Legal Enforcement, Public Supply of Liquidity and Sovereign Risk

Filippo Brutti*
University of Zurich and Study Center Gerzensee

February 2009

Abstract

Sovereign debt crises in emerging markets are usually associated with widespread liquidity and banking crises in the economy. The conventional view is that the domestic financial turmoil is the consequence of foreign retaliation, but there is no clear empirical evidence supporting the application of "classic" default penalties. This paper emphasizes a direct link between sovereign default and liquidity crises, building on two natural assumptions: (i) government bonds represent a source of liquidity due to weak contract enforcement and lack of collateral; (ii) the government cannot discriminate between domestic and foreign agents in the event of default. In this context external debt emerges even in absence of classic penalties and government default is countercyclical, triggers a liquidity crunch and amplifies output volatility. The paper further analyzes the government incentives to undertake financial reforms that enhance private provision of liquidity.

Keywords: Legal institutions, liquidity, sovereign risk, financial dependence.

JEL *Classification:* F34, O16.

*I thank Jaume Ventura for his valuable guidance and countless suggestions, as well as Peter Benczur, Fernando Broner, Paula Bustos, Antonio Ciccone, Davide Debortoli, José Antonio Dorich, Nathan Foley-Fisher, Miklos Koren, Gino Gancia, Nicola Gennaioli, Dirk Niepelt, Silvana Tenreyro, Joachim Voth, Vivian Yue and Fabrizio Zilibotti for helpful comments. I am particularly indebted with Alberto Martin for discussing with me the idea of the paper since the very beginning. I also benefited from comments at the Bank of Hungary, Bank of Italy, EPFL Lausanne, Federal Reserve Board, Study Center Gerzensee, Universitat Pompeu Fabra, University of Warwick, University of Zurich and at the "Micro and Macroeconomic Effects of Financial Globalization" NBER conference. Any remaining errors are my own. Financial support from the European Research Council (ERC Advanced Grant IPCDP-229883) is gratefully acknowledged. Correspondence: brutti@iew.uzh.ch.

1 Introduction

Sovereign debt crises in emerging markets are usually associated with liquidity and banking crises.[1] The conventional view is that such domestic financial turmoil is caused by foreign retaliation, as trade sanctions or exclusion from international financial markets.[2] Yet, this interpretation is controversial. First, there is no clear-cut empirical evidence supporting the application of "classic" penalties.[3] Second, in recent sovereign crises (e.g. Argentina 2001 and Russia 1998) government default had a direct "balance-sheet" effect on domestic financial institutions, since a large fraction of public debt was held domestically (see Mishkin (2006)). In this paper, I study the connection between sovereign defaults and liquidity crises in absence of external penalties.

The model builds on two natural assumptions for emerging markets. First, public debt represents a source of liquidity for the private sector. Indeed, limited enforcement restricts the access to spot credit markets and induces firms to save in government bonds (either directly or indirectly through the banking sector) as a financial buffer that can be drawn in case of unexpected investment opportunities. This is consistent with the negative correlation between creditor rights protection and banks' holdings of government debt observed in the data.[4] Second, the government cannot discriminate between domestic and foreign bond holders in the event of default. This assumption, which stems from the increasing integration of domestic financial markets, is consistent with the large haircuts suffered by domestic financial institutions on their government debt holdings observed in recent debt crises.

The implications of these two assumptions are clear. The government faces a trade-off which explains sovereign repayment even in absence of foreign penalties. A default, indeed, can be beneficial to domestic welfare because it avoids a transfer to foreign creditors, but on the other hand it triggers a liquidity crisis that lowers domestic investment and production. Eventually, the government repayment choice is determined by the state of aggregate productivity, is procyclical and amplifies output volatility through its effect on private investment.

Two strands of the literature are brought together in this paper. The motivation for holding gov-

[1] Applying a methodology similar to Kaminsky and Reinhart (1999) to a large sample of countries over 1980-2000, Borensztein and Panizza (2008) show that over the period 1980-2000 sovereign default has been a good predictor of a banking crisis for a wide sample of emerging economies. Indeed, they find that the probability of a banking crisis in a given year conditional on having a sovereign default in the same year or in the year before is 14 percent, whereas the unconditional probability is only a 2 percent, and the difference between the conditional and unconditional probability is statistically significant. On the other hand, the probability of a sovereign default conditional on a banking crisis is not statistically different from the unconditional probability.

[2] Since the seminal papers of Eaton and Gersovitz (1981) and Bulow and Rogoff (1989), the analysis of the costs associated with default has attracted a large literature. Indeed, as creditors have little power to enforce repayment under existing legal arrangements (due to the jurisprudential principle of "sovereign immunity"), debt repayment hinges on a sovereign's willingness to avoid the cost of a default. See Grossman and Van Huyck (1988), Bulow and Rogoff (1989), Fernandez and Rosenthal (1990), Cole and Kehoe (1998), Kletzer and Wright (2000), Wright (2002), Amador (2004), Yue (2005), Aguiar and Gopinath (2006) and Arellano (2008), among others. Eaton and Fernández (1995) and Sturzenegger and Zettelmeyer (2006) provide two excellent surveys.

[3] See Borensztein and Panizza (2008).

[4] See Kumhof and Tanner (2005).

ernment bonds is based on the corporate finance approach to liquidity hoarding, e.g. Holmstrom and Tirole (1998), and is extended to the case of open economies. The view in this literature is that agents need to save in government bonds because a lack of collateral dampens both their access to spot credit markets and the size of private financial markets, which cannot provide sufficient saving instruments to hoard liquidity. Simple intuition then suggests that the demand for government bonds declines as the economy integrates with a large foreign markets featuring a virtually infinite financial capacity. Yet, this papers shows that this prediction fails miserably when the government can manipulate returns on public bonds. Indeed, by making returns pro-cyclical, the government could encourage the demand for bonds by domestic agents, who seek to reallocate resources from the least to the most productive state, and ultimately its own ability to issue debt.

The focus on the consequences of default on the domestic private sector, instead, is closely related to a number of recent paper in the sovereign debt literature, e.g. Broner and Ventura (2006, 2008), Guembel and Sussman (2009), Gennaioli et al. (2009).[5] These papers share the assumption of imperfect discrimination among creditors and address respectively the welfare and distributional effects of default, the political process governing sovereign repayment and the interaction between private and public capital flows. My paper instead concentrates on the effects on corporate investment and output.

Having established the link between sovereign defaults and liquidity crises, this paper then analyzes the consequences of a financial reform in this economy. The novel implication is that the reform does not necessarily raise welfare and in some cases it has a backfire effect. Suppose that suddenly domestic firms have access to credit lines that are contingent on each firm's future need for liquidity. Conventional wisdom suggests that this reform must have unambiguously positive welfare effects since it allows firms to reallocate efficiently liquidity across future states. However, this interpretation considers only one aspect of the reform. The reverse aspect is that domestic firms will stop hoarding liquidity in the form of public bonds and, as the ex-post cost of default will decline, the government will loose access to foreign credit. In general, then, a financial reform might involve a substitution between private and public investment whose outcome in terms of social welfare depends on their relative returns.

Finally, the empirical section documents that sovereign debt crises are associated with domestic liquidity crises. Using sectoral data for a panel of 45 countries over the period 1980-2000, sovereign default appears to have a disproportionate negative impact on the growth rate of financially dependent sectors. The rest of the paper is organized as follows. Section 2 describes the model. Section 3 discusses the implications of institutional reforms. Section 4 presents the empirical evidence. Finally, section 5 concludes.

