Sovereign Credit Risk, Financial Fragility, and Global Factors

A. Chari[1] F. Garcés[2] J. F. Martínez[3] P. Valenzuela[2]

[1]University of North Carolina at Chapel Hill

[2]University of Chile

[3]Central Bank of Chile

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This Paper

- It explores the relationship between sovereign credit risk, financial fragility, and global (exogenous) financial factors.
- It develops a model-based semi-parametric metric (JLoss) that computes the joint loss distribution of the banking sector conditional on a systemic event.
- JLoss is positively associated with sovereign credit spreads and negatively associated with higher sovereign credit ratings.
- Countries with more fragile banking sectors are more exposed to the influence of exogenous financial factors.

Motivation

Sovereign Credit Risk

- It is very important to find out what are the drivers of sovereign credit spreads and ratings.
- Sovereign credit spreads and ratings are a manifestation of governments' borrowing costs.
- Sovereign credit risk remains a significant determinant of corporate credit risk (Borensztein, Cowan, and Valenzuela, 2013).
- Sovereign credit risk affects corporate investment and economic growth.
- Sovereign credit risk influences the ability of investors to diversify the risk of global debt portfolios (Longstaff et al., 2011).

Motivation

Financial Fragility

- Fragile financial conditions are associated with a higher probability of credit rationing and banking crises.
- Credit rationing and crises affect economic growth and government tax revenue.
- Systemic sovereign risk has its roots in financial markets rather than in macroeconomic fundamentals (Dieckmann and Plank, 2012; Ang and Longstaff, 2013).
- Greater banking-sector fragility predicts larger bank bailouts, larger public debt, and higher sovereign credit risk (Acharya, Drechsler, and Schnabl, 2014).

Empirical Strategy

$$\textit{Credit Risk}_{i,t} = \alpha_i + \eta_t + \beta \textit{JLoss}_{i,t} + \gamma X_{i,t} + \epsilon_{i,t}$$

$$\textit{Credit Risk}_{i,t} = \alpha_i + \eta_t + \beta \textit{JLoss}_{i,t} + \theta \textit{Global}_t \text{ x } \textit{JLoss}_{i,t} + \gamma X_{i,t} + \epsilon_{i,t}$$

- $\textit{Credit Risk}_{i,t}$ is either the sovereign credit spread or rating.
- $\textit{JLoss}_{i,t}$ is the metric of financial fragility.
- $\textit{Global}_t$ represents global (exogenous) financial factors.
- $X_{i,t}$ is a set of time-varying country-level factors.
- α_i and η_t are vectors of country and year fixed effects.

Variables

Sovereign Credit Risk

- Spreads: J. P. Morgan's EMBI Global index over US Treasuries.
- Ratings: S&P (Moody's) ratings for LT debt in foreign currency.

Financial Fragility

- Model-based semi-parametric metric (JLoss) that computes the joint loss distribution of the banking sector conditional on a systemic event.

Global Financial Factors

- VIX, Treasury rate, HY spread, On/off-the-run spread, and Noise.

Control Variables

- Debt to GDP, GDP pc, exchange rate volatility, and bank profitability.

