

Determinants of Banking System Fragility: A Regional Perspective

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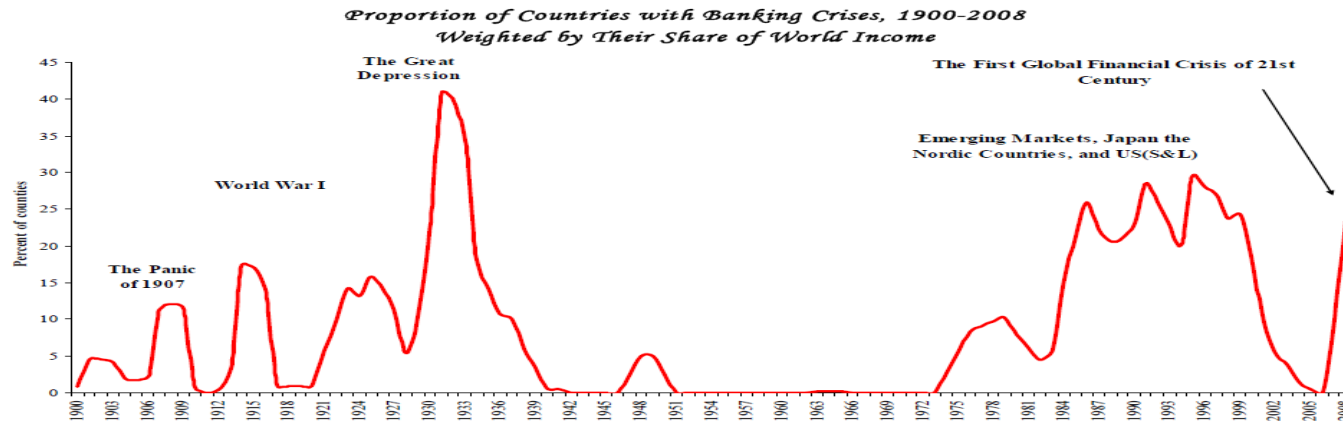
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- Financial systems exhibit periods of instability



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?

- Theory: role of *regional* banking system characteristics
 - ◆ Underinvestment in **liquidity** may lead to contagion (Bhattacharya and Gale (1987), Freixas and Holthausen (2005))
 - shocks from 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**: banking systems relying more on wholesale funding may be more fragile (Huang and Ratnovski (2009), De Haas and van Lelyveld (2011))
- 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))

Banking Fragility – Our Approach

- **Regional** banking system fragility:
 - ◆ extreme negative returns of several countries' banking indices in a region occur simultaneously (coexceedances)
- 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 banks**, **wholesale funding**)

1. We study regional banking fragility

- ◆ Investigate which macro factors and regional banking system characteristics influence regional banking fragility

2. We study cross-regional banking contagion

- Explore cross-regional banking contagion using the number of coexceedances in other regions as explanatory variable
- Investigate which banking characteristics in the host region alleviate cross-regional banking contagion

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)
- We distinguish five categories according to the number of coexceedances, i.e. 0, 1, 2, 3, and 4 or more countries in the tail
- We employ a multinomial logistics model
$$P_i = \frac{G(\beta_i'x)}{1 + \sum_{j=1}^{m-1} G(\beta_j'x)}$$
 to explain the number of coexceedances in a region as a function of a set of covariates x . The covariates include common 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”

- 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

- Explanatory variables:
 - ◆ **Regional macro common factors** as in Bae, Karolyi and Stulz (RFS 2003):
 - Conditional volatility based on regional index derived 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
 - **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”
- 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

