EUROPEAN CENTRAL BANK

EUROSYSTEM

Contagion and the global equity market collapse of the 2007-09 financial crisis

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Severity of the 2007-09 financial crisis …

1. Motivation

- What explains transmission and discrimination?
  - Even markets with little financial leverage affected
  - Was the spread of the crisis "predictable" or different?
- Three hypotheses
  1. Financial integration (with US markets)
     - transmission reflecting "usual" mechanism → "predictable"
  2. Idiosyncratic risk: macro factors vs. micro factors
     - macro policies & fundamentals vs. risk at firm level (leverage, financial constraints, etc.)
  3. Contagion
     - "*transmission above and beyond existing fundamentals*" in 1. and 2.
     - E.g. herd behaviour, "wake-up call" hypothesis, etc.

Motivation

- Mechanisms and implications
  1. "retrenchment" or "repatriation" hypothesis
     - role of financial globalisation, integration, other exposure
     - But is retrenchment indiscriminate?
  2. "global de-leveraging" hypothesis
     - macro risk at country level, e.g. policies & fundamentals
     - calls for macroprudential analysis and surveillance, also globally
  3. "liquidity squeeze" hypothesis: micro risk
     - specific liquidity needs and exposure at firm level
     - stresses role for microprudential regulation and supervision
- Scope and limitations
  - Focus on global equity markets
  - Says nothing about source or severity, but transmission

Methodological contribution

- Controversy in literature on contagion

  → (e.g. Forbes & Rigobon 2002, Dungey et al. 2004, 2005, & others): common shocks vs. idiosyncratic shocks

- Two-factor asset-pricing model
  - Establish benchmark & contagion of what equity market comovements *should be based on existing fundamentals*
  - But can say nothing about causality of linkages
- Unanticipated shock model
  - Identification of well-identified macro shocks (US and foreign markets)
  - Key strength: allows identifying causality
  - Determinants of contagion; channels of transmission

Main findings

1. No contagion from US markets, on average
2. But significant contagion from *domestic* markets
3. Lots of heterogeneity across portfolios
4. Channels that explain global equity exposure to crisis:
   - External exposure only played limited role: mainly via financial integration with US (US beta) → crisis transmission to that extent "predictable"
   - Macro/country risk key explanations: portfolios in countries with strong fundamentals declined by one third less
   - Financial policies – esp. debt and deposit guarantees – played major role in shielding economies

→ Macro policies & vulnerabilities at *country level* had key role

2. Literature

- Current financial crisis
  - Focus on US policy responses (Calomiris 2008, Taylor 2009)
  - Role of liquidity (Heider, Hoerova and Holthausen 2009)
  - Financial constraints rather than demand in US (Tong & Wei 2008)
  - Little on global transmission: IMF (2009) on financial stress transmission, Fratzscher (2009) on global FX markets
- Crisis and role of contagion for transmission
  - Contagion and related channels (Bae et al. 2003, Karolyi 2003, De Gregorio and Valdes, 2001, Dungey et al. 2004, 2005)
  - Transmission channels (Forbes and Rigobon 2002, Bekaert, et al. 2005)
  - Time-varying global market integration (Bekaert & Harvey 1995, 2000)

Literature

- International transmission of specific events/shocks
  - Financial linkages and trade account for part of cross-country equity returns (Forbes and Chinn 2004)
  - Transmission of specific monetary policy or macro news shocks to global equity and FX markets (Hausman and Wongswan 2006, Wongswan 2006, Ehrmann and Fratzscher 2006, Ammer, Vega and Wongswan 2009)

3. Data: 64 countries, 2000 firms, 455 portfolios

Industrialised			Asia-Pacific			Middle-East and Africa		
Australia	S&P ASX	30	China	Shanghai SE 50	50	Bahrain	BHSE	24
Austria	ATX	20	Hong Kong	Hang Seng	42	Botswana	Gaborone	16
Belgium	BEL20	20	India	BSE Sensex 30	30	Egypt	CASE	30
Canada	S&P TSE 60	60	Indonesia	Jakarta LQ-45	45	Israel	Tel Aviv-25	25
Denmark	OMX20	20	Korea	Kospi 50	50	Lebanon	BLOM	19
Finland	OMX25	25	New Zealand	NZX 15	15	Oman	MSM30	30
France	CAC 40	40	Pakistan	Karachi 30 Index	30	Qatar	DSM20	20
Germany	DAX	30	Singapore	Strait Times	30	Tunisia	SE BVMT	32
Ireland	ISEQ	60	Taiwan	TSEC Taiwan 50	50	UAE	DFM	29
Italy	MIB 30	30	Thailand	SET 50	50			
Japan	Topix 70	70					**Latin America**	
Luxembourg	LuxX	9		**Emerging Europe**				
Netherlands	AEX	25				Argentina	Merval	22
Portugal	PSI 20	20	Bosnia	BIRS	13	Bermuda	BSX	21
Slovenia	SBI20	15	Bulgaria	SOFIX	20	Brazil	Bovespa	66
Spain	IBEX 35	35	Croatia	CROBEX	28	Chile	IPSA	40
Sweden	OMX 30	30	Czech Republic	PSE	14	Colombia	IGBC General	28
Switzerland	SMI 30	20	Estonia	OMX	18	Costa Rica	BCT	6
UK	Footsie 100	100	Hungary	BSE	14	Jamaica	JSE	39
			Iceland	OMX ICEX	11	Mexico	Bolsa	36
			Latvia	OMX	35	Venezuela	IBC	17
			Lithuania	OMX	32			
			Malta	MSE	17			
			Norway	OBX	24			
			Poland	WIG 20	20			
			Romania	BET	10			
			Russia	MICEX	30			
			Serbia	Belex 15	15			
			Turkey	ISE National 30	30			
			Ukraine	PFTS	19			

4. Two-factor asset-pricing model

$$R_{i,t} = \delta_i Z_{i,t-1} + \beta_{i,t}^{US} R_{US,t} + \beta_{i,t}^{D} R_{D,t} + e_{i,t} \qquad (1)$$

- $R_{i,t}$: return of country-sector portfolio
- $R_{US,t}$: return of US market
- $R_{D,t}$: (orthogonal) return of domestic market on date t
- $Z_{i,t-1}$: sector FE, dividend yields, value and size factors (Fama-French 1998)

Time-varying factor loadings

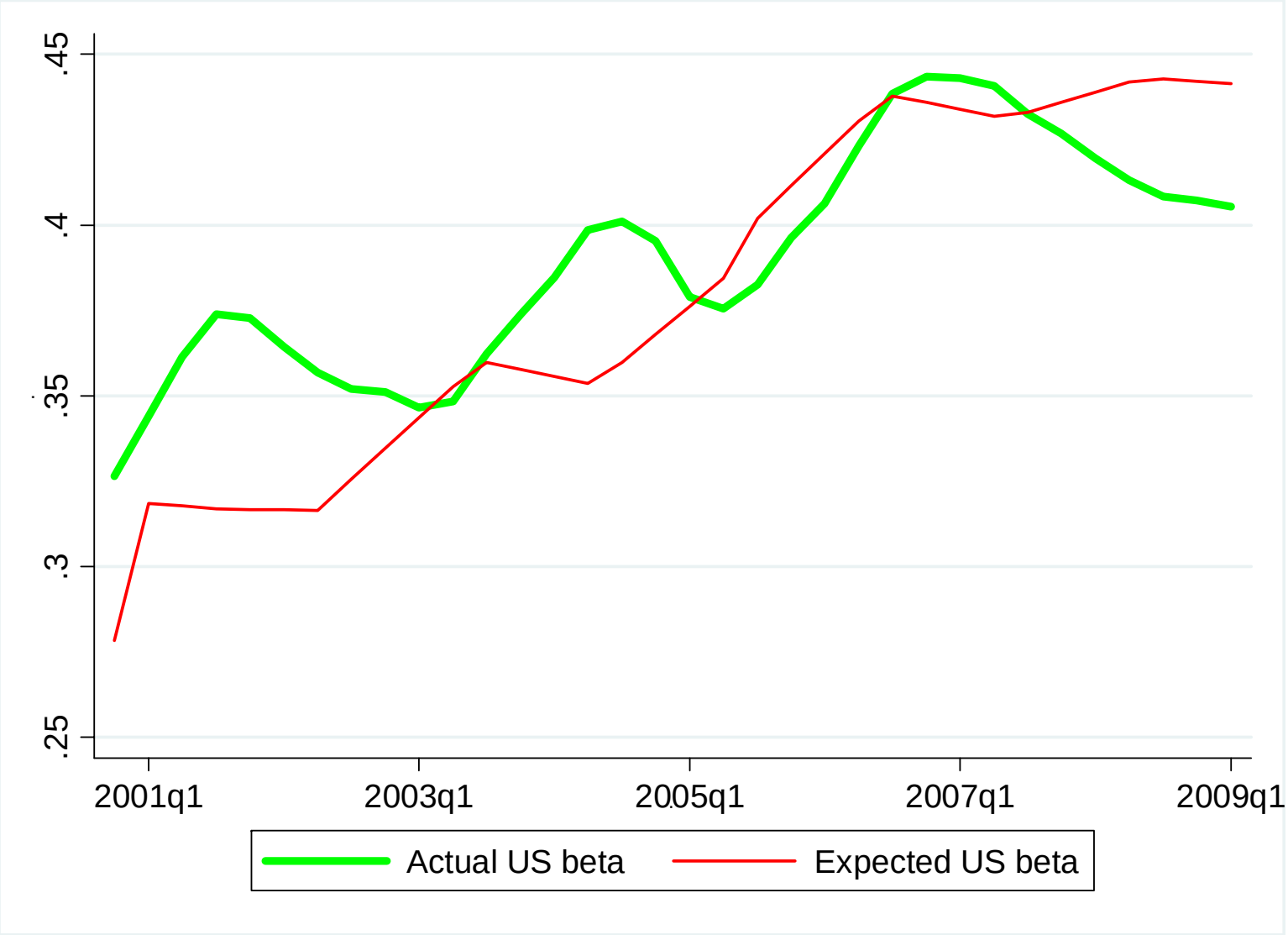
- Key feature: time-varying factor loadings

