

Taxing Bank Leverage: The Effects on Bank Portfolio Allocation

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Motivation

- Regulators/Governments can control bank leverage either by **increasing capital requirements** or **taxing bank leverage**
- Increasing capital requirements, however:
 - Leads banks to **shift the composition of their assets away from loans** (Haubrich et al., 1993; Berger and Udell, 1994; Gropp et al., 2019).
 - Has subsequently **negative effects on bank lending**
 - With possibly adverse consequences for firm investment and employment (Aiyar et al., 2014; Jimenez et al., 2017; Fraise, H., M. Le, and D. Thesmar, 2019)

Research Question(s)

- **What are the effects of taxing bank leverage on bank portfolio allocation?**
- Do bank balance sheets and capital regulation play a role in the transmission of fiscal reforms to the economy?

Taxing Bank Leverage?

The regulator can increase the relative cost of bank debt by

1. **Subsidizing Equity:** Give equity the same tax advantage as to debt \Rightarrow
Allowance for Corporate Equity: Belgium, 2005
2. **Taxing Bank Liabilities:** Apply a tax rate to bank liabilities net of equity \Rightarrow
Liability Tax: Slovakia, 2010 - Germany, 2011

The Bottom Line

In the presence of capital requirements, tax reforms that increase the cost of leverage lead banks to refocus their activity on lending in addition to deleveraging.

Related Literature

1. **Debate on Optimal Capital Regulation (level and design):** Admati et al. (2013), etc.
2. **Tools to Stimulate Lending:**
 - Monetary policy (Kashyap & Stein, 2000; Jimenez, Ongena, Peydro & Saurina, 2012) \Rightarrow ineffective in bad times
 - Quantitative easing (Rodyansky & Darmouni RFS 2017) \Rightarrow generates bubbles
 - **Equity subsidy** \Leftarrow **This paper**
3. **Impact of Taxes on Bank's**
 - Capital structure (De Mooij & Keen, 2016; Schepens, 2016; Schandlbauer, A. 2017; Gambacorta, Ricotti, Sundaresan & Wang, 2017)
 - Business location (Smolyansky, 2019)
 - **Portfolio allocation** \Leftarrow **This paper**

Motivation
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Framework
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Empirical Design
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Portfolio Allocation
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Credit Supply
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Portfolio Risk
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Robustness
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Conclusion
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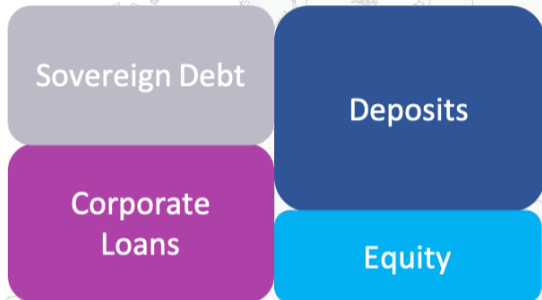


Background

- In perfect capital markets, in the absence of any frictions, a change in bank capital structure should NOT affect bank portfolio allocation
- Banks, however, face two sources of market distortions:
 - Direct and indirect government guarantees (e.g., deposit insurance or too-big-to-fail arguments), which cheapen leverage and give banks incentives to lever up
 - Capital requirements, which impose a minimum ratio of equity to **risk-weighted assets** on banks

⇒ Introducing a tax to bank debt in this setting can lead to a **shift in bank portfolio allocation**

Standard framework à la Rochet (1992)



1. Banks behave as a mean-variance investor with positive risk aversion
2. The regulator requires banks to **hold a minimum level of equity**
3. **Raising equity is costly for banks**
4. **Risk-weights do not perfectly reflect the actual riskiness of each asset:**
corporate loans are penalized relative to OECD government securities (0% RW)

Increasing Capital Requirements (to decrease bank leverage)...



Amplifies the distortions induced by the weights (the distance to the Markowitz portfolio increases)

- ⇒ Banks shift the composition of their assets **away from loans** towards government securities
- ⇒ Loans/Assets ratio and bank lending **decrease**

Taxing Bank Leverage with an ACE...



Partly offsets the distortionary cost of capital requirements by decreasing the relative cost of equity

- ⇒ Banks **refocus their activity on lending**
- ⇒ Loans/Assets ratio and bank lending **increase**

▸ Hypothesis

Taxing Bank Leverage with a Liability Tax...