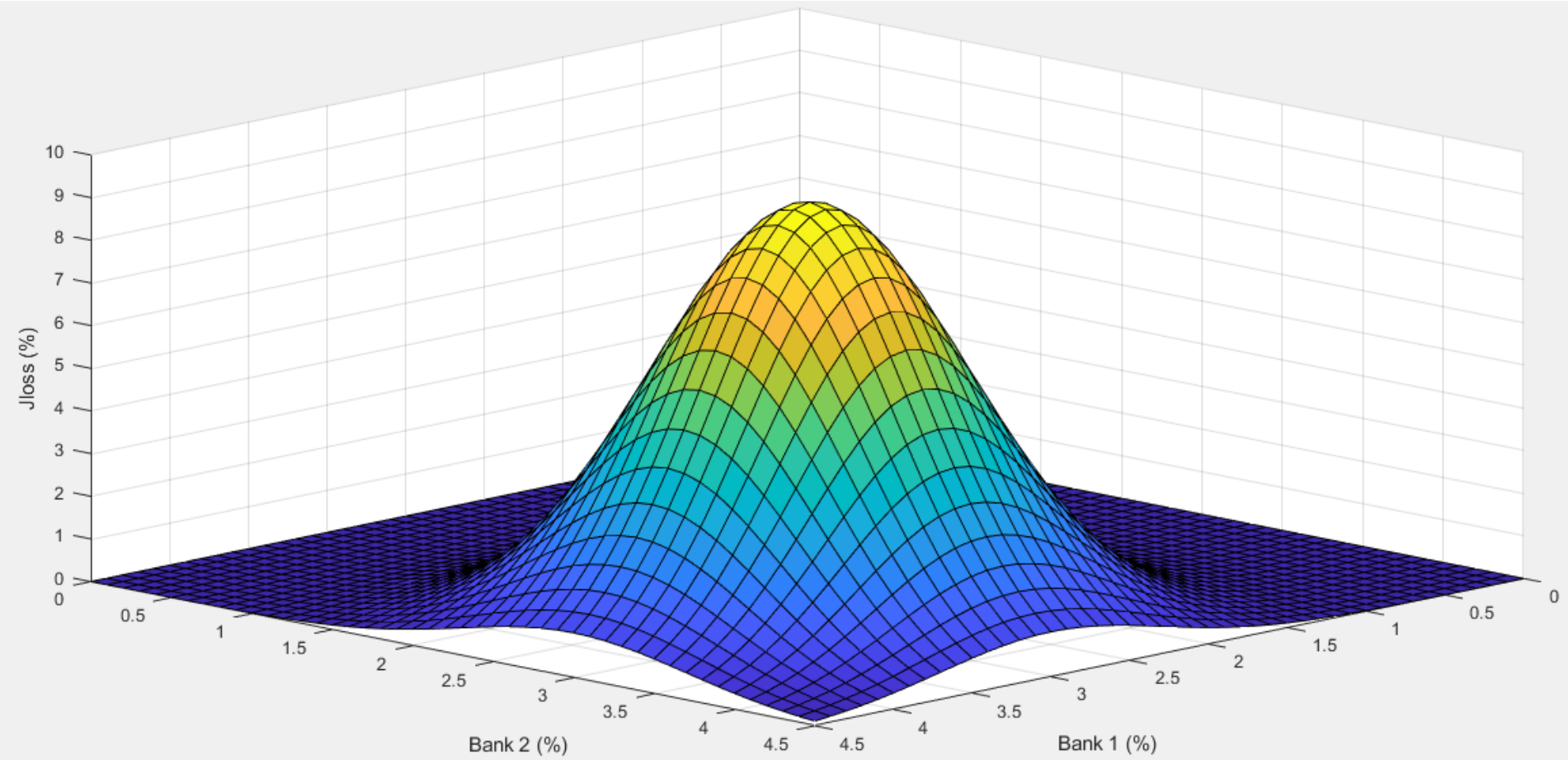
Sample

- 19 EMEs: Argentina, Brazil, Bulgaria, Chile, China, Colombia, Egypt, Indonesia, Malaysia, Mexico, Pakistan, Panama, Peru, Poland, Philippines, Russia, South Africa, Turkey, and Venezuela.
- 298 banks.
- Frequency: quarterly.
- Period: 1999:Q1 to 2016:Q3.

