The Collateral Channel of Monetary Policy: Evidence from the European Central Bank

European Central Bank Workshop

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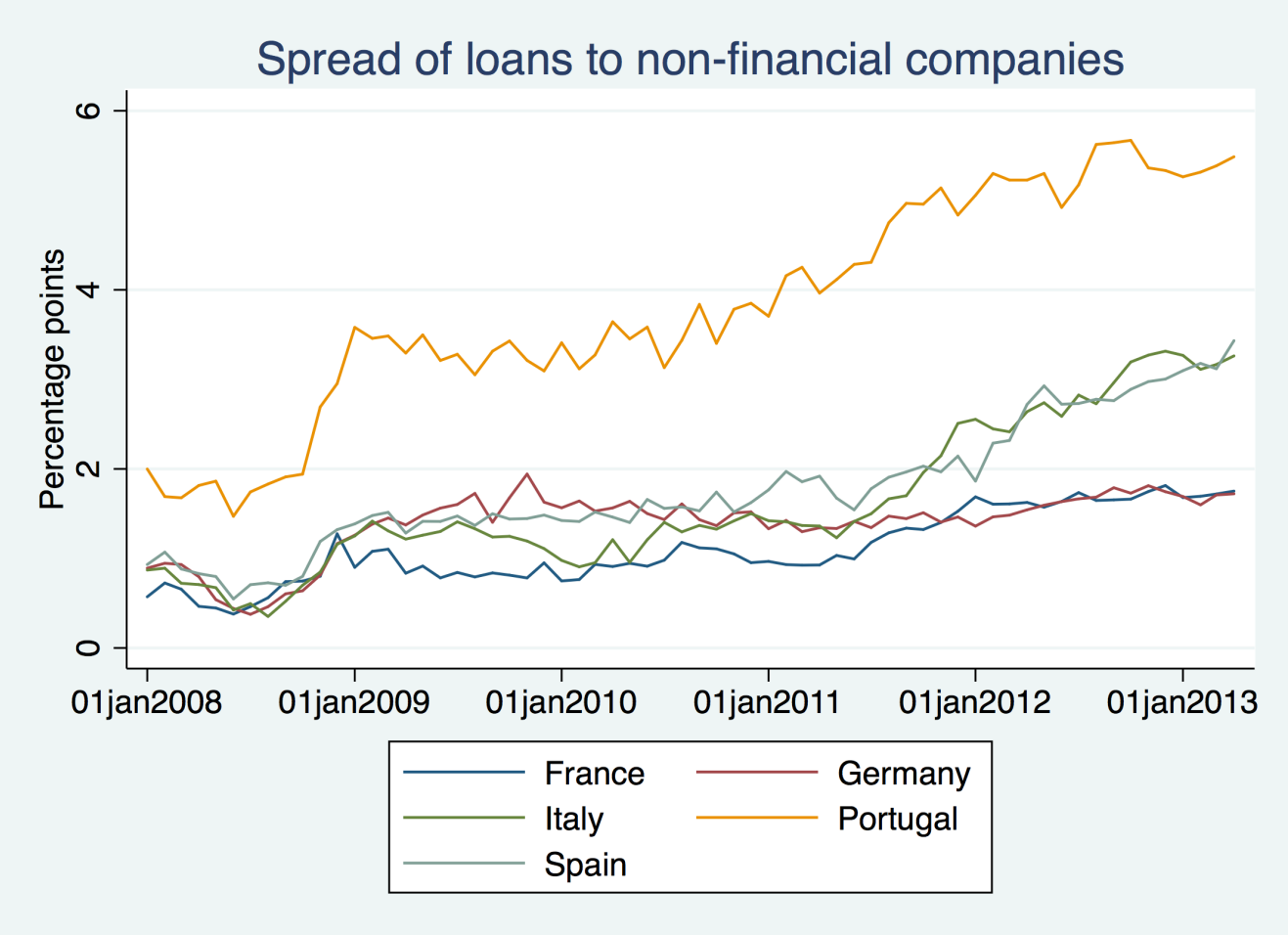
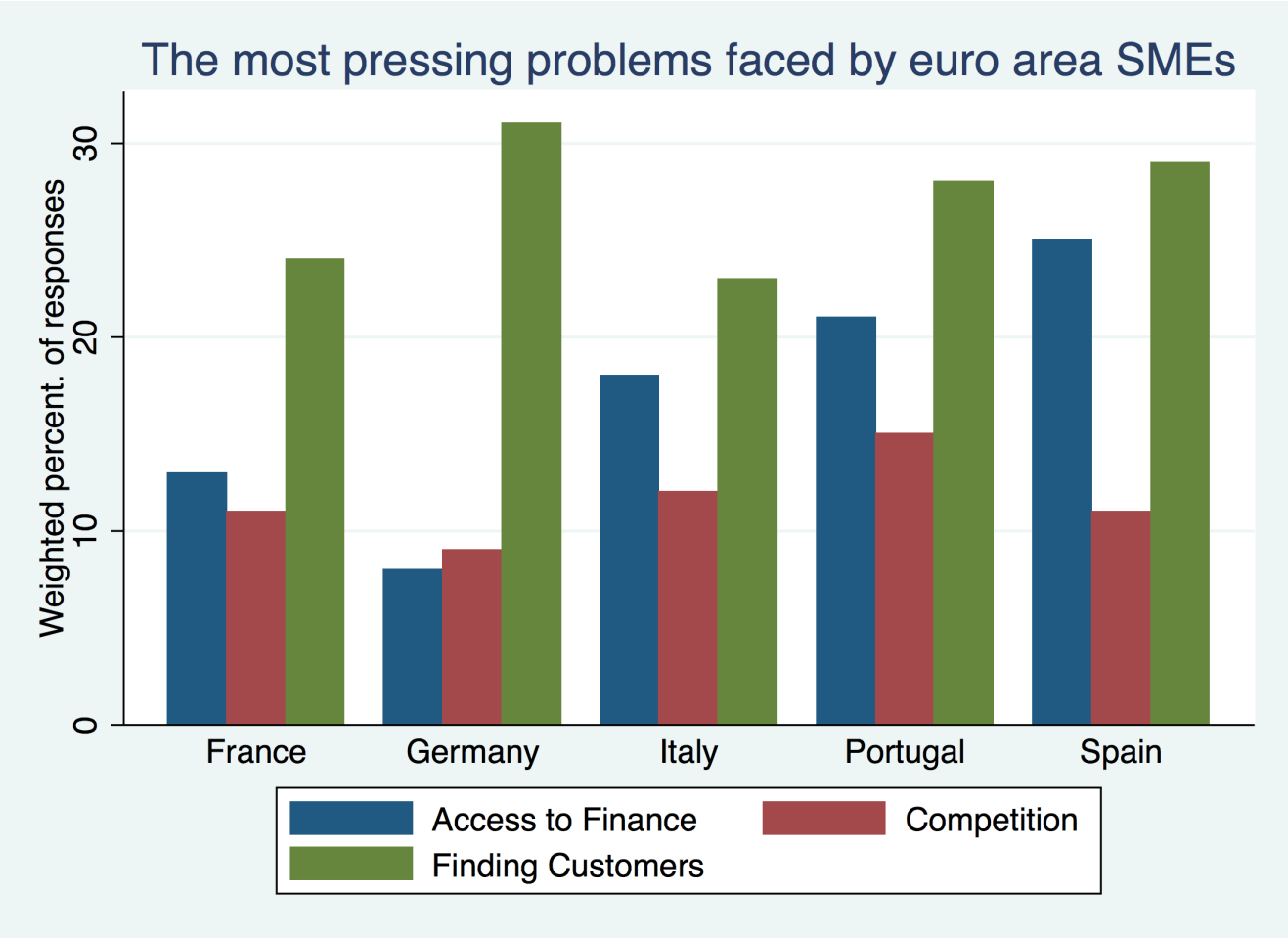
Outline