Also partly offsets the distortionary cost of capital requirements

- ⇒ Loans/Assets ratio increases
- ⇒ Ambiguous effect on lending

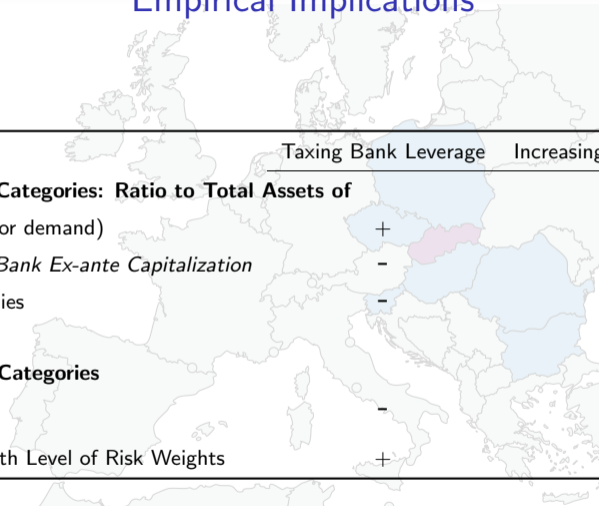
Within Categories of Risk Weights...

Taxing bank leverage, leads banks to

- Invest less in riskier assets (lower reaching-for-yield)
- Increase holding of assets with higher risk weights (across regulatory approaches)



Empirical Implications



Taxing Bank Leverage Increasing Capital Requirements

Across Risk-Weight Categories: Ratio to Total Assets of

Loans (controlling for demand)

+

-

Interaction with Bank Ex-ante Capitalization

-

+

Government Securities

-

+

Within Risk-Weight Categories

Asset Risk

-

+

Loans Interacted with Level of Risk Weights

+

-

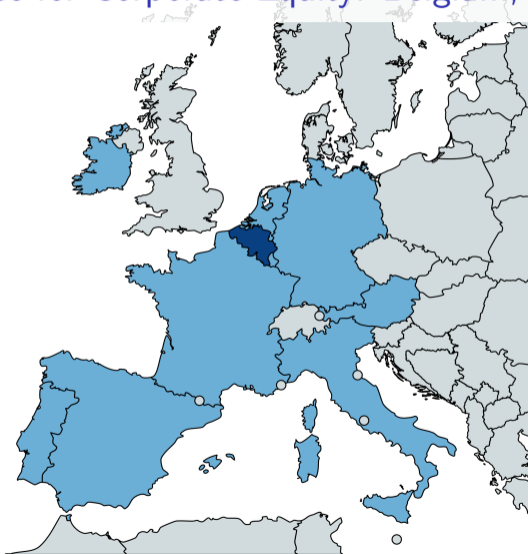


**The Allowance for Corporate Equity:
Evidence from Belgium (2005)**

Overview

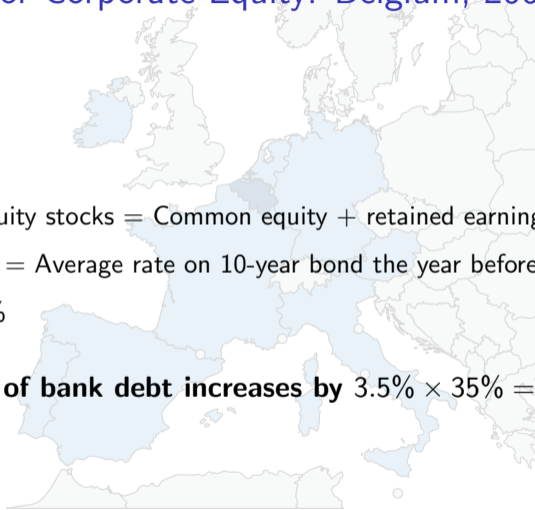
- 
1. Background
 2. Effects on Bank Portfolio Composition
 3. Effects on Credit Supply
 4. Effects on Loan Portfolio Risk

Allowance for Corporate Equity: Belgium, 2005



Allowance for Corporate Equity: Belgium, 2005 (1/2)

- **The tax scheme:**
 - **Base:** Total equity stocks = Common equity + retained earnings
 - **Notional Rate** = Average rate on 10-year bond the year before = 3.5% in 2006
 - **Tax Rate**=35%
- **The relative cost of bank debt increases by $3.5\% \times 35\% = 1pp$**



Allowance for Corporate Equity: Belgium, 2005 (2/2)

- No other simultaneous major tax reforms: The ACE is implemented in 2005q3 to **maintain the fiscal attractiveness of Belgium** after the EU bans another fiscal advantage
- Control group: Applies only to a subset of banks within the same monetary and regulatory regime
- Control for demand:
 - No direct effects on corporate investment in Belgium
 - Applies to banks that are actively lending abroad ⇒ Exploit **cross-border lending** to further disentangle supply from demand
- Effects on Capital Structure: The bank equity ratio increases by 1 pp (Schepens, 2016)

