The value of zero is given when the leader is a centrist or no specific information is available from DBPI.

From the Polity IV database, we obtain *democracy score* that ranges from zero to 10. Higher scores imply that the country has more democratic polity. By including this variable, it takes account of the direct roles democracy may play in facilitating or impeding fiscal discipline.

We also acquire plurality system dummy, margin of majority, legislative and executive indices of electoral competitiveness from DBPI. *Plurality system dummy* has a value of 1 if legislators are elected by a winner-take-all or first-past-the-post rule, as opposed to the system that parties get seats based on the percentage of votes they receive in the election (proportional representation system). In case both a plurality system and proportional representative system are used, we set plurality system dummy as one if the majority or all of the lower house seats are determined by a plurality system. Since this dummy variable gives similar information to that of district magnitude, either one of these two variables is used in actual regressions. *Margin of majority* measures the degree of a ruling party's control in the legislature. It is defined as the fraction of seats in the legislature occupied by the ruling party. Finally, *legislative and executive indices of electoral competitiveness* measure how competitive are the legislative or executive elections. Both indices have values from 1 to 7. If the election is more competitive or more democratic, they have higher values. For example, legislative index of electoral competitiveness is 7 if multiple parties won seats in the legislative election and neither of the parties won more than 75% of the seats.

We also test the significance of the *party fractionalization index*, which describes the composition of political parties in the legislature. The formula for this index is as follows:

$$(1.32) \quad \text{Party fractionalization index} = 1 - \sum s_i^2$$

where  $s_i$  is the proportion of members associated with the  $i^{\text{th}}$  party in the lower house of legislature. If there is only one party in the legislature, this index has a value of zero. As the legislature is more fractionalized among different political parties, the index increases up to the highest possible value of one. *Premier system dummy*, which is one when the chief executive is a prime minister, is also from Arthur Bank's dataset.

Another variable we consider is the share of agriculture, which is inversely associated with the modernization of the economy. Poor agrarian economies have limited access to financial markets and the debt-GDP ratio should stay low. *Share of agricultural sector* is taken from *World Bank's WDI*.

The role of separation of powers in the determination of public finances has been explored by Persson and Tabellini (2000). They show that the size of government tends to be larger under a parliamentary system than under presidential systems where the executive is elected independently of the legislature. Persson and Tabellini's (2000) key insight is that separation of powers introduces checks and balances that reduce the rents that the politicians can extract from public resources. Their model does not have any direct implication for the size of public debt since its concern is the long-term determinants of government size when expenditures are matched by revenues. However, given the increased demand for public expenditures under parliamentary systems, it is possible that the tendency to borrow and smooth taxes and expenditures over time may also be stronger. We create 2 dummy variables that take the value of 1 for the parliamentary or presidential system respectively. The data is constructed based on the information available at Cheibub et al. (2010). Although these dummies have expected signs, they do not prove significant.

Finally, the index of *legal central bank independence* is from Cukierman, Niapti, and Webb (1992). It is calculated using the data for the term length and the appointment procedure of central bank governors, the independence of central bank policy formulation, and central bank objective that are stipulated by the laws. Crowe and Meade (2008) further suggest a measure of *central bank independence and transparency* and claim that greater central bank independence is associated with lower inflation.

## 1.5 Empirical Results

To investigate the implication of the public debt model previously developed, we consider the debt-GDP ratio of a country as an error-correction process,

$$(1.33) \quad \Delta b_{t,i} = -\alpha(b_{t-1,i} - b_{t-1,i}^*) + \gamma \Delta b_{t-1,i}^* + \eta s_{t,i} + \varepsilon_{t,i}$$

where  $\Delta$  is the first difference operator,  $b_{t,i}$  is the debt to GDP of country  $i$  in year  $t$  and  $b_{t,i}^*$  is the expected debt to GDP of country  $i$  in year  $t$  given its steady state characteristics.  $\alpha$  is the speed of adjustment of  $b_{t,i}$ ,  $s_{t,i}$  is the effect of transitory determinants of  $b_{t,i}$ , and  $\gamma$  and  $\eta$  are coefficients.  $\varepsilon_{t,i}$  is the random variable, which may not be *i.i.d.* For calculating the standard errors of estimates, we employ Newey and West's heteroskedasticity-autocorrelation consistent (HAC) method. This ensures that our results will be driven by any remaining autocorrelation or heteroskedasticity.

We specify the relationship of  $b_{t,i}^*$  with the vector of institutional and economic characteristics of country  $i$  in year  $t$  as a linear expression.

$$(1.34) \quad b_{t,i}^* = \beta_1 C_{it} + \beta_2 D_{it} \times C_{it} + \beta_3 R_{it} + \delta_i$$

where  $\beta$ s are parameters,  $C_{it}$  is a measure of enforceability of contracts in general,  $D_{it}$  is an index of institutional capability to maintain fiscal discipline, and  $R_{it}$  is a linear expression of other potential determinants of steady state public debt.  $\delta_i$  is the individual fixed effect of country  $i$ . Considering that building up in credibility expands the government bond issuance limit while stronger fiscal institutions induce the government to borrow less, we can expect that the public debt model previously developed implies the following hypothesis to be tested:

$$(1.35) \quad \beta_1 > 0 \text{ and } \beta_2 < 0.$$

However, there may still be an omitted variables problem because fixed effects analysis eliminates the variables that do not change over time. Fiscal discipline index is the key variable in the analysis but only has one time observation. Therefore, fiscal discipline index will be dropped in our fixed effect analysis. For this reason, we run cross-sectional regression of the estimated individual country fixed effect on *time-invariant variables* such as *fiscal discipline*, *language fractionalization*, and *regional dummies*. This cross-sectional analysis will help investigate the role of fiscal discipline. To control the non-observable influences on fiscal policy related to geographic location or economic development, we add regional dummies such as South East Asia, Middle East Asia and North Africa, Latin America, European Union, and East Central Europe.

$$(1.36) \quad \delta_i = \phi_0 + \phi_1 D_i + \phi_2 Z_i + \nu_i$$

where  $D_i$  is the fiscal discipline of country  $i$ ,  $Z_i$  is a linear expression of other time-invariant factors of country  $i$  including regional dummies,  $\phi$ s are the coefficients and  $\nu_i$  is the random variable.

Table 1.2 summarizes the outcomes from fixed effect analysis and the results are quite consistent with our prediction.

Let us start from the variables in *Steady State Expression*. *Credibility* is positively correlated with public debt at a 5% significant level. However, the coefficient of interaction between *credibility* and *fiscal discipline* has a statistically significant negative sign. As expected, there is a negative correlation between credibility and fiscal discipline. The effect of credibility might decrease with a high level of fiscal discipline. It implies that stronger fiscal institutions induce the government to borrow less once it reaches a sufficiently high level of credibility. For governments that do not face a credit constraint, better fiscal institutions tend to lower the debt level.

Regressions reveal that *unemployment rate* is positively correlated with public debt. In general, a higher unemployment rate is expected to result in larger deficits because the government makes counter-cyclical fiscal policies during economic recession.

One interesting result is that the *real interest rate* is positively correlated with debt though it is not significant. It implies that the refinancing for the maturing debt become more costly and it increase the debt of a country. We test the result with other various interest rate measures but no significant changes emerged. It support that the outcome is quite robust regardless of the interest rate measures.

*The rule of law*, which could be considered as an alternative index of credibility of a country, is positively correlated to debt with 5% significance. It implies that the lack of rule of law undermines the credibility of the government, and, as a result, the government faces tighter credit constraints in financial markets.

*Legislative effectiveness*, which scores between 0 and 3, has an expected negative sign. One can expect that the well-developed checks and balances system may reduce the debt. One interesting observation is that the coefficient of the quadratic term of legislative effectiveness is significant while the coefficient of original values is statistically insignificant. It implies that public debt decrease in a faster way when there is an improvement in legislative effectiveness. Regression (1) in Table 1.2 does not contain this variable; regression (2) uses the original values of legislative effectiveness as an explanatory variable; and regression (3) uses the square of the original value as an explanatory variable.

For the short term effects, we include the banking sector crisis dummies, currency depreciation, aging of society, and GDP per capita. First, *banking sector crisis dummy*, which is equal to 1 if the country is under a banking crisis, has a strong positive correlation with government debt. It implies that a trembling banking sector increases the role of government during a financial crisis in response to significant losses in the banking systems that, after all, increase the role of government.

The increase in *the share of population above 65 years* out of the total population turns out to be positively correlated with debt to GDP rate. It implies that societies with larger elderly groups need to increase their public spending for the welfare programs.

*Currency devaluation* is positively correlated with public debt and turns out to be significant in the fixed effect model. The effect of *currency devaluation* on public debt may be related to accounting method. Fluctuation of foreign exchange rate affects the valuation of existing debt denoted in foreign currencies. For example, currency depreciation increases the value of foreign currency debt in terms of

local currency and it leads to the increase of public debt. Therefore, we can expect the coefficient of currency devaluation to have a positive sign.

After fixed effect analysis, we regress the estimated individual country fixed effect on *fiscal discipline*, *language fractionalization*, *openness* and *regional dummies* to investigate the role of fiscal discipline. Table 1.3 summarizes the outcomes from cross-sectional analysis. The results show that the coefficient on *fiscal discipline* is highly significant at the 0.1% level. It implies that a country with stronger *fiscal discipline* has greater ability to borrow and smooth out shocks.

*Language fractionalization* is found to have a negative coefficient. At first sight, the negative sign may contradict our prediction because using different languages within a country may deter the economic growth and increase public debt. However, the empirical result shows that this is not the case because the heavily fractionalized country stays underdeveloped, has limited access to financial markets and its borrowing level stays low.

*Openness*, which is the share of exports and imports out of GDP, has a positive sign though it is not significant. It is because greater openness is likely to increase the demand for expenditures on social insurance of the households exposed to risk. In particular, this tends to raise the public debt.

## **1.6 Conclusion**

This study investigates the roles of credibility and fiscal discipline on the level of public debt and offers an explanation for the variation of public debt among countries. Considerable existing literature implicitly states that better fiscal institutions reduce the level of government expenditure and public debt and help to solve the overspending caused by the “common pool” problem. However, our analysis finds that there is a positive relationship between institutional capabilities and observed debt levels for the countries with adequate levels of credibility. It is because an increase in the ability of the government to ensure discipline may raise its credibility in international financial markets, and gives more incentives to borrow more. However, if the level of credibility is very strong, then the countries may not want to fully utilize their favorable borrowing positions for long run fiscal sustainability.

By using a simple model, we show that the bond issuance ceiling expands as a country builds up credibility, i.e., countries are able to issue more bonds because the higher credibility reduces the concerns over repudiation of existing debt. The role of credibility on optimal level of debt has an opposite direction. Even though credibility expands the bond issuance ceilings, the optimal level of public debt become

smaller as the country gains more credibility and yields more benefit from maintaining access to capital markets.

We used a panel dataset of 61 countries to examine the implications of the model. From the empirical study, we find that both contract reliability and fiscal discipline are positively correlated with a steady state level of public debt. But the interaction between contract reliability and fiscal discipline index has a negative effect on public debt. This empirical finding again supports our prediction that improvement in fiscal and credit-related institutions take the government more toward a situation where it has greater options to borrow and smooth out debt and other shocks. The countries with a moderately high rate of credibility issue bonds up to or close to its upper bounds because adequate credibility helps these countries to access international borrowing markets. However, some weaknesses in the policymaking institutions in countries lead to relatively high demand for public spending and they end up borrowing relatively more than other countries. Once a government reaches a sufficiently high level of credibility, stronger fiscal institutions induce the government to borrow less.

**Table 1.1 Debt to GDP in 2000s**

Credit ratings of Sovereign Bond <sup>4</sup>	Mean	St. dev	Median
Double AA and above	56.65%	25.31	51.04%
Single A	35.14%	27.23	28.32%
Triple B	38.79%	10.30	42.16%
Double B	54.78%	21.43	55.81%
Single B and Below	59.35%	28.71	55.57%

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<sup>4</sup> List of countries in each category:

Double AA and above countries (18): Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, New Zealand, Portugal, Singapore, Slovenia, Spain, Sweden, United Kingdom, United States.

Single A countries (13): Bahamas, Chile, Czech, Estonia, Greece, Hungary, Korea, Kuwait, Latvia, Lithuania, Malaysia, Slovak Republic, Trinidad and Tobago.

Triple B countries (5): Bulgaria, Mexico, Poland, Romania, Thailand.

Double B countries (12): Brazil, Colombia, Costa Rica, Egypt, El Salvador, Guatemala, India, Jordan, Morocco, Panama, Peru, Philippines.

Single B and Below countries (10): Argentina, Bolivia, Dominican Republic, Ecuador, Indonesia, Jamaica, Pakistan, Paraguay, Uruguay, Venezuela.

**Table 1.2 Fixed Effect Analysis**

**(Dependent Variable: First difference of Debt/GDP)**

Regression	(1)		(2)		(3)	
Explanatory Variables	Coefficient	P-value	Coefficient	P-value	Coefficients	P-value
<b>Speed of Adjustment</b>	0.2145	0.000	0.2137	0.000	0.2143	0.000
<b>Steady State Expression</b>						
Constant	-289.8190	0.000	-283.1703	0.000	-278.7955	0.000
Contract Reliability	18.9948	0.0183	19.2322	0.0053	19.7496	0.004
Reliability×Fiscal discipline	-0.3389	0.0124	-0.3396	0.0037	-0.3336	0.0041
Real interest rate	0.1865	0.6279	0.1749	0.424	0.1260	0.5632
Unemployment rate	3.2109	0.000	3.2106	0.000	3.2865	0.000
Rule of Law	4.7616	0.0428	4.9912	0.0126	5.2954	0.0079
Legislative Effectiveness			-5.1100	0.3629		
Legislative Effectiveness <sup>2</sup>					-5.4219	0.0143
<b>Short-term effects</b>						
Banking Crisis	1.8079	0.0719	1.8670	0.0255	1.9508	0.0191
Currency Depreciation	24.8494	0.0187	24.8836	0.000	25.0263	0.000
Lagged first difference of the Share of 65 above	9.2080	0.0128	9.2308	0.0056	9.0493	0.0064
Lagged first difference of the log GDP per Capita	-22.4652	0.006	-22.5159	0.0064	-23.1210	0.0049
Numbers of Observation	748		748		748	
Numbers of Countries	61		61		61	
$R^2$	0.6099		.6106		.6137	

p-values are based on Newey-West Standard errors, Country and year fixed effect are included in the regression but not listed in the table.