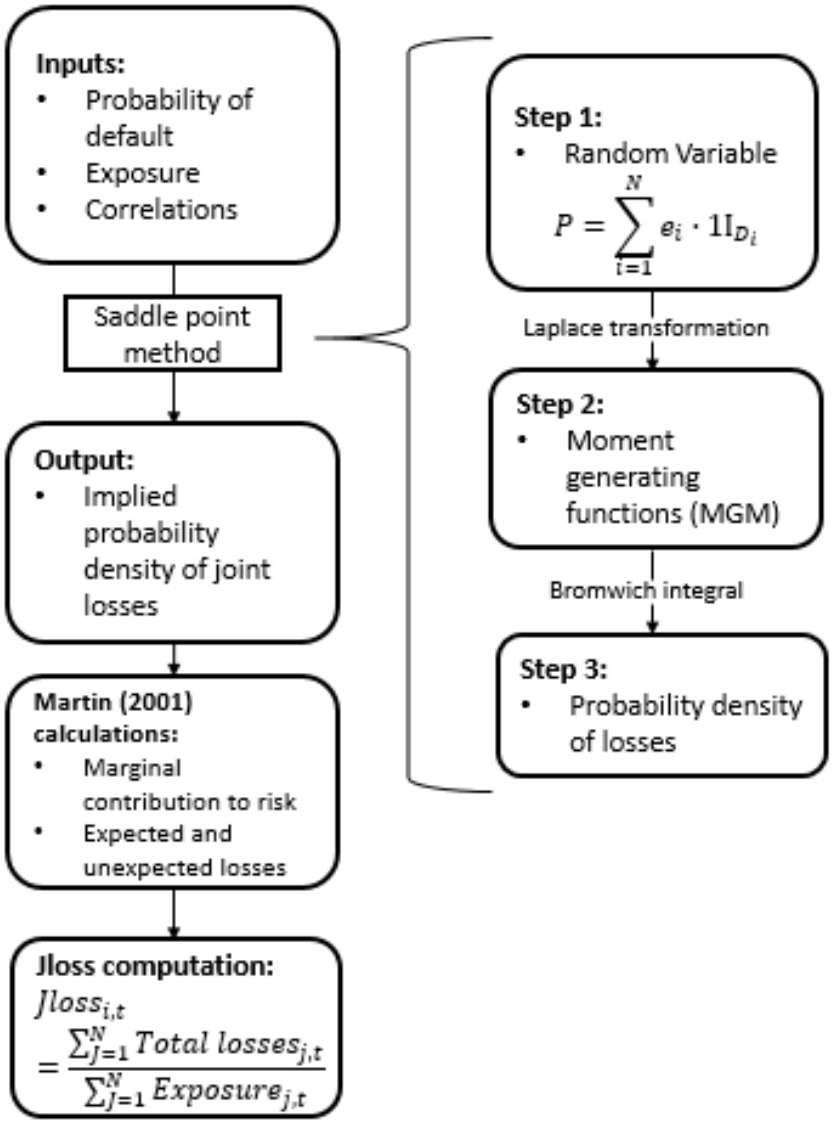
Descriptive Statistics

	N	Mean	S.D.	Min	Max
Sovereign Credit Risk					
EMBI spread	1,187	4.048	6.984	0.410	70.78
S&P rating	1,243	11.15	3.213	1	18
Moody's rating	1,243	11.23	3.438	2	18
Financial Fragility					
JLoss	1,243	6.827	9.113	0.450	47.16
Control Variables					
Profit margin	1,102	15.17	11.74	0.476	99.00
Exchange rate volatility	1,102	0.146	0.642	0	9.681
Debt to GDP	1,102	55.77	36.78	12.70	211.1
GDP per capita	1,102	6,445	3,858	748.0	16,007
VIX	1,102	19.95	8.046	9.510	44.14
U.S. treasury rate	1,102	3.443	1.227	1.471	6.442
High yield spread	1,102	5.396	2.710	2.390	17.22
On/off-the-run spread	1,102	19.59	14.54	2.070	62.91
Noise	1,102	3.138	2.443	0.959	16.17