Overview

1. Background

2. Effects on Bank Portfolio Composition

3. Effects on Credit Supply

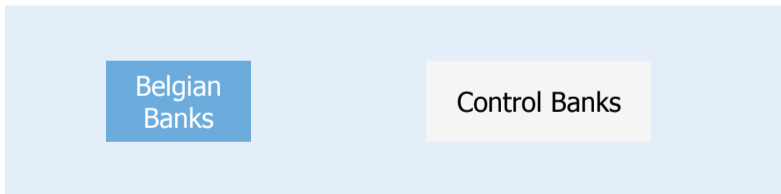
4. Effects on Loan Portfolio Risk



Identification Strategy: Balance Sheet Composition




2005:
Allowance for
Corporate Equity

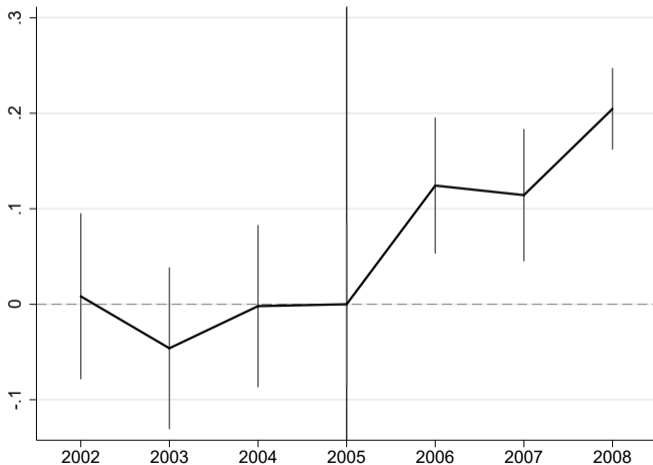


Euro Area: 10 largest economies

Basic Model


$$\text{Loans/Assets}_{b,t} = \beta_t \text{Treated}_b \times \mu_t + \mu_b + \mu_t + \epsilon_{b,t} \quad (1)$$

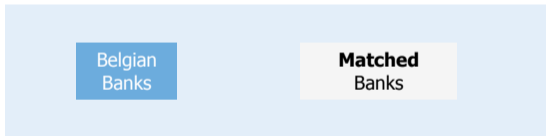
Evolution of Bank Loans to Assets Ratio after the Implementation of an ACE in Belgium (2002 - 2008)



Propensity Score Matching



2005:
Allowance for
Corporate Equity



Euro Area: 10 largest economies

- Matching variables: Total Assets at $t - 1$, Equity Ratio level and growth rate at $t - 1$, Loans to asset ratio, level and growth rate at $t - 1$

Panel Model

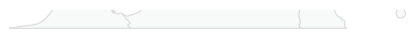
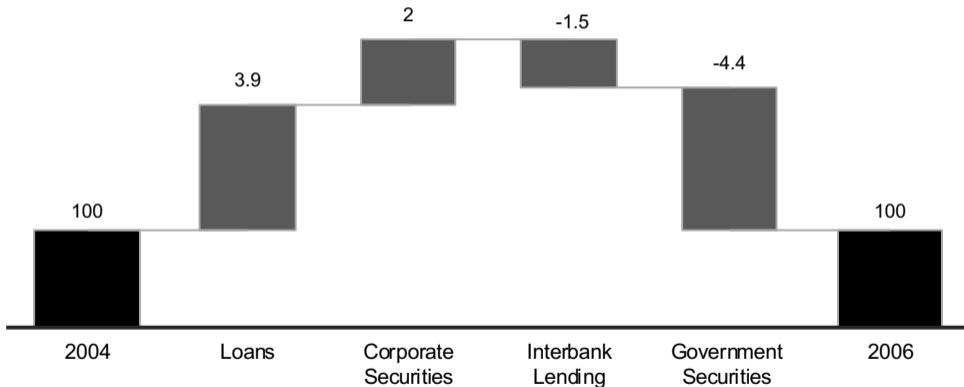
$$\text{Loans/Assets}_{b,t} = \beta \text{Treated}_b \times \text{Post}_t + \lambda Y_{b,t-1} + \gamma C_{c,t-1} + \mu_b + \mu_t + \epsilon_{b,t}$$