Divergence in borrowing cost of small and medium enterprises (SME) in the euro area



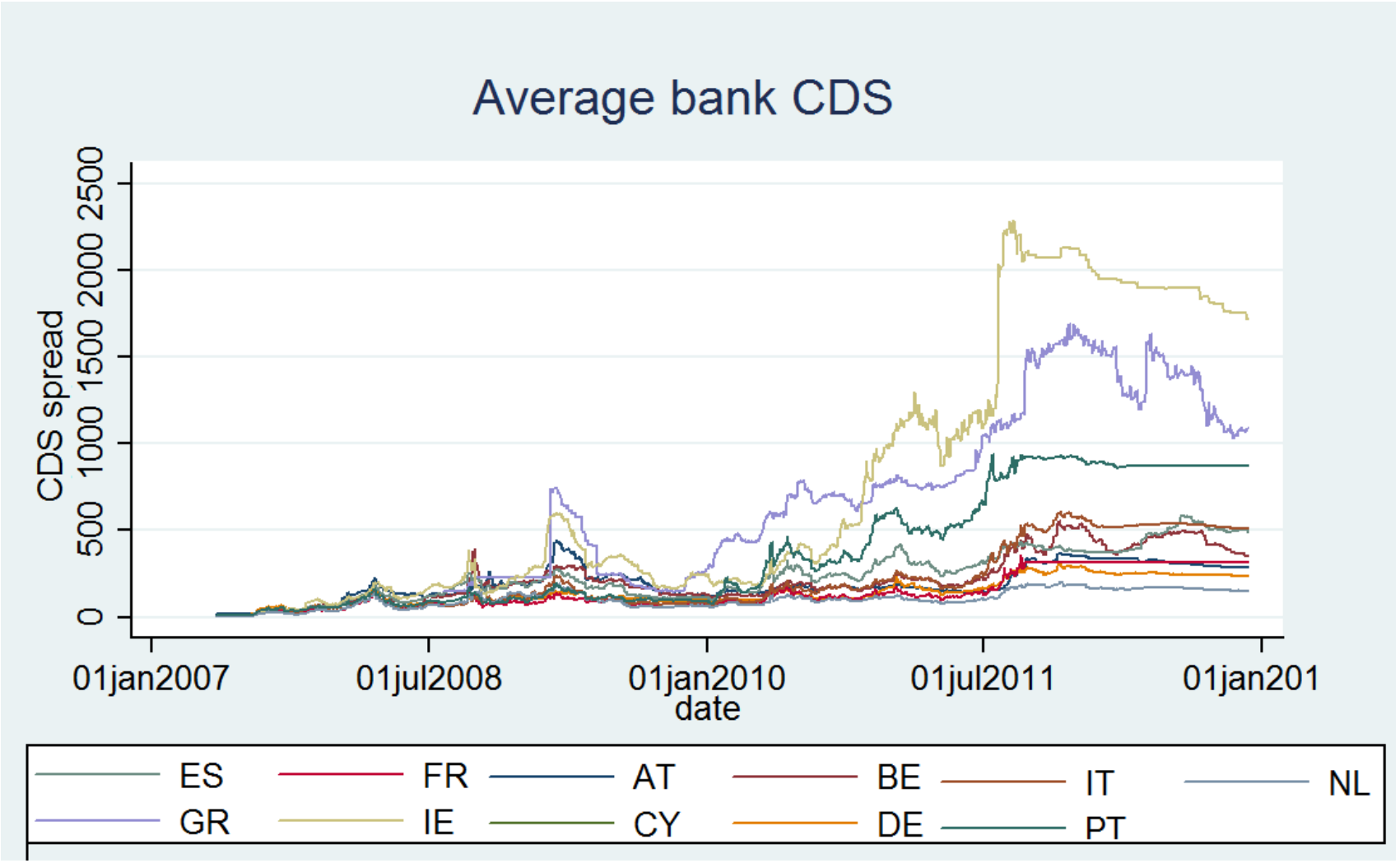
Source: ECB

Survey data suggests the divergence is caused by a fragmentation of financial markets



Source: ECB Survey of SMEs April 2013

Banks' access to funding vary significantly across countries



Source: Bloomberg

The fragmentation of euro area financial markets hampers the transmission of monetary policy

- Weakened transmission of monetary policy during the sovereign debt crisis is a main concern for the ECB
- Mario Draghi (ECB President, Nov. 2012):

  The fragmentation of the single financial market has led to a fragmentation of the single monetary policy. (...) This has made difficult the transmission of impulses coming from an accommodative monetary policy through adjustments in interest rates on loans to households and firms by banks.

The ECB lowered collateral requirements over 2008-2012

Date	Measure
October 2008	The credit threshold for collateral other than ABS is lowered to BBB-
May 2010	Minimum rating threshold of Greek government debt is suspended
March 2011	Minimum rating threshold of Irish government debt is suspended
July 2011	Minimum rating threshold of Portuguese government debt is suspended
December 2011	36 month LTROS with (i) new ABS eligibility requirements; (ii) NCBs may accept additional credit claims as collateral
September 2012	Marketable debt instruments denominated in currencies other than the euro and issued and held in the euro area, are eligible

How does collateral policy affect assets pledged to the ECB and banks' funding costs ?

