Online Supplementary Appendix

The Asymmetric Effects of Financial Frictions

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Abstract

In this Online Appendix I

1. Show the robustness of the results for different definitions of skewness.
2. Show skewness before and after financial liberalization processes.
3. Derive the optimal financial contract with stochastic monitoring and discuss why results are robust to this assumption.
4. Discuss the performance of both the partial and general equilibrium models for levels and volatilities of lending rates and real activity.
5. Perform an alternative calibration with slightly larger default probabilities (more plausible for emerging markets), and show how results improve.
6. Describe the methodology to compute the general equilibrium model.
7. Show all regressions in the paper with controls.

A Robustness on the Skewness Definition

In the main text, I analyze cross-country differences in skewness of real lending rates log changes. Here, I extend the analysis using three alternative approaches to measure skewness.

First, I compute skewness on the distribution of log deviations from a real lending rate trend. For each month, I obtain the difference between the log of real lending rates and the log of the Hodrick-Prescott trend and compute the skewness of this distribution.

Second, the model can be interpreted as a model of skewness in lending spreads rather than a model of skewness in lending rates, since I consider exogenous risk-free interest rates. What is a good approximation of risk-free rates? I use two approaches here. First, I compute spreads between lending rates in a given country and domestic yields of 3-month Treasury Bills. There are two important drawbacks for this approach. On the one hand, information about T-Bills in developing countries is not high-quality. On the other hand, it is likely that aggregate conditions that determine default rates in a given economy also affect its sovereign risk, moving both lending rates and T-Bills. This leads us to the second approach to compute spreads, which is the difference between lending rates in a given country and the U.S. 3-month T-Bill.

Table 1 shows that using these alternative definitions leads to the same conclusion: asymmetry seems to be higher among poor, non-OECD countries with low enforcement of contracts.

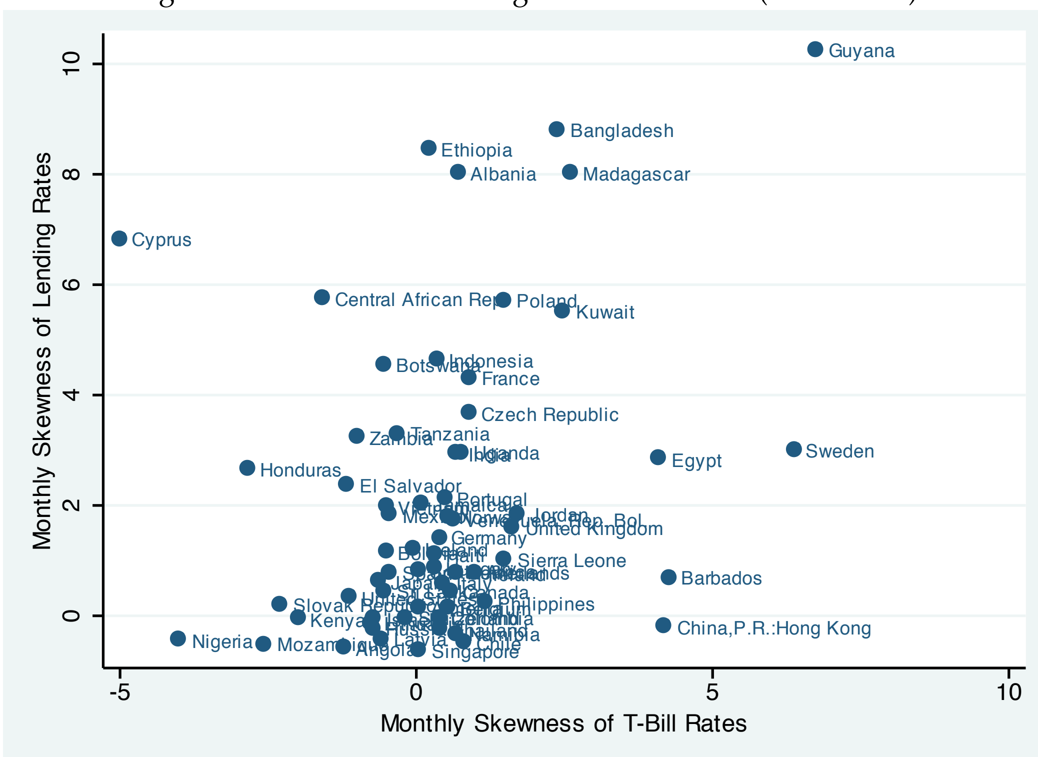
Table 1: Alternative Definitions of Asymmetric Lending Rates

Country Classification	Deviations of Lending Rates			Spreads with domestic T-Bills	Domestic T-Bills	Spread with US T-Bills
Skewness of:	1960-1985	1985-2008	1960-2008	1985 - 2008	1985-2008	1985 – 2008
Income group 1 (richest)	2.55	-0.09	0.85	-0.04	0.21	-0.02
Income group 2	2.59	1.80	1.90	-0.19	0.52	1.28
Income group 3	4.12	1.93	1.92	0.37	0.64	2.00
Income group 4 (poorest)	4.46	2.34	2.63	0.52	-0.46	2.09
OECD	2.21	1.34	2.07	-0.30	0.26	0.17
Non-OECD	4.08	1.49	1.71	0.40	0.15	1.75
High contract enforcement	1.93	0.68	1.53	-0.11	0.20	-0.08
Low contract enforcement	3.65	2.11	2.34	0.67	-0.14	2.50
Private bureau	1.82	0.87	1.06	0.12	0.28	0.79
No private bureau	4.82	1.86	2.20	0.17	-0.07	1.47

Notes: Deviations of Lending Rates are obtained from the distribution of log changes in monthly lending rates in deviations from Hodrick-Prescott trend. Spreads with domestic T-Bills are measured as the difference between real lending rates and 3-month T-Bill rates for the same country, from the Global Financial Dataset. Spreads with US T-Bills are measured as the difference between real lending rates and 3-month T-Bill rates for the United States,

It is important to highlight two features of the data that are consistent with the model. First, Figure 1 shows a strong positive correlation between the skewness of real lending rates and the skewness of T-Bills. This implies that effectively sovereign debt inherits some of the risk from bad economic conditions. Furthermore, learning about these economic conditions affects sovereign and internal lending rates similarly. Still, it seems that the skewness of spreads measured vis-a-vis domestic T-Bills also increases with bankruptcy costs, which suggests learning about ventures' default probabilities is more restrictive than learning about sovereign risk.