Joint Loss of Banks



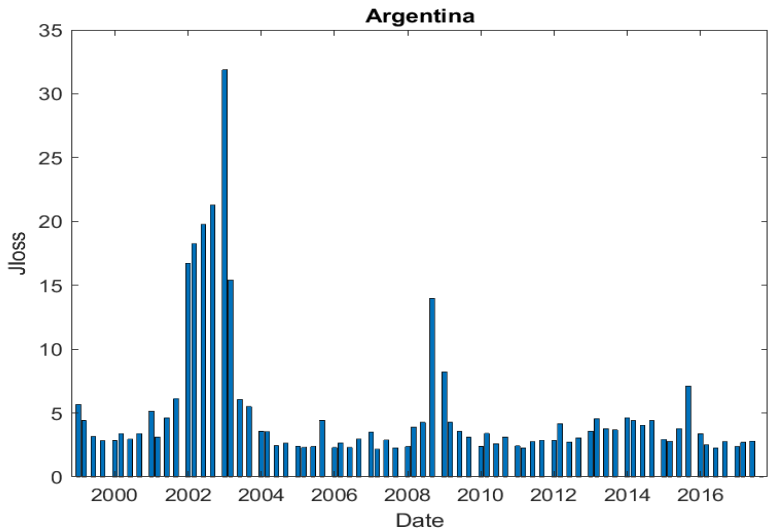
JLoss Computation

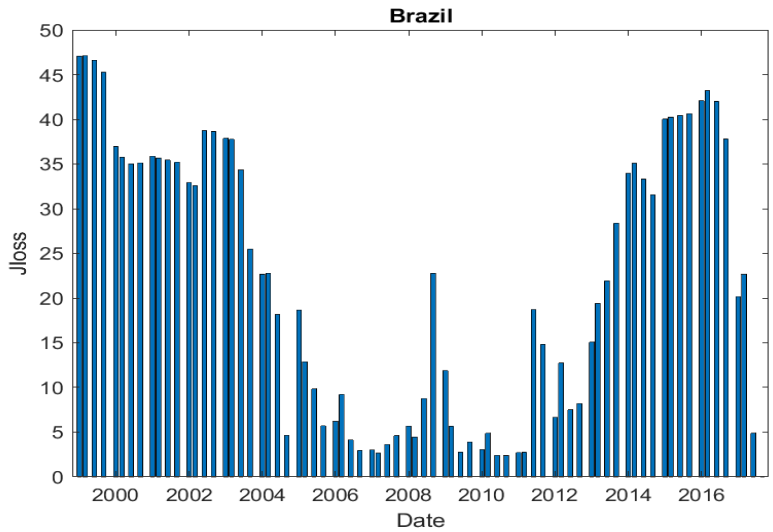


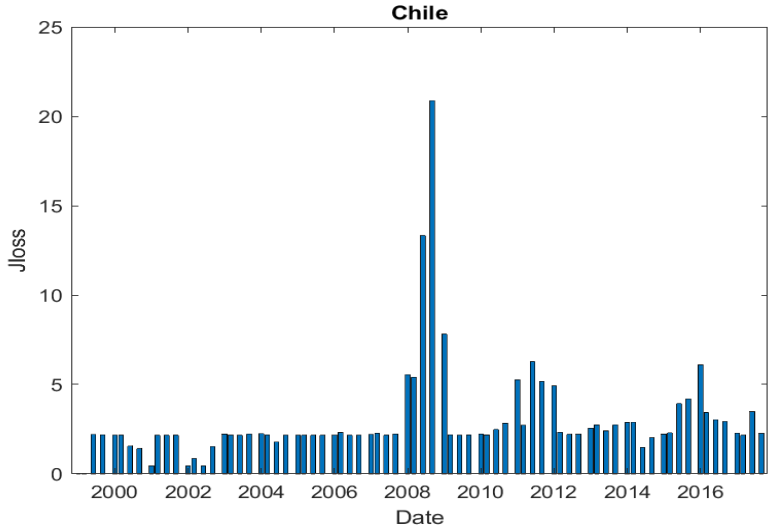
Step by Step:

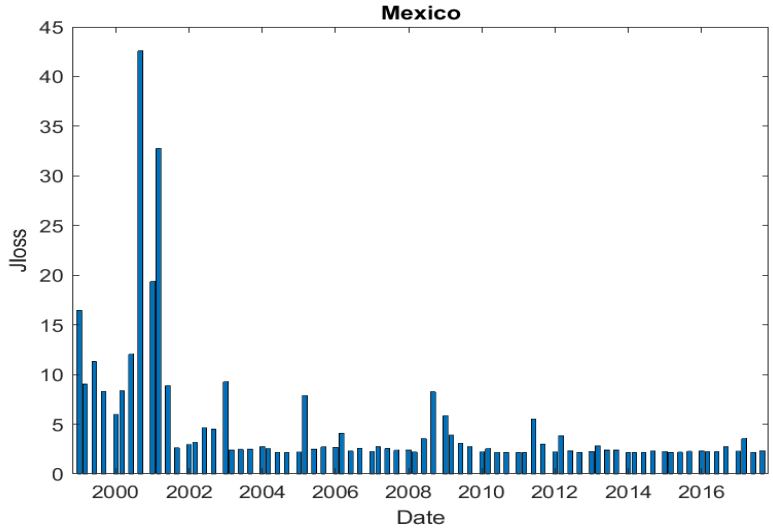
- Calculate default probabilities per bank (Merton) and create a random variable that represents the loss of a portafolio.
- Use the Laplace transformation to move from the R numbers space to the MGF space.
- Find the probability density function in the MGF space.
- Estimate the saddle point, that allows to get back to the real space.
- Calculate the marginal contribution to risk.

