

Inflation and Floating-Rate Loans: Evidence from the Euro-Area

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Abstract

We show that floating-rate corporate debt weakens the transmission of monetary policy, as firms with floating-rate loans keep prices elevated after a rate hike to preserve cash flows. Using monthly data on product-level prices, industry-level inflation rates and the euro-area credit register from 2021 to 2023, we find that the short-run pass-through of monetary tightening to inflation is about 50% smaller in markets dominated by floating-rate loans. To address the selection of firms into floating-rate loans, we exploit within-product-type variation in demand conditions and instrument for floating-rate exposure using bank-side supply factors. The floating-rate effect is stronger when firms rely more on working capital and when competitors also borrow at floating rates, consistent with cost pass-through being feasible only when rivals face the same funding pressure. Firms more exposed to floating-rate loans increase mark-ups more during the tightening cycle, but also see higher funding costs. Overall, had firms across the euro area relied less on floating-rate loans, inflation would have been up to 0.8 percentage points lower in 2022–2023.

Keywords: Monetary policy transmission, Inflation, Floating-rate loans, Market power, Product prices

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1 Introduction

A tightening of monetary policy is widely viewed as the main tool to reduce inflation. In conventional macroeconomic models, higher policy rates slow inflation primarily by reducing aggregate demand (Clarida et al., 1999; Christiano et al., 1999). A large empirical literature confirms that increases in borrowing costs induced by monetary tightening reduce spending through a demand-side channel (e.g., Gertler and Karadi, 2015; Mian and Sufi, 2018), especially for households with mortgages, whose consumption responds significantly to interest rate changes (Di Maggio et al., 2017; Cloyne et al., 2020). Much less is known, however, about whether monetary policy may also affect inflation through firms' own pricing decisions on the supply side.¹ In particular, standard models largely abstract from how the composition of corporate debt affects the transmission of monetary policy.

In this paper, we show that whether corporate debt carries a fixed or floating rate matters for monetary policy transmission. Unlike fixed-rate debt, whose interest rate does not adjust to short-term rate changes, floating-rate debt increases firms' financing costs directly and immediately after a rate hike. As a result, firms with floating-rate loans raise prices to preserve cash flows, dampening the disinflationary effect of monetary tightening. In this sense, floating-rate corporate debt creates a firm-side cost channel of monetary policy, akin to a financing-cost shock (Gilchrist et al., 2017; Lenzu et al., 2025; Drechsler et al., 2026).

To study this question, we combine three micro-level datasets. AnaCredit, the ECB's confidential loan-level credit register, covers all euro-area bank loans above €25,000 and records whether each loan carries a floating or fixed interest rate. We merge AnaCredit with product-level store scanner prices from Information Resources, Inc. (IRi), covering 274,335 products sold by 10,498 firms through supermarkets in France, Germany, and Italy,

¹U.S. Congressman Patman argued in 1970 that raising rates to fight inflation was like "throwing gasoline on fire" (Seelig, 1974), while in the 1980s British businessmen regarded "interest rate as a cost and look to establish a price *rise* in response to increased interest rates" (Goodhart, 1986; Gaiotti and Secchi, 2006). This is reminiscent of the cost channel of monetary policy (Barth and Ramey, 2002).

and with industry-country Consumer Price Index (CPI) data from Eurostat spanning 16 euro-area countries and 43 industries from July 2021 to July 2023. This combination of loan-level credit register data with granular product-level prices is, to our knowledge, unique in the literature. We exploit the merged data at two complementary levels of analysis: at the *product level*, comparing price changes for individual goods sold by floating-rate versus fixed-rate firms within the same product category, country, and month; and at the *market level*, aggregating floating-rate exposure to the country $\times$ industry pair (i.e., market) and estimating how market-level CPI inflation responds to ECB rate changes depending on that exposure. The product-level data allow us to exploit within-product-type variation among retail goods, while the market-level analysis shows that the findings generalize across all euro-area countries and industries in the Eurostat CPI data.

The euro area is particularly well-suited for studying this channel because floating-rate corporate lending is quantitatively important, accounting for roughly half of outstanding corporate loan volume, although it varies substantially across firms, industries, and countries. For example, while Italian and Portuguese corporations obtain 60–80% of credit at floating rates, German and French firms rely predominantly on fixed-rate loans.

Our main finding is that in markets dominated by floating-rate borrowing, the short-run impact of monetary tightening on inflation is about 50% smaller than in markets where fixed-rate loans dominate. At the product level, prices of goods produced by firms fully reliant on floating-rate loans fall by only 0.10 pp after a 100 bps rate hike, compared to 0.33 pp for otherwise similar goods produced by fixed-rate firms. These estimates aggregate to an economically meaningful effect on aggregate inflation: a back-of-the-envelope calculation suggests that, had firms across the euro area relied on floating-rate borrowing as those in the least exposed markets, inflation would have been up to 0.8 percentage points lower following the ECB’s 2022 rate hike.

Our results are novel and important for two reasons. First, we show that, in contrast to floating-rate mortgages, floating-rate corporate loans dampen the transmission of monetary

policy. The net effect of rate hikes on inflation therefore depends, in part, on the composition of corporate debt, which is a dimension that standard models abstract from. Second, the floating-rate channel operates through the repricing of the existing stock of loans (Ippolito et al., 2018), and is therefore distinct from the bank lending channel (Kashyap and Stein, 2000; Jiménez et al., 2012), which works through the supply of new credit.

Our empirical strategy relies on a difference-in-differences (DiD) design, comparing price changes across firms and markets with different pre-tightening floating-rate exposures as the Deposit Facility Rate (DFR) rises.² We measure floating-rate exposure as of the first half of 2021, well before the ECB tightening cycle began and right after Covid-19, when firms did not expect a significant increase in inflation and interest rates.³ The main identification assumption is parallel trends: dynamic DiD specifications confirm the absence of pre-trends at both the market and the product level. At the market level, country-month and industry-month fixed effects absorb time-varying demand shocks at the country and industry level. To further address concerns about confounding supply shocks, such as differential exposure to the Russia–Ukraine war, we include a market-level energy cost control constructed as the product of industry i 's energy input intensity in country c , measured in the first half of 2021, and the energy CPI in country c in month t .

A natural identification concern is the selection of firms into floating- or fixed-rate credit. For example, firms with significant pricing power may also possess bargaining power with their relationship banks, and may prefer floating-rate loans. We address this concern in two steps. The first exploits the structure of our product-level analysis. Our tightest specifications include country $\times$ product-type $\times$ month fixed effects, comparing, for instance, the price of low-fat yogurt sold by a floating- and fixed-rate firm in the same country and month. Since pricing power is primarily derived from product-level demand characteristics (i.e., the elasticity of substitution facing a given product type in a given market), these

²In robustness, we also employ identified monetary policy surprises from high-frequency changes in 1-month Overnight-Index Swap (OIS) rates around ECB press conferences (Altavilla et al., 2019).

³To validate this hypothesis, we show that bank analysts similarly did not expect interest rates to increase until March 2022 and even then, underestimated the speed of rate hikes.

fixed effects absorb the main source of the selection concern. The second step instruments for floating-rate exposure using bank-side supply factors. Following Amiti and Weinstein (2018), we estimate individual bank fixed effects from the cross-section of bank-firm lending relationships in early 2021, which accounts for 45% of the variation, while controlling for firm fixed effects. The estimated bank fixed effects correlate positively with deposit betas (Drechsler et al., 2021), consistent with banks' liability-side composition inducing them to offer floating-rate loans as a hedge (Supera, 2021). We use these loan-amount weighted bank fixed effects as a firm-level instrument for the floating-rate share interacted with the DFR change; the IV estimates are consistent with our baseline in both sign and magnitude.

We further document the conditions under which the floating-rate effect on prices is strongest. The first channel operates through working capital: in markets where firms rely more heavily on credit to finance inputs and labor, changes in funding costs translate more directly into changes in marginal production costs (Christiano et al., 1997; Almeida et al., 2024), and the floating-rate effect on inflation is correspondingly larger. The second channel operates through competitive structure. We find that the floating-rate effect on product prices requires two jointly necessary conditions: high market concentration and competitors who also borrow at floating rates. Neither condition alone is sufficient. Firms in concentrated markets possess customer relationships that give them the pricing power to pass through higher costs (Chevalier and Scharfstein, 1996), but even in concentrated markets a floating-rate firm cannot sustain higher prices if its fixed-rate competitors face no comparable cost increase and can profitably undercut (Bénabou and Gertner, 1993). Consistent with this, we find no significant decline in quantities sold by floating-rate firms that raise prices, indicating that customers accommodate the price increase when competitors face the same funding pressure.⁴

We validate the mechanism by tracing the transmission from policy rates through

⁴This contrasts with the typical finding that firms with greater market power exhibit lower cost pass-through (Amiti et al., 2019; Wang and Werning, 2022). In our setting, market power enables pass-through by allowing firms to exploit customer lock-in—but only when competitive pressure from fixed-rate rivals is absent.

loan-level funding costs to firm-level interest expenses and prices. For a 100 bps increase in the DFR, loan interest rates rise by 70 bps for floating-rate firms and by only 8.4 bps for fixed-rate firms. Balance sheet data from ORBIS confirm that this differential pass-through translates into meaningfully higher total interest payments: floating-rate firms experience an 8% increase in interest expenses relative to total debt for a 100 bps DFR increase. These higher costs induce financing adjustments: floating-rate firms are 50% more likely to renegotiate loan terms one year after the first rate hike than fixed-rate firms, and when they do, they tend to secure lower spreads and convert to fixed-rate terms. Finally, while floating-rate firms raise mark-ups, their interest coverage ratios deteriorate—higher interest payments more than absorb the additional cash flow from increased sales revenue—consistent with the interpretation that the pricing response reflects financial pressure rather than opportunistic mark-up extraction.

We contribute to three strands of the literature. First, we contribute to the literature on how financial conditions shape firm pricing. Gilchrist et al. (2017) and Coibion et al. (2020) show that financial constraints affect inflation through firms' pricing strategies. More recent work on credit shocks yields mixed results: Kim (2020) and Lenzu et al. (2025) document that firms reduce prices in response to credit contractions, using price cuts to generate internal liquidity, while Drechsler et al. (2026) show that monetary tightening under Regulation Q prompted working-capital-dependent firms to raise prices. Our findings align with those of Drechsler et al. (2026), but the mechanism differs: rather than a credit supply contraction, we show that floating-rate corporate debt creates a direct cost shock during a tightening cycle that is sufficient to induce price increases even absent any decline in credit availability.⁵

Second, we contribute to the literature on fixed versus floating-rate debt and monetary policy transmission. Extensive research examines this question for household mortgages

⁵Renkin and Zullig (2024) find that credit supply shocks raise prices for Danish firms in low-demand-elasticity sectors, suggesting that the direction of the pricing response to financial shocks depends on market demand conditions.

(Campbell and Cocco, 2003; Di Maggio et al., 2017; Garriga et al., 2017; Cloyne et al., 2020; Flodén et al., 2020). For corporate borrowers, existing work focuses on investment and stock price responses (Ippolito et al., 2018; Gürkaynak et al., 2022), not firms’ price setting. We show that the corporate floating-rate channel operates in the opposite direction from its household counterpart: floating-rate corporate debt dampens monetary transmission through a supply-side pricing response, while floating-rate household debt amplifies it through demand compression. The composition of corporate debt is thus a quantitatively relevant dimension of monetary transmission that has received comparatively little attention.

Third, we contribute to the macroeconomic literature on the cost channel of monetary policy. Barth and Ramey (2002) propose that when firms borrow to finance working capital, rate hikes raise marginal costs and may lead price-setting firms to increase prices. The limited existing evidence for this channel is largely aggregate (Christiano et al., 1997; Ravenna and Walsh, 2006). To the best of our knowledge, we provide the first firm-level, well-identified micro-evidence for the cost channel, using granular loan-level and product-level data across the euro area.⁶

2 Data

Our dataset combines several sources of detailed information at the loan-, firm-, industry-country (i.e., market) and product-level.

First, we obtain information on non-financial corporations’ loans at a monthly frequency from AnaCredit, a confidential database of the European Central Bank. AnaCredit, available from September 2018, harmonized different credit registers across all euro area countries using a common €25,000 reporting loan threshold. The dataset covers a large set of loan types: overdrafts, trade receivables, financial leases, revolving credit, credit

⁶Earlier survey-based evidence for Italy is found in Gaiotti and Secchi (2006).

lines and other loans, which are all other loans of a non-revolving nature, including term loans. For our analysis we focus on ‘other loans’, credit lines and revolving credit, as these three categories make up the vast majority of credit provided in the euro area (Kosekova et al., 2023). AnaCredit also reports the maturity and the contractual interest rates at the loan-level. Importantly for our analysis, it contains information on the type of interest rate setting: floating or fixed.⁷ AnaCredit also contains information on other loan-level features such as renegotiation and loan arrears. Every quarter, banks need to report whether a loan was renegotiated during that quarter, and whether the renegotiation was due to forbearance measures. We merge AnaCredit with borrower balance sheet data from BvD Orbis, a comprehensive firm-level database with both public and private firms. We use Orbis to gather yearly firm-level data on the firms, as well as to calculate bank-industry concentration, leverage and cash buffer measures.

Second, we obtain Consumer Price Index (CPI) growth from Eurostat. The raw data contains consumer prices at the five-digit Classification of Individual Consumption According to Purpose (COICOP) product category level. We use COICOP-NACE linking tables to obtain CPI growth at the (2-digit) industry-country level, calculating a weighted CPI growth average of all COICOP categories that are related to a 2-digit NACE industry.⁸ Crucially, this procedure focuses solely on household final consumption, and links changes in the consumer prices measured at the COICOP level to the industries that sell these goods and services directly to households, as in Acharya et al. (2024). Figure 1 confirms that our inflation measure, when aggregated from the market-level CPI, aligns with recent market developments and the Harmonized Index of Consumer Prices (HICP) for the euro-area: inflation rose from around 1% in early 2021 to around 10% in the second half of 2022, before

⁷A third type, called “mixed rate” contains loans which have both a fixed and a variable interest rate over their life. For example, a loan where for limited periods of time both fixed and variable interest rates interchange can be classified as a mixed interest rate loan. These are only a small fraction of total loans, approximately 3%. In our empirical analysis, we conservatively consider mixed rates as non-floating.

⁸The basis for the construction of the linking tables is made of consumption allocation tables, which provide information on how household expenditures on a particular COICOP category are allocated to various NACE industries (see Figure A1 in the Online Appendix for an example).

declining rapidly as the ECB increased the Deposit Facility Rate (DFR) from -0.5% in July 2022 to 4% by September 2023.

Finally, we use product-level store scanner price data from Information Resources, Inc. (IRi). The raw data is collected weekly at the store level for each product. We have data available for France, Germany and Italy from January 2020 until December 2023. For each product, we have the unique *ean* identifier (i.e., the product barcode), the name of the product, an anonymized ID for the store where it was sold, the type of supermarket (e.g. hypermarket, supermarket) and the first 2 digits of the store zip-code. There is also information about the product category (e.g., 'vino doc Italiano') , sub-category (e.g., 'vino doc italiano rosso') and type (e.g., 'Chianti'), as well as on the volume (e.g., 75cl). Brand name and vendor (i.e., the firm producing the product), units sold and total sales value is also included.

For our analysis, we aggregate the product-level sales and units data at the product-country-month level. Product-level price is defined as total sales over units sold (Della Vigna and Gentzkow, 2019), and we calculate the year-on-year growth rates for prices. We also keep information on the category and type of product, so that we can run regressions where we compare products within the same category-type(-month).⁹ Brand name and vendor names are used to link with BvD Orbis data, and subsequently to Anacredit. The final sample consists of 274,335 products, belonging to 3,845 different product types and produced by 10,498 firms.¹⁰

⁹We cannot simply use the 'type' as most granular level of observation, as a product-type can be combined with different product categories. For example, the product type '6 months or older' exists both for the product category 'Baby milk' and the category 'Ready-made baby food'.

¹⁰For comparison, before matching with BvD Orbis and AnaCredit, the data consisted of 812,379 products, spread across 4,337 product types.