- Fixed effects
 - Bank and Year (μ_b, μ_t)
 - But also: year \times 2004 size terciles, year \times 2004 equity ratio terciles
- $Y_{b,t-1}$ - time varying bank controls: Log of total assets, Non interest income share
- $C_{c,t-1}$ - time varying country controls: GDP per capital and CPI

Loans to Assets Ratio

	Log				Amount		
	(1)	(2)	(3)	(4)	Equity to Assets >Median (5)	<Median (6)	(7)
Treated × Post	0.10*** (0.02)	0.09*** (0.02)	4.49*** (0.84)	3.93*** (0.71)	0.80 (1.38)	7.14*** (0.63)	8.13*** (1.28)
Treated × Post × 2004 ETA							-0.59*** 0.15
<i>Fixed Effects</i>							
Size Terciles × Year		Yes		Yes	Yes	Yes	Yes
ETA Terciles × Year		Yes		Yes			
Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Accounting Norms	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Bank Controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Country Controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	654	654	654	654	314	340	654
R ²	0.951	0.955	0.955	0.958	0.953	0.969	0.956

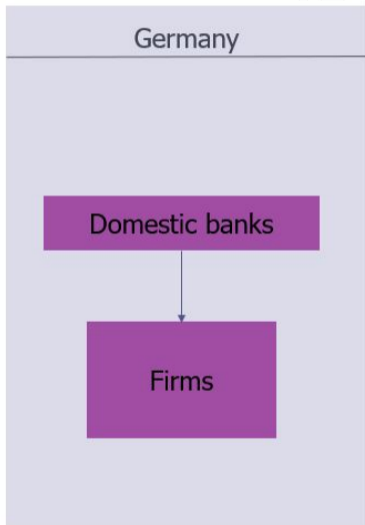
Results: Bank Asset Allocation



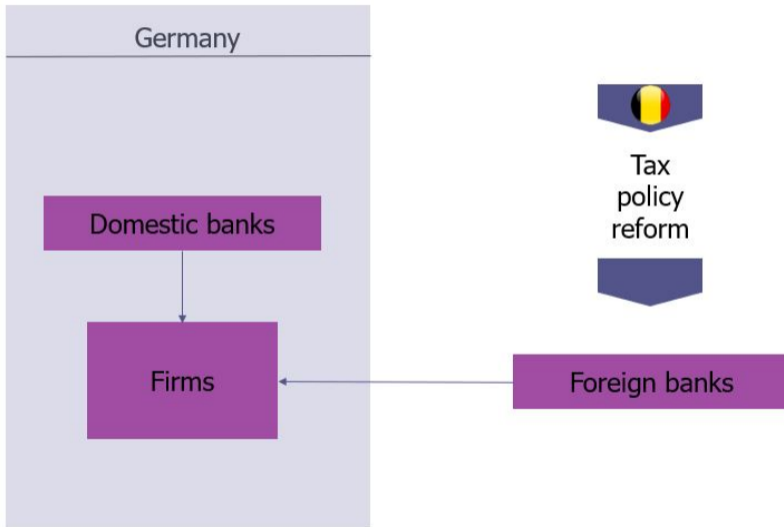
Overview

1. Background
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 4. Effects on Loan Portfolio Risk
- 
- A light blue map of Europe is visible in the background. The map shows the outlines of European countries. The text of the list is overlaid on the map.

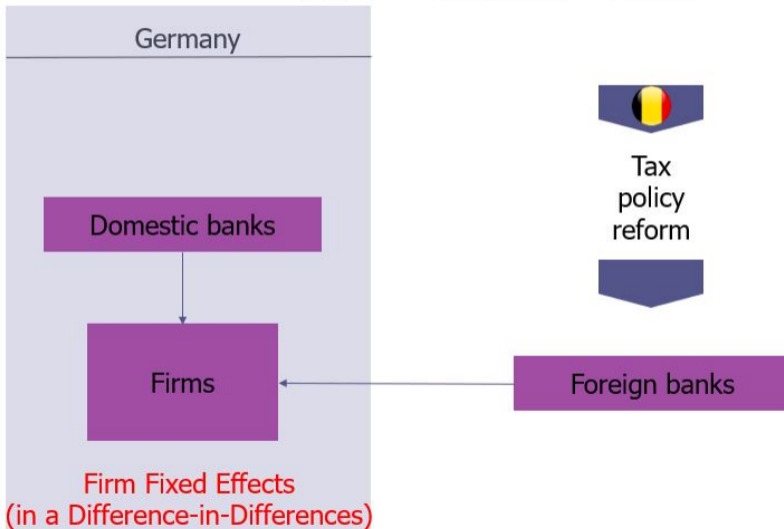
Identification Strategy: Cross-Border Lending



Identification Strategy: Cross-Border Lending



Identification Strategy: Cross-Border Lending



Why the German Credit Market?