JLoss Metric









Sovereign Credit Spreads and JLoss

EMBI spread	(1)	(2)	(3)
JLoss	**0.217*** **	**0.162*** **	**0.121*** **
S&P rating		-0.114***	-0.120***
Exchange rate volatility			0.0272
Profit margin			0.0418***
Debt to GDP			0.327***
GDP per capita			0.239***
Observations	1,187	1,187	1,051
Adjusted R-squared	0.747	0.813	0.827
Country FE	YES	YES	YES
Time FE	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1

Sovereign Credit Ratings and JLoss

S&P rating	(1)	(2)
JLoss	**-0.566*** **	**-0.359*** **
Exchange rate volatility		-0.0919
Profit margin		-0.0653
Debt to GDP		-0.103
GDP per capita		2.754***
Observations	1,243	1,102
Adjusted R-squared	0.828	0.804
Country FE	YES	YES
Time FE	YES	YES

*** p<0.01, ** p<0.05, * p<0.1

Sovereign Credit Spreads, JLoss, and Global Factors

EMBI spread	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
JLoss	-0.493***	-0.243***	-0.221***	-0.0329	-0.474***	-0.310***	-0.164**	0.0139
VIX					-0.171**	0.126**	0.185***	0.184***
U.S. Treasury spread					-0.128**	-0.689***	-0.124**	-0.102*
High yield spread					0.172***	0.204***	-0.128	0.173***
On/off-the-run spread					0.512***	0.627***	0.504***	-0.589***
VIX x JLoss	0.203***				0.208***			
U.S. Treasury rate x JLoss		0.253***				0.320***		
High yield spread x JLoss			0.183***				0.173***	
On/off-the-run-spread x JLoss				0.692***				0.625***
Observations	1,051	1,051	1,051	1,051	1,051	1,051	1,051	1,051
Adjusted R-squared	0.832	0.833	0.832	0.838	0.809	0.814	0.808	0.813
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	NO	NO	NO	NO

*** p<0.01, ** p<0.05, * p<0.1

Sovereign Credit Ratings, JLoss, and Global Factors

S&P rating	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
JLoss	0.728	0.978***	0.415	-0.113	0.324	1.137***	-0.00644	-0.271**
VIX					0.690**	0.378	0.246	0.249
U.S. Treasury rate					1.425***	3.309***	1.424***	1.390***
High yield spread					0.392	0.341	0.814**	0.395
On/Off-the-run spread					-0.768*	-1.046**	-0.751*	0.631
VIX x JLoss	-0.359**				-0.257*			
U.S. Treasury rate x JLoss		-0.925***				-1.077***		
High yield spread x JLoss			-0.414***				-0.241*	
On/off-the-run-spread x JLoss				-1.096***				-0.794**
Observations	1,102	1,102	1,102	1,102	1,102	1,102	1,102	1,102
Adjusted R-squared	0.804	0.807	0.804	0.805	0.807	0.812	0.807	0.807
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	NO	NO	NO	NO

*** p<0.01, ** p<0.05, * p<0.1

Robustness Checks

- Systemic banking crises (Laeven and Valencia, 2018).
- Periods of financial stability.
- Moody's credit ratings.
- Additional interaction effects (Global factors x Sovereign rating and Global factors x Banking crisis).