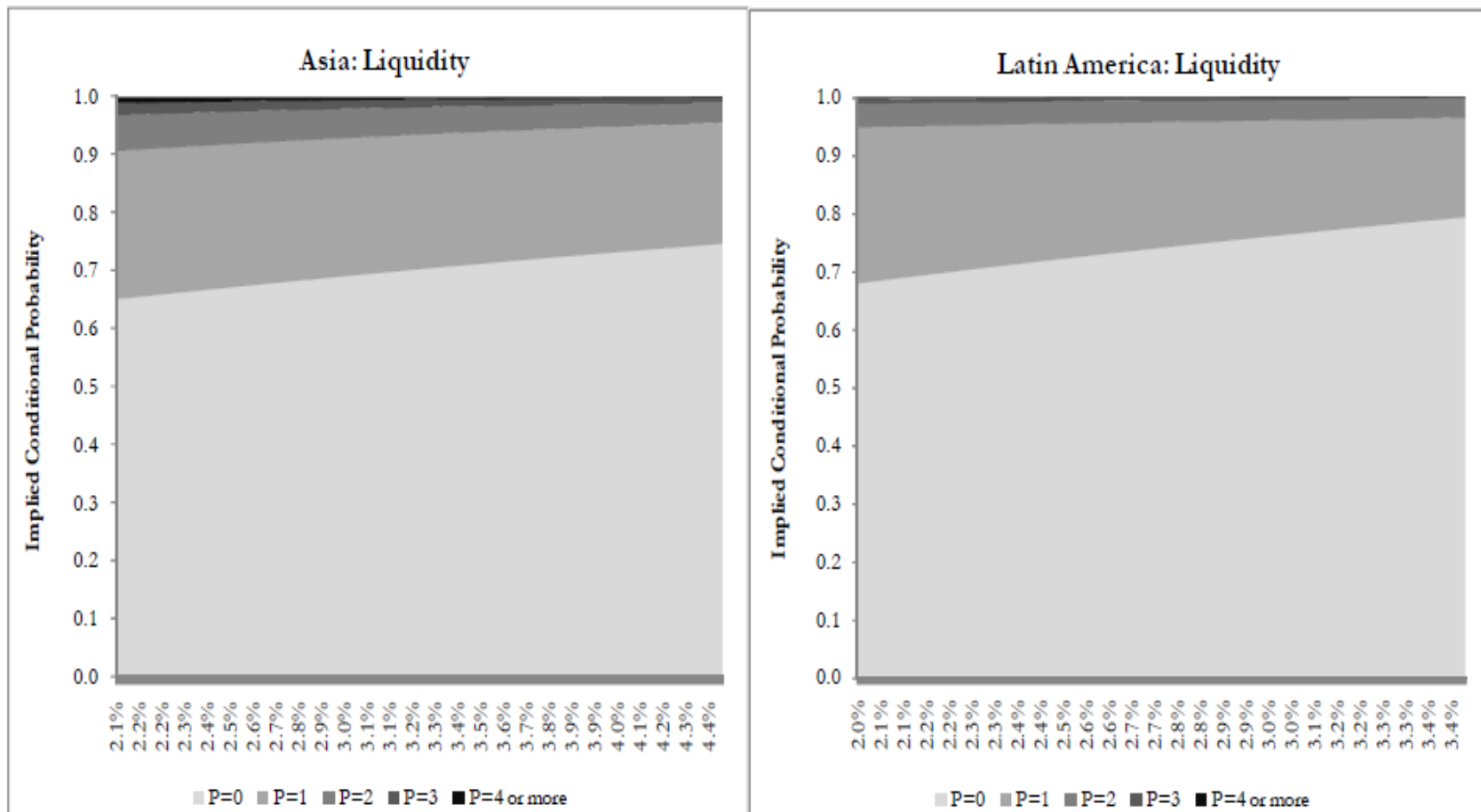
Control for Common Factors YES

^{a, b, 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.

1. Liquidity and Regional Fragility

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

	<u>Coeff</u> <u>Chg Prob</u>		<u>Coeff</u> <u>Chg Prob</u>	
	<u>Panel A: Asia</u>		<u>Panel B: Latin America</u>	
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
	<u>Panel C: US</u>		<u>Panel D: Europe</u>	
	-46.513 ^b	-1.748	-2.642	-0.097

Control for Common Factors YES

^{a, b, 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

1. Concentration and Regional Fragility

Table 6: Banking System Characteristics and Regional Banking System Fragility

	Panel A: Asia		Panel B: Latin America	
	Coeff	Chg Prob	Coeff	Chg Prob
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