**Table 1.2 (cont.)**

List of Countries (61) : Algeria, Argentina, Austria, Bahamas, Belgium, Bolivia, Brazil, Bulgaria, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Finland, France, Germany, Greece, Guatemala, Honduras, Hungary, India, Indonesia, Iran, Ireland, Italy, Jamaica, Jordan, Korea, Kuwait, Latvia, Lithuania, Luxembourg, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Thailand, Trinidad and Tobago, United Kingdom, United States, Uruguay, Venezuela, Yemen Rep.

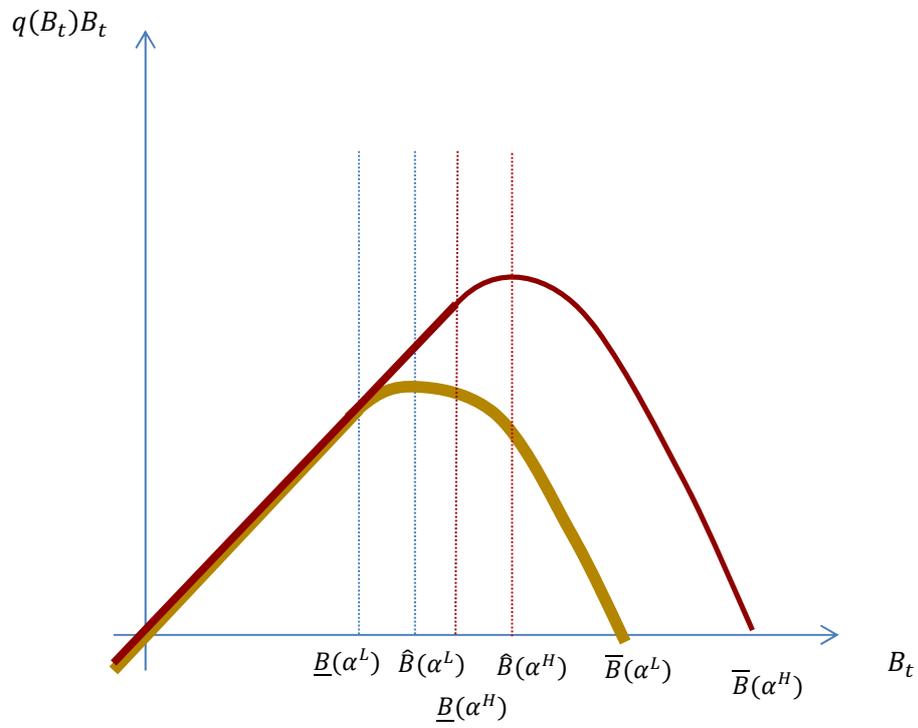
**Table 1.3 Cross Sectional Analysis**

**(Dependent Variable: Estimated Individual Fixed effect)**

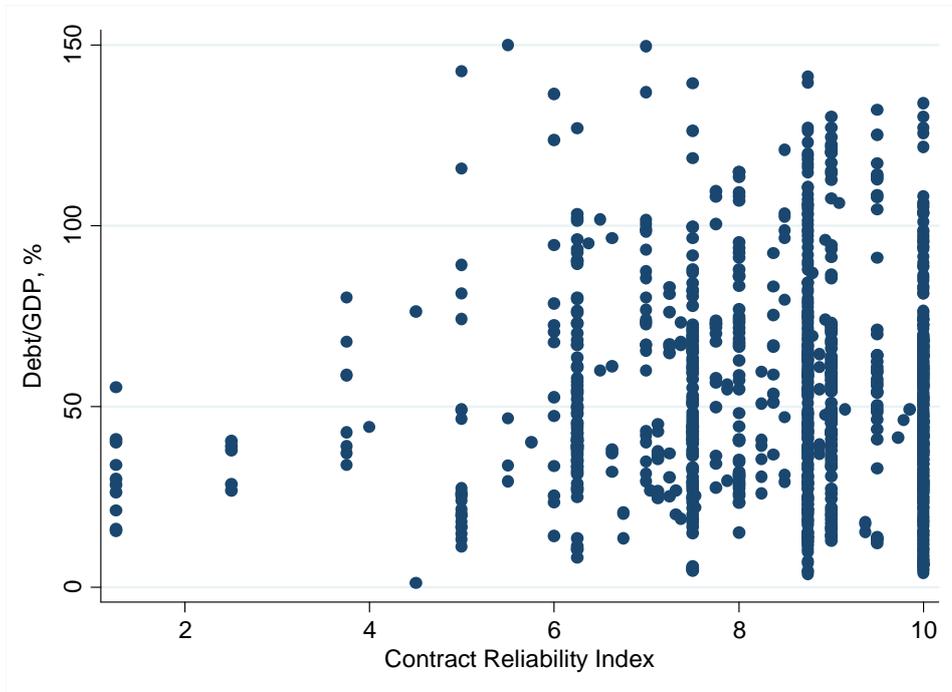
Regression	(1)		(2)		(3)	
Explanatory Variables	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	-409.1158***	0.000	-398.3***	0.000	-378.6***	0.000
Fiscal Discipline	34.3542***	0.000	34.41***	0.000	34.69***	0.000
Openness	14.0189	0.140	14.00	0.142	12.65	0.181
Language Fractionalization	-30.5815*	0.089	-30.19*	0.093	-27.93	0.133
Middle East North Africa	-29.6047	0.144	-36.76*	0.068	-61.47***	0.003
Latin America	-3.2350	0.880	-5.737	0.786	-15.53	0.453
South Asia	53.1466**	0.050	51.28*	0.068	43.65	0.196
East, South East Asia	8.9022	0.696	2.449	0.915	-17.94	0.445
European Union	11.5065	0.560	11.54	0.557	13.95	0.486
East Central Europe	-18.4414	0.461	-18.64	0.451	-16.04	0.516
High income not OECD	-0.2405	0.987	0.364	0.979	5.700	0.666
<i>N</i>	60		60		60	
<i>R</i> <sup>2</sup>	0.7953		0.799		0.801	

p-values are based on Robust Standard errors

Figure 1.1 Government Revenue Curve

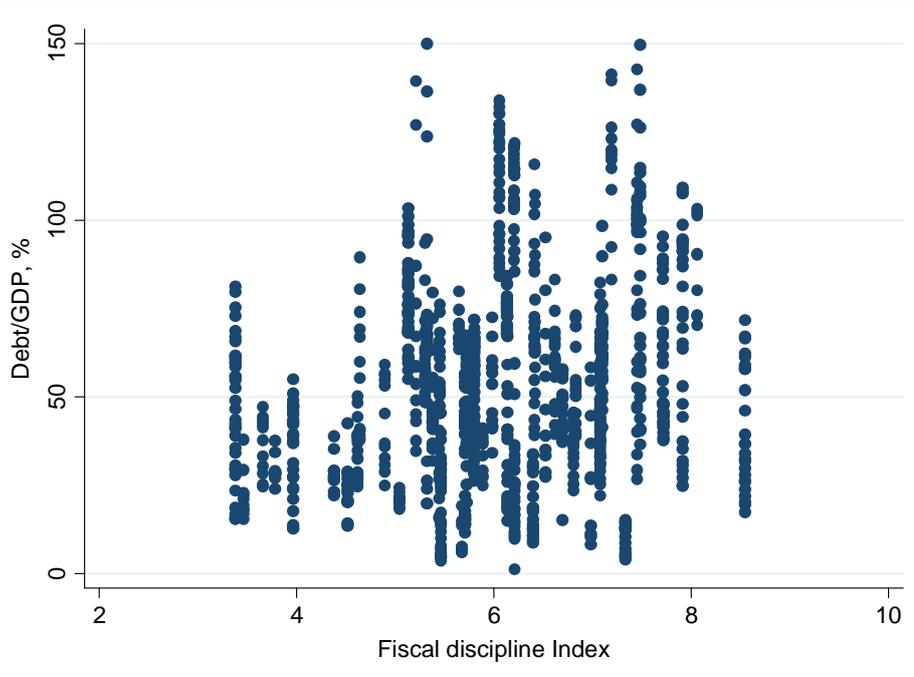


**Figure 1.2 Contract Reliability and Debt-GDP Rate**



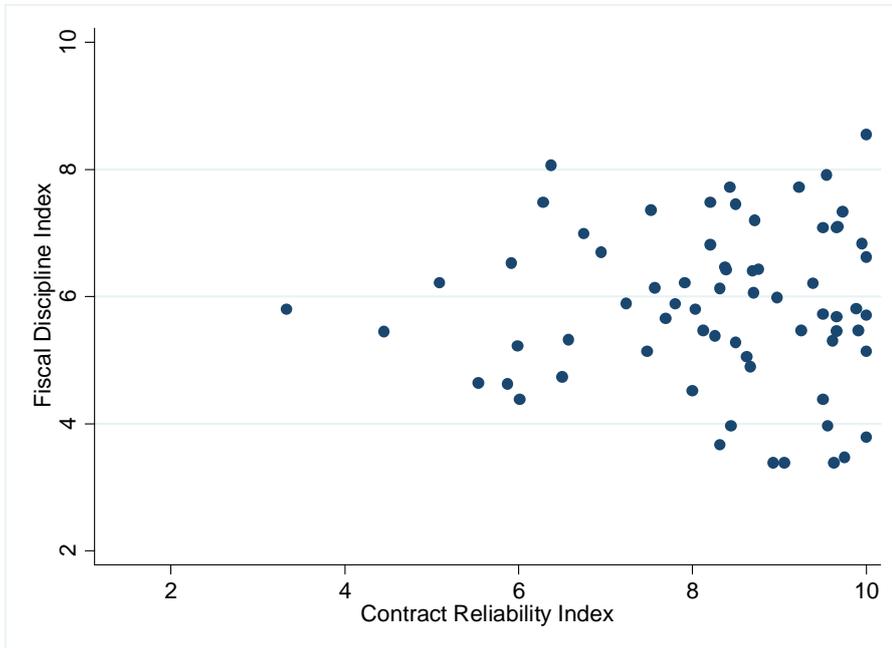
Source: Political Risk Services, ICRG and World Economic Outlook from IMF

Figure 1.3 Fiscal Discipline and Debt to GDP rate



Source: Author's calculation based on various sources, and WEO

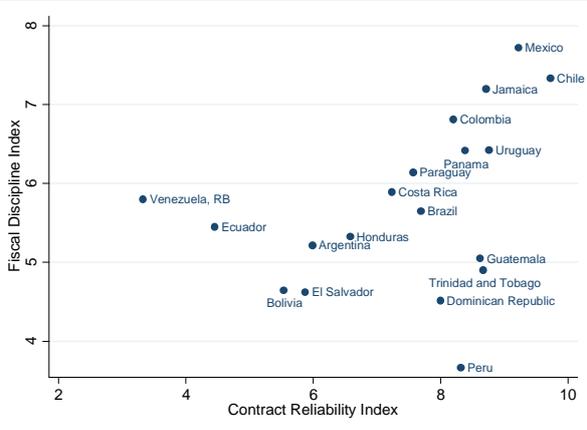
**Figure 1.4 Fiscal Discipline and Contract Credibility in 2000s**



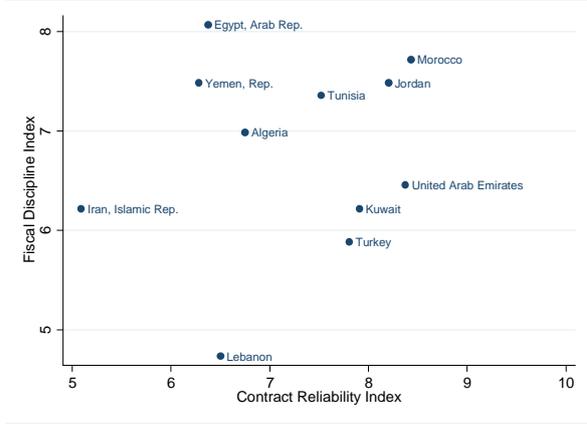
Source: Author's calculation based on various sources, and *ICRG*

**Figure 1.5 Fiscal Discipline and Contract Credibility of each region in 2000s**

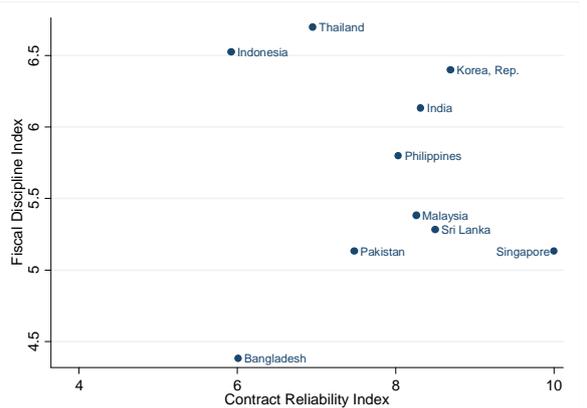
**Latin America**



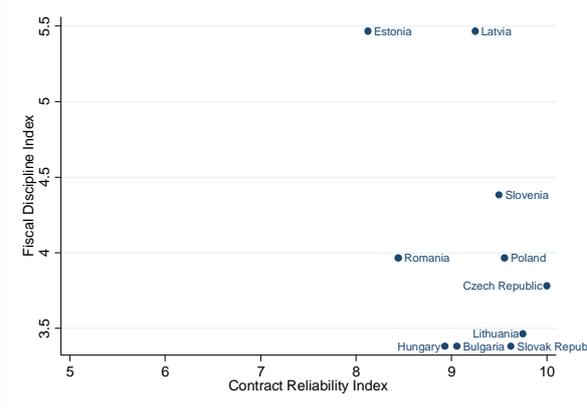
**Middle East Asia, North Africa**



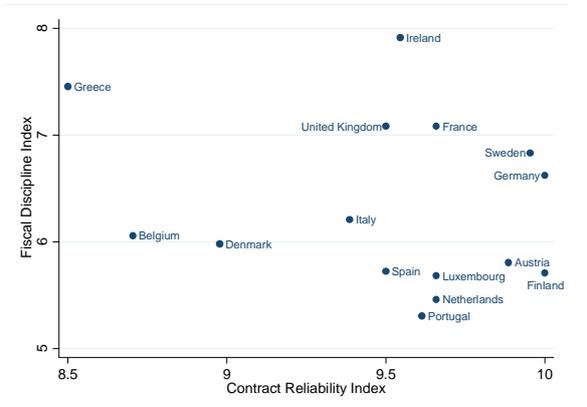
**East, South East Asia**



**Eastern Europe**



**EU**



## **CHAPTER 2**

### **Hiding Public Debt:**

#### **When Accountability Hits Governments That Hide Public Debt**

##### **2.1 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*),<sup>5</sup> 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

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<sup>5</sup> *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 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 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 2.2. The model that guides our work is developed in section 2.3. Section 2.4 discusses the empirical methodology and section 2.5 presents the econometric results. Section 2.6 concludes.

