Monetary policy, the bank-lending channel and labor market adjustment of firms

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What are the real effects of monetary policy in terms of labor adjustment?

We take a firm-level perspective and show:

- 1. Firms reduce employment in response to contractionary monetary policy shocks
 - The more, the more the **bank-lending channel** bites
- 2. Employment falls because of a relative decline in inflows rather than outflows
 - Inflows decline more and outflows decline less, the more the **bank-lending channel** bites
- 3. Inflows fall in particular for **low-wage workers**, whereas firms retain **high-wage workers**

- Combine established measures of monetary policy surprises (Jarocinski and Karadi, 2020) with a unique **data set on workers, firms, and banks** in Germany
- Propose a **decomposition of the firm-level employment flows** across the firm's wage distribution in the context of dynamic local projections at the firm level
- Use **variation in bank equity** as a measure of firm exposure to the bank-lending channel of monetary policy in the context of state-dependent local projections

Contribution to the literature

- Firm-level perspective on labor market flows allows insights into labor hoarding and within-firm reallocation in response to monetary policy shocks
 - Employment adjustment at firm level: Bahaj et al. (2019), Jasova et al. (2021)
 - Labor market flows, not at firm level: White (2018), Coglianese *et al.* (2023), Graves *et al.* (2023); Faia *et al.* (2024), Bergman *et al.* (2022)
- Firm-level heterogeneity in response of **labor adjustment to monetary policy** conditional on financial constraints
 - Investment: Jeenas (2019), Ottonello and Winberry (2020), Jungherr et al. (2022), Cloyne et al. (2023)
 - Financial conditions without MP: Chodorow-Reich (2014); Giroud and Mueller (2017); Bäurle et al. (2021)
- Monetary policy and the income distribution
 - Aggregate, between-firm wage inequality: Coibion *et al.* (2017), Broer *et al.* (2020), Amberg *et al.* (2022), Andersen *et al.* (2023), Gulyas *et al.* (2024), Groiss (2025)
 - Firm-level: Moser et al. (2021), Jasova et al. (2021)

A new firm-level dataset for Germany

- **Dafne**: Yearly financial accounts for public and private firms in Germany
- Establish a dynamic firm-bank link and match with **Bankfocus** to get yearly balance sheet information for banks
- Merge firms from Dafne with administrative establishment-worker data from IAB
 - Draw universe of individual employment information for those firms from **Integrated Labor Market Biographies (IEB)**
 - Calculate total employment, inflows, outflows, and stayers at quarterly frequency
- Final sample consists of 7,776,954 firm-quarter observations from 240,262 unique firms that are linked with 1,789 banks from 2005-2019



Data

Firm-level labor adjustment through the bank-lending channel

Firm-level local projections (Jordà, 2005):

$$Y_{i,t+h} = \alpha_i^h + \alpha_q^h + \beta^h M P_t + \gamma^h Z_{i,t-1} + \varepsilon_{i,t+h}$$

- $Y_{i,t+h}$: firm-level outcomes relative to period t-1
- *MP_t*: high-frequency identified pure monetary policy shock (Jarocinski and Karadi, 2020)
- α_i^h : firm-fixed effects; α_q^h : quarter-fixed effects
- $Z_{i,t-1}$: aggregate and firm-level controls

Firms' exposure to the bank-lending channel

- The bank-lending channel postulates that monetary policy affects the supply of bank loans to the economy (Bernanke and Blinder, 1988; Bernanke and Gertler, 1995)
- Bank balance sheet constraints amplify the loan supply response to MP:
 Bank equity, size, liquidity, reliance to deposits, ...
- We use **bank equity** as exogenous exposure of *firms* to bank-lending channel
 - Well capitalized banks borrow cheaper and shield their lending from shocks (Gambacorta and Marques-Ibanez, 2011), (Jiménez *et al.*, 2012), (Gambacorta and Shin, 2018)
- Identifying assumptions:
 - When MP tightens, lowly-capitalized banks reduce credit supply by more
 - firm-bank relationships are sticky
 - credit constrained firms do not sort themselves into weak banks

Empirical specification II

Firm-level local projection conditional on bank exposure:

$$Y_{i,t+h} = \alpha_i^h + \alpha_q^h + \beta_1^h M P_t + \sum_{g=2}^G \beta_g^h I \left[\mathbf{X_{ibt-1}} \in g \right] \mathbf{MP_t} + \sum_{g=2}^G \psi_g^h I \left[\mathbf{X_{ibt-1}} \in g \right] + \gamma^h Z_{i,t-1} + \varepsilon_{i,t+h}$$

