

Sovereign Default, Domestic Banks and Financial Institutions

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Introduction

- Recent government defaults associated with financial turmoil, where banks take center stage. Link: default \Rightarrow disruptions in the capital of banks that hold public bonds \Rightarrow credit crunch
 - Russia 1998, but also Pakistan, Ecuador, Ukraine and Argentina (IMF 2002)
 - Current debt crisis: downgrading of banks holding greek bonds, E.U. plan to avoid default
- Two key observations:
 - Importance of bank bondholdings strikes at the heart of perfect discrimination in default
 - * Possibility of domestic costs of default (Sturzenegger and Zettelmeyer, 2006)
 - Role of domestic credit markets highlights potential impact of financial institutions
 - * Link between public default risk and financial development (Reinhart et al. 2003)
- We study this link between public default and private credit markets both theoretically and empirically.

This paper

- We build a model where government defaults disrupt banks' capital, hurting credit and investment
 - Banks hold public bonds as a store of liquidity (Holmstrom and Tirole 1998)
 - * Discriminatory default/bank bailouts hindered by secondary markets (Broner et al. 2010)
- Government default more costly when financial institutions are stronger. Stronger institutions boost:
 - Banks' leverage, which amplifies adverse balance sheet effects
 - Capital inflows to private sector, enhancing the size of domestic credit markets
 - * *Complementarity*: if institutions/private markets are strong, government can commit to repay
- We document the following facts (among others), that are consistent with our model's predictions:
 - Sovereign default is followed by fall in private credit
 - Such fall is stronger when: i) Banks hold more government debt, ii) Creditor rights are stronger

Literature

- Government repayment and reputation/penalties
 - Eaton and Gersovitz (1981), Grossman and van Huyck (1988), Bulow and Rogoff (1989a, 1989b), Fernandez and Rosenthal (1990), Atkeson (1991), Cole, Doe, and English (1995), Cole and Kehoe (1997), Kletzer and Wright (2000), Kehoe and Perri (2002), Wright (2002), Amador (2003)
 - * Arellano (2008): on top of reputation, need domestic output cost of default. We provide a microfoundation for it. See also Mendoza and Yue (2008)
- Sovereign debt repayment under non-discrimination
 - Broner and Ventura (2010), Guembel and Sussman (2009), Brutti (2009), Basu (2009)
 - * We stress the role of financial institutions and private capital flows
- Financial institutions, imperfect private contracting and private capital flows
 - Gertler and Rogoff (1990), Boyd and Smith (1997), Caballero and Krishnamurthy (2002), Matsuyama (2004), Caballero, Farhi, and Gourinchas (2007)
 - * We add a government default decision

Basic Setup

- Small, open economy with three dates: $t \in \{0, 1, 2\}$, one consumption good
- At $t = 0$, a public project of size 1 must be undertaken, but initial endowment is $\omega_0 < 1$
 - Government needs to borrow from abroad
 - At $t = 1$, economy has endowment $\omega_1 > 1$
 - Standard commitment problem: in absence of penalties, no repayment/ex-ante financing
- Mass 1 of patient, risk-neutral residents. Share β of them are "bankers", share $1 - \beta$ are "savers"
 - bankers are more productive, so they borrow from savers
 - At $t = 1$ can engage in productive investment yielding, at $t = 2$, output:

$$f_j(I) = A_j \cdot I \quad \text{for } j \in \{S, B\}, \text{ where } A_B \geq A_S = 1$$

Basic Setup (II)

- Timing:

$t = 0$	$t = 1$	$t = 2$
Residents get ω_0 , save/consume \Rightarrow	Residents get $\omega_{1,j}$	
	Asset payments: Govt Repay?	Asset payments
Govt borrows/invests 1 \Rightarrow	Residents borrow/invest I	\Rightarrow Residents get $A_j \cdot I$

- Return to investment stochastic

$$A_B = \begin{cases} A > 1 & \text{with probability } p \\ 1 & \text{with probability } 1 - p \end{cases}$$

to study cyclical properties of default

Financial Markets

- Three short term assets: bank deposits, government bonds, foreign bonds. International rate $r^* \geq 1$
- Domestic assets subject to two *enforcement frictions*:
 - Government bonds: strategic non-discriminatory default
 - * Benevolent government sets (ρ, τ) at $t = 1$ to satisfy

$$\tau = \rho \cdot b \cdot r_g$$

- where τ is lump-sum and r_g incorporates default risk
- Bank deposits (private loans): depositors only recover fraction α of bank income
 - * α captures the quality of financial institutions