## **2.2 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.<sup>6</sup> 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

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<sup>6</sup> For a recent survey, see Polackova (1998). IMF's website, [www.imf.org](http://www.imf.org), provides detailed discussions on fiscal transparency and a comprehensive list of references.

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.

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.<sup>7</sup>

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<sup>7</sup> 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

Crisis in the banking sector also contributes to *SFAs* (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 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.

## 2.3 A Simple Model of Hidden Debt

### 2.3.1 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  $0 < \gamma < 1$ . 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:

$$(2.1) \quad b_1 + x - t_1 \leq \frac{\bar{t}}{1+r}$$

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:

$$(2.2) \quad \Pr(b_2 \leq \bar{t}) = \Pr\left[l \leq \frac{\bar{t}}{(1+r)} - (b_1 + x - t_1 + h)\right] = F\left[\frac{\bar{t}}{(1+r)} - (b_1 + x - t_1 + h)\right]$$

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

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  $y_i'(t_i) \rightarrow 0$  as  $t_i \rightarrow 0$ . 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:

$$(2.3) \quad w(x, h, t_1; b_1) = \alpha(x + \beta h)^\gamma + y_1(t_1) - t_1 + \delta v(b_1 + x - t_1 + h)$$

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:

$$(2.4) \quad v(b_1 + x - t_1 + h) = \int_0^{\bar{t}} [y_2(b) - b] f\left[\frac{b}{(1+r)} - (b_1 + x - t_1 + h)\right] \frac{db}{(1+r)}$$

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

First, consider the case where the government's borrowing constraint in (2.1) is not binding. In this situation, the government's optimal fiscal plan,  $(x^*, h^*, t_1^*; b_1)$ , solves the *Lagrangian* in (2.5) and its first order conditions can be described as (2.6)-(2.8):

$$(2.5) \quad w(x, h, t_1; b_1) + \lambda \left[ b_1 + x - t_1 - \frac{\bar{t}}{1+r} \right] + \mu h,$$

$$(2.6) \quad \frac{\partial w}{\partial t_1} = y'_1(t_1) - 1 - \delta v'(b_1 + x - t_1 + h) - \lambda = 0,$$

$$(2.7) \quad \frac{\partial w}{\partial x} = \gamma \alpha (x + \beta h)^{\gamma-1} + \delta v'(b_1 + x - t_1 + h) + \lambda = 0,$$

$$(2.8) \quad \frac{\partial w}{\partial h} = \beta \gamma \alpha (x + \beta h)^{\gamma-1} + \delta v'(b_1 + x - t_1 + h) + \mu = 0$$

A quick comparison of (2.7) and (2.8) shows that if constraint (2.1) is not binding and (2.7) holds, the first term on the left-hand side of (2.8) 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 (2.6) and (2.7). The interpretation of the above finding is quite straight forward. 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:

$$(2.9) \quad \gamma \alpha (x^*)^{\gamma-1} = 1 - y'_1(t^*) = -\delta v'(b_1 + x^* - t^*)$$

It implies that the government sets its marginal benefit from explicit expenditure,  $\gamma \alpha (x^*)^{\gamma-1}$ , 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 (2.1) binds, then the explicit deficit in period 1,  $d = x - t_1$ , is such that  $x^* - t^* \geq \bar{d} \equiv \frac{\bar{t}}{1+r} - b_1$ . In this case,  $\lambda > 0$  and  $x - t_1$  must equal  $\bar{d}$ . Then the welfare function in (2.3) can be written:

$$(2.10) \quad w(t_1 + \bar{d}, h, t_1; b_1) = \alpha (t_1 + \bar{d} + \beta h)^\gamma + y_1(t_1) - t_1 + \delta v\left(\frac{\bar{t}}{1+r} + h\right)$$

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

$$(2.11) \quad \frac{\partial w}{\partial t_1} = \gamma \alpha (t_1 + \bar{d} + \beta h)^{\gamma-1} + y_1'(t_1) - 1 = 0,$$

$$(2.12) \quad \frac{\partial w}{\partial h} = \gamma \beta \alpha (t_1 + \bar{d} + \beta h)^{\gamma-1} + \delta v' \left( \frac{\bar{t}}{1+r} + h \right) = 0$$

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:

$$(2.13) \quad \frac{\partial^2 w}{\partial t_1^2} = k + y_1''(t_1) < 0,$$

$$(2.14) \quad \frac{\partial^2 w}{\partial h^2} = \beta^2 k + \delta v'' \left( \frac{\bar{t}}{1+r} + h \right) < 0,$$

$$(2.15) \quad S = \frac{\partial^2 w}{\partial t_1^2} \frac{\partial^2 w}{\partial h^2} - \left( \frac{\partial^2 w}{\partial h \partial t_1} \right)^2 = k \delta v'' \left( \frac{\bar{t}}{1+r} + h \right) + y_1''(t_1) \beta^2 k + y_1''(t_1) \delta v'' \left( \frac{\bar{t}}{1+r} + h \right) > 0,$$

where  $k = \gamma(\gamma - 1)\alpha(t_1 + \bar{d} + \beta h)^{\gamma-2} < 0$ .

### 2.3.2 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 (2.11) and (2.12) with respect to  $b_1$ , we get:

$$(2.16) \quad k \left( \frac{\partial t_1}{\partial b_1} - 1 + \beta \frac{\partial h}{\partial b_1} \right) + y_1''(t_1) \frac{\partial t_1}{\partial b_1} = 0$$

$$(2.17) \quad \beta k \left( \frac{\partial t_1}{\partial b_1} - 1 + \beta \frac{\partial h}{\partial b_1} \right) + \delta v'' \left( \frac{\bar{t}}{1+r} + h \right) \frac{\partial h}{\partial b_1} = 0$$

Solve (2.16) and (2.17) for  $\frac{\partial h}{\partial b_1}$ , then we can get:

$$(2.18) \quad \frac{\partial h}{\partial b_1} = \frac{y_1''(t_1) \beta k}{S} > 0.$$

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 (2.16). 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 straight forward. 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.<sup>8</sup>

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

$$(2.19) \quad k \left( \frac{\partial t_1}{\partial(1+r)} - \frac{\bar{t}}{(1+r)^2} + \beta \frac{\partial h}{\partial(1+r)} \right) + y_1''(t_1) \cdot \frac{\partial t_1}{\partial(1+r)} = 0$$

$$(2.20) \quad \beta k \left( \frac{\partial t_1}{\partial(1+r)} - \frac{\bar{t}}{(1+r)^2} + \beta \frac{\partial h}{\partial(1+r)} \right) + \delta v'' \left( \frac{\bar{t}}{1+r} + h \right) \cdot \left( -\frac{\bar{t}}{(1+r)^2} + \frac{\partial h}{\partial(1+r)} \right) = 0$$

From (2.19) and (2.20), we can get the following:

$$(2.21) \quad \frac{\partial h}{\partial(1+r)} = \frac{S + (1-\beta)y_1''(t_1)\beta k}{S} \cdot \frac{\bar{t}}{(1+r)^2} > 0$$

$\frac{\partial h}{\partial(1+r)}$  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 (2.16). The positive sign  $\frac{\partial h}{\partial(1+r)}$  implies that explicit deficit ceiling,  $\bar{d} \equiv \frac{\bar{t}}{1+r} - b_1$ , becomes tighter as the interest rate goes up and the explicit spending should decrease accordingly. This mechanism makes the government seek more hidden expenditure.

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<sup>8</sup> 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.

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

$$(2.22) \quad k \left( \frac{\partial t_1}{\partial \theta} + \beta \frac{\partial h}{\partial \theta} \right) + y_1''(t_1) \frac{\partial t_1}{\partial \theta} = 0$$

$$(2.23) \quad \beta k \left( \frac{\partial t_1}{\partial \theta} + \beta \frac{\partial h}{\partial \theta} \right) + \delta v'' \left( \frac{\bar{t}}{1+r} + h \right) \frac{\partial h}{\partial \theta} + \delta \frac{\partial v'}{\partial \theta} = 0$$

where  $\frac{\partial v'}{\partial \theta} = \int_{\bar{t}}^{\infty} c(b - \bar{t}) f' \left[ \frac{b}{1+r} - \frac{\bar{t}}{1+r} - h \right] \frac{db}{(1+r)}$

From (2.22) and (2.23), we can get:

$$(2.24) \quad \frac{\partial h}{\partial \theta} = - \frac{\{y_1''(t_1) + k\} \delta \frac{\partial v'}{\partial \theta}}{S} < 0$$

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  $\frac{\partial v'}{\partial \theta} < 0$ .<sup>9</sup> The interpretation of  $\frac{\partial v'}{\partial \theta} < 0$  is quite straight forward. Considering that  $v$  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.,  $\frac{\partial h}{\partial \theta} < 0$ .

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<sup>9</sup> 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  $\bar{t} > \mu$ . Then  $c(b - \bar{t}) > 0$  holds by the construction  $f'[\cdot] < 0$ . Therefore,  $\frac{\partial v'}{\partial \theta}$  has a negative value. Next, suppose that  $\bar{t} < \mu$ . Since the cost of repudiate is an increasing function of the excess debt, i.e.,  $c'(b - \bar{t}) > 0$ , we can find :

$$\left| \int_{\mu - \varphi = \bar{t}}^{\mu} c(b - \bar{t}) f' \left[ \frac{b}{1+r} - \frac{\bar{t}}{1+r} - h \right] \frac{db}{(1+r)} \right| < \left| \int_{\mu}^{\mu + \varphi} c(b - \bar{t}) f' \left[ \frac{b}{1+r} - \frac{\bar{t}}{1+r} - h \right] \frac{db}{(1+r)} \right|$$

Therefore, we can show that

$$\begin{aligned} \frac{\partial v'}{\partial \theta} &= \int_{\mu - \varphi = \bar{t}}^{\mu} c(b - \bar{t}) f' \left[ \frac{b}{1+r} - \frac{\bar{t}}{1+r} - h \right] \frac{db}{(1+r)} + \int_{\mu}^{\mu + \varphi} c(b - \bar{t}) f' \left[ \frac{b}{1+r} - \frac{\bar{t}}{1+r} - h \right] \frac{db}{(1+r)} \\ &\quad + \int_{\mu + \varphi}^{\infty} c(b - \bar{t}) f' \left[ \frac{b}{1+r} - \frac{\bar{t}}{1+r} - h \right] \frac{db}{(1+r)} < 0 \end{aligned}$$

## 2.4 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.

### 2.4.1 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 amount needed for its explicit deficit financing on the budget and the discrepancy needs to be adjusted by some factor,  $SFA_t$ , as follows:

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

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:

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

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.

#### **2.4.2 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)<sup>10</sup>.

The data show that the average  $SFA$  has been positive both in the advanced<sup>11</sup> 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 2.1). 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 2.1 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

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<sup>10</sup> 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

<sup>11</sup> 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.

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.

Table 2.1 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 2.1 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.

Figure 2.2 presents the distribution of *SFA* over time for our (panel) sample. Note that Figure 2.2 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 2.2 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 2.3 and 2.4 we present its scatter diagrams against the logs of per capita GDP and  $1+\text{debt}/\text{GDP}$ . Figure 2.3 shows that there is some tendency for lower income countries to have larger *SFAs*. However, the tendency is weak and, in fact, econometrically undetectable once we control for the factors identified by the theoretical model. Figure 2.4 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.

To be able to use the model of section 2.3 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 2.3. 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.

### 2.4.3 *The Explanatory Variables and Operational Hypotheses*

To test the results obtained in section 2.3, 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).<sup>12</sup> 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* 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.

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<sup>12</sup> 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.

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*.<sup>13</sup> 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

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<sup>13</sup> 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.

government spending and run larger deficits compare 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.

## **2.5 Empirical Results**

### **2.5.1 *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 2.1, 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:

$$(2.25) \quad H_{it} = X'_{it} \cdot \alpha(\tau) + \eta_i(\tau) + \theta_t(\tau) + \varepsilon_{it}(\tau)$$

where  $X'_{it}$  is the set of determinants of hidden debt (discussed in the previous subsection),  $\alpha(\tau)$  is the vector of coefficients at  $\tau$ <sup>th</sup> 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)<sup>14</sup>.

The econometric method that we use for estimating (2.25) 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 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.

### 2.5.2 *Summary of Empirical Analysis*

Figure 2.5 reports our main results. The first column in Figure 2.5 shows the outcome of *quantile* regression estimation of equation (2.25) 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

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<sup>14</sup> For statistical analysis of *quantile* regression for panel data, R package “rqpd” has been employed.

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 import 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 rage. *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.

## 2.6 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.

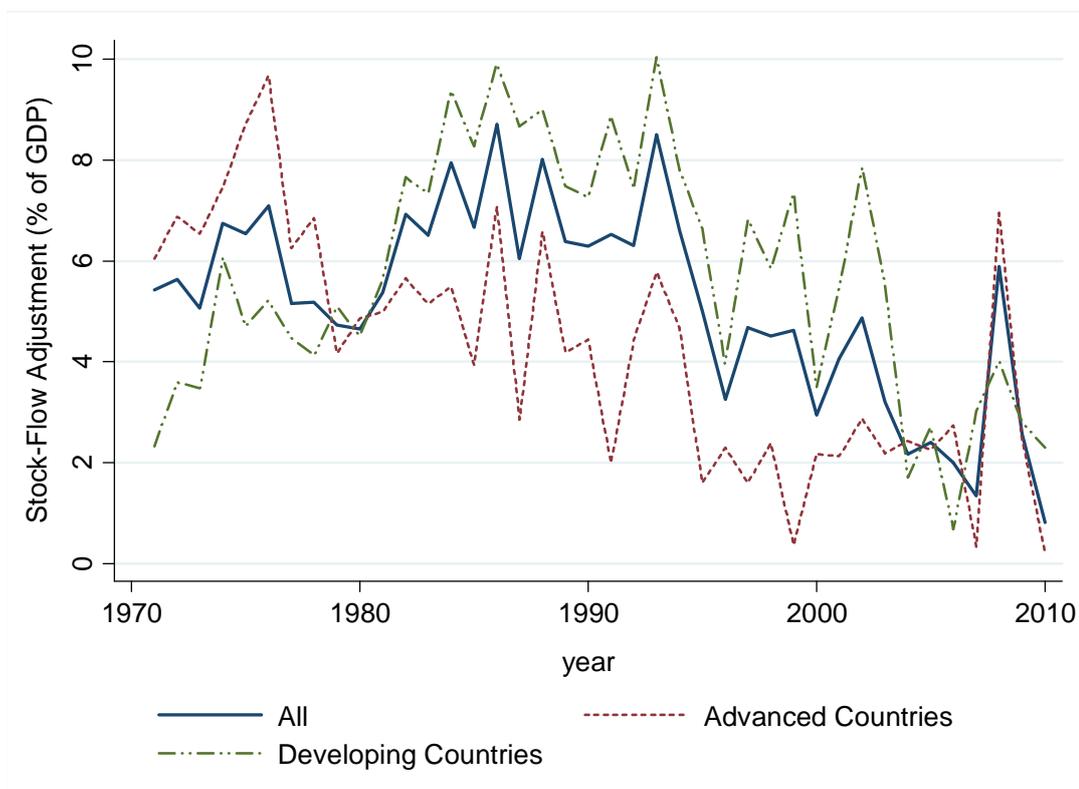
Lastly, it is worth noting that the conformity of the various effects derived from our theoretical framework with the estimation results offers support for the usefulness of *SFA* as a proxy for hidden public spending. The regressions show that this indicator is capable of generating meaningful results 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.