- firm-bank fixed effects, quarter fixed effects
- + New: $\mathbf{X}_{ibt-1},$ bank equity of firms' relationship bank(s)
- I[.] equals 1 if X_{ibt-1} is in quartile g of the bank-equity distribution
- Focus on **multiple-bank** firms
- · Additional controls: industry-time, location-time fixed effects

Results: Wage bill and average wage



• Firms reduce wage costs following a 10 basis points contractionary monetary shock

Results: Wage bill and average wage



- Firms reduce wage costs following a 10 basis points contractionary monetary shock
- Driven by extensive (employment) rather than intensive margin (averages wages)

A closer look at employment dynamics

Employment in period t + h can be written as

$$N_{i,t+h} = N_{i,t-1} + \sum_{s=0}^{h} I_{i,t+s} - \sum_{s=0}^{h} O_{i,t+s}$$

Calculating growth rates between period t + h and t - 1 we get

$$\frac{N_{i,t+h} - N_{i,t-1}}{N_{i,t-1}} = \frac{\sum_{s=0}^{h} I_{i,t+s}}{N_{i,t-1}} - \frac{\sum_{s=0}^{h} O_{i,t+s}}{N_{i,t-1}}$$

 \Rightarrow Decompose employment growth into (relative) contributions of inflows I and outflows O

Employment decomposition into inflows and outflows

$$\frac{N_{i,t+h} - N_{i,t-1}}{N_{i,t-1}}$$



Red: lowest bank-equity quintile, blue: highest bank-equity quintile.

Employment decomposition into inflows and outflows



Red: lowest bank-equity quintile, blue: highest bank-equity quintile.

Employment decomposition into inflows and outflows



Red: lowest bank-equity quintile, blue: highest bank-equity quintile.

Firms reduce employment by hiring less, while outflows do not increase \rightarrow **firms hoard labor**

Employment decomposition by bank equity, h = 6

Multiple-bank firms	(1) Employment	(2) Inflow	(3) Outflow	(4) Employment	(5) Inflow	(6) Outflow
shock	-1.19***	-1.57***	-0.38***			
	(0.18)	(0.21)	(0.10)			
equity Q2 $ imes$ shock	0.39**	0.30*	-0.09	0.18	0.07	-0.11*
	(0.15)	(0.18)	(0.07)	(0.13)	(0.15)	(0.06)
equity Q3 $ imes$ shock	0.43**	0.31	-0.12	0.21*	0.10	-0.11*
	(0.17)	(0.20)	(0.09)	(0.11)	(0.12)	(0.06)
equity Q4 $ imes$ shock	0.54***	0.37*	-0.17	0.24**	0.08	-0.16**
	(0.18)	(0.22)	(0.11)	(0.11)	(0.14)	(0.07)
equity Q5 $ imes$ shock	0.67***	0.39*	-0.28**	0.33***	0.07	-0.26***
	(0.19)	(0.23)	(0.11)	(0.13)	(0.15)	(0.08)
Ν	4,153,019	4,153,019	4,153,019	4,153,018	4,153,018	4,153,018
Benchmark controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
county-time, industry-time FE				\checkmark	\checkmark	\checkmark

Employment decomposition across within-firm wage distribution

$$\frac{N_{i,t+h}^{Q_{t+h-1}} - N_{i,t-1}^{Q_{t-2}}}{N_{i,t-1}} = \frac{\sum_{s=0}^{h} I_{i,t+s}^{Q_{t+s-1}}}{N_{i,t-1}} - \frac{\sum_{s=0}^{h} O_{i,t+s}^{Q_{t+s-1}}}{N_{i,t-1}} + \frac{\sum_{s=0}^{h} \left[S_{i,t+h|t+h-1}^{Q_{t+h-1}} - S_{i,t+h|t+h-1}^{Q_{t+h-1}}\right]}{N_{i,t-1}} + \frac{\sum_{s=0}^{h} \left[S_{i,t+h|t+h-1}^{Q_{t+h-1}} - S_{i,t+h-1}^{Q_{t+h-1}}\right]}{N_{i,t-1}} + \frac{\sum_{s=0}^{h} \left[S_{i,t+h-1}^{Q_{t+h-1}} - S_{i,t+h-1}^{Q_{t+h-1}}\right]}{N_{i,t-1}} + \frac{\sum_{s=0}^{h} \left[S_{i,t+h-1}^{Q_{t+h-1}} - S_{i,t+h-1}^{Q_{t+h-1}}\right]}{N_{i,t-1}} + \frac{\sum_{s=0}^{h} \left[S_{i,t+h-1}^{Q_{t+h-1}} - S_{i,t+h-1}^{Q_{t+h-1}}\right]}{N_{i,t-1}} + \frac{\sum_{s=0}^{h} \left[S_{i,t$$

