"Who bears interest rate risk?"

Peter Hoffmann (ECB/DG-R)

Sam Langfield (ESRB)

Federico Pierobon (ECB/SSM)

Guillaume Vuillemey (HEC Paris)

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Disclaimer: The views expressed are those of the presenter and do not necessarily reflect those of the ECB and/or the Eurosystem.

Intro

- We study banks' exposure to interest rate risk (IRR)
- Relevant for
  - monetary policy ("bank lending channel")
  - financial stability (e.g. S&L crisis, ECB IRR stress test)
- Laboratory: Euro area
  - institutions from 18 countries $\rightarrow$ heterogeneity

What we do

- We combine two new datasets
  - supervisory balance sheet data
  - transaction-level derivatives data
- We compute banks' exposure to interest rate risk
  - three measures, consistent results
- Study cross-sectional variation
- Hedging

What we find

- Banks bear relatively little IRR on aggregate
  - average exposures are close to zero
- Exposures are hetereogeneous
  - some banks gain, some lose
  - significant variation across countries
  - little variation across business models

What we find

- We examine the role of mortgage market design
  - important asset class
  - cross-country heterogeneity
- Loan-rate fixation conventions explain variation in banks' exposures
  - a simple partition accounts for up to 1 SD of dispersion
  - exposures are systematically related to retail lending
- Banks hedge $\sim 25\%$ of exposures via interest rate swaps
  - higher on-balance sheet exposures $\rightarrow$ more hedging
  - risk-sharing between heterogeneous banks (incomplete)

Related Literature (incomplete)

- Interest rate risk in banking: Hellwig (1994), Flannery and James (1984), Begenau, Piazzesi & Schneider (2015), Gomez, Landier & Thesmar (2016), English, Van den Heuvel & Zakrajsek (forthcoming), Drechsler, Savov & Schnabl (2018), Di Tella & Kurlat (2018)
- Risk management in financial institutions: Purnanandam (2007), Rampini and Viswanathan (2010, 2013), Rampini, Viswanathan & Vuillemey (2017), Vuillemey (2017)
- "Bank lending channel": Bernanke and Blinder (1988), Bernanke and Gertler (1989), Kashyap and Stein (1995, 2000), Jimenez, Ongena, Peydro and Saurina (2012), Brunnermeier & Sannikov (2016), Drechsler, Savov & Schnabl (2017)

Data & Measurement

Data

- ECB supervisory statistics
  - focus on "banking book"
  - breakdown of assets & liabilities into 14 maturity buckets
  - information on behaviour of sight deposits
- EMIR data
  - transaction-level data on derivatives positions
  - contract details + counterparty IDs
  - focus on interest rate swaps (IRS)
- single snapshot from 31/12/2015
  - $N = 104$, covering 97% of SSM assets
- Time-series information on net interest margin
  - Bankscope, annual data since 1999 (N=102)

Measurement

- We use three different measures of interest rate risk
  - 2 based on balance sheet data + 1 using income time series
- Net-worth sensitivity ("DV1")

$$\Delta PV = \sum_{t=0}^{\infty} \frac{CF_t^A - CF_t^L}{(1 + r_t + \Delta r)^t} - \sum_{t=0}^{\infty} \frac{CF_t^A - CF_t^L}{(1 + r_t)^t}.$$

- Projected change in NIM (based on 1-year "income gap")

$$\Delta NIM = (CF_1^A - CF_1^L) \times \Delta r$$

- DSS-β

$$\Delta NIM_t = \alpha + \sum_{s=0}^{S} \beta_s^{NIM} \cdot \Delta r_{t-s} + \epsilon_t.$$

Measurement

- Sight deposits require particular treatment
  - significant part of liabilities
  - sticky $\rightarrow$ effectively term liabilities
- In practice, banks model deposit behaviour
- We calibrate deposits based on supervisory data