Figure 1: Skewness in Lending Rates and T-Bills (1960 - 2008)



The second important feature, is that the relation between spreads computed vis-a-vis U.S. T-Bills (which are probably a better measure of risk-free rate in light of the previous results) and different proxies for financial frictions remain highly significant, both economically and statistically. This is summarized in Table 2.

Table 2: Lending Rates Spreads and Financial Frictions

Dependent Variable	Skewness of Lending Rates Spreads with respect to the United States T-Bills (1985-2008)				
Credit to Private Sector/GDP (All countries)	-0.02 (0.01)***				
Credit to Private Sector/GDP (Non-African countries)		-0.01 (0.01) *			
Cost of Bankruptcy			0.05 (0.01)***		
Bankruptcy Duration				0.33 (0.13)**	
Recovery Rate					-0.03 (0.01)***
Constant	2.31 (0.42)***	1.50 (0.40)***	0.27 (0.38)	0.18 (0.51)	1.98 (0.37)***
Observations	94	70	85	85	85

Notes: * Significant at 10%, ** significant at 5%, and *** significant at 1%. Robust standard errors in parentheses.

Dependent Variable	Skewness of Lending Rates Spreads with respect to the United States T-Bills (1985-2008)			
Legal Protection to Financial Assets	-0.71 (0.27)**			
Sophistication for Financial Markets		-0.54 (0.25)**		
Availability of Internet Banking			-0.62 (0.25)***	
Health of Banking Systems				-0.53 (0.20)**
Constant	4.25 (1.36)***	2.97 (1.04)***	3.34 (1.09)***	3.31 (0.98)***
Observations	56	56	56	56

Notes: * Significant at 10%, ** significant at 5%, and *** significant at 1%. Robust standard errors in parentheses.

B Skewness and Financial Liberalization

Data on financial liberalization are obtained from Kaminsky and Schmukler (2008) for the period 1973 – 2005. Their work includes information on liberalization along three dimensions: capital accounts, domestic financial sectors, and stock market capitalization. *Capital account liberalization* refers to an increased ability of corporations to borrow abroad and fewer controls on exchange rate mechanisms and other sorts of capital. *Domestic financial liberalization* refers to a loosening of interest rate controls (lending and deposits) and other restrictions, such as directed credit policies or limitations on foreign currency deposits. *Stock market liberalization* refers to an increase in the degree to which foreigners are allowed to own domestic equity and a decrease in restrictions to repatriate capital, dividends, and interests. I focus on 16 countries for which I have enough data to reliably measure skewness before and after major liberalization events (more than 47 continuous observations before and after).

The main financial liberalization event is defined as occurring in the month in which the maximum number of liberalization changes have been introduced into the financial system. Financial liberalization and restriction processes are defined as the time frame between the first liberalization change and the last one during the sample 1973-2005.

Table 3: Asymmetry of Lending Rates Before and After Main Financial Liberalization Events

Country	Main Financial Liberalization Event		Type of Liberalization	Skewness of Lending Rates	
	Month	Year		Before	After
Canada	March	1975	KA	0.52	0.41
Finland	January	1990	DFS and SM	0.43	0.14
France	January	1985	DFS and KA	2.80	0.05
Ireland	January	1992	DFS and SM	0.59	0.94
Italy	January	1992	KA	0.64	0.60
Japan	January	1985	SM	1.59	-0.30
Korea	January	1999	SM	-0.10	3.80
Philippines	January	1994	SM and KA	0.37	0.17
Portugal	January	1986	SM	4.05	-0.33
Spain	December	1992	KA	2.09	0.48
Sweden	January	1984	KA	3.67	0.02
UK	October	1973	KA	5.57	1.49
Venezuela	April	1996	SM	3.75	0.32

Notes: KA stands for Capital Account, SM stands for Stock Markets and DFS stands for Domestic Financial System. Data on liberalization dates are from Kaminsky and Schmukler (2008).

Table 4: Asymmetry of Lending Rates Before and After Financial Liberalization Processes

Country	Start of Financial Liberalization Event		End of Financial Liberalization Event		Skewness of Lending Rates	
	Month	Year	Month	Year	Before	After
Canada	March	1975	March	1975	0.52	0.41
Chile	January	1984	September	1998	1.17	-0.15
Finland	January	1986	January	1990	1.83	0.13
France	January	1985	January	1990	2.80	0.08
Indonesia	January	1983	August	1989	1.38	0.95
Ireland	May	1985	January	1992	1.82	0.95
Italy	May	1987	January	1992	1.42	0.60
Japan	January	1979	December	1991	1.45	-1.39
Korea	January	1988	January	1999	-0.58	-0.27
Philippines	January	1976	January	1994	8.04	0.17
Portugal	January	1976	August	1992	4.60	-0.09
Spain	January	1981	December	1992	2.22	0.48
Sweden	January	1978	January	1989	4.32	0.68
Thailand	January	1979	June	1992	1.81	0.13
UK	October	1973	January	1981	5.57	2.00
Venezuela	April	1996	April	1996	-1.00	0.35

Notes: Data on liberalization dates are from Kaminsky and Schmukler (2008).

Table 5: Asymmetry of Lending Rates Before and After Financial Restriction Processes

Country	Start of Financial Restriction Event		End of Financial Restriction Event		Skewness of Lending Rates	
	Month	Year	Month	Year	Before	After
Chile	June	1979	January	1983	0.66	1.17
Indonesia	March	1991	March	1991	0.95	5.32
Thailand	August	1995	May	1997	0.13	0.81

Notes: Data on liberalization dates are from Kaminsky and Schmukler (2008).

