

Systemic risk, bank capital and deposit insurance around the world

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Motivation and research questions

„Stronger regulation and supervision [...] would have been a more effective and surgical approach to constraining the housing bubble than a general increase in interest rates.“

Ben Bernanke, former chairman Federal Reserve, January 3, 2010

Motivation and research questions

- Financial crises continue to occur from time to time
- Different theories about how financial crises develop and how bank regulation and supervision could affect financial stability
⇒ no consensus
- Which factors drive systemic risk exposures and contributions?
 - ▶ bank characteristics
 - ▶ regulatory environment
 - ▶ supervisory environment
 - ▶ (country characteristics)
- To what extent is regulation able to prevent systemic crises?

Related literature I

- Cihak, Demirgüç-Kunt and Soledad Martinez Peria (2013, JFStabil): bank regulation and supervision in the context of the global crisis
- Brunnermeier, Dong and Palia (2012, WP AFA 2012): consider factors that drive MES and ΔCoVaR for US banks
- Billio et al. (2012, JFE): PCA / Granger causality networks – ability of systemic risk measures to predict financial stress in out of sample tests
- Giglio et al. (2013, WP): predictive power of systemic risk measures with respect to macroeconomic outcomes
- Beltratti and Stulz (2012, JFE): consider bank specific factors that determine performance

Related literature II

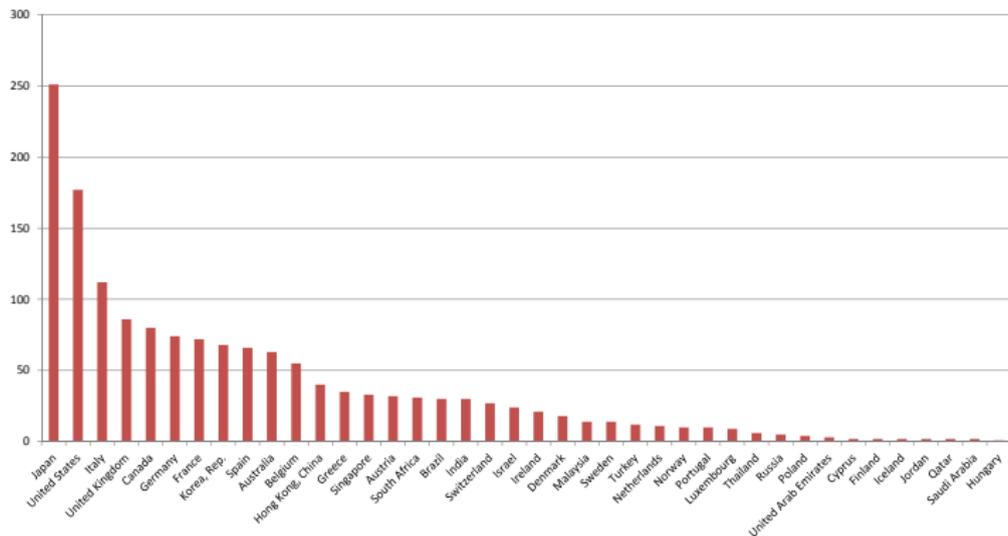
- Beck et al. (2013, JFE): bank competition and stability in cross-country analysis
- Beck and De Jonghe (2013, WP): lending concentration, bank performance and systemic risk in cross-country analysis
- Anginer et al. (2014, JBF): deposit insurance and bank risk during recent crisis
- Anginer et al. (2013, JFE): bank competition and systemic stability
- Drehmann and Tarashev (2013, JFI): systemic risk of interconnected banks

Main impact

- Influence of national bank regulation and supervision on **global** systemic risk
- Banks from 40 countries
- Consider interconnectedness between financial institutions (see Billio et al. (2012, JFE))

Final data sample

- Worldwide sample from 40 countries
- 211 publicly listed international banks, 1536 bank-year observations
- Minimum of 85 banks (2002), maximum of 150 banks (2012)
- 1999-2012



Panel regressions

- Influence of regulatory and supervisory environment on global systemic risk
- Control for idiosyncratic bank characteristics and country-specific variable