Systemic Banking Crisis and Financial Stability

	Whole sample		Excluding crisis	
	(1)	(2)	(3)	(4)
	EMBI spread	S&P rating	EMBI spread	S&P rating
JLoss	**0.112*** **	**-0.330*** **	**0.104*** **	**-0.261*** **
S&P rating	-0.116***		-0.110***	
Exchange rate volatility	0.0292	-0.0547	0.0301	-0.00199
Profit margin	0.0311*	-0.0390	0.0332**	-0.0438
Debt to GDP	0.286***	0.00202	0.241***	0.164
GDP per capita	0.243***	2.693***	0.265***	2.792***
Banking crisis	0.417***	-1.043***		
Observations	1,051	1,102	1,024	1,071
Adjusted R-squared	0.835	0.806	0.810	0.789
Country FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1

Moody's Credit Ratings (1)

EMBI spread	(1)	(2)	(3)
JLoss	**0.217*** **	**0.184*** **	**0.125*** **
Moody's rating		-0.0963***	-0.109***
Exchange rate volatility			0.0396
Profit Margin			0.0296*
Debt to GDP			0.361***
GDP per capita			0.136*
Observations	1,187	1,187	1,051
Adjusted R-squared	0.747	0.794	0.815
Country FE	YES	YES	YES
Time FE	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1

Moody's Credit Ratings (2)

Moody's rating	(1)	(2)
JLoss	**-0.421*** **	**-0.360*** **
Exchange rate volatility		0.0122
Profit Margin		-0.186**
Debt to GDP		0.216
GDP per capita		2.076***
Observations	1,243	1,102
Adjusted R-squared	0.846	0.826
Country FE	YES	YES
Time FE	YES	YES

*** p<0.01, ** p<0.05, * p<0.1

Conclusions

- This paper contributes to the literature on the sovereign credit risk-financial fragility nexus.
- It develops a new measure of fragility in the banking sector (JLoss).
- Sovereign credit risk is closely associated with financial fragility.
- Countries with a more fragile banking sector are more exposed to the influence of global (exogenous) financial factors.
- The results underscore that regulators must ensure the stability of the banking sector to improve governments' borrowing costs in international debt markets.

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20th of January 2020

Sovereign Credit Risk, Financial Fragility, and Global Factors?

by Patricio Valenzuela et al.

Diego L. Puente M.

January 20, 2020

Summary

- This paper explores the relationship between sovereign credit risk, financial fragility and global financial factors.
- Employs a sample of 19 emerging economies from 1999Q1 to 2017Q3.
- Results:
  - Financial fragility is poistively associated with sovereign credit spreads and negatively associated with higher sovereign credit ratings.
  - Countries with more fragile banking sectors are more exposed to the influence of global financial factors related to market volatility, risk-free interest rates, risk premiums, and aggregate liquidity.

Contributions

This study makes three contributions:

1. Introduces a new measure of financial fragility denominated JLoss.
2. Explores the relationship between sovereign credit risk and financial fragility in a sample of emerging economies.
3. Analyses the effect of global factors on sovereign credit risk through the channel of financial fragility.

New Financial Fragility Metric (JLoss)

"JLoss is a model-based semi-parametirc estimation of the expected joint loss of the banking sector after liquidating the collateral."

- Method based on the saddle point approximation technique discussed in Martin, Thompson, and Browne (2001).
  - Bank-specific probabilities of default – Merton (1974) contigent claims distance-to-default approach.
  - Exposure in case of default – Total bank's liabilities
  - Loss given default – 45% of total liabilities (BIS)

New Financial Fragility Metric (JLoss)

- Given that the metric itself is listed as a main contribution it would be important to provide a description of the methodology used as part of the main text.
- Inconsistent definition:

"The expected joint loss of the banking sector in the event of a large financial meltdown."

vs

"The expected joint loss of the banking sector after liquidating the collateral."

New Financial Fragility Metric (JLoss)

According to R. Martin the saddle point method is a credit risk technique for the *"calculation and management of portfolio losses... [its] most natural application is in credit, as through the collateralised debt obligation (CDO) market, and investment banks' exposure to bonds and loans..."*

- You would need to describe how this portfolio management technique can be applied to the study of financial fragility at the country level.

New Financial Fragility Metric (JLoss)

Unclear how this metric is better than other (perhaps simpler) metrics in the literature. For instance Marginal Expected Shortfall (MES) by Acharya et al. (2010).