Investment and Government Default at $t = 1$

- At $t = 1$, max. investment that banks can finance given by

$$\frac{r_1 A_B}{r_1 - \alpha \cdot A_B} \cdot [\beta \cdot y_{1,B}(\rho)]$$

- After A_B realized, government optimally sets ρ , deciding how much to repay:

$$\max_{\rho} [\beta \cdot y_{1,B}(\rho) + (1 - \beta) \cdot y_{1,S}(\rho)] + (A_B - 1) \cdot \left[\frac{r_1 A_B}{r_1 - \alpha \cdot A_B} \cdot \beta \cdot y_{1,B}(\rho) \right]$$

Financing the Modern Sector at $t = 1$

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- From FOC we derive the government's IC constraint

$$[\beta b_B + (1 - \beta) b_S - 1] + (A_B - 1) \cdot \frac{r_1 A_B}{r_1 - \alpha \cdot A_B} \beta \cdot [b_B - 1] \geq 0$$

- if $A_B = 1$ or $b_B \leq 1 \Rightarrow$ government defaults. **Bondholdings crucial:** in equilibrium, $b_B > 1$

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- If $A_B = 1$ or $b_B \leq 1 \Rightarrow$ government defaults. **Bondholdings crucial:** in equilibrium, $b_B > 1$
- If $b_B > 1$ default is costly as it redistributes from banks to savers. Cost of default increases in α :
 - Higher $\alpha \Rightarrow$ greater impact of default on investment

Bank Balance Sheets and Bondholdings

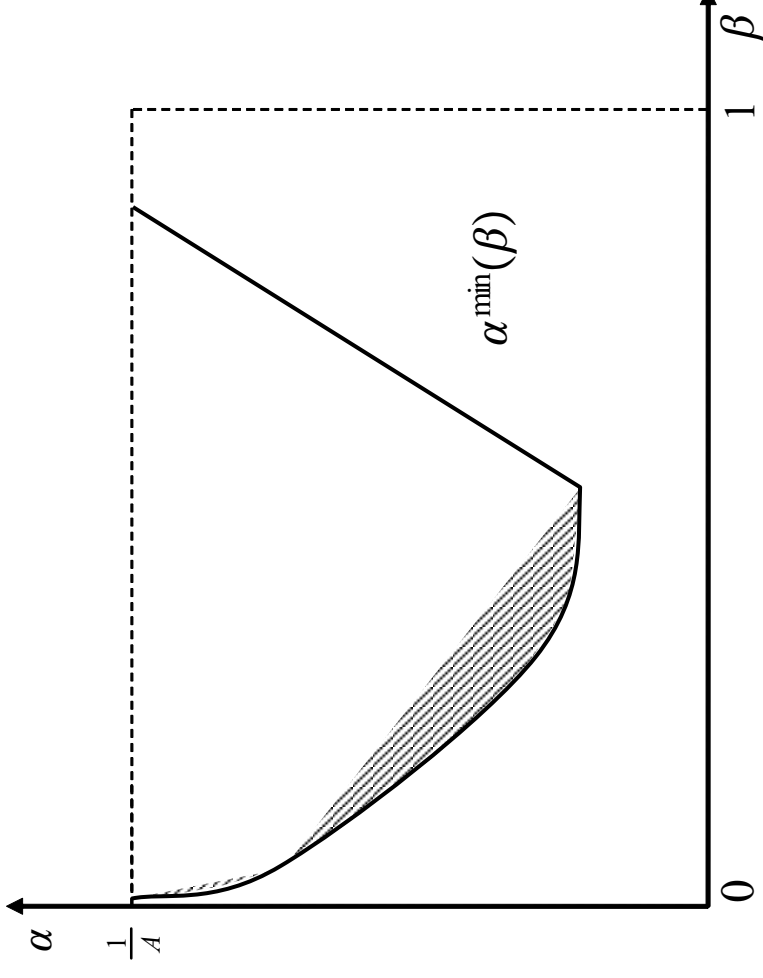
- Bank's wealth at $t = 1$ depends on how many government bonds they can buy at $t = 0$:

$$b_B \leq \omega_0 + \frac{\alpha \cdot \omega_{1,B}}{r_0}$$

- Note: banks want to hold as many government bonds as possible
 - Government only repays if $A_B > 1$: so public bonds pay premium $1/p - 1$ (i.e. $r_g = 1/p$)
 - As a result, public bonds transfer wealth to productive states
 - As a result, public debt provides liquidity when banks need it, as in Holmstrom and Tirole (1998)
 - * Here liquidity provision occurs when economy is productive