Regression

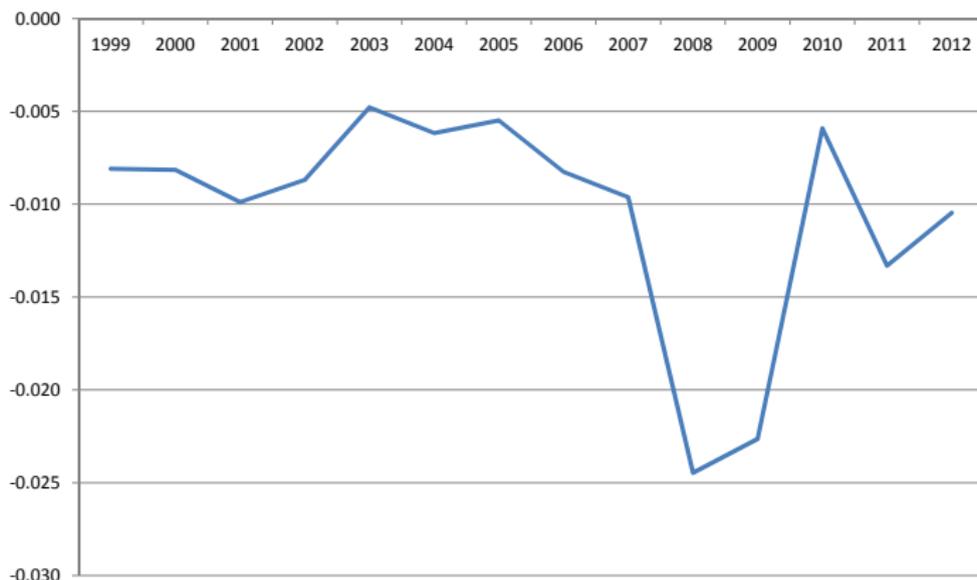
$$\begin{aligned} \text{Systemic risk measure}_{i,t} = & \beta_1 \cdot \text{Tier-1-capital}_{i,t-1} + \beta_{\text{Regulatory}} \cdot X_{i,t-1} \\ & + \beta_{\text{Bank controls}} \cdot Y_{i,t-1} + \beta_{\text{Country controls}} \cdot Z_{i,t-1} + u_i + v_t + \epsilon_{i,t} \end{aligned}$$

- Separate regressions for different systemic risk measures
- Unbalanced panel regression
- Time-fixed and bank-fixed effects
- Clustered-robust standard errors (at the bank level)

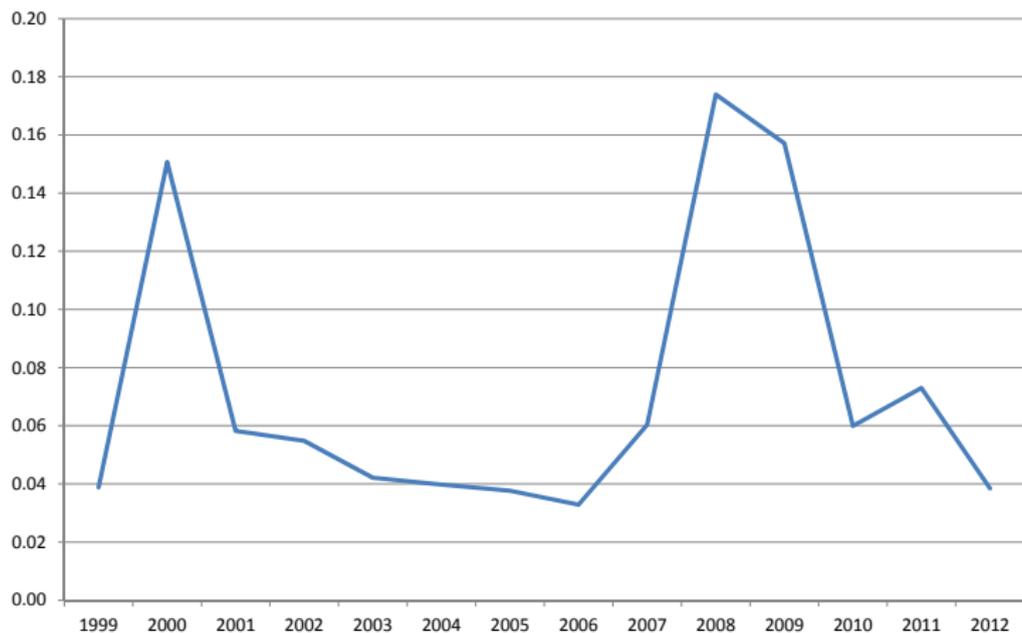
Global systemic risk (contributions and exposures)

