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## Inflation and floating-rate loans: evidence from the euro-area

ChaMP

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**Challenges for Monetary Policy Transmission in a Changing World Network (ChaMP)**

This paper contains research conducted within the network "Challenges for Monetary Policy Transmission in a Changing World Network" (ChaMP). It consists of economists from the European Central Bank (ECB) and the national central banks (NCBs) of the European System of Central Banks (ESCB).

ChaMP is coordinated by a team chaired by Philipp Hartmann (ECB), and consisting of Diana Bonfim (Banco de Portugal), Margherita Bottero (Banca d'Italia), Emmanuel Dhyne (Nationale Bank van België/Banque Nationale de Belgique) and Maria T. Valderrama (Oesterreichische Nationalbank), who are supported by Melina Papoutsi and Gonzalo Paz-Pardo (both ECB), 7 central bank advisers and 8 academic consultants.

ChaMP seeks to revisit our knowledge of monetary transmission channels in the euro area in the context of unprecedented shocks, multiple ongoing structural changes and the extension of the monetary policy toolkit over the last decade and a half as well as the recent steep inflation wave and its reversal. More information is provided on its website.

**Abstract**

We provide novel evidence on the supply-side transmission of monetary policy through a floating-rate channel. After a rate hike, firms with floating-rate loans keep prices elevated to offset higher borrowing costs, thereby reducing the effectiveness of monetary policy. 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 impact of monetary tightening on inflation is 50% smaller when firms rely on floating-rate loans. This effect is stronger for firms that rely more on working capital to finance production and when they can easily pass on higher prices to their sticky customer base (customer capital). Since firms with floating-rate loans face an increase in their financial burden, their loan terms are more frequently renegotiated, often resulting in reduced spreads and a shift from floating to fixed rates. Overall, if firms across the euro area had a lower reliance on floating-rate loans, inflation would have been 0.8 percentage points lower in 2022-2023.



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

**JEL:** E31, E52, G21

# Non-technical Summary

A tightening of monetary policy rates is widely acknowledged as a key tool against inflation. Conventional macroeconomic models suggest that inflation will slow in response to an increase in policy rates due to a reduction in aggregate demand caused by higher borrowing costs (Bernanke and Gertler, 1989; Kashyap et al., 1993).

However, the idea that monetary policy can also affect inflation via the (firm) supply side is generally overlooked (Drechsler et al., 2023). All else equal, an increase in borrowing costs will lead to a reduction in a firm's cash flows, especially when firms need to pre-fund production using working capital. Firms may react to the increase in funding costs by increasing prices, . Such a reaction could weaken the impact of traditional demand-side channels of monetary policy.

In this paper, we provide novel micro-level evidence on the supply-side transmission of monetary policy. To do so, we combine product-level prices and industry-level inflation data with loan-level credit register information for euro-area corporations. Notably, we exploit the fact that having a floating-rate loan implies a direct and immediate impact of a policy tightening on firms' funding costs. In contrast, the pass-through of monetary policy rates on borrowing costs is limited in the presence of debt contracts that are rigid or fixed in nominal terms, such as fixed-rate loans.

Our main finding is that firms with floating-rate loans keep prices elevated after a rate hike in order to offset the negative impact of higher borrowing costs. Our industry-level data reveal that the short-term reduction in inflation during the 2022-2023 monetary-policy tightening in the euro area is 50% smaller in industry-country pairs ("markets") dominated by floating-rate loans.

This finding is confirmed in the more granular product-level prices dataset. A 1 percentage point increase in the ECB policy rate reduces product-price growth by 0.51 percentage points for products sold by firms fully reliant on fixed-rate loans ("fixed-rate firms" henceforth). In contrast, the same increase in the policy rate reduces product-price growth only by 0.23 percentage points for products sold by firms fully reliant on floating-rate loans ("floating-rate firms" henceforth).

We also investigate how the impact of monetary policy on inflation via floating-rate loans varies by characteristics of the market. We propose two main channels. The first is about working capital: if firms rely on credit to finance production and have to pay for input of production (e.g., materials and labor) upfront, their production is affected by changes in the monetary policy rates. Accordingly, we find a stronger impact of floating-rate loans on inflation in markets characterized by firms with high working capital, defined as the ratio of the stock of inventories plus trade receivables over assets. The second channel we propose has to do with customer capital (Chevalier and Scharfstein, 1996). Customer capital is an asset that gives firms market power over a sticky customer base. When these firms are constrained, they choose to charge high markups and deplete their customer capital, sacrificing future market shares and long-term profitability in order to boost current cash-flow (Gilchrist et al., 2017). Accordingly, we find that the impact of floating-rate loans on inflation is present only in more concentrated markets (i.e., higher HHI based on sales' shares) where firms presumably have higher customer capital.

The role of loan interest rate resets is currently missing in discussions on monetary policy, yet our findings suggest it is a crucial consideration for central bankers aiming to control inflation. Our findings imply that the presence of floating-rate corporate loans can weaken the transmission of monetary policy. If firms with floating-rate loans keep prices elevated in response to an interest rate hike, this supply-side reaction counteracts the demand-side effect of monetary policy.

# 1 Introduction

A tightening of monetary policy rates is widely acknowledged as a key tool against inflation. Conventional macroeconomic models suggest that inflation will slow in response to an increase in policy rates due to a reduction in aggregate demand caused by higher borrowing costs (Bernanke and Gertler, 1989; Kashyap et al., 1993). For example, households with mortgages significantly adjust consumption in response to interest rate changes (Di Maggio et al., 2017; Cloyne et al., 2020). In addition, increasing interest rates can also influence the availability of credit, especially when borrowing restrictions limit household debt-to-income (DTI) ratio (Greenwald, 2018; Bosshardt et al., 2024). All these channels lead to a reduction in (household) aggregate demand when interest rates rise.

However, the idea that monetary policy can also affect inflation via the (firm) supply side is generally overlooked (Drechsler et al., 2023).[1] How does this transmission work? All else equal, an increase in borrowing costs will lead to a reduction in a firm's cash flows. Firms may react to the increase in funding costs by increasing prices, sacrificing future market shares in order to boost current cash flows (Gilchrist et al., 2017). Such a reaction could weaken the impact of traditional demand-side channels of monetary policy and makes an increase in interest rates similar to a financially-induced cost shock. This view is not new, and was part of the policy debate during the inflation spikes in 1970-80s: U.S. Congressman Patman argued in 1970 that raising rates to fight inflation was like "throwing gasoline on fire" and in the 1980s British businessmen "regard interest rate as a cost and look to establish a price *rise* in response to increased interest rates".[2]

In this paper, we provide novel micro-level evidence on the supply-side transmission of monetary policy. To do so, we combine product-level prices and industry-level inflation data with loan-level credit register information for euro-area corporations. Notably, we

[1] A notable exception in this respect is Barth and Ramey (2002), who propose a "cost channel" of monetary policy. According to this channel, since marginal costs depend on the real interest rate (Beaudry et al., 2024), a rate hike raises the cost of working capital, reducing production and driving up prices.

