Determinants of Banking System Fragility: A Regional Perspective

Hans Degryse

(KU Leuven, Tilburg University & CEPR)

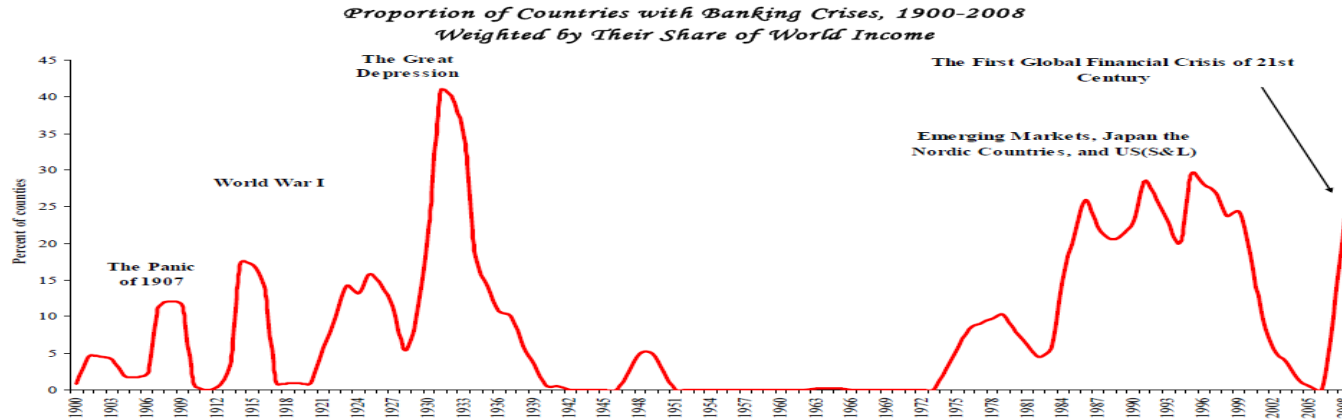## Muhammad Ather Elahi

(CBER, Institute of Business Administration)

María Fabiana Penas

(Tilburg University)

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Motivation

- Financial systems exhibit periods of instability

Proportion of Countries with Banking Crises, 1900–2008
Weighted by Their Share of World Income

Source: Reinhart and Rogoff (2008) NBER WP 14587

- Shocks to a country's financial system are very costly and may spread to other countries within and across regions

   - E.g. financial crisis of 2007-2009, sovereign crisis in Eurozone

- Q. Do *regional* banking system characteristics help in mitigating *regional* banking fragility?

- Q. Do *regional* banking system characteristics help in mitigating *cross-regional* contagion?

Banking Fragility

- Theory: role of *regional* banking system characteristics

  - Underinvestment in **liquidity** may lead to contagion (Bhattacharya and Gale (1987), Freixas and Holthausen (2005))

    - shocks in one country may spread to other countries/ regions (Allen and Gale (2000), Freixas et al. (2000))

  - A higher degree of **capitalization** may reduce contagion (Allen and Gale (2000), Freixas, Parigi and Rochet (2000))

  - **Competition**: competition-fragility <-> competition-stability views (e.g. Allen and Gale (1994), Boyd and de Nicoló (2005)); Martinez-Miera and Repullo (2010))

  - **Foreign banks**: the presence of foreign banks may help to *absorb* shocks or *transmit* shocks (Cetorelli and Goldberg (2012), Ongena, Peydró and van Horen (2012)

  - **Wholesale funding**: a greater reliance on wholesale funding may lead to more banking system fragility (Huang and Ratnovski (2009), De Haas and van Lelyveld (2013))

- Empirics

  - Many studies that look at

    - *individual banks* (e.g. De Jonghe (2010), Gropp et al. (2006, 2009))

    - *country level* (e.g. Beck et al. (2006))

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Banking Fragility – Our Approach

- **Regional** banking system fragility:

  - Coincidence of extreme negative return shocks to several countries' banking indices in a region

- We follow the approach of Bae, Karolyi and Stulz (RFS 2003):

  - they use general market indices for Asia (10 countries), Latin America (7 countries), the US and Europe to study contagion *within* and *across* regions.