**Table 2.1 The Distribution of Stock-Flow Adjustment, 1970–2010  
(as % of GDP)**

Group	Mean (St.dev)	Percentile					# of Obs	# of Countries
		10%	25%	50% (Median)	75%	90%		
All Countries	5.1413 (7.7023)	-.938	.880	3.392	7.059	13.921	1,577	82
Advanced Countries	3.9013 (6.8413)	-1.135	.372	2.162	5.212	12.285	719	29
Developing Countries	6.1804 (8.2167)	-.551	1.642	4.566	8.156	14.852	858	53

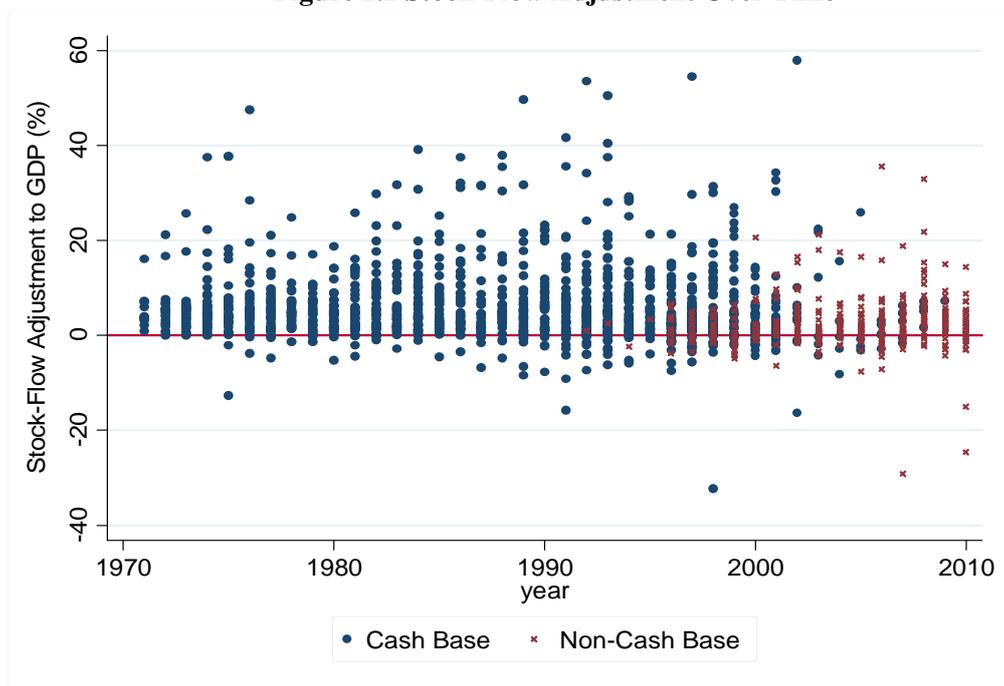
Source: Calculated based on IMF GFS data. Several observations in which SFA is larger than 60% of GDP are excluded from the calculations.

**Figure 2.1 Stock-Flow Adjustment of Advanced and Developing Economies**



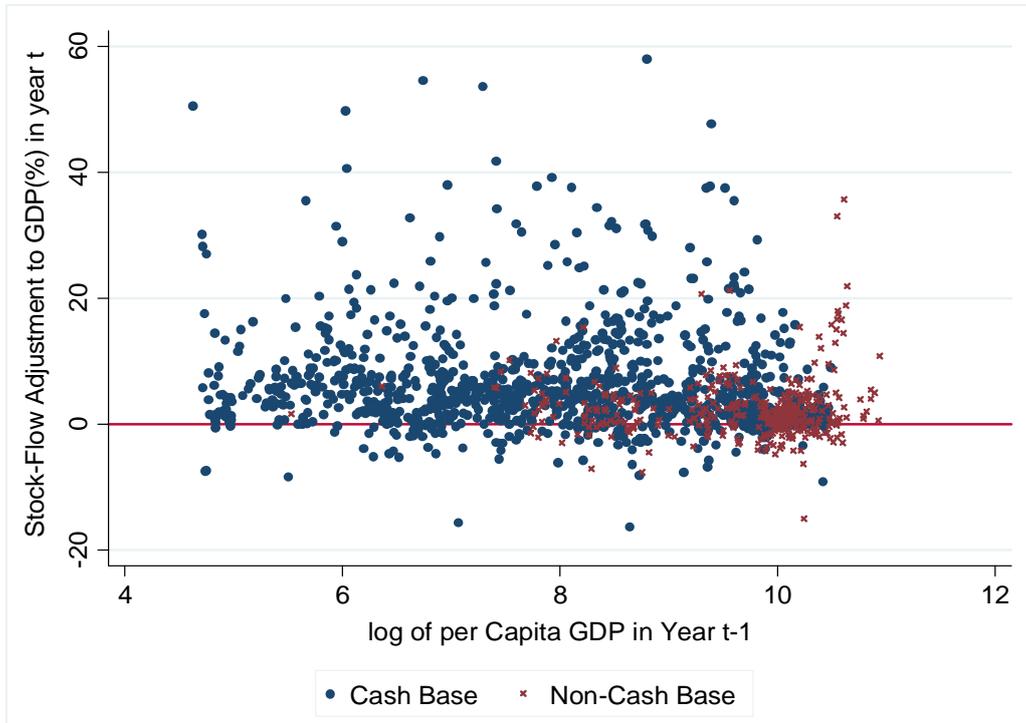
Source: Calculated based on IMF GFS data.

Figure 2.2 Stock-Flow Adjustment Over Time



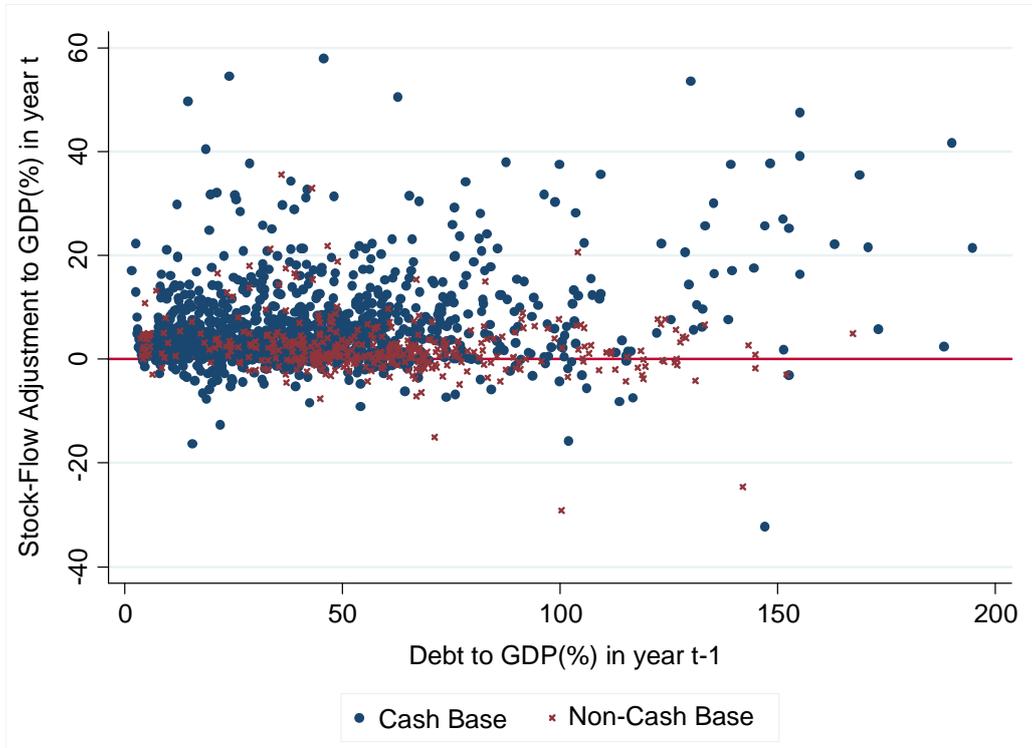
Source: Calculated based on IMF GFS data.

**Figure 2.3 Revealed Hidden Debt vs. Real Per Capita GDP**



Source: Calculated based on IMF GFS data.

**Figure 2.4 Revealed Hidden Debt vs. Debt-GDP Ratio**



Source: Calculated based on IMF GFS data.

**Figure 2.5 Quantile Regression Plots**

(Dependent Variable) Stock Flow Adjustment to GDP, %

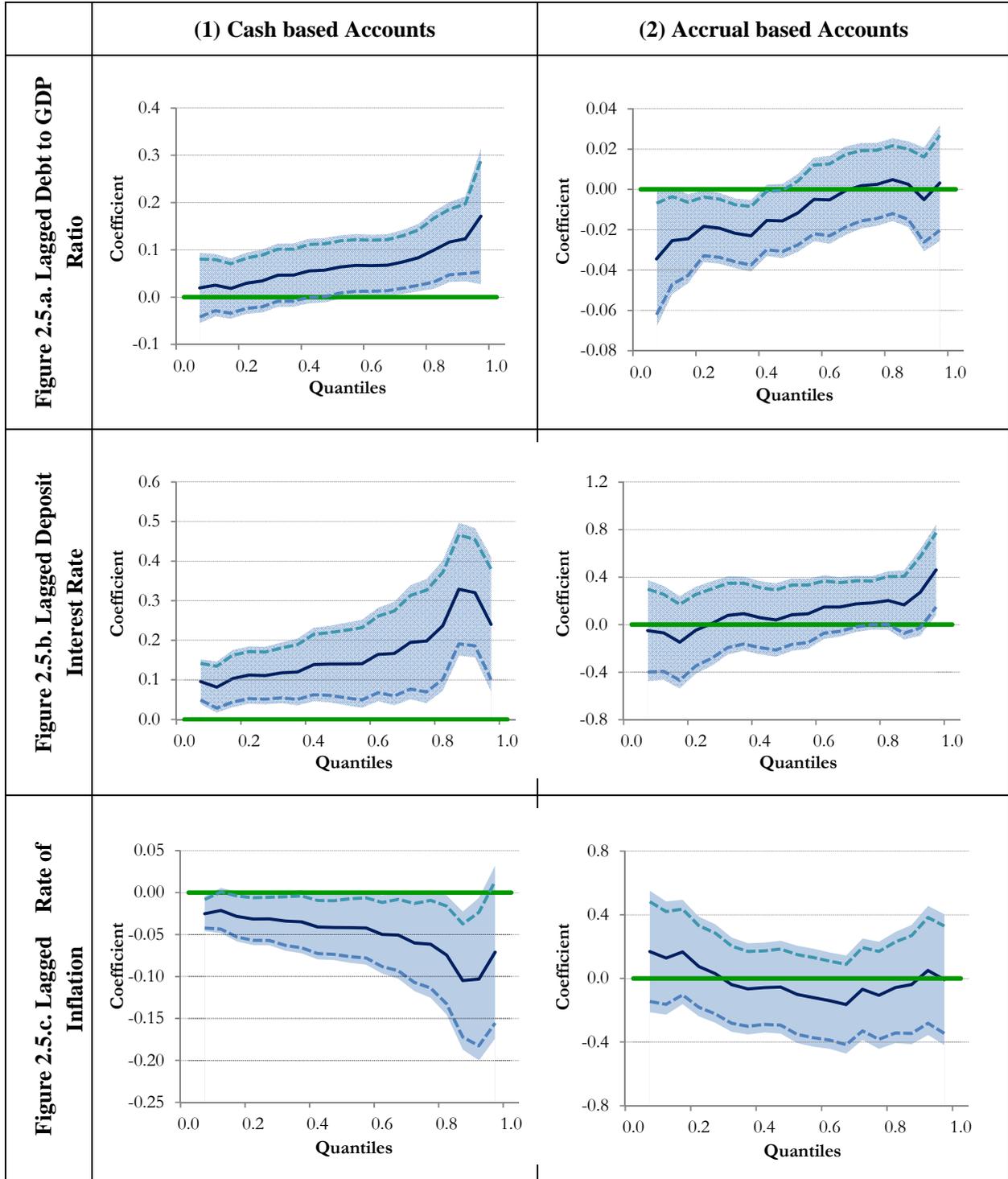


Figure 2.5 (cont.)

