CREDIT SUPPLY, FIRMS, AND EARNINGS INEQUALITY

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Traditional view: Credit channel of MP stabilizes aggregate economy

Question: What are the distributional effects of MP and credit?

- Most important income source for most HHs: labor market
- Little evidence (or theory) on het. labor market effects

This paper: Effects of MP-credit on the dist'n of wages & employment

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Distributional Effects of Monetary Policy (MP) and Credit

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- **Challenge 1:** Endogeneity of MP and credit
  - Difficult to disentangle firms' demand from banks' supply of credit
  - **Our approach:** Negative rates in eurozone as natural experiment
    - Heterogeneous exposure through pre-existing banking relationships

- **Challenge 2:** Requires linked microdata
  - Difficult to track chain from MP → banks → firms → workers
  - **Our approach:** Combine admin. + proprietary data from Germany
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- **Result 1:** Firms in relationships with banks more exposed to negative rates see a reduction in credit supply
  - Aggregates to firm level: reduction in leverage
- **Result 2:** Reduces firm-level wages and employment
- **Result 3:** Reduces within- and between-firm inequality
  - Lower-paid workers' employment ↓, higher-paid workers' wages ↓
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Simple Equilibrium Model of Credit and Search Frictions

Framework:

Burdett & Mortensen ('98) + worker skill het. + firm credit het.

Main insight:

Credit + search frictions $\implies$ distributional effects of MP-credit

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Credit + search frictions $\implies$ distributional effects of MP-credit

- Workers differ in ability $a \in \{a_L, a_H\}$
- Unemployed (U) and employed (E) search for jobs in frictional labor markets segmented by worker type:
    - Job offer from U at rate λ_a^U and from E at rate $\lambda_a^E = s_a \lambda_a^U$
    - Key (illustrative) assumption: $s_{a_L} = 0 < s_{a_H}$
    - Exogenous job destruction at rate δ_a
- Job offer is a wage $w_a \sim F_a(w_a)$
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- Firm type consists of:
  - productivity p
  - credit limit ζ
- In each market, post wage w_a, vacancies v_a at cost $c_a(v_a)$: $c_a'(\cdot) > 0, c_a''(\cdot) > 0$
- Firms take up debt D to finance operating costs:

$$D = \sum_{a \in \{a_L, a_H\}} [w_a l_a + c_a(v_a)]$$

- Idiosyncratic firm credit constraint: $rD \leq \zeta$
- Firm with productivity p and $\{l_a\}_{a \in \{a_L, a_H\}}$ employees produces

$$y(p, \{l_a\}_a) = p \sum_{a \in \{a_L, a_H\}} a l_a$$

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- Burdett & Mortensen ('98) logic: firms ranked by prod.
- Not true here since some prod. firms are credit constrained

Key mechanism: Credit constraint affects "effective firm productivity"

$$\bar{p}_j = p_j \frac{1 + r}{1 + (1 + \psi_j)r}$$

through shadow cost of wages & recruiting, $1 + \psi_j$, where ψ_j denotes the Lagrange multiplier on the credit constraint of firm j

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Key mechanism: Credit constraint affects "effective firm productivity"

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through shadow cost of wages & recruiting, $1+\psi_j$, where ψ_j denotes the Lagrange multiplier on the credit constraint of firm j

Proposition: A reduction in firms' credit limits ζ_j causes

1. lower firm-level wages for identical workers,
2. lower firm-level employment,
3. lower within-firm wage inequality, and
4. lower between-firm wage inequality.

Intuition:

- Low-ability workers are stuck at their outside option
- High-ability workers' wages tied to "effective firm productivity"

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3. lower within-firm wage inequality, and
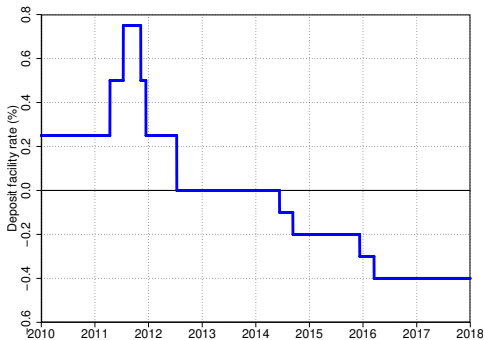4. lower between-firm wage inequality.