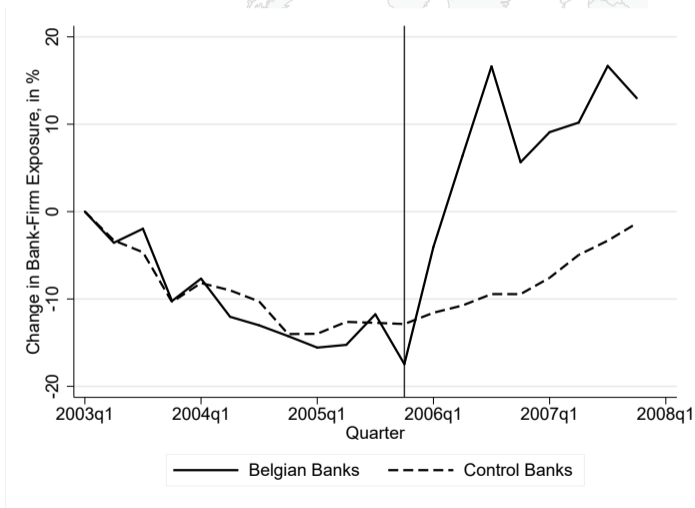


- Both local banks and firms are not affected
- Large exposure to Belgian banks (5 to 10% of the portfolio of foreign loans)
- German credit register covers all loans above 1.5 million at issuance

Identification Strategy: Cross-Border Lending



Lending by Belgian Banks to German Firms (Intensive Margin)



Model

$$\text{CreditGrowth}_{b,f} = \alpha \text{Treated}_{b,f} + \beta X_f + \gamma Y_b + \epsilon_{b,f}$$

- $\text{CreditGrowth}_{b,f}$ - % change in average bank-firm exposure from 2004 to 2005-2006
- $\text{Treated}_{b,f}$ - dummy equal to one for Belgian banks
- Y_b - bank controls: Equity Ratio, Assets, Loans to assets Ratio
- X_f - firm fixed effects to control for firm credit demand

The Belgian ACE: Lending by Belgian Banks to German Firms (2004-2007)

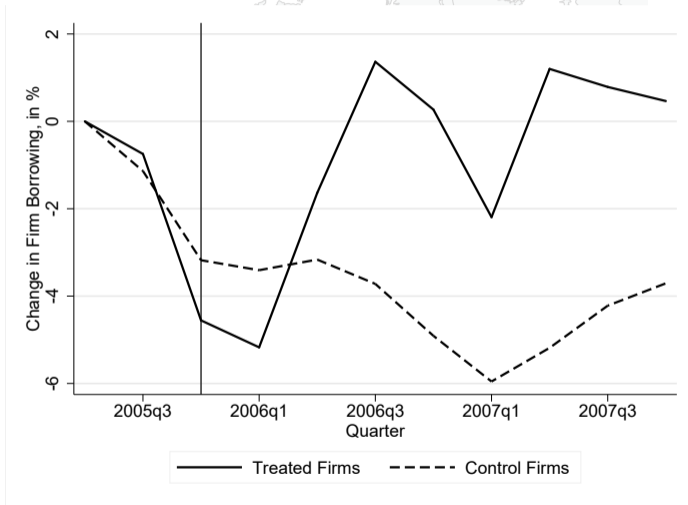
Model	All Bank-Firm Exposures				Intensive Margin		Extensive Margin	
	Growth in Loan Exposure, in %				Growth in Loan Exposure, in %		New Loan Dummy	
	All		Foreign Banks		All	Foreign Banks	All	Foreign Banks
Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	39.9*** (6.2)	41.9*** (8.8)	51.4** (20.5)	44.8*** (14.0)	17.8*** (6.5)	59.6*** (13.5)	12.3*** (1.7)	12.5*** (3.2)
<i>Fixed Effects</i>								
Firm	-	Yes	-	Yes	Yes	Yes	-	-
Industry	Yes	-	Yes	-	-	-	Yes	Yes
<i>2004 Bank Controls</i>								
Loan Growth	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Equity Ratio	Yes	Yes	Yes	Yes	Yes	Yes	-	-
ROA	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Total Assets	Yes	Yes	Yes	Yes	Yes	Yes	-	-
<i>2004 Firm Controls</i>								
# Banks	Yes	-	Yes	-	-	-	Yes	Yes
Total Debt	Yes	-	Yes	-	-	-	Yes	Yes
<i>Relationship Controls</i>								
Size	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Length	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Observations	43,263	34,523	5,105	1,453	24,186	876	36,883	5,105
R ²	0.15	0.47	0.42	0.77	0.45	0.66	0.15	0.21

The Effects on Firm Borrowing, Leverage and Interest Payments

- **Question:** Are Belgian banks crowding out other banks by offering lower interest rates, or do we observe some real effects on firms?