1. Time-varying factor model
   - sequential 6-month windows, weekly data fequency
   - Info about what comovement *exists* → "*actual*" betas/factor loadings
2. Conditional factor model
   - Conditioning on exposure variables $X_{i,t-k}$
   - Info about what comovement *ought to be based on fundamentals* → "*expected*" betas/factor loadings
   - See Bekaert, Harvey & Ng (2005), Bekaert, Hodrick & Zhang (2009)

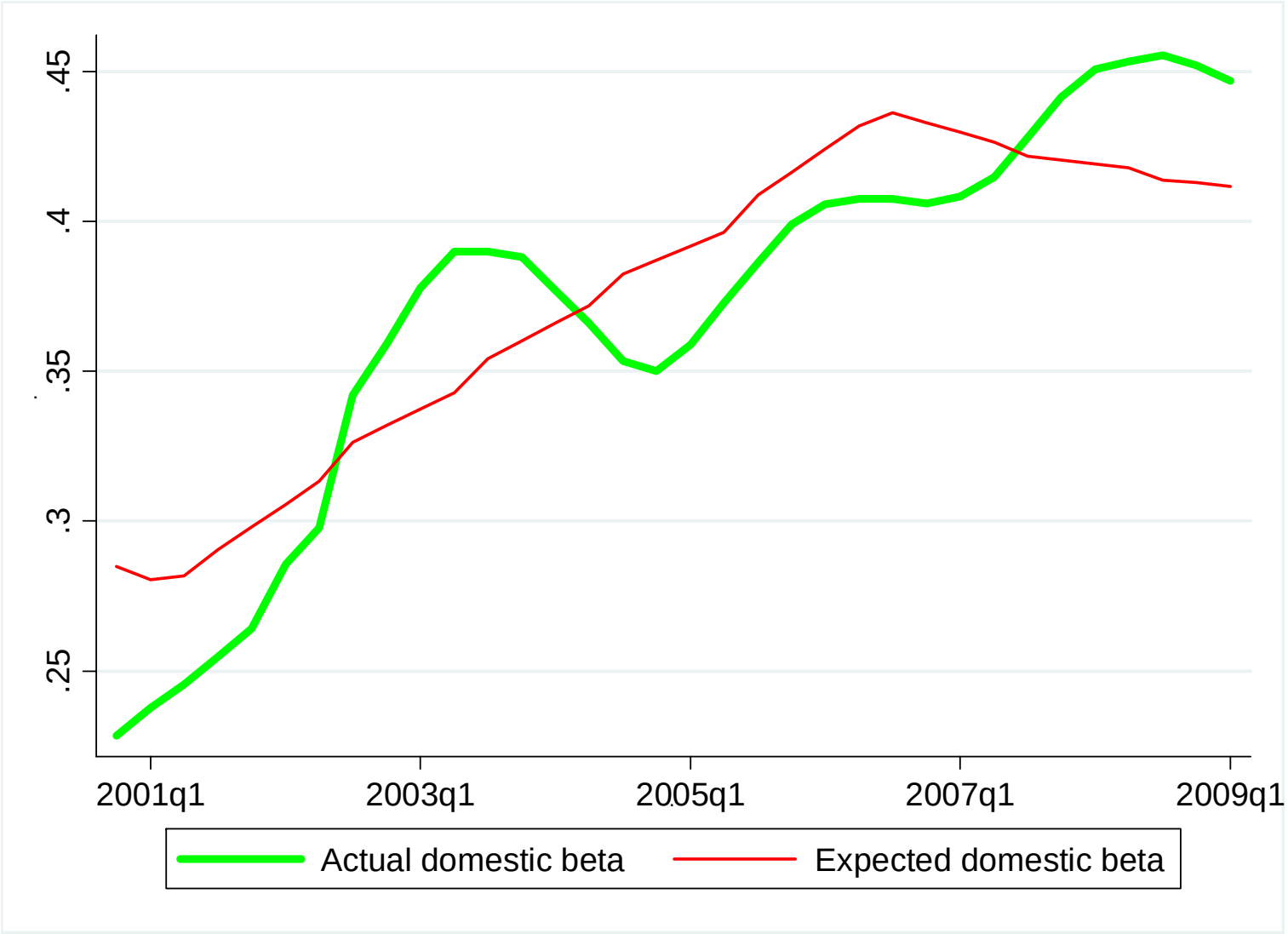
$$\beta_{i,t}^{US} = p_{i,0}^{US} + p_{i,1}^{US} X_{i,t-1}^{US} + p_{i,2}^{US} X_{i,t-1}^{W}$$

$$\beta_{i,t}^{D} = p_{i,0}^{D} + p_{i,1}^{D} X_{i,t-1}^{D} + p_{i,2}^{D} X_{i,t-1}^{W}$$

Contagion vs integration with US market



Contagion vs integration with domestic market



Definition of contagion

- Contagion: unexplained component of comovement = difference between actual and expected factor loadings

$$R_{i,t} = \delta_i \, Z_{i,t-1} + (\beta_{i,t}^{C\,US} + \gamma_i^{US} I_t) \, R_{US,t} + (\beta_{i,t}^{C\,D} + \gamma_i^{D} I_t) \, R_{D,t} + \varphi_i I_t + e_{i,t}$$

- I_t an indicator for 2007-09 financial crisis → Contagion test:

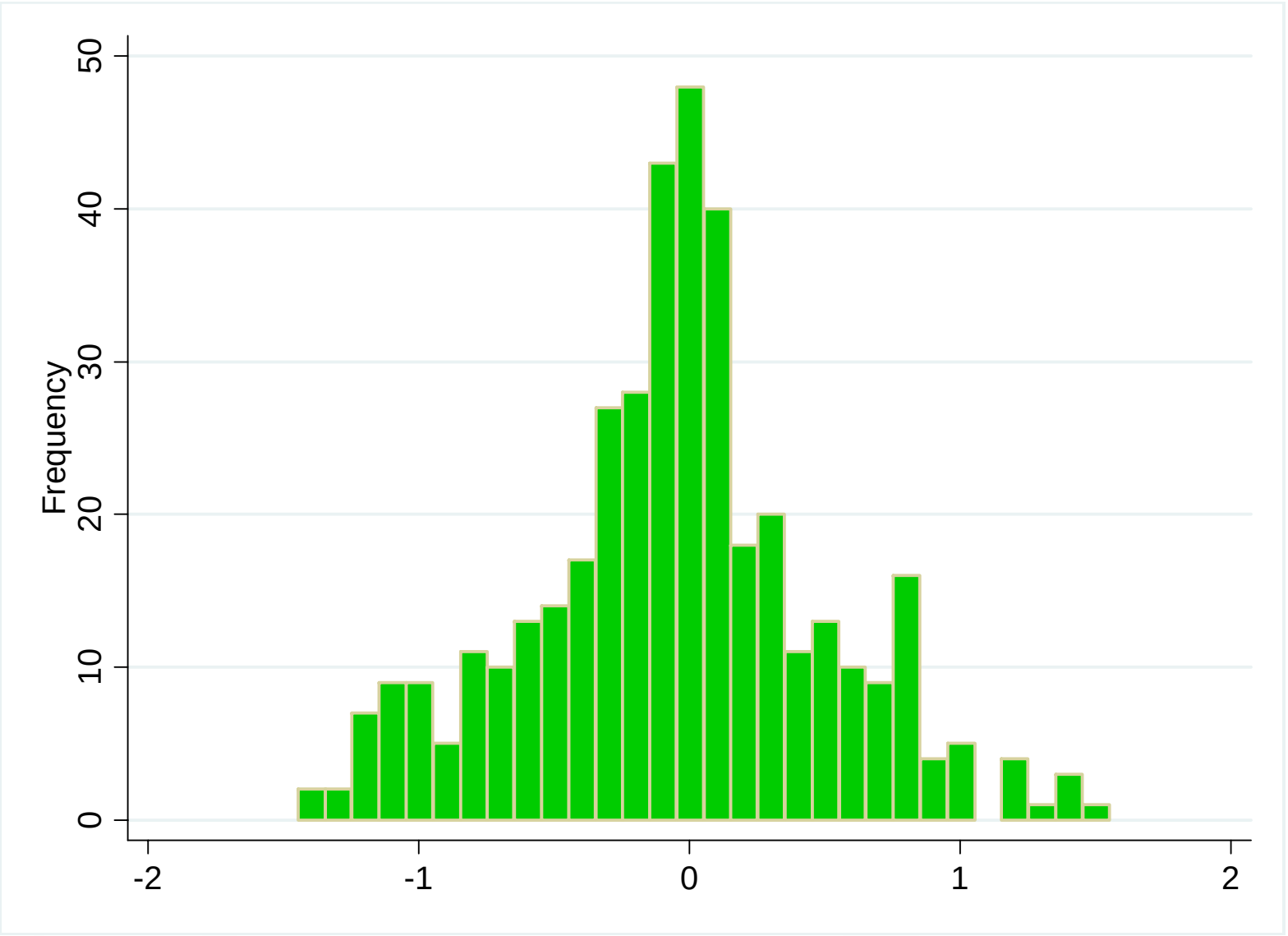
$$H_0 : \gamma_i^{US} = 0 \; ; \; \gamma_i^{D} = 0$$