Intuition:

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Empirical Setting & Research Design

- ECB introduces negative deposit facility rates in June 2014

Negative rates are special: Not passed on to depositors

$\implies$ Increased funding costs for more deposit-reliant banks

$\implies$ Relative (not absolute) reduction in lending by those banks

$\implies$ Het. credit supply shock through preexisting bank-firm rel's

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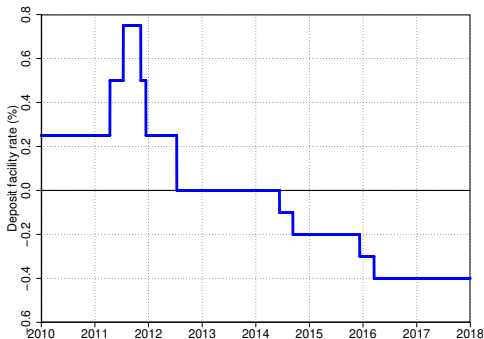$\implies$ Increased funding costs for more deposit-reliant banks

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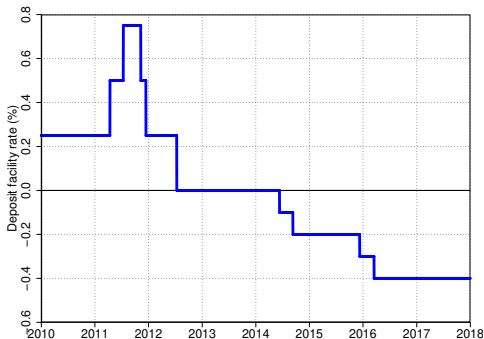$\implies$ Increased funding costs for more deposit-reliant banks

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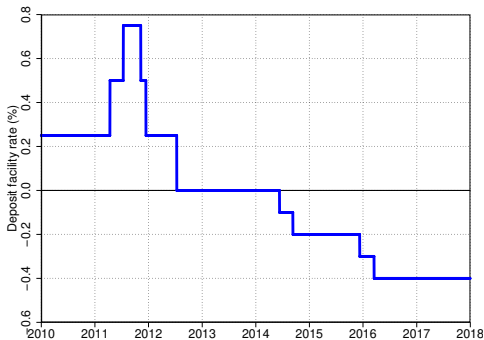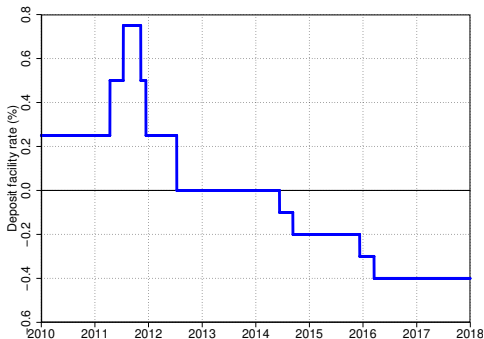$\Longrightarrow$ Increased funding costs for more deposit-reliant banks

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Data

Complete chain from MP → banks → firms → workers in Germany

- Admin. linked German employer-employee data (IAB), 2010–2017
    - Two-sided panel, one obs. per worker-year it, main employer j
- Board compensation (BoardEx)
- Establishment-firm link + firm financials (BvD Amadeus)
- Bank-firm credit relationships (Creditreform)
- Syndicated-loan transactions (Dealscan)
- Bank balance sheets (SNL Financial)

Diff-in-diff: Deposit ratio$_j$ × After(06/2014) = avg. deposit ratio of firm j's banks during 2010–2013 × indicator for negative rates

Coverage: ≈ 36% of all full-time employment in Germany

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Result 1: Effects of Negative Rates on Credit

Diff-in-diff at the loan level (firm j, bank k, semi-annual t):

$$y_{jkt} = \beta \text{Deposit ratio}_j \times \text{After(2014)}_t + \kappa_{jk} + \lambda_{kt} + \varepsilon_{jkt}$$

	Any loan share $\in \{0,1\}$		ln(1 + total loan volume)	
Sample		2010–2017		
Variable	(1)	(2)	(3)	(4)
Deposit ratio$_j$ × After(06/2014)	-0.084***	-0.101***	-1.254**	-1.559***
	(0.030)	(0.030)	(0.511)	(0.514)
Bank-firm FE	Y	Y	Y	Y
Time FE	Y	N	Y	N
Bank-time FE	N	Y	N	Y
N	21,274	21,158	21,274	21,158

$\Longrightarrow$ 1 std. dev. increase in Deposit ratio$_j$

· reduces probability of receiving any loan by 1.1 p.p
· reduces loan volume by 16%

Diff-in-diff at the loan level (intensive margin):

$$y_{jkt} = \beta \text{Deposit ratio}_k \times \text{After(2014)}_t + \kappa_{jk} + \theta_{jt} + \varepsilon_{jkt}$$

