Interbank exposures, off-balance-sheet activities and systemic risk contribution: Evidence from the emerging and developped countries

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Motivation

- ▶ Growing importance and integration of BRICs banks in global banking
  - ▶ Bank assets (2002-2012): increased by 12 times in BRICs; merely tripled in G7
  - ▶ Agreement on establishing a development bank, in March 2013
- ▶ Existing literature focuses on **systemic risk (SR) and determinants** for banks in developed countries.
  - ▶ esp. US and EU
  - ▶ De Jonghe (2010), Knaup and Wagner (2010), Brunnermeier et al. (2011), Moore and Zhou (2012), Lopez-Espinosa et al. (2012)
- ▶ **May differ for banks from emerging and developed countries**
  - ▶ Due to different economic development, financial innovations, openness, regulations and legislation
  - ▶ Wholesale funding a determinant for European banks, not US banks (Lopez-Espinosa et al., 2012)

This paper

- ▶ Quantifies SR based on
    - ▶ Marginal Expected Shortfall (MES) (Acharya et al., 2010)
    - ▶ A new estimator using extreme value theory (EVT) (Qin and Zhou, 2013)
- ▶ Applications: BRICs banks; EU, US and Japanese banks
- ▶ Documents different determinants of systemic risk contribution
    - ▶ BRICs: traditional balance-sheet characteristics
    - ▶ Developped countries:
        - ▶ Balance-sheet characteristics and non-traditional activities, like interbank exposures and off-balance commitment
        - ▶ A positive relationship

MES

- ▶ A system consisting of d banks
  - ▶ negative equity return: $\boldsymbol{X} = (X_1, \cdots, X_d)$
  - ▶ weighted return of system: $Y = \sum_{i=1}^{d} s_i X_i$ for $s_1, \cdots, s_d > 0$
- ▶ System expected shortfall
  - ▶ $E(Y|Y > t)$ for some high threshold t indicated by an extremal event, e.g., when total capital is below a certain fraction of total assets
  - ▶ Decomposition: $E(Y|Y > t) = \sum_{i=1}^{d} s_i E(X_i|Y > t)$
- ▶ MES

$$MES_i = \lim_{t \to \infty} s_i \frac{E(X_i|Y > t)}{E(Y|Y > t)}$$

measures the systemic risk contribution of bank i to the system.

EVT-based estimator

- Assumptions
    - Heavy tails in each r^i
        - Common parameter α (tail index)
        - Different parameter A_i (scale)
    - Tail dependence across $(r^1, \cdots, r^d)$
        - Only about dependence of tail events
        - Characterized by a $d-$dimensional measure H
        - H is determined by the limit behavior of the copula
- The MES estimator

$$MES_i = s_i \frac{\int_W (A_i w_i)^{1/\alpha} \left(\sum_{i=1}^d s_i (A_i w_i)^{1/\alpha} \right)^{\alpha-1} H(dw)}{\int_W \left(\sum_{i=1}^d s_i (A_i w_i)^{1/\alpha} \right)^{\alpha} H(dw)}$$

Application to emerging and developped countries

- Data
  - 77 BRICs banks; 28 US, EU and Japanese banks
  - from 1999Q1 to 2012Q4
  - Equity prices and market capitalization
- Two designs
  - Separate systems
  - A combined system
- Moving window analysis
 - Window length: 4-year
  - Moving by quarter

Potential determinants

- **Size**: total assets/sum of total assets in the system
- Balance-sheet characteristics
    - **leverage (LEV)**: total assets/shareholders' equity
    - **non-performing loans ratio (NPL/TL)**: 100*non-performing loans/total loans
    - **return on asset (ROA)**: 100*trailing 12M net income/ average total assets
    - **market-to-book ratio (MTB)**: market capitalization/book value
- Non-traditional activities
    - **interbank exposures (IA/TA)**: 100*interbank assets/total assets
    - **non-interest income (NII/TR)**: 100*non-interest income/ total revenue
    - **off-balance-sheet activities (OBS/TA)**: 100*off-balance commitment and contingency/total assets

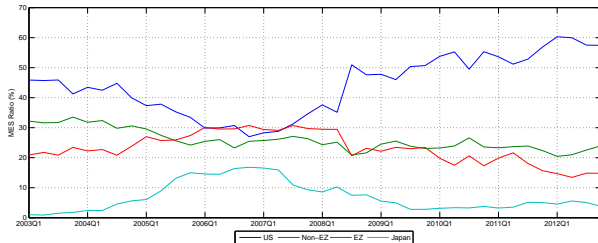# Model specifications

- Four lags: (1) no lag (Lag=0); (2) one quarter (Lag=1); (3) two quarters (Lag=2); (4) one year (Lag=4).
- Panel regression with fixed effects; Time dummies and bank dummies
- Heteroskedasticity and autocorrelation: One-way cluster methodology with banks as the cluster.