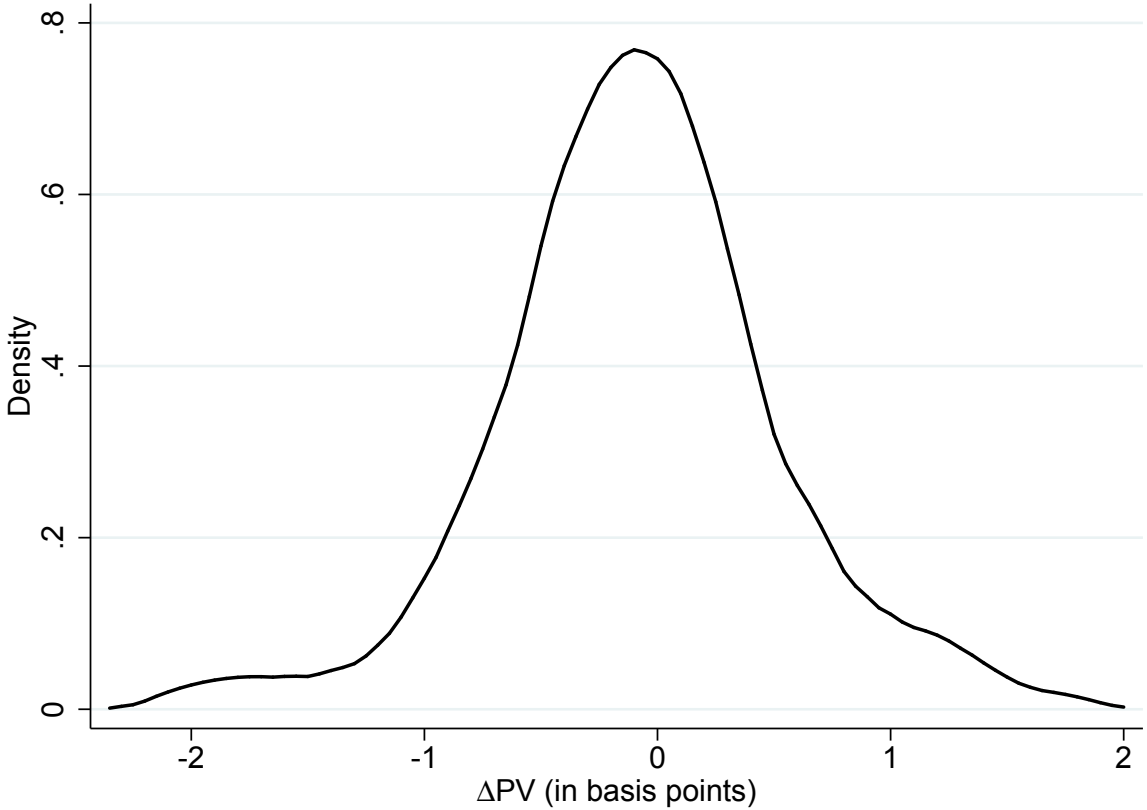
Duration of Sight Deposits

	Mean	StDev	P25	Median	P75
Retail Sight Deposits	2.00	1.56	0.15	2.03	3.13
Corporate Sight Deposits	1.02	1.24	0.00	0.33	1.82
Other Sight Deposits	0.00	0.00	0.00	0.00	0.00
Total Sight Deposits	1.48	1.32	0.01	1.45	2.48