"Recent academic studies have introduced measures of systemic risk... However, given that our metric of the expected joint loss of the domestic banking sector can be interpreted as the direct cost of bailing banks out from a crisis, it should be a particularly significant factor to consider in the pricing of sovereign bonds"

- It is not clear why MES would not accomplish the same?

New Financial Fragility Metric (JLoss)

The MES of an institution can be interpreted as the expected equity loss of a given financial institution when the market itself is in its left tail.

- It is a measure of the sensitivity of a financial firm to systemic risk.
- Acharya et al. (2010) claim MES would have been able to predict the cross section of losses incurred by US financial firms during the 2007-2009 crisis.
- JLoss could perhaps offer new insights if you were to consider other systemic factors (besides market risk). At the moment you only consider the return correlation of each individual bank with a market index (i.e. systemic risk).

New Financial Fragility Metric (JLoss)

. Other questions/suggestions:

- In the system of equations to estimate the market value (V) and volatility of assets (σ_A), d_1 should be a function of σ_A.

$$d_1 = \log\left(V \cdot \frac{E}{D^*}\right) + \frac{\frac{1}{2}\sigma_E^2 \cdot T}{\sigma_E \cdot \sqrt{T}}$$

- In the estimation of Distance to Default (DD) the estimated value of assets ($\hat{V}$) should be $\hat{V} - D^*$ and not $\hat{V}/E - D^*$.

$$DD = \frac{\frac{\hat{V}}{E} - D^*}{\frac{\hat{V}}{E} \cdot \hat{\sigma_A}}$$

New Financial Fragility Metric (JLoss)

. Other questions/suggestions:

- Where do you get the balance sheet and stock market data from?
- The paper you cite Kealhofer (2000) does not exist! There is a paper by that title but does not show the Moody's KMV model methodology.

Focus on Emergin Markets

This paper explores the relationship between sovereign credit risk and financial fragility.

- Greater financial fragility $\Longrightarrow$ larger bank bailouts $\Longrightarrow$ larger public debt $\Longrightarrow$ higher sovereign credit risk

$$Credit\ Risk_{c,t} = \alpha_c + \gamma_t + \beta JLoss_{c,t} + \omega X_{c,t} + \epsilon_{c,t}.$$

  - $\uparrow$ JLoss $\Longrightarrow$ $\uparrow$ Sovereign Credit Spread
  - $\uparrow$ JLoss $\Longrightarrow$ $\downarrow$ Sovereign Credit Rating

Focus on Emergin Markets

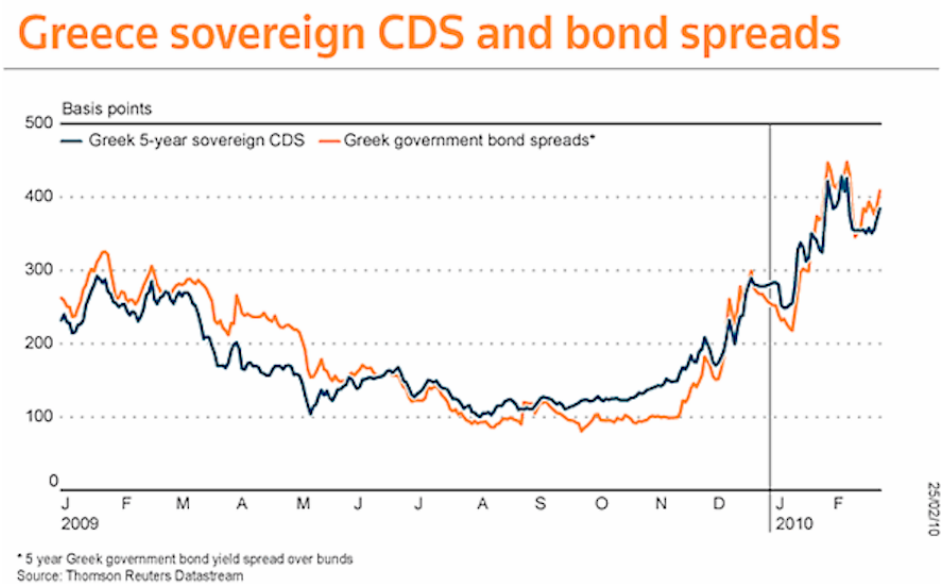
Is the deterioration in sovereign credit risk caused by an increase in the expectation of public support for distressed banks?