[5] See also Sandleris (2006) and Basu (2008).

2 A model of sovereign risk and liquidity crises

This section describes a stylized economy where government debt represents a source of liquidity due to frictions in private credit markets. The model is used to discuss the implications of sovereign risk for private investment and aggregate output.

2.1 Technology

Consider a small open economy that lasts for three periods: $t = 0, 1, 2$. There is a single homogenous good which is produced by a continuum of risky investment projects. Investment in each project j costs one unit of the good in $t = 0$ and returns θA_j in $t = 2$, where θ and A_j denote two independent shocks realized in $t = 1$. θ captures an *aggregate* shock, which affects all projects equally and takes values $\theta_H > 1$ with probability $\pi(\theta_H)$ (good state of the economy) and $\theta_L < 1$ with probability $\pi(\theta_L) = 1 - \pi(\theta_H)$ (bad state of the economy). Let's normalize this shock such that the expected value is one, i.e. $\pi(\theta_H)\theta_H + \pi(\theta_L)\theta_L = 1$. A_j captures an *idiosyncratic* shock, which affects each project individually and takes values $A > 0$ if the project is lucky and zero if the project is unlucky. Each project have an equal probability of being lucky or unlucky. In the latter case, the project admits an additional investment with variable size, i, which returns $\theta\rho\, i$ in $t = 2$. Setting $\frac{A}{2} > 1$ and $\theta_L\, \rho > 1$, both date 0 and date 1 investments are profitable. Figure 1 describes the timing of investment projects.

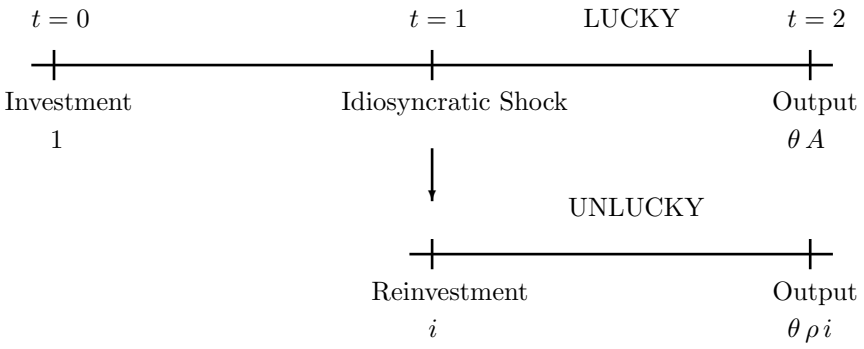

Figure 1: Timing of investment projects

2.2 Agents and Preferences

The economy is populated by a continuum of individuals with mass one, who have zero initial endowment, consume only at date 2 and are risk neutral. There are two types of individuals: *entrepreneurs* (firms) and *workers*, both with mass one half. Entrepreneurs have access to the

investment technology and each one can start a single project. Workers, on the other hand, have no access to the investment technology, but get income w at date 1. There is also a benevolent *government* which maximizes the average welfare of domestic individuals. At date 0, the government has access to public investment project with rate of return $\phi > 1$ and maximum size $\bar{g}$.

2.3 Financial Frictions

The economy is financially integrated with an international financial market (IFM), which is risk neutral, has deep-pockets and can lend/borrow at the normalized interest rate $r^* = 1$. Then, both the entrepreneurs and the government can borrow from the IFM to finance their projects. Let's now discuss the type of financial frictions in this economy. First, entrepreneurs' access to credit is limited by a weak enforcement of creditor rights, which reflects the inability of courts of law to seize the entire value of a debtor's assets.

Assumption 1 *Entrepreneurs can pledge only a fraction γ of expected revenues, while workers cannot commit future income.*

Financial frictions can influence private investment in many ways.[6] Here, I focus on how they affect firms' demand for liquidity by assuming (i) $\gamma \frac{A}{2} > 1$ and (ii) $\gamma \theta_H \rho < 1$. These two conditions imply, respectively, that date 0 investment is profitable for the IFM but date 1 investment is not. Hence, unlucky entrepreneurs cannot borrow on the spot market to finance additional investment.

Firms could obtain the resources required for additional investment by negotiating a positive transfer from the IFM in case of adverse expenditure shock in exchange for an upfront payment. However, for the time being, I restrict this possibility.

Assumption 2 *Entrepreneurs cannot enter into contingent contracts with the IFM.*

Assumption 1 and 2 together imply that firms need to save for future investment and they can do so only purchasing non-contingent bonds. Entrepreneurs can choose to buy either a foreign bond or a public bond, issued by the domestic government. The government, indeed, issues a one-period bond in $t = 0$ to both the IFM and domestic entrepreneurs to finance the investment in the public project and repays it by collecting lump-sum taxes at date 1. Sovereign risk arises whenever the government cannot commit to repay in the future.

Assumption 3 *The government commits to repay its debt with probability π_G.*

[6] Since the seminal contribution of Modigliani and Miller (1958), financial frictions and their consequences have attracted a growing literature. Hubbard (1998) and Stein (2003) provide two excellent surveys. A necessarily incomplete list of past contributions include: Bernanke and Gertler (1989), Bernanke et al. (1999), Kiyotaki and Moore (1997), Carlstrom and Fuerst (1997), Kocherlakota (2000), Martin (2005) on the link between credit cycles and business cycles; Matsuyama (2004), Caballero et al. (2008) on international capital flows and global imbalances; Aghion et al. (2004), Caballero and Krishnamurthy (2001), Mendoza (2006) on emerging market crises and sudden stops.

If $\pi_G = 1$, there is full commitment and the government always repays. If $\pi_G = 0$, there is full discretion and the government can choose whether to repay or not to maximize the welfare of domestic individuals. Following Broner and Ventura (2006), I consider that in the event of a default the government cannot discriminate between domestic and foreign creditors.

Assumption 4 *The government cannot discriminate between domestic and foreign creditors.*

Assumption 4 is consistent with the large haircuts suffered by domestic financial institutions on government bonds during recent debt crises (e.g. Russia 1998 and Argentina 2001). It also reflects the recent development of liquid secondary markets for sovereign bonds, which makes the gathering of informations on individual bondholders both unfeasible and inefficient for the government.[7]

3 Equilibrium

This section solves for the competitive equilibrium of the model under two opposite regimes: the case of full commitment by the government, i.e. $\pi_G = 1$, and the case of full discretion, i.e. $\pi_G = 0$. The comparison between the two cases helps to explain why domestic agents buy government bonds rather than foreign bonds and the connection between sovereign defaults and liquidity crises.