- Durations are correlated with pass-through from market to deposit rates

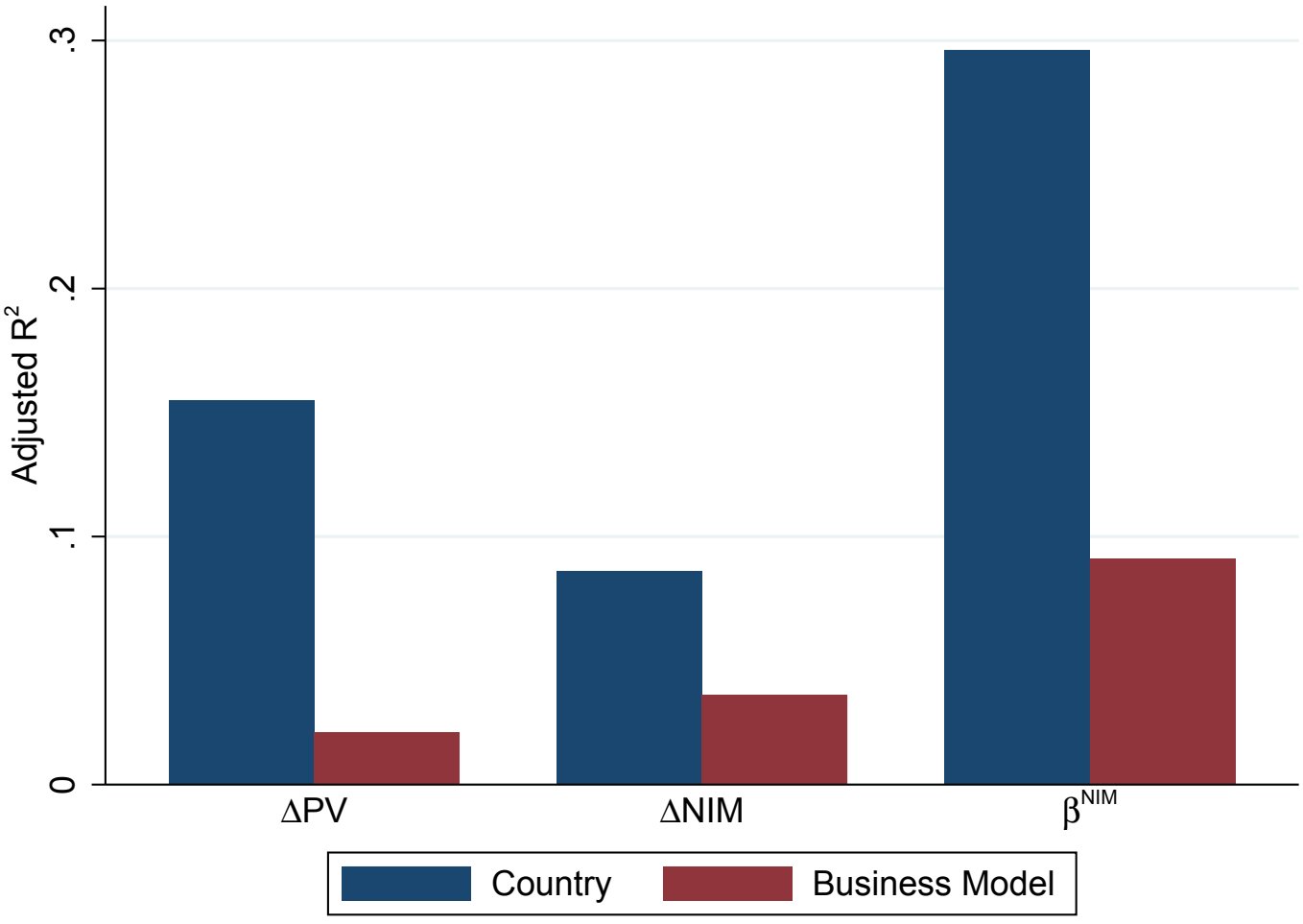
Banks' exposure to IRR

The cross-section of exposures



	Mean	StDev	P25	Median	P75
ΔPV	-0.09	0.57	-0.38	-0.07	0.22

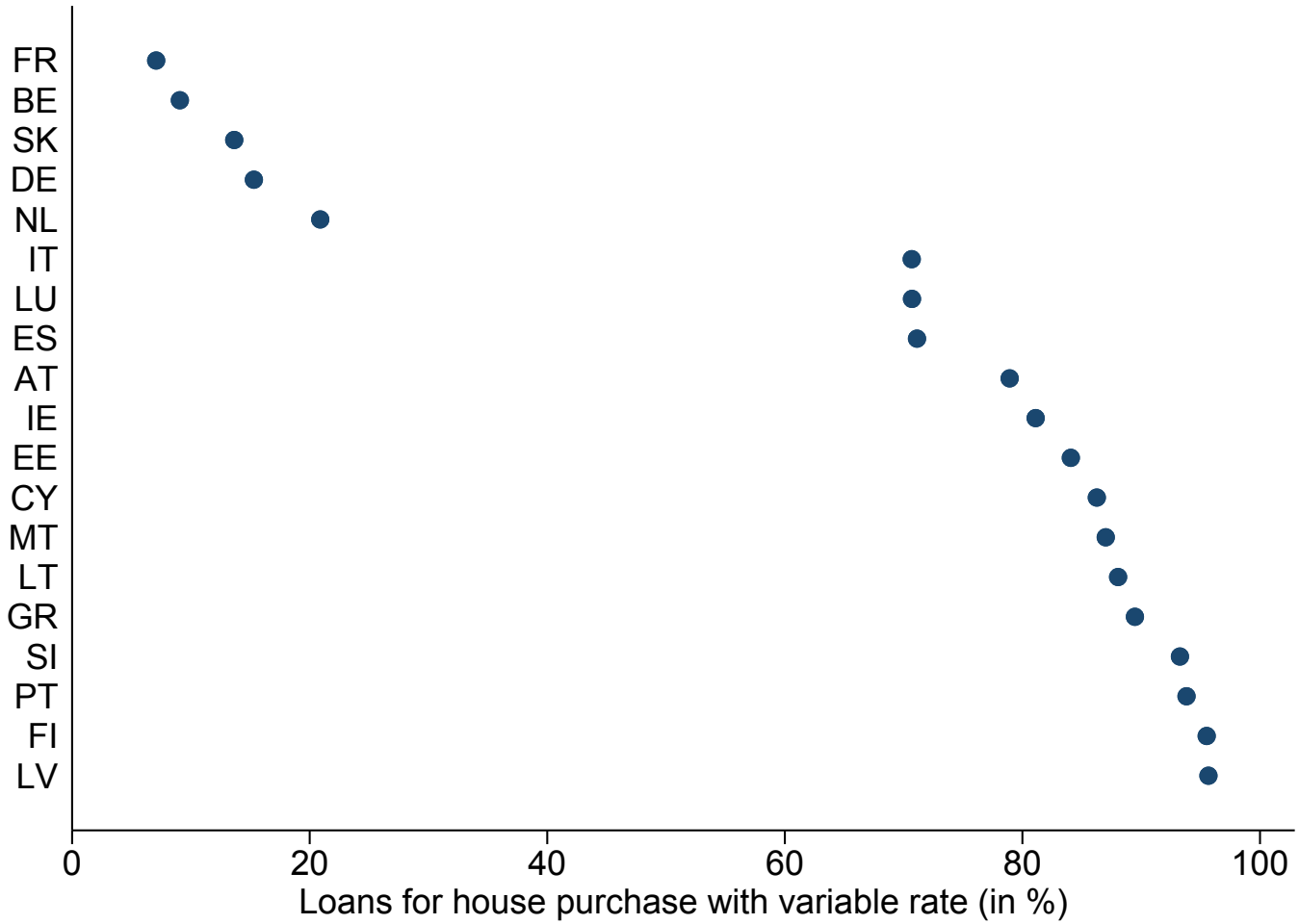
Drivers of dispersion - country vs. business model



A role for mortgage markets?