Debt sustainability

- For given β , define $\alpha^{\min}(\beta)$ as minimum level of α that induces repayment



- $\alpha^{\min}(\beta)$ is non-monotonic in β : exposure of bankers to default is non-monotonic in β
 - banks' share of tax burden: monotonically increasing in β
 - banks' total bondholdings: initially increasing in β but there is an upper bound (ω_0)

Capital Flows to the Private Sector and Public Debt Sustainability

- Without private flows, equilibrium interest rates are r_0 and r_1 . The government's f.o.c. is:

$$(\omega_0 - 1) + (A_B - 1) \cdot \frac{r_1}{r_1 - \alpha \cdot A_B} \beta \cdot \left(\omega_{0,B} + \frac{\alpha \cdot \omega_{1B}}{r_0} - 1 \right) \geq 0$$

- With financial openness, equilibrium interest rates are r_0^* and r_1^* . The government's f.o.c. is:

$$(\omega_0 + \alpha \cdot \omega_1 - 1) + (A_B - 1) \cdot \frac{r_1^*}{r_1^* - \alpha \cdot A_B} \beta \cdot \left(\omega_{0,B} + \frac{\alpha \cdot \omega_{1B}}{r_0^*} - 1 \right) \geq 0$$

- Two conflicting effects of financial liberalization:
 - If domestic interest rate falls, banks' leverage and domestic bondholdings go up. This is good
 - If instead the domestic interest rate goes up, the opposite occurs.
- *Complementarity* between capital flows to the public and the private sector
 - Poor institutions trigger private capital outflows, reducing size of domestic banks, fostering default

Conclusions of theory

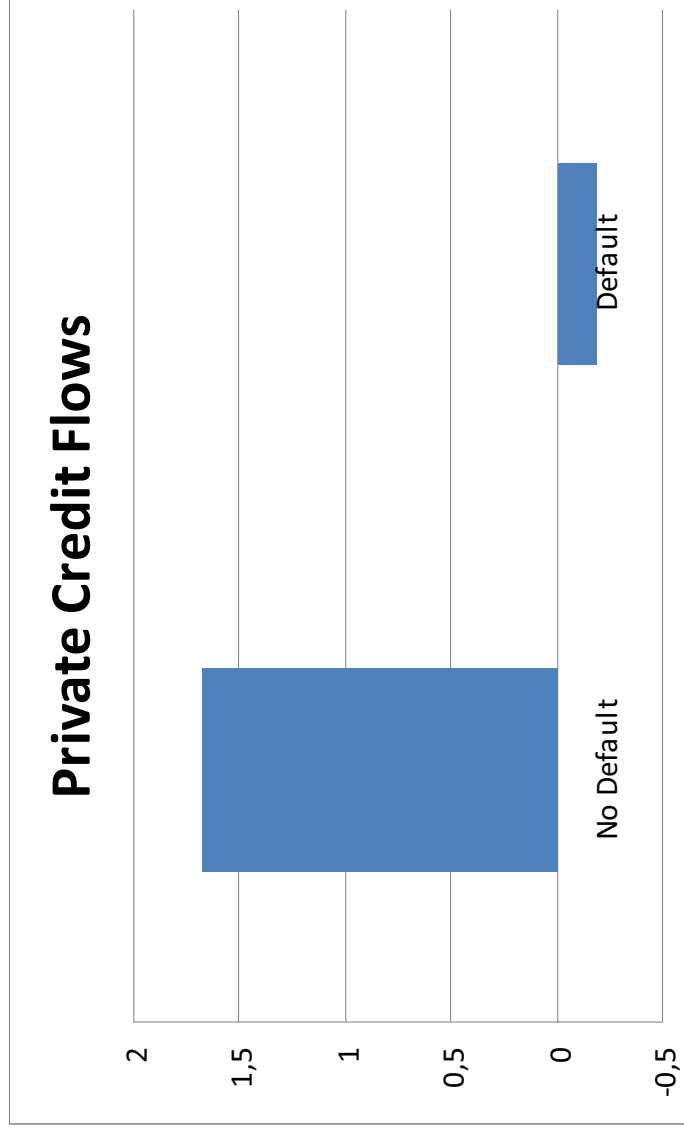
- Main testable predictions of our model:
 1. Public default is followed by fall in private credit
 2. This fall is stronger: i) the higher are banks' bondholdings b_B , ii) the stronger are institutions α
- Additional predictions:
 - 3 Probability of default falls in banks' bondholdings b_B and in the strength of institutions α
 - 4 Stronger institutions α increase ex-ante public borrowing

