Conference on Network Models, Stress Testing and Other Tools for Financial Stability Monitoring and Macroprudential Policy Design Implementation

Mexico City, Mexico, November 2015

Systemic *Risk-Taking Channel of Domestic and Foreign* Monetary Policy

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Introduction

- Risk-taking channel hypothesis: Monetary policy easing leads financial intermediaries to leverage up and take on more risk.
- Systemic risk-taking channel hypothesis: As they leverage up and take risk in response to monetary easing, intermediaries may generate systemic risk, in the sense of:
    i. Correlated failures (due to correlated risk exposures)
    ii. Contagion (due to externalities of leverage decisions)
- There are some papers investigating the risk-taking channel.
- **Contribution: (i) First to investigate systemic risk-taking channel of monetary policy. (ii) Both domestic and foreign policy, for a small open economy, namely Brazil. (iii) Novel systemic risk indicators. (iv) Empirical framework easy to scale up.**

Literature

- Borio and Zhu (2008): "*Risk-taking channel defined as the impact of changes in policy rates on either risk perceptions or risk-tolerance and hence on the degree of risk in the portfolios, on the pricing of assets, and on the price and non-price terms of the extension of funding*."

(i) **Risk tolerance** may increase with wealth, which is higher with lower interest rates,

(ii) **Target rates of return** may be sticky, leading to a search for yield,

(iii) **Expectation** that the authorities will intervene to limit downside risks, through bailouts or monetary policy easing.

(iv) **Leverage constraints** so that easy money eases constraints and incentives leverage.

(v) **Leverage and limited liability** worsen moral hazard in monitoring.

Literature: Theory

- Adrian and Shin (2009) formalize the leverage constraint argument; there is related literature exploring “limits to arbitrage” with similar implications.
- Dell’Ariccia et. al. (2009) formalize the argument that easy money incentive leverage through lower costs of debt, and high leverage reduces incentives for banks to monitor.
- Diamond and Rajan (2009) and Farhi and Tirole (2009) formalize the risk taking incentives of bail-out policies.
- **Acharya (2009) formalizes that banks have incentives to undertake correlated investments due to limited liability, but no link with monetary policy.**

Literature: Evidence

- Jiménez et.al (2014) use credit register data from Spain and show banks lend more to riskier firms during policy easing, particularly for banks with low capital ratios.
- Altumbas et.al (2012) show solvency problems during the crisis were more severe for banks in jurisdictions with low interest rates for a long time and for banks with less capital.
- Maddaloni and Peydró (2011) show lending standards deteriorate in response to lower short-term interest rates.
- Lee et.al (2015) use syndicated loan data to show lenders invest in riskier loans in response to a decline in US policy rates
- **Gong (2014) documents that, compared to nonbank lenders in syndicated loans, banks takes more systemic risk, in the sense of charging lower risk premiums for aggregate risk exposures.**

Empirical Strategy

- Does domestic and foreign monetary policy affect risk taking in such a direction that it affects systemic risk?
- Given **indicators for systemic risk contribution at the bank level**, estimate dynamic panel models with monetary policy variables on the right hand side
  i. fixed effects and subsampling take heterogeneity and omitted variables into account.
  ii. treatment of the endogeneity of the domestic monetary policy variables.

Systemic Risk Indicators

- We consider the Default Correlation and the DebtRank to capture two systemic events, respectively: many banks failing together and a contagion process beginning in a particular bank.
- **Default Correlation** is a novel measure; 1) we compute default probabilities from the Merton model, 2) joint probability distribution from the entropy method of Segoviano (2006), **3) pairwise default correlations, 4) top ten correlations average for each bank**
- **DebtRank** is from Battiston (2012); 1) we take cross exposures in the interbank network and capital buffers data, 2) simulate contagion cascades, 3) compute the resulting potential loss to assets ratio, **4) include impact from secured exposures**

Default Correlation

- Calculate default probabilities DP_i from the Merton Model, with distress barrier DB_i . Input this into the following problem to get the joint return distribution:

$$\widehat{p(x_i,x_j)} = \underset{p(x_i,x_j)}{\operatorname{argmin}}\ C[p,q] = \int\int p(x_i,x_j)\ln[\frac{p(x_i,x_j)}{q(x_i,x_j)}]dx_i dx_j,$$

s.t.

$$\int\int p(x_i,x_j)\boldsymbol{I}_{(-\infty,\ln(DB_i/A_i))}(x_i)dx_i dx_j = DP_{i,t}$$

$$\int\int p(x_i,x_j)\boldsymbol{I}_{(-\infty,\ln(DB_j/A_j))}(x_j)dx_j dx_i = DP_{j,t}$$

$$\int\int p(x_i,x_j)dx_i dx_j = 1$$

$$p(x_i,x_j) \geq 0.$$

- Calculate correlation between indicator variables of default, using the same distress barrier.