Results: Dynamic MES
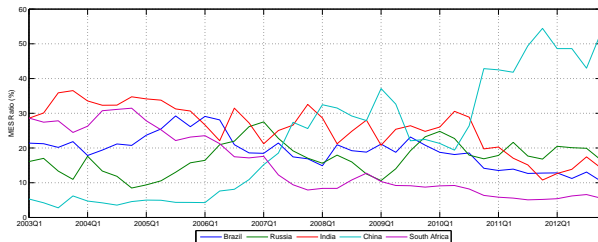
(a) BRICs countries

(b) Developped countries

Results: Static MES and ranking (2012Q4)

Rank	Bank	Region	MES(%)	Rank	Bank	Region	MES(%)
1	ITL	China	17.40	1	WFC	US	13.93
2	SBE	Russia	10.31	2	BAC	US	13.60
3	BCL	China	9.01	3	C	US	11.93
4	VTB	Russia	4.79	4	JPM	US	9.93
...	...	...	...	...	...	...	
11	IU3	Brazil	3.06	11	UBSN	non-EZ	2.78
12	IO3	Brazil	2.95	12	MS	US	2.39
13	SBK	India	2.51	13	ING	EZ	2.39
14	DC3	Brazil	2.47	14	RBS	non-EZ	2.15
...	...	...	...	...	...	...	
74	DHB	India	0.01	25	CRDA	EZ	0.95
75	RK3	Brazil	0.01	26	CBK	EZ	0.63
76	BAY	Russia	0.0010	27	KN	EZ	0.52
77	PRE	India	0.0005	28	DEX	EZ	0.01

BRICS				
	Brazil	Russia	India	China
Russia	46			
India	211	137		
China	128***	83*	507***	
South Africa	42	31	192***	16**
Developped				
	US	non-EZ	EZ	
non-EZ	17			
EZ	13**	16*		
Japan	1**	3*	13	

Results: BRICs

	(1)	(2)	(3)	(4)
	No lag	1 quarter	1/2 year	1 year
Constant	2.085***	2.739***	2.280***	2.874***
Size	0.374***	0.314***	0.250***	0.142***
LEV	-0.059***	-0.058***	-0.059***	-0.062***
NPL/TL	-0.017**	-0.016*	-0.017*	-0.016
ROA	0.120***	0.104**	0.064	-0.04
MTB	0.527***	0.512***	0.534***	0.507***
NII/TR	-0.004	-0.001	-0.002	-0.002
OBS/TA	0.002	0.002	0.003	0.000
IA/TA	-0.008	0.002	0.008	0.008
Time dummies	yes	yes	yes	yes
Bank dummies	yes	yes	yes	yes
R^2	0.632	0.591	0.563	0.496

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Results: Developped countries

| | (1) | (2) | (3) | (4) |
	No lag	1 quarter	1/2 year	1 year
Constant	-10.369***	-11.258***	-9.286***	-5.400***
Size	0.336***	0.283***	0.210**	0.063
LEV	-0.057***	-0.045***	-0.031*	-0.021
NPL/TL	0.06	0.140*	0.218**	0.290***
ROA	-0.463*	-0.152	0.024	-0.118
MTB	1.208***	0.452	0.067	-0.279
NII/TR	0.009	0.014*	0.018**	0.017*
OBS/TA	0.077***	0.073***	0.065***	0.064***
IA/TA	0.107***	0.099***	0.089***	0.085***
Time dummies	yes	yes	yes	yes
Bank dummies	yes	yes	yes	yes
R^2	0.409	0.381	0.345	0.346

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Results: Combined system

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	No lag	1 quarter	1/2 year	1 year
Constant	-1.992***	-2.147***	-2.637***	-1.955***
NII/TR*developped	0.010***	0.012***	0.012***	0.011***
OBS/TA*developped	0.0702***	0.0695***	0.0641***	0.0613***
IA/TA*developped	0.071***	0.067***	0.065***	0.075***
NII/TR*emerging	-0.002	-0.002	-0.002	-0.002
OBS/TA*emerging	0.001	0.001	0.001	0.000
IA/TA*emerging	-0.002	0.000	0.000	-0.001
Controls	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes
Bank dummies	yes	yes	yes	yes
R^2	0.313	0.294	0.254	0.248

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Robustness: Normal and crisis periods

	Emerging		Developed	
	Normal	Crisis	Normal	Crisis
Constant	-3.679*	0.387	4.509***	-16.470***
Size	0.244***	0.518***	0.472***	0.149**
LEV	0.084	-0.027**	-0.127***	-0.007
NPL/TL	0.007	-0.004	-0.256**	-0.153*
ROA	0.783***	0.056	0.049	0.368
MTB	0.758***	0.555***	0.782**	2.794***
NII/TR	-0.002	-0.003	0.005	-0.005
OBS/TA	-0.004	0.000	0.046***	0.111***
IA/TA	-0.005	-0.009	-0.019	0.058***
Time dummies	yes	yes	yes	yes
Bank dummies	yes	yes	yes	yes
R^2	0.631	0.623	0.385	0.358

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Robustness: Systemic risk as dependent variable

	Emerging	Developped
Constant	-1.040**	-12.091***
Size	0.642***	1.423***
Leverage	-0.034***	-0.029***
NPL/TL	-0.006**	0.025*
ROA	0.046***	-0.079
MTB	0.195***	0.563***
NII/TR	-0.0003	0.004***
OBS/TA	0.009	0.073***
IA/TA	-0.006***	0.012***
Time dummies	yes	yes
Bank dummies	yes	yes
R^2	0.958	0.927

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Conclusion

- Documents different determinants of systemic risk for banks from emerging countries and those from developed countries.
- Policy implications
  - Developped countries
    - Strict regulation on both balance-sheet and non-traditional activities like interbank exposures and off-balance-sheet activities
  - Emerging countries like BRICs
    - Now: focus on traditional balance-sheet activities
    - Future: non-traditional activities, albeit of lower priority, due to increasing participation in trading activities