

# Aggregate and Regional Implications of Bank Heterogeneity to the Bank-Lending Channel of Monetary Policy in Monetary Union

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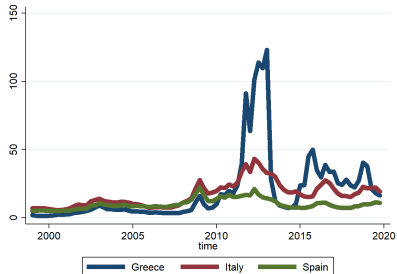
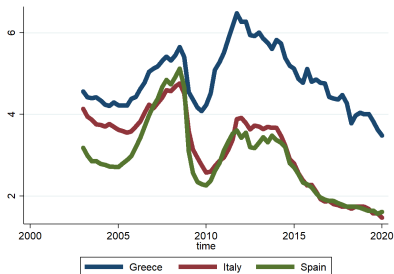
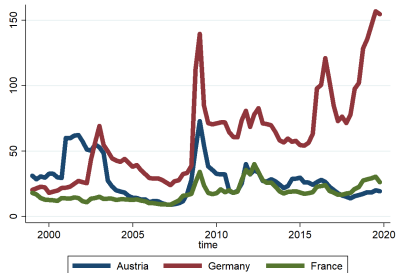
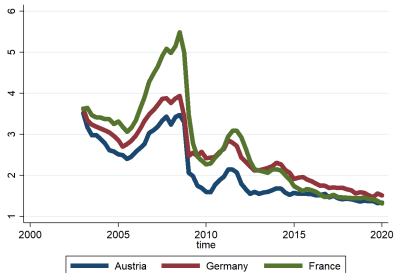
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# Research Question

- We observe huge heterogeneities in banks' net interest income and leverage ratio
  - ▶ This is at odds with the assumption of homogeneous degree of the financial friction
- When regional heterogeneity of the financial friction is taken into account, what are the implications of the union-wide monetary policy?
  - ▶ Does different degree of the financial friction imply different effectiveness of monetary policy?
- Does using a model imply different degree of financial friction compared to the case only micro data is used without a model?
  - ▶ In models, we can track behaviors of all the agents and macroeconomic interactions

**Figure:** Banks' Net Interest Income (%) (Left) and Market Value Bank Leverage (Right): **Core** (top) vs **Peripheral** (bottom) countries



# What We Do

- 1 New-Keynesian with financial acceleration: Gertler and Karadi (2011)
  - ▶ Monetary policy bank lending channel
- 2 Two country, monetary union, complete market model: Groll and Monacelli (forthcoming)
  - ▶ Single union with two regions, single monetary policy
- 3 Compare the estimates of the degrees of the financial friction
  - ▶ Panel Regression
    - ★ We observe data on each EU country

## Results

- In the model, the effects of monetary policy depends on the degree of the financial friction
  - ▶ The monetary policy works more when the degree of financial friction is lower
- The estimates of the financial friction is much tighter in the periphery countries when estimated with panel regression

# Model Environment

- Single country with two states/regions, single central bank
  - ▶ Two types of tradable goods: Home-produced goods and Foreign-produced goods
  - ▶ Households in the two regions can borrow/lend between them, complete market
- Agents: Household, Bank, Intermediate firm, Capital goods producer, Retail firm, Central Bank
  - ▶ **Households:** Deposit to bank, and supply labor to intermediate firm.
  - ▶ **Banks:** Supply loans to intermediate firms by raising deposits from household.
  - ▶ **Intermediate firms:** They finance themselves from bank loan and produce intermediate goods.
  - ▶ **Capital goods producers:** Produce capital under adjustment cost of investment.
  - ▶ **Retail firms:** Produce final goods while set prices under infrequent Calvo pricing opportunity.

## Bank Optimization and Risk Sharing

- Bank faces incentive constraint  $V_t \geq \theta Q_t s_t$  which induces spreads

$$E_t \tilde{\Lambda}_{t,t+1} [(R_{k,t+1} - R_{t+1})] = \theta \frac{\lambda_t}{1 + \lambda_t} \quad (1)$$

- Consumption of home-produced and foreign-produced goods

$$C_t \equiv \left[ (1 - \gamma)^{\frac{1}{\eta}} C_{H,t}^{\frac{\eta-1}{\eta}} + \gamma^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \quad (2)$$

$$\gamma \equiv (1 - n)\alpha \quad (3)$$

where  $n$  is the relative size of Home,  $1 - \alpha$  is home bias

- Risk sharing condition

$$(1 - \gamma - \gamma^*) T_t = \sigma(c_t - c_t^*) \quad (4)$$

$$T_t \equiv \frac{P_{F,t}}{P_{H,t}} \quad (5)$$

- ▶ When  $\alpha = 0$  (no home bias) and  $n = 1/2$  (same size),  $c_t = c_t^*$

## Estimation: Panel Regression

- Based on the structural equation,

$$\frac{L_t^i}{N_t^i} = \frac{E_t R_{t+1}^i}{\theta - E_t[R_{t+1}^{K,i} - R_{t+1}^i]}. \quad (6)$$

- Estimate the following equation.

$$L_t^i = \alpha^i + \beta_1^i R_{t+1}^i + \beta_2^i N_t^i + \beta_3^i \text{Spread}_{t+1}^i + D_t + \epsilon_t^i. \quad (7)$$

where  $D_t$  is control variables.

