The Cost Channel of Monetary Policy: Evidence from Euro Area Firm-level Survey Data

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The views in this paper are solely those of the authors and do not necessarily reflect the views of the European Central Bank or the Eurosystem.

Motivation

▶ How do firms change their prices with changes in monetary policy?

▶ Aggregate demand: Models usually assume that changes in monetary policy have an effect on the economy via the **demand channel**

▶ Aggregate supply: But several papers stress the importance of the **supply channel**, which augments the effect of the demand channel, especially on the short term (e.g. Christiano and Eichenbaum, 1992; Barth and Ramey, 2002; Christiano et al. 2005; Chowdhury et al. 2006; Ravenna and Walsh, 2006; Rabanal, 2007; Ravenna and Walsh, 2008; Surico, 2008; Tillmann, 2008; Henzel et al., 2009; Castelnuovo, 2012)

This Paper

- Empirically assess the **cost channel** of monetary policy transmission in the euro area by focusing on the recent monetary policy hiking cycle
  - Increase in interest rates affects short term financing used to manage **working capital**, raising firms' marginal cost
- Uses survey data on firms' expected selling prices and credit register for their working capital exposure to study the transmission of monetary policy to selling prices
- Compare pricing plans of firms which reply to the survey just before/after ECB Governing Council Meetings

Main result:

- Rate hikes captured by monetary policy shocks lead to higher expected selling prices for firms with working capital exposure

Data

- **Survey on the access to finance of enterprises (SAFE)**
    - Firms' selling price expectations one year ahead
    - Use firms replies from 4 survey waves collected between: (1) 6 March - 14 April 2023; (2) 25 May -26 June 2023; (3) 4 September -18 October 2023; (4) 1 February -12 March 2024

- **AnaCredit**
    - Credit register of the European System of Central Banks which contains information on all individual bank loans to firms at a monthly frequency
    - For each instrument, it reports the interest rate charged by the issuing bank, outstanding and off-balance amount, maturity and other characteristics
    - The purpose of the loan is also specified: here focus on *working capital loans*

- **Monetary policy shocks**
    - Monetary policy shocks as in Altavilla et al. (2019), mapping monetary policy communication into yield curve changes
    - Focus on the *target* component, which is related to the surprise in the immediate setting of the policy rate

Estimation and identification (1)

▶ We focus on firms' indicating their selling price expectation before/after ECB Governing Council Meetings/Press conferences

  ▶ Select optimal time window of up to 6 days before/after Meetings `Distribution expected selling price` `Difference in expected selling price around Meetings`

  ▶ The day on which firms reply to the survey is exogenous $\rightarrow$ uncorrelated with firm characteristics `Balance table firms`

  ▶ Firms replying after the Meeting learn about higher interest rates

▶ Estimate the impact of monetary policy shocks on selling price expectation of firms `Monetary policy shock`

▶ With a focus on the working capital exposure of the firm

  ▶ Theoretically motivated firm heterogeneity to capture the cost channel

  ▶ Interest costs well captured for firms in the SAFE with working capital exposure (in comparison with the universe of firms with working capital exposure) `Interest rates working capital loans`

  ▶ Firms replying in the days before and after the Meeting are similar also in their *borrowing* `Borrowing characteristics`

Estimation and identification (2)

We estimate the following equation:

$$Y_{it} = \alpha + \beta WKexposure_i \times MPShock_t \times Post_{it} + \delta Controls_{it} + \varepsilon_{it}, \tag{1}$$

where:

- i denotes firm
- t denotes daily time
- Y_{it} denotes firm's selling price expectations specified on a given day around the Meeting
- $MPShock_t$ refers to monetary policy shocks
- $Post_t$ captures the days after the Meeting
- $WKexposure_i$ denotes firms' exposure to working capital financing in the month preceding the Meeting
- $Controls_{it}$ stands for further controls or fixed effects, depending on specification

Change in firms' one year ahead selling price expectations

	(1) Δ sellp.	(2) Δ sellp.	(3) Δ sellp.
MPS × Post	-0.0346 (0.0808)	0.0261 (0.0728)	-0.1119 (0.0698)
MPS × Post × WK_ALL	0.2725* (0.1402)		
MPS × Post × WK_ONBS		0.1528 (0.1322)	
MPS × Post × WK_OFFBS			0.3647*** (0.1043)
N	2052	1983	1818
R^2	0.082	0.090	0.075
Size FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Firm control	Yes	Yes	Yes