Bank Debt across Treated and Control Firms



Overview

1. Background
 2. Effects on Bank Portfolio Composition
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The Effects on Loan Portfolio Risk (1/2)

Question:

- Do Belgian banks extend lending to riskier firms
- Or, oppositely, does the ACE reduce banks' incentives to reach for yield (by decreasing the distortions induced by capital requirements)?



The Effects on Loan Portfolio Risk (2/2)

	Loan-Level Measures			Bank-Level Measures	
	Ex-ante		Ex-post	Impaired Loans	
	Leverage		Default	To Gross Loans	To equity
	(1)	(2)	(3)	(4)	(5)
Treated × Post	-0.025*	-0.03*	-1.06	-1.48***	-14.2**
	(0.019)	(0.02)	(5.9)	(0.31)	(4.7)
Bank FE	Yes	Yes	Yes	Yes	Yes
Bank Time Varing Controls				Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Industry FE	-	Yes	Yes	-	-
Observations	1,616	1,616	470	184	189
R^2	0.839	0.800	0.890	0.85	0.74

Motivation
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Framework
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Empirical Design
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Portfolio Allocation
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Credit Supply
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Portfolio Risk
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Robustness
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Conclusion
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A map of Europe with a light blue background. The text "Robustness: The Liability Tax (2010-2011)" is overlaid in the center in a dark blue font. The map shows the outlines of European countries, with some countries like France, Germany, and Italy highlighted in a slightly darker shade of blue.

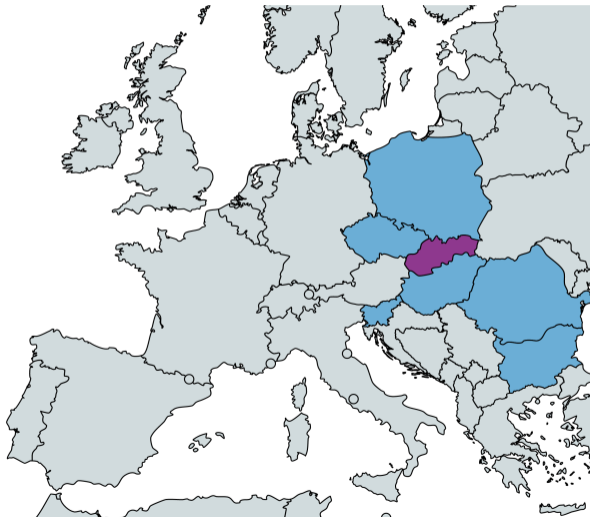
Robustness:
The Liability Tax (2010-2011)

The Liability Tax: The Context

- The IMF starts promoting a levy on bank liabilities minus equity in the aftermath of the financial crisis
- The objective is to
 1. Make banks contribute to the resolution of the next banking crisis
 2. Internalize bank contribution to systemic risk



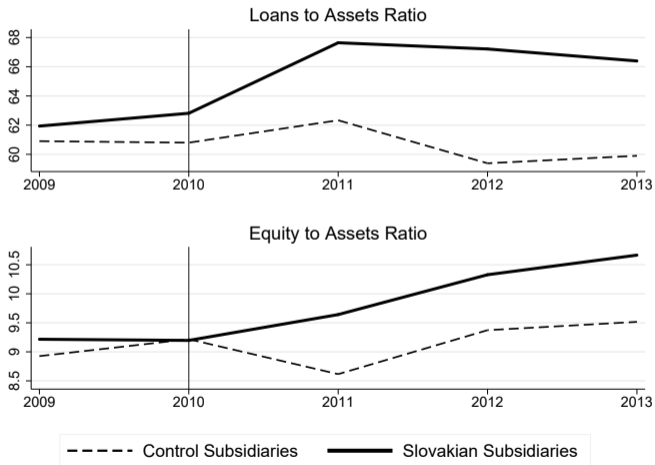
Within Bank Analysis: Liability Tax, Slovakia 2010



Within Bank Analysis: Liability Tax, Slovakia 2010

- Tax scheme
 - **Base:** Total liabilities minus insured deposits and equity
 - **Rate:** 0.40%
- Commercial banks in Slovakia are mostly (80%) subsidiaries of foreign banks
- We, therefore, compare the portfolio allocation and capital structure of subsidiaries within banks, including banks fixed effects
- We hence control for bank specific shocks