- We study **regional banking system fragility** using countries' **banking indices**

- We add **regional banking system characteristics** as explanatory variables (liquidity, capitalization, competition, degree of foreign bank presence, wholesale funding)

Main contributions and outline

1. We study regional banking fragility

   ◆ Investigate which macro factors and <u>regional banking system characteristics</u> influence regional banking fragility

2. We study cross-regional banking contagion

   ▪ coincidence of extreme return shocks *across* regions: explore cross-regional banking contagion using the number of coexceedances in other regions as explanatory variable:

   ▪ Investigate which banking system characteristics in the recipient region alleviate cross-regional banking contagion

Methodology

We focus on *negative* extreme returns

- **Exceedance**: return on the country's banking index lies below 5th percentile value.

- **Coexceedances**: when at least 2 countries are simultaneously in the left tail. It ranges from 2, …, N (where N is the total number of countries in the region)

- Five categories according to the number of coexceedances in a region, i.e. 0, 1, 2, 3, and 4 or more countries in the tail

- Multinomial logistic regression model

$$P_i = \frac{G(\beta_i' x)}{1+\sum_{j=1}^{m-1} G(\beta_j' x)}$$

  explaining the number of coexceedances in a region as a function of a set of covariates *x*. The covariates include macro factors and regional banking system characteristics.

- For the US and Europe, we use a logit model as we treat each of them as "one country"

Data and some descriptives

- Coexceedances computed employing Datastream country banking indices from July 1, 1994 to December 31, 2008 (3784 daily observations) (10 Asian, 7 Latin American countries; US and Europe)

Panel A: Asia

	No. of Coex.	Relative Frequency
0	2497	0.660
1	908	0.240
2	240	0.063
3	84	0.022
>=4	55	0.015

Panel B: Latin America

	No. of Coex.	Relative Frequency
0	2832	0.748
1	719	0.190
2	145	0.038
3	48	0.013
>=4	40	0.011

Panel C: US

0	3594	0.950
1	190	0.050

Panel D: Europe

0	3594	0.950
1	190	0.050

Data

- Explanatory variables:

  - **Regional macro common factors** as in Bae, Karolyi and Stulz (RFS 2003):

    - Conditional volatility based on regional index estimated from a GARCH(1,1) model

    - Daily changes in regional exchange rate

    - Daily 'one-year "regional" interest rate'

  - **Regional banking system characteristics** (Bankscope)

    - Liquidity: (cash + cash equivalent) / total assets

      - robustness check: broader definition

    - Capitalization: capital / total assets

    - Concentration: C5

    - Degree of foreign banks: fraction of foreign held banking assets in region (Claessens and van Horen (2012))

    - Wholesale funding: "net loans/ customer funding" (as in De Haas and van Lelyveld (2013))

    - Asia and Latin America: we employ a country's banking assets as weights to compute the regional values.

    - US and Europe are treated each as "one country"