[2] See Gaiotti and Secchi (2006) and Goodhart (1986).

exploit the fact that having a floating-rate loan implies a direct and immediate impact of a policy tightening on firms' funding costs and cash flows (Gürkaynak et al., 2022). In contrast, the pass-through of monetary policy rates on borrowing costs is limited in the presence of debt contracts that are rigid or fixed in nominal terms, such as fixed-rate loans.

Our main finding is that firms with floating-rate loans keep prices elevated after a rate hike in order to offset the negative impact of higher borrowing costs. Our industry-level data reveal that the short-term reduction in inflation during the 2022-2023 monetary-policy tightening in the euro area is 50% smaller in industry-country pairs ("markets") dominated by floating-rate loans.[3] The inflationary consequences of this mechanism are substantial. If firms across the euro area had borrowed at the same share of floating rate loans as firms in Germany, France, and Belgium (the countries with the lowest reliance on floating rate loans), inflation would have been, on average, 0.8pp lower after the ECB started hiking interest rates in 2022. This finding is also confirmed in the more granular product-level prices dataset. A one percentage point increase in the ECB policy rate reduces product-price growth by 0.51 percentage points for products sold by firms fully reliant on fixed-rate loans ("fixed-rate firms" henceforth). In contrast, the same increase in the policy rate reduces product-price growth only by 0.23 percentage points for products sold by firms fully reliant on floating-rate loans ("floating-rate firms" henceforth).

These findings imply that the presence of floating-rate corporate loans can weaken the transmission of monetary policy. If firms with floating-rate loans keep prices elevated in response to an interest rate hike, this supply-side reaction counteracts the demand-side effect of monetary policy. This contrasts with findings from the mortgage literature (Di Maggio et al., 2017; Flodén et al., 2020), where floating-rate loans enhance monetary policy transmission. In that case the adjustment occurs on the demand side, as households reduce consumption in response to higher borrowing costs. Finally, unlike bank lending channels (e.g., Kashyap and Stein, 2000; Jiménez et al., 2012), our proposed "floating-rate

[3] We define such markets as those in which the share of floating-rate loans is 90%, thus representing the top quintile, compared to markets where fixed-rate loans are more common (30% share, in the bottom quintile).

channel" works via existing loans and not via changes in the credit supply of new loans.

Studying the different margins of monetary policy transmission between floating- and fixed-rate loans is typically difficult due to data limitations, particularly when focusing on US firms. In fact, bank debt of US firms is primarily floating-rate (Vickery, 2008; Ippolito et al., 2018). To address this issue, we leverage on comprehensive data from AnaCredit, a credit register that contains detailed information on individual bank loans in the euro area. We merge AnaCredit with both market-level inflation rates and product-level price data. For our market-level analysis, we aggregate loan-level data to the 2-digit (NACE) industry-country level ("market" level) and match it with data on monthly growth in the CPI across these markets, following Acharya et al. (2024). The final dataset we construct contains 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. Our product-level analysis relies on product-level IRi scanner data for supermarkets in France, Germany and Italy. The final sample consists of 274,335 products, belonging to 3,845 different product types and produced by 10,498 firms.

Our empirical strategy relies on a Difference-in-differences (DiD) methodology, where we regress price changes on the interaction between changes in the ECB policy rate (i.e., the Deposit Facility Rate, DFR) and the ex-ante exposure to floating-rate loans at the firm- or market-level.[4] Our main identification assumption is that of parallel trends. For our market-level analysis, this implies that the inflation rate in fixed-rate markets provides a good counterfactual for the inflation rate of floating-rate markets in the absence of changes in the policy rate. Similarly, for our product-level analysis we need the price evolution of fixed-rate firms to be similar to that of floating-rate firms before the rate hike. A dynamic DiD setup indeed confirms that this is the case during the pre-period, both at the market and at the product level.

A potential concern in our analysis pertains the self-selection of firms into floating or

[4]In robustness, we also employ identified monetary policy surprises using high-frequency changes in 1-month Overnight-Index Swap (OIS) around ECB decisions and press conferences (Altavilla et al., 2019).

fixed-rate credit. As we measure the exposure to floating-rate loans as of the first half of 2021, the identification assumption is that as of early 2021, firms were not anticipating significant rises in interest rates, and thus could not select into floating or fixed rate loans because of these expectations. At that time, the prolonged period of negative interest rates and the low aggregate demand following Covid-19 had kept inflation concerns low in the euro area. Analysts' forecasts from the ECB Survey of Monetary Analysts (SMA) show that market participants were not expecting increase in the DFR until March 2022 and even then, underestimated the speed of the rate hikes (Figure A1 in the Online Appendix). It is then unlikely that corporations expected the rate hikes to happen. In this regard, we also find that floating-rate firms are more likely to switch to fixed-rate loans after rate hikes, suggesting that they could not adjust before the rate hike hit.

Another empirical challenge we face is the possibility that monetary policy differentially affects other market-level factors that also drive inflation. For example, if the policy rate affects demand in floating vs. fixed rate markets differently, this could lead to biased estimates. The granularity of the data allow us to address this concern. In the market-level analysis, we enrich the DiD specification with country-month and industry-month fixed effects, absorbing any industry- and country time-varying demand shocks. At the firm-product-level, we employ an even tighter specification, where we compare products sold within the same product category in a country by different firms. For example, we compare the price of low-fat yogurt produced by a floating-rate firm to that of low-fat yogurt produced by a fixed rate firm in the same month. Doing so effectively absorbs product-specific demand in a country.

Next, we investigate how the impact of monetary policy on inflation via floating-rate loans varies by characteristics of the market. We propose two main channels. The first is about working capital: if firms rely on credit to finance production and have to pay for input of production (e.g., materials and labor) upfront, their production is affected by changes in the monetary policy rates.[5] Accordingly, we find a stronger impact of floating-rate loans on inflation in markets characterized by firms with high working capital, defined as the ratio of the stock of inventories plus trade receivables over assets. The second channel we propose has to do with customer capital (Chevalier and Scharfstein, 1996). Customer capital is an asset that gives firms market power over a sticky customer base. When these firms are constrained, they choose to charge high markups and deplete their customer capital, sacrificing future market shares and long-term profitability in order to boost current cash-flow (Gilchrist et al., 2017). Accordingly, we find that the impact of floating-rate loans on inflation is present only in more concentrated markets (i.e., higher HHI based on sales' shares) where firms presumably have higher customer capital. Intuitively, a floating-rate firm in a competitive market cannot afford to increase prices, as it has no customer base, and it is unable to generate short-term cash flow.[6]

The mechanism of our floating-rate channel of monetary policy works through an increase in firms' cost of funding. The loan-level data from AnaCredit enable us to show that interest rates at the firm-bank level increase markedly following the increase in monetary policy rates when firms have floating-rate loans. Specifically, we find that for a 100 basis points (bps) increase in the monetary policy rate, loan interest rates increase by 70 bps for floating-rate firms and by 9 bps only for fixed-rate firms.[7] A dynamic specification shows that interest rates were identical across the two groups of loans before the rate hike and widen only after the rate hike in August 2022. At the end of the hiking cycle, as the policy rate reached 4%, the difference between floating and fixed-rate loans reached 2%, in line with an aggregate pass-through elasticity of about 0.5. This confirms the presence of an immediate and large increase in funding costs for firms with floating rate loans after rate hikes, even when we control for supply-side factors through bank-time fixed effects.