Within Bank Analysis: Liability Tax, Slovakia 2010



Within Risk-Weight Category - Liability Tax in Germany (2011)

- Heterogeneity in the level of the Liability Tax across banks
- Within corporate loans, **Some banks** have been using the Model-Based (MB) approach to define risk weights, while others not
 - The MB approach results in lower risk weights than the Standardized Approach (SA)
- The **same firm** can receive both SA and MB loans
- There are SA and MB loans **within the same bank**

Liability Tax: Results

Sample	Growth in Loan Exposure, in %						
	All					Model-Based Banks Only	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treated	3.43*	3.68*	3.65*				
	(2.13)	(2.15)	(2.14)				
Treated × MB share		-12.46***					
		(4.27)					
Treated × MB bank			-8.37**				
			(3.36)				
Intensity				1.47	1.44	25.38	
				(1.03)	(1.03)	(24.15)	
Intensity × MB share				-16.37***			
				(4.58)			
Intensity × MB bank					-13.47***		
					(3.41)		
Intensity × MB loans						-45.34**	-46.82**
						(22.30)	(21.31)
<i>Fixed Effects</i>							
Bank	-	-	-	-	-	-	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Bank Controls</i>	Yes	Yes	Yes	Yes	Yes		
2010 Loan Size	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	27,352	27,352	27,352	27,352	27,352	1,211	1,392
R ²	0.562	0.563	0.562	0.563	0.563	0.675	0.669

Motivation
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Portfolio Allocation
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Credit Supply
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Portfolio Risk
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Robustness
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Conclusion
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Conclusion

Conclusion (1/2)

- The paper studies the effects of taxes that increase the relative cost of bank debt on bank portfolio allocation
- Taxing bank leverage induces banks to deleverage AND focus their activities on lending

Conclusion (2/2)

- ⇒ Fiscal policy might be a credible complement to capital requirements to control bank leverage while maintaining credit supply
- ⇒ Any changes in taxes might affect bank portfolio allocation through the interaction with capital regulation
- ⇒ The introduction of the leverage ratio in Basel III should affect bank portfolio allocation by reducing the regulatory advantage of government securities the same way as taxing leverage does

Motivation
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Empirical Design
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Portfolio Allocation
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Credit Supply
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Portfolio Risk
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Robustness
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Conclusion
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Thank you!

The Interaction of Taxes and Capital Requirements (with Government Guarantee)

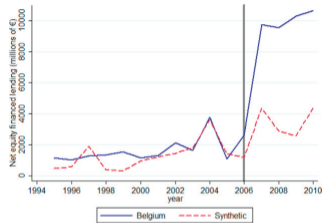
	Capital Requirements		
	No	Yes Imperfect	Yes Perfect
Taxes on Bank Debt			
No	Markowitz Portfolio	Distortions	Markowitz Portfolio
Yes	Distortions	Reduced Distortions	Markowitz Portfolio

The Effects on Firm Borrowing, Leverage and Interest Payments (2/2)

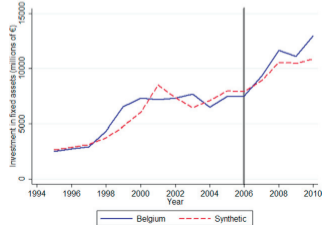
	% Change				Change in pp	
	Bank Debt		Total Debt	Total Assets	Leverage	Interest Rates
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	12.86*** (2.64)	15.69*** (3.94)	4.17** (1.86)	3.13** (1.46)	0.65 (0.48)	0.13* (0.07)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
2004 Firm Characteristics	-	Yes	Yes	Yes	Yes	Yes
Observations	9,106	1,515	1,380	1,380	1,380	1,369
R^2	0.080	0.098	0.089	0.088	0.106	0.048

ACE and Firm Investment (Hebous, JPub.E 2017)