Empirics

- Data. Assemble a large panel from years 1980-2005 that includes:
 - Representative sample of emerging and developed countries from World Bank
 - Sovereign Default Dummy from Standard and Poor's (2008)
 - Private (external) debt from World Development Indicators (IMF 2008)
 - Private Credit from International Financial Statistics (IMF)
 - Proxy institutions with creditor rights index (Djankov, McLiesh and Shleifer 2007), computed for 133 countries in 1978-2003, following LLSV 1998
 - * Index adds one for each of following powers of secured lenders in bankruptcy: (1) restrictions to reorganization; (2) no automatic stay; (3) secured creditors paid first; (4) whether an administrator, and not management, runs the firm in reorganization. The index varies between 0 (poor creditor rights) and 4 (strong creditor rights).
 - Proxy banks' holdings of public debt with financial institutions' net claims to the government relative to their total assets, following Kumhof and Tanner (2004)

Empirical Test I

- *Prediction:* the supply of private credit should fall after a sovereign default. Raw data:
 - Supply of private credit measured by change in private credit / gdp.



Empirical Test I (Cont'd)

- We estimate:

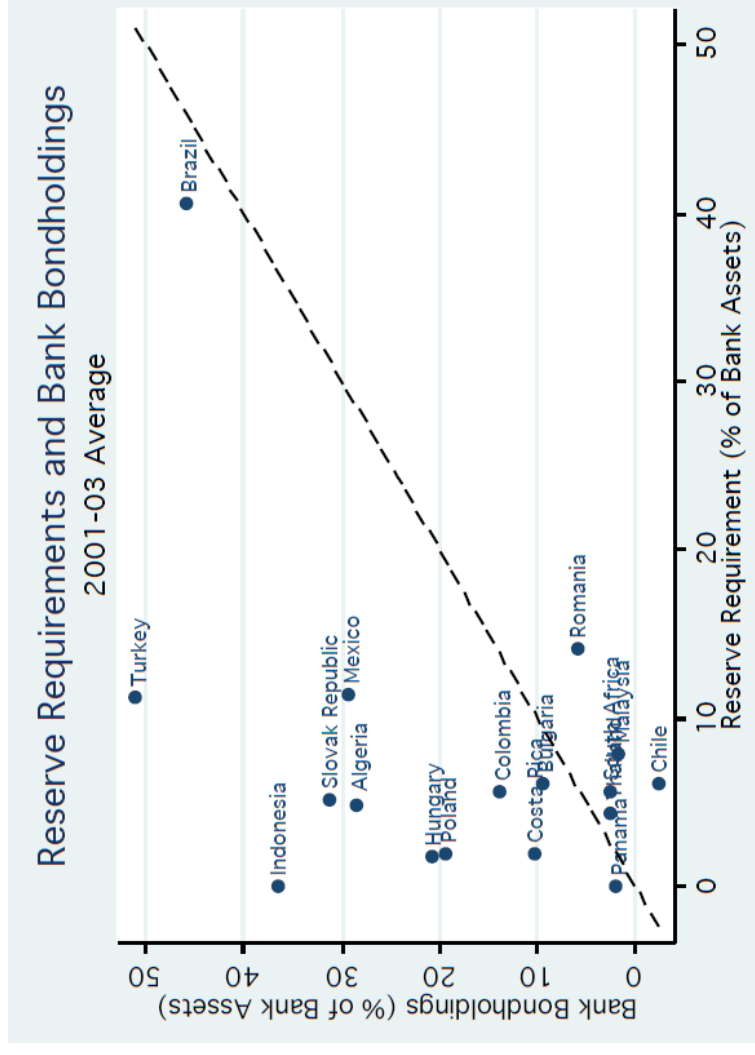
$$(\text{Private Credit Flow})_{i,t} = \alpha_i + v_t + \beta_1 (\text{Sovereign Default})_{i,t-1} + X'_{i,t-1}\gamma + \epsilon_{i,t},$$