[5]Christiano et al. (1997) explicitly model this by including the real interest rate as an additional cost in firms' labor demand.

[6]This makes the result different from the case of standard cost shocks, whereby firms with more market power have a lower cost pass-through (Amiti et al., 2019; Wang and Werning, 2022).

[7]The small effect for fixed-rate loans suggests that the adjustment to monetary policy rates is gradual, occurring only when firms secure new fixed-rate loans as the existing ones mature.

Because floating-rate firms face higher interest payments, they are also more likely to renegotiate loan terms after the rate hike.[8] Specifically, we find that a firm fully reliant on floating-rate loans in a particular bank relationship is 50% more likely to renegotiate its loan terms one year after the first rate hike compared to a firm with fixed-rate loans. Additionally, we analyze which loan terms are adjusted in the renegotiation after the rate hike. We observe that firms with floating-rate loans tend to secure lower spreads on these loans and are more likely to convert to fixed-rate terms, with no significant changes in loan maturity or volume. Finally, while floating-rate firms experience a significant rise in mark-ups, their profitability remains unchanged, as higher interest payments absorb the additional cash flow from increased sales revenue. These findings support the hypothesis that floating-rate firms face a notably higher financial burden due to increased interest payments, prompting adjustments in their financing strategies.

We contribute to several strands of the literature. In macroeconomics, there is a "price puzzle" of monetary policy, namely the fact that prices increase rather than decrease after a monetary tightening (Sims, 1992), at least in the short-run. To explain the puzzle, Barth and Ramey (2002) proposed the existence of a cost channel of monetary policy. When firms need to borrow to finance their working capital, an increase in borrowing costs impacts their marginal costs and hence may lead firms with pricing power to increase prices. Existing evidence in favor of this channel is mostly based on aggregate VAR (Christiano et al., 1997; Ravenna and Walsh, 2006). We provide the first evidence on the cost channel using micro-data in a well-identified setting.[9]

The examination of how firms' own expectations and pricing strategies react to monetary policy tightening in the presence of financial constraints is an important component of overall inflation dynamics (Gilchrist et al., 2017; Coibion et al., 2020). Recent studies have explored the inflationary effects of credit crunches, yielding mixed results. On the one

[8]The data do not indicate whether the borrower or the bank initiates renegotiation, but they do show which loans are renegotiated and what terms change.

[9]Earlier evidence on the cost channel using an Italian firm-level survey is found in Gaiotti and Secchi (2006).

hand, Kim (2020) and Lenzu et al. (2023) find that firms in the US and Belgium, respectively, lower prices in response to a credit contraction. These firms use price reductions as a means of internal financing, liquidating inventory to increase cash reserves while avoiding cuts in other expenditures. On the other hand, Drechsler et al. (2023) show that monetary policy tightening under Regulation Q triggered credit crunches that prompted firms to raise prices, particularly those reliant on external finance to cover production costs when financial constraints became binding.[10] Our findings align with those of Drechsler et al. (2023), though our focus differs: instead of examining a negative supply shock, we show that when corporate loan rates are floating, firms may raise prices to preserve cash flows during a tightening cycle. Consistent with Drechsler et al. (2023), we also find that firms with higher leverage, and hence more dependent on external finance, are more likely to increase prices in response to monetary tightening.

Extensive research has analyzed the choice between fixed or floating-rate household mortgages and how this impacts the transmission of monetary policy (Campbell and Cocco, 2003; Di Maggio et al., 2017; Garriga et al., 2017; Cloyne et al., 2020; Flodén et al., 2020). In the case of household mortgages, floating-rate credit enhances monetary policy transmission as the adjustment occurs on the demand side. Relatively less attention has been devoted to understanding how interest rate setting in corporate loans can affect the pass-through of monetary policy. Studies focusing on the impact of corporate floating-rate loans (Ippolito et al., 2018), especially those maturing (Gürkaynak et al., 2022), analyze the stock price and investment reaction to monetary policy changes, not firms' price setting and inflation. This is surprising as firms' pricing decisions are first-order to understand overall inflation and in light of the large literature studying the effects of monetary policy on corporate investment (Gertler and Gilchrist, 1994; Ottonello and Winberry, 2020).

The mechanism of our floating-rate channel is distinct from the mechanisms at work in

[10] Renkin and Zullig (2024) find that credit supply shocks lead to higher prices for Danish firms, but the effect depends on the elasticity of market demand in different sectors, potentially reconciling the two sets of results. Firms in high-elasticity sectors decrease prices following a negative credit shock.

the bank lending channel and firm balance sheet channel. According to the bank lending channel, monetary policy affects banks' cost of funds, either because of market power (Drechsler et al., 2017; Wang et al., 2022) or capital requirements (Van den Heuvel, 2002) leading to a lower bank loan supply. The firm balance sheet channel posits that tighter monetary policy erodes firms' cash flows and collateral values, leading to a drop in net worth and, due to information asymmetries in credit markets, reduced access to credit, leading to lower investments (Bernanke and Gertler, 1989; Boivin et al., 2010). The floating-rate channel does not require any credit market friction, as funding costs are directly linked to the risk-free policy rate when firms borrow with floating-rate loans.

# 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 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.[11] AnaCredit also contains information on other loan-level

[11] A 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.

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

Finally, the product-level store scanner price data comes from Information Resources, Inc. (IRi). The raw data is collected weekly at the store level for each product. We obtain data 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

[12]The 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 A2 in the Online Appendix for an example).

information about the product category (e.g., ’vino doc Italiano’) , type (e.g., ’vino doc italiano rosso’) and subtype (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 totals sales over units sold (DellaVigna 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). 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.[13] The average (median) product type consists of 71 (25) different products, while the average (median) firm produces 26 (7) different products. Summary statistics are presented in Panel D of Table 1.

## 2.1 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. However, as we describe below, these loans account for about 60% of the total loan volume, as their average amounts tend to be larger than those of fixed-rate loans (see Table A1 in the Online Appendix for a breakdown between floating-rate and fixed-rate loans). 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%.

[13] For comparison, before matching with BvD Orbis and AnaCredit, the data consisted of 812,379 products, spread across 2,909 product types.