DebtRank

- Consider the usual DebtRank recursion on the equity loss (h_j) which propagates over i <u>unsecured</u> leverage to j (W_{ji})

$$h_i(t) = \min\left\{1, h_i(t-1) + \sum_j W_{ji} h_j(t-1)\right\}, \text{ where } j \mid s_j(t-1) = D$$

- **Instead of (h_j) we use a function f(h_j) that depends on <u>secured</u> exposures. Why? We argue that eventual delivery of collateral reduces the eventual recovery of unsecured exposures.**
- To capture this, we use $f(h_j) = h_j + (U_{ji}/W_{ji})h_j$ with U the unsecured exposure. This is just debt rank in W'=U+W. We also consider larger externalities as in $f(h_j) = h_j + \Sigma(U_{ki}/W_{ji})h_k$.
- **Why not simply unsecured DebtRank? No results for this case.**

Monetary Policy Indicators

- The monetary policy variables we consider are:
  i. domestic policy rate,
  ii. effective reserve requirement ratio, and
  iii. US shadow policy rate (Wu and Xia (2015)).
- We take the quarterly change of the policy instruments.
- **What we would expect?**
  - Consistent with the systemic-risk taking channel, we would expect monetary easing by all these instruments to increase systemic risk.
  - Effect may be weaker for US rate after the crisis, due to less global transmission through banks (Bruno and Shin (2012)).
  - And for reserve requirements which is a narrower channel.

Dynamic Panel Model

$$y_{it} = \alpha_i + \sum_{j=1}^{L} \beta_j y_{it-j} + \sum_{j=0}^{1} \gamma_j' MP_{t-j} + \sum_{j=0}^{1} \zeta_j' M_{t-j} + \eta' B_{it-1} + u_{it}$$

y_{it}: Default Correlation, DebtRank

α_i: Fixed effect – bank *i*

$\beta_j, \gamma_j, \delta_j, \zeta_j, \eta_j$: vectors of coefficients for lag *j*

MP_t: Monetary policy variables in *t* (policy rates (dom & foreign), reserve req)

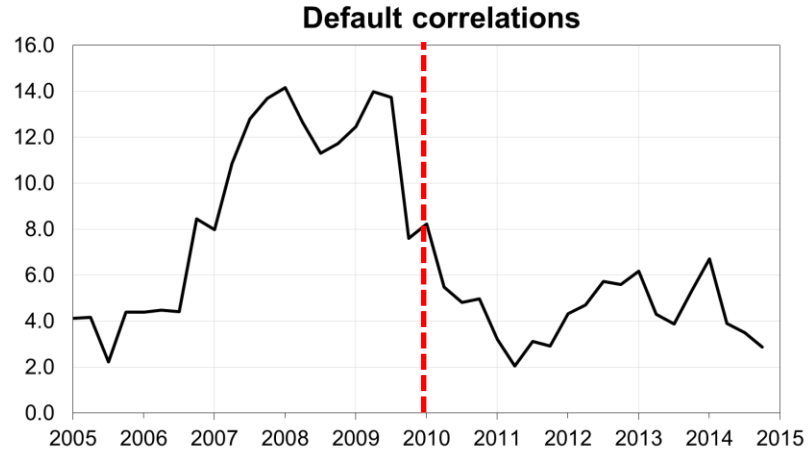
M_t: Macro environment controls in *t* (inflation, credit growth, output gap, exchange rate, country risk)