1. *Liquidity* and Regional Fragility

Table 6: Banking System Characteristics and Regional Banking System Fragility

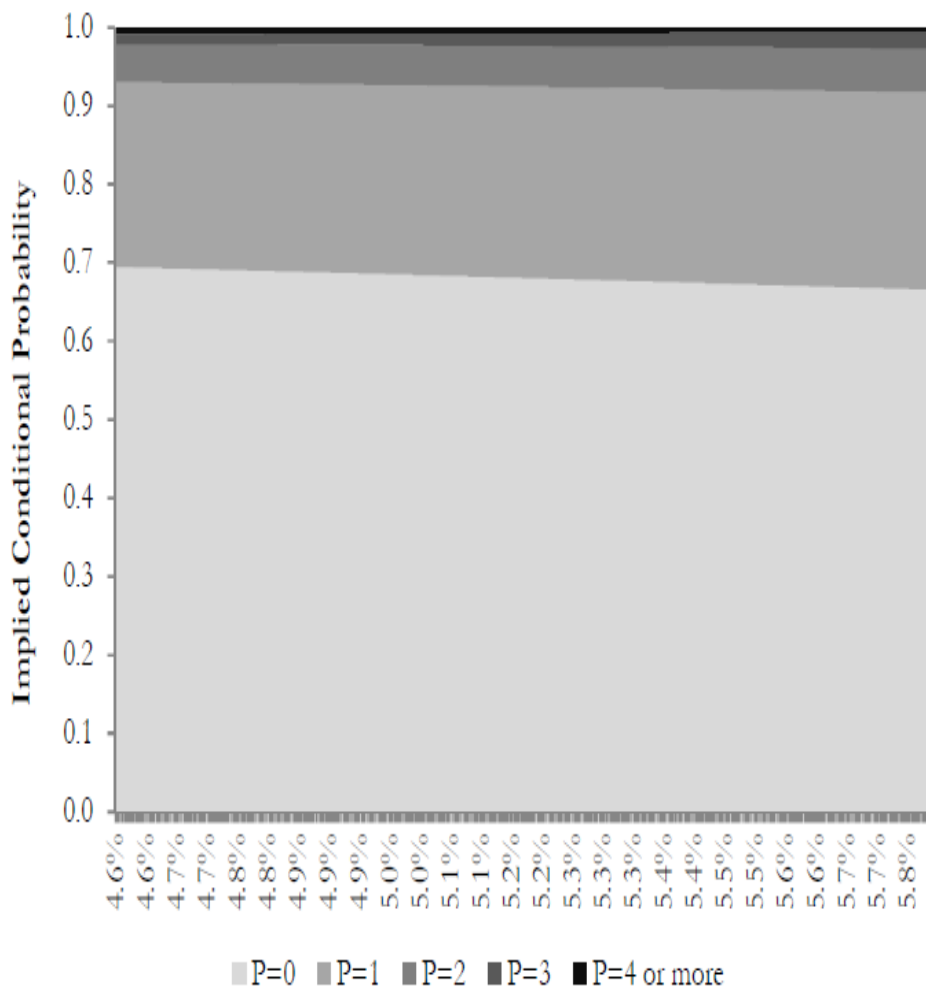|	Coeff	Chg Prob		Coeff	Chg Prob
	Panel A: Asia			**Panel B: Latin America**	
1	-14.590 [c]	-2.011		-51.980 [a]	-7.042
2	-31.030 [b]	-1.305		-100.500 [a]	-2.369
3	-36.470 [c]	-0.502		-99.980 [b]	-0.663
>=4	-83.240 [a]	-0.520		-212.600 [a]	-0.603
	Panel C: US			**Panel D: Europe**	
	-34.954 [b]	-1.316		-73.173 [a]	-2.653

Control for Common Factors   YES

[a, b,] and [c] denotes significance level of 1%, 5% and 10% respectively

◆ **Liquidity** reduces regional banking fragility. The effects have the highest economic significance for Latin America.

Figure 2: Coexceedance Response Curve of Banking Characteristics in Asia and Latin America
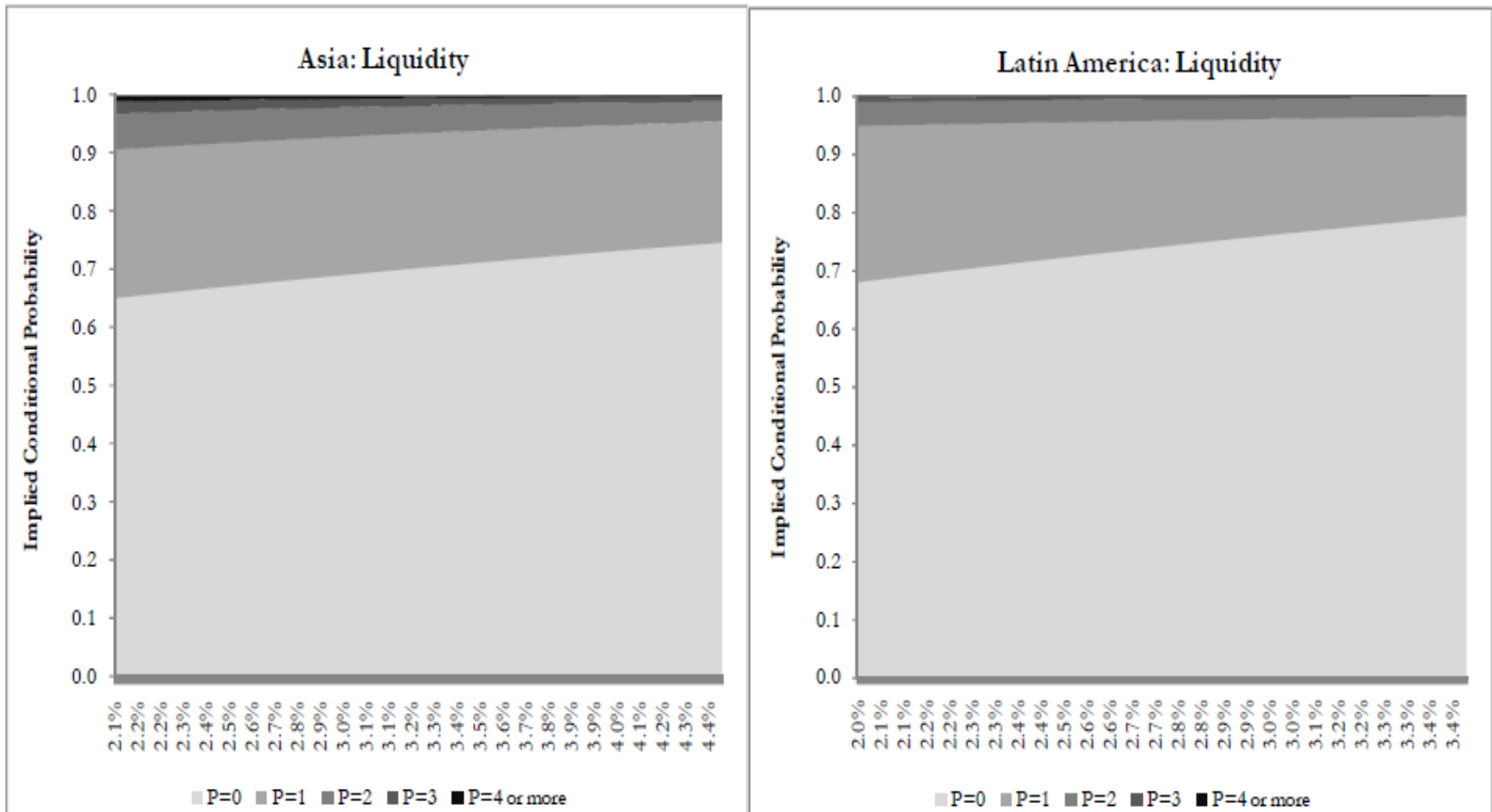
This shows the response of the probability measures for the *full range* of values of each banking characteristic, instead of focusing on the average value as is the case in the marginal probabilities reported in the Tables 5 and 6