Notes: The table shows the effect of monetary policy surprises (target) on firms' one year ahead selling price expectations considering a 6-day time window before and after the Governing Council meetings of the ECB. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

Heterogeneous effects

	(1) SME	(2) Large	(3) Manuf	(4) Other ind.	(5) Old	(6) Young	(7) Single own.	(8) Mult. own.
MPS × Post	0.1591*	-0.1059	-0.1819	0.1002	-0.0246	0.1921	-0.0070	-0.0346
	(0.0816)	(0.1245)	(0.1256)	(0.1215)	(0.0831)	(0.5128)	(0.1712)	(0.0874)
MPS × Post × WK	-0.1209	0.4992**	0.7534***	0.0225	0.2636*	0.2835	0.0103	0.3282**
	(0.1358)	(0.2412)	(0.2168)	(0.2084)	(0.1440)	(1.0392)	(0.2938)	(0.1631)
N	1731	319	823	750	1985	62	517	1473
R^2	0.050	0.198	0.144	0.127	0.087	0.388	0.112	0.119
Size FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table shows the effect of monetary policy surprises (target) on firms' one year ahead selling price expectations considering a 6-day time window before and after the Governing Council meetings of the ECB. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

Market concentration

	(1) HI < MED	(2) HI ≥ MED	(3) TOP5 < MED	(4) TOP5 ≥ MED	(5) TOP10 < MED	(6) TOP10 ≥ MED
MPS × Post	-0.1744*	0.1123	-0.1364	0.0756	-0.1597	0.1044
	(0.1022)	(0.1067)	(0.1077)	(0.1052)	(0.1068)	(0.1014)
MPS × Post × WK_ALL	0.4761***	0.0370	0.4115**	0.1196	0.4454**	0.0616
	(0.1829)	(0.1853)	(0.1877)	(0.1804)	(0.1841)	(0.1726)
N	1159	893	1131	921	1163	889
R^2	0.104	0.142	0.096	0.149	0.102	0.146
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm control	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table shows the effect of monetary policy surprises (target) on firms' one year ahead selling price expectations considering a 6-day time window before and after the Governing Council meetings of the ECB. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

Other firm level outcomes:expected labor costs

	(1) Δ wage	(2) Δ wage	(3) Δ wage
MPS $\times$ Post	-0.0419	-0.0306	-0.0026
	(0.0414)	(0.0340)	(0.0451)
MPS $\times$ Post $\times$ WK_ALL	0.0943		
	(0.0749)		
MPS $\times$ Post $\times$ WK_ONBS		0.0586	
		(0.0683)	
MPS $\times$ Post $\times$ WK_OFFBS			0.0301
			(0.0669)
N	2130	2064	1877
R^2	0.178	0.175	0.183
Size FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Firm control	Yes	Yes	Yes

Notes: The table shows the effect of monetary policy shocks on firms' one year ahead labor cost expectations considering firms' working capital exposure one month before the survey and a 6-day time window before and after the Governing Council meetings of the ECB. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

Other firm level outcomes: expected non-labour input costs

	(1) Δ cost	(2) Δ cost.	(3) Δ cost
MPS $\times$ Post	-0.0061	-0.1425	0.0088
	(0.1805)	(0.1549)	(0.1642)
MPS $\times$ Post $\times$ WK_ALL	0.0812		
	(0.3315)		
MPS $\times$ Post $\times$ WK_ONBS		0.5189*	
		(0.2648)	
MPS $\times$ Post $\times$ WK_OFFBS			-0.0099
			(0.2725)
N	1485	1434	1311
R^2	0.085	0.089	0.076
Size FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Firm control	Yes	Yes	Yes

Notes: The table shows the effect of monetary policy shocks on firms' one year ahead non-labor input cost expectations considering firms' working capital exposure one month before the survey and a 6-day time window before and after the Governing Council meetings of the ECB. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