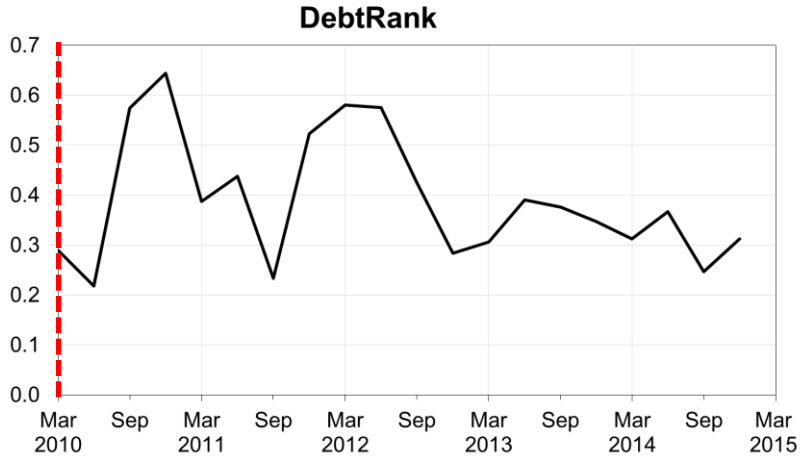
B_{it}: Bank controls in *t* (size, liquidity ratio, return over assets, equity ratio)

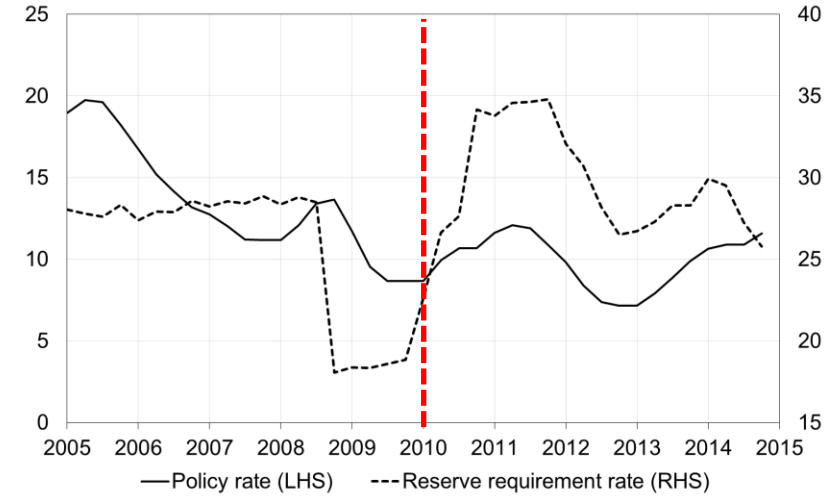
Data

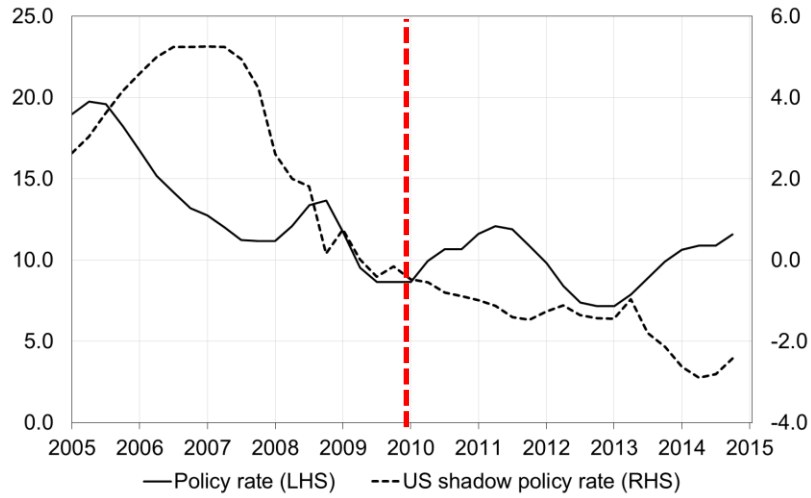
- The frequency is quarterly.
- Banks are conglomerates (that either hold demand deposits or an investment portfolio).
- Up to 160 banks depending on the sample.
- For Default Correlations, the sample runs from 2005Q1 to 2014Q4
- For DebtRank, the sample runs from 2010Q1 to 2014Q4

Data


Default correlations
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


DebtRank
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Mar 2010
Sep
Mar 2011
Sep
Mar 2012
Sep
Mar 2013
Sep
Mar 2014
Sep
Mar 2015


25
20
15
10
5
0
40
35
30
25
20
15
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Policy rate (LHS)
Reserve requirement rate (RHS)


25.0
20.0
15.0
10.0
5.0
0.0
6.0
4.0
2.0
0.0
-2.0
-4.0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Policy rate (LHS)
US shadow policy rate (RHS)