- Key strengths of approach:
  - No arbitrary benchmark for measuring contagion
  - Allows distinction between integration and contagion
  - Takes into account natural evolution of integration
  - Distinction US contagion vs domestic contagion

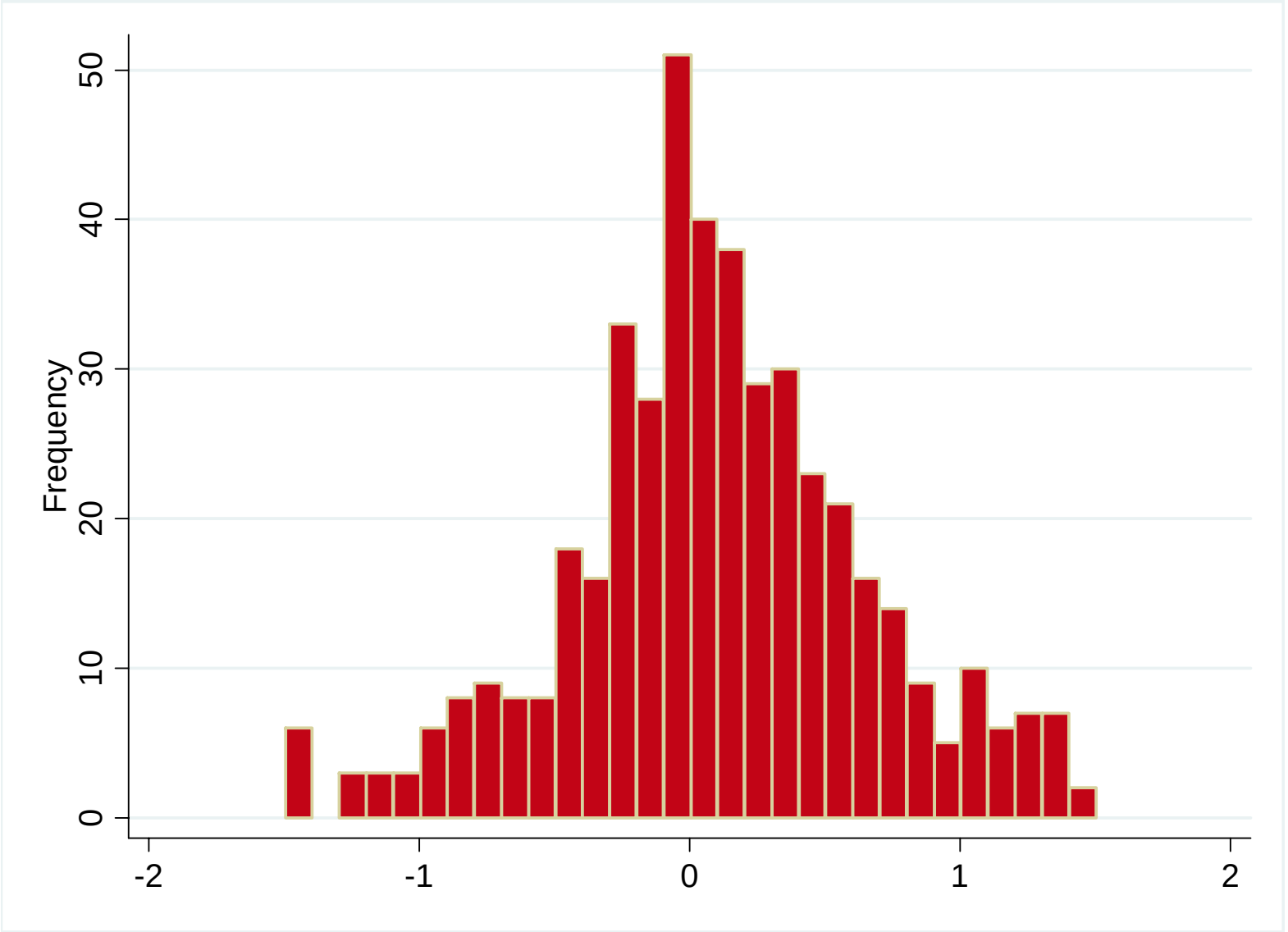
Testing for contagion in the 2007-09 crisis

	Contagion from US markets		Contagion from domestic markets	
	coef.	*s.e.*	coef.	*s.e.*
All	-0.003	*0.013*	0.217***	*0.03*
Region:				
Latin America	0.007	*0.037*	-0.141**	*0.062*
Europe	0.054**	*0.021*	0.175***	*0.037*
Mid. East/Africa	-0.034	*0.026*	0.315***	*0.048*
Asia	-0.04	*0.026*	0.117***	*0.044*
Sector:				
Basic Materials	0.098**	*0.048*	0.204**	*0.078*
Communications	-0.129***	*0.033*	0.093*	*0.05*
Consumer, Cyclical	-0.009	*0.032*	0.270***	*0.074*
Consumer, Non-cyclical	-0.038	*0.028*	0.087*	*0.048*
Diversified	0.052	*0.063*	0.089	*0.120*
Energy	0.116***	*0.040*	0.200***	*0.066*
Financial	0.042	*0.030*	0.132***	*0.040*
Industrial	0.012	*0.035*	0.237***	*0.065*
Technology	-0.272***	*0.090*	0.189	*0.116*
Utilities	0.01	*0.036*	0.260**	*0.114*

Contagion from US market (factor model)



Contagion from domestic market (factor model)



Methodological issue

- Controversy in literature on contagion
  - → (e.g. Forbes & Rigobon 2002, Dungey et al. 2004, 2005, & others): common shocks vs. idiosyncratic shocks
- Two-factor asset-pricing model
  - Establish benchmark & contagion of what equity market comovements *should be based on existing fundamentals*
  - But can say nothing about causality of linkages
- Unanticipated shock model
  - Identification of well-identified macro shocks (US and foreign markets)
  - Key strength: allows identifying causality

5. Unanticipated shock model

- Identification of well-identified macro shocks $S_{US,t}$ and $S_{D,t}$ (US and foreign markets) & their transmission:

$$R_{i,t} = \delta_i \, Z_{i,t-1} + (\chi_i^{US} + \lambda_i^{US} I_t) \, S_{US,t} + (\chi_i^{D} + \lambda_i^{D} I_t) \, S_{D,t} + \varphi_i \, I_t + e_{i,t}$$

$$R_{US,t} = \delta_{US} \, Z_{US,t-1} + (\chi_{US}^{US} + \lambda_{US}^{US} I_t) \, S_{US,t} + \varphi_{US} \, I_t + e_{US,t}$$

- Substitution of $S_{US,t}$ of (8) into (7) yields:

$$R_{i,t} = \ldots + \left(\frac{\chi_i^{US} + \lambda_i^{US} I_t}{\chi_{US}^{US} + \lambda_{US}^{US} I_t} \right) R_{US,t} + e_{i,t}$$

Definition of contagion

- US contagion: increase in transmission of shock to foreign market more strongly than increase for US market

$$H_0 : \left(\frac{\chi_i^{US} + \lambda_i^{US}}{\chi_{US}^{US} + \lambda_{US}^{US}} \right) - \left(\frac{\chi_i^{US}}{\chi_{US}^{US}} \right) = 0$$

- Analogously for domestic contagion:

$$H_0 : \left(\frac{\chi_i^{D} + \lambda_i^{D}}{\chi_{D}^{D} + \lambda_{D}^{D}} \right) - \left(\frac{\chi_i^{D}}{\chi_{D}^{D}} \right) = 0$$