3 Summary statistics and stylized facts

In contrast to their US counterparts, European firms have a unique mix of bank debt structures, encompassing both floating and fixed-rate loans. Table 1 shows summary statistics for our sample. In Panel A, we report loan-level characteristics for all loans in December 2021. Approximately 24% of outstanding loans have a floating-rate. As of December 2021, interest rates on corporate loans were at 2%, and average loan maturity is about 8 years. The firm 1-year average probability of default (PD) is 6.8%, although the average hides significant heterogeneity: half of the firms in the sample have a PD of less than 1%. Additionally, about three quarters of the loans are term loans and are collateralized.¹¹ Finally, over 80% of floating-rate loans use the EURIBOR (3M, 6M or 12M) as a reference rate and interest rates reset within the year (see Figure A2 and A3 in the Online Appendix).

As shown in Panel A of Figure A4 there are substantial differences in the incidence of floating-rate loans across countries: for example, firms in Germany and France typically use fixed-rate loans (70% of total loan volumes), whereas Italian and Portuguese corporations rely more on floating-rate loans (60-80% of total loan volumes). The country heterogeneity is similar for household mortgages (e.g., Badarinza et al., 2016) and has a significant impact on the transmission of monetary policy across the euro-area. Panel B of Figure A4 shows that there is also significant variation across industries in the use of floating-rate loans. For example, firms involved in wholesale trade activities (NACE code 45) obtain more than 80% of credit in the form of floating-rate loans, while in services, such as healthcare (NACE code 86), the share is less than 30%. See Table A2 in the Online Appendix for a list of all industries in our sample.

In the first part of our analysis, we aggregate the loan-level data at the firm-product

¹¹As we show in Table A1 in the Online Appendix, the distribution across loan types and maturity is similar for floating-rate and fixed-rate loans: 72% (73%) of floating-rate (fixed-rate) loans are term loans, 27% (28%) are credit lines, and both have an average maturity of around 8 years. Floating-rate loans are slightly more likely to be collateralized (79% vs. 71%) and borrowers with floating-rate loans are on average assigned a higher probability of default (9.5% vs. 6.3%).

level and match it to product prices. Our sample is made of over 5 million observations at the firm-product level at monthly frequency. Summary statistics can be found in Panel B of Table 1. The average annualized price growth in sample is almost 4%, with significant heterogeneity, with the average firm having a Herfindahl-Hirschman Index (HHI) of 0.05 in its product space. Next, we also aggregate the loan-level data at the firm level to match it with yearly firm financials. Panel C of Table 1 shows that the average firm has an interest coverage ratio of around 27, paying on average an interest rate of 1.5% per year.

For the last part of our analysis, we aggregate the loan-level data to the country-industry level (using either two-digit NACE codes or a combination of multiple two-digit NACE codes¹²), in order to be able to match it with the CPI data. Our final sample consists of 13,944 industry-country (i.e., market) monthly observations from 16 euro-area countries and 43 industries (encompassing 63 two-digit NACE industries) from July 2021 to July 2023.¹³ Summary statistics for this sample can be found in Panel D of Table 1. Average inflation has been approximately 6.53% over the sample period, but there is considerable variation across different markets. Some markets saw inflation rates as high as 24%, while others experienced decreases in price levels. Similarly, while about 60% of loan volumes across euro-area markets are comprised of floating-rate loans, the proportions vary widely. Some have as little as 3% in floating-rate loans, while others rely entirely on them. The ECB increased the deposit facility rate, the main ECB monetary policy tool, from -0.5% to 4% over the sample period.

¹²In some cases, the COICOP-NACE linking tables do not provide an exact two-digit NACE code match, but rather a match to a group of NACE codes. For example, we can calculate CPI for the category "Manufacturing of food, beverages and tobacco", which corresponds to the NACE two-digit industries 10, 11 and 12, but not for each of them separately.

¹³The 16 countries in the sample are: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovenia, and Spain. The inflation data is incomplete for Greece, Ireland and Slovakia. Croatia is also excluded from the sample given that it adopted the euro in January 2023.

4 Empirical strategy and results

Our empirical strategy relies on DiD models at different levels of aggregation at the firm-product, firm or market-level. Identification is obtained by comparing changes in product or market inflation before and after changes in the Deposit Facility Rate (DFR), across firms or markets with a different incidence of floating-rate loans. Importantly, since changes in the DFR affect all firms and banks simultaneously, we do not incur the canonical problems associated with staggered DiD designs (Baker et al., 2022).

The choice between floating-rate or fixed-rate loans is influenced by several factors at both the borrower and bank levels. To formally assess which factors affect the choice of floating-rate loans, we conduct a variance decomposition, regressing the share of floating-rate loans in bank-firm relationships as of July 2022 on various fixed effects, as shown in Table A3 in the Online Appendix.¹⁴ A borrowing firm's industry (63 industries) explains less than 2% of variation in the share of floating-rate loans, while the country of the headquarters (19 countries) explains almost 30%. Firm-specific fixed effects (631,982 firms) explain 36% of the variation, only slightly more than country factors. This underlines the importance of country-specific factors in the choice of rate setting: firms located in Germany or France most likely obtain fixed-rate loans, while those in Italy and Portugal are more likely to be offered floating-rate loans. This is remarkable given that no regulation prevents German or French banks from offering floating-rate loans.¹⁵ Because of these differences, we will not use country-level variation in our empirical analysis, but rather within country-industry (i.e., market) differences.

Notably, bank-specific fixed effects (2,593) explain around 45% of the variation, suggesting that bank heterogeneity (e.g., interest rate risk exposure) is the most important

¹⁴We limit the sample to firms with multiple bank relationships, as (among other factors) we want to assess the extent to which firm-specific variation affects the choice between floating-rate and fixed-rate loans.

¹⁵The causes of the cross-country heterogeneity have not been fully determined, but likely reasons include government policies, path dependence, sources of mortgage funding, and past inflation experiences (Campbell and Cocco, 2003; Cenyon and Szabó, 2024). Countries also differ in terms of prepayment penalties, costs of refinancing, recourse, the frequency of variable-rate resets, and reference rates (Badarinza et al., 2016).

determinant of floating-rate loans. Motivated by this variance decomposition, we use bank fixed effects as instrument for floating-rate loans in Section 4.2.1.

4.1 Loan interest rates

In this section, we investigate the effect of having floating-rate loans on loan interest rates at the firm level. We estimate the following equation:

$$LoanRate_{ft} = \beta ShareFloat_f \times \Delta DFR_t + \delta_f + \rho_{ict} + \epsilon_{ft}, \quad (1)$$

where the dependent variable $LoanRate_{ft}$ is the average contractual interest rate on credit to firm f in month t . This is a weighted average of individual loan rates to the firm, where the weights are equal to the share of each loan in the firm total borrowing.

$ShareFloat_f$ is the ratio of floating-rate loans in the total borrowing by firm f during the first six months of 2021. We use predetermined values before our event window, and one year before the first rate hike, to avoid simultaneity bias. Our identification assumption is that, as of the first half 2021, firms did not expect inflation and hence interest rates to increase significantly in the near future. The prolonged negative interest rate period in the aftermath of Covid-19 had not made inflation and future interest rates a pressing concern in the euro-area. Bank analysts' forecasts from the ECB Survey of Monetary Analysts (SMA) appear to confirm the validity of this hypothesis: interest rates were not expected to increase until March 2022 and even then, the speed of the rate hikes was underestimated (Figure A5 in the Online Appendix). If bank analysts did not expect rate hikes to happen in 2021, it is unlikely that corporations did. We further confirm this when we test for pre-trends in the dynamic specification below.

ΔDFR_t is the contemporaneous year-on-year change in DFR in month t , i.e., the current DFR in month t minus the DFR in month $t - 12$. We use a 12-month change to account for the long and variable lags of monetary policy on inflation and real economic activity (Fried-

man, 1961). Importantly, we include firm (δ_f) fixed effects, which absorb all time-invariant firm-level factors, and market $\times$ month (ρ_{ict}) fixed effects, which absorb all time-varying country-industry shocks. In our baseline specification, we choose to cluster standard errors at the market level, but the results are robust to clustering at the firm level.

Table 2 shows the estimates for Eqn. (1). Our estimates of $\hat{\beta}$ indicate a pass-through of about 0.7 of the policy rate into loan rates for floating-rate firms. Specifically, column (1) of Table 2 shows that for a 100 basis points (bps) increase in the policy rate, the cost of credit for a floating-rate firm goes up by 70 basis points ($0.084+0.614$). Conversely, fixed-rate firms see an increase in loan rates of only 8.4 bps.¹⁶ Importantly, progressively saturating the regression with month, firm, and market-month fixed effects in columns (2)-(3) does not significantly affect the estimated coefficient $\hat{\beta}$.

Lastly, in column 4 of Table 2 we use ORBIS data to measure the total interest rate paid by firms over total liabilities, as resulting from their financial statements. This alleviates concerns that firms might be able to switch to other sources of debt financing that are not directly affected by an increase in the central bank rate. Most of the small firms in our sample are bank-dependent and cannot easily substitute between bank loans and other sources of debt. This yearly-level analysis confirms the increase in overall funding costs for firms more exposed to floating-rate loans. Floating-rate firms experience an 8% increase ($0.12/1.52$) relative to the mean interest expenses over debt for 100 bps increase in DFR.

These findings highlight that monetary policy tightening increases firms' funding costs substantially and immediately for firms more exposed to floating-rate loans.

Our main identification assumption is that of parallel trends - i.e., that firm funding costs would have followed similar trends for floating-rate or fixed-rate firms in the absence of changes in the policy rate. It is therefore important to test for the absence of pre-trends by estimating a dynamic version of Eqn (1), where we replace ΔDFR_t with monthly time dummies D_t . The coefficients on the interaction terms with $ShareFloat_f$ thus estimate the

¹⁶The pass-through for fixed-rate firms is not exactly zero as some loans mature and are rolled-over at higher rates.

change in the dependent variable relative to the omitted baseline period (July 2022, the month before the first rate hike). This allows us to also visually inspect and test when the break takes place.

Figure 2 shows that the cost of credit for firms more exposed to floating-rate loans increases exactly in August 2022, after the first rate hike by the ECB in July, although the increase becomes statistically significant after about three months. Importantly, there was no difference in the evolution of interest rates between floating and fixed-rate firms before July 2022, when the DFR was flat and negative, which is reassuring. The negative estimated coefficients imply that floating-rate firms had a small, albeit insignificant, rate discount compared to fixed-rate firms. This may explain why these firms choose floating-rate loans to begin with. By the end of the hiking cycle, the policy rate reaches 4% and the difference between floating and fixed-rate loans widens to 2%, in line with a pass-through elasticity of about 0.5, as estimated in Table 2.

4.2 Product-level prices

After having presented the evidence of the pass-through of monetary policy on loan rates, we next show how the increase in financing costs affects product prices. In line with data availability, we focus on whether product prices set by individual firms selling in supermarkets in Germany, Italy, and France are affected by monetary policy.¹⁷ To this end, we employ data provided by IRi and matched to Anacredit, as detailed in the previous section.

We estimate the following specification at the firm-product-country-month level:

$$\Delta P_{fpct} = \beta \text{ShareFloat}_f \times \Delta DFR_t + \delta_{fp} + \gamma_{ckt} + \epsilon_{fpct}, \quad (2)$$

¹⁷We restrict the set of firms to those that are borrowers in AnaCredit. Importantly, a firm will be in our sample irrespective of its nationality, as long as it borrows from a European bank and sells its products in either Germany, Italy, or France.

where the subscript f denotes a firm, p product, k product category, country c , and t a month, from July 2021 to July 2023. The dependent variable ΔP_{fpct} is the year-on-year growth rate in firm-product prices. We also control for GDP growth, and, in the most conservative specification, we include firm-product fixed effects as well as country $\times$ product category-type $\times$ month fixed effects. The latter alleviate concerns that our results might be driven by differential demand responses of Italian, German or French consumers for the same product category (e.g., 'vino doc italiano rosso') in the same month during our sample period. Standard errors are clustered at the firm-level.

The results are presented in Table 3. In column (1), where we only employ firm-product fixed effects, we find that a 100bps increase in the policy rate implies a 25bps reduction in price growth for products of firms on average, consistent with the expected sign of monetary tightening on inflation. Yet, this masks significant heterogeneity between firms. In column (2), we show that for products of firms fully reliant on fixed-rate loans the reduction in price growth is actually 33bps, while it is only around 10bps ($-0.328+0.232$) for those firms borrowing exclusively through floating-rate loans. As a result, for these firms the effect of the monetary policy tightening on product prices is almost 70% smaller.

As we progressively include additional fixed effects at the month level (column 3), or country-product category-month level (column 4), the DiD coefficient of interest on $ShareFloat_f \times \Delta DFR_t$ remains similar in magnitude (+20bps) and becomes even more statistically significant. Overall, we find that firms with a higher share of floating-rate loans increase product prices significantly more when the ECB raises interest rates.

Figure 3 provides support for the absence of pre-trends by estimating a dynamic version of Eqn (2), where we replace ΔDFR_t with monthly time dummies D_t . As before, the coefficients on the interaction terms with $ShareFloat_f$ estimate the change in the dependent variable relative to July 2022. Prior to July 2022, year-on-year product price growth of firms with varying shares of floating-rate loans was similar, as indicated by coefficients close to zero and statistically insignificant. However, starting in July 2022, firms with a higher share

of floating-rate loans experienced significantly higher price growth rates. These findings support the validity of our identification strategy also at the product-firm level.

4.2.1 Bank fixed effects as instrument for floating-rate choice

Despite the absence of pre-trends in our main specification, our DiD approach does not account for the potential selection of firms into floating- and fixed-rate loans. For example, firms with extensive pricing power may also possess significant bargaining power with their relationship banks. As a result, these firms may both increase prices and have more floating-rate loans.

To address the issue of selection of firms into specific financing patterns, we exploit heterogeneity on the bank-side of the lending relationship. The variance decomposition in Table A3 in the Online Appendix suggests that bank unobserved heterogeneity is the main determinant of the share of floating-rate loans at the bank-firm level. This is the case because banks, due to the composition of their liability side, are differentially exposed to interest rate risk, which induces some banks to offer more floating-rate loans than others. For example, if a bank has a lot of liabilities that pay a market rate, it will hedge this exposure by offering floating-rate loans (Supera, 2021). We make two identification assumptions. First, the bank's liability side is exogenous to the individual firm. Second, the formation of firm-bank relationships is not driven by the interest rate setting on loans. While the second assumption may be violated if firms with a preference for floating-rate loans systematically select into relationships with banks that offer such loans, we assume that the match is determined by other firm-bank specific factors unrelated to the floating-rate loan choice.

We follow an approach reminiscent of Amiti and Weinstein (2018). First, we use monthly bank-firm level data from the first half of 2021, and for each month regress the share of floating-rate loans within each relationship on bank fixed effects. We perform this procedure in two alternative ways: first, we include firm fixed effects in the regression, and second, we replace firm with market fixed effects. The first approach allows to fully

absorb unobserved borrower heterogeneity using firm fixed effects and hence to identify supply-side factors with bank fixed effects, but can only be estimated for banks lending to firms with more than one lending relationship. Conversely, the second approach, using market instead of firm fixed effects, allows to use the full sample of banks and firms, at the cost of a less tight identification. Formally, we estimate bank fixed effects either from:

$$ShareFloat_{fb} = \gamma_b + \mu_f + \epsilon_{bf}, \quad (3)$$

or from the following:

$$ShareFloat_{fbm} = \gamma_b + \mu_m + \epsilon_{bf}, \quad (4)$$

where m denotes the market (i.e., country-industry) in which firm f operates. We estimate $\widehat{\gamma}_b$ for each month between January and June 2021. In order to cleanly isolate supply-side variation and avoid a mechanical own-observation bias, we use a sample that excludes the firms in our product-level sample. In the second step, we bring in the firms from our product-level sample, and aggregate the estimated bank fixed effects $\widehat{\gamma}_b$ at the firm-level using the share of credit of each bank b to firm f for each month ($\sum_b w_{bf} \widehat{\gamma}_b$). Finally, we take the firm-level average of these monthly, firm-level estimates and multiply by the change in DFR. We use this variable as an instrument for $ShareFloat_f \times \Delta DFR_t$ in Equation (2). This approach allows us to estimate the effect of changes in the DFR for firms more or less exposed to floating-rate loans, instrumenting the exposure through supply-side factors (i.e., removing the effect of selection of firms into specific loans or any other potential effects of a firm's overall loan demand).