- We expect $\beta_1 < 0$
- Supply of private credit measured also by % change in private credit.
- Controls:
 - Country and time dummies.
 - Macroeconomic (domestic and external) shocks: GDP and unemployment growth, inflation, exchange rate depreciation and sudden stops (/banking crises)
 - Ex-ante default risk
- Propensity Score regressions

	Private Credit Flows to GDP			Private Credit % Flows			Private Debt Flows to GDP		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Sovereign Default) _{t-1}	-0.028** (0.011)	-0.024* (0.014)	-0.028** (0.012)	-0.053* (0.028)	-0.086** (0.043)	-0.074** (0.036)	-0.007** (0.003)	-0.016*** (0.005)	-0.007* (0.004)
(GDP p.c. Growth) _{t-1}	0.326*** (0.117)	0.415*** (0.131)	0.353*** (0.119)	1.714*** (0.378)	0.393*** (0.079)	0.444*** (0.079)	0.143*** (0.032)	0.020 (0.012)	0.033*** (0.012)
(Unemployment Growth) _{t-1}	-0.058*** (0.013)	-0.046*** (0.012)	-0.055*** (0.012)	-0.067 (0.053)	-0.140*** (0.053)	-0.141*** (0.050)	0.003 (0.009)	-0.001 (0.006)	-0.002 (0.009)
(Default Risk) _{t-1}	0.003 (0.024)	-0.022 (0.041)	-0.002 (0.024)	-0.049 (0.073)	-0.173 (0.103)	-0.077 (0.072)	-0.009 (0.006)	-0.049*** (0.012)	-0.015** (0.006)
(Inflation) _{t-1}		0.000 (0.003)	0.000 (0.003)		-0.028* (0.016)	-0.028* (0.016)		-0.002** (0.001)	-0.002** (0.001)
(Exc. Rate Depreciation) _{t-1}		0.000 (0.002)	0.000 (0.002)		0.033*** (0.009)	0.034** (0.009)		0.001* (0.001)	0.002** (0.001)
Constant	0.021 (0.020)	-0.001 (0.034)	0.013 (0.028)	0.092 (0.056)	0.099 (0.085)	0.164** (0.069)	-0.009** (0.005)	-0.020*** (0.009)	-0.009* (0.005)
Time dummies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects?	No	. Fixed..	Random	No	. Fixed..	Random	No	. Fixed..	Random
Hausman χ^2			16.11			80.37***			69.4***
Clustered Std Errors?	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
No Observations	698	698	698	698	698	698	297	297	297
No Countries	46	46	46	46	46	46	22	22	22
No Defaults	46	46	46	46	46	46	43	43	43
Adjusted R ²	0.096	0.090	0.096	0.278	0.266	0.275	0.216	0.143	0.199

Empirical test II

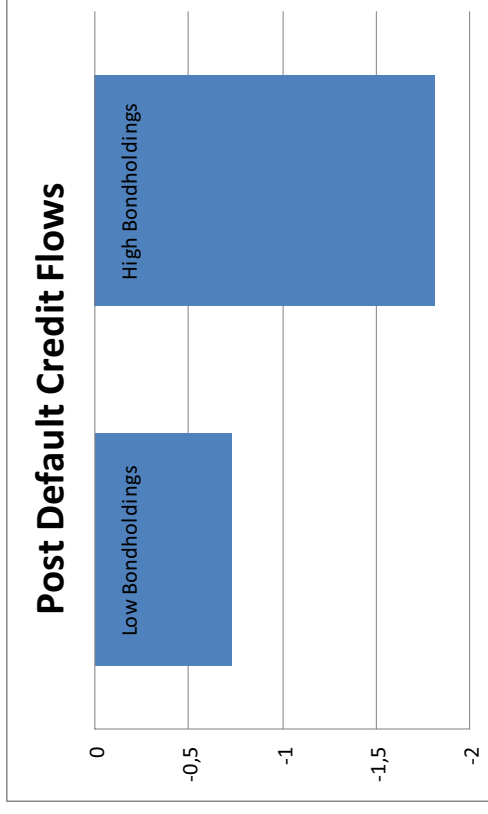
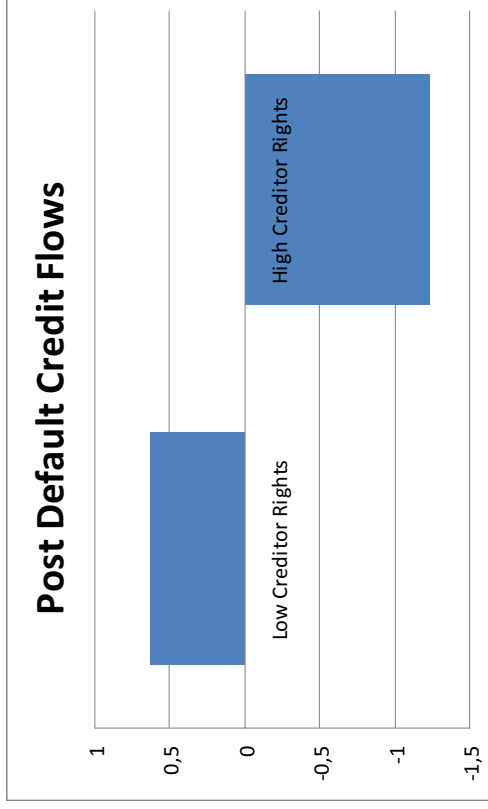
- *Prediction:* the fall in private credit following a default should be increasing in banks' holdings of public debt and in creditor rights
- Banks' public debt-holdings in our dataset:



- In most countries reserve requirements are not binding

Empirical test II (Cont'd)

- Raw data:



- We estimate:

$$\begin{aligned} (\text{Private Credit Flow})_{i,t} = & \alpha_i + v_t + X'_{i,t-1}\gamma + \beta_1 (\text{Sovereign Default})_{i,t-1} \\ & + \beta_2 (\text{Sovereign Default})_{i,t-1} \cdot (\text{Creditor Rights})_{i,t-1} \\ & + \beta_3 (\text{Sovereign Default})_{i,t-1} \cdot (\text{Bank Debt Holdings})_{i,t-1} + \epsilon_{i,t} \end{aligned}$$

- We expect $\beta_2 < 0$ and $\beta_3 < 0$.

	Private Credit Flows to GDP				Private Credit % Flows			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Sovereign Default) _{t-1}	-0.054***		-0.160**	-0.169***	-0.100**		-0.586*	-0.574*
*(Creditor Rights) _{t-1}	(0.010)		(0.061)	(0.061)	(0.039)		(0.332)	(0.326)
(Sovereign Default) _{t-1}		-0.066*	-0.151**	-0.153**		-0.406**	-0.723**	-0.562*
*(Bank Bondholdings) _{t-1}		(0.040)	(0.059)	(0.067)		(0.190)	(0.322)	(0.308)
((Creditor Rights) _{t-1}	0.027		0.030**	-0.001	0.053*		0.284**	-0.002
	(0.016)		(0.014)	(0.008)	(0.027)		(0.107)	(0.012)
(Bank Bondholdings) _{t-1}		-0.007	0.032	-0.017		-0.022	0.117	-0.048
		(0.043)	(0.043)	(0.044)		(0.259)	(0.282)	(0.110)
(Sovereign Default) _{t-1}		-0.026	0.287**	0.304**	0.102	0.010	1.214	1.149*
	0.053**	(0.020)	(0.127)	(0.127)	(0.065)	(0.109)	(0.724)	(0.685)
(GDP p. c. growth) _{t-1}	0.440***	0.596***	0.526***	0.550***	1.868***	1.929**	1.032	1.891*
	(0.141)	(0.161)	(0.195)	(0.178)	(0.449)	(0.893)	(1.190)	(0.989)
(Unemployment Growth) _{t-1}	-0.054***	-0.057**	-0.055***	-0.055**	-0.057	-0.143	-0.191*	-0.083
	(0.013)	(0.023)	(0.020)	(0.022)	(0.055)	(0.093)	(0.105)	(0.116)
(Default Risk) _{t-1}		-0.018	-0.009	-0.008	-0.122	-0.184	-0.301	-0.095
	(0.050)	(0.026)	(0.036)	(0.030)	(0.081)	(0.160)	(0.218)	(0.114)
(Inflation) _{t-1}		-0.000	-0.033*	-0.006	-0.013	-0.040	0.105	0.041
	(0.002)	(0.018)	(0.025)	(0.023)	(0.009)	(0.082)	(0.130)	(0.110)
(Exc. Rate Depreciation) _{t-1}	0.001	0.036*	0.000	0.006	0.016*	0.041	-0.139	-0.069
	(0.001)	(0.019)	(0.030)	(0.027)	(0.005)	(0.185)	(0.161)	(0.135)
Time dummies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects?	. Fixed..	. Fixed..	. Fixed..	Random	. Fixed..	. Fixed..	. Fixed..	Random
Hausman χ^2				2.53				11.57
Clustered Std Errors?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No Observations	608	271	197	197	608	270	197	197
No Countries	46	37	36	36	46	37	36	36
No Defaults	27	14	11	11	27	13	11	11
Adjusted R-squared	0.083	0.170	0.133	0.229	0.241	0.316	0.081	0.344