- Common factor exposures
 - ▶ Dynamic Marginal Expected Shortfall (DynMES)
 - ▶ SRISK
- Individual institution in left tail
 - ▶ ΔCoVaR
- Forward-looking measures
- Based (mostly) on asset returns

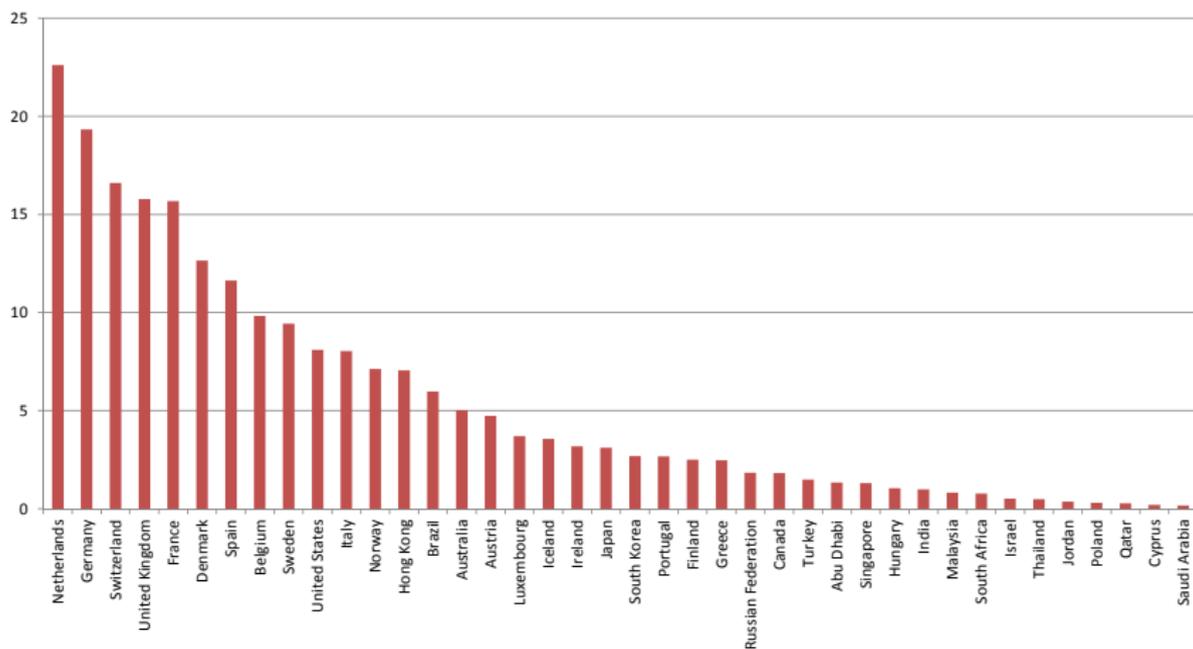
Development of the contribution to global systemic risk from 1999-2012



Development of the systemic risk exposure from 1999-2012



Capital Shortfall of banks sorted by country, 1999-2012



Independent variables

- Idiosyncratic bank characteristics (total assets, market-to-book ratio, leverage, total income, non-interest income, loans, foreign loans, cash & due from banks, **Tier 1 Capital**, ...)
- **Measure for interconnectedness** (Billio et al. (2012))
- **Regulatory environment** (dataset of Barth et al. (2013)): supervision, governance, accounting, activity restrictions, capital regulatory, deposit insurance
- Calculated well established measures from literature (Liquidity beta, Amihud liquidity measure, ...)
- Country-specific variables (WDI database, Anti-Director Rights Index (Spamann (2010)), Herfindahl-Hirschmann Index, cross-border capital transactions (Chinn and Ito (2008)))
- Control for financial crisis (Laeven and Valencia (2012))

Descriptive statistics

- Variation of systemic risk measures across time and countries
- Variation of bank characteristics across time and countries
- Size more than doubled over past 14 years
- Business model of banks varies across countries (Leverage, Non-interest income, loans to asset ratio)
- Liquidity dry-up during global financial crisis; market-to-book ratio highlights market turbulences
- Loans constant; Short-term funding decreasing
- Regulatory environment shows variation across time and countries
- Regulatory capital requirements tighten