- The structural relationship between  $\beta_3^i$  and  $\theta^i$  is

$$\hat{\beta}_3^i = \frac{\beta \text{Spread}}{\theta - \beta \text{Spread}}, \quad (8)$$

# Estimation Results

VARIABLES	(1) Aggregate	(2) Core	(3) Peripheral
Deposit Rate	0.0139 (0.212)	0.648* (0.342)	1.140 (0.831)
Bank Equity <sup>1</sup>	0.396*** (0.113)	0.363** (0.142)	0.521** (0.234)
Spreads <sup>2</sup>	5.612*** (1.156)	8.753*** (1.588)	12.64** (5.279)
Lending Demand <sup>3</sup>	0.00573 (0.00488)	-0.00691 (0.00826)	0.00766 (0.00626)
Constant	9.251*** (1.446)	7.270*** (2.724)	5.426** (2.716)
Time FE	Yes	Yes	Yes
Observations	116	59	57
Number of country_id	8	4	4

- The implied values of the degree of financial degree are

$$\hat{\theta}_{Peripheral} = 0.512, \hat{\theta}_{Core} = 0.260.$$

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<sup>1</sup>Logged value.

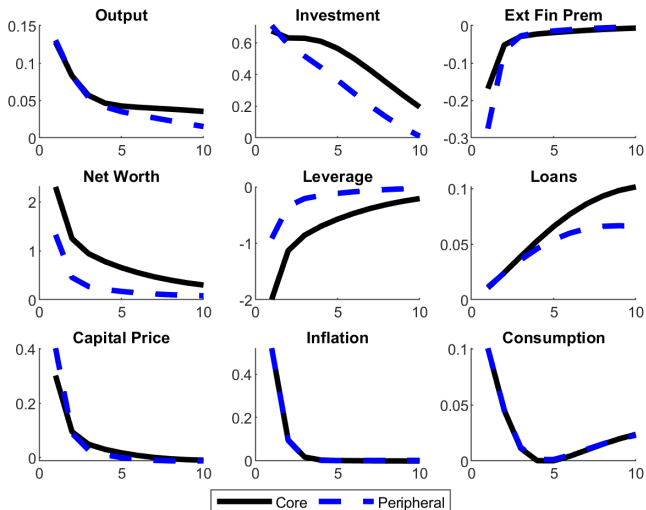
<sup>2</sup>Average loan rate minus average deposit rate.

<sup>3</sup>ECB Bank Lending Survey, net percentage of lending demand for small and medium size enterprises.



# Simulation for core and peripheral countries

## Interest Rate Shock



## Appendix: Conclusion

- With an union model with bank-lending channel, we studied how different degree of the financial friction affects the responses to monetary policy
- The region with tighter friction has smaller responses to monetary policy
- With data on EU countries, we estimate the degree of the financial friction with panel regression
- Core countries have much looser financial constraint and the peripheral countries have very tight financial constraint

## Appendix: Calibration

Table: Calibration

	Parameters	Home	Foreign
Financial Intermediaries			
$X$	Proportional transfer to the entering bankers	0.002	
$\sigma$	Continuation rate of the bankers	0.972	
$\theta$	Fraction of asset that can be diverted	0.260	0.512
$efp_{ss}$	Steady-state external finance premium	0.0025	
Open economy			
$n$	Relative size of Home region	1/2	
$1 - \alpha$	The degree of Home bias	0.6	0.6

This implies the steady-state level of leverage is 5.7773 in Home and 1.1208 in Foreign.

## Appendix: Estimation Data

### Bank / Financial Variables

Variables	Level	Sources	Quarters
Bank Net Worth (MTM)	Country	ECB Statistical Data Warehouse	1989Q3-2020Q1
Bank Loan	Country	ECB Statistical Data Warehouse	1999Q1-2019Q4
Spreads (NIM)	Country	ECB Statistical Data Warehouse	2003Q1-2020Q1
Deposit Rate	Country	ECB Statistical Data Warehouse	2003Q1-2020Q1
Lending Demand	Country	ECB Bank Lending Survey	2000Q1-2020Q1

### Other Economic Variables

Variables	Level	Sources	Quarters
Output	Country	OECD	1989Q3-2020Q1
Consumption	Country	OECD	1989Q3-2020Q1
Inflation (CPI)	Country	OECD	1989Q3-2020Q1
Hours Worked	Country	ECB Statistical Data Warehouse	2000Q2-2015Q2
Wage	Country	OECD	1989Q3-2020Q1
Investment (GFCF)	Country	OECD	1989Q3-2019Q1
Monetary Policy Rate	Country	Deutsche Bundesbank	1999Q1-2020Q1