US and foreign macroeconomic news shocks

			Surprise / shock	
Variable	***Definition / Unit***	***Obs.***	***Mean***	***std. dev.***
US macro news:				
GDP	Quarterly YoY % change	56	0.071	0.407
Consumer confidence	index (around 100)	174	0.009	0.193
Housing starts	Monthly, in 1000	169	0.037	0.269
Industrial production	MoM % change	150	-0.031	0.765
NAPM / ISM	index (around 50)	172	-0.018	0.382
NF payroll employment	MoM change (100,000)	175	-0.001	0.007
Retail sales	in %	152	-0.024	0.842
Trade balance	in USD billion	175	0.001	0.138
Unemployment	in %	111	-0.018	0.115
Domestic macro news:				
Trade balance	in USD billion	2021	0.007	1.429
GDP	Quarterly YoY % change	983	0.015	0.392
Industrial production	MoM % change	2129	-0.029	0.416
Unemployment	in %	1675	-0.009	0.112

Increase in *transmission* in the 2007-09 crisis

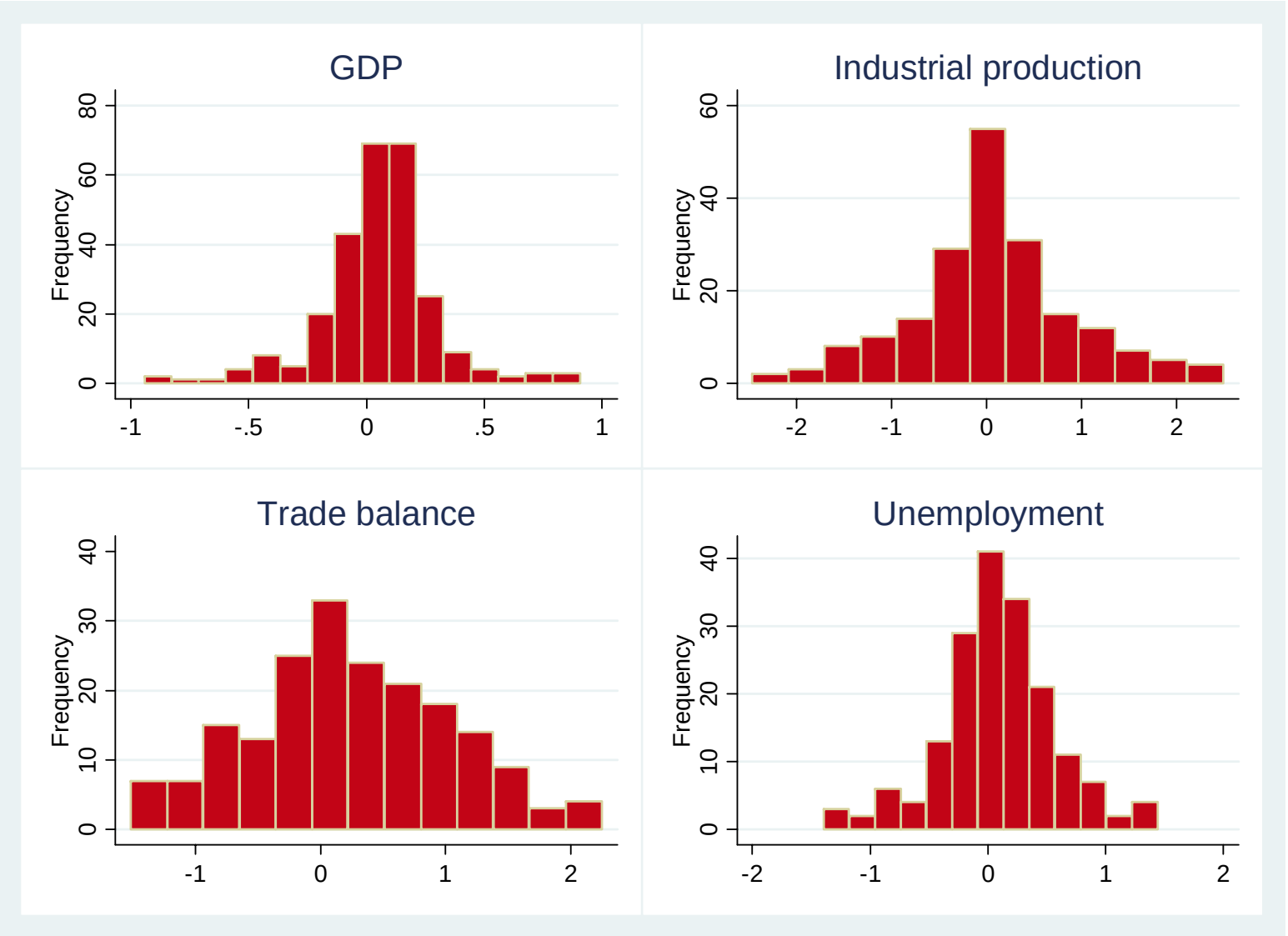
	Non-US returns					US market returns				
	before crisis		during crisis			before crisis		during crisis		
	coef.	*s.e.*	coef.	*s.e.*	*signific.*	coef.	*s.e.*	coef.	*s.e.*	*signific.*
US macro news:										
GDP	0.223***	*0.048*	2.209***	*0.405*	0.00	0.071	*0.124*	0.703*	*0.362*	0.09
Consumer confidence	0.275***	*0.079*	1.891***	*0.314*	0.00	0.384**	*0.158*	2.960***	*0.932*	0.01
Housing starts	-0.031	*0.04*	1.237***	*0.269*	0.00	-0.210**	*0.101*	1.464	*1.034*	0.11
Industrial production	0.010	*0.018*	0.418***	*0.051*	0.00	0.182***	*0.042*	-0.446***	*0.137*	0.00
NAPM / ISM	0.060**	*0.028*	0.496***	*0.177*	0.01	-0.031	*0.086*	2.388***	*0.426*	0.00
NF payroll employment	0.090***	*0.02*	0.805***	*0.14*	0.00	-0.013	*0.054*	1.195***	*0.329*	0.00
Retail sales	0.023	*0.015*	1.036***	*0.098*	0.00	-0.024	*0.028*	2.003***	*0.22*	0.00
Trade balance	0.251**	*0.097*	0.406*	*0.206*	0.56	1.148***	*0.245*	2.437**	*1.038*	0.23
Unemployment	-0.056	*0.087*	1.171***	*0.371*	0.00	-0.301	*0.363*	4.046***	*1.186*	0.00
Domestic macro news:										
Trade balance	0.017***	*0.003*	1.430***	*0.475*	0.00					
GDP	0.212	*0.159*	-0.12	*0.644*	0.61					
Industrial production	0.054	*0.091*	-0.141	*0.324*	0.54					
Unemployment	0.151	*0.226*	1.413**	*0.702*	0.09					
Observations			551280					14150		
R-squared			0.02					0.12		

Contagion in the 2007-09 crisis

	Contagion from US markets				Contagion from domestic markets			
	GDP		Trade balance		GDP		Trade balance	
	mean	*s.e.*	mean	*s.e.*	mean	*s.e.*	mean	*s.e.*
All	-0.061	*0.049*	-0.235 ***	*0.048*	0.084 *	*0.048*	0.137 ***	*0.047*
Region:								
Latin America	-0.081	*0.136*	-0.029	*0.116*	-0.035	*0.040*	0.100 ***	*0.000*
Europe	0.040	*0.062*	-0.306 ***	*0.068*	-0.003	*0.032*	0.186 **	*0.094*
Mid. East/Africa	0.272 ***	*0.076*	0.095	*0.128*	0.654 *	*0.374*	0.100	*0.089*
Asia	-0.460 ***	*0.126*	-0.319 ***	*0.110*	0.057 **	*0.025*	0.071 ***	*0.017*
Sector:								
Basic Materials	0.035	*0.119*	-0.034	*0.150*	-0.160	*0.155*	0.123	*0.099*
Communications	-0.254 **	*0.109*	-0.335 **	*0.131*	0.040	*0.121*	0.132 ***	*0.031*
Consumer, Cyclical	0.005	*0.157*	-0.370 **	*0.171*	0.349	*0.302*	0.248 **	*0.117*
Consumer, Non-cyclica	-0.117	*0.132*	-0.179	*0.145*	0.153	*0.107*	-0.135	*0.325*
Diversified	-0.312	*0.331*	-0.424 *	*0.213*	0.016	*0.061*	0.086 ***	*0.017*
Energy	0.260	*0.176*	-0.302 **	*0.133*	0.151	*0.147*	0.174 ***	*0.059*
Financial	0.058	*0.131*	-0.162	*0.110*	0.081	*0.068*	0.136	*0.117*
Industrial	-0.131	*0.163*	-0.083	*0.152*	0.073 **	*0.036*	0.201 **	*0.075*
Technology	-0.407 **	*0.194*	-0.755 **	*0.268*	0.060	*0.085*	0.195	*0.153*
Utilities	-0.010	*0.113*	-0.081	*0.122*	0.004	*0.089*	0.241 **	*0.110*