Taking Stock: Public Default and Financial Intermediation

- Consistent with our mechanism, default is followed by credit crunch which is stronger when:
 - banks hold more public debt
 - creditor rights are stronger
- These results are extremely robust to:
 - controlling for sudden stops in capital flows
 - controlling for banking crises
 - propensity score estimation
 - system of variables (SUR) estimation

Empirical test III: Ex-ante test of probability of default

- *Prediction:* higher creditor rights and higher bank-debtholdings should decrease probability of default:

$$\begin{aligned} \text{Pr}(\text{Public Default})_{i,t} = & v_t + \beta_1 (\text{Creditor Rights})_{i,t-1} + \beta_2 (\text{Change in Private Ext. Debt to GDP})_{i,t-1} + \\ & + \beta_3 (\text{Bank Debtholdings})_{i,t-1} + X'_{i,t-1}\gamma + \epsilon_{i,t}, \end{aligned}$$

- We expect $\beta_1 < 0$, $\beta_3 < 0$ and $\beta_2 < 0$ (complementarity)

	(1)	(2)	(3)	(4)
(Creditor Rights) _{<i>t-1</i>}	-0.036** (0.048)		-0.035** (0.028)	-0.004 (0.164)
(Private Debt Flows) _{<i>t-1</i>}		-2.52** (0.046)	-2.95** (0.034)	-0.206* (0.063)
(Bank Bondholdings) _{<i>t-1</i>}				-0.025** (0.039)
(GDP p.c. growth) _{<i>t-1</i>}	-0.146 (0.290)	-0.144 (0.199)	-0.213* (0.090)	-0.024* (0.042)
(Default Risk) _{<i>t-1</i>}	0.153 (0.194)	0.160* (0.081)	0.058 (0.600)	0.053*** (0.002)
(Short-Term Debt) _{<i>t-1</i>}	6.5(e^{-12})*** (0.000)	4.8(e^{-12})*** (0.000)	6.2(e^{-12})*** (0.000)	2.1(e^{-12})*** (0.000)
(Foreign Reserves) _{<i>t-1</i>}	-0.006 (0.146)	-0.007** (0.048)	-0.007* (0.096)	0.002** (0.001)
Time dummies?	Yes	Yes	Yes	Yes
No Observations	257	278	257	133
No Countries	21	21	21	16
Defaults	46	47	46	25
Pseudo R ²	0.240	0.279	0.284	0.525

Empirical test IV: Ex-ante test on the amount of public borrowing

- *Prediction:* improvements in creditor rights should increase public debt:

$$(\text{Public Debt})_{i,t} = \alpha_i + v_t + \beta_3 (\text{Creditor Rights})_{i,t-1} + \beta_4 (\text{Private External Debt})_{i,t-1} + X'_{i,t-1}\gamma + \epsilon_{i,t},$$

- We expect $\beta_3 > 0$ and $\beta_4 > 0$ (complementarity)

	(1)	(2)	(3)
(Creditor Rights) _{t-1}	0.205** (.100)		0.270** (.101)
(Private Debt) _{t-1}		0.811** (0.326)	0.817** (.373)
(GDP per capita) _{t-1}	-0.075 (.099)	0.109 (.185)	0.265 (.187)
(Default Risk) _{t-1}	0.100 (.150)	0.368* (.192)	0.504** (.224)
(Inflation) _{t-1}	0.028 (.197)	-0.290 (.239)	-0.002 (.311)
(Unemployment) _{t-1}	0.152*** (.040)	0.039 (.076)	0.173** (.079)
Time dummies?	Yes	Yes	Yes
Country fixed effects?	Yes	Yes	Yes
Clustered SE?	Yes	No	No
No Observations	207	77	64
No Countries	38	15	15
R ²	0.009	0.121	0.177