C Optimal Equilibrium with Stochastic Monitoring

Proposition 1 *In the optimal equilibrium with stochastic monitoring ($\pi_t \in [0,1]$) borrowers never lie ($z_{it} = 1$) and monitoring probabilities and lending rates are, for all lenders j at time t, given by*

$$\pi_{it} = \begin{cases} 1 & if \quad v_{it} < \frac{1+r+(1-\theta_t)\gamma}{\theta_t} \\ \frac{1+r}{\theta_t v_{it} - (1-\theta_t)\gamma} & otherwise \end{cases} \tag{1}$$

$$(1+\rho_{it}) = \begin{cases} \frac{1+r+(1-\theta_t)\gamma}{\theta_t} & if \quad v_{it} < \frac{1+r+(1-\theta_t)\gamma}{\theta_t} \\ \frac{(1+r)v_{it}}{\theta_t v_{it} - (1-\theta_t)\gamma} & otherwise \end{cases} \tag{2}$$

Entrepreneurs i borrow ($b_{it} = 1$) from any lender j whenever

$$v_{it} \geq \widetilde{\nu}_t = \frac{1+r+w+(1-\theta_t)\gamma}{2\theta_t} + \frac{\sqrt{(1+r+w)^2 + (1-\theta_t)\gamma[2(1+r-w)+(1-\theta_t)\gamma]}}{2\theta_t} \tag{3}$$

Proof. As in the main text, we assume full commitment, which means that the lender commits to following the random strategy π_{it}. Note that the standard debt contract, where $\pi_{it} = 1$ regardless of v_{it}, is also an equilibrium. However, when v_{it} is high enough, it is not necessary $\pi_{it} = 1$ to achieve truth–telling. A lower monitoring probability reduces lending rates maintaining incentives to pay back, which is naturally preferred by borrowers. Borrowers tell the truth if $v_{it} - (1+\rho_t) > (1-\pi_t)v_{it}$, subject to $\pi_{it} \leq 1$. The solution is $\pi_{it} = min\{\frac{(1+\rho_{it})}{v_{it}}, 1\}$.

From perfect competition, the previous π_{it} implies that, $\theta_t(1+\rho_{it}) - (1-\theta_t)\gamma\frac{(1+\rho_{it})}{v_{it}} = 1 + r$. Solving first for $1+\rho_{it}$ and then for π_{it}, gives equations (1) and (2). Given this contract conditional on v_{it}, entrepreneurs borrow if $\theta_{it} v_{it}\left[1 - \frac{1+r}{\theta_t v_{it} - (1-\theta_t)\gamma}\right] \geq w$. From this equation, comes the cutoff in equation (3). ■.

Four features of this equilibrium are worth noting. First, $\widetilde{\nu}_t > \frac{1+r+(1-\theta_t)\gamma}{\theta_t}$ for all monitoring costs $\gamma \geq 0$. This means that, effectively, borrowers have a level of v_{it} such that monitoring costs are given by $\pi_{it} = \frac{1+r}{\theta_t v_{it} - (1-\theta_t)\gamma}$, from equation (1), and lending rates are given by $(1+\rho_{it}) = \frac{(1+r)v_{it}}{\theta_t v_{it} - (1-\theta_t)\gamma}$, from equation (2). Second, if $\gamma = 0$ or $\theta_t = 1$ the unique equilibrium is the standard debt contract with non-stochastic monitoring. Third, cutoffs in the optimal equilibrium are smaller than those under a standard debt contract since lending rates are lower. Finally, the optimal equilibrium generates the same asymmetry implications as the standard debt contract. Monitoring costs still magnify crashes (γ increases levels of lending rates), and beliefs still follow a time-irreversible process that delays recoveries. This proof follows the same logic as the one for Proposition 2.

It is also worthwhile to highlight that, even though I prove stochastic bankruptcy is preferred when there is full commitment, Krasa and Villamil (2000) show that the optimal contract is again one with bankruptcy in pure strategies when there is no commitment to the conditions and previsions of the contract originally signed.

D Performance of the Models for Levels and Volatilities

D.1 Levels of Lending Rate Spreads

I decompose lending rates in the partial equilibrium model into three terms: a risk-free rate, a risk premium (the risk-free rate adjusted by default probabilities), and the expected bankruptcy costs needed to solve the frictions imposed by asymmetric information,

$$\rho_t = r + \frac{(1-\theta_t)}{\theta_t}(1+r) + \frac{(1-\theta_t)}{\theta_t}\gamma. \tag{4}$$

Lending spreads are defined as $(\rho_t - r)$. Since $\frac{\partial(\rho_t - r)}{\partial\gamma} = (1-\theta_t)/\theta_t > 0$, spreads increase with monitoring and bankruptcy costs. Here I show that this is a robust empirical prediction and that the calibrated version of the models can quantitatively explain spread differences across countries.

a. Monitoring Costs Increase Lending Spreads

I construct lending spreads by calculating the monthly difference between real lending rates and domestic three-month Treasury bill yields for each country.[1] I then calculate the average spread for each country in the sample period 1985–2005.

Table 6 shows the results of running regressions between average levels of lending spreads and my general and specific measures of financial development. All coefficients have the expected sign and are statistically significant. An important drawback is that, unlike regressions to explain skewness, level comparisons may be capturing important differences in methodologies and definitions across countries. Despite that drawback, results are robust to many sample restrictions and seem consistent with the prediction that monitoring and bankruptcy costs increase lending spreads.

[1] The data on three-month Treasury bill yields was obtained from the Global Financial Database (GFD) (2008). I have monthly data for 63 countries from 1960 to 2005.