1. Capitalization and Regional Fragility

Table 6: Banking System Characteristics and Regional Banking System Fragility

	Coeff	Chg Prob		Coeff	Chg Prob
	Panel A: Asia			**Panel B: Latin America**	
1	9.014	1.327		-32.980 [a]	-4.587
2	14.390	0.570		-50.560 [a]	-1.188
3	46.590	0.701		-34.100	-0.209
>=4	-17.290	-0.155		-71.670 [b]	-0.239
	Panel C: US			**Panel D: Europe**	
	-46.513 [b]	-1.748		-2.642	-0.097

Control for Common Factors   YES

[a, b,] and [c] denotes significance level of 1%, 5% and 10% respectively
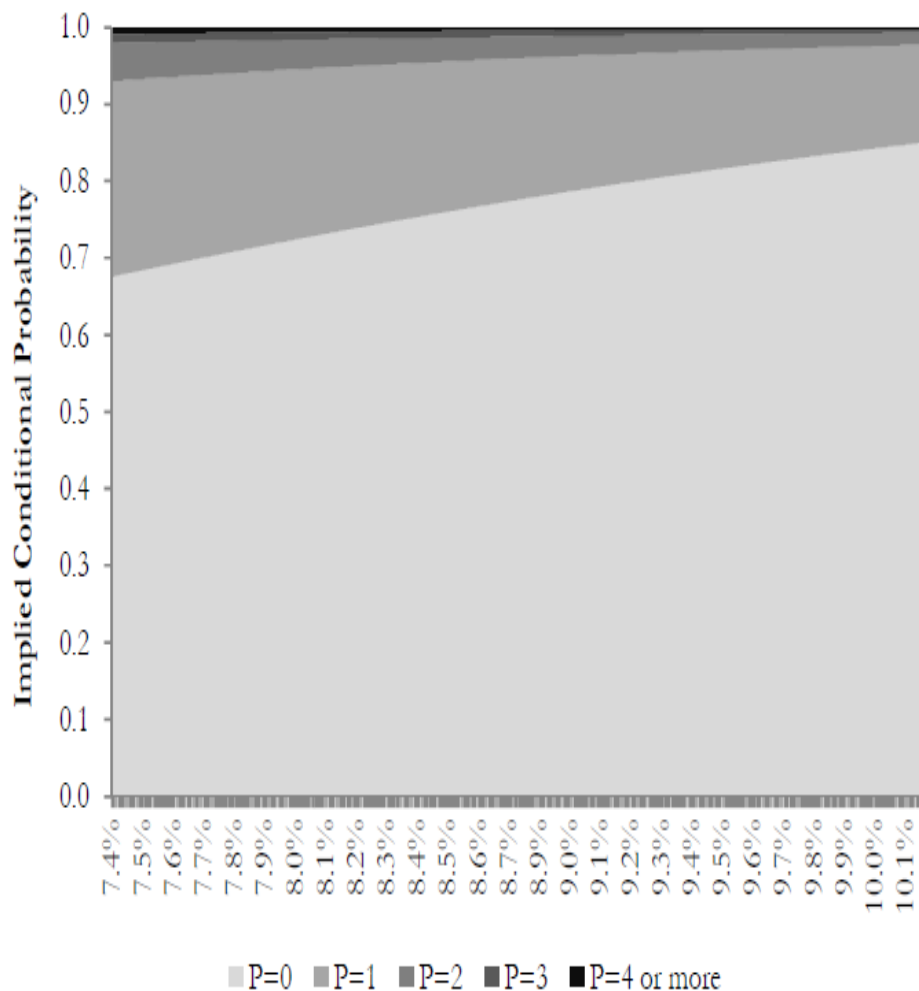
◆ **Capitalization** reduces regional banking fragility for Latin America and US, which are on average better capitalized