- Mortgages are an important part of bank assets
  - strong growth since 80s (Jorda, Schularick and Taylor, 2016)
  - $>$ 35% of total lending in Euro area
- Mortgages markets differ in design (Campbell, 2012)
  - one important dimension: loan-rate fixation
  - matters for interest rate risk
  - highly heterogeneous in the Euro area

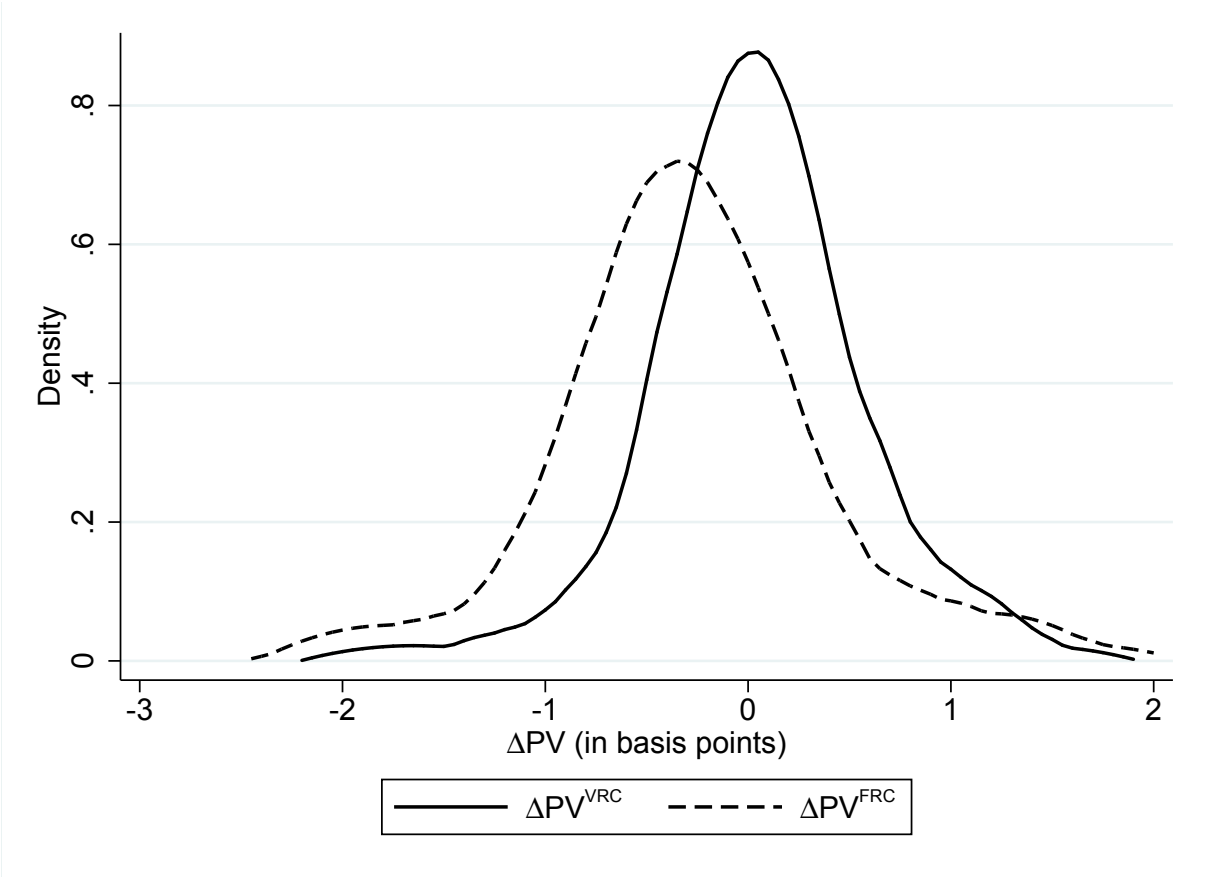
Loan-rate fixation conventions



Loan-rate fixation conventions

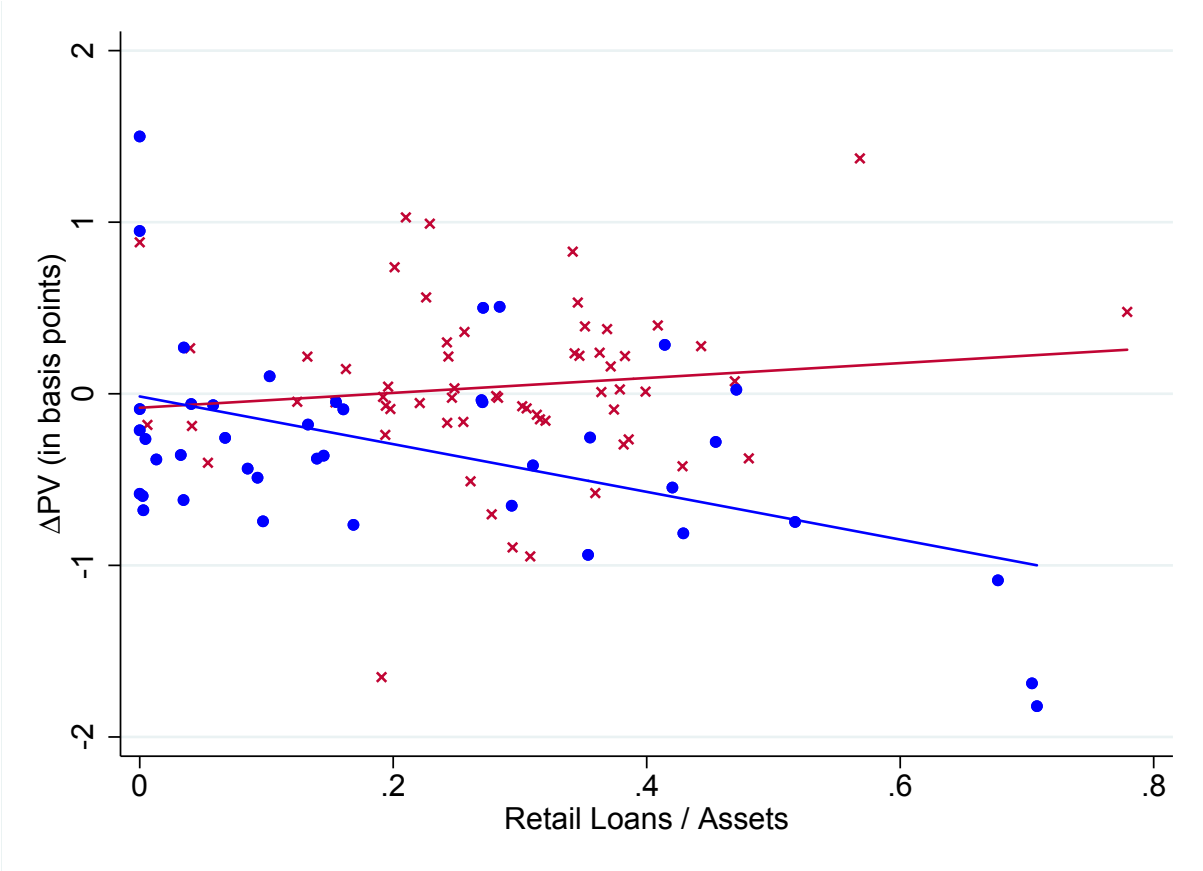
- We argue: loan-rate fixation conventions are **exogenous** for banks
  - affect supply of long-/short-maturity loans
  - prevent maturity-matching of assets & liabilities
- Supporting arguments
  - Albertazzi et al. (2017): mortgages from cross-border banks line up with local conventions
  - Campbell (2012): heterogeneity persists in Euro area, despite market integration and convergence in inflation
  - low time-series volatility within countries
- We split banks into 2 country groups (variable- vs. fixed-rate)

Heterogeneity across country groups



- Difference in means $= 0.35$ ($\sim 60\%$ of one SD)

The role of retail loans (85% mortgages in Euro area)



- Mean(Retail Loans/Assets) = 0.25
- Difference at mean = 0.46 ($\sim$ 80% of one SD)

Explaining exposures

	(1)	(2)	(3)	(4)
	ΔPV	ΔPV	ΔPV	ΔPV^{BS}
VRM	0.348**	-0.066	0.020	-0.035
	(2.40)	(-0.25)	(0.12)	(-0.13)
Retail Loans/Assets		-1.390*	-1.768***	-1.585*
		(-2.07)	(-3.09)	(-2.00)
VRM × *Retail Loans/Assets*		1.824**	1.748**	2.182**
		(2.20)	(2.59)	(2.18)
R-squared	0.096	0.210	0.306	0.386
N	104	104	104	104
BM FE	No	No	Yes	Yes