Table 6: Lending Rate Spreads and Financial Development

Dependent Variable	Average Lending Rates Spreads (1985-2008)				
Credit to Private Sector/GDP (All countries)	-0.04 (0.01)***				
Credit to Private Sector/GDP (Non-African countries)		-0.04 (0.01)***			
Cost of Bankruptcy			0.15 (0.04)***		
Bankruptcy Duration				0.56 (0.36)	
Recovery Rate					-0.06 (0.02)***
Constant	7.16 (0.88)***	6.87 (1.14)***	2.82 (0.60)***	3.66 (0.89)***	7.69 (1.14)***
Observations	63	50	58	58	58

Notes: * Significant at 10%, ** significant at 5%, and *** significant at 1%. Robust standard errors in parentheses.

Dependent Variable	Average Lending Rates Spreads (1985-2008)			
Legal Protection to Financial Assets	-1.76 (0.55)***			
Sophistication for Financial Markets		-1.41 (0.47)***		
Availability of Internet Banking			-1.19 (0.48)**	
Health of Banking Systems				-1.16 (0.46)**
Constant	13.75 (3.21)***	10.81 (2.44)***	9.73 (2.46)***	10.59 (2.83)***
Observations	43	43	43	43

Notes: * Significant at 10%, ** significant at 5%, and *** significant at 1%. Robust standard errors in parentheses.

b. Monitoring Costs Are Quantitatively Important

Here I show that differences in monitoring costs are also quantitatively important to explain differences of lending spreads across countries.

The first column of Table 7 shows the average real lending rates for the country classifications defined earlier, and the second column shows average lending spreads. While real lending rates among the poorest countries roughly double those among the richest countries, the spreads are more than double. The third column shows simulated spreads from the calibrated version of the model. In the fourth and fifth columns, spreads are decomposed between risk premia (based on three-month Treasury bill yields for each country in the sample) and financial frictions costs (based on the estimated monitoring and bankruptcy costs from Djankov et al.

(2008)) as specified in equation (4).

Table 7: Data vs. Model Spreads of Lending Rates

Country Classification	Data		PE Model			
	Lending Rates	Spreads	Spreads	$\frac{(1-\theta)(1+r)}{\theta}$	$\frac{(1-\theta)}{\theta}\gamma$	Percentage that γ explains
Income group 1 (richest)	10.4	2.9	2.9	2.8	0.1	3.4
Income group 2	19.6	4.1	3.3	3.0	0.3	9.1
Income group 3	16.9	6.0	5.4	4.7	0.7	13.0
Income group 4 (poorest)	21.5	8.0	5.7	4.7	1.0	17.5
OECD	11.9	2.9	3.0	2.8	0.2	6.7
Non-OECD	18.8	6.4	5.3	4.7	0.6	11.3
High contract enforcement	12.1	3.2	3.1	2.9	0.2	6.5
Low contract enforcement	19.2	6.0	5.4	4.7	0.7	13.0
Private bureau	14.7	3.8	3.1	2.9	0.2	6.5
No private bureau	20.0	7.0	5.4	4.7	0.7	13.0

Two conclusions can be drawn from Table 7. First, a comparison of the data and simulated spreads (the second and third columns) shows that the partial equilibrium model matches spreads observed in developed countries and underestimates spreads in less-developed countries. However, the spread differences are significant, with spreads in the poorest countries doubling those in the richest countries. Second, as shown in the last column, monitoring costs account for almost 20% of spreads in developing countries (income group 4) and less than 5% in developed ones (income group 1).

Similar results are obtained from the general equilibrium model. By construction, I match the default rates observed in the data. The effects of monitoring and bankruptcy costs arise from the product of the default rates and those costs, which is the deadweight loss of financial frictions.

D.2 Volatilities

Now I study the ability of the models to capture the level and cross-country differences in volatility of lending rates and economic activity. First, I compute the standard deviation of the logarithm of lending rates, investment, and output per capita, for 1985–2008. The standard deviation of log variables delivers a proxy for the coefficient of variation; hence, all standard deviations should be interpreted as a percentage of the mean. First, I show the empirical relation between volatility and financial development. Then, I discuss the performance of the models to accommodate such a relation.

Table 8 shows that the volatilities of lending rates and economic activity decline significantly with the level of financial development. In contrast, only investment seems to depend significantly on the level of monitoring and bankruptcy costs. The larger the level of bankruptcy costs, the larger the volatility of investment. This is also illustrated in the first three columns of Table 9. Even though the differences in volatility of lending rates and output are not large, the investment of underdeveloped countries is twice as volatile as that of developed countries (recall that income group 4 has just one observation, so it should be ignored).

Table 8: Volatility and Financial Development

Dependent Variable: Standard Deviation - Log of	Lending Rates		Investment		GDP per capita	
Credit to Private Sector/GDP	-0.03		-0.07		-0.02	
	(0.01)**		(0.01)***		(0.00) **	
Cost of Bankruptcy		0.05		0.23		0.03
		(0.05)		(0.12)*		(0.06)
Constant	6.9	5.4	14.4	7.1	6.4	5.1
	(0.8)***	(0.9)***	(1.8)***	(1.5)***	(0.9)***	(1.2)***
Observations	84	76	46	44	52	51

Notes: The standard deviation is computed on the logarithm of these variables. Then, these coefficients measure the change in standard deviations of the dependent variable, in terms of the mean of the dependent variable, when there is an increase of 1% in the independent variable.

Table 9 offers two main messages with respect to the performance of the models. First, it shows that both models succeed in generating a positive relation between bankruptcy costs and volatility and, in both cases, investment is the only variable showing a significant positive relation. Second, neither model matches the level of volatility in the data. However, as I show next, this result may be just the result of using data from the United States to calibrate default rates in good and bad times.