Default Correlation and Monetary Policy I

VARIABLES	(1) 2005-14	(2) 2005-14	(3) 2005-14	(4) 2010-14	(5) 2010-14	(6) 2010-14
Default corr $_{t-1}$	0.77***	0.73***	0.72***	0.70***	0.70***	0.69***
	(0.043)	(0.049)	(0.049)	(0.035)	(0.059)	(0.063)
Default corr $_{t-2}$	-0.01	-0.02	-0.02	0.02	0.04	0.04
	(0.022)	(0.021)	(0.020)	(0.024)	(0.042)	(0.041)
Default corr $_{t-3}$	-0.13***	-0.16***	-0.17***	-0.16***	-0.12***	-0.12***
	(0.040)	(0.045)	(0.046)	(0.019)	(0.026)	(0.039)
Δ*Policy rate* $_{t}$	-0.56***	-0.58***	-0.64***	-1.09***	-0.89**	-1.05**
	(0.160)	(0.161)	(0.167)	(0.360)	(0.417)	(0.472)
Δ*Policy rate* $_{t-1}$	0.15	0.20	0.21	-0.08	-0.01	-0.05
	(0.128)	(0.124)	(0.137)	(0.301)	(0.354)	(0.428)
Δ*US policy rate* $_{t}$	-0.62***	-0.90***	-0.97***	-0.46	-0.34	-0.42
	(0.199)	(0.242)	(0.250)	(0.448)	(0.475)	(0.552)
Δ*US policy rate* $_{t-1}$	-0.17	-0.37*	-0.44**	-0.18	0.09	0.02
	(0.194)	(0.216)	(0.222)	(0.451)	(0.507)	(0.596)
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Micro Controls	No	Yes	Yes	No	Yes	Yes
Only Private Banks	No	No	Yes	No	No	Yes
Observations	4,465	4,215	3,816	2,211	2,064	1,890
Number of Banks	160	150	137	137	126	117
Sargan p-value	0.203	0.299	0.439	0.293	0.228	0.270

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Long-run effects

Δ*Policy rate Coef*	-1.08*	-0.82**	-0.93**	-2.67***	-2.38	-2.86
Δ*US policy rate Coef*	-2.09***	-2.75***	-3.04***	-1.48	-0.66	-1.05

Default Correlation and Monetary Policy II

VARIABLES	(1) 2005-14	(2) 2005-14	(3) 2005-14	(4) 2010-14	(5) 2010-14	(6) 2010-14
$\Delta Policy\ rate_{t}$	-0.65***	-0.66***	-0.76***	-1.35**	-1.45	-1.85**
	(0.199)	(0.211)	(0.224)	(0.560)	(2.824)	(0.864)
$\Delta Policy\ rate_{t-1}$	0.26	0.28*	0.32*	0.41	0.94	1.23**
	(0.167)	(0.166)	(0.184)	(0.543)	(1.194)	(0.530)
$\Delta Required\ res_{t}$	-0.07	-0.06	-0.08	-0.16	-0.27	-0.33*
	(0.046)	(0.049)	(0.055)	(0.112)	(0.240)	(0.183)
$\Delta Required\ res_{t-1}$	0.00	-0.00	0.00	0.10	0.11	0.15
	(0.052)	(0.053)	(0.060)	(0.095)	(0.118)	(0.115)
$\Delta US\ policy\ rate_{t}$	-0.52**	-0.80***	-0.83***	-0.22	0.27	0.46
	(0.248)	(0.274)	(0.297)	(0.626)	(1.208)	(0.781)
$\Delta US\ policy\ rate_{t-1}$	-0.27	-0.44*	-0.54**	-0.54	-0.45	-0.62
	(0.217)	(0.240)	(0.250)	(0.477)	(0.576)	(0.668)
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Micro Controls	No	Yes	Yes	No	Yes	Yes
Only Private Banks	No	No	Yes	No	No	Yes
Observations	4,465	4,215	3,816	2,211	2,064	1,890
Number of Banks	160	150	137	137	126	117
Sargan p-value	0.169	0.253	0.393	0.254	0.220	0.223

Default Correlation and Monetary Policy II

VARIABLES	(1) 2005-14	(2) 2005-14	(3) 2005-14	(4) 2010-14	(5) 2010-14	(6) 2010-14
$\Delta Policy\ rate_{t}$	-0.65***	-0.66***	-0.76***	-1.35**	-1.45	-1.85**
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	(0.217)	(0.240)	(0.250)	(0.477)	(0.576)	(0.668)