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1. Capitalization and Regional Fragility

1. Concentration and Regional Fragility

Table 6: Banking System Characteristics and Regional Banking System Fragility

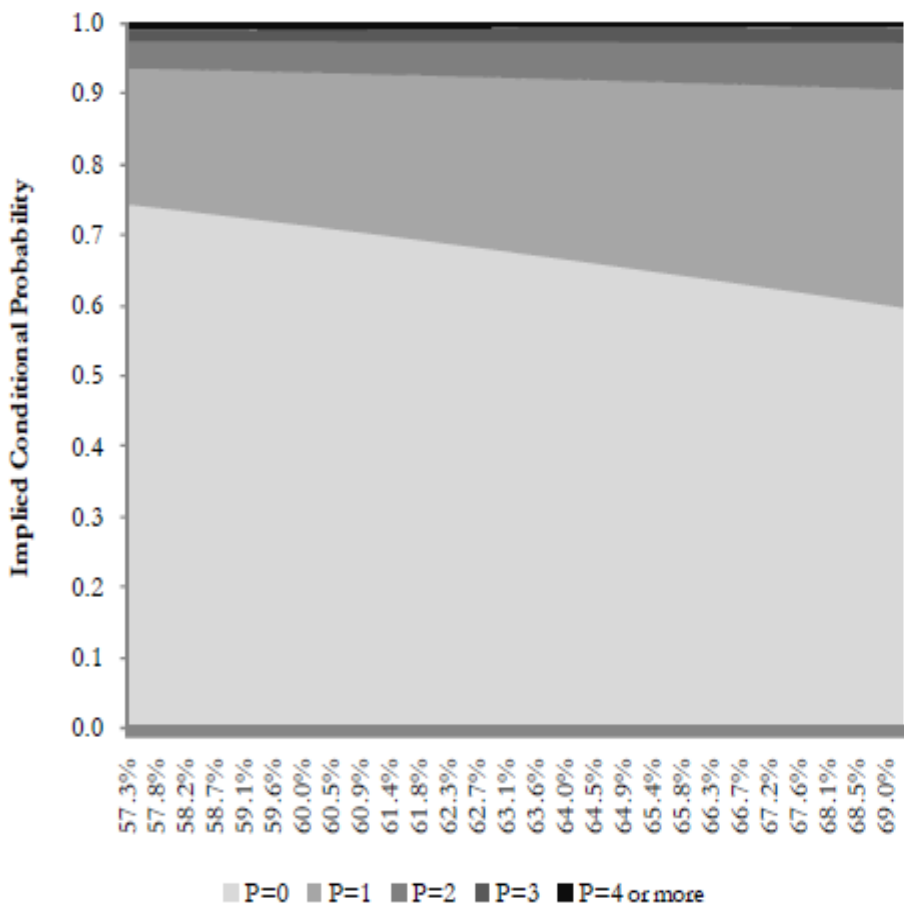|	Coeff	Chg Prob		Coeff	Chg Prob
	Panel A: Asia			**Panel B: Latin America**	
1	5.773 [a]	0.966		5.822 [a]	0.820
2	6.403 [a]	0.238		7.746 [a]	0.181
3	4.206	0.041		3.350	0.016
>=4	-1.850	-0.028		11.150 [c]	0.038
	Panel C: US			**Panel D: Europe**	
	32.830 [a]	1.199		38.664 [a]	1.338