Table 9: Volatilities: Data vs. Models

Country Classification	Data			PE Model			GE Model		
	LR	Inv	GDP	LR	Inv	GDP	LR	Inv	GDP
Income group 1 (richest)	5.1	6.4	4.6	2.3	72.6	67.2	5.6	0.85	0.03
Income group 2	8.7	13.4	7.0	2.0	89.8	78.1	5.6	1.35	0.08
Income group 3	4.0	14.2	5.8	2.0	90.4	78.8	5.6	1.39	0.09
Income group 4 (poorest)	5.5	3.3	2.0	1.9	100.4	84.8	5.7	1.65	0.16
OECD	4.1	8.0	4.7	2.2	74.3	68.2	5.6	1.01	0.04
Non-OECD	6.0	11.5	5.9	2.0	90.0	78.6	5.7	1.48	0.11
High contract enforcement	7.0	6.3	4.4	2.2	79.8	71.8	5.6	1.12	0.05
Low contract enforcement	4.7	9.1	5.4	2.0	106.5	88.9	5.7	1.62	0.15
Private bureau	6.7	8.5	4.5	2.2	79.8	71.7	5.6	1.13	0.05
No private bureau	5.5	11.5	6.7	2.0	110.3	85.0	5.7	1.55	0.13

Notes: The standard deviation is computed on the logarithm of these variables. Then, these coefficients represent the standard deviation in terms of the percentage of the mean.

E Alternative Calibration with Higher Default Rates

Now, I recalibrate the general equilibrium model using slightly higher default rates in good times (0.5% rather than 0.35%) and in bad times (3% rather than 0.85%). Even though these default rates are chosen merely as an example, evidence of default in emerging countries during crises suggests they are not implausible.[2] As shown in Figures 2 and 3, calibrating the model to these default rates critically improves its ability to accommodate the cross-country differences in skewness of lending rates and investment, without significantly affecting the simulated skewness of output.

Figure 2: Models' Performance on the Asymmetry of Lending Rates

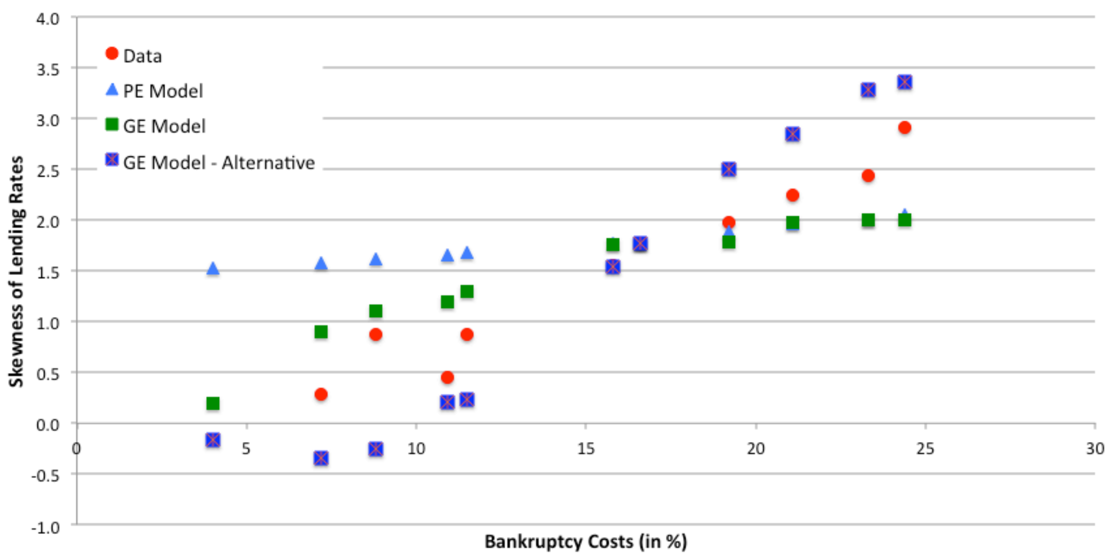
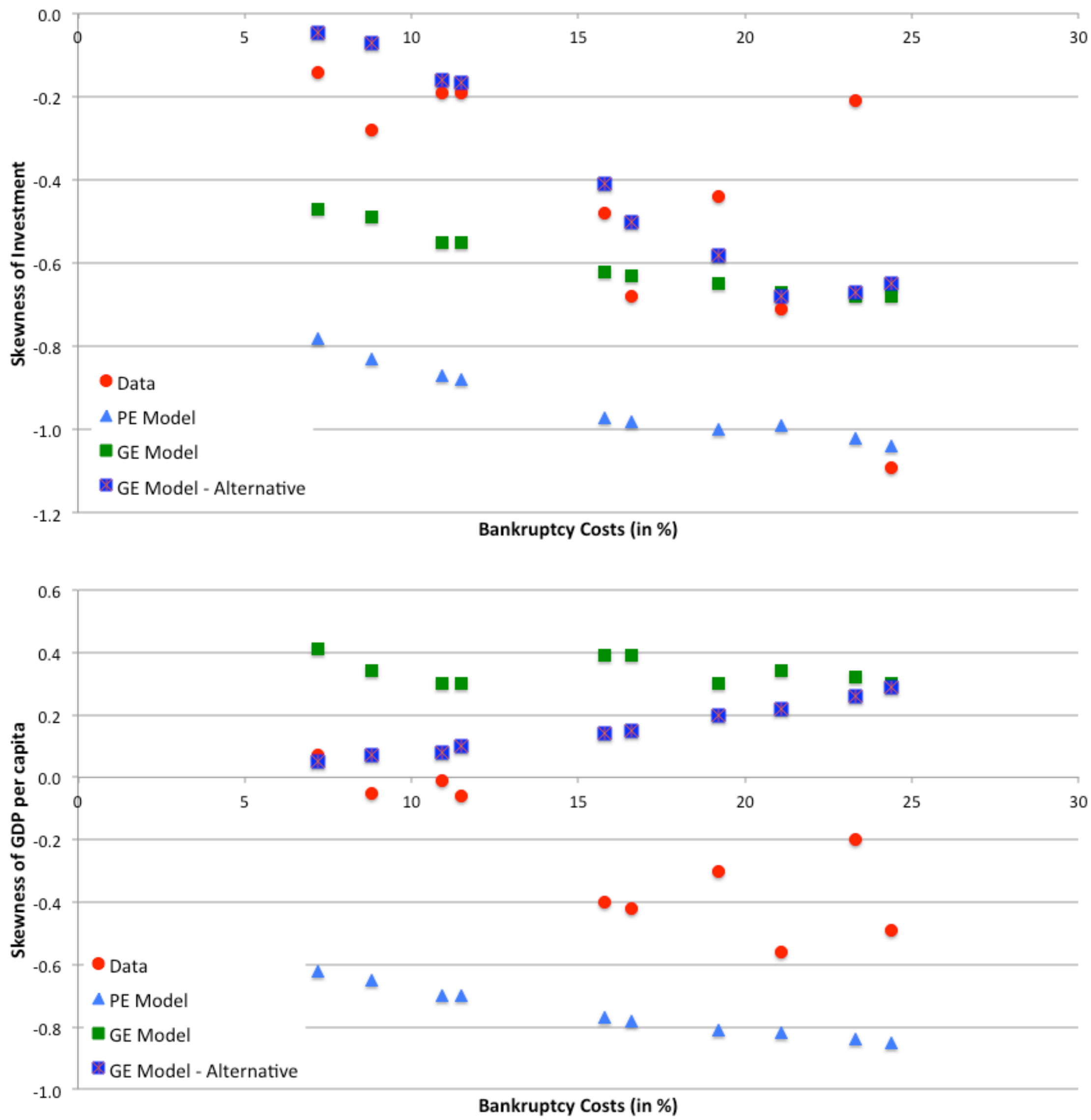