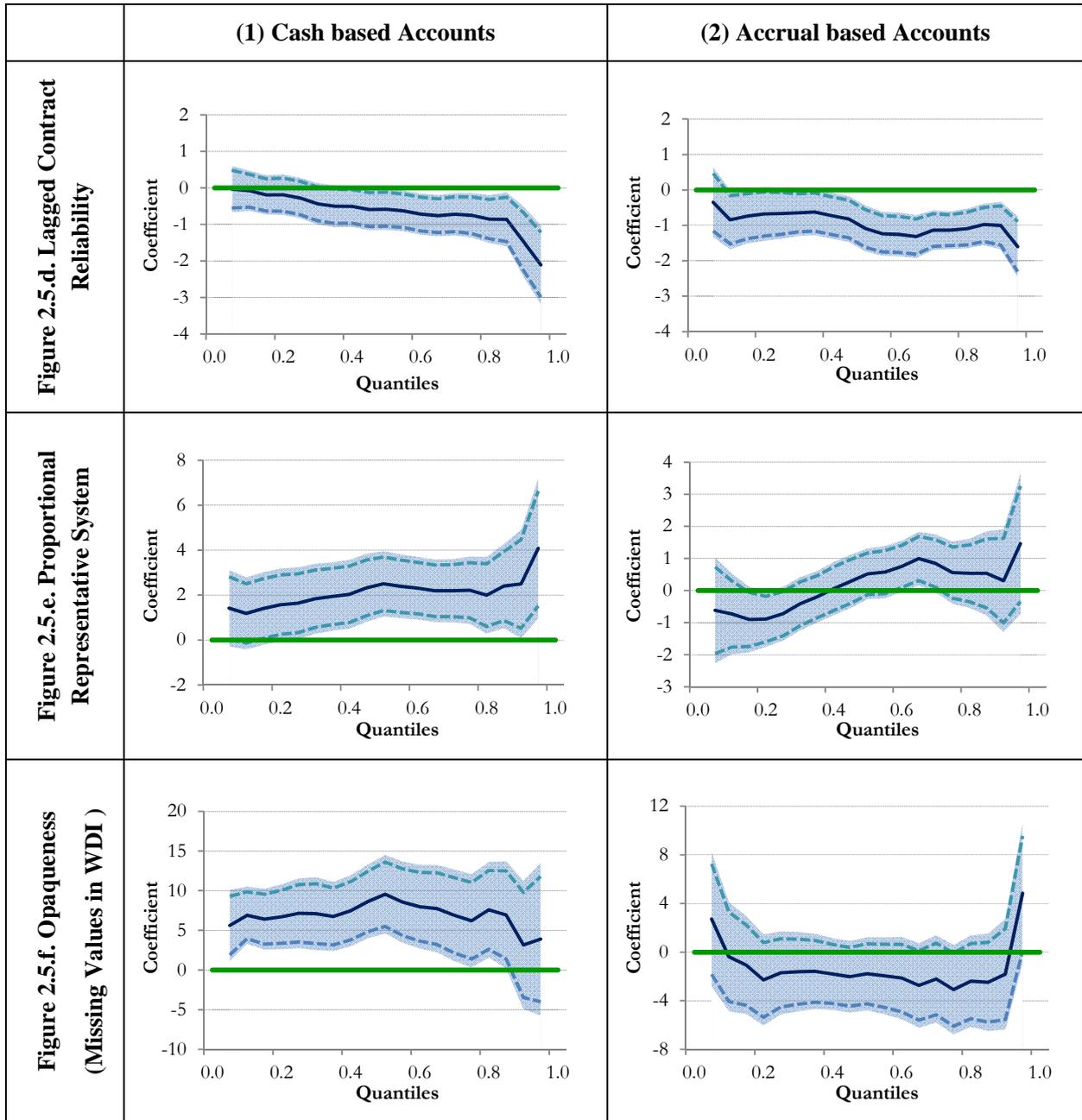
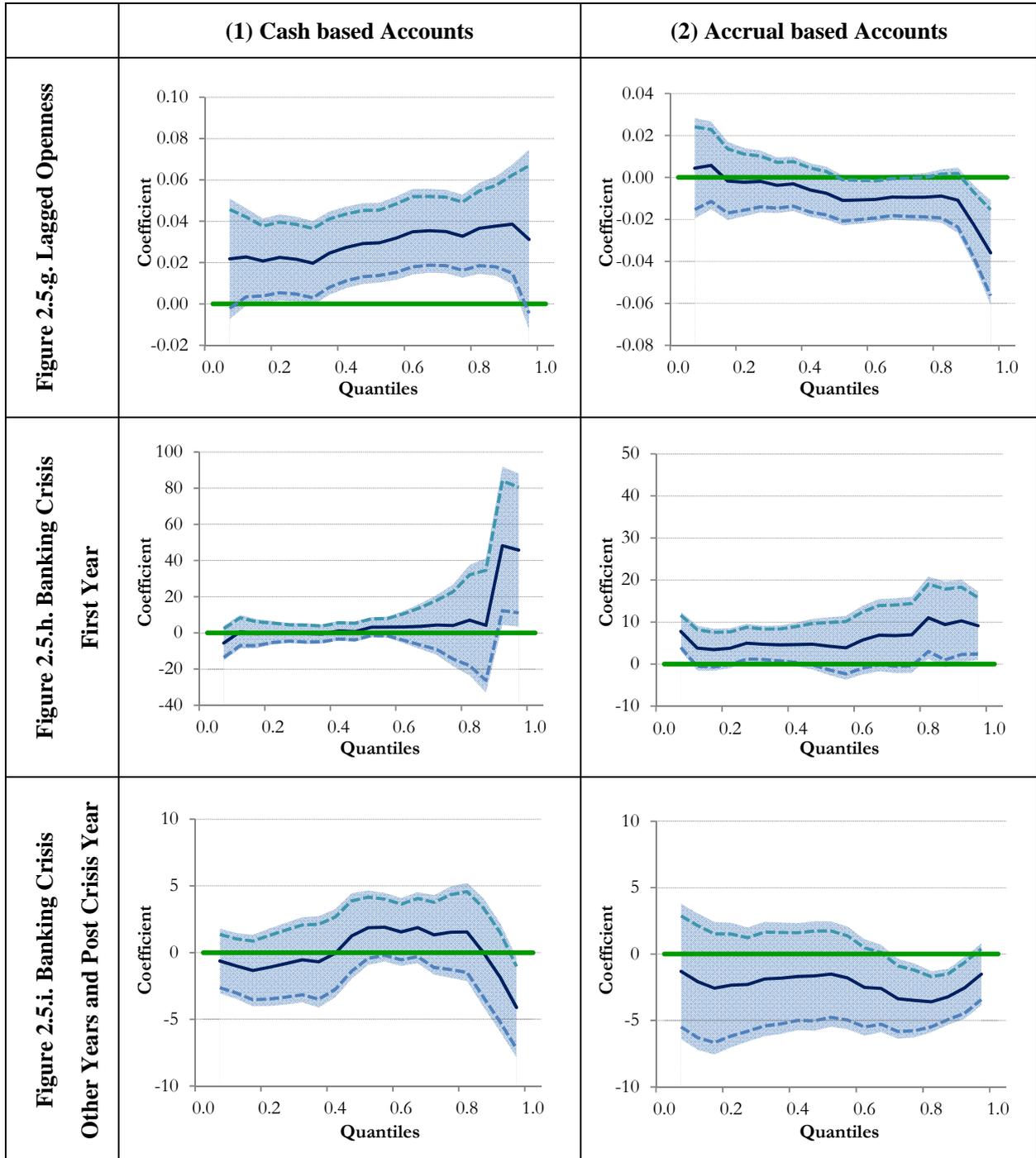


Figure 2.5 (cont.)



**Figure 2.5 (cont.)**

**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

## CHAPTER 3

### The Role of Budget Institutions in Emerging Market Credit Spreads

#### 3.1 Introduction

This study examines the role of budget institutions in credit spreads of emerging market countries' sovereign bonds. The credit spread, i.e. interest difference between a country's bond and a risk-free sovereign bond, reflect the default risk evaluated by investors. Therefore, a country with higher default risk faces wider credit spreads because investors want to receive a higher interest benefit to compensate for the possible losses from holding risky assets. In accessing a country's default risk, investors take into account the risk characteristics at that time and there can be many possible determinates of credit spreads. Some researchers find that global financial market conditions such as investor's risk appetite and global liquidity are important determinants of yield spreads (Dungey et al., 2001; González-Rozada and Yeyati, 2008). On the other hand, other researchers emphasize country-specific factors such as political and fiscal factors as determinants of credit risk in emerging markets (Baldacci et al., 2011). Furthermore, considering that risk premia is about the possible default of sovereign bonds, the fiscal shape of a country may also influence the credit spread. An increase in public debt signals a weakening of fiscal prudence and investors punish this country by charging higher interest rates. However, this may be mitigated by strong fiscal institutions. The effect of budget institutions on spreads may be explained by the "common pool" problem. The traditional "common pool" framework suggests that excessive public spending is caused when the participants do not incur the full cost and may want to over-extract resources from the budget. This common pool spending bias should be lower in countries with better fiscal institutions (Gleich, 2003) and robust institutions should strengthen the credibility of government promises about future fiscal behavior (Hallerberg and Wolff, 2008). Finally, market participants should also recognize this and investor bond prices will be less dependent on annual fiscal behavior of a country.

The contributions of this study to the existing literature are twofold. First, this study examines the effect of budget institutions on sovereign interest rate spreads in emerging markets. Although there is a pioneering work that studies the role of fiscal institutions on credit spreads among Euro zone countries (Hallerberg and Wolff, 2008), no attempts have been made in the area of emerging markets, to the best of our knowledge. Emerging economies tend to have larger variances in budgets and political institutions and are considered more vulnerable to external shocks compared to the developed Euro zone countries.

Therefore, the effectiveness of fiscal and political institutions may play more important roles in determining the credit risk premia in developing economies. Next as an econometric tool, we adopt *quantile* regression that has several advantages in analyzing the determinants of credit spreads over classical least square estimation. One advantage is that the *quantile* regression estimates are more robust against outliers that can be often observed in financial market data than ordinary least square (OLS) regression. Another important advantage of *quantile* regression is that we can investigate how explanatory variables differently influence the risk premia among different regions. This turns out to be a huge advantage, considering that classical least square regression assumes covariate effects shift the entire distribution by a fixed amount in all regions.

To estimate the determinants of yield spreads in emerging markets, we construct a panel dataset of 24 developing countries. The dependent variable that is a measure for credit spreads in this study is the Emerging Market Bond Index (EMBI) from JP Morgan. The first set of explanatory variables of interest is the level of public debt. Considering that yield spreads reflect the default possibility of a country, the spreads are expected to increase with weakening fiscal soundness such as raising debt. The next group of explanatory variables is the possible determinants of emerging market credit spreads. We investigate whether budget discipline and credibility have negative relationships with spreads. Better institutions and reputations may decrease the uncertainty over honoring debt and possibly lower risk premia. We can also expect that a larger international reserve in a country will decrease the default risk over foreign currency debt and hence reduce credit spreads in emerging markets. The third group of variables is the international financial market situation such as investor's risk appetite and global liquidity. To control for the evolution of international financial markets, we add time fixed effects because these global factors are commonly affect all the countries for a certain time.

The remainder of this study is organized as follows. Section 3.2 reviews previous literature. Section 3.3 provides information about the data including the sources and the overall description of key variables. Section 3.4 describes the empirical method and presents the results of our empirical analysis and section 3.5 provides some overall conclusions.

### **3.2 Existing Literature**

Financial market globalization lowers the barriers related to the in and out flows of capital and increases the opportunities for emerging market countries to borrow money on the international financial

markets by issuing foreign currency bonds. International bankers charge higher interest compared to the risk-free countries because investments in risky bonds have a certain probability of default and the bankers want to compensate for this expected loss with higher interest rates. Therefore, theoretically the yield spreads between risk-free countries and emerging markets reflect the expected probability of default.

In the area of empirical analysis, there have been a lot of efforts to explain the determinants of the spreads. Empirical research on the credit spreads can be largely divided into two groups. The first group of studies emphasizes the role of global factors in explaining the emerging market risk spreads while the other group focuses on the role of country-specific economic factors.

Many studies shed light on the importance of global market conditions as determinants of credit spreads both in emerging markets and advanced economies. Eichengreen and Mody (1998) finds that changes in spreads were dominated more by sharp adverse shifts in market sentiment than by changes in fundamentals. They collect data on nearly 1,000 developing-country bonds issued in 1991 to 1996 and find that changes in observable issuer characteristics and the responsiveness of spreads do not provide an adequate explanation for changes over time in the value of new bond issues and launch spreads. However, they claim that in important periods, such as the wake of the Mexican crisis, blanket shifts in sentiment play a dominant role. González-Rozada and Yeyati (2008) construct a panel dataset of 33 emerging economies and show that a large fraction of the time variability of emerging market bond spreads is explained by the evolution of global factors such as risk appetite, global liquidity and contagion from systemic events such as the Russian default. Dungey et al. (2001) analyze the determinants of long-term bond spreads in five advanced economies - Australia, Japan, Germany, Canada and the UK - over 1991 to 1999. They decompose the interest rate spreads into national and global factors and find that spreads are mainly determined by common international factors such as investors' general risk aversion.

Another stream of the literature has tried to investigate whether country specific characteristics derive any changes in country risk premiums. As a pioneering effort, Edwards (1986) analyzes the determination of country risk premia both in the bank loan and sovereign bonds of emerging markets. They find that debt is positively correlated while reserves are negatively correlated with the risk premia of a country. Using data on yields for Mexican and Brazilian sovereign bonds, they also find that the major turning points in these spreads were related to major economic or political events in these countries. Bernoth et al. (2012) emphasizes the role of fiscal performance. They show that yield spreads respond significantly to measures of government indebtedness, both before and after the start of the Economic and

Monetary Union (EMU). Interestingly, they also find that after the start of the EMU, markets seem to pay less attention to government debt levels than they did before. They explain that this result may reflect that public debates about the fiscal performance of EMU countries have generally focused on deficits and have disregarded debt ratios since 1999. Akitoby and Stratmann (2008) examine the effects of fiscal policy on sovereign risk spreads and show debt-financed spending using panel data from emerging market countries. They find that higher public debt levels result in wider spreads as markets perceive the potential unsustainable pace of fiscal policy, while tax-based spending lowers spreads. Ul Haque et al. (1996) analyze the determinants of creditworthiness indicators for over 60 developing countries. Their results indicate that economic fundamentals like the ratio of non-gold foreign exchange reserves to imports, growth, and inflation explain a large amount of the variation in the credit ratings constructed by three credit rating institutions: Euromoney, Economist Intelligence Unit, and Institutional Investor. Furthermore, they find that country ratings were adversely affected by an increase in international interest rates, independent of the domestic economic fundamentals.

However, the role of credit rating is rather controversial. González-Rozada and Yeyati (2008) conclude that ratings appear to be largely endogenous, reflecting changes in spreads rather than anticipating them. Indeed, a closer look reveals that credit rating or outlook changes lag spread movements and elicit little (if any) additional effect on spreads. Rowland and Torres (2004) show that creditworthiness, as measured by Institutional Investor's Creditworthiness Index that is quite similar to the credit ratings from Standard and Poor's or Moody's, is also a key determinant for emerging market sovereign debt cost. Credit rating indicators are in turn found to be influenced by macroeconomic fundamentals.

Recently, some researchers investigate the role of political institutions in financial markets. Akitoby and Stratmann (2010) show that improvements in democratic rights and increased government accountability lower sovereign spreads, using a panel of emerging market economies. They also show that debt levels and international reserves are significant factors in determining spreads. Baldacci et al. (2011) show that country-specific political and fiscal factors affect credit risk in emerging markets. Higher levels of political risk are associated with wider credit spreads because poor political stability and weak institutions of a country may signal to the markets a lack of commitment to sound economic policies. They also find that high debt and deficits leads to an increase in credit spreads, implying again that the fiscal position matters as highly indebted countries are penalized by international capital markets. Ciocchini et al. (2003) investigate how corruption is related to the spreads in the emerging markets. They showed that governments and firms in more corrupt countries have to pay higher spreads because corruption limits the government's ability to meet debt obligations and therefore increases default risk.

Budget institutions can be a potential factor that determines credit spreads of a country because the governments with better budget institutions are more likely to maintain fiscal soundness in the long run and it may lead to lower yield spreads. Despite the importance of budget institutions, only a limited number of studies have investigated the role of political factors in financial markets and the existing pioneering works are limited to European countries. Hallerberg and Wolff (2008) show that fiscal policy remains a significant determinant of risk premia in EMU countries. Individual country deficits should be less important in countries with better institutions, as financial markets believe that they are not driven by a systematic bias but rather reflect temporary effects. However, to the best of our knowledge, no attempt has been made regarding the role of budget institutions in interest spreads in the area of emerging market economies.