- Methodology:
  - Data: assets pledged by banks to the ECB (aggregated at country-level) from January 2009 to September 2011
  - Econometric model: discrete choice logit model
    - Estimate changes in collateral pledged by banks under various collateral policies
    - Estimate impact of collateral policy on banks' funding cost
- Main finding: Impact of collateral policy varies with bank- and asset-characteristics
- This suggests that ECB measures to relax collateral requirements contribute to a convergence in banks' funding costs

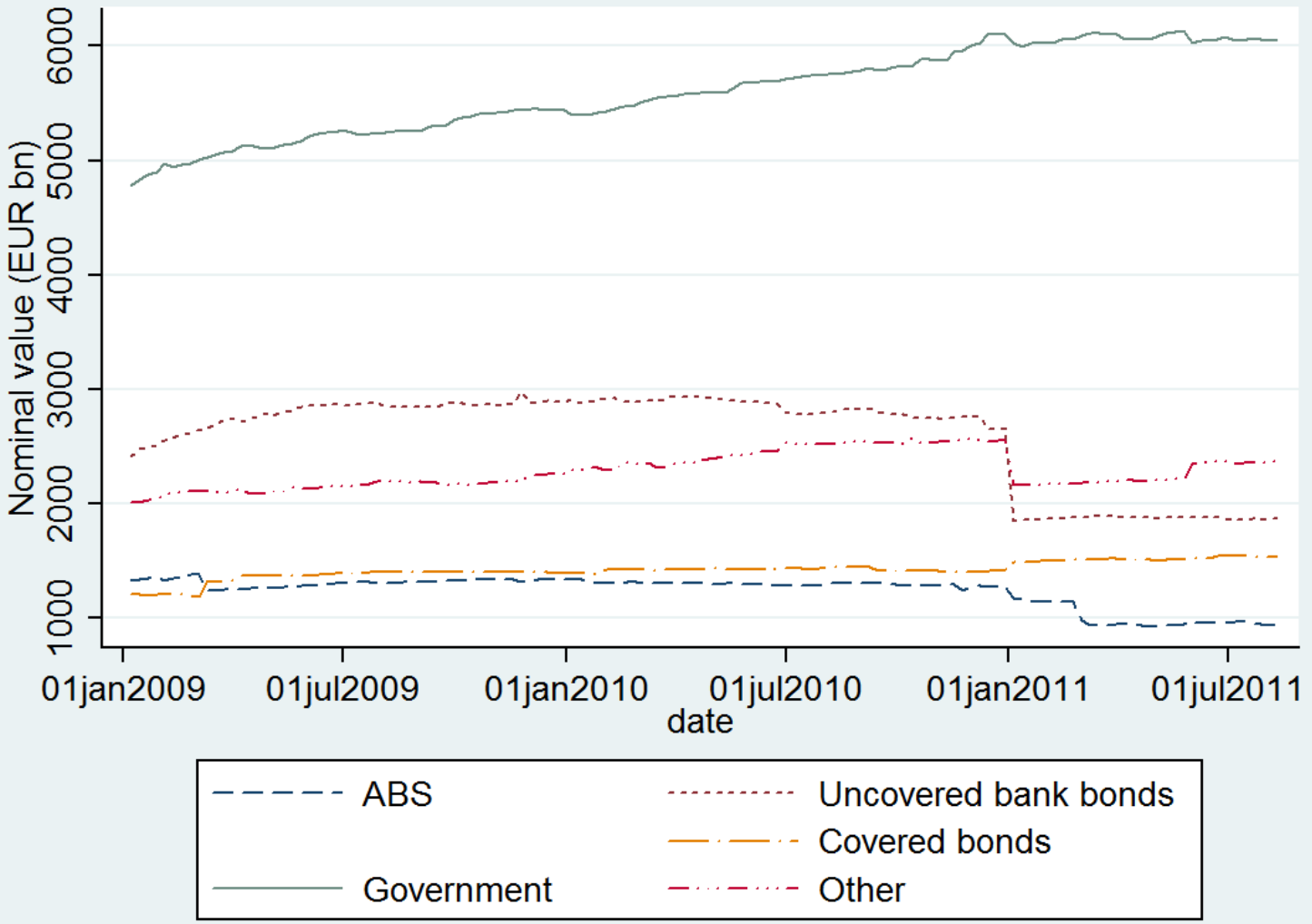
Outline

ECB collateral policy

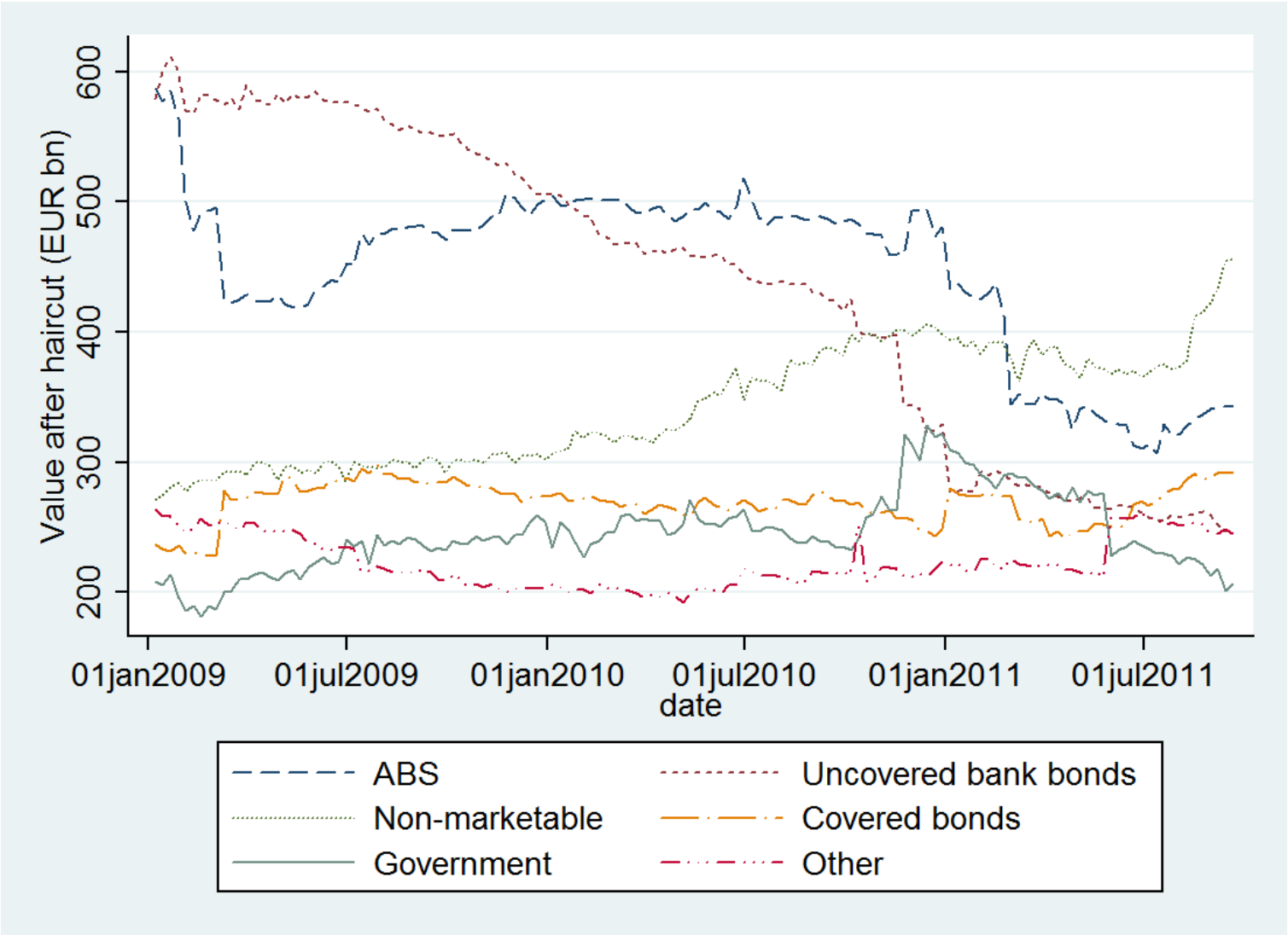
Credit quality	*Residual maturity (years)*	*Liquidity categories* Category I fixed coupon	Category I zero coupon	Category II* fixed coupon	Category II* zero coupon	Category III* fixed coupon	Category III* zero coupon	Category IV* fixed coupon	Category IV* zero coupon	Category V*
Steps 1 and 2 (AAA to A-)**	0-1	0,5	0,5	1,0	1,0	1,5	1,5	6,5	6,5	16
	1-3	1,5	1,5	2,5	2,5	3,0	3,0	8,5	9,0	
	3-5	2,5	3,0	3,5	4,0	5,0	5,5	11,0	11,5	
	5-7	3,0	3,5	4,5	5,0	6,5	7,5	12,5	13,5	
	7-10	4,0	4,5	5,5	6,5	8,5	9,5	14,0	15,5	
	>10	5,5	8,5	7,5	12,0	11,0	16,5	17,0	22,5	
		Liquidity categories								
Credit quality	*Residual maturity (years)*	Category I fixed coupon	Category I zero coupon	Category II* fixed coupon	Category II* zero coupon	Category III* fixed coupon	Category III* zero coupon	Category IV* fixed coupon	Category IV* zero coupon	Category V*
Step 3 (BBB+ to BBB-)**	0-1	5,5	5,5	6,0	6,0	8,0	8,0	15,0	15,0	Not eligible
	1-3	6,5	6,5	10,5	11,5	18,0	19,5	27,5	29,5	
	3-5	7,5	8,0	15,5	17,0	25,5	28,0	36,5	39,5	
	5-7	8,0	8,5	18,0	20,5	28,0	31,5	38,5	43,0	
	7-10	9,0	9,5	19,5	22,5	29,0	33,5	39,0	44,5	
	>10	10,5	13,5	20,0	29,0	29,5	38,0	39,5	46,0	