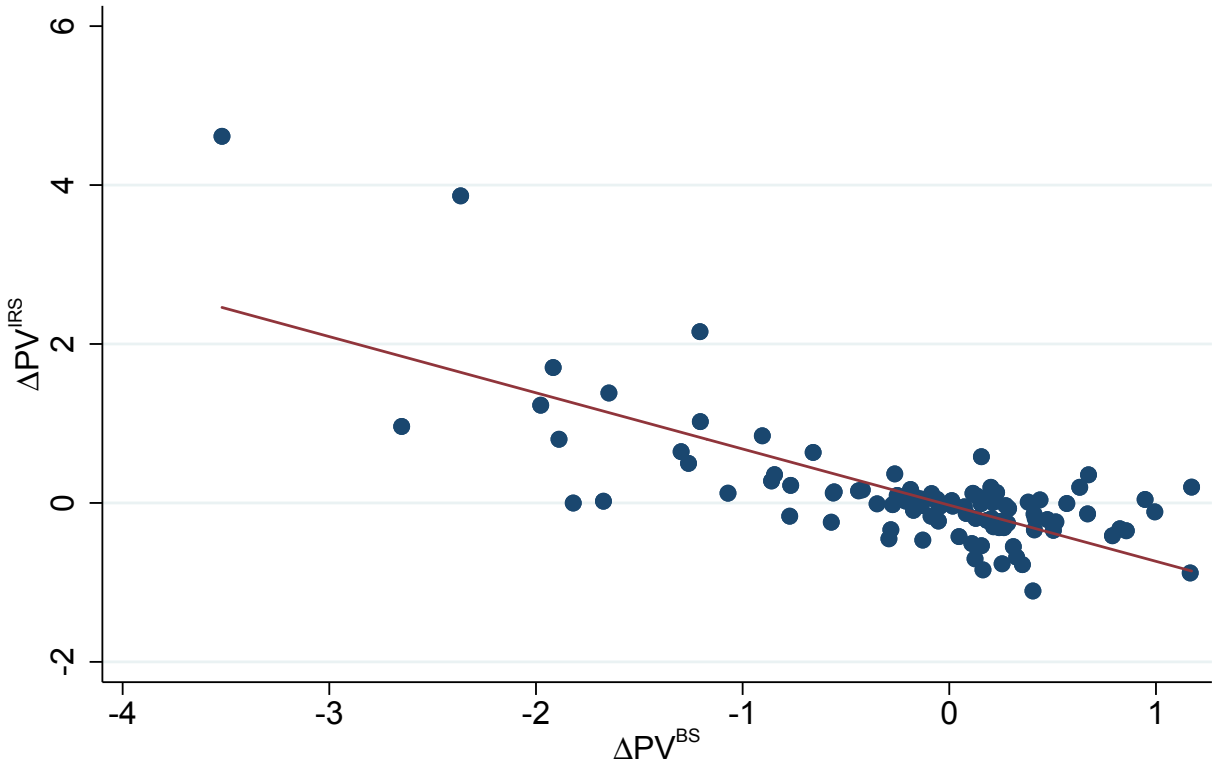
- $VRM = 1$ for banks from variable-rate countries (0 otherwise)

Explaining the asset side

	(1)	(2)	(3)	(4)	(5)
	ΔPV^{Assets}	ΔPV^{Assets}	ΔPV^{Assets}	ΔPV^{Loans}	ΔPV^{Sec}
$\Delta PV^{Liabilities}$	0.736***	0.606***	0.617***	0.405***	0.212***
	(10.17)	(8.24)	(9.75)	(4.42)	(4.55)
VRM		0.668***	0.189	0.364***	-0.175
		(3.49)	(1.08)	(3.81)	(-1.05)
Retail Loans/Assets			-1.386*	-1.586***	0.199
			(-1.89)	(-3.22)	(0.52)
VRM $\times$ *Retail Loans/Assets*			2.003**	1.811***	0.192
			(2.35)	(3.36)	(0.36)
R-squared	0.519	0.636	0.681	0.675	0.281
N	104	104	104	104	104