Emerging economies tend to have larger variances in budgets and political institutions and are considered more vulnerable to external shocks compared to the developed countries in the Euro zone. Therefore, the effectiveness of fiscal and political institutions may play more important roles in determining the credit risk premia in developing economies.

### **3.3 Data Set and Overview of Data**

#### **3.3.1 Overview of the data**

This section presents a general description regarding the movement of sovereign bond spreads. As a measure of credit spread, we use the Emerging Market Bond Index (EMBI)<sup>15</sup> calculated by JP Morgan of 21 emerging market countries. The period may vary based on the data availability.

Figure 3.1 describes the overall trend in the EMBI composite index. It shows that there was a downward trend in bond spreads during the 2000s decade before the financial crisis in 2008. This trend suggests the existence of strong global factors. The global financial market situation including investors' risk appetite and liquidity have been pointed as important determinants of credit spreads (Dungey et al., 2001, González-Rozada and Yeyati, 2008). Figure 3.1 depicts proxy investors' risk appetite by Market Volatility Index (VIX) from the Chicago Board Options Exchange. VIX has been considered as a key measure for investors' sentiment and market volatility. A higher VIX index implies that investors expect the market volatility will increase. The evolution of global liquidity has been proxied by the real international interest rate (LIBOR). The LHS graph in Figure 3.1 shows the strong co-movement between

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<sup>15</sup> We use the quarterly averaged EMBI index compiled by Global Financial Data ([www.globalfinancialdata.com](http://www.globalfinancialdata.com)).

the EMBI index and VIX. It implies that investors' risk appetite is a key determinant of emerging market spreads. The RHS graph provides the visual relationship between EMBI and real LIBOR. Again, EMBI is closely correlated to LIBOR, which is a proxy for global liquidity, but the correlation became loose in 2006 and 2007. We can infer that the market kept an optimistic view and invested in emerging market sovereign bonds in spite of monetary tightening in 2006 and 2007.

Previous literature has shown that *debt to GDP ratio* is negatively related to credit spreads (Edwards, 1984; Hanson, 1974; Harberger, 1980; Sachs, 1984). This relationship is not difficult to find in our dataset. Figure 3.2 shows the relationship between public debt and credit spreads. The basic conclusion is that fiscal performance is closely related to the risk premia. In other words, fiscal deterioration such as an increase in public debt also increases the risk of default and, hence, raises the borrowing cost of a country.

### **3.3.2 Data Set and Key Variables**

The dataset used for estimation consists of country level panel data for 21 emerging market countries<sup>16</sup> during 1995 and 2010. The limit on the number of countries and observations is set by the availability of consistent data for the relevant variables, particularly information on EMBI credit spreads, government debt as a percentage of GDP and fiscal discipline index data.

Public debt data are obtained from IMF's World Economic Outlook (WEO). Collecting fiscal performance data is not an easy task due to the recent change in accounting methods of the International Monetary Fund (IMF). The most common way to get cross-country panel government financial data is to use the International Monetary Fund International Financial Statistics (IFS) or International Monetary Fund Government Finance Statistics (GFS). These datasets, however, suffer from the inconsistency of before and after the change of accounting methods. IMF revised its Government Finance Statistics Manual in 2001. After that, only a limited number of countries, which are mainly the advanced countries, reported their debt data according to this new method; the debt data of the rest of the countries are treated as missing variables in the new GFS dataset. Due to the difficulty of collecting raw data from IFS and GFS, we used the government financial statistics from IMF's World Economic Outlook (WEO). WEO database provides the debt data of various advanced and emerging countries after 1982.

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<sup>16</sup> List of countries (21): Argentina, Brazil, Bulgaria, Chile, Colombia, Dominican Republic, Egypt, El Salvador, Indonesia, Jamaica, Lebanon, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Tunisia, Turkey, Uruguay, Venezuela

Given the adverse effect of debt to GDP ratio on a country's ability to honor its existing debt, we can expect that the fiscal discipline to mitigate the widening of spreads from increasing public debt because robust fiscal institutions should strengthen the credibility of government promises about future fiscal behavior (Hallerberg and Wolff, 2008). To test the significance of fiscal institutions, we include the interaction of debt-GDP ratio with the indicator of *Fiscal Discipline Index* and expect that the coefficient of interaction term has a negative sign. However, there is no single source with a consistent indicator covering a large number of countries with respect to the measurement of fiscal discipline. To ensure that the regressions are based on data with sufficient cross-country variation, I use the common denominator of all available regional data on budget institutions to construct a common index for them. These studies and their regional focuses are as follows:

Central and Eastern Europe - Gleich (2003).

Western Europe - Hallerberg, Strauch, and von Hagen (2001).

Latin America - Alesina et al. (1999).

Middle East and North Africa - Esfahani (2001).

South and East Asia - Lao-Araya (1998).

Among these studies, the budget institutions index developed by Alesina et al. (1999) is based on the least amount of information, while the indices constructed by Esfahani (2001) and Hallerberg, Strauch, and von Hagen (2001) are most data intensive. Lao-Araya (1998) and Gleich (2003) use simpler versions of the latter study's index. For building a broad cross-country index, I adopt the methodology of Alesina et al. (1999) and apply it to the countries covered by the other four studies. For some of these countries, the data provided by the studies needed to be supplemented by examining other sources, which was done by consulting the relevant IMF, World Bank or other publications. This approach ensured the largest set of countries in the database. The more detailed methods adopted in the other studies yield indices that incorporate more information about fiscal policy institutions. However, the Alesina et al. method captures important elements of the information covered by all other studies, hence the rationale for adopting it.

The Alesina et al. method consists of ranking the answers to 10 questions, presented in Appendix A. The rankings of answers are reflected in the scores listed in the table, with higher scores reflecting greater opportunity for fiscal discipline.<sup>17</sup> Questions 1, 2, 3, 7 and 8 pertain to issues regarding "borrowing constraint." The first three questions ask about the existence of constitutional constraints on the deficit, the

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<sup>17</sup> In Alesina et al. (1999), the scores range from 0 to 10. I have scaled the range from 0 to 1. The purpose of rescaling is to avoid the regression coefficients that are very small and require many digits after the decimal point.

importance of a macroeconomic plan as a constraint to the budget process, and the existence of borrowing constraints on the central government. Questions 7 and 8 relate to whether the deficit constraints are binding *ex ante* or *ex post*. The average of the scores for these five questions yields a "borrowing constraint sub-index." Questions 4, 5 and 6 highlight "agenda setting" powers of the finance minister (or whichever office is responsible for the overall budget design). Question 4 deals with the role of the finance minister within the government in the budget design stage. Questions 5 and 6 capture the relative position of the government vis-à-vis the legislature in the approval stage. The average score for these three questions forms the "agenda setting sub-index." Questions 9 and 10 are concerned with whether or not the budget of the central government can be subverted and "contaminated" by the borrowing practices of other public agencies. The less the central government has control, and the more other agencies can influence the budget balance, the less meaningful is the government's budget plan. The average of the scores for these two questions yields an "*ex post* control sub-index." Finally, to construct an overall "fiscal discipline index," we calculate the average of the three sub-indices. Note that all these indices range from 0 to 1, with higher values representing greater ability to ensure discipline.

The index of fiscal discipline thus constructed yields data for 69 countries.<sup>18</sup> For most countries, the assessment of fiscal institutions is available for only one point in time. We use such observations for all years in our panel data because fiscal institutions do not change very often.

### 3.3.3 *Additional Control Variables*

A number of other variables have been examined in the empirical studies of sovereign spreads. In the empirical work presented here, we use a set of such variables to control for effects that are not (or should not) be captured by the variables representing *Fiscal Outcomes* and *Budget Institution Index*. This set consists of *Foreign Reserves*, *External Debts*, *CPI*, and *Law and Order Index*.

Considering that credit spreads indicate the default risk of a country on its foreign currency bonds, we add several variables that possibly affect the ability to honor its outstanding debt denominated in foreign currencies. In this sense, both *Foreign Reserves as share of GDP* and *External Debt as share of*

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<sup>18</sup> These countries are: Algeria, Argentina, Austria, Bahamas, Bangladesh, Belgium, Bolivia, Brazil, Bulgaria, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Finland, France, Germany, Greece, Guatemala, Honduras, Hungary, India, Indonesia, Iran, Ireland, Italy, Jamaica, Jordan, Korea, Rep., Kuwait, Latvia, Lebanon, Lithuania, Luxembourg, Malaysia, Mexico, Morocco, Nepal, Netherlands, New Zealand, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Singapore, Slovak Republic, Slovenia, Spain, Sri Lanka, Sweden, Thailand, Trinidad and Tobago, Tunisia, Turkey, UAE, United Kingdom, USA, Uruguay, Venezuela, and Yemen.

*GDP* are added as explanatory variables. *Reserves to GDP ratio* is expected to be negatively correlated to the risk premia as higher international reserves reflect a stronger ability to service debt or absorb a negative external shock (Baldacci and Kumar, 2010). On the other hand, we would expect the coefficient on *External Debt to GDP ratio* to be positive because the increase in external debt makes a country more vulnerable to sudden external shocks. *International Reserve* and *external debt* data for each country are taken from World Development Indicator (WDI).

Macroeconomic situation factors such as GDP growth rate and inflation may also be possible determinants of credit spreads. A high rate of inflation may indicate structural problems in the government's finances. When a government appears unable or unwilling to pay for current budgetary expenses through taxes or debt issuance, it must resort to seigniorage benefits by printing money, which leads to persistent inflation in the economy. Furthermore, public dissatisfaction with inflation may in turn lead to political instability (Cantor and Packer, 1996). Therefore, one may expect to find that the credit spreads increase with higher inflation. We obtain the country's annual inflation rate data measured by CPI from WDI. We also include the per capita income and GDP growth rate because they may possibly increase the country's ability to honor debt; but those GDP related variables turn out to be insignificantly related to yields in our regressions.

As a socio-political variable that may affect the country's ability to repay debt, we consider the *Law and Order Index* available from the *International Country Risk Guide* (ICRG) dataset (see Knack and Keefer, 1995). This index measures the country's strength and impartiality of the legal system and popular observance of the law. This index ranges between 0 and 6, with higher scores indicating lower risks. Thus, a country can enjoy a high rating if it has a prudent judicial system, but can have a low rating if the law is routinely ignored without effective sanctions (for example, widespread illegal strikes). Our hypothesis is that the *Law and Order Index* is *negatively* related to *spreads* because the governments with stronger enforceability of contracts are more likely to fulfill its previous obligations including debt.

As already seen in Figure 3.1, there is a clear sign that global financial markets influence the emerging market bond spreads. Global factors such as investor's risk appetite and global liquidity have been pointed out as important determinants of credit spreads (Dungey et al., 2001, González-Rozada and Yeyati, 2008). To control for the evolution of international financial markets, we add a year fixed effect into the regression. Indeed, many year dummies turn out to be significant in explaining the fluctuation of emerging market credit spreads.

There may be many other possible determinants of credit spreads. Some such variables have been used in the empirical literature, though the theoretical foundations for experiments have not been developed. I also experimented with several indicators of this type. However, no significant result emerged and therefore, I will not dwell on them in the rest of this study.

*Demographic composition* may determine the level of credit spreads. Countries with faster population aging may face stronger spending pressures over the medium term, limiting the space for fiscal adjustments and finally increasing the default risk of countries. Therefore, aging may be positively correlated to credit spreads (Baldacci and Kumar, 2010). As a measure of aging, we use the share of population above 65 years of age out of total population obtained from *WDI*.

The *Database of Political Institutions* (DBPI) consists of various data and ranks on political and bureaucratic characteristics of most countries in the world. District magnitude and government orientation index are from this dataset. *District magnitude* is the average number of representatives elected per electoral district. If the legislature is composed of lower and upper houses, the measure is the average of the two houses weighted by the numbers of each house's seats. In case no competitive election for the legislature exists, we give the value of zero to this variable. It is because the information we want to obtain from district magnitude is the probability of one-party majority government. As previously discussed, this probability gets higher as district magnitude decreases. Since one-party majority government is always guaranteed in case no competitive election exists, we give a number less than one for the completeness of our dataset. *Government orientation* has a value of 1 if the chief executive is from a conservative or right-wing party, and a value of -1 if from a liberal or left-wing party. For the definitions of conservative and liberal party, we use the ones given by DBPI. The value of zero is given for a centrist or if no specific information is available from DBPI.

We also acquire plurality system dummy, margin of majority, legislative and executive indices of electoral competitiveness from DBPI. *Plurality system dummy* has a value of 1 if legislators are elected by a winner-take-all or first-past-the-post rule, as opposed to the system where parties get seats based on the percentage of votes they receive in the election (proportional representation system). In case both a plurality system and proportional representative system are used, we set plurality system dummy as one if the majority or all of the lower house seats are determined by a plurality system. Since this dummy variable gives similar information that district magnitude does, either one of these two variables is used in actual regressions. *Margin of majority* measures the degree of the ruling party's control in the legislature. It is defined as the fraction of seats in the legislature occupied by the ruling party. Finally, *legislative and*

*executive indices of electoral competitiveness* measure how competitive the legislative or executive elections are. Both indices have values from 1 to 7. If the election is more competitive or more democratic, they have higher values. For example, legislative index of electoral competitiveness is 7 if multiple parties won seats in the legislative election and neither of the parties won more than 75% of the seats.

From the Polity IV database, we obtain *democracy score* that ranges from zero to 10. A high score implies that the country has more democratic polity. By including this variable, it takes account of the direct roles democracy may play in facilitating or impeding fiscal discipline.

We tried *bureaucratic quality*, *corruption*, *contract reliability*, and *government stability* variables provided by ICRG to test the significance of the political and bureaucratic characteristics of a country. The scores are compiled by a survey method that experts on each country's characteristics are involved in. The indices range from 0 to 6 or 10, and higher scores indicate better institutions.