Source: ECB General Documentation 2010

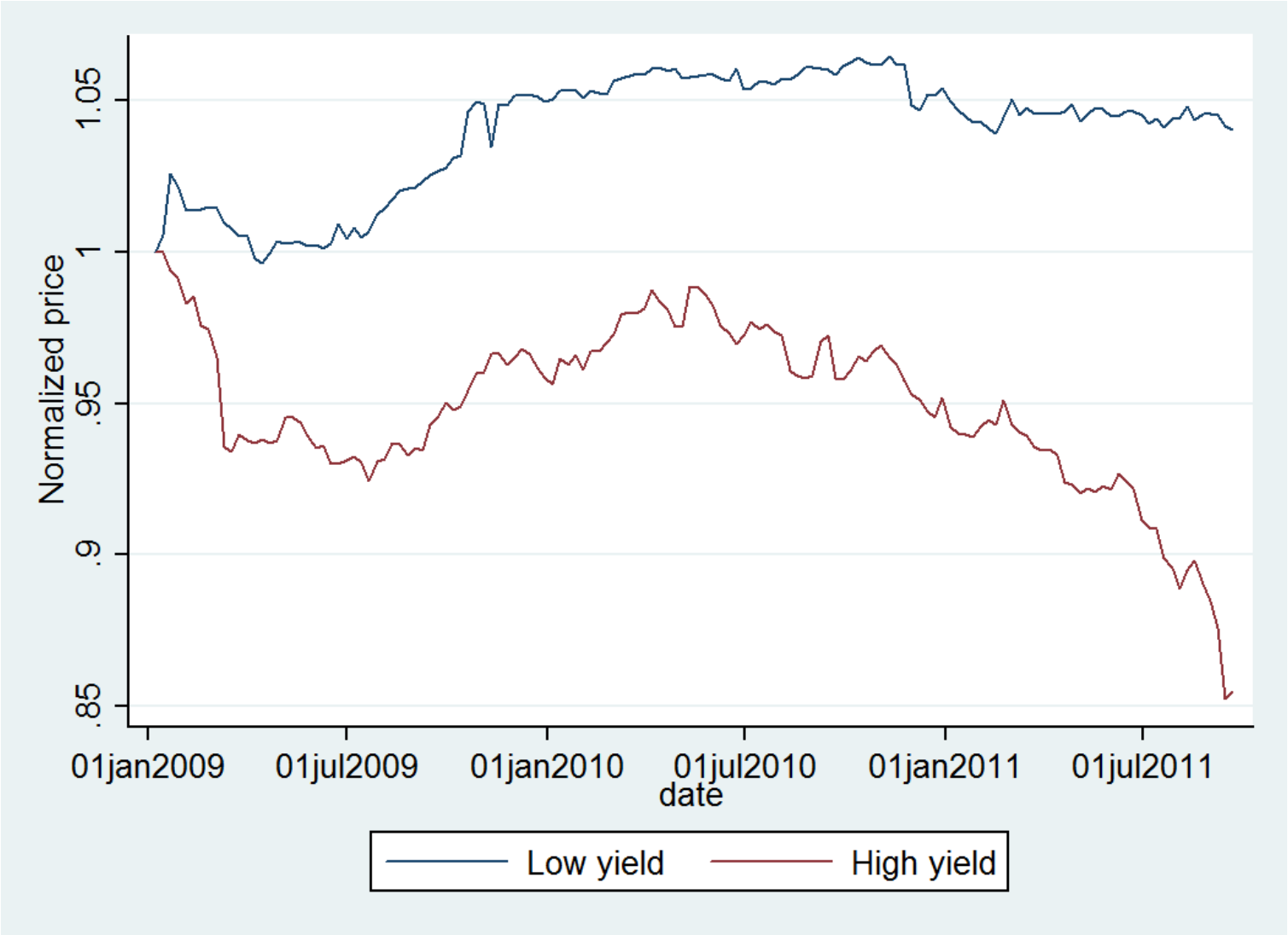
Nominal value of assets eligible as collateral



ECB collateral pool (nominal value)