3.1 Equilibrium with government commitment

At date 0 the representative entrepreneur borrows d from the IFM and save in government and foreign bonds with face value b and f to maximize the expected profit from the project,

$$\sum_{\theta} \pi(\theta) \left(\frac{y_l(\theta) + y_u(\theta)}{2} \right) - d \tag{1}$$

where $y_l(\theta) = \theta A + (b + f - \tau)$ and $y_u(\theta) = \theta \rho(b + f - \tau)$ denote respectively the output from a lucky and an unlucky project. Notice that unlucky entrepreneurs fully reinvest in the project, i.e. $i = b + f - \tau$, since additional investment has strictly positive net returns. The budget

[7] Suppose the government can discriminate among domestic and foreign bondholders. Then, foreigners would always unfold their positions by selling bonds to domestics (which have the incentive to buy the bond at any non-negative discount) before maturity and would *de facto* receive their payment in any future contingency. Then, if the government wants to avoid the repayment of foreigners, it must commit to default on all bond holders indiscriminately (e.g., by not gathering information on secondary market transactions). By doing so, the government can gain an additional degree of freedom and, as shown in the next section, implement a contingent repayment policy. The following quote from Reinhart et al. (2003) is enlightening: *"the view that extemal debt is completely separable from domestically issued debt is dead wrong"*

constraint of the entrepreneur is

$$1 + b + f \;=\; d, \tag{2}$$

where government bonds have unit price as foreign bonds and the cost of initial investment is one. Limited contract enforcement restrains date 0 borrowing by imposing,

$$d \;\leq\; \gamma \sum_{\theta} \pi(\theta) \left(\frac{y_l(\theta) + y_u(\theta)}{2} \right). \tag{3}$$

Maximization of (1) subject to (2)-(3) features a corner solution where the borrowing constraint is binding and government and foreign bonds are perfect substitutes. This result hinges on that the expected (gross) return of entrepreneurs on both bonds is higher than the borrowing rate, i.e. $\bar{\rho} \equiv \frac{(1+\rho)}{2} > 1$. In particular, firms' saving in government and foreign bonds is

$$b + f = \gamma \, \frac{\frac{A}{2} - \bar{\rho}\,\tau - 1}{1 - \gamma\,\bar{\rho}}. \tag{4}$$

Aggregation across individuals implies that the average income of entrepreneurs is $Y_E(\theta) = \frac{y_l(\theta)+y_u(\theta)}{2} - d$ and the average income of workers is $Y_W = w - \tau$. Social welfare is given by the sum of entrepreneurs' and workers' income plus the return on public investment,

$$W(\theta) = \frac{1}{2} Y_E(\theta) + \frac{1}{2} Y_W + \phi \; g \tag{5}$$

The problem of the government then consists in choosing date 0 public investment and debt issuance, g and B, and date 1 taxation, τ, to maximize the expected value of social welfare, i.e. $\sum_\theta \pi(\theta) \; W(\theta)$, subject to the budget constraints $B = g$ and $\tau = B$. Maximization implies the following condition:

$$g = \begin{cases} \bar{g} & \text{if} \quad \phi \;\geq\; \frac{1}{2}\left(1 + \frac{\bar{\rho} - \gamma\bar{\rho}}{1 - \gamma\bar{\rho}}\right) \\ 0 & \text{if} \quad \phi \;<\; \frac{1}{2}\left(1 + \frac{\bar{\rho} - \gamma\bar{\rho}}{1 - \gamma\bar{\rho}}\right) \end{cases}, \tag{6}$$

which states that the government undertakes the public investment only if the future return exceeds the cost of taxation required to pay for it. Suppose now that the government invests in the public project. Then, government debt equals the size of public investment, i.e. $B = \bar{g}$. By imposing market clearing, the level of external debt is $b^* = B - \frac{1}{2} b$. Hence, if public investment $\bar{g}$ is greater or equal than the right hand side of (4), there exists one equilibrium in which the government can only issue debt domestically. Otherwise, the government needs to borrow from the IFM, as domestic demand for public bonds is too low. As sovereign risk emerges only when the government is borrowing from abroad, I will henceforth focus on this case.

3.2 Equilibrium with sovereign risk

Consider now that the government cannot commit and chooses whether to repay or not its debt to maximize the welfare of domestic individuals. In absence of discrimination between domestic and foreign creditors, the government faces a clear trade-off: indeed, debt repayment involves both an efficient reallocation from workers to entrepreneurs, which raises aggregate investment, but also a transfer to foreign creditors (IFM), which lowers resources available for consumption. Let $e \in \{0, 1\}$ denote the government's repayment policy, where $e = 1$ indicates repayment and $e = 0$ indicates default. Repayment then occurs only if the increase in entrepreneurs' average income (LHS) exceeds the loss in workers' average income (RHS),

$$Y_E(\theta, e = 1) - Y_E(\theta, e = 0) \;\geq\; Y_W(e = 0) - Y_W(e = 1) \tag{7}$$

where the average income of entrepreneurs $Y_E(\theta, e) = \frac{y_l(\theta,e)+y_u(\theta,e)}{2} - d$ depends on the policy e through the face value of government bonds and taxation, as in

$$y_l(\theta, e) = \theta\, A + f + e\,(b - \tau) \quad \text{and} \quad y_u(\theta, e) = \theta\, \rho\big(f + e(b - \tau)\big), \tag{8}$$

while the average income of workers depends on e only through taxation, as in $Y_W(e) = w - e\,\tau$.[8] The RHS of (7) depends on the return on unlucky firms' investment and is increasing in aggregate productivity θ, while the LHS is constant. Therefore, there might be an equilibrium where (7) is satisfied for $\theta = \theta_H$ but not for $\theta = \theta_L$. In such a case, the government's repayment policy would be procyclical. Let's now show that this is actually verified in the unique equilibrium of the model.

At date 0, the representative entrepreneur then decides how much to save in public and foreign bonds taking into account the risk of opportunistic behavior by the government. In particular, he chooses $\{d, b, f\}$ to maximize

$$\sum_{\theta} \pi(\theta) \left(\frac{y_l(\theta, e) + y_u(\theta, e)}{2} \right) - d, \tag{9}$$

subject to the budget constraint and the borrowing constraint. When the government repays only when productivity is high, the budget constraint of the entrepreneur is

$$1 + f + \pi(\theta_H)\, b = d, \tag{10}$$

where $\pi(\theta_H)$ is the actuarial fair of government bonds required to compensate risk neutral agents

[8] Notice that I have expressed condition (7) in terms of the average income of two groups of agents rather than in terms of total income since entrepreneurs and workers have equal mass.

for default in the bad state. The borrowing constraint is given by

$$d \leq \gamma \sum_{\theta} \pi(\theta) \left(\frac{y_l(\theta, e) + y_u(\theta, e)}{2} \right). \tag{11}$$

Revenue maximization now implies that domestic entrepreneurs save only in government bonds. Intuitively, government bonds are now contingent on the state of the economy, allowing domestic firms to reallocate liquidity to the state in which the productivity of additional investment is higher. A simple rearrangement of (9) shows indeed that the expected (gross) return on government bonds $\bar{\rho}_H \equiv \frac{1+\theta_H \rho}{2}$, which is greater than the expected return (gross) on foreign bonds, $\rho = \frac{1+\rho}{2}$, since $\theta_H > 1$. Given that both returns exceed the borrowing rate, the borrowing constraint must be binding and the following condition holds:

$$b = \gamma \frac{\frac{A}{2} - \pi_H \bar{\rho}_H \tau - 1}{\pi_H (1 - \gamma \bar{\rho}_H)} \qquad \text{and} \qquad f = 0. \tag{12}$$