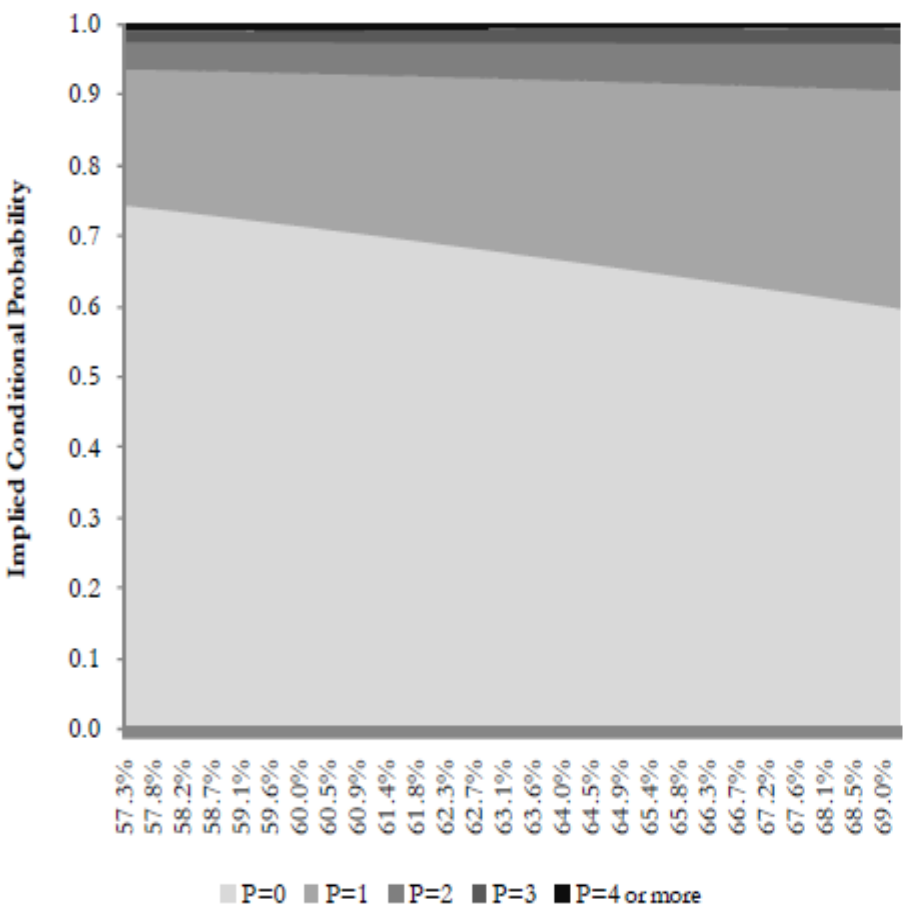
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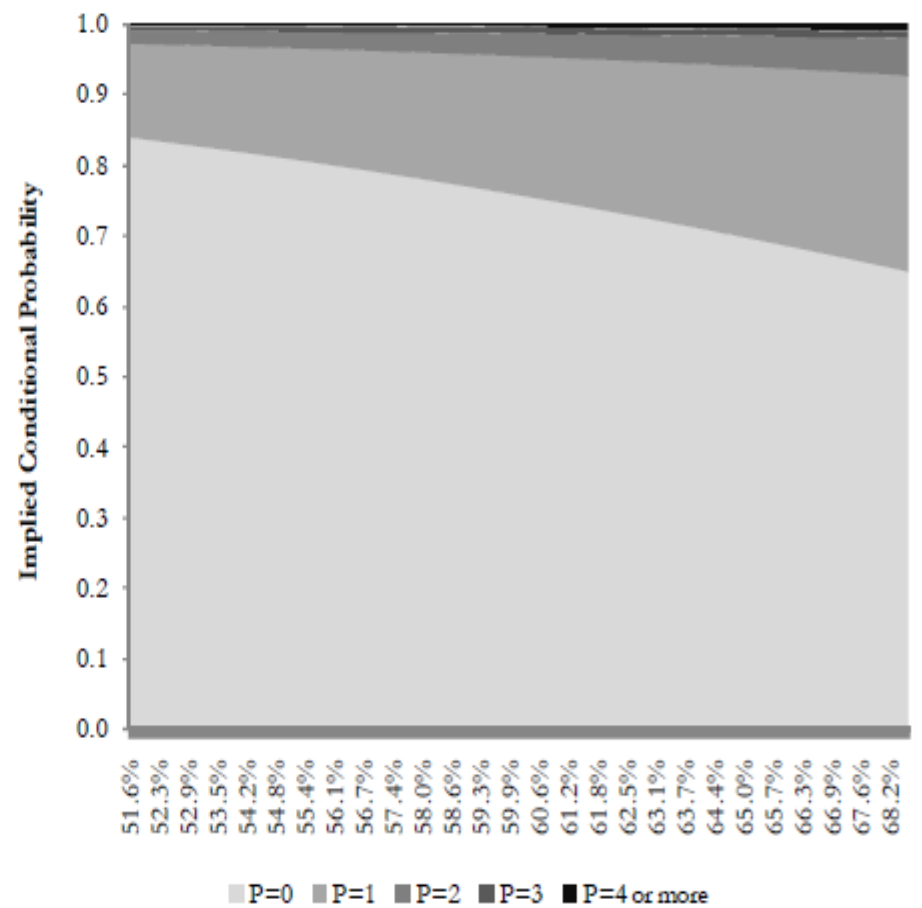
- ◆ **Concentration** increases regional banking fragility in all regions => support for competition-stability view

1. Concentration and Regional Fragility

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 ^d	-1.183	-3.472 ^d	-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, 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

1. Wholesale Funding 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	-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, 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