Conclusions: takeaways

- Strong institutions reduce public default risk by amplifying banks' balance sheet effects:
 - *Complementarity*: these effects stronger in open economies with *private* inflows
- General implications: domestic market institutions may help governments to buy commitment
 - Indirect gains of financial liberalization (Kose et al. 2006): it disciplines the government if and only if institutions are good. Implications for:
 - * Threshold effects
 - * Sequencing of financial liberalization and reform
 - * Feasibility of public liquidity provision in different countries
 - More broadly, impact of market institutions on other distortionary policies (e.g. devaluations)

Extensions

Link between public investment and modern sector: nothing depends on it

Government incentive to repay depends only on bondholdings

Bondholdings depend only on procyclical return of bonds

Discriminatory taxation

Crucial considerations: can effects of default be undone?

Not necessarily in more general model (i.e., heterogeneous banks)

Role of risk aversion

Savers avoid government bonds

Banks strictly want to hold government bonds in equilibrium (as long as not too risk averse)

TABLE I – DESCRIPTION OF THE VARIABLES USED IN THE ANALYSIS

Variable	Description
Public Debt to GDP	Ratio of public debt, which is an external obligation of a public debtor, including the national government, a political subdivision (or an agency of either), and autonomous public bodies. Source: World Development Indicators (September 2008).
Private Debt to GDP	Ratio of private, nonguaranteed external debt, which is an external obligation of a private debtor that is not guaranteed for repayment by a public entity. Source: International Monetary Fund, World Development Indicators (September 2008).
Private Credit to GDP	Ratio of credit from deposit taking financial institutions to the private sector (International Financial Statistics lines 22d and 42d) to GDP (International Financial Statistics line 99b), expressed as a percentage. Line 22d measures claims on the private sector by commercial banks and other financial institutions that accept transferable deposits such as demand deposits. Line 42d measures claims on the private sector given by other financial institutions that do not accept transferable deposits but that perform financial intermediation by accepting other types of deposits or close substitutes for deposits (e.g., savings and mortgage institutions, post office savings institutions, building and loan associations, certain finance companies, development banks, and offshore banking institutions). Source: International Monetary Fund, International Financial Statistics (September 2008).
Public Bond Share	Ratio of Public Bond, which is the public domestic debt securities issued by government, as a share of Public Debt, which is an external obligation of a public debtor, including the national government, a political subdivision (or an agency of either), and autonomous public bodies. Government bond data is taken from the electronic version of the Bank of International Settlements' Quarterly Review: International Banking and Financial Market Developments by sector and country of issuer.
Sovereign Default	Dummy variable that equals 1 if in year $t-1$ the sovereign issuer is in default. Sovereign default is defined as the failure to meet a principal or interest payment on the due date (or within the specified grace period) contained in the original terms of the debt issue. In particular, each issuer's debt is considered in default in any of the following circumstances: (i) For local and foreign currency bonds, notes and bills, when either scheduled debt service is not paid on the due date, or an exchange offer of new debt contains terms less favorable than the original issue; (ii) For central bank currency, when notes are converted into new currency of less than equivalent face value; (iii) For bank loans, when either scheduled debt service is not paid on the due date, or a rescheduling of principal and/or interest is agreed to by creditors at less favorable terms than the original loan. Such rescheduling agreements covering short and long term debt are considered defaults even where, for legal or regulatory reasons, creditors deem forced rollover of principal to be voluntary. Source: Standard & Poor's (2008).
Creditor Rights	An index aggregating creditor rights, following La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). A score of one is assigned when each of the following rights of secured lenders are defined in laws and regulations: First, there are restrictions, such as creditor consent or minimum dividends, for a debtor to file for reorganization. Second, secured creditors are able to seize their collateral after the reorganization petition is approved, i.e., there is no automatic stay or asset freeze. Third, secured creditors are paid first out of the proceeds of liquidating a bankrupt firm, as opposed to other creditors such as government or workers. Finally, if management does not retain administration of its property pending the resolution of the reorganization. The index ranges from 0 (weak creditor rights) to 4 (strong creditor rights) and is constructed as at January for every year from 1978 to 2003.
GDP	Logarithm of gross domestic product (current US dollars) from 1981 to 2005. Source: World Development Indicators (2008).
GDP per Capita	Logarithm of gross domestic product per capita (Atlas method) from 1981 to 2005. Source: World Development Indicators (2008).
GDP per Capita Growth	Annual growth in gross domestic product per capita from 1981 to 2005. Source: World Development Indicators (2008).