Control for Common Factors   YES

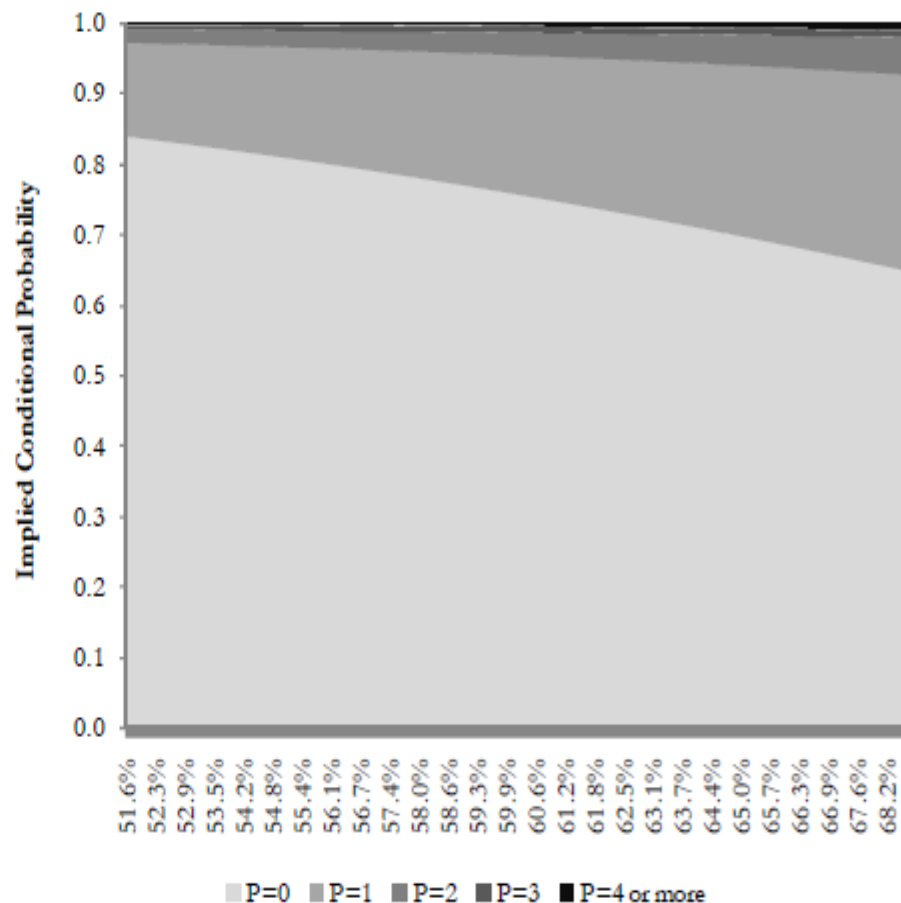[a, b,] and [c] denotes significance level of 1%, 5% and 10% respectively

◆ **Concentration** increases regional banking fragility in all regions => support for competition-stability view

Asia: Concentration — Latin America: Concentration

This shows the response of the probability measures for the *full range* of values of each banking characteristic, instead of focusing on the average value as is the case in the marginal probabilities reported in the Tables 5 and 6