Hedging

Hedging - on- vs. off-balance sheet exposures



β = -0.707, t-stat = -4.44

α = -0.028, t-stat = -0.40

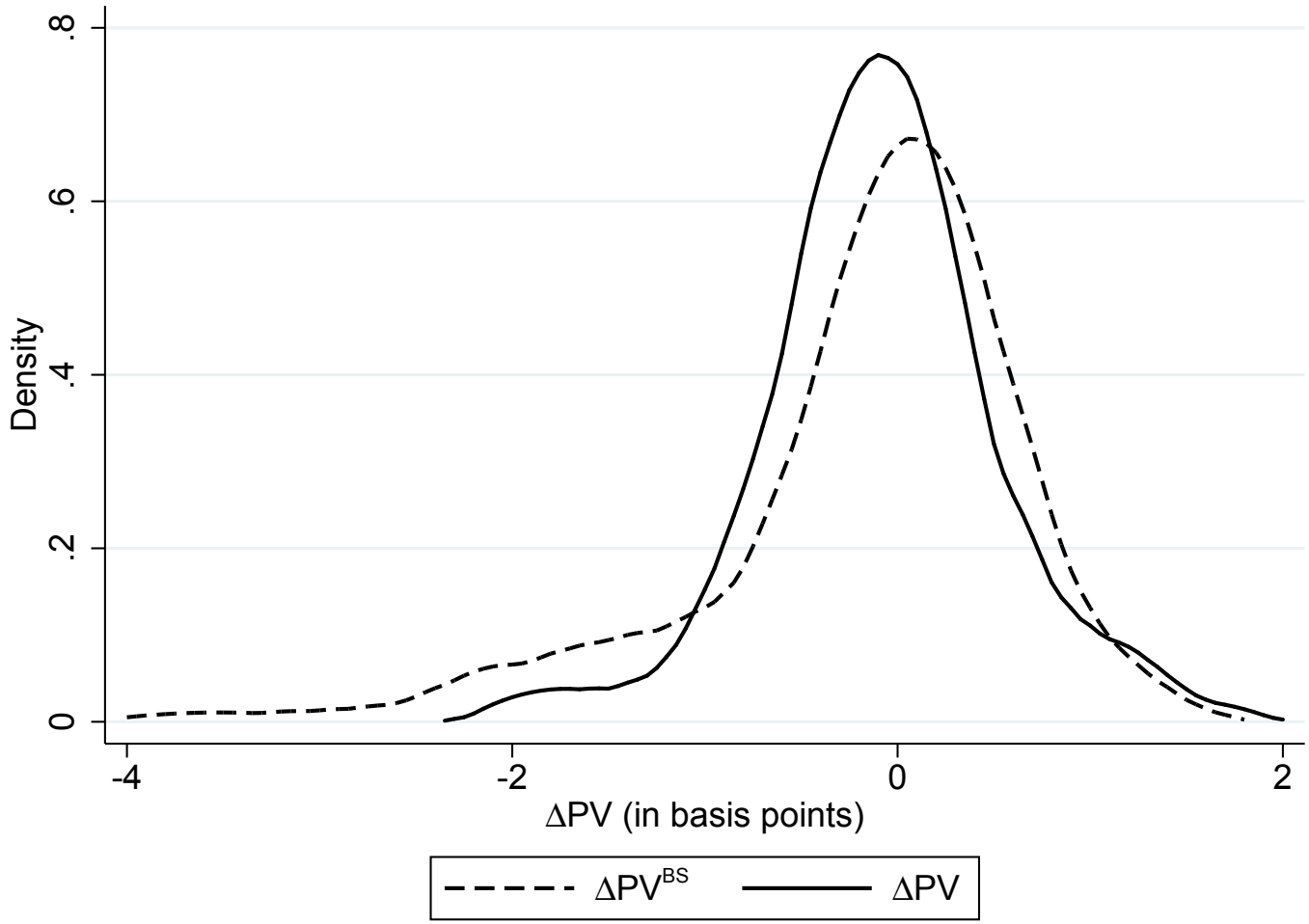
Hedging

- Hedging = reduction of exposures (independent of sign)

	Mean	StDev	P25	Median	P75
$\lvert\Delta PV^{BS}\rvert$	0.54	0.62	0.16	0.28	0.72
$\lvert\Delta PV\rvert$	0.40	0.39	0.09	0.27	0.57
$\lvert\Delta PV\rvert - \lvert\Delta PV^{BS}\rvert$	-0.14	0.44	-0.21	-0.04	0.04
$log(\lvert\Delta PV\rvert) - log(\lvert\Delta PV^{BS}\rvert)$	-0.29	1.02	-0.63	-0.24	0.25
H0: $\lvert\Delta PV^{BS}\rvert - \lvert\Delta PV\rvert = 0$	p-value = 0.030, t-statistic = -2.36				
H0: $log(\lvert\Delta PV\rvert) - log(\lvert\Delta PV^{BS}\rvert) = 0$	p-value = 0.008, t-statistic = -3.02				

- Banks hedge valuation risk, not income risk
  - consistent with hedge accounting rules
- Exposures are reduced by $\sim 25\%$