Additionally, about three quarters of the loans are term loans and are collateralized.[14] 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 A3 and A4 in the Online Appendix).

As shown in Panel A of Figure 2 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 corporations rely more on floating-rate loans (60% of total loan volumes). This country ranking is similar to what has been shown in the context of household mortgages (e.g., Badarinza et al., 2016). This has a significant impact on the transmission of monetary policy across euro-area countries, which have not been explored for corporate loans. Panel B of Figure 2 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 A3 in the Online Appendix for a list of all industries in our sample.

For the first 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 codes[15]), 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.[16] Summary statistics for this sample can be found in Panel B of Table 1. Average

[14]As 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%).

[15]In 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

[16]The 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

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 deposit facility rate, the main ECB monetary policy tool, has been increased from 0 to 4% over the sample period.

In the second part of our analysis, we aggregate the loan-level data at the bank-firm level. The sample consists of more than 110 million bank-firm-month observations and covers 3,570 banks and 3.9 million firms from 19 euro-area countries. Summary statistics can be found in Panel C of Table 1. Given that many of the firms are small, the average bank-firm exposure is approximately €660,000, with a median of €110,000. Over the sample period, average interest rates across various loan types hover around 2.19%. Notably, the share of floating-rate loans at the bank-firm level is 25%, significantly lower than at the market level, indicating that floating-rate loans are more common among larger firms, which constitute a greater portion of loan volumes. Lastly, loans typically have maturities ranging from 7 to 9 years.

# 3 Empirical strategy and results

Our empirical strategy relies on DiD models at different levels of aggregation, i.e., firm-bank, firm or market-level. Identification is obtained by comparing changes in inflation before and after changes in the Deposit Facility Rate (DFR), across firm-bank relationships, 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 in 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

the euro in January 2023.

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 A2 in the Online Appendix.[17] A borrowing firm's industry (63 industries) explains less than 2% of variation in the share of floating rate, 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. The evidence points to country-specific cultural factors and path-dependence playing a key role in explaining rate setting.[18] 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 determinant of floating-rate loans.

## 3.1 First-stage: Loan interest rates

In this section, we investigate the effect of having floating-rate loans on loan interest rates at the bank-firm level. This is akin to a first-stage. We estimate the following equation:

$$LoanRate_{fbt} = \beta ShareFloat_{fb} \times \Delta DFR_t + \alpha X_{ft-1} + \delta_{fb} + \delta_{ict} + \gamma_{bt} + \epsilon_{fbt}, \quad (1)$$

[17] We 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.

[18] The 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; Cenzon 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).

where the dependent variable $LoanRate_{fbt}$ is the contractual interest rate between firm $f$ and bank $b$, in month $t$. This is a weighted average of individual loan rates in the relationship, where the weights are equal to the share of each loan in the bank-firm relationship. Panel C of Table 1 shows that average interest rates were around 2.2% over the sample period (i.e., from July 2021 to July 2023).

$ShareFloat_{fb}$ is the ratio of floating-rate loans in the relationship between firm $f$ and bank $b$ to total loans of 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. In fact, 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. Analysts' forecasts from the ECB Survey of Monetary Analysts (SMA) appear to confirm the validity of this hypothesis: market participants were not expecting increases in interest rates until March 2022 and even then, underestimated the speed of the rate hikes (Figure A1 in the Online Appendix). It is then unlikely that corporations expected the rate hikes to happen in 2021. We further confirm this when we test for parallel pre-trends in the dynamic specification below. Panel C of Table 1 shows that about 25% of firm-bank credit is floating.

$\Delta DFR_t$ is the contemporaneous year-on-year change in DFR (i.e., the Deposit Facility Rate, the euro-area policy rate) 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 (Friedman, 1961). We also add lagged firm-level controls ($X_{ft-1}$), such as the log of the firm's total assets. Importantly, we include firm-bank ($\delta_{fb}$) fixed effect, which absorb all time-invariant expect of the firm-bank relationship, including bank specialization (Paravisini et al., 2023). We also have market-month ($\delta_{ict}$) fixed effect, which absorb all time-varying country-industry shocks, and bank-month ($\gamma_{bt}$) fixed effects, which absorb any supply-side shock from the bank side. In our baseline specification, we choose to cluster standard errors at the market level, but the results are robust to clustering at the firm or bank-firm level.

Table 2 shows the estimates for Eqn. (1). Our estimates of $\widehat{\beta}$ indicate a pass-through of about 0.6 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 (0.0937+0.609). Conversely, fixed-rate firms firms see an increase in loan rates of only 9 bps.[19] Importantly, progressively saturating the regression with month, market-month and bank-month fixed effects in columns (2)-(4) does not affect the estimated coefficient $\widehat{\beta}$.

These findings confirm the presence of an immediate and large increase in funding costs for firms with floating rate loans after rate hikes, even when we control for supply-side factors through bank-time fixed effect. Monetary policy increases the cost of funding significantly more 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. We provide a formal test of this assumption by estimating a dynamic version of Eqn (1), where we replace $\Delta DFR_t$ with monthly time dummies $D_t$. The coefficients on the interaction terms with $ShareFloat_{ic}$ thus estimate the 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.

Crucially, Figure 3 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. Importantly, there was no difference in interest rates between floating and fixed-rate firms before July 2022, when the DFR was flat and negative, which is reassuring regarding the parallel trend assumption. The negative estimated coefficients imply that floating-rate firms had a small, albeit insignificant, rate discount compared to fixed-rate firms. This may

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

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.

## 3.2 Floating-rate Channel of Monetary Policy: Product-level prices

After presenting the evidence of the pass-through of monetary policy on loan rates, we next show how product prices set by individual firms for products sold in supermarkets in Germany, Italy, and France are affected by monetary policy. To this end, we employ data provided by Information Resources, Inc. (IRi), which collects weekly product-level data at the store level. A product is identified through a barcode and thus uniquely attributed to the producing firm. For each firm, we aggregate data at the product-country-month level. We then use the product prices defined as the ratio of sales value to units sold (DellaVigna and Gentzkow, 2019) to calculate year-on-year growth rates in monthly prices for each product. We rely on the brand and vendor name to link these data with BvD Orbis data, and subsequently with Anacredit to obtain the share of floating rate loans for a given firm. The final sample consists of 274,335 products, belonging to 3,845 different product categories that are produced by 10,498 firms. The average (median) product type consists of 71 (25) different products, while the average (median) firm produces 26 (7) different products.