1. Foreign Banks and Regional Fragility

Table 6: Banking System Characteristics and Regional Banking System Fragility

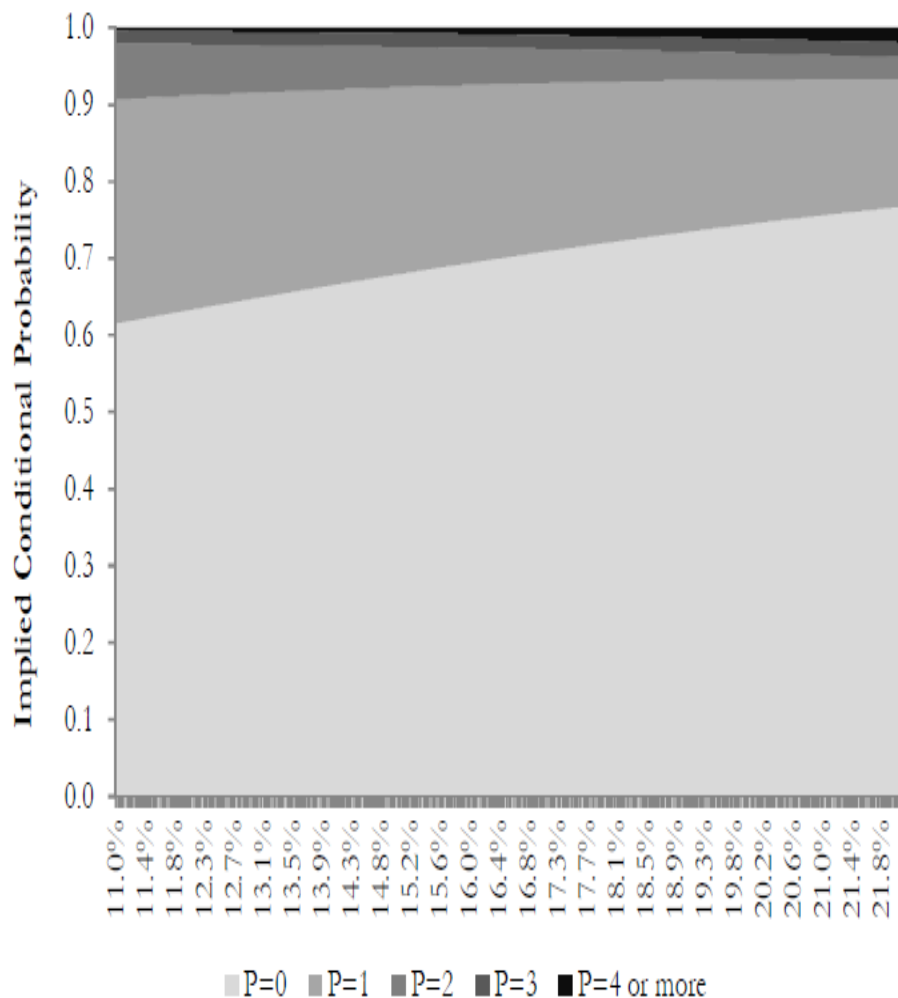|	Coeff	Chg Prob		Coeff	Chg Prob
	Panel A: Asia			**Panel B: Latin America**	
1	-7.029 [a]	-1.183		-3.472 [a]	-0.450
2	-10.450 [a]	-0.443		-8.979 [a]	-0.221
3	-0.783	0.025		-8.436 [b]	-0.060
>=4	12.133	0.100		-12.083 [b]	-0.040
	Panel C: US			**Panel D: Europe**	
	5.901 [b]	0.254		0.213	0.009

Control for Common Factors   YES

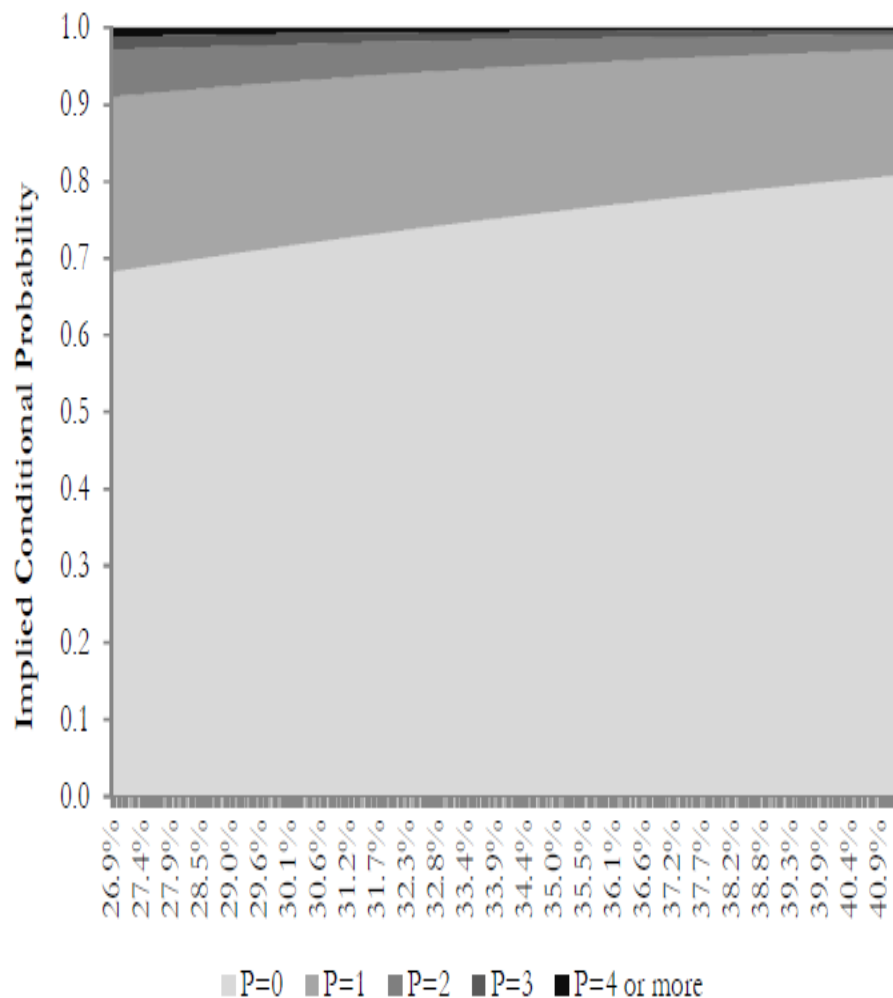[a, b,] and [c] denotes significance level of 1%, 5% and 10% respectively