To provide an economic intuition on the relation of these estimated bank fixed effects with banks' liability side, we focus on a subset of banks for which observe data on deposit pricing. Following Drechsler et al. (2017), we estimate the deposit beta for each bank, i.e., the sensitivity of deposit rates to the monetary policy rate. A high deposit beta thus means

that the interest rate expenses on deposits co-move closely with the monetary policy rate. We then plot the estimated bank fixed effects against the deposit beta. Figure A6 shows a strongly positive relation between a bank’s deposit beta and the estimated bank fixed effects, confirming that banks with higher interest rate sensitivity on their liability side are more likely to offer floating-rate loans on their asset side.

Results of our IV estimation are presented in Table 4. Columns (1) and (2) report the estimates from the first stage, using either $\widehat{\gamma}_b$ from Equation (3) or (4). Both instruments are strong and positively correlated with the fraction of floating-rate loans at the firm level, with a 1st stage F-stat well above 300. The difference in the sample size between the two estimations is due to the presence of firm fixed effects which allows to estimate Equation (3) only for firms with multiple relationships as of March 2021. Columns (3) and (4) report the second stage of the 2SLS estimation using either instrument: we find that a 100bps increase in the DFR has an effect that is between 27bps and 38bps weaker for firms fully reliant on floating-rate loans. The magnitude of the effects, given a baseline result of 19bps in column 4 of Table 3, suggests that the OLS estimate is downward biased. Overall, this suggests that demand-side factors that may simultaneously drive the selection of firms into specific loans and their pricing dynamics lead to an attenuation of our results.

4.2.2 Heterogeneity: Working Capital and Customer Capital

We next examine two mechanisms through which higher funding costs translate into higher product prices. The first is a cost channel operating through working capital: when firms borrow to finance production inputs, a rise in floating interest rates directly increases their marginal cost. The second is a pass-through channel: firms with market power over a sticky customer base can pass higher costs onto customers rather than absorbing them through compressed margins—but only when competitors face the same cost pressure and therefore cannot profitably undercut them. These two channels are complementary: the first explains *why* floating-rate firms face higher marginal costs after a rate hike, and the

second explains *which* firms are able to translate those costs into higher output prices.

Standard macroeconomic models treat the interest rate on outstanding debt as irrelevant to the marginal cost of production. This assumption breaks down, however, when firms rely on bank credit to finance working capital, that is, when they must pay for inputs (materials, labor) upfront, before collecting sales revenue. In such cases, production costs are directly linked to borrowing costs (Almeida et al., 2024), so a rise in the floating rate acts as an increase in marginal cost (Drechsler et al., 2026). This cost-channel mechanism is incorporated in several macroeconomic models (Christiano et al., 1997; Barth and Ramey, 2002), where the real interest rate appears as an additional component of firms' labor demand alongside the real wage.

Crucially, this link between floating rates and marginal cost extends beyond firms that directly borrow to finance working capital. Even firms that self-finance production from internal funds are affected: higher interest payments on outstanding floating-rate debt drain the firm's liquid resources, raising the shadow cost of deploying internal cash for production. Drawing on the logic of Froot et al. (1993), when internal funds serve as a buffer against future liquidity needs, depleting that buffer raises the opportunity cost of every dollar allocated to working capital. A rate hike thus increases the effective marginal cost of production through this internal-liquidity channel, even absent any new borrowing. We formalize this mechanism in a simple model in Online Appendix B, showing that the sensitivity of marginal cost to the policy rate is increasing in the firm's stock of outstanding floating-rate loans. The key implication is that the floating-rate channel operates more broadly than a traditional working capital channel, which requires external financing of working capital. In our framework, any firm with outstanding floating-rate loans faces a higher shadow cost of production when rates rise.

We test this channel using a specific feature of AnaCredit that identifies working capital loans. Column (2) of Table 5 shows that the floating-rate effect is more than twice as large for firms with working capital loans compared to firms without (column 1), although the

effect is present and statistically significant even for the latter.

Even when firms face higher marginal costs, they can only raise output prices if their customers do not defect to competitors. Customer capital—the accumulated stock of customer relationships—gives firms market power over a sticky customer base (Chevalier and Scharfstein, 1996). When financially squeezed, firms may optimally exploit this asset by raising prices: in effect, they run down their stock of customer capital, sacrificing long-term market share in exchange for short-term cash flow (Gilchrist et al., 2017). We use market concentration (HHI based on sales shares) as an initial proxy for customer capital: firms in more concentrated markets face fewer competing alternatives and are therefore more likely to possess persistent customer relationships. Columns (3) and (4) of Table 5 confirm that the floating-rate effect is almost three times larger in above-median HHI markets, consistent with customer capital amplifying price pass-through.

Market concentration alone, however, is not sufficient for pass-through to occur: even in concentrated markets, a floating-rate firm cannot raise prices if its competitors remain on fixed-rate loans and face no comparable cost increase. A competitor with fixed-rate funding can profitably undercut a floating-rate firm that raises prices, eroding the very customer base the pass-through mechanism relies upon.¹⁸ Pass-through therefore requires a second condition: that competitors face the same increase in funding costs, i.e., that they too borrow at floating rates and are thus unable to profitably undercut. The consumer search model of Bénabou and Gertner (1993) provides a formal demand-side foundation for this condition: when consumers correctly anticipate that competing firms face equivalent cost increases and will charge higher prices, the expected gain from searching for a lower price falls. This reduction in search incentives weakens competitive pressure on individual firms, reinforcing the supply-side argument that rivals with the same cost shock cannot profitably undercut. To test this joint prediction, we perform a double split of the data.

¹⁸This contrasts with the typical case of cost shocks, where firms with greater market power exhibit lower cost pass-through (Amiti et al., 2019; Wang and Werning, 2022). In our setting, market power enables pass-through by allowing firms to exploit customer lock-in, but this only materializes when competitive pressure from fixed-rate rivals is absent.

We first divide products into those with below- and above-median HHI of total sales, distinguishing competitive from concentrated market environments. Within each group, we further split by competitors' floating-rate exposure, defined as the share of floating-rate loans among all firms in the same product market, capturing whether rivals face the same cost increase as the firm.

Table 6 confirms that the price effect is concentrated exclusively among firms in concentrated markets where competitors also have high floating-rate exposure. All other columns are statistically insignificant, demonstrating that neither market concentration alone (column 3) nor competitive cost symmetry alone (column 2) is sufficient: both conditions must hold simultaneously for pass-through to occur.

A key implication of the customer capital mechanism is that price increases should be absorbed by the existing customer base rather than triggering a loss of market share. If customers are sticky and competitors face the same cost pressures, floating-rate firms raising prices should not see a significant decline in quantities sold. To test this, we re-estimate Equation 2 with the natural logarithm of quantities sold as the outcome variable. Table 7 reports the results. In column (1), using the full sample, we find no significant reduction in quantities for firms more exposed to floating-rate loans. This result holds across all subsamples when we replicate the double split from Table 6 (columns 2–5). The absence of a quantity effect is consistent with the mechanism we outlined above: sticky customers accommodate the price increase, and competitors facing the same cost pressure have no incentive to undercut. This short-run stability is in line with the customer capital framework: in Chevalier and Scharfstein (1996) firms sacrifice *future* market share by depleting customer relationships, but this long-run erosion only materialises if competitors eventually gain a cost advantage. This is precisely the condition that is absent here, since rivals face the same floating-rate exposure. It also helps identify the mechanism as supply-driven. A demand-side explanation for our baseline result would not predict the specific pattern of heterogeneity we document across firms and market structures.

Taken together, the evidence in this section supports a supply-side cost-channel interpretation of the floating-rate mechanism. Higher funding costs raise the marginal cost of floating-rate firms through the working capital channel; and where firms have market power over a sticky customer base, particularly in concentrated markets where competitors also borrow at floating rates and therefore cannot undercut, those higher costs are passed on as higher prices. The stability of quantities sold further validates this interpretation and is difficult to reconcile with alternative demand-driven explanations.

5 Aggregate Inflation

In this section, we show that the granular product-level results aggregate up at the broader CPI inflation level. Moving from product-level to the market level also allows us to demonstrate that our results generalized across countries and industries not included in the product-level data. In our baseline specification, we estimate the following regression equation:

$$\Delta CPI_{ict} = \beta ShareFloat_{ic} \times \Delta DFR_t + \alpha' X_{ict} + \delta_{ic} + \eta_{it} + \gamma_{ct} + \epsilon_{ict}, \quad (5)$$

where the subscript ic denotes a market, i.e., a combination of 2-digit NACE industry i and country c , and t a month, from July 2021 to July 2023. The dependent variable ΔCPI_{ict} is the year-on-year CPI growth rate for market ic in month t constructed from COICOP product categories as described in Section 2.

$ShareFloat_{ic}$ is the ratio of floating-rate loans to total borrowing in market ic during the first six months of 2021. ΔDFR_t is the contemporaneous year-on-year change in DFR. As in the previous analyses, we use the actual change in the policy rate as opposed to unexpected changes in interest rates (as in Drechsler et al., 2017), as it is the former that increases borrowing costs. We also include two market-level controls (X_{ict}): energy costs and GDP growth. Following Acharya et al. (2023), we define energy costs at the market

level as the product of the energy input intensity for industry i in country c — measured in the first half of 2021, prior to the tightening cycle — and the energy CPI in country c in month t . Since energy input intensity varies across industries i within the same country c , this control generates variation at the country $\times$ industry $\times$ month level, ensuring that industries with different production technologies are assigned different energy cost shocks even within the same country and month. This directly absorbs the concern that our estimates might reflect differential exposure to the energy price shock that accompanied the ECB tightening cycle rather than the floating-rate channel itself. Crucially, in more saturated specifications we include market (δ_{ic}), industry-month (η_{it}), and country-month (γ_{ct}) fixed effects, which absorb the aggregate macro controls. These fixed effects help us rule out confounding demand factors that are industry- and country-specific and may also be affected by monetary policy changes. Standard errors are clustered at the market level.

Table 8 reports the result for the estimation of Equation (5). In column (1), we find that a 100 bps increase in the DFR is associated with a contemporaneous 34 bps decrease in the annualized inflation rate. Column (2) adds an interaction term for the share of floating-rate loans, showing a larger effect in markets with only fixed-rate loans (-64 bps) but a 0.5 bps reduction for every 1 percentage point increase in the floating-rate loan share. This means that in a market with a median share of floating-rate loans ($ShareFloat_{ic}=61$), the impact of the policy rate on inflation is 48% smaller ($-0.64+0.005*61=-0.335$) compared to a market with only fixed-rate loans. After controlling for time-varying shocks at the country and industry levels with country $\times$ month and industry $\times$ month fixed effects in column (3), which absorb the coefficient of the policy rate, together with energy costs in column (4), the interaction term grows larger. The estimates suggest that in a market with a median share of floating-rate loans the effect of the policy rate on inflation is almost zero. Finally, in column (5) we confirm that the results hold if we compare markets with above the median dependence on floating-rate loans.

To support the validity of our identification strategy, Figure 4 presents the dynamic

DiD specification. Prior to July 2022, inflation rates in markets with varying shares of floating-rate loans were similar, as indicated by coefficients close to zero and statistically insignificant. However, starting in July 2022, markets with a higher share of floating-rate loans saw significantly higher inflation rates. By June 2023, the difference in inflation between a market fully reliant on floating-rate loans and one with only fixed-rate loans reached 5 percentage points, in line with product-level results in Figure 3.

Given the long and variable lags of monetary policy, an alternative way to interpret our results is by using local projections, following Jordà (2005). Figure 5 presents the impulse response functions (IRFs) for a 100 bps policy rate increase on inflation over a 12-month horizon.¹⁹ Panel A shows that in the average market, the effect peaks around month 8, with inflation dropping by about 150 bps. In Panel B, we incorporate the estimated interaction term from column (4) of Table 8 and simulate IRFs for two hypothetical markets, one with a bottom (30%) and one with a top quintile (90%) share of floating-rate loans. The results highlight a striking difference in the response of inflation to the same increase in the policy rate: in markets dominated by floating-rate loans, inflation declines by 53 bps in the first six months compared to 94 bps in fixed-rate markets. This means that, in the short-run, the impact of monetary policy tightening on inflation is almost 50% smaller in markets dominated by floating-rate loans. Although the IRFs almost converge by the end of the year, the inflation decreases are still 25% smaller in floating-rate markets.

These results highlight the significant heterogeneity in the transmission of monetary policy across euro-area markets (e.g., Ciccarelli et al., 2013). For context, the average share of floating-rate loans in German or French markets in the first half of 2021 was 24%, compared to 41% in Spain, 60% in Italy and up to 80% in Portugal. Our estimates therefore suggest that the effectiveness of monetary policy in curbing inflation is 25-50% smaller in the periphery (Italy, Spain and Portugal) compared to core countries (France and Germany).

¹⁹In Figure A7 in the Online Appendix we run the analysis using high-frequency monetary policy surprises from Altavilla et al. (2019), i.e., the median quote of the 1 month Overnight Index Swap (OIS) rate from a 30-minute window before the ECB press release to the median quote in the window 30 after the press conference.

To further assess the economic magnitude of the effect of floating-rate loans on inflation, we do the following counterfactual exercise, based on a partial-equilibrium aggregation of our estimates: what would inflation in the euro area have been if each industry had borrowed at the same share of floating-rate loans as the average firm in the same industry in Germany, France and Belgium (the three countries with the lowest share of floating-rate loans)? Results are presented in Figure 6. The figure shows actual inflation against the counterfactual estimate using the low floating-rate countries. The estimates show that inflation would have been 0.8pp lower in the euro area after the ECB started hiking interest rates in August 2022 if firms were less reliant on floating-rate loans. This is likely an upper bound, as it is based on a partial-equilibrium estimation which does not consider the indirect general-equilibrium effects (e.g., demand-side effects which are inflationary). Still, it suggests that inflation would have converged to the 2% target faster if the share of floating-rate corporate loans had been lower.

6 Firm-level outcomes

In this section, we study outcomes at the firm-level. Specifically, we want to test whether firms raise mark-ups, i.e. raise prices above their funding cost, potentially improving their profitability, and whether they are able to do so as not to impair their financial soundness.

To this end, we use data from Orbis for euro-area firms from 2020 to 2023. We use two different proxies for mark-ups: EBIT over sales (Acharya et al., 2024) and a markup estimation following De Loecker and Warzynski (2012) and De Loecker et al. (2019). This approach relies on optimal input demand conditions obtained from standard cost minimization to determine markups for each firm. More precisely, this approach relies on the insight that the output elasticity of a variable production factor is only equal to its expenditure share in total revenue when price equals marginal cost of production. Under any form of imperfect competition, however, the relevant markup drives a wedge between

the input’s revenue share and its output elasticity (see Acharya et al., 2024, for a detailed discussion on how to implement this methodology using Orbis data). Furthermore, we consider interest coverage ratio (calculated as EBITDA over interest expenses) as a proxy for financial health. We then regress the yearly outcomes on the change in DFR and its interaction with the share of floating-rate loans of the firm as of 2021.

Table 9 reports the estimates of this specification. Columns (1) and (3) show that, conditional on firm fixed effects and time-varying firm-level controls (e.g., the log of total assets), firms more exposed to floating-rate loans see a larger increase in their mark-ups, irrespective of the proxy used, following an increase in the DFR. Columns (2) and (4) confirm this pattern even after including granular country-industry-year fixed effects.

Finally, the results in columns (5) and (6) indicate that, despite the effects on prices, floating-rate firms see a stronger deterioration in their financial health as their interest coverage ratio decreases. This suggests that higher bank funding costs translate into overall significantly higher costs for these firms, above and beyond the increase in their product prices. This is natural given that most firms are small-medium enterprises with limited access to other forms of funding.

Overall, the results in this section confirm the takeaways from previous sections. Furthermore, they also suggest that, while firms more reliant on floating-rate loans increase prices, they do so to mostly compensate for the larger increase in funding costs they face. Therefore, we find no evidence of “greedflation” or that firms that are forced to raise prices also increase in profitability.