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

$$\Delta P_{fpct} = \beta ShareFloat_f \times \Delta DFR_t + \delta_{fp} + \gamma_{ckt} + \epsilon_{fpct}, \tag{2}$$

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 $\Delta P_{fpct}$ is the year-on-year growth rate in firm-product prices. In the most conservative specification we control for firm-product fixed effects as well as for country-product category-month fixed effects. The latter help alleviating concerns that our results might be driven by differential demand responses of Italian, German or French consumers for the same product category (e.g., Chianti wine) 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 do not employ any fixed effect, we find that a 100bps increase in the policy rate implies a 51bps reduction in price growth for products of firms fully reliant on fixed rate loans. Yet, the reduction in price growth is only of 23bps for products of firms borrowing exclusively through floating rate loans. As a result, for these firms the effect of the monetary policy tightening on product prices is 66% smaller. Importantly, the coefficient on $ShareFloat_f$ is not significant, indicating that floating-rate firms do not experience a different evolution of product prices in the period before the rate hikes.

As we progressively include additional fixed effects at the firm-product level (column 2), month (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 4 again provides a formal test of the parallel trends assumption by estimating a dynamic version of Eqn (2), where we replace $\Delta DFR_t$ with monthly time dummies $D_t$. As before, the coefficients on the interaction terms with $ShareFloat_{ic}$ thus estimate the 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. 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.

## 3.3 Floating-rate Channel of Monetary Policy: Aggregate CPI

We now show that the well-identified product-level results aggregate up at the CPI inflation level. In our baseline specification, we estimate the following regression equation:

$$\Delta CPI_{ict} \quad = \quad \beta ShareFloat_{ic} \times \Delta DFR_t + \alpha' X_{ict} + \delta_{ic} + \eta_{it} + \gamma_{ct} + \epsilon_{ict}, \tag{3}$$

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 $\Delta CPI_{ict}$ 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 over total in market $ic$ during the first six months of 2021. $\Delta DFR_t$ is the contemporaneous year-on-year change in DFR. Additionally, 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.[20] We include market-level controls ($X_{ict}$) like energy costs and other aggregate macro controls such as GDP growth and the euro-area inflation rate (HICP). Crucially, in more saturated specifications we include market ($\delta_{ic}$), industry-month ($\eta_{it}$), and country-month ($\gamma_{ct}$) 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. Given our narrow event window, one year before and one year after the rate hikes, market characteristics such as the overall economic, financial dependence and market structure can be considered time-invariant.

Our main results are presented in Table 4. 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

[20] In robustness tests, we run impulse response function as in Jordà (2005) using high-frequency identified monetary policy surprises from Altavilla et al. (2019). The results are unchanged.

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.

Figure 5 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 4 percentage points. These findings support the validity of our identification strategy and underscore the importance of the floating-rate channel in monetary policy transmission.

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 6 presents the impulse response functions (IRFs) for a 100 bps policy rate increase on inflation over a 12-month horizon.[21] 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 4 and simulate IRFs for two hypothetical markets, one with

[21] In Figure A5 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.

a bottom (30%) and one with a top quintle (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 is at least 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).

To further assess the economic magnitude of the effect of floating rate loans on inflation, we do the following counterfactual exercise: what would the inflation in the euro area have been if each industry borrowed at the same share of floating rate 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 7. 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 suggests that inflation would have converged to the 2% target faster if the share of floating rate corporate loans had been lower.

### 3.4 The floating-rate channel of monetary policy: Heterogeneity

Next we study how the floating-rate channel of monetary policy varies by characteristics of the market.

First of all, we expect the channel to be stronger in markets where firms use more working capital. In fact, when firms rely on credit to finance production and have pay for input of production (e.g., materials and labor) upfront, before realizing sales revenue, their production is directly linked to funding costs. A working capital or cost-channel is included in some macroeconomic models (Christiano et al., 1997; Barth and Ramey, 2002), where the real interest rate features as an additional cost in firms' labor demand, alongside with the real wage. Second, the pass-through of interest rates on prices should be higher when firms have higher customer capital (Chevalier and Scharfstein, 1996). Customer capital is an asset that gives firms market power over a sticky customer base. Firms need to invest in this asset to maintain it and, when they are constrained, they may save and not invest in it by raising prices. This will deplete their customer capital, sacrificing future market shares and long-term profitability in order to boost current cash-flow, as in Gilchrist et al. (2017). Intuitively, a floating-rate firm in a competitive market cannot raise prices without losing customers, because it lacks an established customer base.[22]

Table 5 shows the results of these heterogeneity tests using sample median splits for Eqn (3). First, we investigate the working capital channel. Working capital is defined using firm-level Orbis data as the ratio of total inventories (i.e., raw materials, finished and in-progress goods) plus trade receivables over total assets. We then take a weighted average at the market-level, where the weights are the share of firms' total assets in the market. We find that the floating-rate channel is stronger in markets with an above the median reliance on working capital (column 2), where the coefficient is 60% larger than in the baseline (column 4 of Table 4). Notably, the coefficient for markets with above the median reliance on working capital is almost three times higher than for those with below the median, and the difference is statistically significant at 10% level (t-stat for the difference in coefficients equal to 1.63). Second, we test whether customer capital matters. Our proxy for customer capital is market concentration (i.e., Herfindahl-Hirschman Index, or HHI) based on sales'

[22] This 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).

shares. The effect in markets with an above the median HHI is about 60% larger than the baseline estimate (column 4 of Table 4), indicating that high-concentration markets drive the results in the full sample. Limiting the analysis to markets with below-median HHI, we find that the interaction term's coefficient is negative and insignificant, indicating a strong difference in the coefficients in the two subsamples (t-stat for the difference in coefficients equal to 3.03)

We test for parallel trends in our heterogeneity analyses by running a dynamic DiD specification for each sample median split. Figures A6 and A7 in the Online Appendix show effects for low and high- working capital and concentration markets, respectively. Not only do we confirm the insights from Table 5, namely that a rate tightening is less effective in floating-rate markets only when these have high working capital concentration, but we also do not find any difference in CPI growth rates before the initial rate hike, confirming the parallel trend assumption.

Overall, this evidence points towards the importance of the floating rate channel of monetary policy as a cost channel. In fact, it materializes only in markets where firms are able to pass through the increase in their funding costs to their customers, and where these costs are more relevant and more likely to push firms towards financial distress. This evidence also help us rule out demand-based confounding factors which would not be dependent on firms' characteristics in the market.

### 3.5 Robustness: Upstream Input Prices

A potential challenge we face in our empirical methodology is that firms with floating-rate firms could experience systematically different shocks compared to fixed-rate firms. While including industry-month and country-month fixed effects helps alleviate this concern, there is still a possibility that floating-rate firms experience distinct time-varying market shocks. For example, if these firms have rising input costs during a rate tightening, they may raise prices due to increased non-financial costs. Our proposed floating-rate channel centers on an increase in firms' financial costs, not operating input costs — though both could theoretically play a role. To test this, we re-estimate Eqn. (3) using the growth in the upstream input producer price index (PPI) as the dependent variable. This variable is measured at the market level, weighting the PPI of a market's upstream suppliers, where the weights are constructed using the share of inputs provided by a given upstream market.