1. Summary of Results on Regional Fragility

- 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

- **Cross-regional contagion:**
 - ◆ analysed by including in the multinomial logit model, **coexceedances in triggering region as additional explanatory variable**
 - **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”

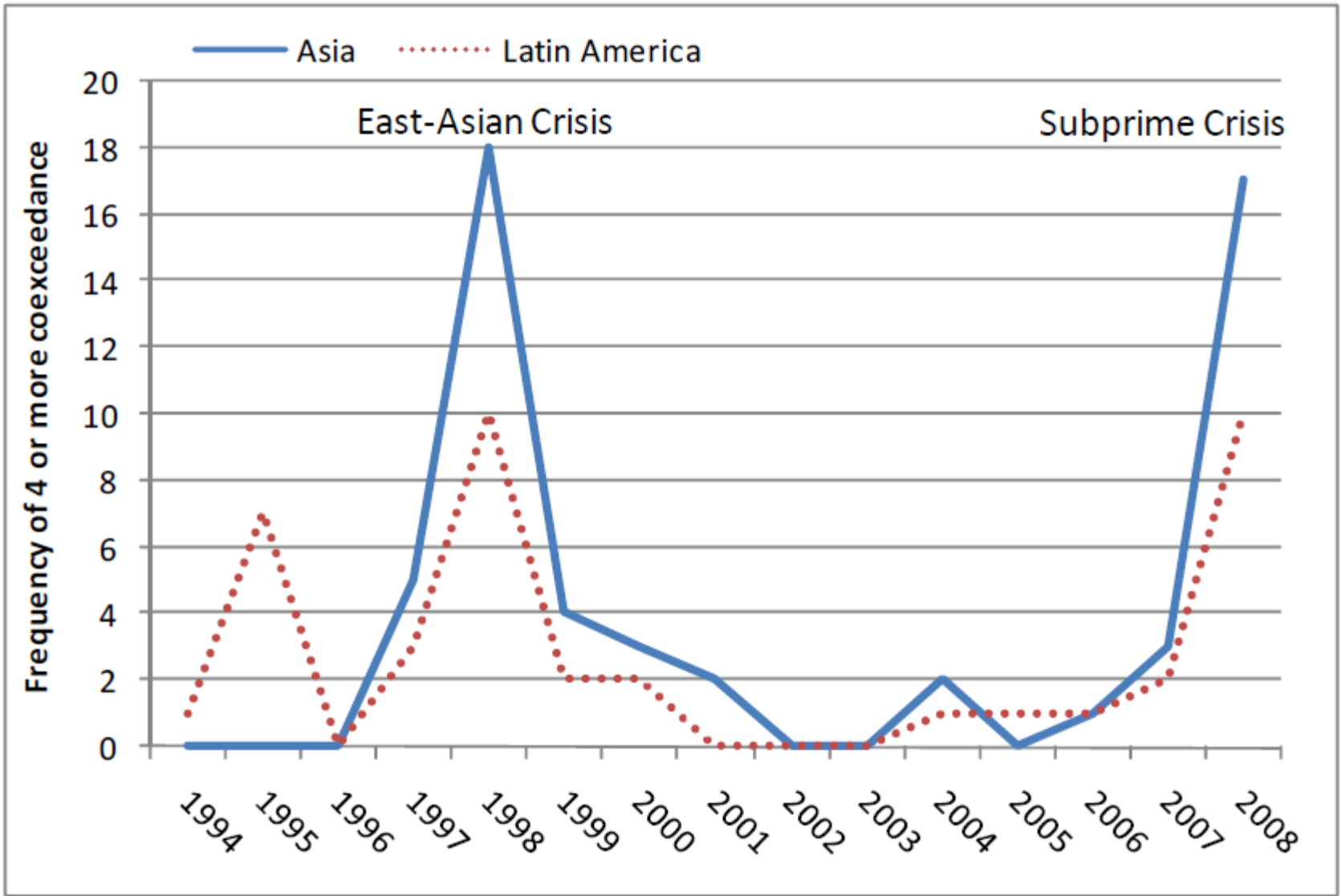
- ◆ **Liquidity:** when significant, **greater liquidity attenuates cross-regional contagion.**
 - Asia: reduces contagion from Latin America
 - Latin America: reduces contagion from US
 - Europe: reduces contagion from Latin America
 - in general, even if not significant at the average level, still 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

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 MaRs:

- 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

Thank you!



Contagion within region

- **Contagion within region:**

- ◆ Unexplained portion of regional banking fragility

- pseudo- R^2 is around 7 percent for Latin America and Asia with common factors and banking characteristics and is around 14% for US and Europe

= > Contagion within region is relatively larger in developing regions compared to developed regions