- Sort the workforce into firm-specific wage quartiles
- Changes in employment in firm i between periods t + h and t 1 in terms of the wage quartile from t 1 can be decomposed into
 - 1. cumulative inflows I_i minus outflows O_i
 - 2. plus workers that stayed in the firm between t 1 and t + h, but resort into or out of the respective quartile
- Here, we will show impulse horizon $h=6 \ {\rm only}$

Employment decomposition by bank equity, wage quartiles, h=6



Red: lowest bank-equity quintile, blue: highest bank-equity quintile. Multiple-bank firms.

Additional findings

- Bank relationships: weaker effects for single bank firms
- Asymmetry: strong response to **contractionary** monetary policy
- What drives the fall in outflows?
 - 1. outflows by outcome type:
 - job-to-job transitions (*ee outflows*) decrease (stronger for transitions with higher wages)
 - flows to non-employment (en outflows) increase (amplified by BLC)
 - 2. outflows by job tenure:
 - higher decrease for very short tenure (1 quarter) and long tenure (3+ years)
 - 3. outflows by skill:
 - strong decrease for the high skilled labor (amplified by BLC)

Summary

- Contractionary monetary policy shocks lead to a fall in firm-level employment through a reduction in inflows, not through outflows
 → Firms hoard labor
- The decline in inflows is especially strong for low-wage workers, while outflows decline for high-wage workers
 → Firms reallocate towards high-wage workers
- Effects are driven by firms for which the bank-lending channel 'bites'
 → Firms hoard high-wage labor even more
- Outlook: Role of EPL, labor scarcity, effect on wages

Appendix

Some details on our sample

- Drop firms in the financial sector, public administration, and defense
- Focus on full-time employees that are subject to social security (regular jobs)
- Focus on middle month of a quarter to calculate quarterly dataset
- We classify employment as existing employment (stayer), new employment (inflow) and terminating employment (outflow) based on the mobility of workers between consecutive quarters.
- We create firm level payroll, employment and wage measures for all types of employment.
- We cover about 20 percent of total employment according to national accounts

Data descriptives

	Mean	Min	p10	p50	p90	Мах	Observations
Employment	56.06	1	11	22	103	55377	7,776,954
Inflow rate	0.07	0.00	0.00	0.04	0.17	216.40	7,776,954
Outflow rate	0.06	0.00	0.00	0.04	0.15	1.00	7,776,954
Mean daily wage	96.13	3.10	58.96	91.07	139.56	773.02	7,776,954
Wage sum	6371.69	3.10	850.60	2059.34	10719.63	12502244	7,776,954
Firm age	29.69	0	7	23	58	804	7,776,954
No. of banks	1.82	1	1	2	3	16	7,776,954
Bank equity ratio	0.06	0.00	0.03	0.06	0.09	0.16	7,776,954
Firm total assets	7018.83	57.10	398.33	1752.50	14509.33	135844.33	6,624,824
Firm leverage	0.33	0.00	0.00	0.26	0.75	1.41	6,510,834

Table 1: Summary statistics at the firm level, 2005-2019. Source: IEB, Dafne,Bankscope-Bankfocus.



Panel A: AWFP Sample									
	mean	min	p10	p50	p90	max	observations		
employment	11.61	1	1	3	19	55264	87,348,601		
mean daily wage	76.58	0.01	35.17	70.24	122.22	3296.25	87,348,601		
wage sum	1282.46	0.01	43.42	183.82	1722.34	12813336	87,348,601		
Panel B: IEB Establi	shment Sa	mple							
employment	44.43	1	4	18	85	55377	9,812,189		
wage	97.08	0.03	57.87	91.14	143.70	773.02	9,812,189		
wage sum	5050.08	0.03	372.97	1681.81	8777.37	12502244	9,812,189		

Table 2: Summary statistics at the establishment level, 2005-2019. Source: AWFP, IEB.