Other firm level outcomes: expected employment

	(1)	(2)	(3)
	Δ empl.	Δ empl.	Δ empl.
MPS ×*Post*	0.2917	0.1878	0.0459
	(0.1870)	(0.1579)	(0.1457)
MPS ×*Post* × *WK_ALL*	-0.6252*		
	(0.3394)		
MPS ×*Post* × *WK_ONBS*		-0.4041	
		(0.2950)	
MPS ×*Post* × *WK_OFFBS*			-0.2131
			(0.2995)
N	1511	1461	1333
R^2	0.108	0.107	0.106
Size FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Firm control	Yes	Yes	Yes

Notes: The table shows the effect of monetary policy shocks on firms' one year ahead employment expectations considering firms' working capital exposure one month before the survey and a 6-day time window before and after the Governing Council meetings of the ECB. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

Robustness checks

- ▶ Placebo period
- ▶ Alternative event windows
- ▶ Firm liquidity
- ▶ Inflation releases
- ▶ Change in the deposit facility rate

Conclusion

- ▶ Show evidence supporting the cost channel of monetary policy: tighter monetary policy leads to higher expected selling prices for firms with working capital exposure
- ▶ Larger, established firms, and those in the manufacturing sector, are more likely to raise expected prices if they depend on working capital
- ▶ Firms in concentrated markets are less affected, possibly because they can absorb higher cost shocks without raising prices

Caveats:
- ▶ Do not capture the dynamic effect on selling prices
- ▶ Results do not contradict the overall impact of monetary policy tightening

Thank you!

Distribution of selling price expectations before and after the ECB Governing Council Meetings
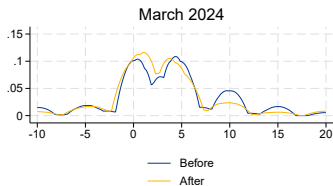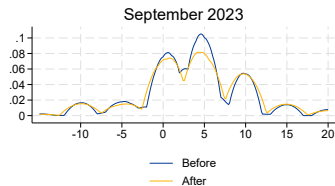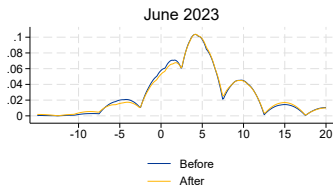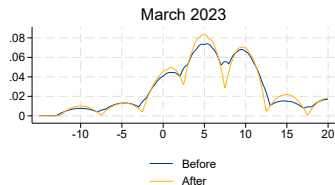

Notes: The chart shows kernel densities for the expectations of selling prices for firms replying 6 days before/after the ECB Governing Council meeting.

Selling price expectations of firms *around the days* of the ECB Governing Council Meetings meetings
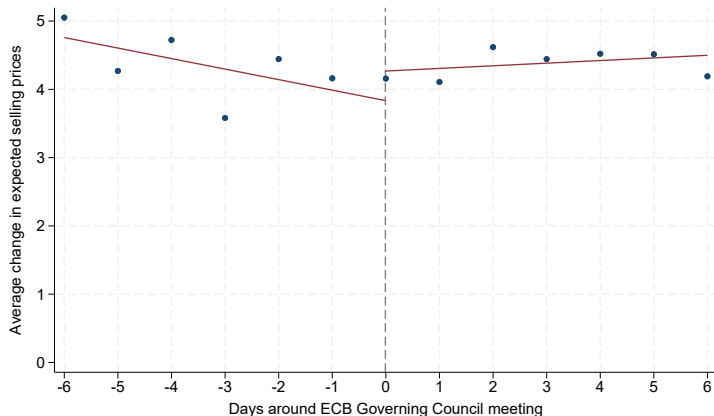
Notes: The chart shows a binned scatter plot for the expectations of selling prices for firms replying up 6 days before/after the ECB Governing Council meeting.

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Share of firms responding in the SAFE survey in the days around the GOVC meeting
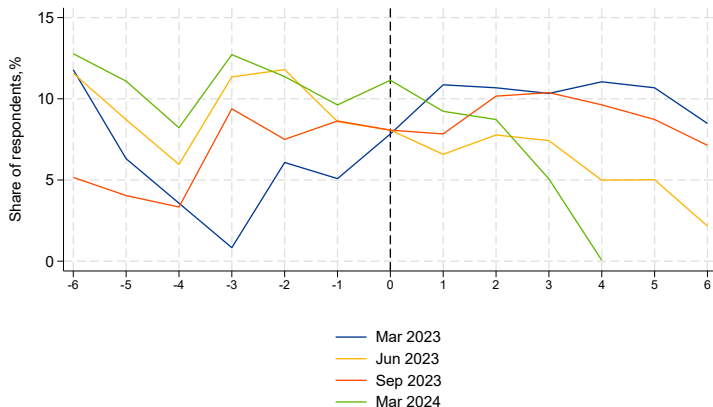
Notes: The chart shows the share of firms responding up to 6 days before/after the ECB Governing Council meetings.