Similarly as before, the government chooses $\{g, B, \tau\}$ to maximize the expected value of social welfare, i.e. $\sum_{\theta=\theta_H,\theta_L} \pi(\theta)\ W(\theta, e)$, where

$$W(\theta, e) = \frac{1}{2} Y_E(\theta, e) + \frac{1}{2} Y_W(e) + \phi\ g, \tag{13}$$

subject to the budget constraints $\pi_H B = g$ and $\tau = B$. In absence of commitment, however, future repayment must be incentive compatible at least when $\theta = \theta_H$ to induce individuals to buy government bonds,

$$Y_E(\theta_H, e = 1) - Y_E(\theta_H, e = 0) \ \geq \ Y_W(e = 0) - Y_W(e = 1). \tag{14}$$

Maximization of social welfare implies that the incentive compatibility constraint is binding, the repayment policy of the government is procyclical, i.e. $e = 1$ if $\theta = \theta_H$ and $e = 0$ if $\theta = \theta_L$, and that, substituting for$Y_E(\theta_H, e)$ and $Y_W(e)$ and $\tau = B = \frac{1}{2} b + b^*$ in (14), the level of external debt equals a fraction of domestic debt, i.e. $b^* = \frac{1}{2} \left(\frac{\theta_H \rho - 1}{\theta_H \rho + 3} \right) b$. The reason is twofold. The government wants to increase its debt to maximize public investment.[9] This eventually triggers a procyclical repayment policy which encourages entrepreneurs' demand for government bonds, raises the cost of sovereign default and relax further the government borrowing constraint.

[9]Notice that I am still assuming that the return on public investment exceeds the implied cost of taxation in order to make the government willing to borrow, i.e. $\phi \geq \frac{1}{2} \left(1 + \frac{1+\theta_H \rho}{2} \right)$.

3.3 Discussion

The previous model shows that sovereign debt might emerge even in absence of classic penalties and that sovereign default triggers a liquidity crisis that disrupts private investment when economic conditions worsen and amplifies output volatility. Both results arise as a consequence of the liquidity role of public debt. Given that generality has been sacrificed in favor of analytical simplicity, a detailed discussion of the main aspected of the model is required.

- The model extends Holmstrom and Tirole (1998) argument that government debt represents a source of liquidity to the case of open economies. These authors consider a similar framework to the one previously described where agents need to hoard financial assets for precautionary reasons. Government intervention can be welfare improving particularly when private financial markets are downsized by a lack of collateral, because it expands the supply of financial assets.[10] Quite remarkably, my model shows that this result holds even when the economy integrates with a financial market with virtually infinite capacity. Indeed, the contingency on sovereign bonds make them an imperfectly substitutable source of liquidity, since it allows the domestic private sector to reallocate efficiently resources to the most productive state. Nevertheless, preferences play a crucial role here, since a high degree of risk aversion could induce domestic agents to buy the foreign bond to smooth consumption across states. The nature of liquidity needs then becomes crucial. If agents wanted to save resources to invest in the future, they would tend to prefer portfolios which perform better when the economic outlook is good and good investment opportunities are likely to arise. Otherwise, if they wanted to save resources to finance consumption, they would tend to prefer portfolios with countercyclical performance to hedge against adverse shocks in other sources of income (e.g. labor income). In such a case, however, domestic demand for public debt could also be encouraged by existing forms of financial repression (e.g. tax incentives, capital outflows restrictions), which would raise the government's access to foreign borrowing by affecting the cost of future default.

- Government debt enhances private liquidity because it involves a redistribution of resources from taxpayers to entrepreneurs that private financial markets cannot accomplish. An implicit assumption then is that the government cannot make transfer across domestic individuals, or equivalently that there is non discrimination in taxation. With perfect tax discrimination, the government would always default on debt and just redistribute resources from workers to entrepreneurs. This assumption, however, seems a realistic one, as a similar redistribution scheme generally entails substantial political costs for the government, and represents a common stand in the recent literature (see Broner and Ventura (2006), Guembel and Sussman (2009), Gennaioli et al. (2009)).

- The need for public supply of liquidity also hinges on the absence of private contingent

[10] The government, indeed, can issue securities above collateral limits by committing future taxpayers' income through taxation.

assets. This assumption, which is taken as given in the model, can be easily justified by considering that the idiosyncratic expenditure shock is private information. In such a case, spot credit markets are still inaccessible to unlucky entrepreneurs, since a demand for additional funds in $t = 1$ immediately reveals the entrepreneur's type causing lenders to refuse further credit (recall that additional investment is not profitable for the IFM). Furthermore, if the shock is unobservable, agents cannot write contracts contingent on it.

- Finally, government bonds are often held by financial institutions while firms rely on banks to manage their liquidity needs (e.g. through cash deposits or credit lines). Empirical evidence on government bond holdings of domestic banks represents a large fraction of total assets, with higher figures corresponding to developing countries and, among this group, to countries with weak creditor rights protection (see Reinhart et al. (2003) and Kumhof and Tanner (2005)). This observation, however, is not inconsistent with the model. Consider a competitive banking sector, composed by a mass of atomistic banks which borrow from the IFM and lend to a single firm. This new setup is clearly equivalent to the previous whenever there is no commitment problem between banks and firms (i.e. banks can monitor projects), but there is a commitment problem between banks and the IFM (e.g. banks can pledge only a fraction of their assets). This interpretation is suggested by Gennaioli et al. (2009). Furthermore, the new setup can also explain the observation of interest rate spikes in the event of a default-triggered liquidity crisis. Suppose that each firm has access to two investment opportunities in $t = 1$ with different productivities. Then, sovereign default, by reducing the value of banks' assets and therefore the resources available for lending to firms, implies that firms can finance only the most productive investment and the equilibrium interest rate raises.

4 Financial reforms

This section considers the implications suggested by this model on the effect of a financial reform on sovereign debt. As discussed above, the cost of default, and ultimately the existence of sovereign debt, hinges on that public debt represents a source of liquidity due the following frictions in private financial markets:

i) the lack of private collateral, as described in Assumption 1;

ii) the absence of contingent contracts, as described in Assumption 2;

Collateral constraints limit firms' access to spot credit markets at date 1, while the absence of contingent contracts, i.e. contracts that guarantee a transfer if a firm turns unlucky in exchange for a premium, induce firms to purchase government bonds to hoard a reserve of liquidity. Let's now consider a financial reform that affects exclusively the missing market for private insurance,

i.e. point ii). Arguably, indeed, collateral constraints might also reflect factors that are not directly related with financial regulation (e.g. asset tangibility).

4.1 Contingent contracts

Suppose that domestic firms can be separated in two subgroups: good firms, which are transparent, easy to value and well regulated; and bad farms, which instead are opaque, difficult to value and poorly regulated. The difference between the two types of firms implies that the expenditure shock is observable for good firms, which are able to enter in contingent contracts with the IFM, but not for bad firms. The government can undertake a costless reform that improves financial supervision and increases the number of good firms in the economy.