Data descriptives by industry

Industry	IEB Sample	AWFP Sample
1 Agriculture, forestry and fishing	1.24	2.14
2 Mining and quarrying	0.33	0.14
3 Manufacturing	27.29	10.95
4 Electricity, gas, steam and air conditioning supply	0.69	0.31
5 Water supply, sewerage, waste management and remediation activities	1.23	0.57
6 Construction	14.75	12.31
7 Wholesale and retail trade: repair of motor vehicles, and motorcycles	18.05	21.62
8 Transportation and storage	6.35	4.58
9 Accommodation and food service activities	2.65	6.23
10 Information and communication	4.67	2.9
12 Real estate activities	1.34	2.25
13 Professional. scientific and technical activities	7.23	9.79
14 Administrative and support service activities	6.42	5.51
16 Education	0.96	2.88
17 Human health and social work activities	4.73	11.41
18 Arts, entertainment and recreation	0.73	1.39
19 Other services	1.31	5.02

Data coverage



Figure 1: Employment Comparison: Coverage and year-on-year growth. Source: IEB, Destatis.



Descriptives by bank equity at firm level, 2005-2019

Panel A: low-equity banks								
	mean	min	p10	p50	p90	max	observations	
employment	87.71	1	11	27	164	53857	1,511,242	
inflow	0.07	0.00	0.00	0.04	0.17	57.06	1,511,242	
outflow	0.06	0.00	0.00	0.04	0.15	1.00	1,511,242	
mean wage	104.87	9.17	58.68	98.00	161.48	380.00	1,511,242	
wage sum	11135.14	10.54	901.97	2708.10	19307.04	11803545.00	1,511,242	
age	26.62	0	7	20	49	761	1,511,242	
num. of banks	1.68	1.00	1.00	1.00	3.00	8.00	1,511,242	
bank equity ratio	0.03	0.00	0.01	0.03	0.05	0.06	1,511,242	
firm assets	11201.50	57.10	410.21	2331.00	34111.33	135844.33	1,231,623	
firm leverage	0.28	0.00	0.00	0.21	0.69	1.41	1,201,917	
Panel B: high-equit	y banks							
employment	35.77	1	11	19	64	14083	1,556,788	
inflow	0.07	0.00	0.00	0.04	0.17	216.40	1,556,788	
outflow	0.07	0.00	0.00	0.05	0.17	1.00	1,556,788	
mean wage	90.01	9.64	58.72	86.78	124.35	306.84	1,556,788	
wage sum	3500.27	9.64	805.35	1660.72	6012.62	3739034	1,556,788	
age	28.30	0	7	22	53	804	1,556,788	
num. of banks	1.49	1	1	1	2	9	1,556,788	
bank equity ratio	0.09	0.05	0.06	0.09	0.11	0.16	1,556,788	
firm assets	3705.84	57.10	354.00	1313.58	6620.67	135844.33	1,347,986	
firm leverage	0.35	0.00	0.00	0.30	0.78	1.41	1,327,744	

Aggregate monetary policy responses, 2005-2019



Figure 2: Aggregate responses to a 2-standard deviation contractionary monetary policy shock. Data is from the national accounts, total dependent employment excludes self-employed.

Monetary policy shocks



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Monetary policy transmission

- Interest rate hikes directly affect the cost of borrowing for firms and households and deposit rates ("cost-of-capital" channel)
- These effects may be amplified, e.g., through banks such that small interest rate changes may have large effects
 - *balance-sheet channel*: higher policy rates compress asset prices, thus lowering the net worth of borrowers
 - *bank-lending channel*: the impact of policy tightening on the supply of bank loans to the economy
 - *risk-taking channel*: banks are incentivized to make riskier investments in an environment of lower interest rates

Identification of bank-lending channel

- We argue that firms with low-equity banks are more financially constrained
- 2 conditions
 - 1. firm-bank relationships are sticky
 - less than 4 percent of firms change their main relationship bank within 2 years in our data
 - Dwenger *et al.* (2020) also find that firms in Germany typically have long-term bank relationships
 - 2. exogeneity: firms do not sort themselves to weak banks if they are already constrained themselves, for example, due to a weak balance sheet
 - Firms with low equity banks are, on average, larger, older and have lower leverage
 Table
 - Financially constrained firms tend to sort into strongly capitalized banks to insure themselves.
 - Our MP transmission mechanism works not through, but despite this sorting.