Long-run effects

$\Delta Policy\ rate\ Coef$	-1.02*	-0.84*	-0.96**	-2.25**	-1.18	-1.44
$\Delta Required\ res\ Coef$	-0.17	-0.14	-0.17	-0.14	-0.38	-0.42
$\Delta US\ policy\ rate\ Coef$	-2.10***	-2.76***	-3.01***	-1.82	-0.39	-0.35

DebtRank and Monetary Policy I and II

VARIABLES	(1) 2010-14	(2) 2010-14	(3) 2010-14	(4) 2010-14	(5) 2010-14	(6) 2010-14
Debt Rank $_{t-1}$	0.14	0.14	0.29**	0.14	0.14	0.29**
	(0.154)	(0.155)	(0.134)	(0.157)	(0.162)	(0.133)
Δ*Policy rate* $_{t}$	-0.48**	-0.49***	-0.55***	-0.37	-0.28	-0.49**
	(0.193)	(0.176)	(0.194)	(0.247)	(0.227)	(0.203)
Δ*Policy rate* $_{t-1}$	0.16	0.23	-0.54	-0.19	-0.10	-0.97**
	(0.517)	(0.519)	(0.384)	(0.638)	(0.663)	(0.495)
Δ*Required res* $_{t}$				0.04	0.06	0.02
				(0.067)	(0.072)	(0.059)
Δ*Required res* $_{t-1}$				-0.08	-0.08	-0.10**
				(0.064)	(0.070)	(0.052)
Δ*US policy rate* $_{t}$	0.23	0.24	-0.14	0.06	0.06	-0.32
	(0.352)	(0.373)	(0.285)	(0.369)	(0.406)	(0.324)
Δ*US policy rate* $_{t-1}$	0.17	0.24	-0.90	-0.00	0.18	-1.25*
	(0.885)	(0.928)	(0.702)	(1.069)	(1.105)	(0.730)
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Micro Controls	No	Yes	Yes	No	Yes	Yes
Only Private Banks	No	No	Yes	No	No	Yes
Observations	2,152	1,920	1,767	2,152	1,920	1,767
Number of Banks	151	136	127	151	136	127
Sargan p-value	0.119	0.160	0.110	0.164	0.098	0.167

DebtRank and Monetary Policy I and II

VARIABLES	(1) 2010-14	(2) 2010-14	(3) 2010-14	(4) 2010-14	(5) 2010-14	(6) 2010-14
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	(0.885)	(0.928)	(0.702)	(1.069)	(1.105)	(0.730)

Long-run effects

Δ*Policy rate Coef*	-0.37	0.29	-1.53**	-0.65	-0.45	-2.07**
Δ*Required res Coef*				-0.04	-0.02	-0.11
Δ*US policy rate Coef*	0.46	0.56	-1.46	0.07	0.28	-2.21

Robustness

- Results are qualitatively the same,

  (i) Foreign policy rate is the average of USD, EUR shadow rates.

  (ii) Macroprudential policy indicator included as macro control.

  (iii) Alternative definition of the debtRank incorporating secured exposure externalities on unsecured ones.

  (iv) Different lag specifications.

Conclusion

- Domestic policy rate: robust evidence that monetary easing increases both systemic risk indicators
  - This effect is higher in the post-crisis sample, maybe reflecting the lower level of domestic interest rates.
- Reserve requirements rates: monetary easing increases systemic risk, but it is not significant (narrow channel and liquidity buffer)
- Foreign policy rate: Evidence that foreign monetary easing increases systemic risk looking at the entire sample
  - For the post-crisis sample (including that for the DebtRank measures), effects have the same sign, but are not significant (lesser role of banks in the transmission of foreign shocks).

Final Comments

- The risk-taking channel literature is relatively new; even more so when considering the systemic risk-taking dimension.
- Our empirical strategy is easy to scale up. One may use different systemic risk measures and samples, including cross-country.
- Variations of the specification are also welcome, such as including interaction between systemic risk indicators or average values of indicators as control variables.
- It would also be nice to incorporate the micro-panel into a macro-model to capture interactions. For example, right now we are tentatively exploring the impulse response to monetary policy shocks in such a framework.

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Thank you!