	Any loan share $\in \{0,1\}$			ln(1 + total loan volume)		
Sample	2010–2017		2013–2015	2010–2017		2013–2015
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deposit ratio$_k$ × After(06/2014)	-0.085*	-0.122**	-0.158**	-1.475*	-2.099*	-2.630*
	(0.048)	(0.061)	(0.076)	(0.852)	(1.108)	(1.382)
Deposit ratio$_k$ × After(07/2012)		0.066			1.113	
		(0.089)			(1.611)	
Bank-firm FE	Y	Y	Y	Y	Y	Y
Firm-time FE	Y	Y	Y	Y	Y	Y
N	15,554	15,554	6,508	15,554	15,554	6,508

$\implies$ Controls for credit demand, placebo, short time window

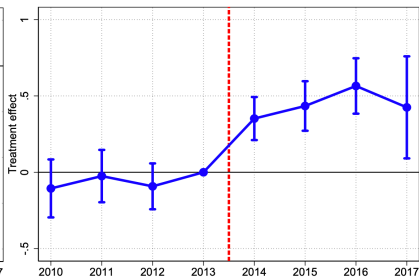# FIRM-LEVEL AGGREGATION: DELEVERAGING AND CASH HOARDING

Estimate at firm-year level:

$$y_{jt} = \sum_{\tau=2010}^{2017} \beta_\tau \text{Deposit ratio}_j \times \mathbf{1}[t = \tau] + \psi_j + \delta_t + \varepsilon_{jt},$$

where $y_{jt} = \text{leverage}_{jt} = \frac{\text{LT-debt}_{jt} + \text{ST-loans}_{jt}}{\text{Assets}_{jt}}$ or $y_{jt} = \ln(\text{cash}_{jt})$

leverage$_{jt}$ ln(cash$_{jt}$)
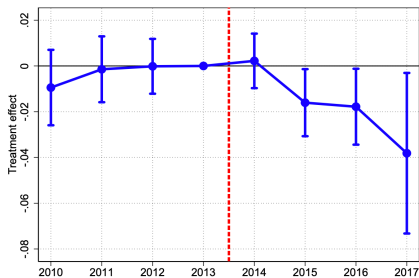
Irrespective of how negative rates affect aggregate lending,

firms in rel'ns with banks more exposed to negative rates...

1. ...experience a relative reduction in credit...
2. ...driven by credit supply (not credit demand)...
3. ...and imperfectly substitute, leading to a firm-level credit shock.

Result 2: Effects of Credit on Wages & Employment

Novel: Worker-level evidence on effects of MP-induced credit supply.

Log wage or unemployment for worker i at firm j in year t:

$$y_{ijt} = \beta \text{Deposit ratio}_j \times \text{After}(2014)_t + \theta_{ij} + \delta_t + \varepsilon_{ijt}$$

$\implies \beta$ captures effect of greater exposure to negative rates / negative credit supply shock on firm-level mean wages and employment

Mean effects on wages, employment:

$$y_{ijt} = \beta \text{Deposit ratio}_j \times \text{After(2014)}_t + \theta_{ij} + \delta_t + \varepsilon_{ijt}$$

	ln(wage)		Unemployed next year $\in \{0, 1\}$	
Deposit ratio$_j$ × After(2014)	-0.019**	-0.077***	0.007**	0.011***
	(0.009)	(0.010)	(0.003)	(0.004)
Worker FE	Y	N	Y	N
Firm FE	Y	N	Y	N
Worker-firm match FE	N	Y	N	Y
Year FE	Y	Y	Y	Y
N	70,137,681	67,731,621	65,253,153	63,505,552

$\implies$ 1 std. dev. increase in Deposit ratio$_j$

- reduces wages by 1.2%
- increases unemployment risk by 0.2 p.p

Result 3: Effects of Credit on Within- & Between-Firm Inequality

- What about distributional effects within firms?

$$y_{ijt} = \beta \text{Deposit ratio}_j \times \text{After(2014)}_t \times \text{Worker rank}_i + \theta_{ij} + \mu_{jt} + \varepsilon_{ijt}$$