Assumption 2' *Let $\lambda \in \left(0, \frac{1}{2}\right)$ denote the number of good firms, i.e. firms that can enter in contract contingent on the expenditure shock. The government can increase λ with no cost.*

Suppose for analytical convenience that there is no aggregate productivity shock. In $t = 0$ good firms can now buy a contingent security from the IFM, which promise a unit transfer in case of expenditure shock. Let x denote the quantity of contingent securities purchased by each sophisticated firm, which are traded at the actuarial fair price $q = \frac{1}{2}$. Given that the expected return on each contingent security is greater than the return on government bonds, i.e. $\rho > \frac{1+\rho}{2}$, good firms do not save in government bonds and get an average revenue

$$Y_{Eg} = \frac{A}{2} - 1 \; + \; \frac{1}{2}(\rho - 1)x \; - \; \frac{1+\rho}{2}\tau, \tag{15}$$

where $x = \frac{\gamma \frac{A}{2} - 1 - \frac{1+\rho}{2}\tau}{\frac{1}{2}(1-\gamma\rho)}$. The average revenue of bad firms instead is given by

$$Y_{Eb} = \frac{A}{2} - 1 \; + \; \frac{1}{2}(\rho - 1)b \; - \; \frac{1+\rho}{2}\tau, \tag{16}$$

where $b = \frac{\gamma \frac{A}{2} - 1 - \frac{1+\rho}{2}\tau}{1 - \gamma \frac{1+\rho}{2}}$. Since $x > b$, the average revenue of good firms is higher than the average revenue of bad firms, i.e. $Y_{Eg} > Y_{Eb}$. Then, a reform that increases the number of good firms will increase the aggregate income of entrepreneurs.

The financial reform, however, involves a trade-off for the government because an increase in λ lowers the number of domestic firms that save in public bonds and, ultimately, the ability of the government to borrow from the IFM. Social welfare is computed by adding the income of individual types plus the return on public investment,

$$W = \lambda Y_{Eg} + \left(\frac{1}{2} - \lambda\right) Y_{Eb} \; + \; Y_W + \phi \; g, \tag{17}$$

where Y_W is the total income of workers and is defined as before. Budget balance requires that

the public investment g is financed by issuing debt which is repaid in $t = 1$ by collecting taxes, i.e. $\left(\frac{1}{2} - \lambda\right) b + b^* = g$ and $\tau = \left(\frac{1}{2} - \lambda\right) b + b^*$. Finally, future repayment must be incentive compatible, i.e.

$$\left(\frac{1}{2} - \lambda\right) \Big(Y_{Eb}(e=1) - Y_{Eb}(e=0)\Big) \;\geq\; \lambda \Big(Y_{Eg}(e=1) - Y_{Eg}(e=0)\Big) + \\ + \Big(Y_W(e=1) - Y_W(e=0)\Big). \tag{18}$$

Consider now that the return on government's investment exceed the implied cost of taxation, i.e. $\phi \geq \frac{1}{2}\left(1 + \frac{1+\rho}{2}\right)$. Then, the government borrows from the IFM up to the point in which the incentive compatibility constraint (18) is binding. Maximization of social welfare with respect to λ then implies the following condition,

$$\begin{cases} \lambda = 0 \quad \text{if} \quad \kappa\,\phi \geq (Y_{Eg} - Y_{Eb}) \\ \lambda = 1 \quad \text{if} \quad \kappa\,\phi < (Y_{Eg} - Y_{Eb}) \end{cases}$$

where $\kappa = \frac{4}{3+\rho} b$ denotes the marginal increase in public investment with respect to λ. This condition then implies that the government's incentive to undertake a legal reform is positively related to the average return on private investment, since $Y_{Eg} - Y_{Eb}$ is increasing in ρ, and negatively to the return on public investment.

4.2 Discussion

It is widely accepted that legal institutions are crucial to foster economic development. Yet, institutions show also a strong persistence, with poor countries being particularly resilient to institutional reforms. To the best of my knowledge, the previous literature addresses the strong persistence in institutions emphasizing either the role of initial conditions that are extremely costly to revert (e.g. the legal origin literature pioneered by) or political economy arguments according to which the economic elite is willing to maintain the *status quo* to reduce competition. The model presented in the previous section does not share these features with this literature, given that reforms have no exogenous costs and the government is benevolent, but has similar implications. In particular, when sovereign risk is considered, legal reforms, that expand the range of contracts the agents can sign, are not necessarily pareto-improving since they reduce the provision of public goods by the government.

Far from making a normative statement on financial reforms, the model provides an explanation for why some countries tend to adopt legal standards that increase the appetite of domestic agents for government bonds. Mishkin (2006) reports the example of Argentina, where bank reserve requirements clearly privileged government bonds by classifying them as *"being the least*

risky of all assets that a bank could hold" and by successively raising the share of government bonds in total reserves to allow the central government to collocate additional debt.

A natural question to ask is whether the government can affect domestic demand for government bonds through other channels. One possible channel is the interest rate paid on bonds. Indeed, the government could encourage domestic demand for government bonds by raising interest rates and lowering the opportunity cost of holding liquidity. However, in presence of increasingly integrated bond markets is not clear whether the government would be able to affect the interest rate as agents will try to exploit arbitrage possibilities.

5 Sovereign defaults and liquidity crises: empirical evidence

This section documents that sovereign debt crises are associated with liquidity crises. Using sectoral data for a panel of 45 countries over the period 1980-2000, it shows that sovereign defaults have a disproportionate negative impact on the growth rate of sectors that rely extensively on external finance and have high working capital needs. This evidence, however, cannot be considered as a proper test of the model, as theories that stress the role of financial retaliation from foreign creditors cannot be rejected. For example, a sudden stop in foreign lending has likely a greater impact on financially dependent industries. It is also true that identification problems represent a common feature of the empirical sovereign debt literature.[11] One advantage of using the cross-industry variation within each country is that it is possible to control for country-wide characteristics, as for instance the degree of capital account liberalization (and thus the effects captured hold for any level of penetration of foreign financial institutions in the domestic credit market).

This empirical hypothesis is tested using the dynamic panel data model,

$$\begin{aligned} y_{i,c,t} \;=\; \alpha_{i,c} \;+\; \lambda_{i,t} \;+\; \mu_{c,t} \;+\; y_{i,c,t-1} \;+ \\ +\; \Big(\beta_{F,\tau}\, FinDep_i \;+\; \beta_{L,\tau}\, Liq_i \;+\; \beta_{X,\tau}\, X_i\Big) \cdot DEF_{c,t} \;+\; \epsilon_{i,c,t}, \end{aligned} \tag{19}$$

where $y_{i,c,t}$ is the (log) value added in industry i of country c in time t, $y_{i,c,t-1}$ is the lagged dependent variable controlling for mean reverting dynamics, $\alpha_{i,c}$, $\lambda_{i,t}$ and $\mu_{c,t}$ are a set of fixed effects that control for sector-country, sector-time and country-time characteristics. The main focus is on the interaction of the default indicator $DEF_{c,t}$ and a variety of industry characteristics.[12] In particular, $FinDep_i$ is a measure of an industry's dependence on external finance, Liq_i is a measure of an industry's need for liquidity and X_i is a variable set of additional industry

[11] See the survey in Sturzenegger and Zettelmeyer (2006).

[12] The average effect of default on each sector instead is captured by the country-time fixed effect $\mu_{c,t}$.

characteristics which is used to check the robustness of the results to the inclusion of further controls. Following Rajan and Zingales (1998), the sector characteristics are measured using US data in order to capture technological differences across sectors that are invariant across countries. Given that $FinDep_i$ and Liq_i take higher values when an industry shows greater financial dependence and higher liquidity needs, negative coefficients on the interaction terms, i.e. $\beta_F < 0$ and $\beta_L < 0$, suggest that this industry experiences sharper output losses in the event of default.