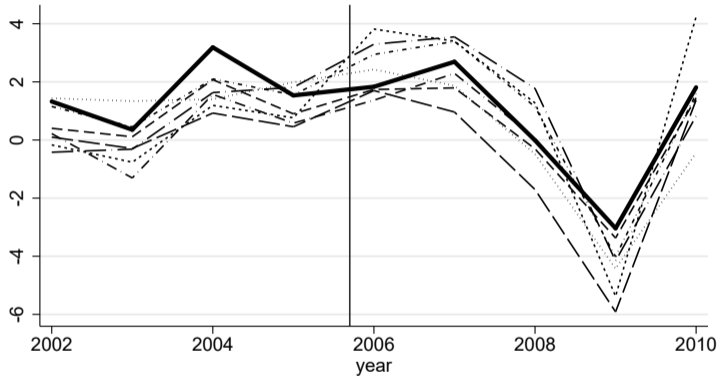
(a) Passive Investment



(b) Active Investment



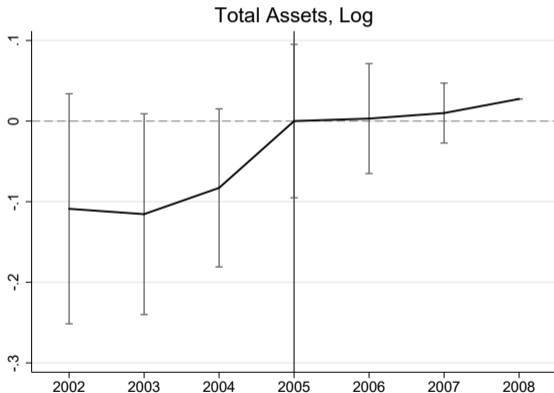
GDP Growth in Belgium and Neighbor Countries



Evolution of Bank Equity to Assets Ratio after the Implementation of an ACE in Belgium (2002 - 2008)



Evolution of Bank Total Assets after the Implementation of an ACE in Belgium (2002 - 2008)



Basic Framework

- It is a static model with only two dates:
 - $t = 0$, when the bank chooses the composition and the size of its portfolio
 - $t = 1$, when all assets and liabilities are liquidated.
- The bank can invest in a set of two possible assets, or groups of assets:
 - Corporate loans, denoted L
 - Securities, denoted S
 - $(\tilde{r}_L; \tilde{r}_S)$ is the vector of random returns with mean $\mu = (\mu_L; \mu_S)$ and with invertible variance-covariance matrix Σ
- There are only two liabilities: equity capital E and deposits D

Market Imperfections

- **Government Guarantee:** Deposits are fully insured, and hence remunerated at the riskless rate that we normalize to zero. Issuing additional equity ΔE , however, induces a cost R
- **Capital Requirements:** The regulator defines regulatory risk weights $w = (w_L; w_S)$ and requires the ratio of equity to risk-weighted assets to be higher than k . Thus, the bank is constrained to satisfy

$$\frac{E}{w_L x_L + w_S x_S} \geq k$$

Optimization Problem (1/2)

- Two dimensions
 1. Bank optimal size, i.e. amount of equity to issue
 2. Optimal portfolio allocation across loans and securities
- The net wealth of shareholders is in period 1:

$$\tilde{\Pi} = x^T(1 + \tilde{r}) - D - E_0 - \Delta E - (R - \Theta)\Delta E. \quad (2)$$

where E_0 is the initial equity of existing shareholders and Θ an equity subsidy that reduces the cost of equity by a rate Θ

- We introduce the accounting equation $x_L + x_S = D + E_0 + \Delta E$ and obtain

$$\begin{aligned} \tilde{\Pi} &= x^T(1 + \tilde{r}) - x_1 - x_2 - (R - \Theta)\Delta E \\ \Leftrightarrow \tilde{\Pi} &= x^T\tilde{r} - (R - \Theta)\Delta E. \end{aligned}$$

Optimization Problem (2/2)

- The bank behaves as a mean-variance investor with risk aversion γ . The objective function of the bank is

$$\mathcal{V} = \mathbb{E}(\tilde{\Pi}) - \frac{\gamma}{2} \text{Var}(\tilde{\Pi}), \quad (3)$$

- The Lagrangian the bank satisfies is, therefore,

$$\mathcal{L} = x^T \mu - \frac{\gamma}{2} x^T \Sigma x - k \lambda x^T w + \Delta E[\lambda - R + \Theta] + \lambda E_0. \quad (4)$$

- The asset portfolio the bank chooses satisfies

$$x = (\gamma \Sigma)^{-1} (\mu - k(R - \Theta)w). \quad (5)$$

Solution

We introduce the *Markowitz Portfolio* x^M and obtain

$$\frac{x_L}{x_S} = \frac{1 - \frac{w_L}{\mu_L} k(R - \Theta) x_L^M}{1 - \frac{w_S}{\mu_S} k(R - \Theta) x_S^M}. \quad (6)$$

1. An equity subsidy impacts the composition of the bank portfolio as soon as regulatory risk weights do not perfectly reflect the riskiness of each asset.
2. While both an equity subsidy and an increase in capital requirements increase banks incentives to deleverage, the effects on the bank portfolio go in opposite direction.