Contagion from US market (shock model)

Contagion from domestic market (shock model)



Confirmation from shock model

- The crisis is different! → 3- to 4-fold increase in the strengths of the shock transmission
- Yet also US returns have become more sensitive to a given shock during crisis

  → explains why US beta from asset-pricing model has been rather stable, yet return dispersion has increased
- Role of idiosyncratic, country-specific shocks key

6. Explaining contagion

$$\gamma_i = \delta \; Z_i + \kappa^{US} \hat{\beta}_i^{US} + \kappa^{D} \hat{\beta}_i^{D} + e_i$$

- with $\gamma_i = \gamma_i^{US}$ for the test for US contagion and $\gamma_i = \gamma_i^{D}$ for domestic contagion
- Z: portfolio i country risk and sector-level risk (incl. value and size factors as Fama-French controls)
- β^{US}: portfolio i US beta

Cross-section: 455 country-sector portfolios

	US contagion			Domestic contagion		
A. External exposure						
US beta	-0.223**	-0.182	-0.116	-0.126	-0.063	-0.086
Domestic beta	0.042	0.013	-0.009	0.126	0.204***	0.215***
Trade integration w. US	-0.002			-0.013***		
Financial integration w. US	0.010			0.000		
Trade openness	-0.002*			0.002***		
Financial openness	0.010			0.000		
Exchange rate exposure	-0.002			0.000		
Interest rate exposure	0.012			-0.011		
B. Country risk						
Political country risk	-0.098***		-0.087***	-0.009**		-0.008*
Financial country risk	0.007			0.006		
Sovereign rating	-1.986***		-0.328*	-0.260**		-0.433***
C. Financial policies						
Debt guarantees		-0.167	-0.097		-0.431***	-0.427***
Deposit guarantees		-0.510***	-0.484***		0.401***	0.425***
Capital injections		-1.330***	-0.912**		0.148	0.188
D. Macroeconomic fundamentals						
FX reserves		-0.009***	-0.009***		0.001	0.001
Current account position		-0.010*	-0.011*		-0.006	-0.009*
Government budget		-0.011	-0.014		-0.014*	-0.009
E. Financial constraints						
Financial constraint		0.001			-0.001	
Value factor		-0.003**			-0.001	
Size factor		0.015			0.006	

7. Explaining crisis severity

$$\gamma_i = \delta \; Z_i + \kappa^{US} \hat{\beta}_i^{US} + \kappa^{D} \hat{\beta}_i^{D} + e_i$$

- with $\gamma_i = \gamma_i^{US}$ for the test for US contagion and $\gamma_i = \gamma_i^{D}$ for domestic contagion
- Z: portfolio i country risk and sector-level risk (incl. value and size factors as Fama-French controls)
- β^{US}: portfolio i US beta

Cross-section: 455 country-sector portfolios

Role of financial policies

- What has made the crisis different – why is country risk priced and micro risk less so?
- Significant extensions & introductions of financial policies (P_i)
  - Debt guarantees
  - Deposit guarantees
  - Capital injections
- Not all countries implemented such policies, and important differences across countries

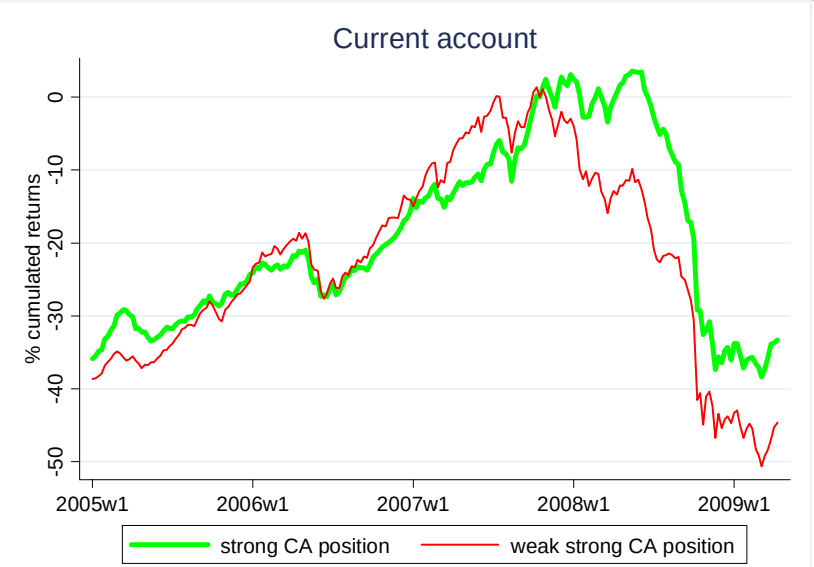
Role of *country risk* and *macro fundamentals*

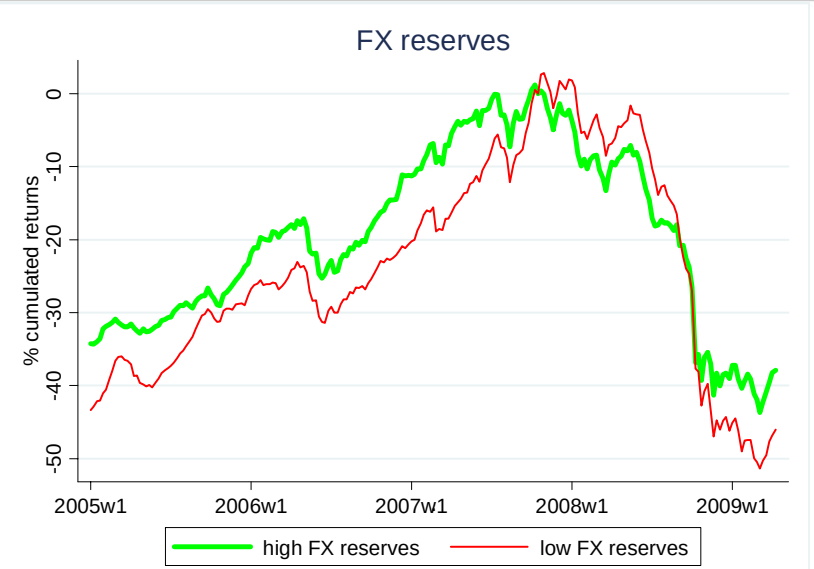
	B. Country risk			D. Macroeconomic fundamentals			
Variable:	Composite political country risk	Composite financial country risk	Sovereign rating	FX reserves	Current account position	Unemploy-ment rate	Government budget
A. During the crisis: 7 August 2007 – 15 March 2009							
Variable:	0.371	1.205*	1.043**	0.820**	0.603**	-1.038**	0.523
US beta	-0.304***	-0.246***	-0.327***	-0.269***	-0.246***	-0.270***	-0.255***
Domestic beta	-0.139**	-0.147**	-0.135**	-0.170***	-0.149**	-0.152***	-0.134**
Interdecile difference	10.56	13.86	12.52	7.55	8.85	-14.68	4.42
R-squared	0.21	0.22	0.22	0.21	0.22	0.21	0.19
B. Before the crisis: 1 January 2005 -- 6 August 2007							
Variable:	-1.118***	-0.217	-2.129**	-1.324*	-0.668	1.807***	-1.009
US beta	0.389***	0.278**	0.385***	0.299**	0.274**	0.295**	0.267**
Domestic beta	0.038	0.079	0.048	0.104	0.060	0.065	0.038
Interdecile difference	-31.86	-2.49	-25.55	-12.18	-9.81	25.55	-8.51
R-squared	0.14	0.11	0.13	0.12	0.11	0.13	0.10
C. Whole sample period: 1 January 1995 -- 6 August 2007							
Variable:	0.503	0.226	2.267*	-0.796	-0.808	0.235	2.122
US beta	0.733***	0.812***	0.639***	0.836***	0.801***	0.807***	0.790***
Domestic beta	0.249	0.220	0.276	0.231	0.220	0.219	0.266
Interdecile difference	14.35	2.60	27.21	-7.33	-11.87	3.32	17.90
R-squared	0.10	0.10	0.10	0.10	0.10	0.10	0.10

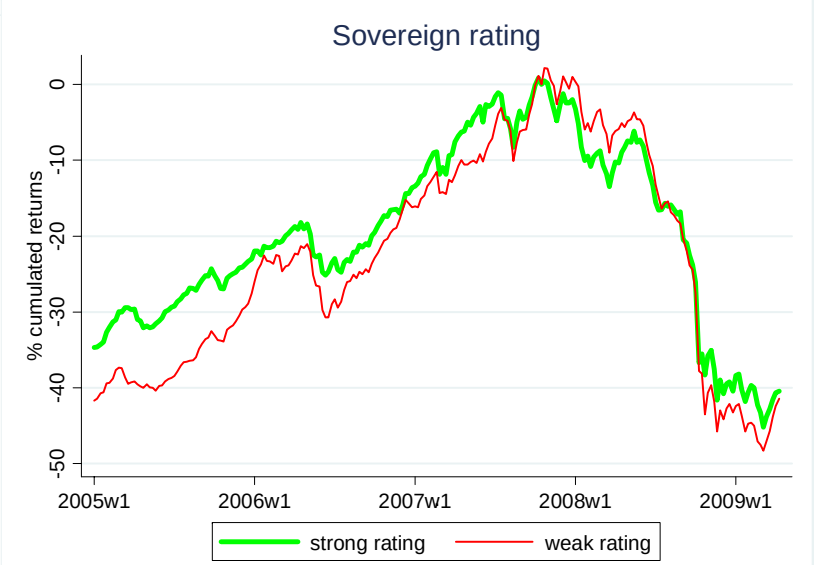
Role of *micro risk* and *financial policies*