5.1 Econometric methodology

Industry-time effects, $\lambda_{i,t}$ and country-time effects, $\mu_{c,t}$, are first eliminated by industry-time and country-time differencing prior to estimation, i.e. by subtracting first the mean for each industry and year and then the mean for each country and year. Then, I use the Arellano-Bond estimator to eliminate industry-country fixed effect and correct for reverse causality in the lagged dependent variable. The moment conditions used for identification are construct using the first lag of the lagged dependent variable, taken in levels. Instead, the interaction between the default dummies and the industry characteristics is considered fully exogenous and, to the extent that the model is already over-identified, are not used as instruments. Finally, I check both the Sargan test to verify the validity of the instruments and the second-order serial correlation in the error term which must be absent if the fixed-effect hypothesis is correct.[13]

5.2 Data

Data on manufacturing industries at the 3-digit ISIC classification are obtained from the INDSTAT3 2005 database available from the United Nations Industrial Development Organization. Original data in current US dollars are first converted in constant prices using the US GDP deflator, as reported in the World Bank's *World Development Indicators 2006.*

The financial dependence index, $FinDep_s$, measures the share of investment that is not financed with cash flow from operations, as in Rajan and Zingales (1998). Data are obtained from Kroszner et al. (2007) as an average over 1980-1999 and are normalized between 0 to 1 to simplify readiness. The liquidity needs index, Liq_s, measures the median ratio of inventories over annual sales of US public manufacturing firms from Compustat, as in Raddatz (2006). This ratio reflects liquidity needs since the longer the production process the larger is the value of inventories over current sales. Data are obtained fromKroszner et al. (2007) as an average over 1980-1999. The correlation between the two measures is 0.09 and is not statistically different from zero, suggesting that the two indexes capture different aspects of an industry's financial needs. The Raddatz measure

[13] See Baltagi (1995) (p. 131).

indeed captures very short term working capital needs, while the Rajan and Zingales index does not specifically distinguish between short- and long-term.

Two additional indexes are included to control for alternative explanatory sector characteristics: assets' tangibility, $Tang_s$, and export orientation, $ExpOr_{s,c}$. The first measures the median ratio of fixed assets over total assets for US firms during 1980-1999 and is taken from Kroszner et al. (2007). The second measures the average share of exports over total sales at the country-industry level, as in[14]

$$ExpOr_{s,c} = \frac{1}{T} \sum_{t=1980}^{1980+T} \frac{Exports_{s,c,t}}{Output_{s,c,t}}.$$

Data are from Nicita and Olarreaga (2001), who report export and import values for each ISIC industry for the countries in the sample over 1980-2000.

Finally, default episodes are taken from the Standard and Poor's sovereign default database, as reported in Beers and Chambers (2002). This database includes all sovereign defaults on loans or bonds with private agents between 1975 and 2002, and reports the period during which the debtor government remained in default. The immediate effect of default is captured giving a value of one to the dummy variable in the first year of each default episode. Finally, the resulting sample includes 28 manufacturing sectors in a cross-section of 108 countries over the period 1980-2000, although the sectoral representation can vary across countries and years.

5.3 Results

Table 3 reports the one-step first-differenced GMM estimates of (19) where I do not include positive lags for the default indicator (i.e. T = 0) in order to focus on the instantaneous effects of default. Furthermore, table 3 reports the main estimates for 1980-1990 sample and for the 1990-2002 sample to check the time stability of the key coefficients over the two periods. Notice, first, that the autocorrelation coefficient ρ is statistically significant and pretty stable over the different specifications. A back-of-envelope calculations suggests that temporary shocks to sectoral output are quite persistent over time, with an implied persistency of about three years.

Turning to the interaction between sovereign default and industry characteristics, the point es-

[14]The export orientation index cannot be computed using only US data, as the other industry characteristics. Indeed, the crucial assumption in the Rajan and Zingales methodology is that the rank of US industries based on financial needs is maintained across all countries (if an industry is more financially dependent in the US it is likely to be more financially dependent also in Argentina). Whilst this assumption is reasonable when it refers to financial needs, it is likely to be rejected when we look at industries' export orientation since technological factors do predict that the export orientation of industries in different countries is shaped by country-specific comparative advantages (if a US industry exports more with respect to other industries, this does not imply that the same industry in Argentina will export more than other Argentine industries).

timates of β_F and β_L have negative sign over all specifications and this result suggests that industries with high dependence on external finance and high liquidity needs experience a disproportionate contraction in the event of sovereign default. Yet, the results also show that this effect is statistically significant and robust to the inclusion of additional industry controls only in the sub-period 1990-2002. This result does not imply a rejection of the theoretical model, but, possibly, a stronger support for it. Indeed, a crucial assumption in the model, namely the non-discrimination between foreign and domestic bond holders, suits more realistically the institutional set-up of sovereign debt markets in the 1990s. As noted by Broner and Ventura (2006), during the 1980s most sovereign borrowing was granted by foreign financial institutions in the form of syndicated bank loans, whilst private national financial markets were highly segmented. *"This institutional setup clearly facilitates ex-post discrimination, as governments can choose not to pay foreign banks without interfering with domestic asset trade."* During the 1990s, instead, many governments in emerging markets started to issue debt in the form of anonymous bonds, which are highly traded in secondary markets. In these economies, governments usually fail to keep track of the large volumes of transaction in public bond secondary market and end up with almost no information of the ultimate holders of debt (Panizza (2008)). Finally, notice that the effect captured by coefficient β_1 is also economically significant, as it implies that, in the first year of a default episode, the level of output in the most financially dependent sector (Transportation equipment) is roughly a 27 percent lower than the output in the least financially dependent one (Tobacco), after controlling for additional industry characteristics.

6 Conclusion

Sovereign debt crises in emerging markets are usually associated with financial turmoil and liquidity crises throughout the economy. This connection is suggested by both anecdotical and empirical evidence. In particular, defaults episodes appear to lead banking crises. However, there is no clear evidence supporting the application of foreign penalties when default occurs.

This paper then proposes a novel mechanism linking sovereign defaults with liquidity and banking crises without any intervention of foreign creditors. The model considers a standard unwillingness-to-pay problem assuming that: (i) the enforcement of private contracts is limited and, as a result, public debt represents a source of liquidity; (ii) the government cannot discriminate between domestic and foreign agents. The model shows that external debt might emerge even in absence of classic penalties imposed by foreign creditors. Indeed, the prospect of triggering a liquidity crisis throughout the economy restores the ex-post incentive to pay of the government. Nonetheless, liquidity crises might arise when economic conditions deteriorate and the government chooses opportunistically to default in order to avoid the repayment of foreign agents.

This paper then contributes to a recent strand of the sovereign debt literature that focuses on the direct consequences of sovereign default on the domestic economy, most notably Broner

and Ventura (2006). Yet, the mechanism and, thereby the consequences arising in the event of default, differ from the one highlighted by these authors. In their setup, a sovereign default leads to an undesirable redistribution of resources within the economy. In my model, instead, sovereign default leads to a disruption of private investment. Along different lines, these two papers suggest a remarkable policy implication: as they show that the source of the costs associated with default is to be looked for in the direct consequences on the domestic private sector and not in foreign penalties, these papers provide a theoretical underpinning for crises resolution policies that refuse to sacrifice domestic claims to service external debt.

Finally, this paper provides a fully-fledged framework to think about domestic legal and institutional reforms. Different types of reforms are considered and, for each one of them, the implications on international capital flows are remarked. In particular, the model shows that government's incentive to undertake a legal reform is positively related to the average return on private investment and negatively to the return on public investment. The paper then suggests a possible explanation for cross-country and cross-time variation in legal institutions which differs from studies stressing political economy issues.