### 3.4 Empirical Analysis

To test empirically, we regress with both country fixed effects and time fixed effect. As seen in Figure 3.1, there exist strong global trends in emerging market spreads. It suggests that time fixed effects need to be added to control for any time varying biases that are common across all countries. We examine the role of fiscal institutions by interaction terms. In other words, we investigate how the interactions of institutions with public debts affect the credit spreads. The structure of the model is the following:

$$\ln EMBI_{it} = \beta_0(\tau)Debt_{it} + \beta_1(\tau)Debt_{it} \times F_i + X'_{it} \cdot \beta_1(\tau) + \eta_i(\tau) + \delta_t(\tau) + \varepsilon_{it}(\tau)$$

where  $\ln EMBI_{it}$  is the log of EMBI index of country  $i$  in year  $t$ ,  $\beta$ s are parameters at  $\tau$ th percentile,  $Debt_{it}$  is the log of government debt as a percentage of GDP,  $f_i$  is the measure for fiscal discipline index of country  $i$  and ranges between 0 and 1.  $X'_{it}$  is a set of possible determinants of credit spreads: *log of International Reserve* and *log of External debt as a percentage of GDP*, *Law and Order Index*, and *log of CPI* are included in the regression.  $\eta_i(\tau)$  is the individual fixed effect of country  $i$  and  $\delta_t(\tau)$  is the time fixed effect in year  $t$ .  $\varepsilon_{it}$  is the error term and we employ bootstrapping standard error for calculating the standard errors of estimates. We use one lag for explanatory variables to avoid possible endogeneity problems.

The econometric method that we use for the estimation is a *quantile* regression with fixed effects for the panel dataset (Koenker, 2004). *Quantile* regression has several advantages in analyzing the

determinants of *Credit spreads*. It is a statistical technique intended to estimate and conduct inference about 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 risk premia among different regions. For example, it is possible to estimate whether *Debt to GDP* alters spreads of a country with a high level of credit spreads in the same way that a country with low level of credit spreads is affected. It turns out to be a huge advantage, considering that the classical least squares 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 squares regression. Some EMBI observations have large values and the least squares regression estimates can be heavily affected by the outliers once they are included. Dropping those observations, however, is not a proper way because they may reflect the country specific issues at that time. Finally, *Quantile* regression can compromise the outlier problem 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 less concern about robustness issues. A 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, which have been proposed by Koenker (2004)<sup>19</sup>.

We ran regressions both with and without the interaction of debt with the fiscal institution variable and the results are plotted in Figure 3.3. Regression (1) in Figure 3.3 does not include the interaction term shows the effect of an increase in debt on spreads when the fiscal institution of a country is neglected. Regression (2), however, includes the interaction between debt to GDP ratio and budget institution and enables us to test the significance of the budget institution. We used the log value of explanatory variables in both regressions and 21 countries are included in the regressions<sup>20</sup>. Again, Figure 3.3 presents the graphs of estimated coefficients in each percentile. Each plot depicts one coefficient in the quantile regression model while the shaded grey area depicts a 95% confidence interval. The dotted line implies a 90% confidence interval.

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<sup>19</sup> For statistical analysis of quantiles regression for panel data, R package “rqpd” has been employed.

<sup>20</sup> 24 countries are in our sample when we run regression without interaction terms. But in the regression outcomes presented, we only include the 21 countries to keep the same country list both in regression with and without interaction terms. The regression results do not change when we include 3 other countries (South Africa, Ukraine, and Vietnam) that do not have a fiscal discipline index.

First consider how *public debts* affect the *credit spreads*. The regression shows that increases in Debt to GDP ratio significantly widens credit spreads for all percentiles and the coefficients of debt to GDP steadily increase as regression moves to the upper tails of the quantile. Note that the upper percentile such as  $\tau = .9$  of the distribution indicates the situation that a country faces high yield spreads. This finding suggests that investors penalize the deterioration of a country's fiscal position by raising borrowing cost. Furthermore, investors are more sensitive to increases in debt when this country has already shown the symptoms of economic troubles and repayment problems such as high spreads.

As expected, *the interaction of Debt to GDP with fiscal discipline* has a significant negative sign for all percentiles. Furthermore, the interaction term has a more positive effect on spreads, i.e., narrowing the spreads, in the upper tail than in the lower tail. For example in Regression (2) in Figure 3.3, the coefficient of the interaction term is -4.03664 at the .25 percentile but it becomes -5.51249 at the .75 percentile and -6.35972 at the .90 percentile. It implies that better fiscal institutions tend to mitigate the widening of credit spreads caused by increases in debt; this positive effect is larger when the country's spreads are already widened. It is possible because the market participants perceive that country will maintain fiscal soundness in the long run, although its public debt increases in the short run even under severe negative shock. Therefore, the risk premia of a country with better fiscal institutions does not increase as badly as the country with weak fiscal institutions.

Perhaps surprisingly, the widening of credit spreads caused by changes in debt can be fully offset by strong fiscal discipline if a country has a perfect (in the sense of our measurement) fiscal institution. The coefficients of the interaction terms are very close or slightly bigger than the coefficients of *debt to GDP*. Considering that the measure of fiscal discipline index ranges from 0 and 1, the interaction term has the exact same values as *debt to GDP* if the *fiscal discipline index* is 1 and it shrinks as the country's fiscal discipline has a lower score that is close to 0. Therefore, the adverse effect of raising debt on spreads is much smaller if a country has a strong discipline. For example, the coefficients of *debt to GDP* and *interaction term* are 4.2378 and -4.5914 respectively at the 50<sup>th</sup> percentile of Regression (2). It indicates that a one unit increase of *log of debt to GDP ratio* makes the median value of *log of EMBI* go up by 4.2378, while the interaction term makes this value decrease by -4.5914 when the budget index is 1.

Now suppose that the country's fiscal discipline index is 0.338, which is the lowest score in our sample. Then the net effect of a one unit increase in *log of debt to GDP* on the *log of EMBI* is 4.6267. However, the net effect stays only at 0.6366 if a country's fiscal discipline index is 0.806, which is the highest score in our sample. Comparing the magnitude of coefficients of *log of debt to GDP* from the

regression without and with the interaction term also supports our hypothesis. The coefficients of *log of debt to GDP ratio* from the regression without the interaction term are obviously smaller than the ones from the regression with interaction. For example, at the 50<sup>th</sup> percentile, the coefficient of *log of debt to GDP* in Regression (1) is 1.7468 and the coefficient in Regression (2) is 4.238, which includes interaction between *debt to GDP* and *fiscal institution*. It is because the coefficient in Regression (1) reflects the net effect of changes in debt on spreads while the coefficient of *debt to GDP* in Regression (2) explains the possible increases of spreads before the interaction of *debt to GDP* with *fiscal discipline* decreases the magnitude of widening spreads.

Both *Foreign reserve* and *external debt* have the expected correlation with spreads. *Foreign Reserve to GDP ratio*, which provides insulation against external shock, is *negatively* related to credit spreads with statistical significance. *Foreign Reserve to GDP* has a quite uniform effect on spreads over the whole range of the distribution. i.e., the size of coefficients is quite stable in all quantiles. It implies that any accumulation of foreign reserves decreases the spreads linearly with the same magnitude in all regions. *External debt to GDP ratio*, which indicates the vulnerability of a country to external shocks, is positively correlated with credit spreads.

The regressions show that the stronger *socio-political* institutional feature measured by the *Law and Order Index* reduces the borrowing cost of a country and this positive effect is stable across all the percentiles. One notch higher of the indicator decreases the log of EMBI by about -0.1 throughout the distribution in Regression (2). Macroeconomic instability measured by CPI has a deleterious effect on the borrowing cost of a country. If a country suffers from higher inflation, it may suggest the structural problem of the government's finances and investors are willing to charge higher interest rates.

### **3.5 Conclusion**

This study investigates the role of fiscal discipline on credit spreads in emerging market countries. The analysis takes into account country-specific factors and global trends for a panel of 21 emerging market economies. The key finding is that fiscal institutions are a significant determinant of risk premia. We find that the increases in public debt lead to widening of the spreads but it becomes less important when a country has better fiscal institutions. In other words, better fiscal institutions tend to mitigate the widening of credit spread from increases in debt.

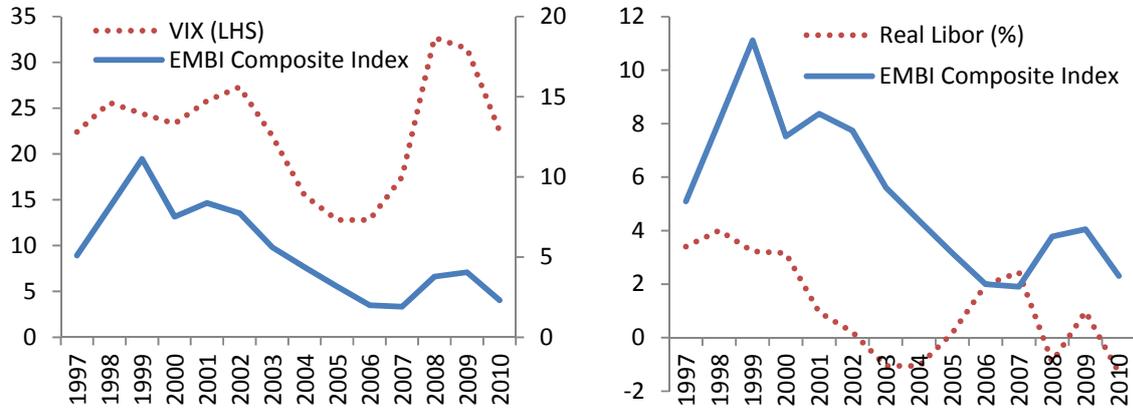
Furthermore, the quantile regression method which was adopted for the analysis helps to estimate the different influence of fiscal discipline on spreads along the distribution of credit spreads. It turns out that the fiscal institutions have strong forces to decrease the credit spreads as regression moves to the upper tails of distribution, which refers to the higher credit spread regions. It is possible because the market participants consider the role of fiscal institutions when pricing the risk premia of sovereign bonds. Investors perceive that the country will be more likely to maintain fiscal prudence in the long run in spite of short run deterioration in the fiscal position if it has better fiscal institutions.

An interesting outcome of this study is that the widening of spreads can be completely offset by good fiscal discipline in a country. It implies that the negative impact of borrowing more money from financial markets on bond yield spreads will be negligible if a country has good fiscal institutions. It can explain why some countries face much higher yield spreads while another country can borrow money at about the same price.

Last, other than public debt and budget institutions, it is worth noting that the socio-political characteristics of a country such as *Contract Reliability* and observance of *Law and Order* also play important roles in determining the level of sovereign bonds yield spreads. Better fiscal and political characteristics decrease the possible default risk of a country and lead to lower credit spreads. In practice, we can say that improving institutional characteristics and becoming more reliable in the financial markets helps a country to borrow money at a lower interest rate.

Chapter 3 Figures

Figure 3.1 Trends in Emerging Market Sovereign Bond Spread



Source: Global Financial Data and Chicago Board Options Exchange (CBOE)

**Figure 3.2 EMBI and Public Debt**

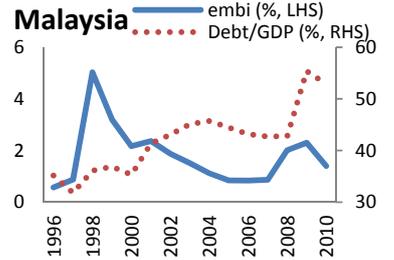
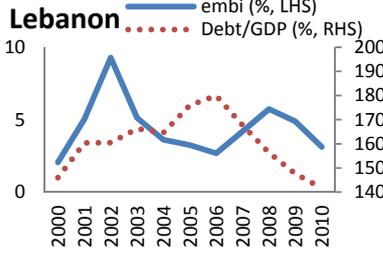
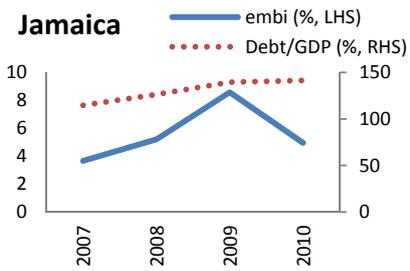
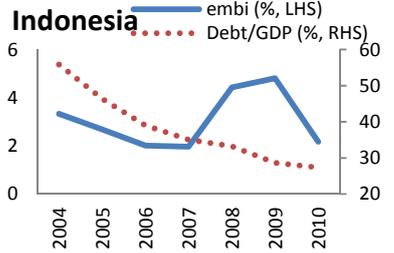
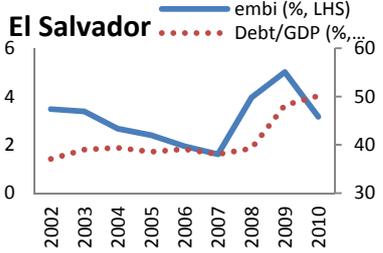
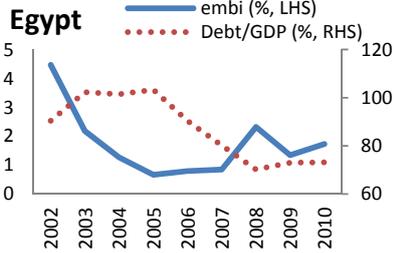
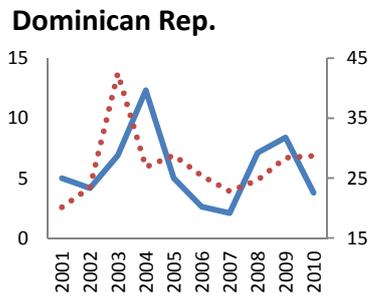
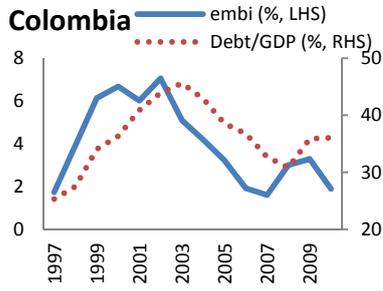
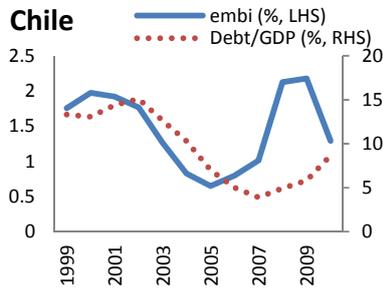
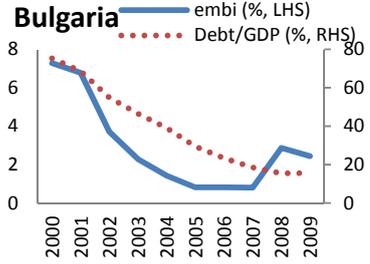
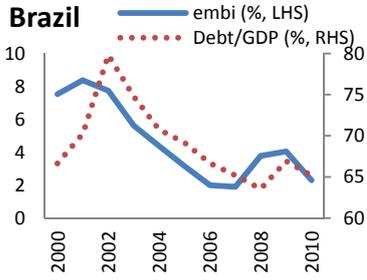
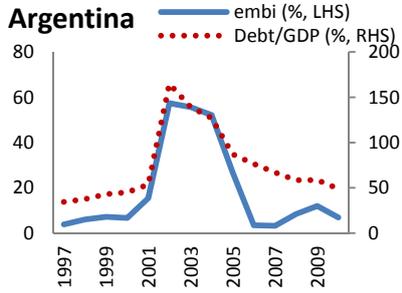
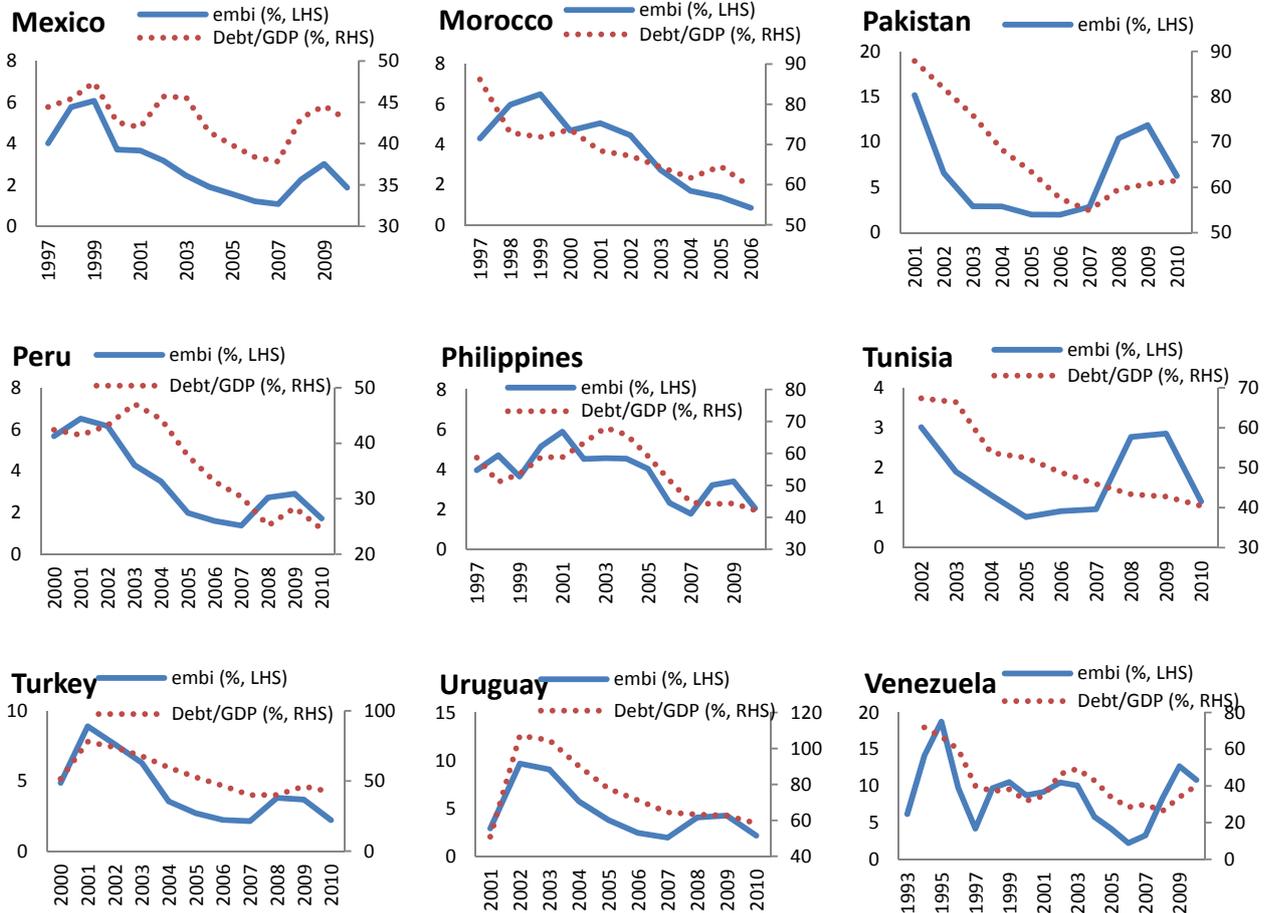