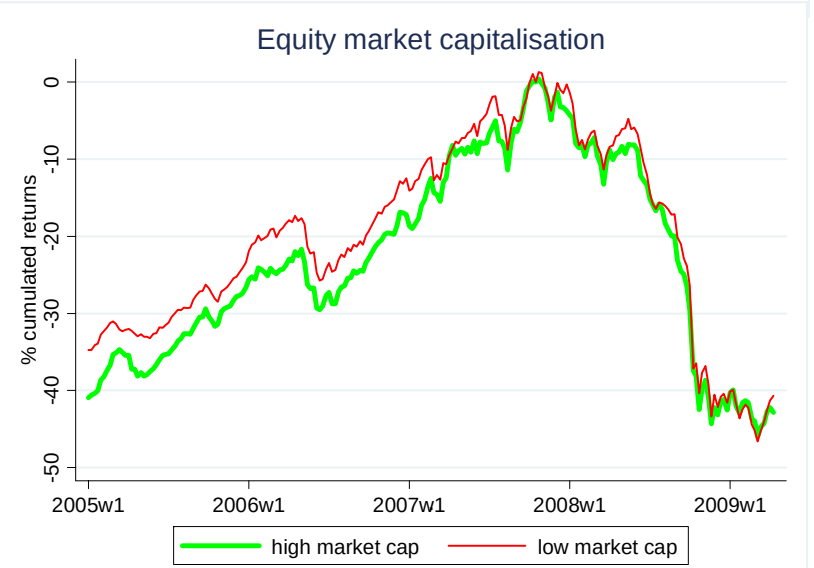
	C. Financial policies			E. Fin. constraints	
Variable:	Debt guarantees	Deposit guarantees	Capital injections	Financial constraint	Value factor
A. During the crisis: 7 August 2007 – 15 March 2009					
Variable:	10.233**	9.737**	2.772	10.572	-0.076
US beta	-0.349***	-0.360***	-0.360***	-0.248**	-0.258***
Domestic beta	-0.142**	-0.146**	-0.151**	-0.153**	-0.149**
Interdecile difference	16.92	8.26	3.15	2.38	-0.36
R-squared	0.22	0.22	0.22	0.23	0.19
B. Before the crisis: 1 January 2005 -- 6 August 2007					
Variable:	--	--	--	0.612	-0.056
US beta				0.393***	0.269**
Domestic beta				0.052	0.046
Interdecile difference				0.14	-0.27
R-squared				0.18	0.10
C. Whole sample period: 1 January 1995 -- 6 August 2007					
Variable:	--	--	--	2.322**	-0.242
US beta				0.531*	0.785***
Domestic beta				0.396	0.203
Interdecile difference				0.52	-1.15
R-squared				0.12	0.10

Role of country-level macro fundamentals for crisis severity

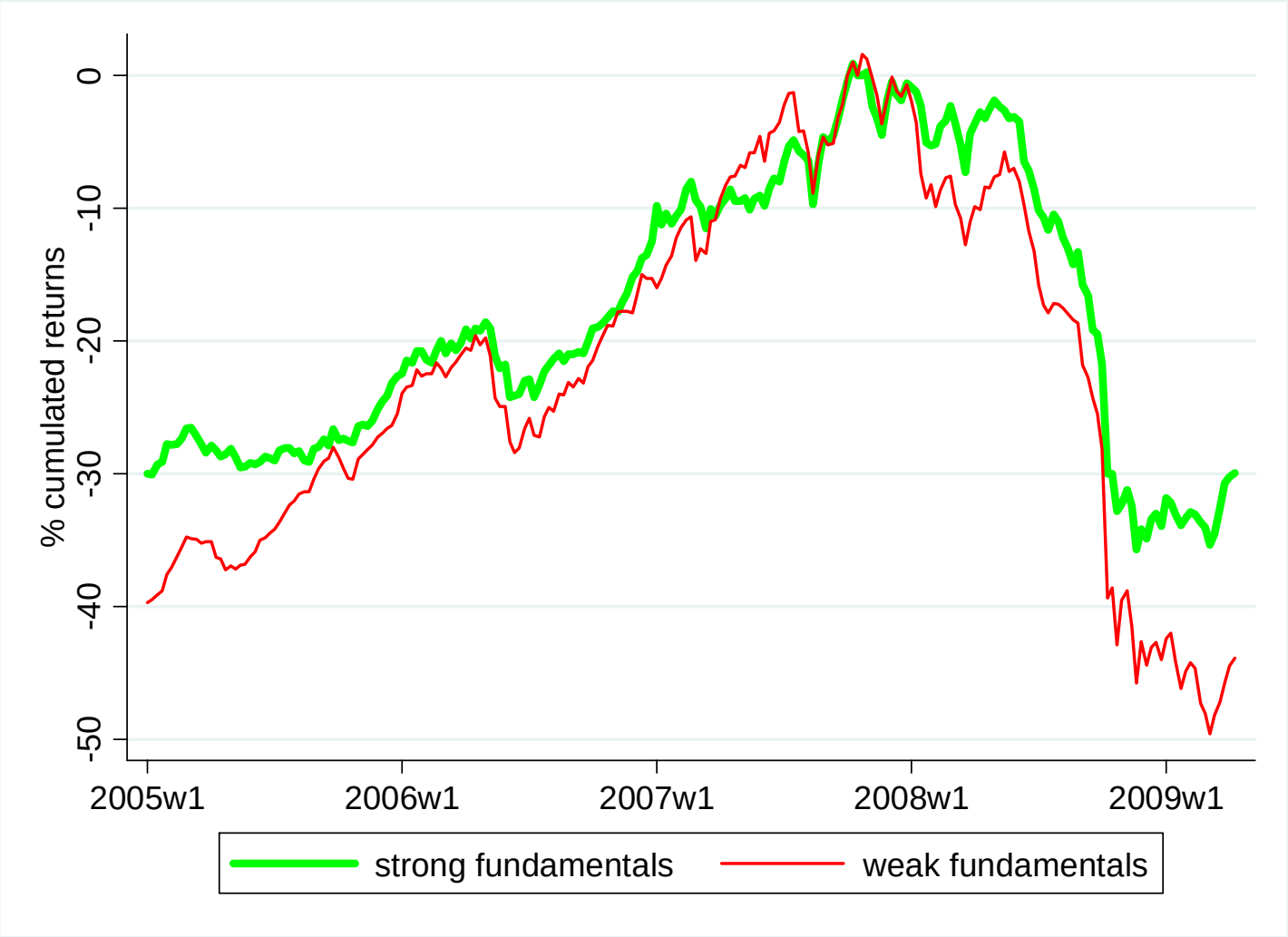








Role of country-level macro fundamentals for crisis severity



8. Summing up

1. No contagion from US markets, on average
2. But significant contagion from *domestic* markets
3. Lots of heterogeneity across portfolios
4. Channels that explain global equity exposure to crisis:
   - External exposure only played limited role: mainly via financial integration with US (US beta) → crisis transmission to that extent "predictable"
   - Macro/country risk key explanations: portfolios in countries with strong fundamentals declined by one third less
   - Financial policies – esp. debt and deposit guarantees – played major role in shielding economies