References

Aghion, P., P. Bacchetta, and A. Banerjee (2004). Financial development and the instability of open economies. *Journal of Monetary Economics 51*(6), 1077–1106.

Aguiar, M. and G. Gopinath (2006). Defaultable debt, interest rates and the current account. *Journal of International Economics 69*(1), 64–83.

Amador, M. (2004). A political model sovereign debt repayment. 2004 Meeting Papers 762, Society for Economic Dynamics.

Arellano, C. (2008). Default Risk and Income Fluctuations in Emerging Economies. *American Economic Review 98*(3), 690–712.

Baltagi, B. H. (1995). *Econometric Analysis of Panel Data*. eds J. Wiley&Sons, Chischester.

Basu, S. (2008). Sovereign debt and domestic economic fragility. Technical report, MIT, mimeo.

Beers, D. and J. Chambers (2002). Sovereign Defaults: Moving Higher Again in 2003? *Standard and Poor's Research. New York*.

Bernanke, B. and M. Gertler (1989). Agency costs, net worth, and business fluctuations. *The American Economic Review 79*(1), 14–31.

Bernanke, B. S., M. Gertler, and S. Gilchrist (1999). The financial accelerator in a quantitative business cycle framework. In J. B. Taylor and M. Woodford (Eds.), *Handbook of Macroeconomics*. Elsevier Science.

Borensztein, E. and U. Panizza (2006). Do sovereign defaults hurt exporters? RES Working Papers 1018, Inter-American Development Bank, Research Department.

Borensztein, E. and U. Panizza (2008). The Cost of Default. IMF Working Papers 08/238, International Monetary Fund.

Broner, F. and J. Ventura (2006). Globalization and risk sharing. Universitat Pompeu Fabra. Mimeo.

Broner, F. and J. Ventura (2008). Rethinking the effects of financial liberalization. Universitat Pompeu Fabra. Mimeo.

Bulow, J. and K. Rogoff (1989). Sovereign debt: Is to forgive to forget? *American Economic Review 79*(1), 43–50.

Caballero, R., E. Farhi, and P. Gourinchas (2008). An Equilibrium Model of "Global Imbalances" and Low Interest Rates. *The American Economic Review 98*(1), 358–393.

Caballero, R. and A. Krishnamurthy (2001). International and domestic collateral constraints in a model of emerging market crises. *Journal of Monetary Economics 48*(3), 513–548.

Carlstrom, C. T. and T. S. Fuerst (1997). Agency costs, net worth, and business fluctuations: A computable general equilibrium analysis. *American Economic Review 87*(5), 893–910.

Cole, H. L. and P. J. Kehoe (1998). Models of sovereign debt: Partial versus general reputations. *International Economic Review 39*(1), 55–70.

Eaton, J. and R. Fernández (1995). Sovereign debt. *Handbooks in Economics* (3), 2031–2078.

Eaton, J. and M. Gersovitz (1981). Debt with potential repudiation: Theoretical and empirical analysis. *The Review of Economic Studies 48*(2), 289–309.

Fernandez, R. and R. W. Rosenthal (1990). Strategic models of sovereign-debt renegotiations. *Review of Economic Studies 57*(3), 331–49.

Gennaioli, N., A. Martin, and S. Rossi (2009, August). Institutions, public debt and foreign finance. Economics Working Papers 1170, Department of Economics and Business, Universitat Pompeu Fabra.

Grossman, H. I. and J. B. Van Huyck (1988). Sovereign debt as a contingent claim: Excusable default, repudiation, and reputation. *American Economic Review 78*(5), 1088–97.

Guembel, A. and O. Sussman (2009, October). Sovereign debt without default penalties. *Review of Economic Studies 76*(4), 1297–1320.

Holmstrom, B. and J. Tirole (1998). Private and public supply of liquidity. *Journal of Political Economy 106*(1), 1–40.

Hubbard, R. (1998). Capital-Market Imperfections and Investment. *Journal of Economic Literature 36*(1), 193–225.

Kaminsky, G. and C. Reinhart (1999). The Twin Crises: The Causes of Banking and Balance of Payments Crises. *American Economic Review 89*(3), 473–500.

Kiyotaki, N. and J. Moore (1997). Credit cycles. *The Journal of Political Economy 105*(2), 211–248.

Kletzer, K. M. and B. D. Wright (2000). Sovereign debt as intertemporal barter. *American Economic Review 90*(3), 621–639.

Kocherlakota, N. (2000). Creating Business Cycles Through Credit Constraints. *Federal Reserve Bank of Minneapolis Quarterly Review 24*(3), 2–10.

Kroszner, R., L. Laeven, and D. Klingebiel (2007). Banking crises, financial dependence, and growth. *Journal of Financial Economics 84*(1), 187–228.

Kumhof, M. and E. Tanner (2005). Government debt: A key role in financial intermediation. IMF Working Papers 05/57, International Monetary Fund.

Martin, A. (2005). Endogenous credit cycles. Economics Working Papers 916, Department of Economics and Business, Universitat Pompeu Fabra.

Matsuyama, K. (2004). Financial market globalization, symmetry-breaking, and endogenous inequality of nations. *Econometrica 72*(3), 853–884.

Mendoza, E. (2006). Endogenous Sudden Stops in a Business Cycle Model With Collateral Constraints: A Fisherian Deflation of Tobin's Q. *NBER Working Paper*.

Mishkin, F. S. (2006). *The Next Great Globalization*. Princeton, N.J.: Princeton University Press.

Modigliani, F. and M. H. Miller (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review 48*(3), 261–297.

Nicita, A. and M. Olarreaga (2001). Trade and production, 1976-99. Policy Research Working Paper Series 2701, The World Bank.

Panizza, U. (2008). Domestic and external public debt in developing countries. Debt and Finance Analysis Unit, Division of Globalization and Development Strategies, UNCTAD. Mimeo.

Raddatz, C. (2006). Liquidity needs and vulnerability to financial underdevelopment. *Journal of Financial Economics 80*(3), 677–722.

Rajan, R. G. and L. Zingales (1998). Financial dependence and growth. *American Economic Review 88*(3), 559–86.

Reinhart, C., K. Rogoff, and M. Savastano (2003). Debt intolerance. *Brookings Papers on Economic Activity* (1), 1–75.

Sandleris, G. (2006). Sovereign Defaults: Information, Investment and Credit. Johns Hopkins. Mimeo.

Stein, J. C. (2003). Agency, information and corporate investment. In G. Constantinides, M. Harris, and R. M. Stulz (Eds.), *Handbook of the Economics of Finance*. Elsevier.

Sturzenegger, F. and J. Zettelmeyer (2006). *Debt defaults and lessons from a decade of crises*. Cambridge: MIT Press.

Wright, M. (2002). Reputation and sovereign debt. Mimeo. Stanford.

Yue, V. Z. (2005). Sovereign default and debt renegotiation. 2005 Meeting Papers 138, Society for Economic Dynamics.