Wage bill and average wage by bank equity, h=6

Multiple-bank firms	(1)	(2)	(3)	(4)	(5)	(6)
	Employment	Wage sum	Wage	Employment	Wage sum	Wage
shock	-1.19*** (0.18)	-1.62*** (0.22)	-0.42*** (0.08)			
equity Q2 $ imes$ shock	0.39**	0.44***	0.04	0.18	0.16	0.16
	(0.15)	(0.16)	(0.05)	(0.13)	(0.11)	(0.11)
equity Q3 $ imes$ shock	0.43**	0.45**	0.00	0.21*	0.20*	0.20*
	(0.17)	(0.20)	(0.07)	(0.11)	(0.10)	(0.10)
equity Q4 $ imes$ shock	0.54***	0.57***	0.01	0.24**	0.24**	0.24**
	(0.18)	(0.22)	(0.08)	(0.11)	(0.10)	(0.10)
equity Q5 $ imes$ shock	0.67***	0.75***	0.05	0.33***	0.34***	0.34***
	(0.19)	(0.23)	(0.08)	(0.13)	(0.12)	(0.12)
N Benchmark controls county-time, industry-time FE	4,153,019 Y	4,153,019 Y	4,153,019 Y	4,153,018 Y Y	4,153,018 Y Y	4,153,018 Y Y

Full sample: Employment and wages

	Full Sample							
	(1) Employment	(2)	(3)	(4) Employment	(5)	(6) Wasa		
	Employment	wage sum	wage	Employment	wage sum	wage		
shock	-0.94*** (0.20)	-1.32*** (0.25)	-0.36*** (0.08)					
equity Q2 $ imes$ shock	0.14 (0.19)	0.11 (0.21)	-0.05 (0.06)	0.09 (0.12)	0.06 (0.12)	0.06 (0.12)		
equity Q3 $ imes$ shock	0.29 (0.20)	0.23 (0.24)	-0.08 (0.07)	0.08 (0.11)	0.04 (0.11)	0.04 (0.11)		
equity Q4 $ imes$ shock	0.34* (0.21)	0.31 (0.25)	-0.06 (0.08)	0.16 (0.12)	0.12 (0.12)	0.12 (0.12)		
equity Q5 $ imes$ shock	0.43** (0.21)	0.42* (0.25)	-0.05 (0.08)	0.21 (0.13)	0.17 (0.13)	0.17 (0.13)		
N	7,776,954	7,776,954	7,776,954	7,776,954	7,776,954	7,776,954		

Single Bank Firms

Full sample: Employment decomposition

	Full Sample								
	(1)	(2)	(3)	(4)	(5)	(6)			
	Employment	Inflow	Outflow	Employment	Inflow	Outflow			
	Emptoyment	mitow	outitow	Employment	mitow	outitow			
shock	-0.94*** (0.20)	-1.41*** (0.26)	-0.47*** (0.13)						
equity Q2 $ imes$ shock	0.14	0.14	0.00	0.09	0.09	-0.00			
	(0.19)	(0.24)	(0.11)	(0.12)	(0.15)	(0.07)			
equity Q3 $ imes$ shock	0.29	0.25	-0.04	0.08	0.04	-0.04			
	(0.20)	(0.25)	(0.13)	(0.11)	(0.15)	(0.08)			
equity Q4 $ imes$ shock	0.34*	0.22	-0.12	0.16	0.06	-0.10			
	(0.21)	(0.26)	(0.14)	(0.12)	(0.16)	(0.08)			
equity Q5 $ imes$ shock	0.43**	0.28	-0.15	0.21	0.06	-0.14			
	(0.21)	(0.27)	(0.14)	(0.13)	(0.18)	(0.09)			
Ν	7,776,954	7,776,954	7,776,954	7,776,954	7,776,954	7,776,954			

Single Bank Firms

Employment decomposition by bank equity, wage quartiles





Asymmetric responses I



Figure 3: Wage and employment responses contractionary (red) and expansionary (blue) monetary policy shock at the firm level. The bands represent 68 and 95 percent confidence bands.



Asymmetric responses II: contractionary (red), expansionary (blue)



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Asymmetric responses III: contractionary (red), expansionary (blue)



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