Table 10 shows that this calibration also improves critically the simulated levels of volatility. Even though the relations between volatilities and bankruptcy costs maintain their sign – the volatility of lending rates is insensitive to bankruptcy costs, while the volatility of economic activity increases in bankruptcy costs – the levels of simulated volatilities are closer to those in the data. Why this improvement? Intuition comes from the effect of a larger difference in default between good and bad times on the price of capital. When the economy is in bad times, the decline in the price of capital, q_t, depresses investment and output. The drop in investment introduces a limit to the increase in lending rates during bad times. Recall that $(1 + \rho_t) = q_t(1 + r_t^k)$ (equation 16 in the main text) and $(1 + r_t^k) = \bar{\omega}_t \frac{i_t}{i_t - n_t}$ (equation 15 in the main text). A large decline in i_t tends to increase $(1 + r_t^k)$ (the interest rate in terms of capital), which is compensated by the decline in q_t (a cheaper capital price), which then moderates the

[2] Default rates reached a peak of 50% in Argentina during April 2002, 18% in Brazil during November 2002, and 33% in Mexico during April 2003.

Figure 3: Models' Performance on the Asymmetry of Economic Activity



volatility of lending rates.

The compensating effect of the endogenous price of capital moderates the volatility of lending rates but not the volatility of economic activity, which reacts more to large differences of default between good and bad times.

Finally, note that, in the benchmark calibration, default rates are symmetric. However, in this alternative calibration, default rates are negatively skewed and expected default rates are positively skewed, which is consistent with the findings in Section 5 in the main text.

Table 10: Volatilities: Benchmark vs Alternative Calibration

Country Classification	Data			Benchmark GE Model			GE Model – Higher Default Rates		
	LR	Inv	GDP	LR	Inv	GDP	LR	Inv	GDP
Income group 1 (richest)	5.1	6.4	4.6	5.6	0.85	0.03	7.3	4.2	0.49
Income group 2	8.7	13.4	7.0	5.6	1.35	0.08	7.5	7.9	0.95
Income group 3	4.0	14.2	5.8	5.6	1.39	0.09	7.5	8.3	0.99
Income group 4 (poorest)	5.5	3.3	2.0	5.7	1.65	0.16	7.5	11.1	1.12
OECD	4.1	8.0	4.7	5.6	1.01	0.04	7.4	5.1	0.58
Non-OECD	6.0	11.5	5.9	5.7	1.48	0.11	7.5	9.2	1.05
High contract enforcement	7.0	6.3	4.4	5.6	1.12	0.05	7.4	6.2	0.73
Low contract enforcement	4.7	9.1	5.4	5.7	1.62	0.15	7.5	10.8	1.12
Private bureau	6.7	8.5	4.5	5.6	1.13	0.05	7.4	6.3	0.77
No private bureau	5.5	11.5	6.7	5.7	1.55	0.13	7.5	9.8	1.08

Notes: The standard deviation is computed on the logarithm of these variables. Then, these coefficients represent the standard deviation in terms of the percentage of the mean.

F Computation of the General Equilibrium Model

The model is solved numerically using a projection method. More specifically, I use Chebyshev collocation and approximate the function $\bar{\omega}(K,\mu)$ with $5th$ order Chebyshev basis for K and $3th$ order Chebyshev basis for μ. These are chosen as the smallest orders to get a precision in the projection of $1e-5$. In order to deal with the two dimensionality of the policy $\bar{\omega}(K,\mu)$ we use the Tensor product.

To be more specific, given an approximated function $\bar{\omega}(K,\mu,\xi)$, where ξ is the vector of coefficients of the Chebyshev basis, I am able to derive all the other policies, as functions of K, μ, ξ and thus able to compute residuals from the Euler equation (23) in the main text. The vector ξ is the solution of the system of 15 equations in 15 unknowns, where the 15 unknowns are the coefficients of the Chebyshev basis and the 15 equations are given by the Euler equation evaluated at the 15 collocation pairs (K_i,μ_i). In order to compute expectations I use 10 point quadratures.

To solve the model exploiting projection methods I need a functional restriction $N(h)=0$ that is defined by the system of equilibrium equations. Using projections I find $\tilde{h}$ that approximates h such that $N(h)=0$. Knowledge of $\tilde{h}$ allows me to get all the policy functions. There are potentially many different choices of h, so I choose $\bar{\omega}(K,\mu)$ and use the dynamic Euler equation (23) in the main text as the restriction $N(\cdot)$, since within the Euler equation are nested all the other equilibrium conditions. The projection method specifically allows me to solve for an approximated function $\bar{\omega}(K,\mu)$, that satisfies the restriction. There are 5 steps necessary to approximate the solution by projection. Here I briefly outline how to deal with each step.