6.1 Loan renegotiation

Finally, we study whether firms with floating-rate loans change their financing decisions after the rate hike occurs. Specifically, we test whether they become more likely to renegotiate specific terms of their existing loans after the rate tightening. From Anacredit data, we can measure whether loans are renegotiated and which terms are changed, at quarterly

frequency, albeit we cannot identify whether the firm or the bank initiated the renegotiation. This analysis sheds light on the significance of the increase of the financial burden for the firm and its effect on corporate finance policies.

We estimate the following specification:

$$y_{fbt} = \beta \text{ShareFloat}_{fb} \times \Delta \text{DFR}_t + \delta_{fb} + \gamma_{bt} + \rho_{ict} + \epsilon_{fbt}, \quad (6)$$

where y_{fbt} is a dummy equal to 1 if a loan between bank b and firm f was renegotiated in quarter t . ShareFloat_{fb} is the ratio of floating-rate loans over total loans during the first 6 months of 2021 in relationship fb . Standard errors are clustered at the market level. The sample consists of quarterly observations at the firm-bank level from July 2021 to July 2023.

In Panel A of Table 10, we show that a higher share of floating-rate loans is associated with a higher likelihood of a renegotiation in the bank-firm relationships. Column (1) shows that the probability of renegotiating after a 100 bps increase in DFR goes up by 15 bps for a firm fully reliant on floating-rate loans. Notably, this is a large effect: since the unconditional probability of renegotiation in sample is 1% (Panel A of Table 1), a 100 bps increase in the DFR increases the likelihood of renegotiation by 15% for a firm fully reliant on floating-rate loans. Columns (2)-(4) further show that these estimates do not qualitatively change when saturating the specification with quarter, market-quarter, and bank-quarter fixed effects.

Importantly, as was the case for interest rates, Figure 7 shows that the effect takes place only from the third quarter of 2022, following the first hike in July 2022. By the end of the sample period (June 2023), the probability that a firm fully dependent on floating-rate loans renegotiates its loan terms is 0.5% higher, i.e., a floating-rate firm is 50% more likely to renegotiate its loan terms compared to a firm that only relies on fixed-rate loans.

Lastly, we examine which loan terms were renegotiated for floating-rate loans from July

2021 until July 2023. The regression specification at the loan-level is as follows:

$$y_{lbcit} = \beta Post_t + \delta_{cbi} + \epsilon_{lt}, \quad (7)$$

where l indicates a loan, b a bank, c a country, i an industry and t a quarter. The dependent variables y_{lbcit} are four different indicators, equal to one if: the loan spread was reduced, the loan switched from being floating-rate to fixed-rate, the maturity of the loan was reduced or the committed amount of the loan was reduced. $Post_t$ is a dummy equal to one after July 2022, zero otherwise. For this analysis, we restrict the sample to floating-rate loans that were renegotiated during the sample period, comparing those renegotiated before and after the July 2022 first rate hike. Standard errors are clustered at the bank level.

Panel B of Table 10 reports the results for Equation (7). Following the rate hikes, renegotiations are significantly more likely to involve a decrease in the spread over the benchmark rate (e.g., Euribor) and a switch from a floating- to a fixed-rate. Conversely, we find no evidence that firms obtain longer maturities or larger exposures.

Overall, these results point towards the relevance of the increase in the funding costs for firms more exposed to floating-rate loans: not only do they pay more on their loans, but they are more likely to take necessary steps to mitigate the adverse effects of monetary policy. It further suggests that many firms did not expect inflation and interest rates to increase after Covid-19, as those with floating-rate loans switched to fixed-rate after the rate hikes, altering their funding structures.

7 Conclusion

In this paper, we provide novel evidence on the supply-side transmission of monetary policy. We find that when firms borrow using floating-rate rather than fixed-rate loans, they increase prices to offset higher borrowing costs after rate hikes. This channel hampers the effectiveness of monetary policy. In the euro-area periphery (Italy, Portugal and Spain)

where floating-rate loans are more common than in the core (France and Germany), the effectiveness of monetary policy in curbing inflation is up to 50% lower.

The role of loan interest rate resets is currently missing in discussions on monetary policy. A policy implication is to foster competition in product markets, as there is no difference in the pricing response of floating-rate firms in competitive markets. Conversely, when floating-rate firms have market power, they are able to pass higher costs onto consumers, especially when their competitors also borrow floating. This difference highlights how competition policy could support the inflationary goals of monetary tightening.

References

- Acharya, Viral, Matteo Crosignani, Tim Eisert, and Christian Eufinger, "Zombie Credit and (Dis-)Inflation: Evidence from Europe," *The Journal of Finance*, 2024, 79 (3), 1883–1929.
- Acharya, Viral V, Matteo Crosignani, Tim Eisert, and Christian Eufinger, *How Do Supply Shocks to Inflation Generalize?: Evidence from the Pandemic Era in Europe* number w31790, National Bureau of Economic Research, 2023.
- Almeida, Heitor, Daniel Carvalho, and Taehyun Kim, "The Working Capital Credit Multiplier," *The Journal of Finance*, 2024, 79 (6), 4247–4302.
- Altavilla, Carlo, Luca Brugnolini, Refet S. Gürkaynak, Roberto Motto, and Giuseppe Ragusa, "Measuring euro area monetary policy," *Journal of Monetary Economics*, 2019, 108, 162–179. "Central Bank Communications: From Mystery to Transparency" May 23-24, 2019 Annual Research Conference of the National Bank of Ukraine Organized in cooperation with Narodowy Bank Polski.
- Amiti, Mary and David E. Weinstein, "How Much Do Idiosyncratic Bank Shocks Affect Investment? Evidence from Matched Bank-Firm Loan Data," *Journal of Political Economy*, 2018, 126 (2), 525–587.
- , Oleg Itskhoki, and Jozef Konings, "International Shocks, Variable Markups, and Domestic Prices," *The Review of Economic Studies*, 02 2019, 86 (6), 2356–2402.
- Badarinza, Cristian, John Y. Campbell, and Tarun Ramadorai, "International Comparative Household Finance," *Annual Review of Economics*, 2016, 8, 111–144.
- Baker, Andrew C., David F. Larcker, and Charles C.Y. Wang, "How much should we trust staggered difference-in-differences estimates?," *Journal of Financial Economics*, 2022, 144 (2), 370–395.
- Barth, Marvin J. and Valerie Ramey, "The Cost Channel of Monetary Transmission," in "NBER Macroeconomics Annual 2001, Volume 16" NBER Chapters, National Bureau of Economic Research, Inc, June 2002, pp. 199–256.
- Bénabou, Roland and Robert Gertner, "Search with Learning from Prices: Does Increased Inflationary Uncertainty Lead to Higher Markups?," *The Review of Economic Studies*, 1993, 60 (1), 69–93.
- Bolton, Patrick, Hui Chen, and Neng Wang, "A unified theory of Tobin's q , corporate investment, financing, and risk management," *The journal of Finance*, 2011, 66 (5), 1545–1578.
- Campbell, John Y. and João F. Cocco, "Household Risk Management and Optimal Mortgage Choice," *Quarterly Journal of Economics*, 2003, 118, 1449–1494.
- Cenzon, Josefina and Barna Elek Szabó, "Mortgage choice and inflation experiences in the Eurozone," *Journal of Monetary Economics*, 2024, 147, 103611. Monetary Policy challenges for European Macroeconomies.
- Chevalier, Judith and David Scharfstein, "Capital-Market Imperfections and Countercyclical Markups: Theory and Evidence," *American Economic Review*, 1996, 86 (4), 703–25.
- Christiano, Lawrence J., Martin Eichenbaum, and Charles L. Evans, "Sticky price and limited participation models of money: A comparison," *European Economic Review*, June 1997, 41 (6), 1201–1249.

- , —, and —, “Monetary Policy Shocks: What Have We Learned and to What End?,” *Handbook of Macroeconomics*, 1999, 1, 65–148.
- Ciccarelli, Matteo, Angela Maddaloni, and José-Luis Peydró**, “Heterogeneous transmission mechanism: monetary policy and financial fragility in the eurozone,” *Economic Policy*, 2013, 28 (75), 459–512.
- Clarida, Richard, Jordi Galí, and Mark Gertler**, “The Science of Monetary Policy: A New Keynesian Perspective,” *Journal of Economic Literature*, 1999, 37 (4), 1661–1707.
- Cloyne, James, Clodomiro Ferreira, and Paolo Surico**, “Monetary Policy when Households have Debt: New Evidence on the Transmission Mechanism,” *The Review of Economic Studies*, 01 2020, 87 (1), 102–129.
- Coibion, Olivier, Yuriy Gorodnichenko, and Tiziano Ropele**, “Inflation Expectations and Firm Decisions: New Causal Evidence,” *The Quarterly Journal of Economics*, 2020, 135, 165–219.
- Della Vigna, Stefano and Matthew Gentzkow**, “Uniform Pricing in U.S. Retail Chains*,” *The Quarterly Journal of Economics*, 06 2019, 134 (4), 2011–2084.
- Di Maggio, Marco, Amir Kermani, Benjamin J. Keys, Tomasz Piskorski, Rodney Ramcharan, Amit Seru, and Vincent Yao**, “Interest Rate Pass-Through: Mortgage Rates, Household Consumption, and Voluntary Deleveraging,” *American Economic Review*, 2017, 107 (11), 3550–3588.
- Drechsler, Itamar, Alexi Savov, and Philipp Schnabl**, “The Deposits Channel of Monetary Policy*,” *The Quarterly Journal of Economics*, 05 2017, 132 (4), 1819–1876.
- , —, and —, “Banking on Deposits: Maturity Transformation without Interest Rate Risk,” *The Journal of Finance*, 2021, 76 (3), 1091–1143.
- , —, and —, “Credit Crunches and the Great Stagflation,” 2026. Working Paper.
- Flodén, Martin, Matilda Kilström, Jósef Sigurdsson, and Roine Vestman**, “Household Debt and Monetary Policy: Revealing the Cash-Flow Channel,” *The Economic Journal*, 12 2020, 131 (636), 1742–1771.
- Friedman, Milton**, “The Lag in Effect of Monetary Policy,” *Journal of Political Economy*, 1961, 69 (5).
- Froot, Kenneth A, David S Scharfstein, and Jeremy C Stein**, “Risk management: Coordinating corporate investment and financing policies,” *Journal of Finance*, 1993, 48 (5), 1629–1658.
- Gaiotti, Eugenio and Alessandro Secchi**, “Is There a Cost Channel of Monetary Policy Transmission? An Investigation into the Pricing Behavior of 2,000 Firms,” *Journal of Money, Credit and Banking*, 2006, 38 (8), 2013–2037.
- Garriga, Carlos, Finn E. Kydland, and Roman Šustek**, “Mortgages and Monetary Policy,” *The Review of Financial Studies*, 2017, 30, 3337–3375.
- Gertler, Mark and Peter Karadi**, “Monetary Policy Surprises, Credit Costs, and Economic Activity,” *American Economic Journal: Macroeconomics*, January 2015, 7 (1), 44–76.
- Gilchrist, Simon, Raphael Schoenle, Jae Sim, and Egon Zakrajšek**, “Inflation Dynamics during the Financial Crisis,” *American Economic Review*, 2017, 107 (3), 785–823.

- Goodhart, Charles**, “Financial Innovation and Monetary Control,” *Oxford Review of Economic Policy*, 12 1986, 2 (4), 79–102.
- Gürkaynak, Refet, Hatice Gokce Karasoy-Can, and Sang Seok Lee**, “Stock Market’s Assessment of Monetary Policy Transmission: The Cash Flow Effect,” *The Journal of Finance*, 2022, 77 (4), 2375–2421.
- Ippolito, Filippo, Ali K. Ozdagli, and Andres Perez-Orive**, “The transmission of monetary policy through bank lending: the floating rate channel,” *Journal of Monetary Economics*, 2018, 95, 49–71.
- Jiménez, Gabriel, Steven Ongena, José-Luis Peydró, and Jesús Saurina**, “Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications,” *American Economic Review*, 2012, 102 (5), 2301–2326.
- Kashyap, Anil K. and Jeremy C. Stein**, “What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?,” *American Economic Review*, June 2000, 90 (3), 407–428.
- Kim, Ryan**, “The Effect of the Credit Crunch on Output Price Dynamics: The Corporate Inventory and Liquidity Management Channel,” *The Quarterly Journal of Economics*, 07 2020, 136 (1), 563–619.
- Kosekova, Kamelia, Angela Maddaloni, Melina Papoutsis, and Fabiano Schivardi**, “Firm-bank relationships: A cross-country comparison,” SAFE Working Paper Series 390, Leibniz Institute for Financial Research SAFE 2023.
- Lenzu, Simone, David Rivers, Joris Tielens, and Hu Shi**, “Financial Shocks, Prices, and Productivity,” *Review of Economic Studies* (forthcoming), 2025.
- Loecker, Jan De and Frederic Warzynski**, “Markups and Firm-Level Export Status,” *American Economic Review*, 2012, 102 (6), 2437–71.
- , **Jan Eeckhout, and Gabriel Unger**, “The Rise of Market Power and the Macroeconomic Implications,” *Quarterly Journal of Economics*, 2019, 135, 561–644.
- Mian, Atif and Amir Sufi**, “Finance and Business Cycles: The Credit-Driven Household Demand Channel,” *Journal of Economic Perspectives*, August 2018, 32 (3), 31–58.
- Ravenna, Federico and Carl Walsh**, “Optimal monetary policy with the cost channel,” *Journal of Monetary Economics*, 2006, 53 (2), 199–216.
- Renkin, Tobias and Gabriel Zullig**, “Credit Supply Shocks and Prices: Evidence from Danish Firms,” *American Economic Journal: Macroeconomics*, April 2024, 16 (2), 1–28.
- Seelig, Steven A**, “Rising interest rates and cost push inflation,” *The Journal of Finance*, 1974, 29 (4), 1049–1061.
- Supera, Dominik**, “Running Out of Time (Deposits): Falling Interest Rates and the Decline of Business Lending, Investment and Firm Creation,” 2021. Working Paper.
- Wang, Olivier and Iván Werning**, “Dynamic Oligopoly and Price Stickiness,” *American Economic Review*, August 2022, 112 (8), 2815–49.
- Òscar Jordà**, “Estimation and Inference of Impulse Responses by Local Projections,” *American Economic Review*, March 2005, 95 (1), 161–182.

Figure 1: Inflation and the Deposit Facility Rate

The figure plots the evolution of the averaged year-over-year CPI growth over all 583 markets (i.e., country-industry pairs) in our sample, the Harmonized Index of Consumer Prices (HICP) from Eurostat and the ECB Deposit Facility Rate (DFR) between January 2021 and June 2024

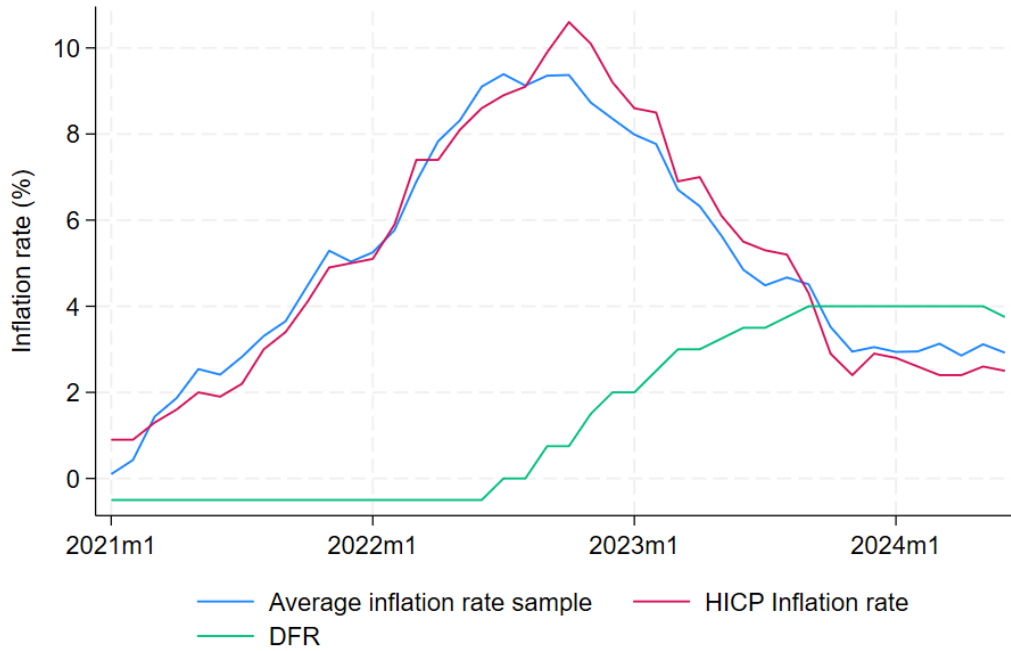


Figure 2: Dynamic DiD - Interest Rates

The sample consists of monthly observations at the firm level from July 2021 until July 2023. The figure shows the monthly β coefficients and 95% confidence intervals for the following regression specification:

$$InterestRate_{ft} = \sum_{t=July2021}^{t=July2023} \beta_t \times ShareFloat_f \times D_t + \delta_f + \rho_{ict} + \epsilon_{ft},$$

with July 2022 as the omitted period. The subscript i indicates an industry (2-digit NACE level), c a country (euro-area countries), and t a month. The dependent variable y_{ft} is the monthly average interest rate on credit to firm f in month t (in %). D_t is a dummy equal to 1 in month t , 0 otherwise. $ShareFloat_f$ is the ratio of floating-rate loans over total loans during the first 6 months of 2021 for firm f . δ_f and ρ_{ict} are firm and market-month fixed effects, respectively. Standard errors are clustered at the market level.