Table A4 in the Online Appendix presents our results. In column (1), we find that the rate tightening reduces inflation in upstream PPI too, and not just CPI-inflation. When we add the interaction with the share of floating-rate loans in column (2), we find that floating rate markets do not experience different PPI growth in their upstream markets compared to fixed-rate markets. If anything the interaction term is slightly negative, suggesting that floating-rate firms may even face lower input prices, indicating some upstream market power. This pattern holds when we saturate the regression with country-time and industry-time fixed effects, together with energy costs.

In summary, our results indicate that floating-rate firms increase consumer prices due to higher financial expenses from rate hikes, rather than input cost shocks or other market-level fluctuations.

# 4 Firm-level Outcomes and Loan Renegotiation

## 4.1 Firm-level outcomes

In this section, we study outcomes at the firm-level. Specifically, we want to understand whether firms with a higher share of floating-rate loans face an increase in their overall funding costs, as they might use other sources of funding (e.g., bonds or trade credit) to offset the increase in the cost of bank loans. We also want to test whether firms raise mark-ups, i.e. raise prices above their funding cost, potentially improving their profitability.

To this end, we use data from Orbis for euro-area firms from 2020 to 2023.[23] Because

[23] At the time of writing, Orbis data for 2023 is available only for a small sub-sample of firms.

of the lack of firm-level output prices, we use EBIT over sales as a proxy of firm-level mark-ups (De Loecker et al., 2020). Furthermore, we consider return on asset (ROA) as a measure of profitability, and the average interest paid (calculate as the interest expenses over total financial debt) as a proxy for funding cost. 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 6 reports the estimates of this specification. Column (1) shows that, conditionally on firm fixed effects and time-varying firm-level controls (e.g., the log of total assets), firms have lower mark-ups following an increase in the monetary policy rate. This is consistent with the overall decrease in CPI following a rate tightening. However, when we add the interaction with the share of floating-rate loans in column (2), we find that this effect is almost entirely offset for firms fully exposed to floating-rate loans.

Importantly, columns (3) and (4) of Table 6 show that, following the rate hikes, firms become less profitable on average, but this effect does not differ for firms with more floating-rate loans - i.e., these latter firms do not become more profitable or decrease profitability less. In fact, columns 5 and 6 report that, while all firms experience on average an increase in the interest paid, firms fully reliant on floating-rate loans experience an increase in interest paid that is around 50% higher.

Finally, the results in columns (5) and (6) indicate that floating-rate firms indeed have higher overall interest paid on their debt funding. This suggests that higher bank funding costs translate into overall higher cost for these firms. 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 - i.e. monetary policy decreases inflation. 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

## 4.2 Loan renegotiation

Finally, we study whether firms with floating-rate loans are more likely to renegotiate specific terms of their existing loans. While the data do not identify whether the firm or the bank initiated the renegotiation, they do show whether loans are renegotiated and which terms are changed. 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 Eqn. (1) where the dependent variable is a dummy equal to one if the loan in relationship $fb$ is renegotiated at a quarterly frequency. We show that a higher share floating-rate loans is associated with a higher likelihood of a renegotiation in the bank-firm relationships. Column (1) of Table 7 shows that the probability of renegotiating after a 100 bps increase in DFR goes up by 20 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 20% for a firm fully reliant on floating-rate loans. Columns (2)-(6) further show that these estimates do not qualitatively change when saturating the specification with quarter, market-quarter, and firm- and bank-quarter fixed effects.

Importantly, as it was the case for interest rates, Figure 8 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:

$$y_{lbcit} = \beta Post_{\mathrm{t}} + \delta_{cbi} + \epsilon_{lt}, \tag{4}$$

where $l$ indicates a loan, $b$ a bank, $c$ a country, $i$ an industry and $t$ a quarter. The dependent variable $y_{lbcit}$ is a dummy 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* 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.

Table 8 reports the results for Eqn. (4). 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.

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# 5 Conclusion

In this paper, we provide novel evidence on a new channel through which monetary policy impacts inflation. 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 25-50% lower.

The role of loan interest rate resets is currently missing in discussions on monetary policy, yet our findings suggest it is a crucial consideration for central bankers aiming to control inflation. This is especially relevant in countries and sectors where floating-rate loans dominate. One effective approach could be to foster greater competition in product markets. In competitive markets, we find no difference in the pricing response of floating-rate firms. These firms cannot increase prices without risking a complete loss in their market shares, meaning they bear the financial impact of rate hikes. Conversely, when floating-rate firms have market power, they are able to pass higher costs onto consumers, preserving cash flow despite some loss to fixed-rate competitors. This difference highlights how competition policy could support the inflationary goals of monetary tightening.

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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

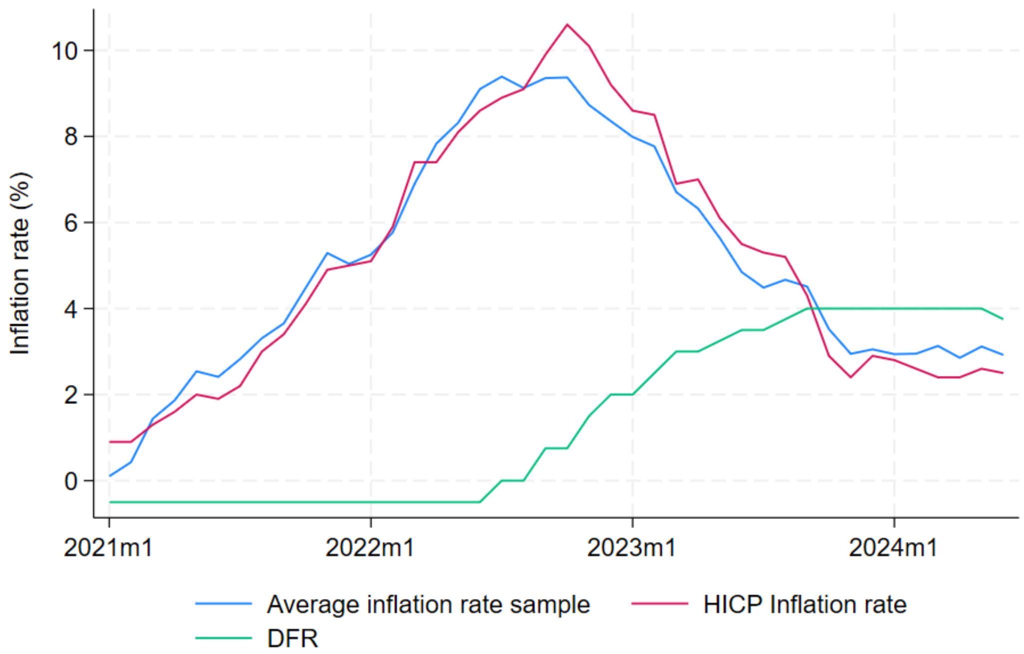
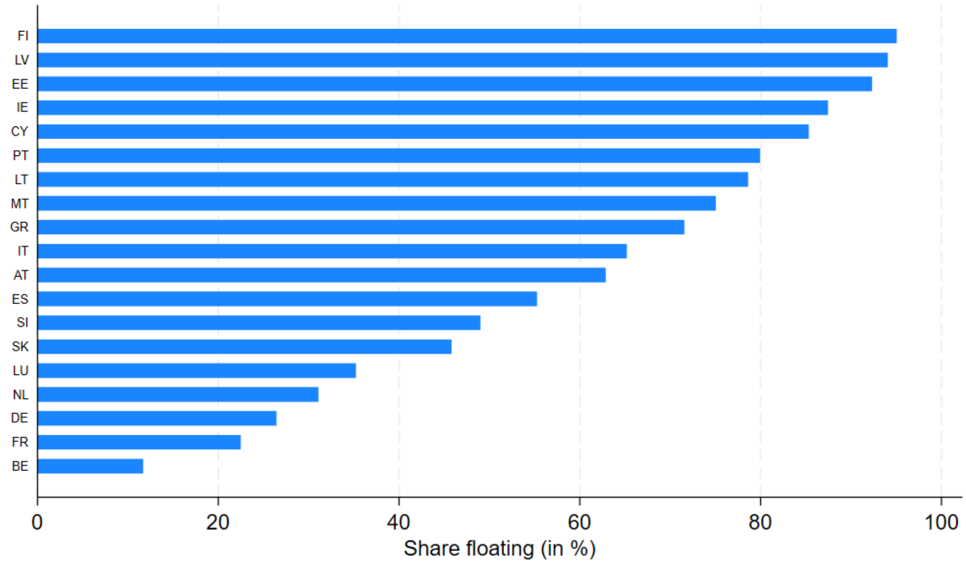