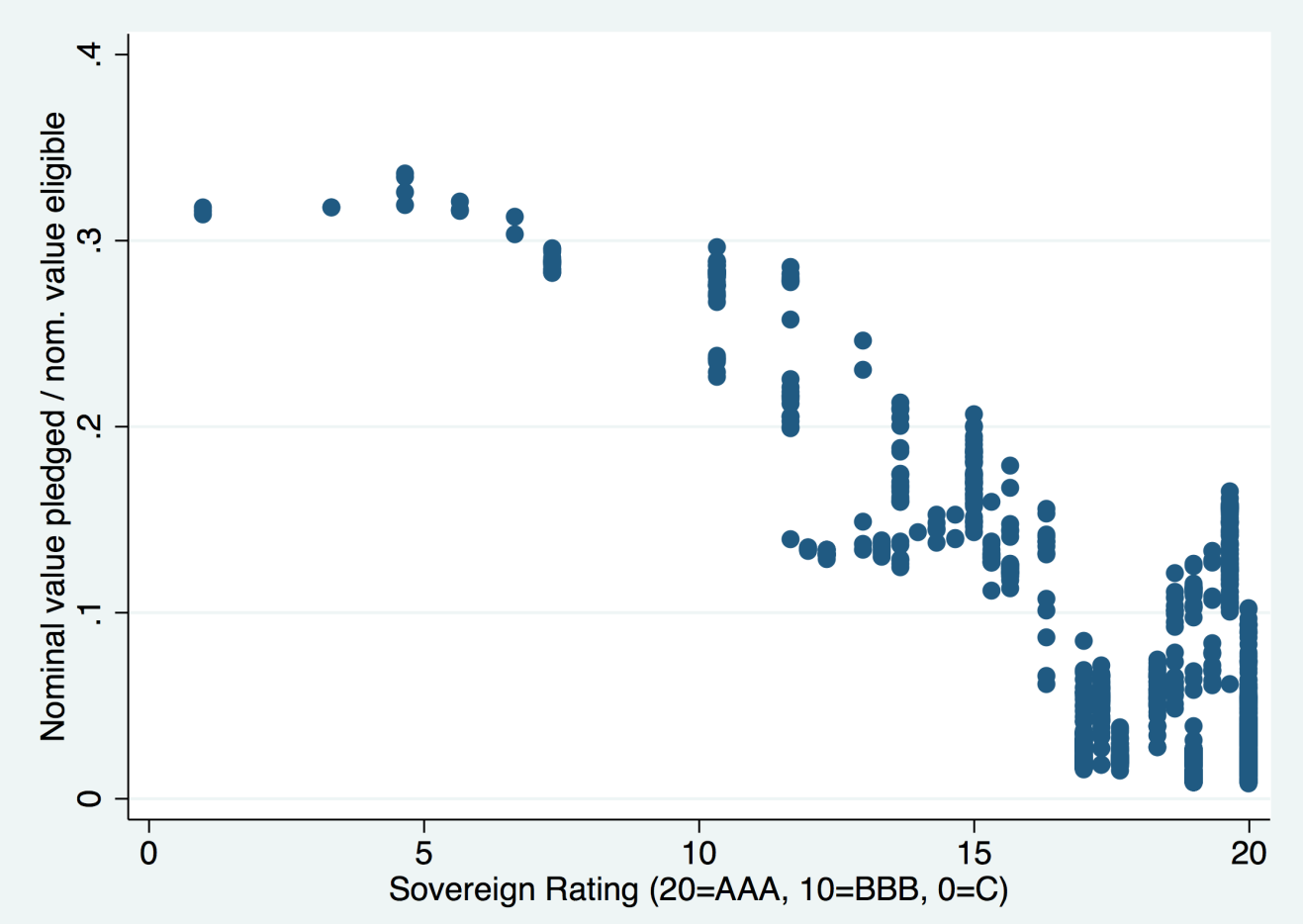


Average price of collateral: High-yield versus Low-Yield countries

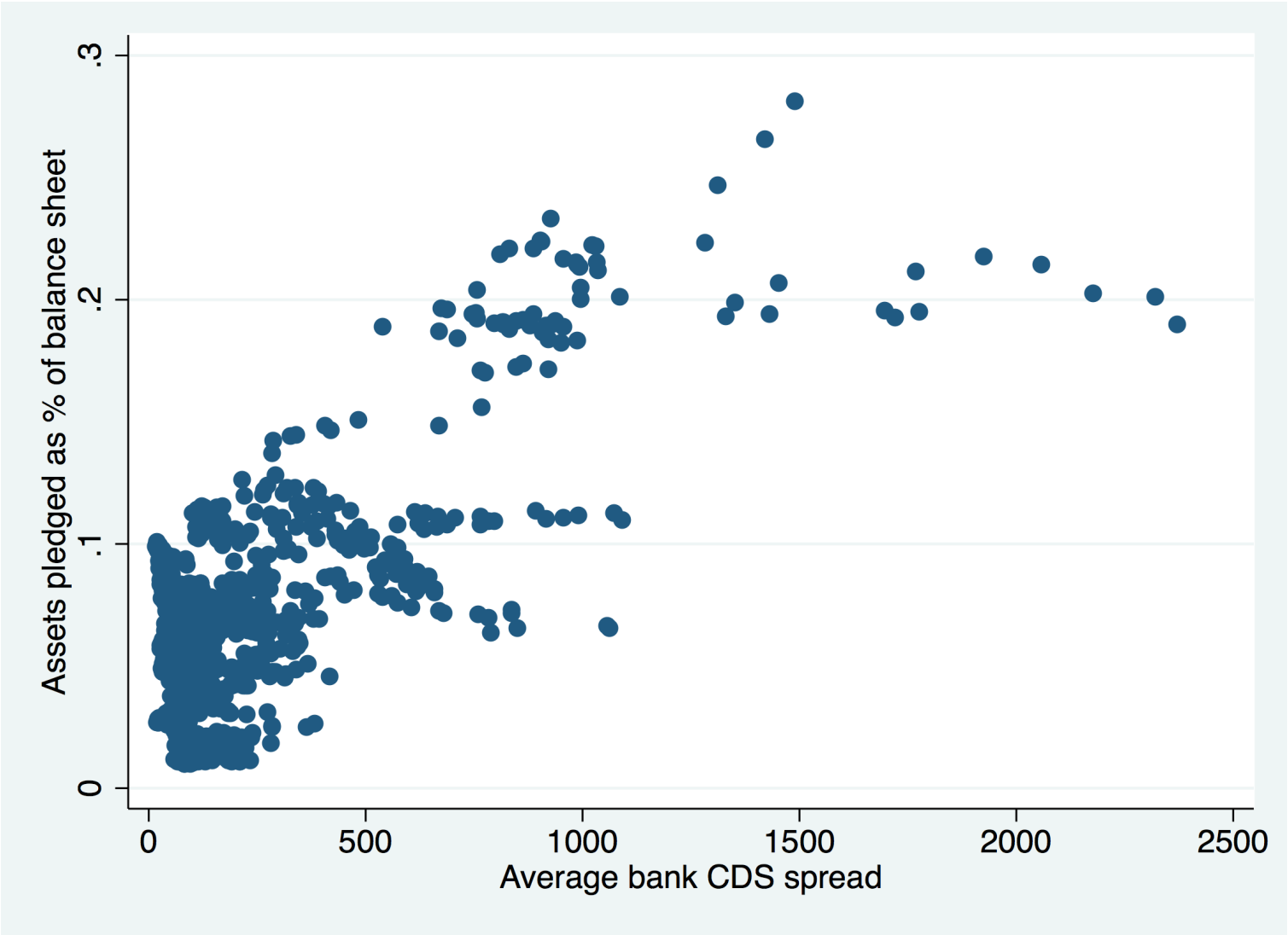


Illiquid assets (with low rating) are pledged to the central bank

Proportion of government bonds pledged to the ECB for the 10 countries in the sample (weekly)