Regressions of a bank's systemic risk measures

Dependent variable	Model (1) dynMES	Model (2) dynMES	Model (3) dynMES	Model (4) SRISK	Model (5) SRISK	Model (6) SRISK	Model (7) ΔCoVaR	Model (8) ΔCoVaR	Model (9) ΔCoVaR	
<i>Bank-level characteristics</i>										
Total Assets	0.079 (0.138)	0.024 (0.668)	0.011 (0.866)	31300000.000 (0.000)	*** (0.000)	32000000.000 (0.000)	*** (0.000)	32000000.000 (0.000)	*** (0.000)	0.003 (0.600)
Market-to-book	0.028 (0.106)	0.017 (0.427)	0.020 (0.414)	-1156282.000 (0.424)	-62195.120 (0.952)	167304.400 (0.881)	-0.002 (0.386)	-0.002 (0.386)	-0.004 (0.395)	-0.004 (0.440)
Leverage	0.000 (0.920)	0.001 (0.102)	0.001 (0.031)	** (0.031)	7853.740 (0.650)	5179.602 (0.846)	17828.980 (0.527)	0.000 (0.934)	0.000 (0.173)	0.000 (0.103)
Non-interest income	-0.032 (0.083)	* (0.101)	-0.034 (0.090)	-0.044 (0.882)	* (0.749)	-328575.200 (0.586)	-1579848.000 (0.749)	957892.100 (0.088)	* (0.116)	0.002 (0.049)
Cash and Due from Banks	-0.299 (0.201)	-0.731 (0.209)	-0.998 (0.583)	* (0.583)	15300000.000 (0.294)	34900000.000 (0.096)	55700000.000 (0.221)	* (0.221)	0.055 (0.391)	0.072 (0.228)
Loans	0.014 (0.799)	0.020 (0.800)	-0.032 (0.680)	-0.032 (0.126)	-12000000.000 (0.204)	-8641442.000 (0.204)	-13100000.000 (0.090)	* (0.624)	0.009 (0.338)	0.014 (0.179)
Loan Loss Provisions	0.945 (0.178)	0.789 (0.178)	0.824 (0.178)	0.824 (0.123)	176000000.000 (0.030)	184000000.000 (0.030)	** (0.023)	** (0.023)	0.020 (0.734)	0.037 (0.579)
Tier 1 Capital	-0.006 (0.056)	* (0.079)	-0.006 (0.079)	* (0.062)	-0.007 (0.276)	* (0.861)	310870.100 (0.779)	64883.280 (0.001)	*** (0.001)	0.001 (0.008)
Debt Maturity	0.047 (0.162)	0.042 (0.368)	0.067 (0.238)	0.067 (0.412)	-2125289.000 (0.121)	454961.400 (0.867)	1522273.000 (0.605)	-0.003 (0.280)	-0.003 (0.432)	-0.004 (0.420)
Deposits	-0.033 (0.735)	-0.108 (0.390)	-0.175 (0.086)	-0.175 (0.217)	-14600000.000 (0.086)	* (0.055)	-18600000.000 (0.193)	* (0.079)	0.018 (0.138)	0.022 (0.098)
Performance	-0.013 (0.237)	-0.005 (0.631)	-0.012 (0.977)	-0.012 (0.977)	21413.270 (0.993)	6746.547 (0.993)	183299.200 (0.803)	0.003 (0.011)	** (0.006)	0.003 (0.003)
Interconnectedness	0.127 (0.028)	** (0.056)	0.035 (0.394)	0.035 (0.672)	464831.600 (0.823)	3323095.000 (0.444)	8360315.000 (0.088)	* (0.001)	0.017 (0.001)	*** (0.013)
<i>Country characteristics</i>										
GDP Growth	-0.010 (0.075)	* (0.091)	-0.009 (0.128)	* (0.312)	-0.008 (0.128)	-629974.800 (0.312)	-1075259.000 (0.037)	** (0.839)	-0.000 (0.556)	0.000 (0.086)
HHI	0.355 (0.003)	*** (0.002)	0.563 (0.067)	*** (0.067)	0.548 (0.000)	* (0.155)	48700000.000 (0.037)	*** (0.037)	0.043 (0.013)	** (0.024)
Stock market importance	-0.692 (0.011)	** (0.001)	-0.872 (0.000)	** (0.000)	-1.321 (0.814)	*** (0.814)	7487482.000 (0.211)	*** (0.211)	-24300000.000 (0.559)	-11000000.000 (0.692)
<i>Regulatory environment</i>										
Activity Restrictions		0.005 (0.533)	-0.015 (0.272)	-0.015 (0.272)	-0.015 (0.272)	-0.015 (0.272)	-2400312.000 (0.007)	*** (0.007)	-684436.600 (0.407)	0.001 (0.139)
Capital Regulatory Index		-0.004 (0.507)	-0.007 (0.352)	-0.007 (0.352)	-0.007 (0.352)	-0.007 (0.352)	1405214.000 (0.011)	** (0.011)	831316.300 (0.132)	0.000 (0.574)
Independence of Supervisory Authority		-0.003 (0.787)	-0.003 (0.827)	-0.003 (0.827)	-0.003 (0.827)	-0.003 (0.827)	369760.100 (0.723)	-435784.900 (0.690)	-0.001 (0.474)	-0.001 (0.426)
Official Supervisory Power		0.005 (0.063)	* (0.936)	0.000 (0.936)	0.000 (0.936)	0.000 (0.936)	-557849.200 (0.090)	* (0.366)	-313999.600 (0.366)	0.000 (0.924)
Private Monitoring Index		0.015 (0.035)	** (0.035)	0.022 (0.021)	** (0.021)	0.022 (0.021)	913393.500 (0.279)	578291.000 (0.410)	-0.001 (0.392)	-0.001 (0.696)
Moral Hazard Index			0.038 (0.015)	** (0.015)	0.038 (0.015)	** (0.015)		307696.400 (0.866)	0.008 (0.006)	0.008 (0.006)
Bank-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	662	521	464	464	662	521	464	662	521	464
R ²	0.426	0.493	0.508	0.581	0.581	0.581	0.566	0.574	0.579	0.601
Adj. R ²	0.402	0.46	0.471	0.563	0.563	0.528	0.533	0.555	0.551	0.57