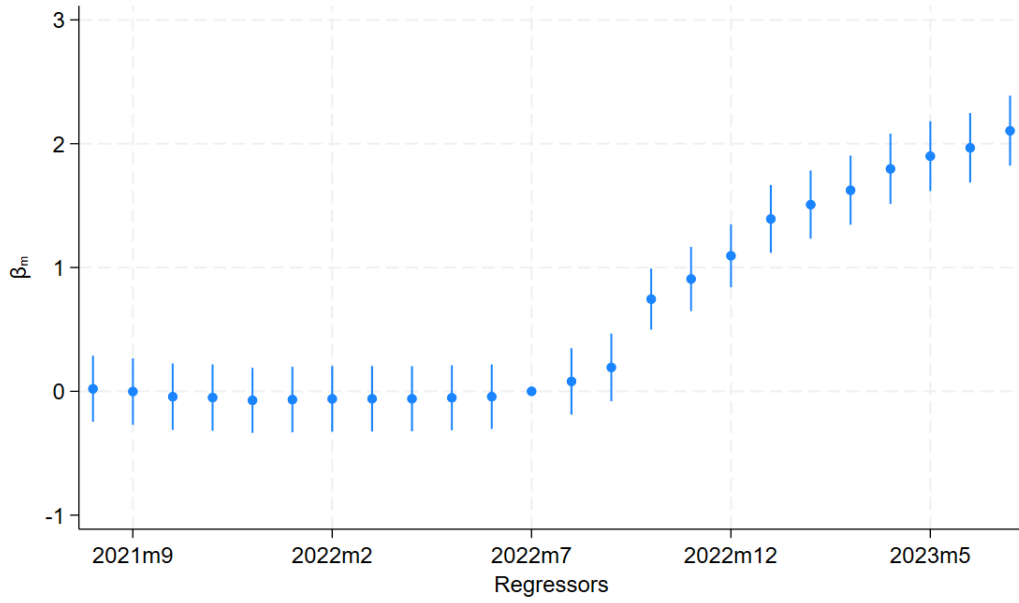


Figure 3: Dynamic DiD - Product prices

The figure shows the monthly β coefficients and 95% confidence intervals for the following regression specification:

$$ProductPrice_{fpt} = \sum_{t=July2021}^{t=July2023} \beta_t \times ShareFloat_f \times D_t + \delta_{fp} + \gamma_{ckt} + \epsilon_{fpct}, \quad (8)$$

with July 2022 as the omitted period. The sample consists of monthly observations at the firm-product level from July 2021 until July 2023. The subscript f indicates a firm, p a product, k product category, c a country, and t a month. The dependent variable y_{fpt} is year-on-year growth rate of product price p by firm f . $ShareFloat_f$ is the ratio of floating-rate loans over total during the first 6 months of 2021 for firm f . D_t is a dummy equal to 1 in month t , 0 otherwise. Standard errors are clustered at the firm level.

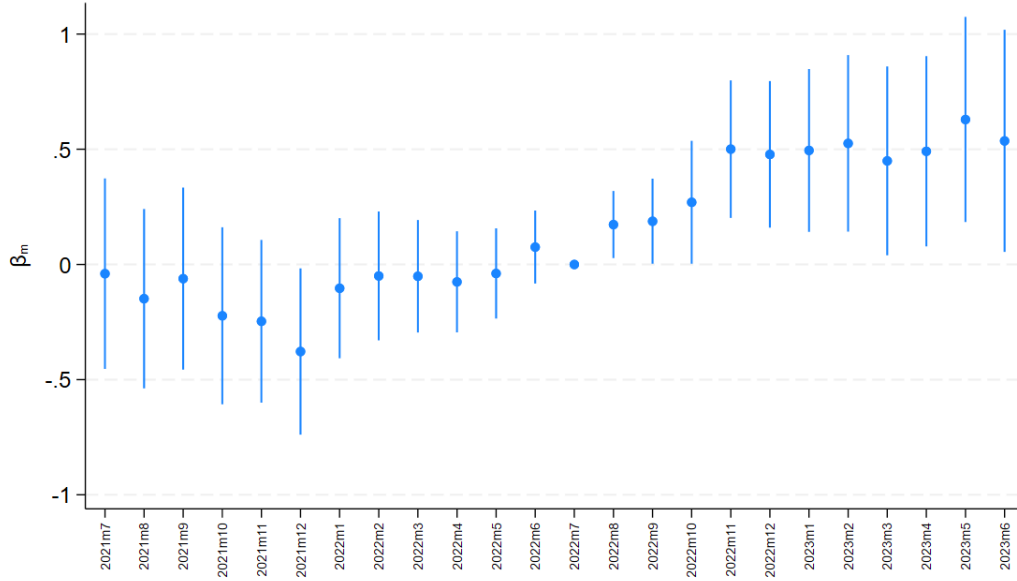


Figure 4: Dynamic DiD: market-level CPI

The figure shows the monthly β coefficients and 95% confidence intervals for the following regression specification:

$$CPI\ Growth_{ict} = \sum_{t=July2021}^{t=July2023} \beta_t \times ShareFloat_{ic} \times D_t + \beta_2 X_{ict} + \delta_{ic} + \eta_{it} + \gamma_{ct} + \epsilon_{ict}, \quad (9)$$

with July 2022 as the omitted period. The sample consists of monthly observations at the market level from July 2021 until July 2023. The subscript i indicates an industry (2-digit NACE level), c a country, and t a month. The dependent variable y_{ict} is the monthly year-on-year CPI growth rate. $ShareFloat_{ic}$ is the ratio of floating-rate loans over total during the first 6 months of 2021 in market ic . D_t is a dummy equal to 1 in month t , 0 otherwise. X_{ict} denotes market-level controls such as energy costs, as well as market (δ_{ic}), industry-month (η_{it}), and country-month (γ_{ct}) fixed effects. Standard errors are clustered at the market level.

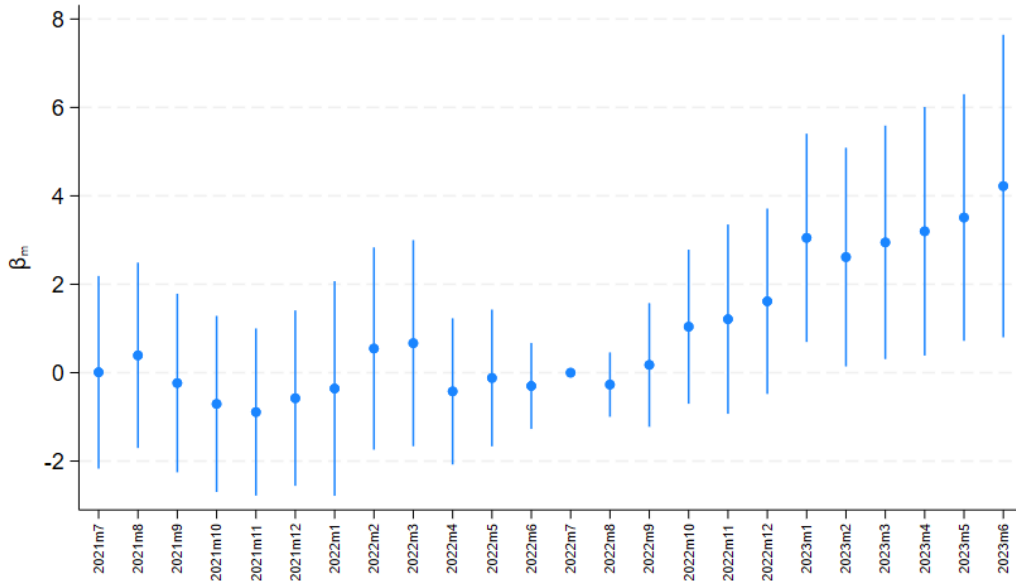
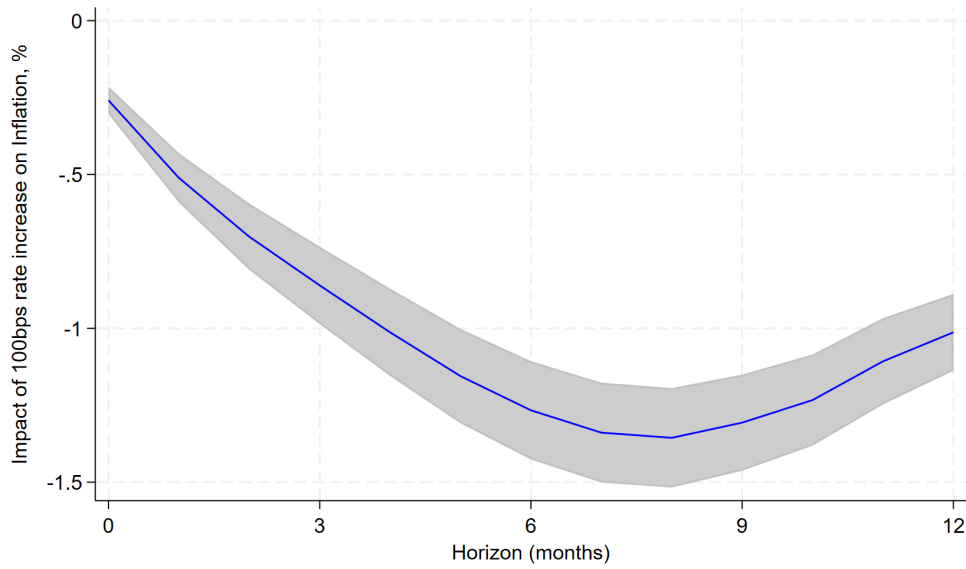


Figure 5: The Impact of Monetary Policy on Inflation: Floating and Fixed-rate Markets

This figure shows the impulse response functions by local projection (Jordà, 2005) for a 100bps increase in the deposit rate facility (DFR) on inflation (CPI growth) using a 12-month horizon and controlling for lagged inflation. We plot the impulse response function for the average market (Panel A) and for markets with a low (20th pct.=30%) vs. high (80th pct.=90%) share of floating-rate loans (Panel B) using the estimates from column (4) of Table 8. The sample consists of monthly observations at the market level from July 2021 until July 2023. Shaded areas represent 95% confidence bands.

Panel A. Baseline



Panel B. Floating vs. Fixed-rate Markets

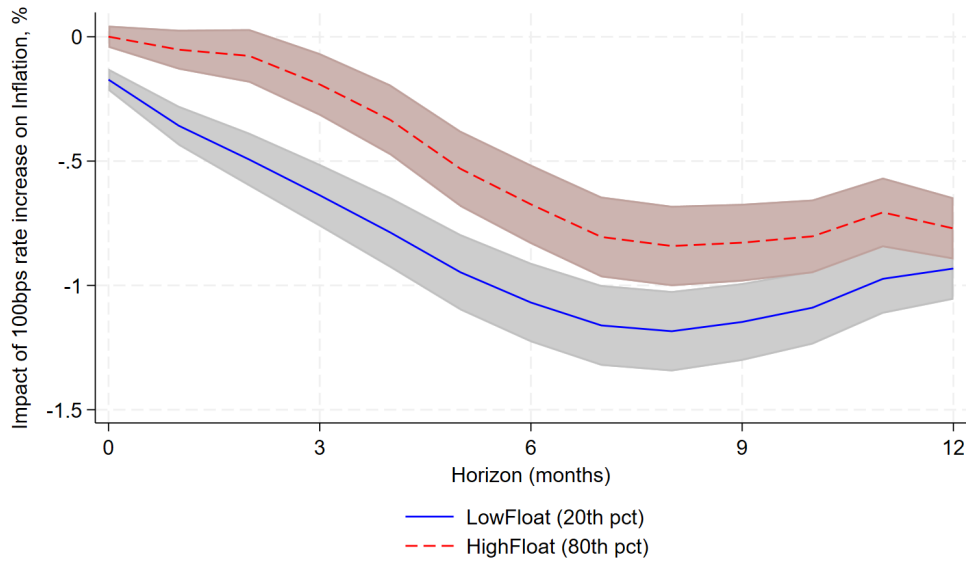


Figure 6: Counterfactual Inflation growth with Low Floating-Rate Loans

This figure shows the counterfactual inflation rate if each industry borrowed the same share of floating-rate loans as the average firm in the same industry in Germany, France, and Belgium (the countries with the lowest share of floating-rate loans).

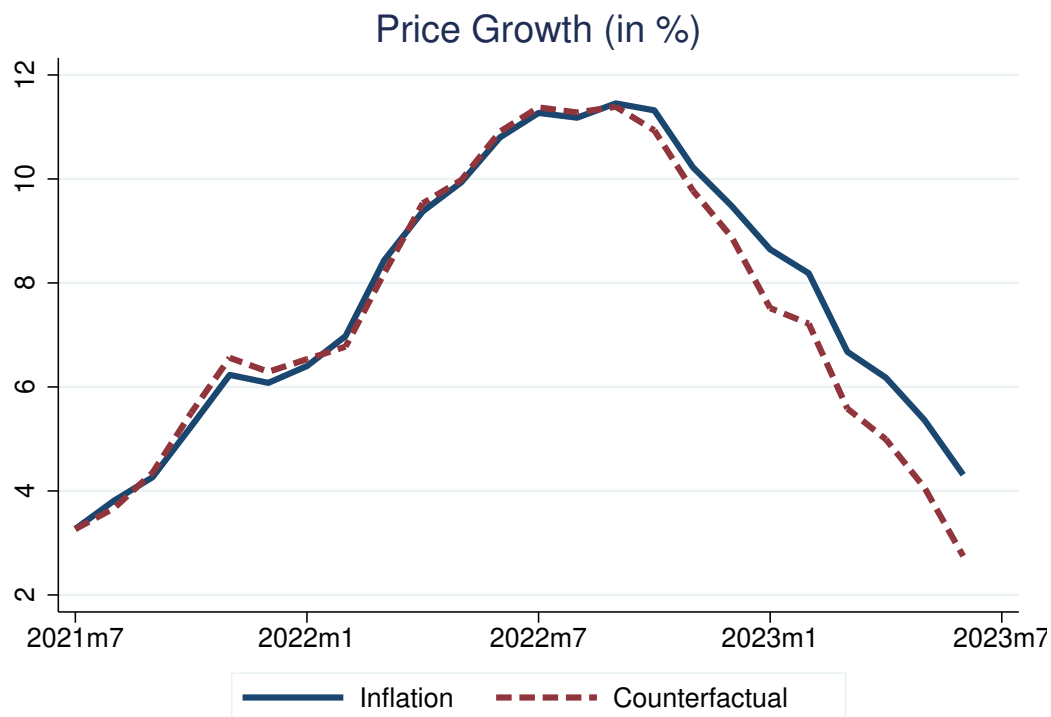


Figure 7: Dynamic DiD - Renegotiation

The figure shows the quarterly β coefficients and 90% confidence intervals for the following regression specification:

$$Renegotiation_{fbt} = \sum_{t=2021Q2}^{t=2023Q2} \beta_t \times ShareFloat_{fb} \times D_t + \delta_{ict} + \gamma_{bt} + \epsilon_{fbt}, \quad (10)$$

with 2022Q2 as the omitted period. The sample consists of quarterly observations at the firm-bank level from the second quarter of 2021 until the last quarter of 2023. The subscript i indicates an industry (2-digit NACE level), c a country (euro-area countries), and t a quarter. The dependent variable y_{fbt} is a dummy equal to 1 if one of the loans by bank b to firm f was renegotiated in quarter t . D_t is a dummy equal to 1 in quarter t . $ShareFloat_{fb}$ is the ratio of floating-rate loans over total loans during the first 6 months of 2021 for firm f with bank b . δ_{ict} and γ_{bt} are market-quarter and bank-quarter fixed effects. Standard errors are clustered at the market-quarter level.