Riskier banks borrow more from the ECB



Outline

The empirical challenge

- Collateral differs by asset characteristics (maturity, rating, asset type)
  - Example: 10 ratings, 2 maturities, 9 asset types, guaranteed or not -> 360 asset types
- The quantity of collateral j pledged by banks could be:

$$q_j = \alpha_j - \beta_j h_j + \sum_{k=1;\neq j}^{N} \gamma_{jk} h_k$$

- Challenge: large number of cross-haircut elasticities to estimate (360^2 !)
- Solution: Use insights from theory to restrict the number of parameters to estimate (similar to discrete choice logit model Mc. Fadden 1973)

Overview of empirical model

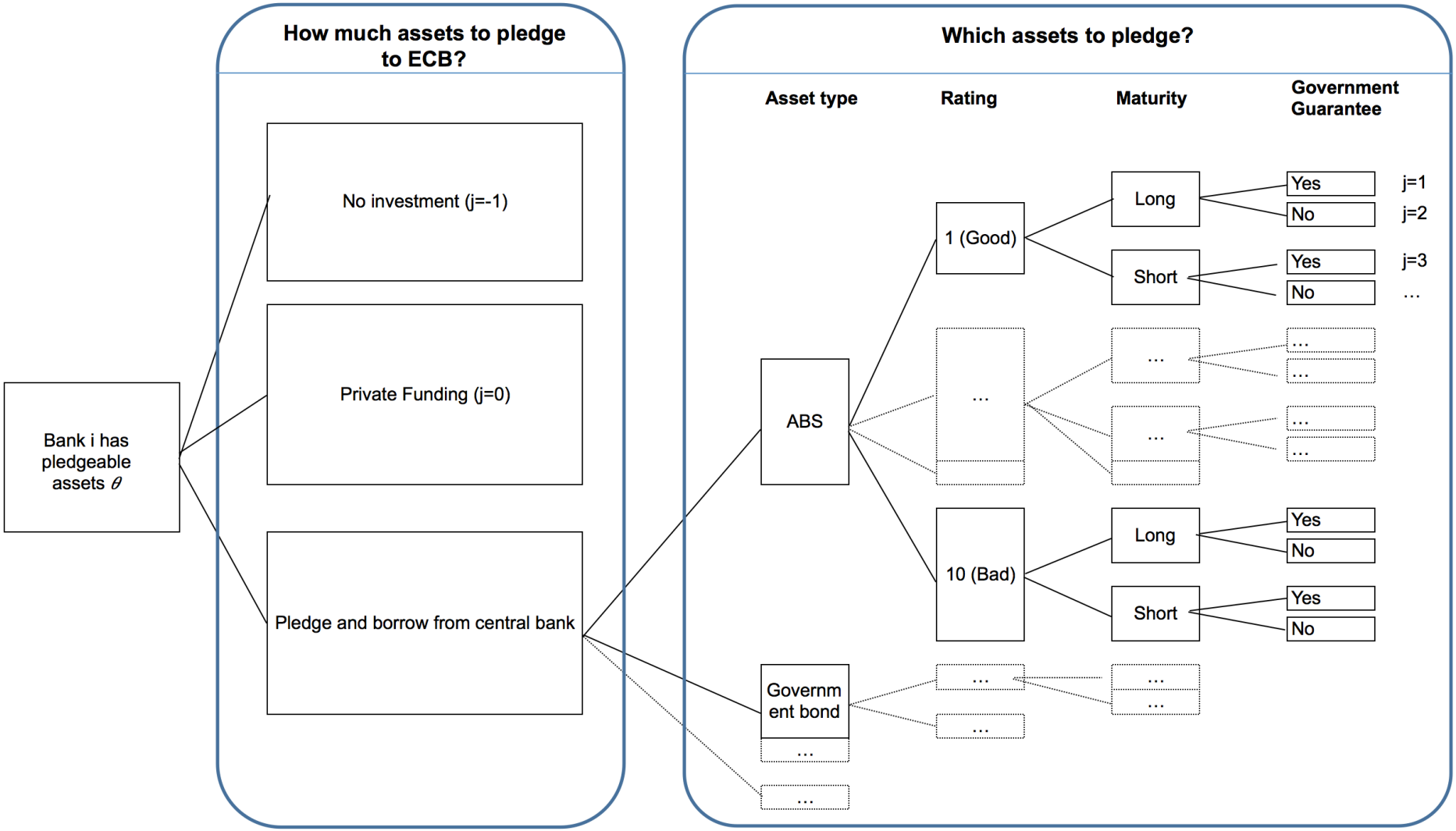
- A commercial bank has a pool of assets $(\theta_1, \theta_2, \ldots, \theta_j, \ldots, \theta_N)$
- It chooses an optimal funding and investment scheme by making repeated decisions (eg. 100 decisions for EUR 1 mln each)
- For each decision, the bank chooses
  - A funding source (private investors / central bank / no borrowing)
  - A collateral $j = 1, \ldots, N$ to use if it chooses central bank funding

Bank makes funding-investment choices

Let $X_1, \ldots, X_N$ be the amounts of collateral pledged and X_0 be the amount borrowed from the private market.
For each decision i the bank has the following funding opportunities with marginal profits π_i

- No investment: $\pi_{-1i} = 0$
- Private funding: $\pi_{0i} = R'(q) - p - k_0\left(X_{0(i)}\right)$, where $k_0\left(X_{0(i)}\right)$ is a cost of funding that depends on the amount borrowed in the private market $X_{0(i)}$
- Central bank funding collateralized by asset j:
  $\pi_{ji} = R'(q) - h_j + v_j + p + \theta_j - k\left(X_{j(i)}, X_{(i)}\right)$ where $X_{j(i)}$ is the quantity of asset j that has already been pledged as collateral as of decision i, X_j is the *total* amount of collateral pledged and $k(\cdot,\cdot)$ is an increasing cost function

Choice structure



Marginal profit specification

- Assume that the cost function is

$$K\left(X_{j(i)}, X_{(i)}\right) = \ln\left(\frac{X_{j(i)}}{X_{(i)}}\right)^{\sigma}\left(\frac{X_{(i)}}{T}\right),$$

- It can be shown (Anderson, de Palma, Thisse 1992 and Verboven, 1996) that the share of asset pledged X_j to total funding takes the nested logit form

$$\frac{X_j}{\sum_{k=0}^{N} X_k} = \frac{\exp\left(\frac{\pi_j}{1-\sigma}\right)}{\left(\sum_{k=1}^{N}\exp\left(\frac{\pi_k}{1-\sigma}\right)\right)^{\sigma}\sum_{k=0}^{N}\left(\exp\left(\frac{\pi_k}{1-\sigma}\right)\right)^{1-\sigma}}.$$