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Characteristics of firms <u>replying before/after MP shocks</u>

|	Before mean/sd	After mean/sd	Difference/T-statistics t
Size, 1-9 empl.	0.35	0.37	-3.05**
	(0.48)	(0.48)	
Size, 10-49 empl.	0.29	0.31	-1.83
	(0.46)	(0.46)	
Size, 50-249 empl.	0.26	0.24	2.54*
	(0.44)	(0.43)	
Size, ¿=250 empl.	0.10	0.08	4.13***
	(0.30)	(0.27)	
Industry	0.25	0.25	1.22
	(0.44)	(0.43)	
Construction	0.12	0.12	0.03
	(0.33)	(0.33)	
Trade	0.23	0.23	-0.69
	(0.42)	(0.42)	
Services	0.39	0.40	-0.51
	(0.49)	(0.49)	
¿=10 years	0.90	0.91	-1.92
	(0.31)	(0.29)	
¿=5, ¡10 years	0.07	0.06	1.94
	(0.26)	(0.24)	
¿=2, ¡5 years	0.03	0.03	0.15
	(0.16)	(0.16)	
¡2 years	0.01	0.01	0.72
	(0.08)	(0.07)	
Public shareholders	0.03	0.02	2.08*
	(0.16)	(0.14)	
Family/entrepreneurs	0.42	0.43	-1.82
	(0.49)	(0.50)	
Other firm	0.15	0.14	0.80
	(0.36)	(0.35)	
Venture capital	0.01	0.01	0.13
	(0.09)	(0.09)	
One owner, natural p.	0.36	0.36	-0.16
	(0.48)	(0.48)	
Labor productivity, Eur th.	63.67	66.53	-1.17
	(83.26)	(88.77)	
Observations	7292	9371	16663

Notes: *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

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Loan characteristics of firms with working capital exposure replying before/after the Meeting

|	Before mean/sd	After mean/sd	T-statistics of the difference t
Outstanding amount, Th. Eur	817.80 (2282.18)	845.40 (2572.71)	-0.42
Off-balance amount, Th. Eur	437.53 (958.45)	394.74 (901.06)	1.67
Rate outstanding amount, Percent	2.98 (3.23)	2.97 (3.24)	0.04
Rate off-balance amount, Percent	3.47 (3.73)	3.57 (3.81)	-0.93
Maturity, outstanding amount, Months	18.81 (65.99)	20.04 (74.38)	-0.64
Maturity, off-balance amount, Months	5.65 (30.28)	5.22 (34.71)	0.49
Observations	2326	3115	5441

Notes: The table shows the characteristics of bank loans of firms with exposure in AnaCredit replying up to 6 days before and 6 days after the ECB Governing Council meetings and the significance of the average difference between the two groups of firms (t-statistics). *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

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Rates on loans with working capital purpose to firms in AnaCredit and SAFE
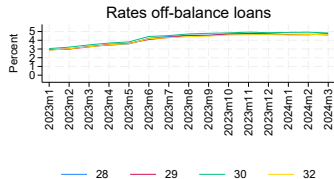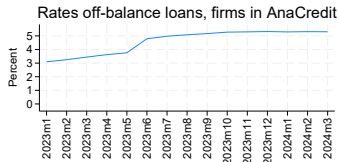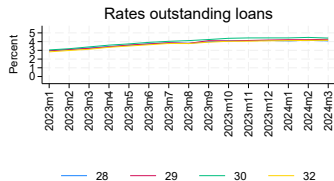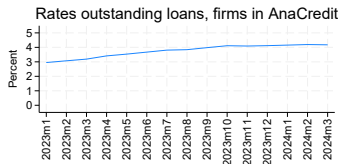