A A snapshot of the Argentine crisis

After being almost fatally wounded by the shock wave of the Mexican Tequila Crisis in 1994-1995, the Argentinean banking system was deeply reformed by the introduction of a new regulatory regime, called BASIC, designed following the international standards in the Basel Accord. As reported by Mishkin (2006) in his recent book *The Next Great Globalization*, the reform was instigated by concerns raised by depositors' run on domestic banks and the consequent decline in bank lending to non-financial companies which drove the Argentine economy into a recession. The new regime had *"strict liquidity requirements, which required banks to hold* 20% *of short-term deposits in safe and liquid assets"*. Though, from the Basel Accord it inherited *"a weighting scheme for measuring bank risk according to which government bonds were classified as being the least risky of all assets that a bank could hold"* designed to fit advanced countries better than emerging markets. Thus, at the outset of the 2001 crisis Argentine banks were already major holders of government debt and the banks' exposure grew further when the limits on the share of government bonds in bank reserves were lifted to allow the central government to collocate additional debt: *"the banks went along because, with their high interest rates, the bonds would be very profitable if the government avoided default"*. By then, the stability of the banking system was compromised. When the government announced a temporary suspension of debt payments and, soon after, abandoned the currency board, most firms were declared insolvent on their dollar-denominated debts and the strength of bank balance sheets was seriously undermined by large losses in both the defaulted government debt and private loans. That precarious situation was further exacerbated by the subsequent asymmetric *pesofication* of bank loans and deposits. With banks not granting new loans, businesses dramatically cut back on their spending, aggravating further the economic downturn. While the trigger of the Argentine debt crisis is arguably in four external shocks (namely, the appreciation of the US dollar, the decline in the terms of trade, the Russian crisis and the Brazilian exchange rate crisis), Mishkin's analysis shows that the cost of the government's default was substantially magnified by the destabilization of the internal credit market.

B Data Description

Log Value Added (y). Log of value added in US dollars at the 3-digit ISIC classification for manufacturing sectors. Data are sourced from the UNIDO INDSTAT 2005 database. Original data are deflated using the GDP deflator in United States from the World Bank's *World Development Indicators 2006 CD-ROM.*

Default Dummy (DEF). Dummy variable taking a value one in the first year of a default episode. Data on default episodes are sourced from the Standard and Poor's sovereign default database, as reported in Beers and Chambers (2002). This database includes all sovereign defaults on loans or bonds with private agents between 1975 and 2002, and reports the period during which the debtor government remained in default.

Financial Dependence ($FinDep$). An index constructed as the median share of capital expenditures not financed with the cash flow from operations (capital expenditures minus cash flow from operation divided by capital expenditures) by US-based, publicly listed firms. The index is sourced from Kroszner et al. (2007), who provide a 3-digit ISIC based reclassification of the data originally constructed by Rajan and Zingales (1998) for a mixture of 3-digit and 4-digit ISIC sectors. The data refer to the period 1980-1999 and, originally, range from -1.14 (Tobacco) to 0.72 (Transport equipment), with a higher number indicating greater financial dependence. To ease statical inference, I normalize the index such that it ranges from 0 to 1.

Liquidity Needs (Liq). An index constructed as the median ratio of inventories over total sales for US-based, publicly listed firms. This index has been initially proposed by Raddatz (2006) to measure industrys financial needs that focuses on short-term liquidity needs. The data are sourced from Kroszner et al. (2007), who compute the Raddatz index for the 3-digit ISIC manufacturing sectors. The data refer to the 1980s and, originally, range from 0.07 (Tobacco) to 0.72 (Plastic Products), with a higher number indicating greater financial dependence. To ease statical inference, I normalize the index such that it ranges from 0 to 1.

Tangibility ($Tang_s$). An index constructed as the median ratio of net property, plant and equipment to total assets by US-publicly listed firms during the period 1980-1999 in each 3-digit ISIC manufacturing sector. The data are sourced from Kroszner et al. (2007). The original data range from 0.12 to 0.62, and are normalized such that they range from 0 to 1.

$ExpOr_{s,c}$. An index of export orientation computed as the average share of exports over total sales for each industry in each country included in the sample. The data source used to construct the export orientation index is Nicita and Olarreaga (2001), who report export and import values for each ISIC industry.

B.1 Deletion criteria

First, I delete all observations for which the data for value added are either missing or negative. Second, given that the initial panel is unbalanced, I remove all sector-country-year observations with data for less than 5 years. This reduces the within estimator's sensitivity to isolated observations in the panel. Third, I exclude all country-year pairs reporting data for less than 10 sectors, in order to guarantee sufficient within country-year variation in the interaction between financial dependence and default (captured by the coefficient β_1). The same criterium is applied in Borensztein and Panizza (2006). Fourth, I drop those observations for which the growth rate of value added fall in the top and bottom 1 percent of the distribution. This is a common strategy in order to limit the noise created by outliers.

Table 1: **Default episodes in the sample**

Country	Default year
Argentina	1989
Bolivia	1986
Bolivia	1989
Chile	1983
Costa Rica	1981
Costa Rica	1984
Cuba	1982
Dominican Republic	1981
Ecuador	1982
Egypt, Arab Rep.	1984
El Salvador	1981
Ghana	1987
Guatemala	1986
Honduras	1981
Jamaica	1981
Jamaica	1987
Jordan	1989
Kuwait	1990
Madagascar	1981
Madagascar	1986
Malawi	1982
Mexico	1982
Morocco	1986
Nigeria	1982
Panama	1983
Panama	1987
Peru	1983
Philippines	1983
Poland	1981
Senegal	1981
Senegal	1990
Serbia and Montenegro	1983
South Africa	1985
South Africa	1989
Tanzania	1984
Turkey	1982
Uruguay	1983
Uruguay	1987
Uruguay	1990
Venezuela, RB	1983
Venezuela, RB	1990

Table 2: **Estimation Results**

	(1) 1980-1990	(2) 1980-1990	(3) 1990-2002	(4) 1990-2002	(5) 1990-2002
$y_{s,c,t-1}$	0.373***	0.375***	0.455***	0.454***	0.483***
	(0.054)	(0.054)	(0.059)	(0.059)	(0.055)
$DEF_{c,t} \cdot FinDep_s$	-0.094	-0.097	-0.208*	-0.196*	-0.275*
	(0.070)	(0.071)	(0.117)	(0.117)	(0.148)
$DEF_{c,t} \cdot Liq_s$	-0.092*	-0.069	-0.053	-0.126	-0.093
	(0.052)	(0.069)	(0.088)	(0.115)	(0.125)
$DEF_{c,t} \cdot Tang_s$		0.033		-0.115	-0.044
		(0.065)		(0.116)	(0.143)
$DEF_{c,t} \cdot ExpOr_{s,c}$					-0.078
					(0.160)
1^{st} autocorr.	0.00	0.00	0.00	0.00	0.00
2^{nd} autocorr.	0.00	0.00	0.42	0.42	0.27
Sargan test	0.00	0.00	0.21	0.21	0.12
Obs.	15406	15406	15605	15605	12828

***,**,* represent significance at 1%, 5%, and 10%, respectively. The table reports the one-step first-differenced GMM estimator for the main specifications for the 1980-1990 and the 1990-2002 samples. The set of instruments includes the first lag of the lagged dependent variable. Country-time effects are removed by country-time differencing prior to estimation. Sector-country fixed effects are removed by first differencing. Heteroskedasticity-consistent standard errors are reported within parenthesis. 1^{st} autocorr. and 2^{nd} autocorr. are auto-correlation tests on the estimation residuals. p-values for the asymptotic $N(0,1)$ distribution are reported. The Sargan test of over-identifying restrictions is based on a two-step GMM estimation. p-values for the asymptotic χ^2 distribution are reported.