Step 1 The first step is to choose a bounded state-space $X \subset R^n$ and a family of functions $\varphi_i(x) : X \to Y$, $i = 0, 1, ...$ that are the basis of the projection. These are two state variables, K and μ, thus I choose the set $X \subset R^2$ such that, during the solution of the model and the simulations, the policy for capital never hits the closure. The evolution of beliefs is bounded by definition. Hence I have $X = [0, 1] \times [K_{min}, K_{max}]$. I choose $\varphi_i(K, \mu)$ to be the terms of the Tensor product of Chebyshev basis of order 3 for μ and of order 5 for K.

Step 2 The second step requires to choose a degree of approximation p, and let

$$\bar{\omega}(K, \mu, \xi) = \sum_{i=0}^{p} \xi_i \varphi_i(K, \mu) \tag{5}$$

The choice of p is is driven by the trade-off between speed of computation and precision. I choose p in order to have the Euler Equation unit free error to be smaller than $1e - 5$ on the whole support X. The resulting p is 15, that is given by Tensor product of the $3rd$ order polynomial for μ and $5th$ order polynomial for K.

Step 3 The third step defines the residual function

$$R(\xi, x) \equiv R(\xi, K, \mu) \equiv N(\bar{\omega}(K, \mu, \xi))$$

using the model restrictions. The residual function is calculated from the restriction that the Euler equation (**??**) is satisfied. Hence, given a functional form $\bar{\omega}(K, \mu, \xi)$ and the equilibrium equation we need to create a functional representation of the Euler equation. In order to do so we proceed as follows

1. For a given pair (K, μ) I obtain $\bar{\omega} = \bar{\omega}(K, \mu, \xi)$
2. Given $\bar{\omega}$ and μ I can solve the contracting problem to get surplus shares f, g and the price of capital q. In order to calculate f and g I need to calculate the expected amount of default, which depends on the realized variance σ^2_{ω}. In order to calculate the expectation I use 10 point quadratures.
3. Given K I can solve for entrepreneurs wage, w^e, and net worth, n, using the production function
4. Given n, g and q I can solve for investment i by the optimality condition of the contract.
5. Using the budget constraint of the entrepreneur, that depends from q, n, f and g, I can get entrepreneur's consumption c^e

6. Last, by market clearing I get lenders' consumption c

7. Given the equilibrium investment i I compute (K', μ'). It is important to notice that K' and μ' both depends on the true variance of entrepreneurs projects, σ_ω^2, thus I use two 10 point quadratures, one centered at M_L and one centered at M_H, in order to calculate the expectations of the lender on the pairs (K', μ').[3]

8. For each of the 20 quadrature pairs (K', μ') using steps 1-6 we calculate c', q' and r'.

9. Last I calculate the Euler equation errors using the quadrature points to take the expectation with respect to the current belief μ. For a generic x the expectation is approximated as follows

$$E(x') = \mu \sum_{i=1}^{10} x'_{i,L} s_i + (1-\mu) \sum_{i=1}^{10} x'_{i,H} s_i$$

   where s_i are the quadrature weights, and $x'_{i,j}$ are the values of x' calculated for the point i of quadrature centered at M_j, with $j \in \{L, H\}$.

Step 4 The fourth step requires to choose a projection function v_i and a weighting function s to solve for the unknown vector of coefficients ξ. ξ solves $V_i = 0$, $i = 0, 1, .., p$, where V_i is defined as

$$V_i \equiv \int_X s(x) R(\xi, x) v_i(x) dx$$

I choose to use a collocation method that exploits the Dirac delta function as the weighting function

$$s(x) = \begin{cases} 0 & if\, x \neq x_i \\ 1 & if\, x = x_i \end{cases}$$

and assigns $v_i = 1\, \forall i$. Last, I need to pick 15 collocation pairs $x_i = (K_i, \mu_i)$: I choose them to be equal to the Tensor product of the zeros of the $3rd$ and $5th$ order Chebyshev polynomials. In order to solve for ξ I use a Newton-Raphson algorithm.

Step 5 The last step consists of verifying the quality of the approximation. I choose as a target that the Euler equation unit free errors, as reported in Judd and Guu (1997), are smaller than $1e-5$.

[3] Note that for each K' there exist a unique μ' that is obtained using the observed signal (K') and the Bayesian updating from equations (12) and (13) in the main text.

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G Regressions with Controls

Table 11: Asymmetry and Financial Development - With Controls

Dependent Variable	Skewness Lending Rates 1960 - 2008	Skewness Lending Rates 1985 - 2008	Skewness Investment 1960 - 2008	Skewness Output 1960 - 2008
Credit to Private Sector / GDP	-0.022	-0.020	0.007	0.003
	(0.012)*	(0.008)***	(0.004)*	(0.003)
GDP per capita	-0.153	-0.381	0.113	0.276
	(0.537)	(0.336)	(0.180)	(0.145)*
GDP Volatility	-0.001	-2.926	-1.058	-1.115
	(1.614)	(2.778)	(0.940)	(0.703)
Average Inflation	-0.600	-0.351	0.076	-0.001
	(0.247)**	(0.232)	(0.100)	(0.077)
Constant	3.960	3.533	-0.575	-0.246
	(0.807)***	(0.764)***	(0.222)**	(0.180)
Observations	94	94	46	52

Notes: * Significant at 10%, ** significant at 5%, and *** significant at 1%. Robust standard errors are reported in parentheses. For each country I compute the sample average of yearly credit to private sector as a percentage of GDP and quarterly GDP per capita, GDP coefficient of variation and inflation from the IMF's IFS database.