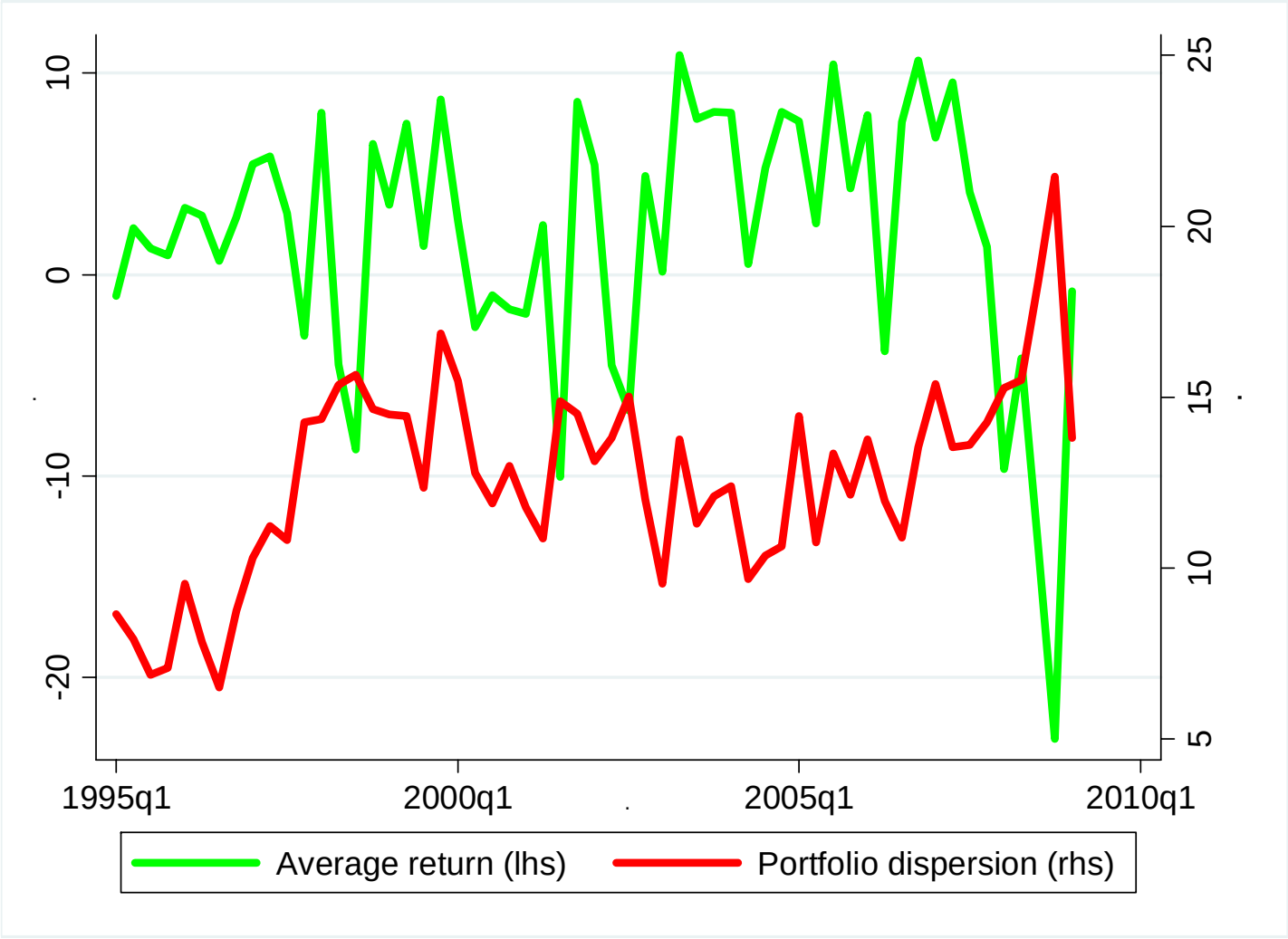
→ Macro policies & vulnerabilities at *country level* had key role

Implications for policy

- Focus on reform of international financial architecture
- Emphasis on microprudential reforms: regulation and supervision of institutions and markets
- But: findings suggest that macroprudential risks dwarfed micro / firm-level risks during crisis – at least when analysing global transmission of crisis
- Role of macroprudential analysis & risk at country level

APPENDIX

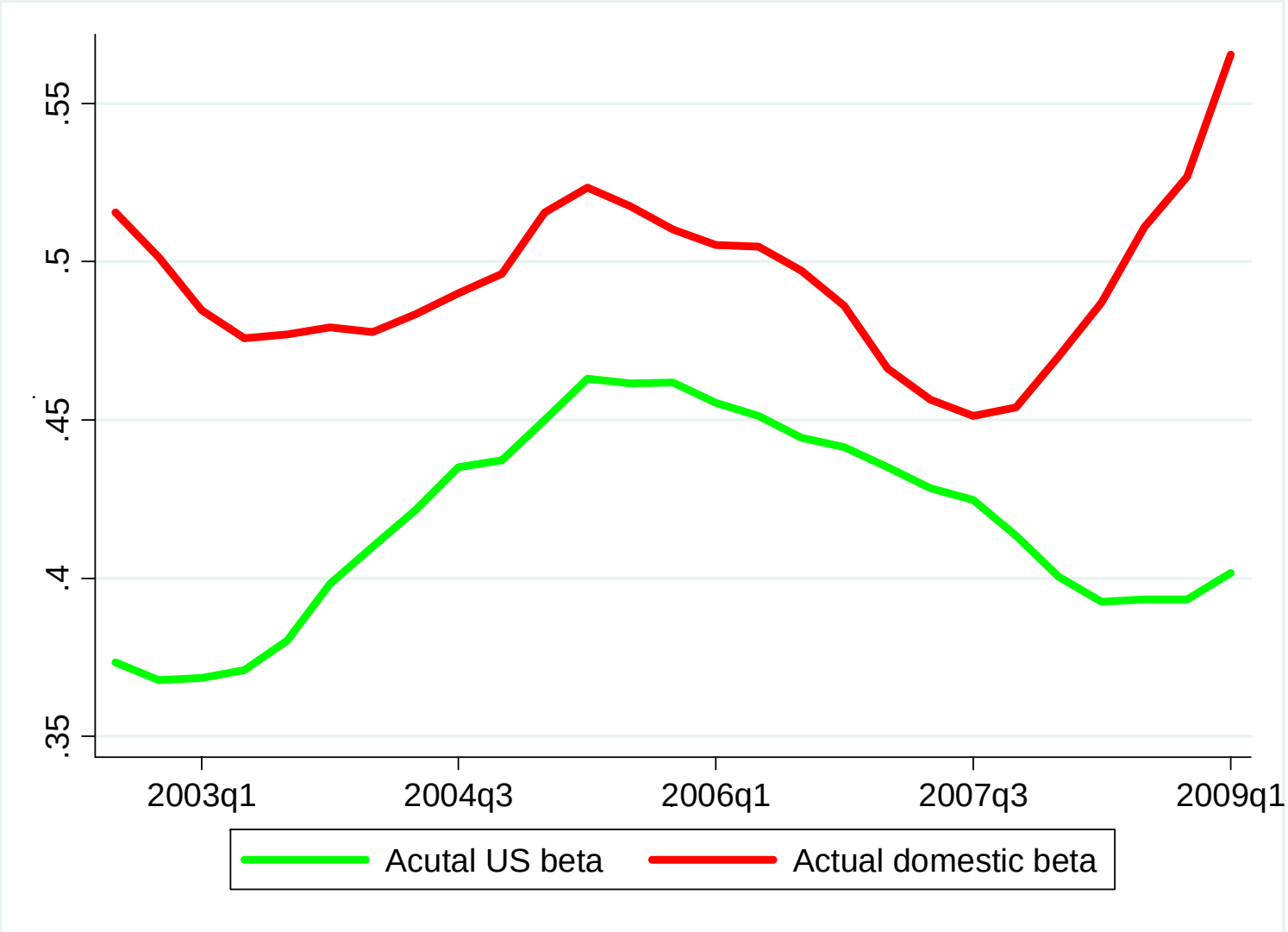
Portfolio equity returns and their dispersion