Further analyses

- Specific influence of characteristics during financial crisis?
interaction terms: short-term funding, interbank loans, Tier 1 capital, interconnectedness
- Quartile analysis (Tier 1 capital)
- Design of a deposit insurance scheme / factors mitigating moral hazard
- Miscellaneous indexes (MSCI World, BANKSWD, ...)

Bank-specific and regulatory interactions

Panel A: Regressions of banks' dynamic MES

	(1) MES	(2) MES	(3) MES	(4) MES	(5) MES	(6) MES	(7) MES	(8) MES
Moral Hazard Index \times Tier 1 Capital	-0.002 (0.728)							
Crisis \times Tier 1 Capital		-0.008* (0.090)						
Total Assets \times Interconnectedness			-0.070 (0.612)					
Cash and Due from Banks \times Interconnectedness				2.286 (0.669)				
Crisis \times Cash and Due from Banks					-0.051 (0.943)			
Crisis \times Moral Hazard Index						-0.032 (0.229)		
Interconnectedness \times Crisis							-0.192* (0.085)	
Interconnectedness \times Debt Maturity								0.220 (0.252)
N	464	416	464	464	416	416	416	464
R ²	0.509	0.493	0.509	0.509	0.490	0.494	0.493	0.510
adj. R ²	0.470	0.446	0.470	0.470	0.443	0.447	0.446	0.471

Key factors to systemic risk

- Higher regulatory capital decreases systemic risk
- Size and interconnectedness increase global systemic risk
- Deposit insurance schemes that require banks and depositors to bear more financial risk are associated with higher global systemic risk
- Competition increases global systemic risk
- Non-factors: non-interest income, short-term funding
- Regulatory capital decreases systemic risk exposure during crisis
- Short-term funding increases systemic risk during crisis
- For banks in upper quartiles (Tier 1 capital) size no longer main driver of capital shortfall; capital shortfall increases with non-interest income

Data sample - data screens

- Thomson Reuters Financial Datastream (source: SFB 649)
- Sample limited to banks with total assets $>$ \$ 50 billion (Dodd-Frank Act)
- Financial accounting data from Worldscope database
- All data collected in U.S. dollars
- All publicly traded banks included in country lists and dead firm lists
- Exclude banks with missing Worldscope data, secondary listings and non-primary issues
- Screening procedures as proposed by Ince and Porter (2006)
- Exclude bank-years, if the number of zero return days is more than 80 percent in a given month (Karolyi (2012))
- Control for selection bias (opaqueness)