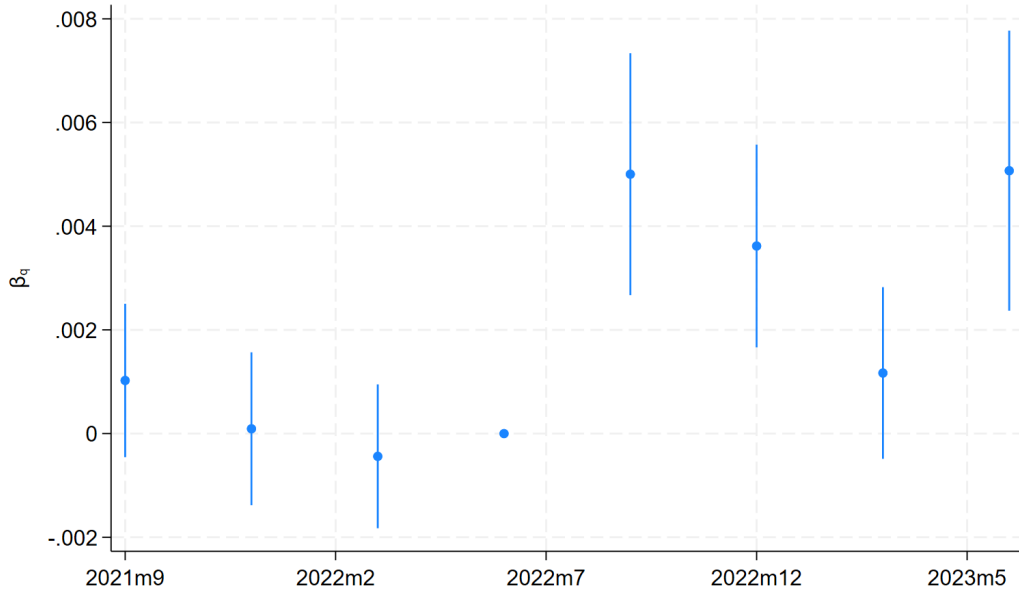


Table 1: Summary Statistics

The sample in Panel A consists all outstanding term loans and credit lines in December 2021. All variables are observed at the loan level. Firm PD is the 1-year probability of default on the firm's loans. The sample in Panel B contains product-level prices from IRI. Price growth is the year-on-year growth rate in firm-product prices. ΔDFR is the year-over-year change in the ECB's Deposit Facility Rate. $ShareFloat_f$ is the ratio of floating-rate loans in the total borrowing by firm f during the first six months of 2021. HHI is the Herfindahl-Hirschman-Index of a market in 2021, calculated using firm-level turnover data from Orbis. The sample in Panel C consists of monthly observations at the bank-firm level from July 2021 until July 2023. The sample in Panel D consists of monthly observations at the market level from July 2021 until July 2023. A market is defined as a country-industry combination, with industry defined at the 2-digit NACE level. *Inflation rate* is the year-over-year percentage change in the market-level Harmonised Index of Consumer Prices (HICP), taken from Eurostat. *Cash ratio* is the ratio of cash over total assets, *Leverage ratio* is defined as debt over total assets. Both are calculated using 2021 Orbis data. *Energy cost* is calculated using a country-level CPI index for energy and the total energy use in a market, collected from Eurostat.

	Observations	Mean	Std.dev.	1 st pct.	Median	99 th pct.
<u>Panel A</u>	Loan level (cross-section Dec2021)					
floating-rate dummy	10,915,310	0.239		0	0	1
Loan amount (th. EUR)	10,915,310	197	534	0.339	40.910	4000
Interest rate (%)	10,915,310	2.062	1.710	0	1.620	10.471
Initial loan maturity (days)	10,915,310	2981	2463	57	2191	12447
Firm PD (%)	7,453,408	6.871	20.791	0.030	0.887	100
Collateral dummy	10,915,310	0.726		0	1	1
Term loan dummy	10,915,310	0.727		0	1	1
Credit line dummy	10,915,310	0.273		0	0	1
Renegotiated dummy	10,915,310	0.010		0	0	1
<u>Panel B</u>	Firm-Product level, Jul2021-Jul2023					
Price growth (YoY %)	5,435,394	3.95	10.65	-26.14	1.82	45.33
ΔDFR	5,435,394	1.14	1.43	0.00	0.00	4.00
ShareFloat	5,435,394	0.37	0.38	0.00	0.26	1.00
HHI	5,435,394	0.05	0.08	0.00	0.03	0.40
Share working capital loans	5,435,394	0.07	0.20	0.00	0.00	1.00
GDP growth (YoY %)	5,435,394	3.40	1.84	0.53	4.12	5.56
<u>Panel C</u>	Firm level (yearly) - 2021-2023					
EBIT/Sales (%)	1,965,404	8.18	12.81	-13.03	4.78	43.97
Interest paid (Orbis) (%)	1,946,561	1.52	1.18	0.10	1.21	4.43
Interest coverage ratio	1,880,081	26.82	44.43	-3.95	9.37	188.74
Mark-up	1,484,038	1.15	0.52	0.04	1.04	3.09
ΔDFR	1,965,404	1.49	1.46	0.00	2.50	3.25
ShareFloat _f	1,965,404	0.36	0.41	0.00	0.13	1.00
<u>Panel D</u>	Market level, Jul2021-Jul2023					
Inflation rate (%)	13,944	6.53	6.11	-6.11	4.94	24.78
ShareFloat	13,944	0.59	0.29	0.002	0.61	1
ΔDFR	13,944	1.18	1.45	0.00	0.00	4.00
HHI	13,728	0.19	0.26	0.00	0.07	1.00
Energy cost	11,544	4.00	9.28	0.02	0.92	47.25

Table 2: Loan Interest Rates

The sample consists of monthly observations at the firm level from July 2021 until July 2023 in columns (1)-(3) and firm-year observations in column (4). The regression specification is as follows:

$$LoanRate_{ft} = \beta ShareFloat_f \times \Delta DFR_t + \delta_f + \rho_{ict} + \epsilon_{ft},$$

where f indicates a firm, c a country, i an industry and t a month. The dependent variable $LoanRate_{ft}$ is the monthly average interest rate on credit to firm f in month t from AnaCredit in columns (1)-(3) and the total interest paid over total liabilities from Orbis in column (4). $ShareFloat_f$ is the ratio of the floating-rate loans over the total loans during the first 6 months of 2021 for firm f . ΔDFR is the year-over-year change in the ECB's Deposit Facility Rate. Standard errors clustered at the market level are in parentheses.

	Interest rate (AnaCredit)			Total Interest paid (Orbis)
	(1)	(2)	(3)	(4)
ShareFloat _{<i>f</i>} × Δ DFR	0.614*** (0.038)	0.614*** (0.039)	0.534*** (0.041)	0.123*** (0.007)
Δ DFR	0.0844*** (0.024)			
Observations	84,467,794	84,467,794	84,467,794	1,946,553
Firm FE	Y	Y	Y	Y
Month FE	N	Y	-	-
Country-industry-month FE	N	N	Y	Y

Table 3: Product prices and Floating-rate Loans

The sample consists of monthly firm-product-country level data, from July 2021 until July 2023. $ShareFloat_f$ is the ratio of the floating-rate loans over the total loans during the first 6 months of 2021 for firm f . ΔDFR is the year-over-year change in the ECB's Deposit Facility Rate (DFR). Standard errors clustered at the firm level are in parentheses.

		Price growth (YoY)		
	(1)	(2)	(3)	(4)
ΔDFR_t	-0.245*** (0.0448)	-0.328*** (0.0576)		
$ShareFloat_f \times \Delta DFR$		0.232* (0.120)	0.226* (0.120)	0.188*** (0.0671)
Observations	5,435,394	5,435,394	5,435,394	5,435,394
Firm-Product FE	Y	Y	Y	Y
Month FE	N	N	Y	N
Country-ProductCategoryType-Month FE	N	N	N	Y
GDP growth control	Y	Y	-	-

Table 4: Product Prices and floating-rate loans: IV setup

The sample consists of monthly firm-product-country level data, from July 2021 until July 2023. $ShareFloat_f$ is the ratio of the floating-rate loans over the total loans during the first 6 months of 2021 for firm f . ΔDFR is the year-over-year change in the ECB's Deposit Facility Rate (DFR). Bank FE_{firm FE} denotes average bank fixed effects $\widehat{\gamma}_b$ estimated from the following regression on a month-by-month basis using data for the first six months of 2021: $ShareFloat_{fb} = \gamma_b + \mu_f + \epsilon_{bf}$. Bank Similarly, FE_{market FE} denotes bank fixed effects $\widehat{\gamma}_b$ estimated from the following regression: $ShareFloat_{fbm} = \gamma_b + \mu_m + \epsilon_{bf}$, where m is the market where firm f operates. Standard errors clustered at the firm level are in parentheses.

	First stage		Second stage	
	ShareFloat _f × Δ DFR		Price growth (YoY)	
	(1)	(2)	(3)	(4)
	IV1	IV2	IV1	IV2
Bank FE _{firm FE} × Δ DFR	0.182*** (0.00930)			
Bank FE _{market FE} × Δ DFR		0.195*** (0.00933)		
ShareFloat _f × Δ DFR			0.264* (0.153)	0.380*** (0.145)
Observations	5,435,088	5,435,394	5,435,088	5,435,394
Firm-Product FE	Y	Y	Y	Y
Country-ProductCategoryType-Month FE	Y	Y	Y	Y
1 st stage F-stat			381.96	435.87

Table 5: Heterogeneity: Working Capital Loans and Market Power

The sample consists of monthly firm-product-country level data, from July 2021 until July 2023. Columns (1) and (2) show results for products sold by firms with (without) working capital loans. Columns (3) and (4) show results for products sold by firms in markets where the HHI based on Sales in 2021 was below (above) the sample median. $ShareFloat_f$ is the ratio of the total amount of floating-rate loans over the total amount of loans during the first 6 months of 2021 for firm f . ΔDFR is the year-over-year change in the ECB's Deposit Facility Rate. Standard errors clustered at the firm level are in parentheses.

	WC loans		HHI	
	(1) No	(2) Yes	(3) Low	(4) High
$ShareFloat_f \times \Delta DFR$	0.164** (0.0801)	0.343*** (0.117)	0.109 (0.0933)	0.284*** (0.0719)
Observations	3,721,836	1,702,920	2,710,560	2,724,834
Firm-Product FE	Y	Y	Y	Y
Country-ProductCategoryType-Month FE	Y	Y	Y	Y

Table 6: HHI and competitor's market share

The sample consists of monthly firm-product-country level data, from July 2021 until July 2023. This table splits the sample by HHI (low /high) and by the share of floating-rate loans in the product market (low /high). Columns (1)-(2) show results for products sold by firms in low HHI markets, columns (3)-(4) for high HHI markets. Within each HHI category, we further split by whether the share of floating-rate loans in that product market is below or above the median. $ShareFloat_f$ is the ratio of floating-rate loans over the total loans during the first 6 months of 2021 for firm f . ΔDFR is the year-over-year change in the ECB's Deposit Facility Rate. Standard errors clustered at the firm level are in parentheses.

	HHI Low		HHI High	
	(1) Low	(2) High	(3) Low	(4) High
<i>Share floating in product market</i>				
$ShareFloat_f \times \Delta DFR$	0.0710 (0.132)	0.138 (0.105)	0.141 (0.0908)	0.354*** (0.0885)
Observations	1,355,958	1,354,602	1,351,800	1,372,290
Firm-Product FE	Y	Y	Y	Y
Country-ProductCategoryType-Month FE	Y	Y	Y	Y

Table 7: Product Quantities, HHI and competitor's market share

The sample consists of monthly firm-product-country level data, from July 2021 until July 2023. Column (1) shows the effect on quantities in the full sample. Next, the sample is split by HHI (low/high) and by the share of floating-rate loans in the product market (low/high). Columns (2)-(3) show results for products sold by firms in low HHI markets, columns (4)-(5) for high HHI markets. Within each HHI category, we further split by whether the share of floating-rate loans in that product market is below or above the median. $ShareFloat_f$ is the ratio of floating-rate loans over the total loans during the first 6 months of 2021 for firm f . ΔDFR is the year-over-year change in the ECB's Deposit Facility Rate. Standard errors clustered at the firm level are in parentheses.

	Full sample	HHI Low		HHI High	
<i>Share floating in product market</i>		Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)
$ShareFloat_f \times \Delta DFR$	0.339 (0.594)	-1.416 (1.134)	1.628 (1.080)	0.171 (0.903)	0.466 (0.733)
Observations	5,435,394	1,114,266	1,560,318	1,567,770	1,157,064
Firm-Product FE	Y	Y	Y	Y	Y
Country-ProductCategoryType-Month FE	Y	Y	Y	Y	Y

Table 8: CPI Inflation and Floating-rate Loans

The sample consists of monthly market-level (i.e., industry-country pairs) data, from July 2021 until July 2023. $ShareFloat_{ic}$ is the ratio of the total amount of floating-rate loans over the total amount of loans during the first 6 months of 2021 in market ic . ΔDFR is the year-over-year change in the ECB's Deposit Facility Rate (DFR). High Share is a dummy equal to one if the share of floating-rate loans in market ic is above the median, zero otherwise. *Energy cost* is calculated using a country-level CPI index for energy and the total energy use in a market. Macro control variables are the euro-area Harmonised Index of Consumer Prices (HICP) and GDP growth. Standard errors clustered at the market level are in parentheses.

	Inflation rate (%)				
	(1)	(2)	(3)	(4)	(5)
ΔDFR	-0.338*** (0.0916)	-0.645*** (0.194)			
$ShareFloat_{ic} \times \Delta DFR$		0.521* (0.289)	1.084*** (0.302)	0.987*** (0.317)	
$High\ Share_{ic} \times \Delta DFR$					0.347** (0.165)
Energy cost				0.0414 (0.0466)	0.0392 (0.0476)
Observations	13,944	13,944	13,920	11,544	11,544
Macro controls	Y	Y	-	-	-
Country-industry FE	Y	Y	Y	Y	Y
Ind-month FE	N	N	Y	Y	Y
Country-month FE	N	N	Y	Y	Y

Table 9: Firm-level Outcomes

The sample consists of yearly observations at the firm level from 2020 until 2023. The regression specification is as follows:

$$y_{ft} = \beta \text{ShareFloat}_f \times \Delta \text{DFR}_t + \alpha X_{it} + \delta_{ict} + \gamma_f + \epsilon_{ft},$$

where f indicates a firm, and t a year. The dependent variable y_{ft} is either (EBIT/Sales), a mark-up proxy, or the interest coverage ratio (EBITDA over interest expenses). ShareFloat_f is the ratio of floating-rate loans over total loans during the first 6 months of 2021 for firm f . ΔDFR is the year-over-year change in the ECB's Deposit Facility Rate. X_{it} is a vector of firm-level controls, such as the $\text{Ln}(\text{total assets})_{f,t}$. δ_{ict} is an industry-country-year fixed effect, γ_f is a firm fixed effect. Standard errors clustered at the firm level are in parentheses.