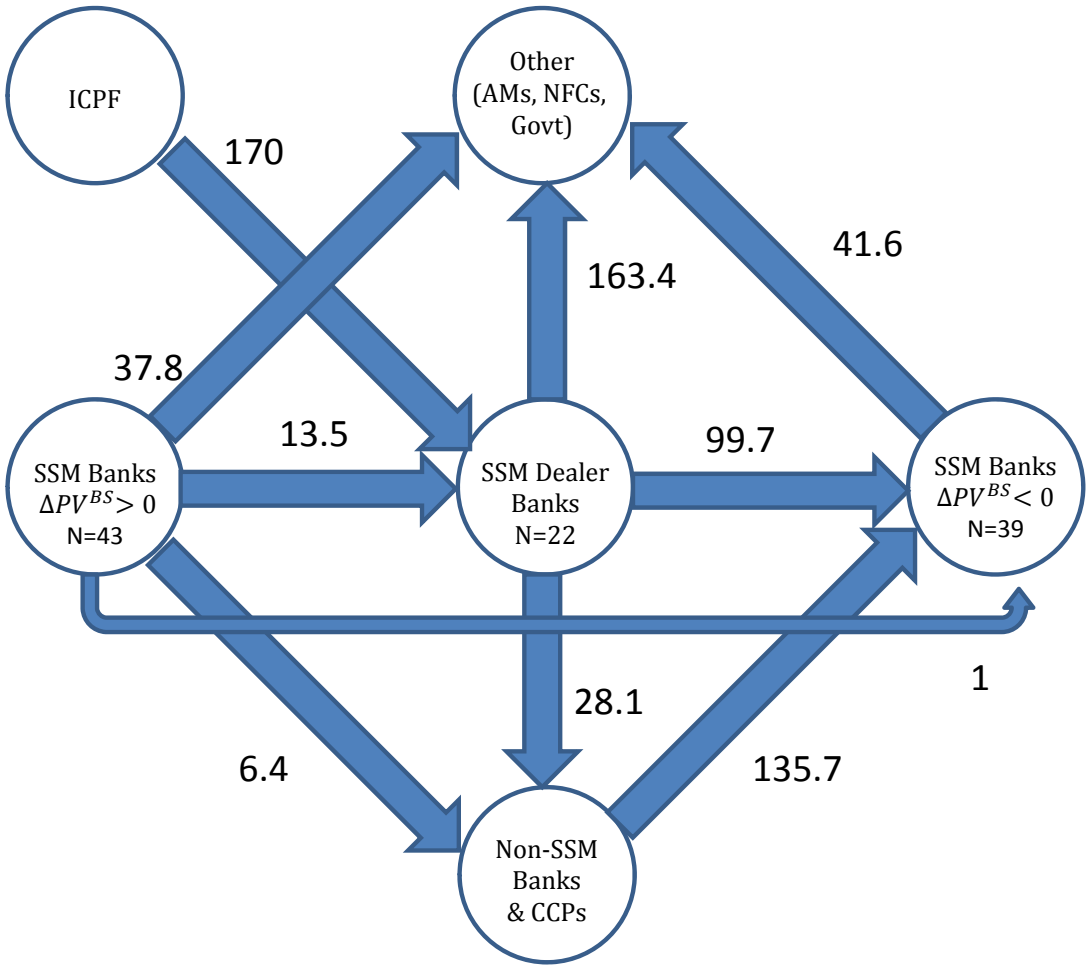
Exposures before and after hedging



Intensity of hedging

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\lvert\Delta PV^{BS}\rvert$	-0.348*					-0.396**	-0.462**	-0.384**	-0.392**
	(-1.88)					(-2.26)	(-2.35)	(-2.21)	(-2.30)
Opp. Sign		-0.570**				-0.621**	-0.636**	-0.667**	-0.593**
		(-2.24)				(-2.53)	(-2.60)	(-2.55)	(-2.83)
VRM			-0.099				-0.304		
			(-0.40)				(-1.34)		
%NPL				0.980				1.132	
				(0.97)				(1.56)	
Size					0.110				0.057
					(0.99)				(0.70)
R-squared	0.111	0.132	0.079	0.089	0.089	0.174	0.186	0.191	0.177
N	104	104	104	104	104	104	104	104	104

Risk-sharing in the IRS market

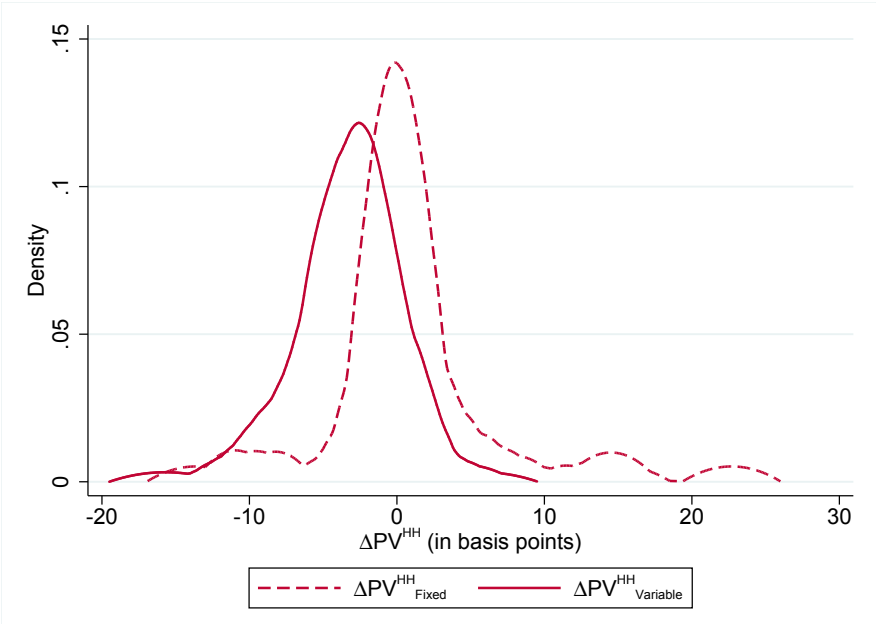


Policy implications - banks

- Recent models stress the re-distributive effects of MP between banks and non-financial sector
  - Brunnermeier & Sannikov (2016), Diamond & Rajan (2012)
  - "stealth recapitalization"
- Our findings suggest
  - these effects need not be large
  - re-distributive effects *within* banking sector are larger
- We estimate (+25 bps shock)
  - non-financial sector $\longrightarrow$ banks: €4.6 billion
  - banks $\longleftrightarrow$ banks: €6.6 billion

Policy implications - households

- Banks also reveal some information about households' exposures
  - deposits=assets, loans=liabilities
- We find the same cross-country heterogeneity



- IRR is borne by different sectors across euro area countries
  - potential challenge for montary policy

Conclusions

- We examine banks' exposure to interest rate risk
  - novel data for on- and off-balance sheet exposures
- Banks bear little interest rate risk on aggregate
- Exposures are heterogeneous
- Loan-rate conventions in mortgage markets explain cross-sectional variation
- Banks use swaps to reduce exposures, but hedging is incomplete
- Policy implications