Figure 2: Fixed and floating-rate loans: Country and Sector heterogeneity in 2021

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

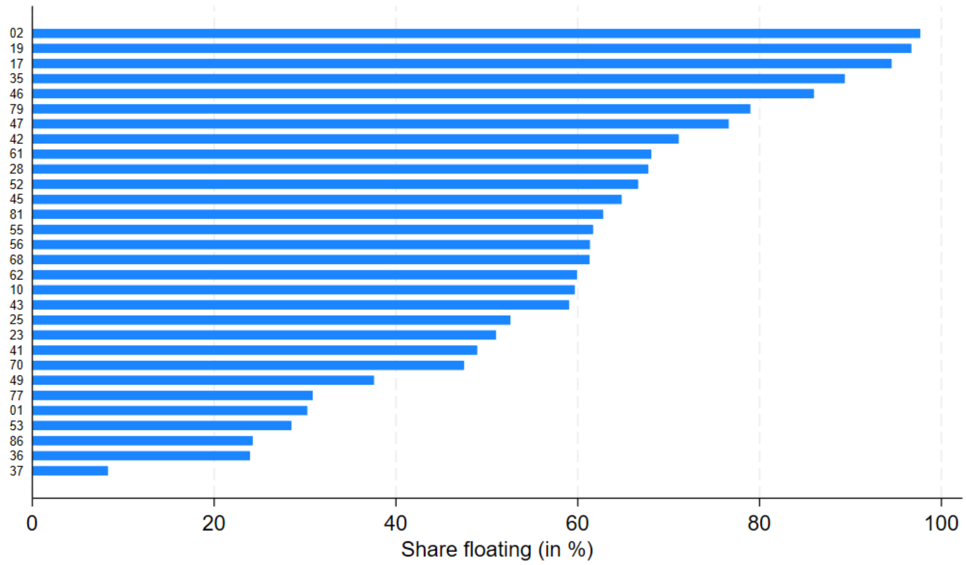


Figure 3: Dynamic DiD - Interest Rates

The sample consists of monthly observations at the firm-bank level from July 2021 until July 2023. The figure shows the monthly $\beta$ coefficients and 90% confidence intervals for the following regression specification:

$$y_{fbt} = \sum_{t=July2021}^{t=July2023} \beta_t \times ShareFloat_{\mathrm{fb}} \times \mathrm{D_t} + \delta_{ict} + \gamma_{bt} + \epsilon_{fbt},$$

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 $y_{fbt}$ is the monthly average interest rate on credit by bank $b$ to firm $f$ in month $t$ (in %). $D_t$ is a dummy equal to 1 in month $t$, 0 otherwise. $ShareFloat_{fb}$ is the ratio of floating-rate loans over total loans during the first 6 months of 2021 for firm $f$ with bank $b$. $\delta_{ict}$ and $\gamma_{bt}$ are market-month and bank-month fixed effects. Standard errors are clustered at the market-month level.

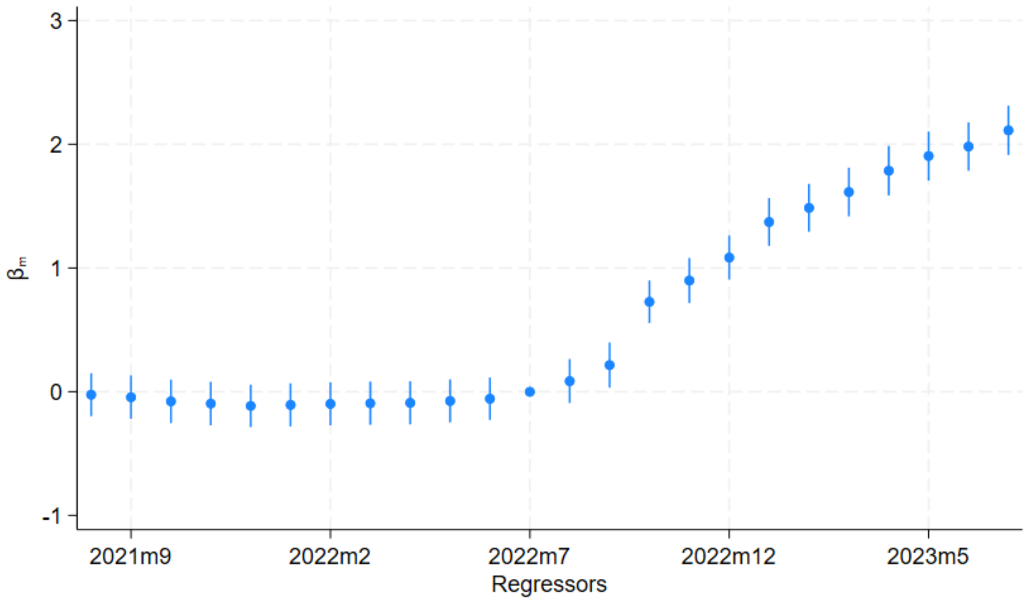


Figure 4: Dynamic DiD - Product prices

The figure shows the monthly $\beta$ coefficients and 90% confidence intervals for the following regression specification:

$$y_{ict} = \sum_{t=July2021}^{t=July2023} \beta_t \times ShareFloat_f \times D_t + \delta_{fp} + \gamma_{ckt} + \epsilon_{fpct}, \quad (5)$$

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 $f$ indicates a firm, $p$ a product, $k$ product category, $c$ a country, and $t$ a month. The dependent variable $y_{ict}$ is year-on-year growth rate of product price $p$. $ShareFloat_f$ 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.