Notes: Left panels show rates at origination of outstanding/off-balance sheet nominal amounts with working capital purpose for all firms in AnaCredit, whereas right panels show rates of outstanding or off-balance sheet nominal amounts with working capital purpose for firms in the SAFE waves. Back

Key ECB interest rates
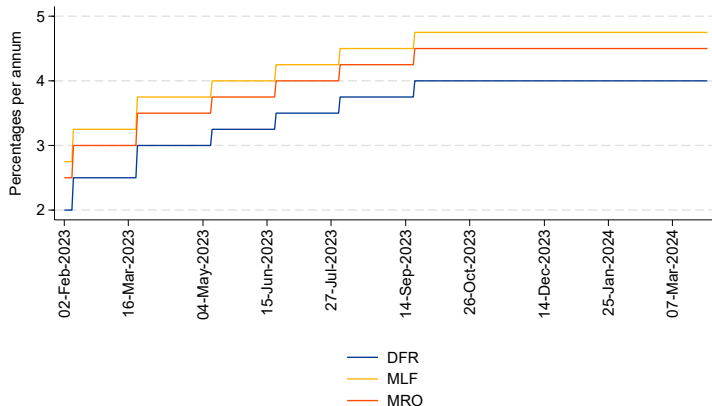
Notes: The chart shows the ECB deposit facility rate (DFR), the marginal lending facility rate (MLF) and the main refinancing operation rate (MRO) for the ECB Governing Council meetings taking place between February 2023 and March 2024.

Monetary policy shocks
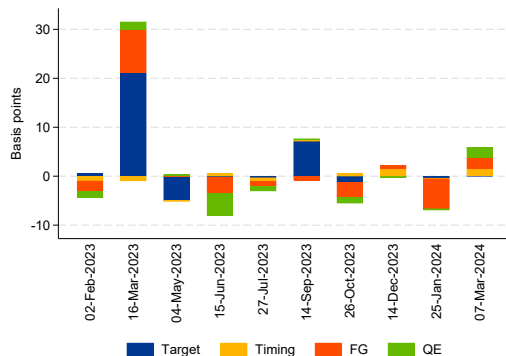
Notes: The chart shows monetary policy shocks, computed as in Altavilla et al. (2019) for the ECB Governing Council meetings taking place between February 2023 and March 2024. Back

Importance of working capital for euro area firms

Loan volumes by purpose / Type of working capital loan
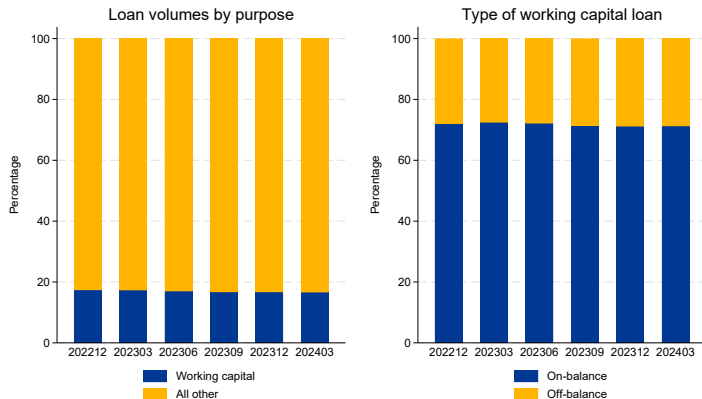
Notes: The left panel shows the share of loans with working capital purpose to total loans for firms in the euro area, based on AnaCredit. The right panel shows the share of on-balance and off-balance loans with working capital purpose for firms in the euro area, based on AnaCredit.