- Impact of **foreign banks** depends upon region
  - reduces fragility in Asia and Latin America
  - increases fragility in the US

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Table 6: Banking System Characteristics and Regional Banking System Fragility

	Coeff	Chg Prob		Coeff	Chg Prob
	Panel A: Asia			**Panel B: Latin America**	
1	-2.087 [a]	-0.373		-1.042	-0.112
2	-1.639 [c]	-0.057		-5.782 [b]	-0.153
3	0.231	0.013		-4.881	-0.036
>=4	5.249 [b]	0.040		-10.570 [b]	-0.039
	Panel C: US			**Panel D: Europe**	
	5.919 [b]	0.223		1.353	0.049

Control for Common Factors   YES

[a, b,] and [c] denotes significance level of 1%, 5% and 10% respectively

- Impact of **wholesale funding** differs across regions:
  - increases fragility in US and extreme coexceedances in Asia
  - reduces fragility in Latin America and lower number of coexceedances in Asia

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- Regional banking characteristics:

  - Greater liquidity and capitalization reduce regional banking fragility.

  - Support for the **competition-stability** view

  - Impact of foreign banks and wholesale funding depend upon region

    - Reduce fragility in Asia and Latin America

    - Increase fragility in the US

2. *Cross-regional contagion: general*

- Include in the recipient's multinomial logit model **coexceedances in triggering region as additional explanatory variable**
    - while controlling for
        - the recipient's banking system characteristics and macro factors
        - triggering regions conditional stock market volatility

    - **Asia as recipient**: US and Europe are significant but US more important; Latin America only for higher number of coexceedances

    - **Latin America as recipient**: cross-regional contagion from any region significantly increases regional banking fragility, but the impact is lowest for Asia

    - **Europe as recipient**: cross-regional contagion from all three regions

    - **US as recipient**: only Europe and Latin America generate cross-regional contagion

- In general: cross-regional contagion impact from developed region is higher than from developing region

2. Host-region banking characteristics and cross-regional contagion

- **Do host-region banking characteristics attenuate cross-regional contagion?**

  Include as additional covariate the **interaction term**

  "coexceedances in triggering region* host-region bank characteristic"

  - Liquidity: when significant, **greater liquidity attenuates cross-regional contagion**.

    - Asia: reduces contagion from Latin America

    - Latin America: reduces contagion from US

    - Europe: reduces contagion from Latin America

    - in general, even if not significant at the average level, still attenuating for several data points

  - Capitalization: when significant, **greater capitalization attenuates cross-regional contagion**

    - Latin America: attenuates from US

    - Europe: attenuates from Asia and Latin America

    - in general, even if not significant at the average level, still attenuating for several data points

  - Concentration, Foreign Banks and Wholesale Funding: results differ across region

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Concluding remarks

1. Regional banking system characteristics influence regional fragility

    ◆ Greater liquidity and capitalization help in mitigating regional banking fragility

    ◆ Concentration increases regional banking fragility

    ◆ Impact of foreign banks and wholesale funding depends upon region

2. A host region's banking liquidity and capitalization reduces the impact of cross-regional contagion

Implications for macro-prudential supervision:

- monitor not only individual (or country's) banking characteristics but also a region's banking system characteristics

- a region's banking system characteristics may also mitigate the impact of cross-regional contagion

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Thank you!