Variable	ln(wage)			Unemployed next year $\in \{0,1\}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Deposit ratio × After(2014) × Bottom 20% within firm	0.034*	0.069***	0.051***	0.009**	0.004	0.013***
	(0.018)	(0.019)	(0.017)	(0.004)	(0.004)	(0.004)
Deposit ratio × After(2014) × Middle 60% within firm	-0.017**	-0.012*	-0.014**	0.018***	0.016***	0.019***
	(0.007)	(0.007)	(0.007)	(0.002)	(0.002)	(0.002)
Deposit ratio × After(2014)	-0.008			-0.008**		
	(0.007)			(0.003)		
Deposit ratio × Bottom 20% within firm	-0.136***	-0.142***		0.004	0.009**	
	(0.021)	(0.018)		(0.004)	(0.004)	
Deposit ratio × Middle 60% within firm	-0.112***	-0.106***		0.001	0.003	
	(0.015)	(0.013)		(0.003)	(0.003)	
After(2014) × Bottom 20% within firm	0.154***	0.141***	0.071***	0.029***	0.032***	0.050***
	(0.013)	(0.013)	(0.013)	(0.002)	(0.002)	(0.003)
After(2014) × Middle 60% within firm	0.010**	0.007	-0.011**	-0.005***	-0.001	0.000
	(0.004)	(0.005)	(0.005)	(0.002)	(0.001)	(0.002)
Worker FE	Y	Y	N	Y	Y	N
Firm FE	Y	N	N	Y	N	N
Worker-firm FE	N	N	Y	N	N	Y
Year FE	Y	N	N	Y	N	N
Firm-year FE	N	Y	Y	N	Y	Y
N	61,987,235	61,519,347	59,839,079	58,204,386	57,773,587	56,308,377

$\implies$ Lower credit supply reduces within-firm wage inequality

- What about distributional effects between firms?

$$y_{ijt} = \beta \text{Deposit ratio}_j \times \text{After(2014)}_t \times \text{Firm rank}_j + \theta_{ij} + \delta_t + \varepsilon_{ijt}$$

	ln(wage)			Unemployed next year $\in \{0,1\}$		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deposit ratio × After(2014) × Firm pay rank	-0.107***	-0.050	-0.137***	-0.012	-0.028***	-0.009
	(0.031)	(0.037)	(0.031)	(0.007)	(0.009)	(0.010)
Deposit ratio × After(2014)	0.021	-0.017	0.060***	0.003	0.002	-0.017***
	(0.021)	(0.024)	(0.019)	(0.005)	(0.005)	(0.006)
After(2014) × Firm pay rank	-0.061***	-0.034	0.173***	0.001	-0.033***	-0.065***
	(0.023)	(0.028)	(0.023)	(0.005)	(0.006)	(0.007)
Worker FE	N	Y	N	N	Y	N
Firm FE	Y	Y	N	Y	Y	N
Worker-firm FE	N	N	Y	N	N	Y
Year FE	Y	Y	Y	Y	Y	Y
N	71,540,608	69,627,349	67,372,241	65,654,460	64,700,521	63,076,967

$\implies$ Lower credit supply reduces between-firm wage inequality

- So far, fixed worker composition through worker-level controls
- How about firm-level inequality?

	ln(P90/P10)	ln(P90/P10)	ln(P90/P10)	ln(P50 board total/P5)
Sample	All	Public firms	Public firms	DAX firms
Variable	(1)	(2)	(3)	(4)
Deposit ratio × After(2014)	-0.013**	-0.373**	-0.510***	-0.877*
	(0.006)	(0.160)	(0.183)	(0.485)
Non-euro deposit ratio × After(2014)			-0.029	
			(0.117)	
Firm FE	Y	Y	Y	Y
State-year FE	Y	Y	Y	N
Year FE	N	N	N	Y
N	2,771,902	1,324	1,149	266

$\Longrightarrow$ Firm-level inequality declines, especially at the very top

- How about firm-level employment?

Variable	ln(no. of all employees) (1)	ln(no. of nonmanagerial employees) (2)	Share nonmanagerial (3)	Share part-time (4)
Deposit ratio × After(2014)	-0.015***	-0.021***	-0.006***	-0.011***
	(0.005)	(0.005)	(0.001)	(0.001)
Firm FE	Y	Y	Y	Y
State-year FE	Y	Y	Y	Y
N	2,803,152	2,803,152	2,803,152	2,803,152

$\Longrightarrow$ Firm-level employment declines, especially lower-skill

CONCLUSION

- Studied effects of MP-credit on dist'n of wages & employment
- Main insight: Contractionary MP-credit supply shock causes
  - higher-paid workers' wages ↓ ⟺ within-firm wage inequality ↓
  - higher-paying firms' wages ↓ ⟺ between-firm wage inequality ↓
- Firm het. as a new channel for distrib'nal consequences of MP

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