	EBIT/Sales		Mark-up		Interest coverage	
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{ShareFloat}_f \times \Delta \text{DFR}$	0.162*** (0.0119)	0.223*** (0.0135)	0.00343*** (0.000305)	0.00284*** (0.000343)	-0.963*** (0.0393)	-0.773*** (0.0451)
ΔDFR	0.0611*** (0.00618)		0.00114*** (0.000143)		-0.715*** (0.0245)	
Observations	1,965,404	1,965,404	1,484,038	1,484,038	1,880,081	1,880,081
Firm FE	Y	Y	Y	Y	Y	Y
Firm controls	Y	Y	Y	Y	Y	Y
Country-industry-year FE	N	Y	N	N	Y	Y

Table 10: Loan Renegotiation and Terms

This table presents the analysis of loan renegotiations. Panel A focuses on the probability of renegotiation. The sample consists of quarterly observations at the firm-bank level from Q3 2021 to Q3 2023. The specification is:

$$y_{fbt} = \beta \text{ShareFloat}_{fb} \times \Delta DFR_t + \delta_{fb} + \gamma_{bt} + \rho_{ict} + \epsilon_{fbt},$$

where y_{fbt} is a dummy equal to 1 if a loan between bank b and firm f was renegotiated in quarter t . ShareFloat_{fb} is the ratio of floating-rate loans over total loans during the first 6 months of 2021. ΔDFR is the year-over-year change in the ECB's Deposit Facility Rate. Standard errors are clustered at the industry-country level. Panel B analyzes loan terms following renegotiation. The sample consists of quarterly observations at the loan level for floating-rate loans renegotiated from July 2021 to July 2023. The specification is:

$$y_{lbcit} = \beta \text{Post}_t + \delta_{cbi} + \epsilon_{lit},$$

where dependent variable y_{lit} is a dummy equal to 1 if: (1) the loan spread was reduced; (2) the loan switched from floating to fixed-rate; (3) the maturity was reduced; or (4) the committed amount was reduced. Post is a dummy equal to one after July 2022. Standard errors are clustered at the bank level.

Panel A: Loan Renegotiation				
	(1)	Renegotiation dummy		
		(2)	(3)	(4)
ΔDFR	-0.0002 (0.0002)			
$\text{ShareFloat}_{fb} \times \Delta DFR$	0.0015*** (0.0004)	0.0015*** (0.0004)	0.0017*** (0.0005)	0.0007*** (0.0002)
Observations	34,788,710	34,788,710	34,788,341	34,783,863
Bank-Firm FE	Y	Y	Y	Y
Quarter FE	N	Y	-	-
Country-industry-quarter FE	N	N	Y	Y
Bank-quarter FE	N	N	N	Y
Panel B: Loan Terms after Renegotiation				
	Spread decrease (1)	Float to fixed (2)	Maturity decrease (3)	Loan volume decrease (4)
Post	0.0253** (0.0111)	0.0099*** (0.0031)	0.0078 (0.0127)	-0.0026 (0.00251)
Constant	0.120*** (0.0062)	0.0039** (0.0017)	0.127*** (0.0069)	0.0093*** (0.0012)
Observations	208,500	224,041	204,773	184,478
Country-industry-bank FE	Y	Y	Y	Y

Online Appendix A: Tables and Figures

Figure A1: Example of COICOP-CPA transition matrix

This figure shows an example of a COICOP-CPA transition matrix for Austria

<i>CPA x COICOP</i>		01.1	02.2	04.5	09.3	Total
		Food	Tobacco	Electricity, gas and other fuels	Other recreational items and equipment, gardens and pets	
01	Products of agriculture, hunting and related services	2383080	61651	-	913837	3358568
02	Products of forestry, logging and related services	-	-	521557	43503	565060
03	Fish and fishing products	123244	-	-	-	123244
05-07	Coal a.lignite; crude petroleum a.natural gas; metal ores	-	-	35791	-	35791
08-09	Other mining a. quarrying prod.; mining support services	-	-	-	15400	48336
10	Food products	13300811	-	-	641128	15105243
Total		15807135	3425510	7055310	3715785	177798703

Figure A2: Floating-rate Loans: Reference Rate

This figure shows the share of floating-rate loans divided by the reference rate. The sample is that of all loans in the Euro-area issued before the rate hike (August 2022).

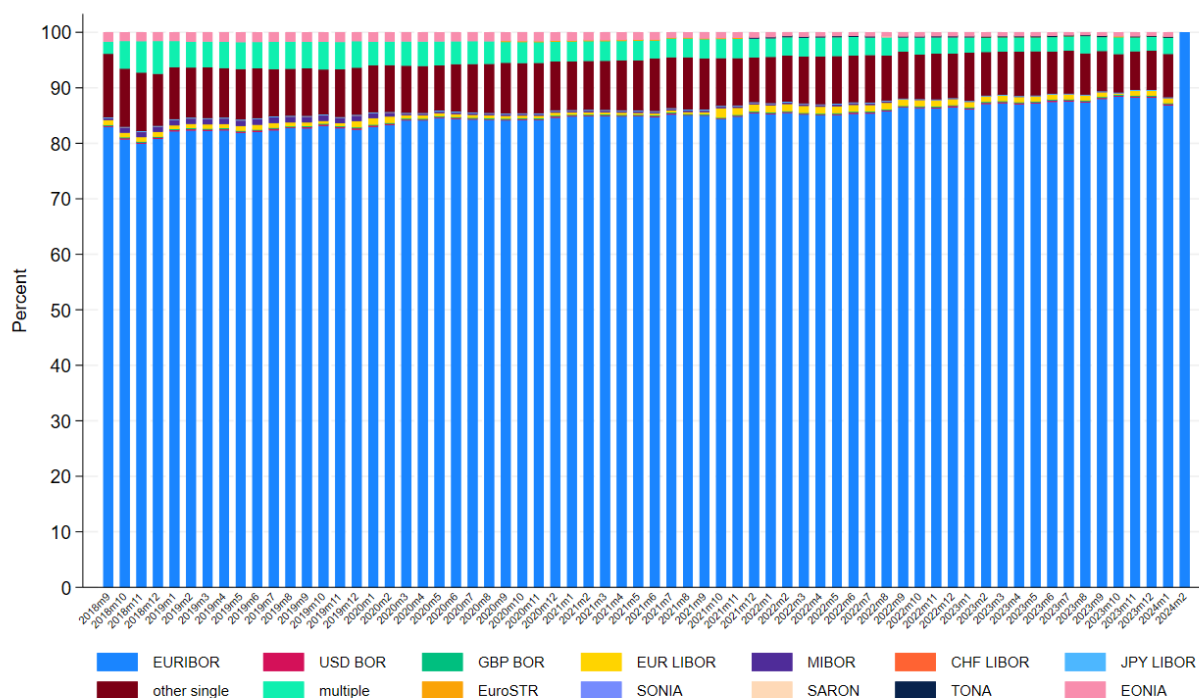


Figure A3: Floating-rate Loans: Reference Rate Maturity

This figure shows the share of floating-rate loans divided by the maturity of the reference rate. The sample is that of all loans in the Euro-area issued before the rate hike (August 2022).

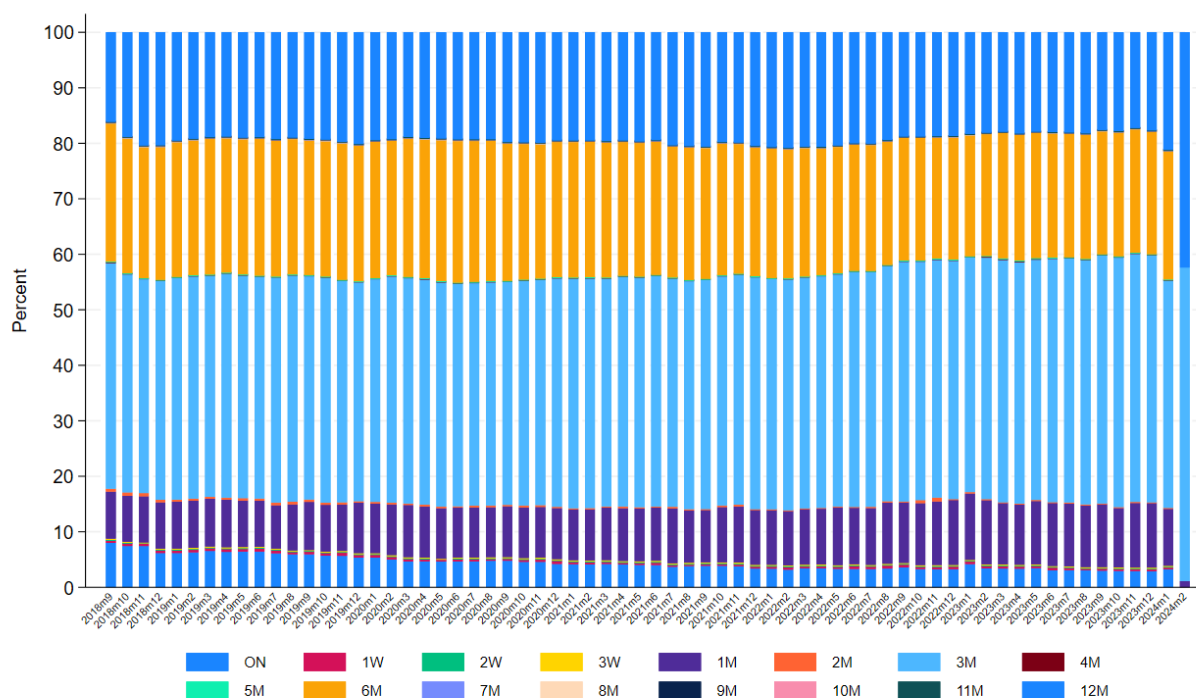
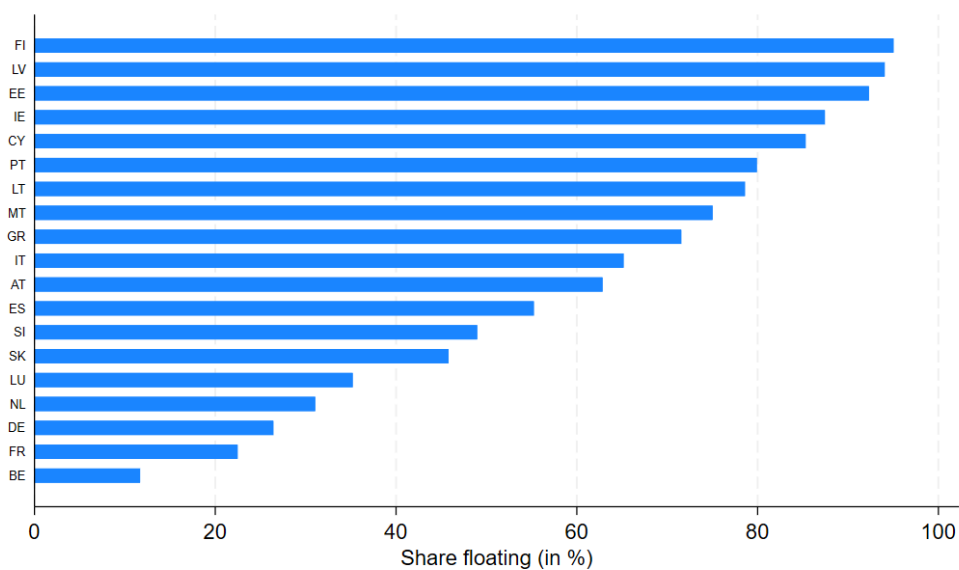


Figure A4: Fixed and floating-rate loans: Country and Sector heterogeneity in 2021

This figure shows the share of floating-rate loans across euro-area countries (Panel A) and industries (Panel B).

Panel A. By Country



Panel B. By Sector

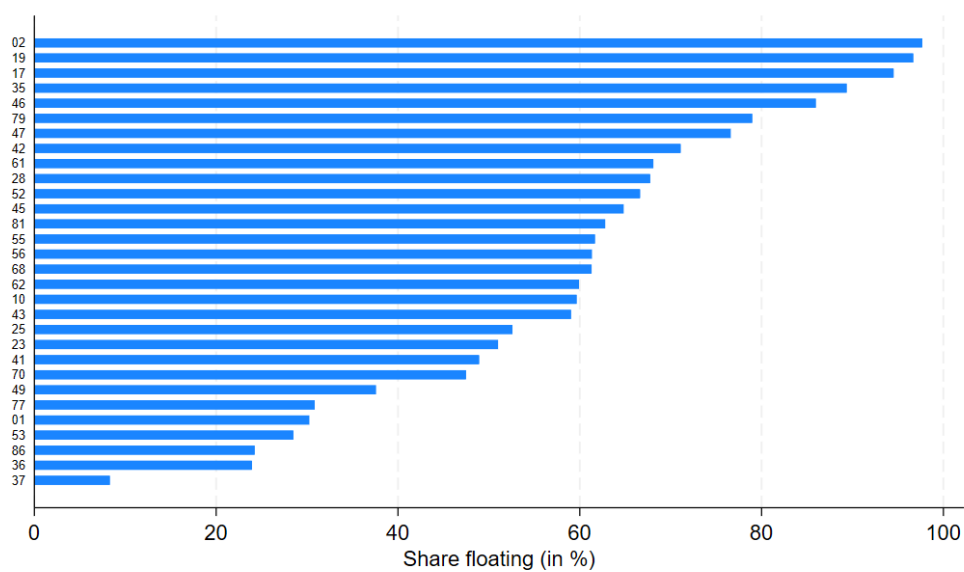


Figure A5: Analysts' Forecasts of ECB Deposit Facility Rate

This figure shows the median expectation from the Survey of Monetary Analysts (SMA) for the Deposit Facility Rate (DFR) at different survey dates for 1-12months ahead horizons, together with actual DFR (black dashed line). More info on the survey at [this link](#)

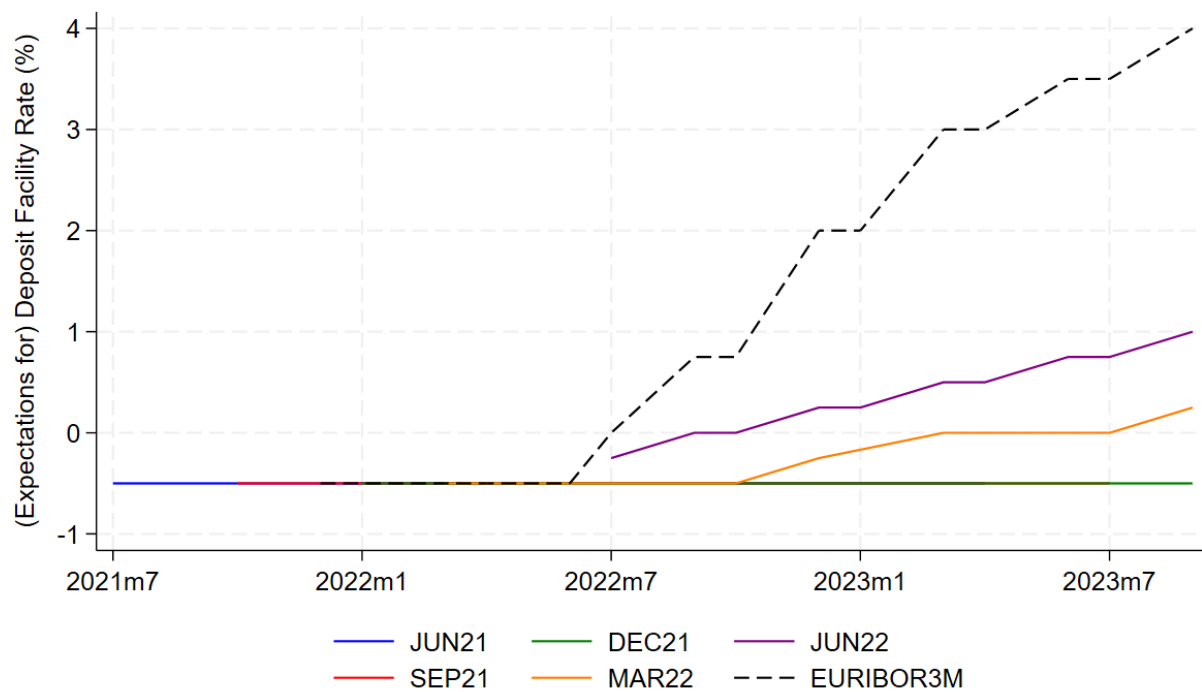


Figure A6: Supply-driven floating-share and deposit betas

The figure shows a binscatter plot with Deposit Betas on the x-axis and bank fixed effects on the y-axis, for the subsample of banks for which we have deposit rate data available. Deposit betas are estimated using monthly bank-level deposit rates between July 2022 and July 2023. Bank $FE_{firm\ FE}$ denotes the average bank fixed effects $\widehat{\gamma}_b$ estimated from the following regressions on a month-by-month basis using data for the first six months of 2021 (i.e. estimated as the ones we use in our IV setup in Table 4): $ShareFloat_{fb} = \gamma_b + \mu_f + \epsilon_{bf}$. $ShareFloat_{fb}$ is the ratio of the floating-rate loans over the total loans for firm f at bank b . μ_f is a firm fixed effect.