Change in firms' one year ahead selling price expectations -monetary policy shocks

	(1)	(2)	(3)	(4)	(5)	(6)
	Δ sellp.	Δ sellp.	Δ sellp.	Δ sellp.	Δ sellp.	Δ sellp.
MPS × Post	0.0223	0.0306	0.0334*	0.0312	0.0402**	0.0600*
	(0.0196)	(0.0194)	(0.0194)	(0.0192)	(0.0192)	(0.0356)
N	13853	13853	13853	13853	13853	4007
R^2	0.019	0.033	0.043	0.058	0.061	0.055
Size FE	No	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes	Yes	Yes
Country FE	No	No	No	Yes	Yes	Yes
Time FE	No	No	No	No	Yes	Yes
Firm control	No	No	No	No	No	Yes

Notes: The table shows the effect of monetary policy surprises (target) on firms' one year ahead selling price expectations considering a 6-day time window before and after the Governing Council meetings of the ECB. Further controls included as discussed in the main text, not shown. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

Robustness: Results for placebo period

	(1) Δ sellp.	(2) Δ sellp.	(3) Δ sellp.
MPS × Post × WK_ALL	2.6190 (2.0061)		
MPS × Post × WK_ONBS		2.1667 (1.8546)	
MPS × Post × WK_OFFBS			-0.0531 (1.6365)
N	554	534	500
R^2	0.128	0.128	0.159
Size FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Firm control	Yes	Yes	Yes

Notes: The table shows the effect of monetary policy shocks on firms' one year ahead selling price expectations considering firms' working capital exposure one month before the survey and a 6-day time window before and after the Governing Council meetings of the ECB. November 23, 2023 is considered as a mock date for ECB Governing Council meeting while firms' replies for selling price expectation are used for wave 31 of the Survey, run between 13 November and 13 December 2023, the only Survey which does not overlap with a Governing Council meeting, but has information on firms' selling price expectations. Further controls included as discussed in the main text, not shown. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

Robustness: Alternative event window

	(1) Δ sellp.	(2) Δ sellp.	(3) Δ sellp.
MPS × Post	-0.0609 (0.1268)	0.0104 (0.1062)	-0.1061 (0.1193)
MPS × Post × WK_ALL	0.2110 (0.2169)		
MPS × Post × WK_ONBS		0.0884 (0.1797)	
MPS × Post × WK_OFFBS			0.2730 (0.1746)
N	1213	1178	1080
R^2	0.090	0.095	0.066
Size FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Firm control	Yes	Yes	Yes

Notes: The table shows the effect of monetary policy shocks on firms' one year ahead selling price expectations considering firms' working capital exposure one month before the survey and a 3-day time window before and after the Governing Council meetings of the ECB. Further controls included as discussed in the main text, not shown. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

Robustness: Control for firm liquidity

	(1) Δ sellp.	(2) Δ sellp.	(3) Δ sellp.
Internal funds	-1.1408***	-0.9969**	-1.2837***
	(0.4105)	(0.4127)	(0.4434)
MPS × Post	-0.0432	0.0200	-0.1295*
	(0.0808)	(0.0733)	(0.0694)
MPS × Post × WK_ALL	0.2805**		
	(0.1372)		
MPS × Post × WK_ONBS		0.1518	
		(0.1307)	
MPS × Post × WK_OFFBS			0.3883***
			(0.1034)
N	2052	1983	1818
R^2	0.090	0.096	0.085
Size FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Firm control	Yes	Yes	Yes

Notes: The table shows the effect of monetary policy shocks on firms' one year ahead selling price expectations considering firms' working capital exposure one month before the survey and a 6-day time window before and after the Governing Council meetings of the ECB. Further controls included as discussed in the main text, not shown. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.

Robustness: CPI surprise

	(1) Δ sellp.	(2) Δ sellp.	(3) Δ sellp.
EA CPI surprise $\times Post$	0.0136	0.0245	0.0527**
	(0.0231)	(0.0228)	(0.0236)
EA CPI surprise $\times Post \times WK\_ALL$	0.0101		
	(0.0436)		
EA CPI surprise $\times Post \times WK\_ONBS$		-0.0086	
		(0.0431)	
EA CPI surprise $\times Post \times WK\_OFFBS$			-0.0473
			(0.0430)
N	4108	3932	3454
R^2	0.870	0.869	0.870
Size FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Firm control	Yes	Yes	Yes

Notes: The table shows the effect of monetary policy shocks on firms' one year ahead selling price expectations considering firms' working capital exposure one month before the release and a 6-day time window before and after the release. EA CPI surprise is the difference between the realised year-on-year growth rate for inflation all-items and the one year ahead selling price expectations reported by SAFE respondents. Further controls included as discussed in the main text, not shown. *** = significant at 1-percent level; ** = significant at 5-percent level; * = significant at 10-percent level.