Table 12: Asymmetry of Lending Rates and Bankruptcy Costs - With Controls

Dependent Variable	Skewness of Lending Rates					
	1960 - 2008			1985 - 2008		
Cost of Bankruptcy	0.036			0.034		
	(0.015)**			(0.015)**		
Bankruptcy Duration		0.188			0.042	
		(0.136)			(0.135)	
Recovery Rate			-0.017			-0.006
			(0.013)			(0.011)
GDP per capita	-0.247	-0.332	-0.065	-0.676	-0.878	-0.764
	(0.401)	(0.424)	(0.539)	(0.298)**	(0.314)***	(0.349)**
GDP Volatility	-0.493	-0.699	-0.369	-3.688	-3.996	-3.777
	(1.937)	(1.838)	(1.964)	(2.972)	(3.008)	(2.946)
Average Inflation	-0.267	-0.277	-0.340	-0.126	-0.149	-0.170
	(0.232)	(0.238)	(0.226)	(0.221)	(0.221)	(0.220)
Constant	1.835	1.999	2.956	1.941	2.589	2.842
	(0.974)*	(1.039)*	(0.750)***	(0.875)**	(0.969)***	(0.774)***
Observations	82	82	82	82	82	82

Table 13: Asymmetry of Real Activity and Bankruptcy Costs - With Controls

Dependent Variable	Skewness of Investment			Skewness of Output		
Cost of Bankruptcy	-0.011			0.005		
	(0.012)			(0.013)		
Bankruptcy Duration		-0.058			-0.072	
		(0.068)			(0.057)	
Recovery Rate			-0.001			0.004
			(0.005)			(0.004)
GDP per capita	0.374	0.328	0.407	0.413	0.305	0.314
	(0.154)**	(0.166)*	(0.163)**	(0.133)***	(0.144)**	(0.146)**
GDP Volatility	-0.800	-0.904	-0.819	-1.031	-1.141	-1.164
	(0.832)	(0.825)	(0.843)	(0.702)	(0.685)	(0.705)
Average Inflation	0.082	0.066	0.069	0.006	-0.003	0.030
	(0.110)	(0.113)	(0.115)	(0.071)	(0.067)	(0.075)
Constant	-0.359	-0.288	-0.490	-0.318	0.036	-0.348
	(0.299)	(0.342)	(0.309)	(0.289)	(0.275)	(0.197)*
Observations	43	43	43	49	49	49

Notes: * Significant at 10%, ** significant at 5%, and *** significant at 1%. Robust standard errors are reported in parentheses. All independent variables are from Djankov et al. (2005, 2008) and the IMF's IFS database.

Table 14: Asymmetry of Lending Rates and Monitoring Costs - With Controls

Dependent Variable	Skewness of Lending Rates							
	1960 - 2008				1985 - 2008			
Legal protection for financial assets	-0.44				-0.90			
	(0.36)				(0.39)**			
Sophistication of financial markets		-0.58				-0.86		
		(0.29)**				(0.28)***		
Availability of Internet banking			-0.65				-0.52	
			(0.31)**				(0.30)*	
Health of banking systems				-0.33				-0.57
				(0.19)*				(0.21)***
GDP per capita	0.12	0.42	0.29	0.03	0.41	0.56	0.05	0.14
	(0.35)	(0.33)	(0.34)	(0.33)	(0.29)	(0.29)*	(0.24)	(0.32)
GDP Volatility	-0.27	-0.04	-0.31	-0.93	2.37	1.26	0.86	1.20
	(1.81)	(1.64)	(1.86)	(1.66)	(3.26)	(3.16)	(3.62)	(3.08)
Average Inflation	0.07	0.17	0.11	0.08	0.43	0.57	0.47	0.49
	(0.28)	(0.30)	(0.32)	(0.30)	(0.26)*	(0.28)*	(0.28)*	(0.26)*
Constant	3.61	3.47	4.03	3.28	4.48	3.46	2.66	3.11
	(1.83)**	(1.38)**	(1.63)**	(1.16)***	(1.99)**	(1.34)**	(1.55)*	(1.24)**
Observations	56	56	56	56	56	56	56	56

Notes: * Significant at 10%, ** significant at 5%, and *** significant at 1%. Robust standard errors are reported in parentheses. All independent variables are from Porter et al. (1999) and the IMF's IFS database.

Table 15: Asymmetry of Real Activity and Monitoring Costs - With Controls

Dependent Variable	Skewness of Investment				Skewness of Output			
Legal protection for financial assets	0.24				0.15			
	(0.24)				(0.20)			
Sophistication of financial markets		0.15				0.10		
		(0.13)				(0.11)		
Availability of Internet banking			0.13				0.13	
			(0.12)				(0.09)	
Health of banking systems				0.10				0.08
				(0.09)				(0.09)
GDP per capita	0.12	0.17	0.25	0.24	0.25	0.26	0.27	0.29
	(0.21)	(0.19)	(0.16)	(0.15)	(0.17)	(0.13)*	(0.13)**	(0.11)**
GDP Volatility	-1.95	-1.79	-1.63	-1.57	-1.71	-1.67	-1.63	-1.52
	(1.09)*	(0.95)*	(0.83)*	(0.88)*	(0.93)*	(0.87)*	(0.80)**	(0.80)*
Average Inflation	0.04	0.02	0.05	0.04	-0.02	-0.04	-0.03	-0.03
	(0.12)	(0.12)	(0.11)	(0.12)	(0.07)	(0.08)	(0.08)	(0.08)
Constant	-1.26	-0.72	-0.77	-0.70	-0.71	-0.39	-0.53	-0.41
	(0.96)	(0.41)*	(0.58)	(0.41)*	(0.85)	(0.34)	(0.38)	(0.39)
Observations	40	40	40	40	45	45	45	45

Notes: * Significant at 10%, ** significant at 5%, and *** significant at 1%. Robust standard errors are reported in parentheses. All independent variables are from Porter et al. (1999) and the IMF's IFS database.