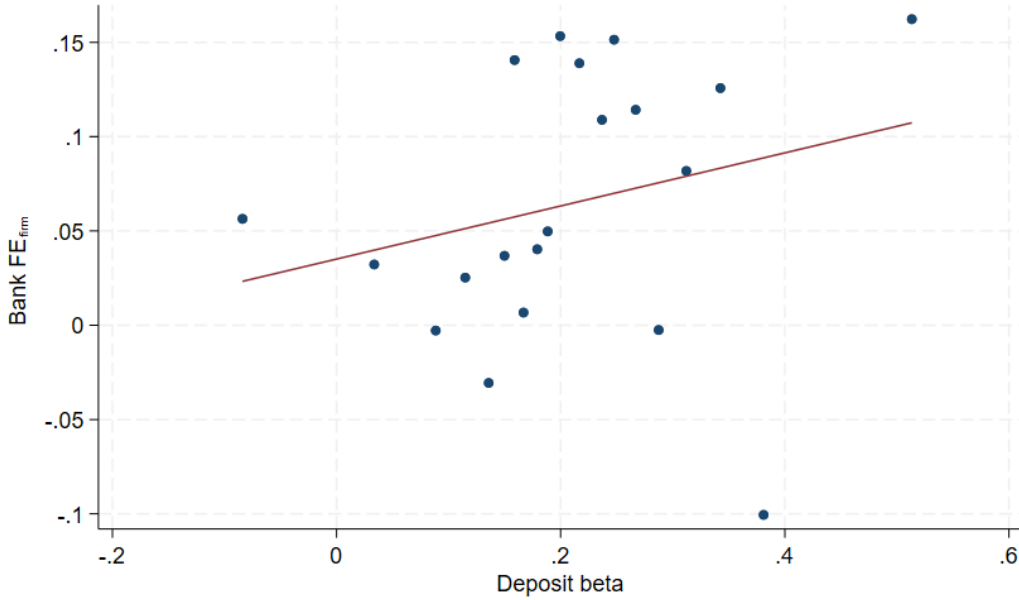
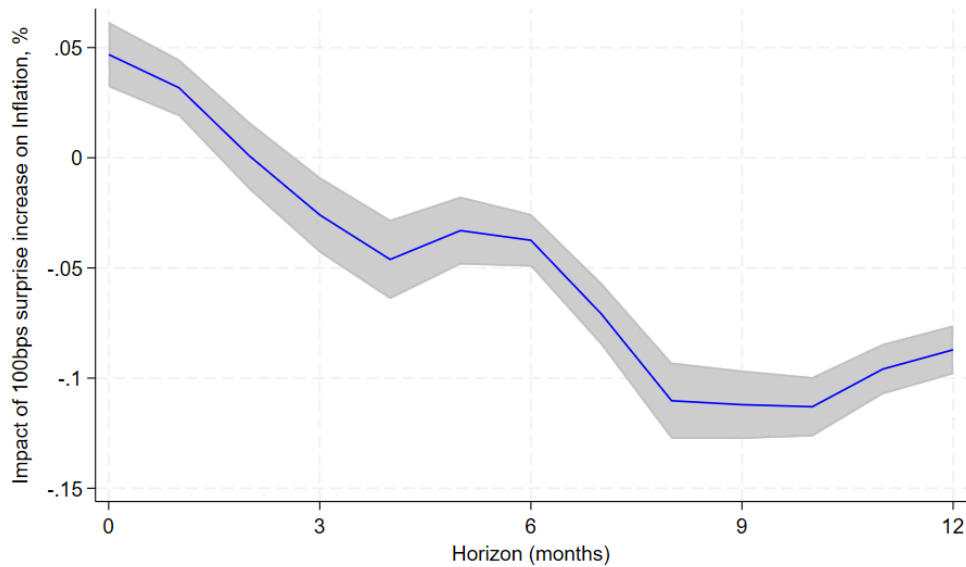


Figure A7: Monetary Policy Surprises and Inflation: Floating and Fixed-rate Markets

This figure shows the impulse response functions by local projection (Jordà, 2005) for a 100bps increase in monetary policy surprise using high-frequency changes from Altavilla et al. (2019) on inflation (CPI growth) using a 12-month horizon. The monetary policy surprise is the change in the median quote of the 1 month Overnight Index Swap (OIS) rate from a 30-minute window before the ECB press release to the median quote in the window 30 after the press conference (Euro Area Monetary Policy event study Database, EA-MPD). We plot the impulse response function for the average market (Baseline - Panel A) and for markets with a low (20th pct.=30%) vs. high (80th pct.=90%) share of floating-rate loans (Panel B) using the estimates from column (4) of Table 8. The sample consists of monthly observations at the market level from July 2021 until July 2023. Shaded areas represent 95% confidence bands.

Panel A. Baseline



Panel B. Floating vs. Fixed-rate Markets

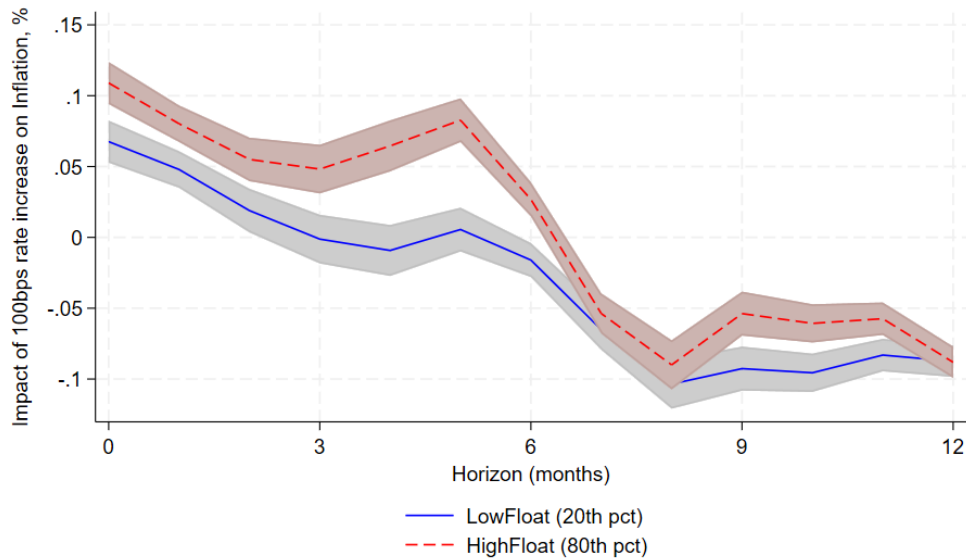


Table A1: Loan-level Summary Statistics: Floating-rate vs. Fixed-rate Loans

The sample in the upper panel consists all outstanding term loans and credit lines in December 2021. All variables are observed at the loan level. Firm PD is the 1-year probability of default on the firm's loans.

	Observations	Mean	Std.dev.	1 st pct.	Median	99 th pct.
floating-rate loans						
Loan amount (th. EUR)	2,610,336	270	668	0.270	50	4000
Interest rate (%)	2,610,336	2.307	1.490	0	1.974	7.250
Initial loan maturity (days)	2,610,336	2961	2748	54	2183	12021
Firm PD (%)	1,390,330	9.518	25.049	0.030	1.310	100
Collateral dummy	2,610,336	0.789		0	1	1
Term loan dummy	2,610,336	0.718		0	1	1
Credit line dummy	2,610,336	0.282		0	0	1
Renegotiated dummy	2,610,336	0.012		0	0	1
Euribor dummy	2,610,336	0.823		0	1	1
Fixed-rate loans						
Loan amount (th. EUR)	8,304,974	174	483	0.409	38.567	3125
Interest rate (%)	8,304,974	1.985	1.767	0	1.510	11.580
Initial loan maturity (days)	8,304,974	2988	2366	65	2191	12606
Firm PD (%)	6,063,078	6.263	19.635	0.030	0.820	100
Collateral dummy	8,304,974	0.706		0	1	1
Term loan dummy	8,304,974	0.729		0	1	1
Credit line dummy	8,304,974	0.271		0	0	1
Renegotiated dummy	8,304,974	0.008		0	0	1

Table A2: Industry List

NACE code	Description
01	Crop and animal production, hunting and related service activities
02	Forestry and logging
05-09	Mining and quarrying
10-12	Manufacturing of food, beverages and tobacco
16	Manufacturing of wood and cork
18	Printing and reproduction of media
19	Manufacture of coke and refined petroleum products
21	Manufacture of basic pharmaceutical products and preparations
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
26	Manufacture of computer, electronic and optical products
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
33	Repair and installation of machinery and equipment
36	Water collection, treatment and supply
37-39	Sewerage, waste collection and waste management activities
41-43	Construction
45	Wholesale and retail trade and repair of motor vehicles
49	Land transport and transport via pipelines
50	Water transport
51	Air transport
52	Warehousing and support activities for transportation
53	Postal and courier activities
55-56	Accommodation and food services
58	Publishing activities
59-60	Motion picture, video, television, programming and broadcasting
61	Telecommunications
62-63	Computer programming, consultancy and related activities; information services
69-70	Legal and accounting activities, management consultancy and head offices
71	Architectural and engineering activities; technical testing and analysis
7475	Other professional, scientific and technical activities, veterinary activities
77	Rental and leasing activities
78	Employment activities
79	Travel agency, tour operator reservation service and related activities
80-82	Security and investigation, services to buildings, office admin and business support
84	Public administration and defence; compulsory social security
85	Education
86	Human health activities
87-88	Residential care, social work without accommodation
90-92	Arts, libraries, musea and other cultural activities
93	Sports activities and amusement and recreation activities
97-98	Activities of households as employers

Table A3: Floating-rate Determinants: Variance Decomposition

The sample consists of the cross-section of bank-firm relationships the euro area in July 2022. The dependent variable is the share of floating-rate debt in the lending relationship ShareFloat_{fb} . In column 1 through 5, several fixed effects are added, starting with the (2-digit) industry or country of the borrowing firm, then the firm, the bank and finally $\text{firm} \times \text{bank}$. We report the adjusted R-squared from each regression.

	ShareFloat_{fb}				
	(1)	(2)	(3)	(4)	(5)
Adjusted R-sq.	0.0175	0.286	0.363	0.452	0.518
Observations	1578795	1578795	1578275	1578795	1578188
Fixed effect	Industry	Country	Firm	Bank	Firm&Bank

Online Appendix B: Model on Working Capital, Internal Funds, and Floating-Rate Loans

This appendix develops a simple model showing that a rate hike can raise marginal cost even when the firm fully self-finances working capital. The mechanism is that higher rates tighten internal liquidity through outstanding floating-rate loans, raising the shadow cost of using internal funds. The idea of a ‘shadow value of internal liquidity’ is in line with Froot et al. (1993).

As a starting point, we assume that the firm must pre-pay working capital wq (e.g., materials, payroll). The unit input price is w . Because cash is needed before sales, financing conditions affect marginal costs.

7.1 Finance building blocks

7.1.1 Internal funds depend on the policy rate

Internal liquid funds at $t = 0$ are reduced by interest on legacy floating-rate loans D^{leg} :

$$A_0(i) = \bar{A} - iD^{\text{leg}}, \quad D^{\text{leg}} > 0. \quad (11)$$

Rationale: A higher policy rate i immediately lowers available cash by raising payments on existing floating-rate loans, even before new production decisions.

7.1.2 Shadow cost of internal funds

Using internal cash is costly because it depletes a precautionary buffer. The firm faces uncertain future cash needs; running down liquidity today raises the expected cost of future shortfalls. We model this as:

$$\rho(u) = \rho_0 + \gamma u, \quad u \equiv \frac{I}{A_0(i)}, \quad \gamma > 0. \quad (12)$$

Here I is internal funds deployed for working capital, and $u \in [0, 1]$ is the utilization rate of the liquidity buffer.

Rationale:

- $\rho_0 \geq 0$ captures returns to alternative uses of cash that are not tied to the policy rate: e.g. returns to holding inventories, or maintaining relationships with suppliers who offer better terms to liquid buyers.
- γu captures the precautionary motive: depleting a larger share of the buffer raises the probability of costly future illiquidity. This could also reflect covenant concerns—as $u \rightarrow 1$, the firm approaches liquidity thresholds that trigger creditor scrutiny or tighter credit terms.
- γ is a scaling parameter that controls how sensitive the shadow cost is to utilization.
- Also see e.g. (Froot et al., 1993) and (Bolton et al., 2011) on shadow cost of cash.

7.1.3 External borrowing

If internal cash is insufficient, the firm borrows at the policy-linked rate. The external borrowing cost is equal to:

$$C_E(B; i) = iB. \quad (13)$$

7.1.4 Financing rule

Internal funds are cheaper than external funds: working-capital needs are met by internal funds first, then borrowing:

$$I(i, q) = \min\{wq, A_0(i)\}, \quad (14)$$

$$B(i, q) = wq - I(i, q) \geq 0. \quad (15)$$

7.2 Total cost and marginal cost

Total financing cost of producing q units is the sum of input costs, shadow cost of internal funds, and borrowing cost:

$$TC(q; i) = wq + \rho(u) \cdot I + i \cdot B. \quad (16)$$

7.2.1 Regime A: no borrowing

Condition: $A_0(i) \geq wq$, so $I = wq$, $B = 0$, and $u = wq / A_0(i)$.

Total cost becomes:

$$TC(q; i) = wq + \left(\rho_0 + \gamma \frac{wq}{A_0(i)} \right) wq = wq (1 + \rho_0) + \gamma \frac{(wq)^2}{A_0(i)}. \quad (17)$$

Taking the derivative with respect to q :

$$MC_A(i) = w \left(1 + \rho_0 + \frac{2\gamma wq}{A_0(i)} \right). \quad (18)$$

Key result: Marginal Cost (MC) depends on internal funds $A_0(i)$ directly. A rate hike that reduces liquidity (lowering A_0) raises MC even when the firm does not borrow. The channel is that scarcer internal funds mean higher utilization u for any given output, which raises the shadow cost.

7.2.2 Regime B: borrowing at the margin

Condition: $A_0(i) < wq$, so $I = A_0(i)$, $B = wq - A_0(i)$, and $u = 1$.

Total cost:

$$TC(q; i) = wq + (\rho_0 + \gamma) A_0(i) + i (wq - A_0(i)). \quad (19)$$

Since $A_0(i)$ does not depend on q , the derivative with respect to q is:

$$MC_B(i) = w(1 + i). \quad (20)$$

Once internal funds are exhausted, the marginal unit is financed entirely by borrowing at rate i . The shadow cost of internal funds is sunk at $u = 1$ and doesn't affect the margin.

7.3 Comparative statics on i

In Regime A:

$$\frac{\partial MC_A}{\partial i} = \frac{2\gamma w^2 q \cdot D^{\text{leg}}}{A_0(i)^2} > 0. \quad (21)$$

Interpretation: Higher i drains internal funds (via $\partial A_0 / \partial i = -D^{\text{leg}} < 0$), which raises the utilization rate and hence the shadow cost. The effect is stronger when:

- Legacy floating debt D^{leg} is larger (more cash drain per rate increase).
- Output q is larger (higher utilization for given A_0).
- The buffer is already thin (A_0 small, so utilization is sensitive).

7.4 Prices

With a static markup:

$$p = (1 + \mu) MC, \quad \mu \geq 0. \quad (22)$$

In Regime A, prices now inherit the liquidity channel: a rate hike raises p even with zero borrowing, through the effect on $A_0(i)$ and hence on utilization-adjusted shadow costs.

7.5 Key takeaways

- Monetary tightening raises marginal costs even when working capital is internally financed because draining liquidity (via higher payments on legacy floating-rate

loans) increases the shadow cost of using internal funds.

- The model has one additional parameter (γ) relative to a standard cost-channel setup, capturing the sensitivity of shadow cost to buffer utilization.