Problem can be reduced to linear IV estimation

- Normalize profit of outside good to 0
- The expression for shares can be developed to (Berry 1994)

$$\ln X_j - \ln X_0 = \frac{\tilde{\pi}_j}{1-\sigma} - \sigma \ln \left(\sum_{k=1}^{N} \exp \left(\frac{\tilde{\pi}_k}{1-\sigma} \right) \right),$$

i.e.

$$\ln \frac{X_j}{X_0} = \theta_j - h_j + v_j + p + \sigma \ln s_{jg}.$$

- The intra-group share is endogenous and calls for instruments
  - We use variations in price of other assets -> similar to Berry, Levinsohn and Pakes (1995)

Identification

We estimate

$$\ln \frac{X_j}{X_0} = \theta_j - h_j + v_j + p + \sigma \ln s_{jg}.$$

Potential concerns:

1. Endogenous haircut: the ECB's policy depends on *observable* asset characteristics
2. Intra-group share s_{jg}: use instrument (price of other collateral)
3. Country, time, country-asset type interaction effects

Outline

Estimation: overview of variables

We estimate

$$\ln(X_{jct}) - \ln(X_{0ct}) = \alpha_{jct} - \beta_1 h_{jt} + \beta_2 \text{rating}_j + \beta_3 \text{gov guar}_j + \beta_4 \text{gov guar}_j \times \text{rating}$$

$$\ldots + \beta_5 \text{rating}_{ct} + \beta_6 \text{maturity}_j + \beta_7 \text{holding}_{jct} + \epsilon_{jct}.$$

- h_{jt}: asset j's ECB haircut
- rating_j: collateral j's rating
- gov guar_j: is collateral j guaranteed by the government?
- rating_{ct}: home country's government rating
- maturity_j: maturity of collateral j
- $\alpha_c + \alpha_j + \alpha_{cj}$: Country, time, country-asset type interaction effects

Results

	(1) $log(X_{jct}/X_{gct})$	(2) $log(X_{cjt}/X_{c0t})$	(3) $log(X_{cjt}/X_{c0t})$	(4) $log(X_{cjt}/X_{c0t})$
Haircut	-0.360*		2.614	-1.589*
	(0.205)		(2.402)	(0.874)
price	-0.945**		1.673	-1.014**
	(0.399)		(1.378)	(0.465)
Share of CB funding s_{jg} (instrumented)	0.905**		1.685**	0.594**
	(0.0752)		(0.594)	(0.211)
Gov. guaranteed asset	-0.255		1.704	-1.015*
	(0.170)		(1.494)	(0.527)
Gov. guarantee × gov. rating	-0.0278*		0.171	-0.100*
	(0.0167)		(0.149)	(0.0533)
Asset rating	0.0297		-0.206	0.122*
	(0.0231)		(0.179)	(0.0634)
Country c's gov. rating	-0.190**		-0.315**	-0.116**
	(0.00953)		(0.127)	(0.0440)
Maturity	-0.166		1.263	-0.744*
	(0.169)		(1.083)	(0.385)
Available collateral θ	-0.000000139*		0.000000179	0.000000450*
	(7.68e-08)		(0.000000344)	(0.000000253)
Time	No	Yes	No	Yes
Asset-country interaction	No	Yes	Yes	Yes
Observations	116612	125971	116612	116612
R^2	0.188	0.126	0.301	0.302

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$

Policy counterfactuals: Impact of 1% haircut increase

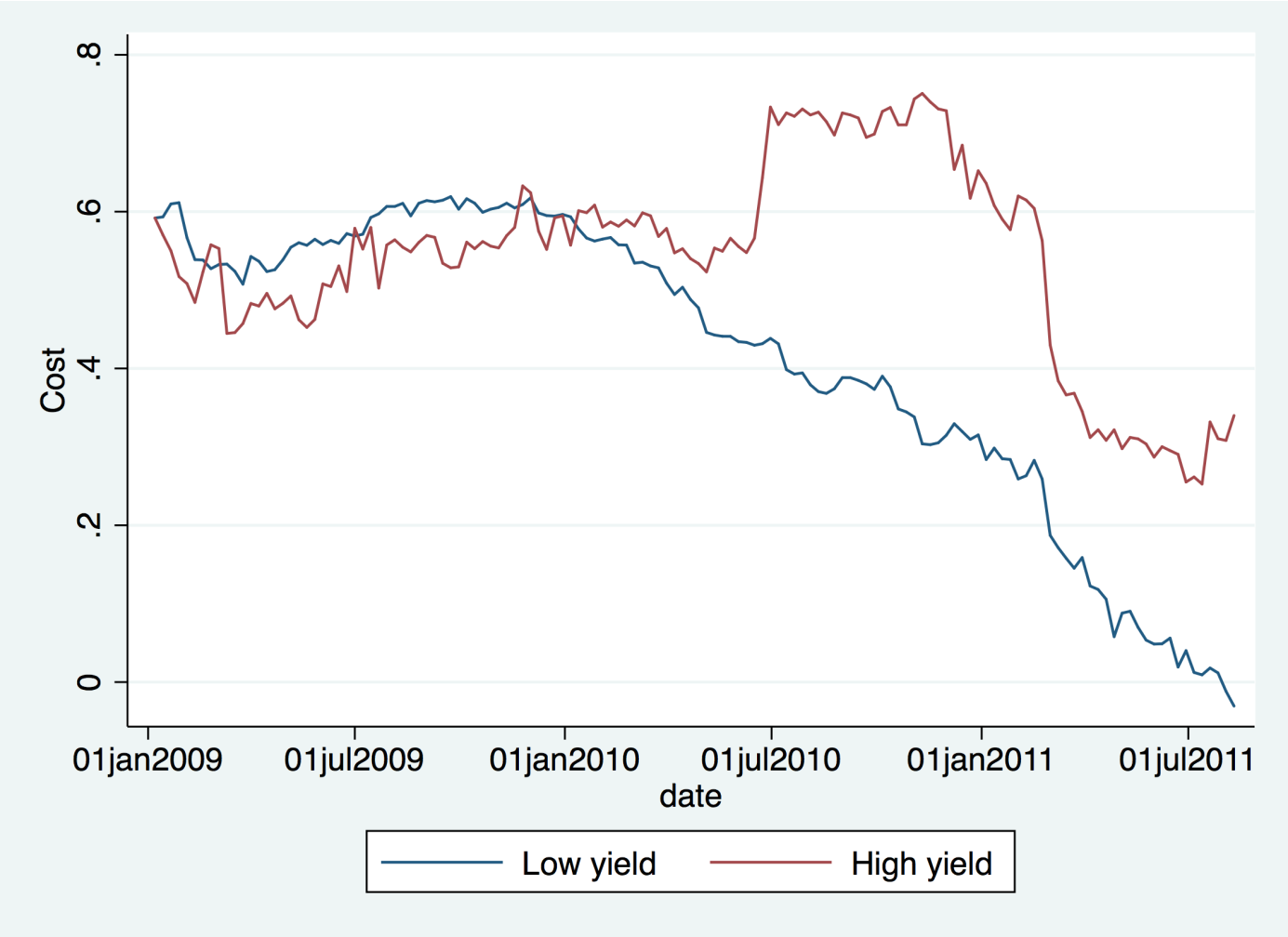
Table 5: Nested logit: Impact of a 1 % increase in haircut by asset class (relative terms)