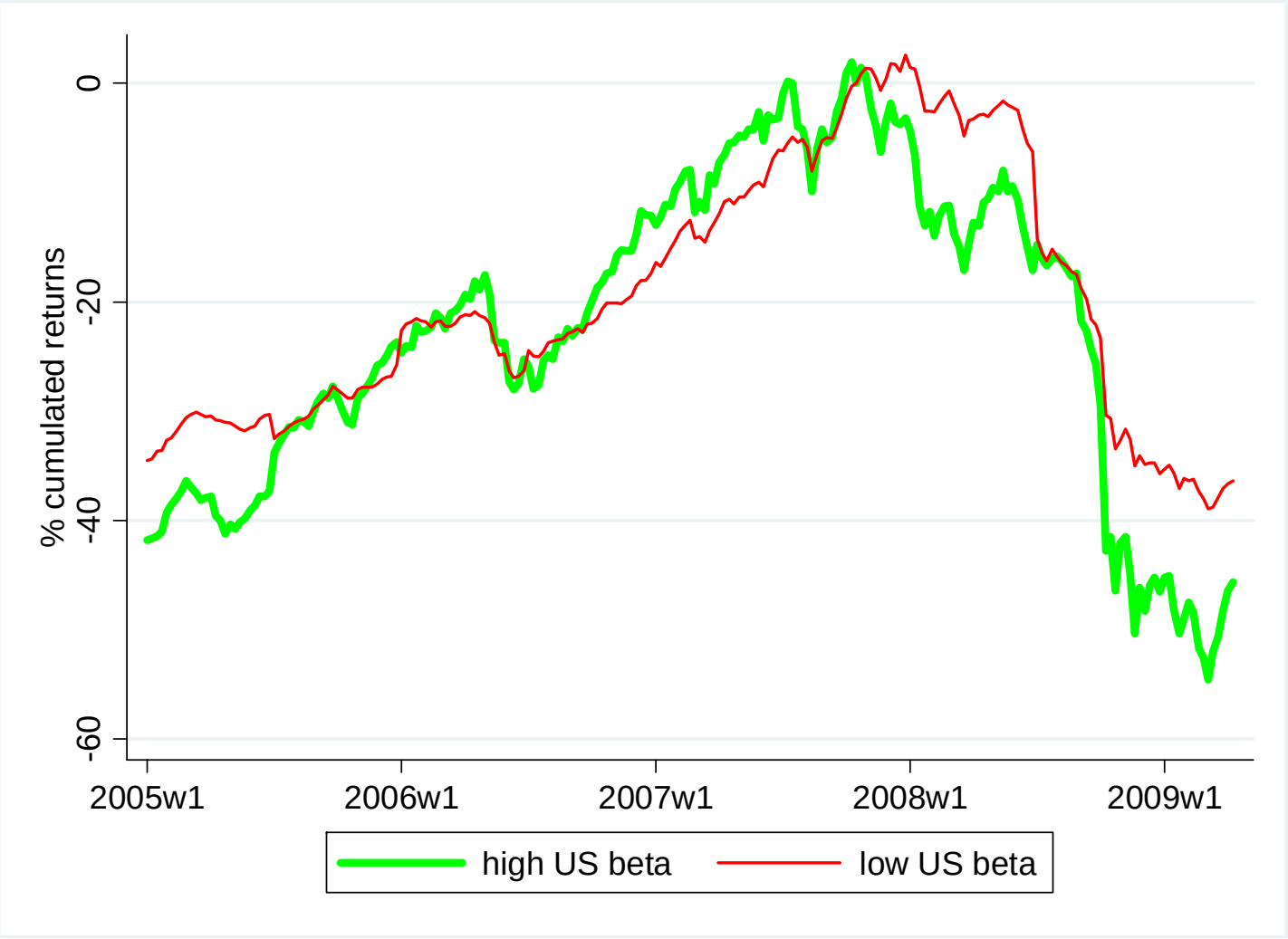
Summary stats: macro & micro determinants

Variables	Definition	mean	std. dev.	min.	max.
Macroeconomic fundamentals:					
Composite country risk	ICRG composite country index	76.48	7.73	54.30	91.80
Composite economic country risk	ICRG country economic risk index	38.89	4.39	28	49
Composite financial country risk	ICRG country financial risk index	38.92	4.79	28	50
FX reserves	Ratio of FX reserves to GDP	18.35	4.69	4.80	100.70
Sovereign rating	Rating of country's sovereign debt	16.29	4.75	6	22
Current account position	Ratio of current account to GDP	0.68	7.59	-17.11	27.98
Government budget	Ratio of fiscal balance to GDP	-0.18	4.24	-7.80	19.61
Interest rate	3-month money market, in %	0.82	3.60	-13.03	13.39
Inflation rate	CPI inflation rate, in %	4.30	3.47	-1.20	17.12
Unemployment rate	in %	7.81	6.18	2.10	38.71
External exposure:					
Trade openness	Ratio of exports plus imports to GDP	108.39	76.43	28.17	455.40
Financial openness	Ratio of portfolio assets & liab. to GDP	-1.19	9.87	4.42	64.41
Equity market capitalisation	Ratio of equity market cap. To GDP	71.86	90.59	4.60	593.90
Exchange rate exposure	exposure coefficient, see section 2	-0.71	7.08	-17.93	27.50
Firm-specific characteristics:					
Exchange rate exposure	exposure coefficient, see section 2	-8.42	93.56	-690.75	808.82
Interest rate exposure	exposure coefficient, see section 2	3.99	126.88	-833.46	577.24
Financial constraint	based on Whited and Wu (2006), see section 2	60.83	43.22	0.087	99.57
Value factor	Price-to-Book ratio	4.46	19.64	0.04	359.26
Size	Total assets (log)	9.42	3.11	0.68	18.10
Financial policy variables:					
Deposit guarantees	BIS, Bloomberg timeline, national sources	0.44	0.50	0	1
Debt guarantees	BIS, Bloomberg timeline, national sources	0.32	0.47	0	1
Capital injections	BIS, Bloomberg timeline, national sources	0.26	0.44	0	1

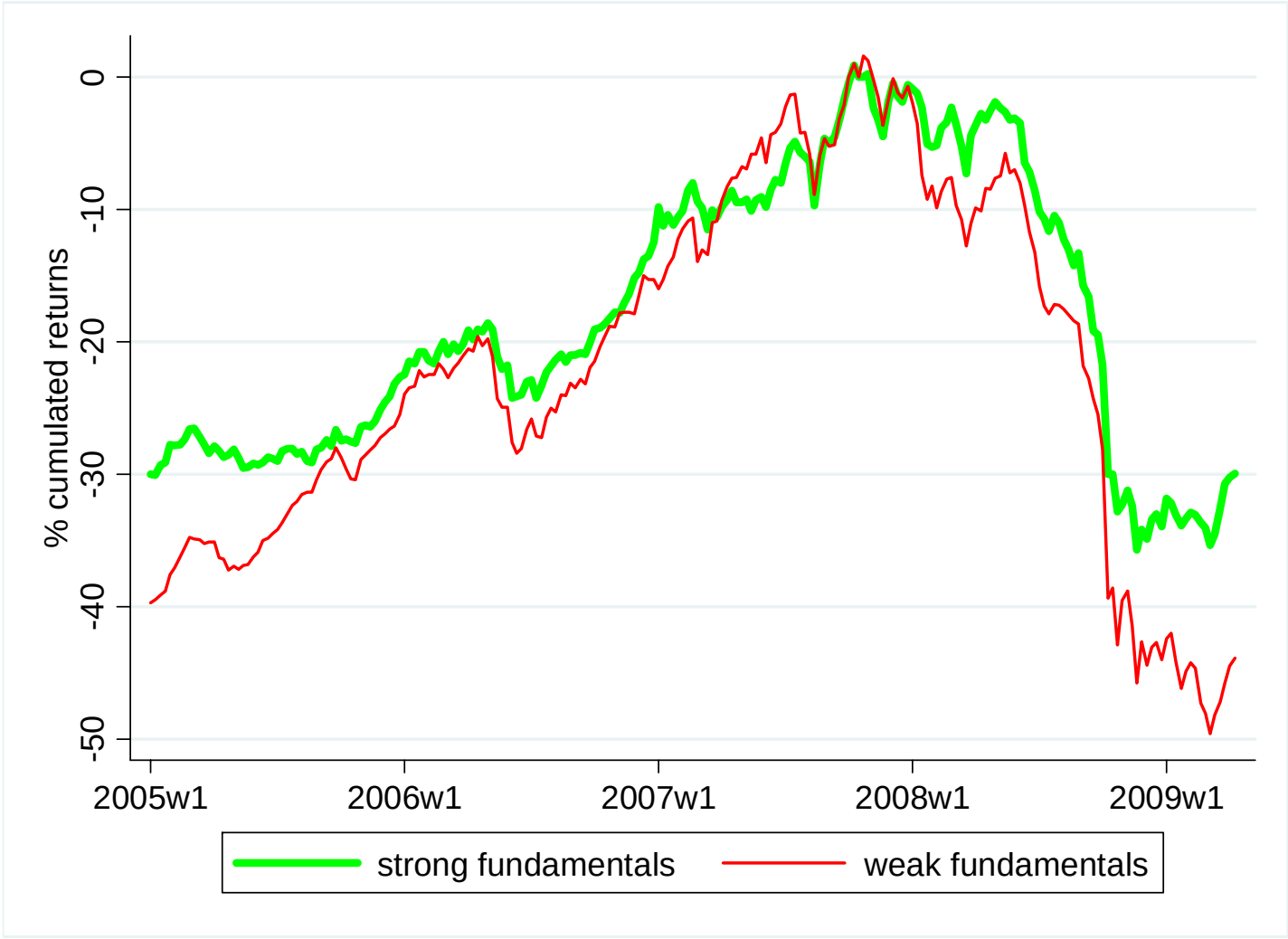
Evolution of heterogeneity in actual integration



Role of integration with US markets for crisis severity



Role of country-level macro fundamentals for crisis severity



Estimation of exchange rate & interest rate exposures

$$R_{i,t} = \delta_0 + \delta_i \Delta s_{i,t} + \kappa_i R_t^{US} + e_{i,t}$$

$$R_{i,t} = \eta_0 + \eta_i \Delta r_{i,t} + \kappa_i R_t^{US} + e_{i,t}$$

- $R_{i,t}$: return of country-sector portfolio *i* on date *t*
- R^{us}_t : return of US stock market on date *t*
- $S_{i,t}$: bilateral exchange rate change vs. USD on date *t*
- $r_{i,t}$: change in domestic 3-month interest rate on date *t*

(Dominguez and Tesar, 2001 & 2006; Amer et al. 2009)

Decomposition of cross-section return dispersion

Dispersion in beta-fitted returns vs. idiosyncratic