- You could estimate expected external support by following Correa et al. (2014) as the difference between the credit rating that accounts for external support and the standalone rating.

Focus on Emergin Markets

"The goal of this paper is to shed light on the relationship between sovereign credit risk and financial fragility in the banking sector."

- Why the exclusive focus on emerging markets?
- You could also include developed economies and perhaps contrast findings between the two groups.
- Use alternative lists of emerging countries to double your sample.
  - Other groups of analysts (e.g. S&P, MSCI, Dow Jones) consider Greece as an emerging economy.



Focus on Emergin Markets

Differentiate between private and state-owned banks.

- For instance, in China and Venezuela, a fragile banking system may have a larger impact on sovereign credit spreads compared to countries with a mostly private (international) banking system.

Focus on Emergin Markets

Given the different nature of the countries in your sample and the different distributions of spreads and credit ratings it would be important to estimate the regression model by clustering standard errors at the country level.

Table 2: Descriptive Statistics for Sovereign Credit Spreads

Country	Mean	Standard Deviation	Minimum	Maximum
Argentina	13.95	17.35	2.04	70.78
Brazil	5.31	3.98	1.4	24.12
Bulgaria	4.35	4.68	0.65	21.54
Chile	1.49	0.54	0.55	3.43
China	1.25	0.53	0.44	2.93
Colombia	3.33	2.04	1.12	10.66

New Channel for the Effect of Global Factors

Countries with more fragile banking sectors are more exposed to the influence of global financial factors:

- VIX
- 10-year U.S. Treasury rate
- 10-year U.S. High Yield spread
- On/off-the-run U.S. Treasury spread

$$Credit\ Risk_{c,t} = \alpha_c + \gamma_t + \beta JLoss_{c,t} + \theta JLoss_{c,t}\ x\ Global_t + \omega X_{c,t} + \epsilon_{c,t}$$

New Channel for the Effect of Global Factors

These global factors are extremely US-centric:

- The reported effect you find on the interaction term may be driven by the level of trade and economic integration each country has with the US.
  - US slowdown $\Longrightarrow$ less funding for local banks $\Longrightarrow$ higher financial fragility and sovereign credit spreads.
- You could consider other factors such as oil prices and US dollar exchange rate.

New Channel for the Effect of Global Factors

"The identification assumption is that, in the absence of domestic financial fragility, the sovereign bond spreads and sovereign credit ratings are exposed to similar global shocks"

- Is this plausible?
- Does a significant drop in oil prices have the same effect for all countries in your sample? Russia and Venezuela?

New Channel for the Effect of Global Factors

- How to interpret the fact that the coefficients on the variable JLoss in Tables 6 and 7 have the "wrong" sign?

Table 6: Sovereign Bond Spreads, Financial Fragility, and Global Factors

EMBI spread	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
JLoss	-0.493***	-0.243***	-0.221***	-0.0329	-0.474***	-0.310***	-0.164**	0.0139
	(0.125)	(0.0655)	(0.0651)	(0.0263)	(0.118)	(0.0606)	(0.0687)	(0.0266)

Table 7: Sovereign Credit Ratings, Financial Fragility, and Global Factors

S&P rating	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
JLoss	0.728	0.978***	0.415	-0.113	0.324	1.137***	-0.00644	-0.271**
	(0.498)	(0.327)	(0.291)	(0.135)	(0.474)	(0.283)	(0.267)	(0.121)

Typos

- Third, this study takes an additional step beyond the extant literature by exploring a channel.
- For instance,The credit rating for Russia ranges from 1 to 14 during the sample period.
- Figure 1 displays our aggregate JLoss metric.
- In addition, since the SRISK is a metric that is based on capital deficits given a praticular stressted scenario...
- . . . the assumptions of conditional independence and the semi-parametric calculation allow us to improve efficience...

Typos

- The term α_c represents a vector of country fixed effects that control for all time-invariant country-specifc factors.
- Then, we exclude of our simple periods crises.
- Countries with a more fragile banking sector are more expose to the influence of global financial factors.

Thank you!