Figure 3.2 (cont.)



Source: Global Financial Data and World Economic Outlook

Figure 3.3 *Quantile Regression Plots*

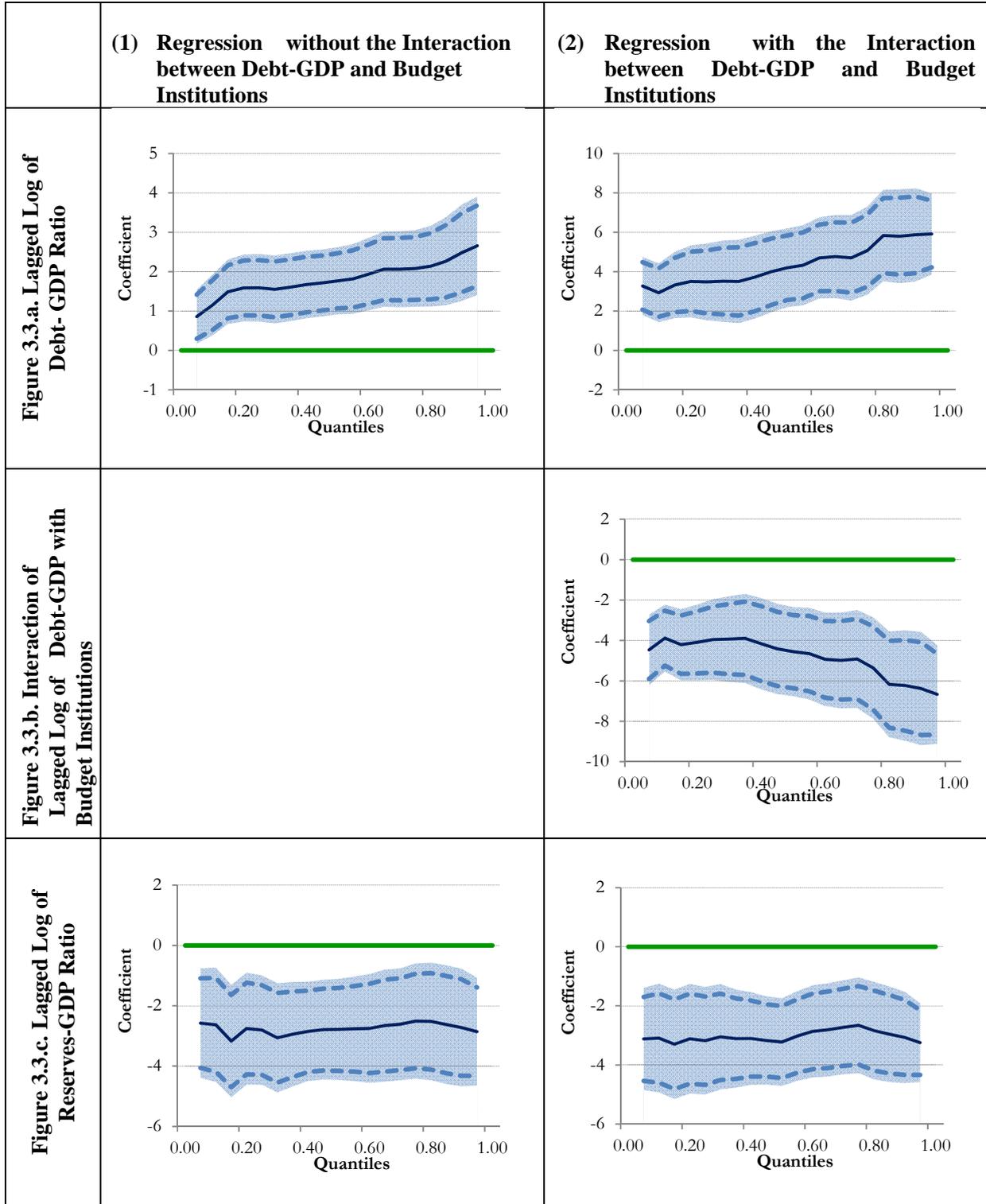
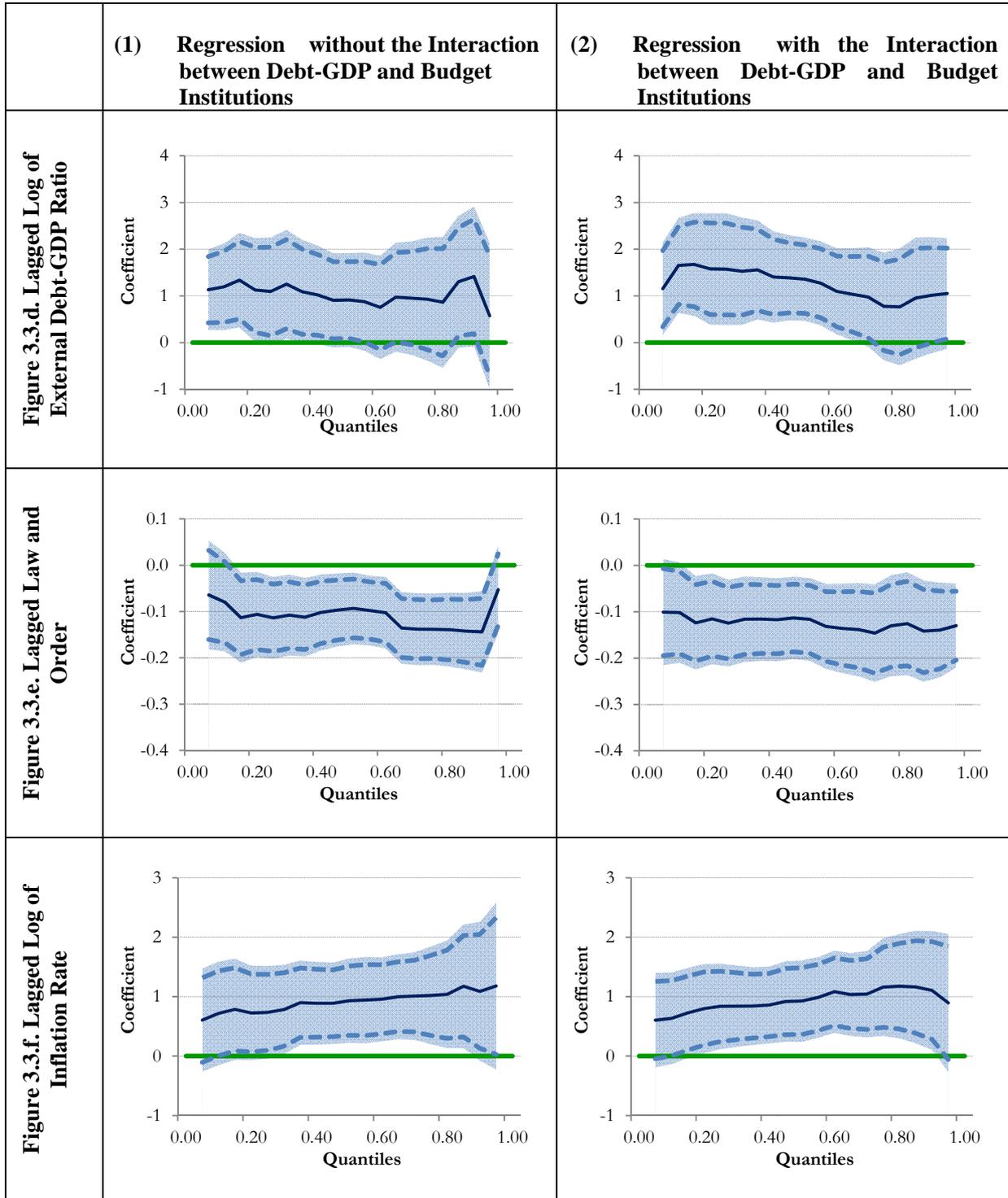


Figure 3.3 (cont.)



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## Appendix A. Assessment of Budget Institutions: Alesina et al (1999) Method

Institutional Arrangement	Score	Institutional Arrangement	Score
1. What constitutional constraints are there on the fiscal deficit?		7. Can the budget be modified after Congress approval?	
<i>No restrictions</i>	0.00	<i>On Government's or Congress' initiative</i>	0.00
<i>Budget should include proper financing for deficit</i>	0.50	<i>On government's initiative without congressional approval</i>	0.50
<i>Deficits are not allowed</i>	1.00	<i>On government's initiative with congressional approval</i>	0.75
		<i>No</i>	1.00
2. Is there a legal requirement for the approval of a macro program to precede the presentation of the budget to Congress? How important is this requirement in practice?		8. Is the government legally empowered to cut spending after the budget has been approved?	
<i>Not important or not required</i>	0.00	<i>No</i>	0.00
<i>Relatively important</i>	0.50	<i>At government's discretion on any item</i>	0.67
<i>Very important</i>	1.00	<i>At government's discretion for non-earmarked expenditures</i>	0.67
		<i>Only when revenues are lower than projected</i>	1.00
3. What kind of borrowing constraints are there on the government?		9. Does the central government typically assume debt originally contracted by other public agencies? Under what circumstances?	
<i>Govt. borrows if shortfall</i>	0.00	<i>Including non-guaranteed debt</i>	0.00
<i>Congress approves each borrowing operation</i>	0.33	<i>Frequently</i>	0.33
<i>Ceiling set by the government</i>	0.67	<i>Occasionally</i>	0.67
<i>Ceiling set by Congress</i>	1.00	<i>Only on guaranteed debt</i>	0.75
		<i>Exceptionally</i>	1.00
4. Is the authority of the Minister of Finance greater than that of the spending ministers on budgetary issues?		10. Can these agencies borrow autonomously?	
<i>No</i>	0.00	State and local governments	
<i>Somewhat greater</i>	0.50	<i>Yes, without restrictions</i>	0.00
<i>Yes, considerably greater</i>	1.00	<i>With local legislative approval</i>	0.125
		<i>With central government approval</i>	0.250
5: Restrictions on the content of amendments to the budget by Congress: Congress can only pass amendments...		<i>With Congress approval</i>	0.375
<i>with no restrictions</i>	0.00	<i>No</i>	0.50
<i>that do not increase spending</i>	0.25	Public enterprises	
<i>that do not increase the deficit</i>	0.50	<i>Yes, without restrictions</i>	0.00
<i>that do not increase the deficit or spending without government approval</i>	0.75	<i>With central government approval</i>	0.20
<i>that do not increase deficit or spending</i>	0.10	<i>With Congress approval</i>	
6: What happens if Congress rejects the budget, or does not approve it within the constitutionally set time frame?		<i>No</i>	0.50
<i>The government submits a new budget or previous year's budget is enacted by 12ths</i>	0.20		
<i>The government submits a new budget</i>	0.40		
<i>The government resigns</i>	0.50		
<i>The previous year's budget is enacted</i>	0.60		
<i>No funds may be expended</i>	0.80		
<i>The budget proposed by government is enacted</i>	1.00		