		Impact of 1% haircut increase of						
	Initial share	Gov	ABS	Pfand	Uncov	Corp	Reg	Jumbo
Government	0.0629	-3.47%	0.95%	0.40%	0.84%	0.16%	0.11%	0.10%
ABS	0.1350	0.44%	-2.97%	0.40%	0.84%	0.16%	0.11%	0.10%
Pfandbriefe	0.0563	0.44%	0.95%	-3.52%	0.84%	0.16%	0.11%	0.10%
Uncovered	0.1200	0.44%	0.95%	0.40%	-3.07%	0.16%	0.11%	0.10%
Corporate	0.0231	0.44%	0.95%	0.40%	0.84%	-3.75%	0.11%	0.10%
Regional G	0.0162	0.44%	0.95%	0.40%	0.84%	0.16%	-3.80%	0.10%
Jumbo	0.0142	0.44%	0.95%	0.40%	0.84%	0.16%	0.11%	-3.82%
Total CB	0.4277	-0.13%	-0.29%	-0.12%	-0.26%	-0.05%	-0.03%	-0.03%

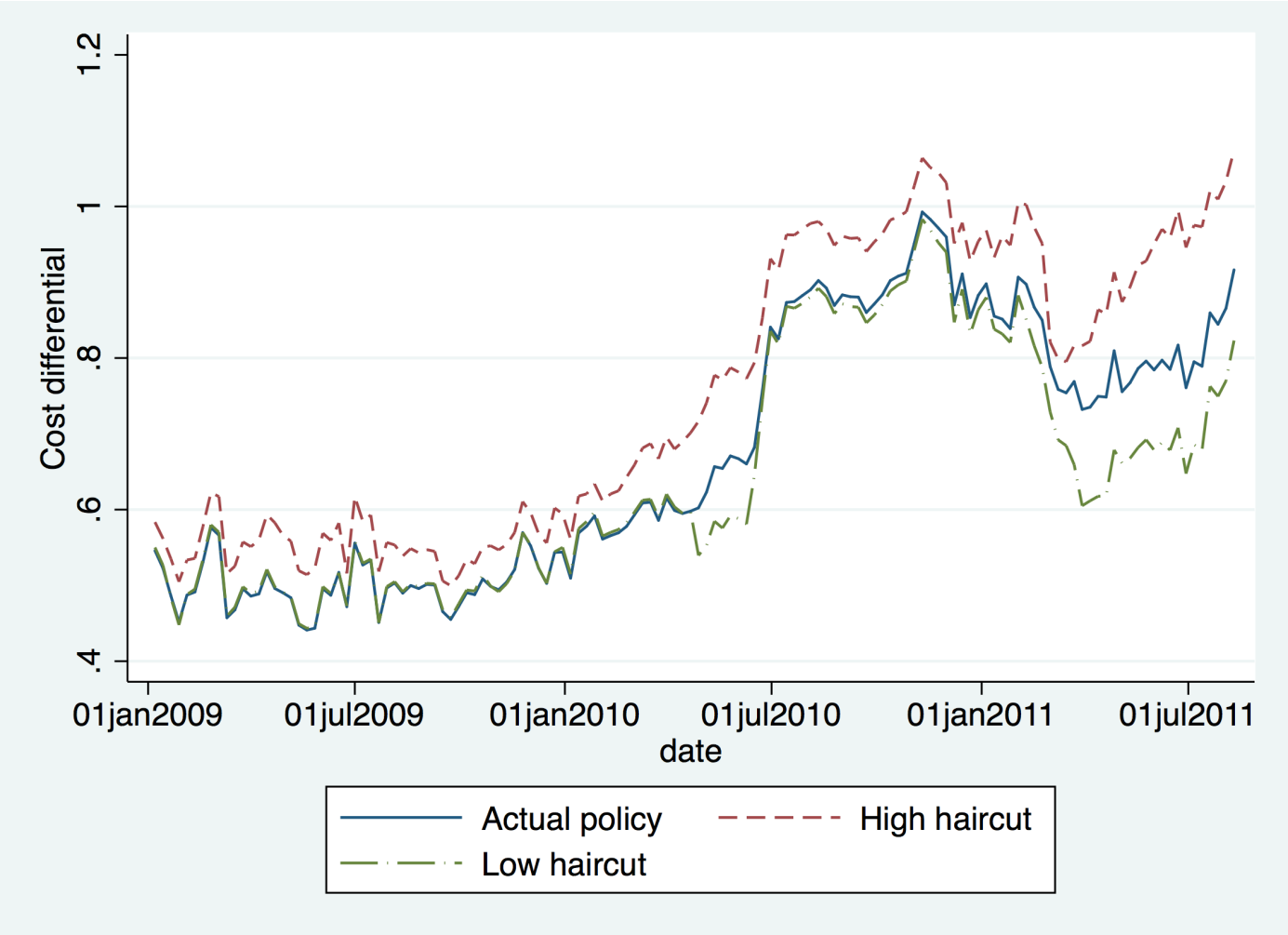
Policy counterfactuals: Impact of 10% haircut increase on non-investment grade government bonds

	Impact on low yield countries			Impact on high yield countries		
Asset	Initial share	Absolute	Relative	Initial share	Absolute	Relative
Gov. above A-	2.11%	0.03%	1.42%	3.65%	0.16%	4.29%
Gov. below A-	1.08%	-0.41%	-37.74%	5.64%	-1.97%	-34.86%
ABS	6.18%	0.09%	1.42%	12.93%	0.55%	4.29%
Pfandbriefe	3.22%	0.05%	1.42%	6.84%	0.29%	4.29%
Uncovered bank b	5.03%	0.07%	1.42%	6.56%	0.28%	4.29%
Corporate bonds	0.56%	0.01%	1.42%	2.23%	0.10%	4.29%
Regional governm	1.29%	0.02%	1.42%	0.29%	0.01%	4.29%
Jumbos	0.78%	0.01%	1.42%	0.52%	0.02%	4.29%
Total central bank	20.25%	-0.14%	-0.68%	38.67%	-0.55%	-1.42%

Counterfactual private funding cost in low- and high-yield countries



Cost differential under various haircut policies



Outline

Conclusion: The impact of collateral policy on banks' funding cost varies with bank- and asset-characteristics

- We use an original econometric approach to study the collateral channel of monetary policy
- Our results can predict the collateral pool under various collateral policy scenarios
- We find that collateral policy has a differentiated impact on banks' funding cost
- Suggests that collateral policy could complement the interest rate tool to transmit monetary policy in the Euro area

Thank you for your attention

Questions?