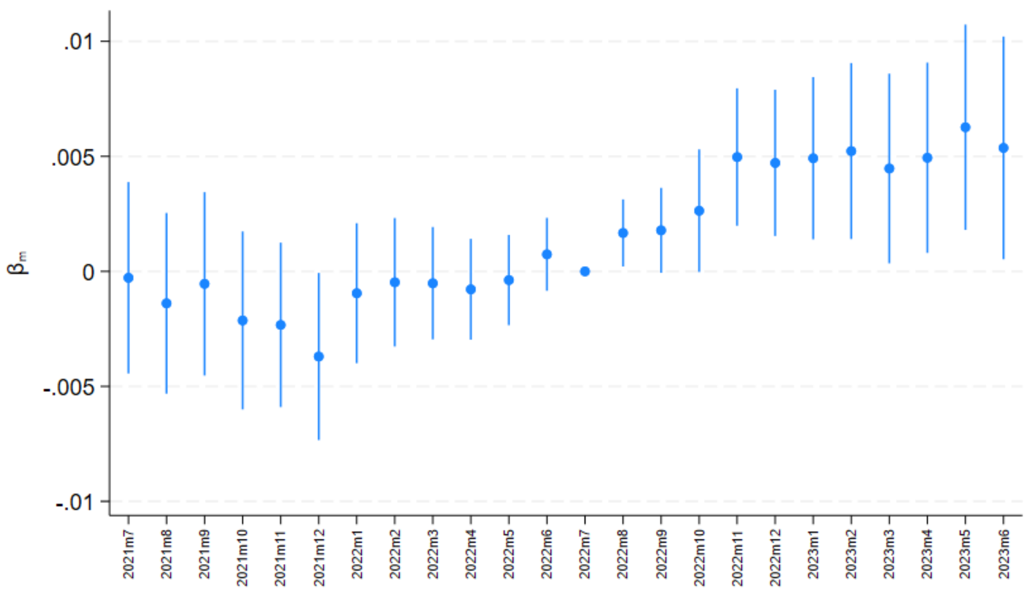


Figure 5: Dynamic DiD: market-level CPI

The figure shows the monthly $\beta$ coefficients and 90% confidence intervals for the following regression specification:

$$y_{ict} = \sum_{t=July2021}^{t=July2023} \beta_t \times ShareFloat_{\text{ic}} \times D_t + \beta_2 X_{ict} + \delta_{ic} + \eta_{it} + \gamma_{ct} + \epsilon_{ict}, \quad (6)$$

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 annualized inflation 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 ($\delta_{ic}$), industry-month ($\eta_{it}$), and country-month ($\gamma_{ct}$) fixed effects. Standard errors are clustered at the market level.

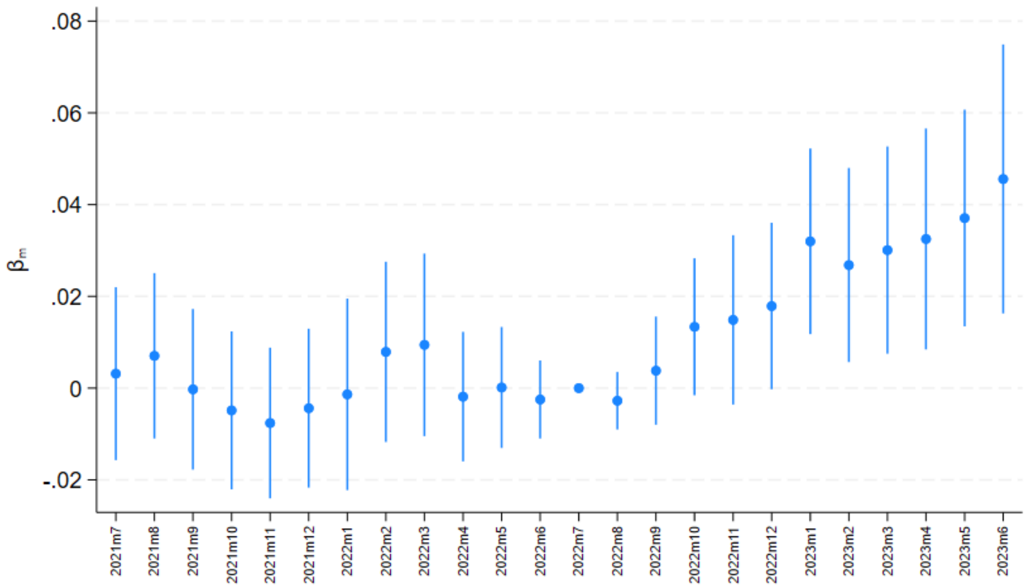
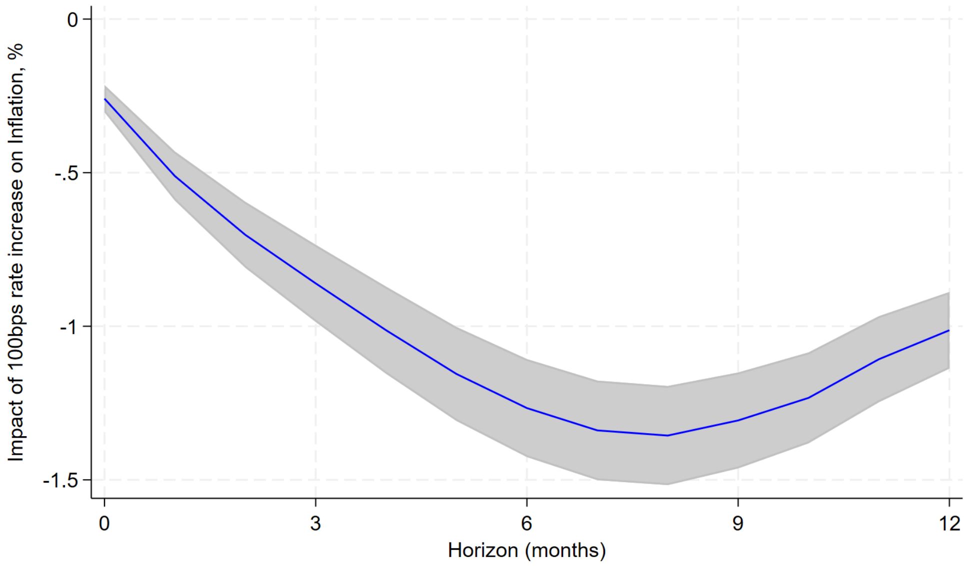


Figure 6: The Impact of Monetary Policy on Inflation: Floating and Fixed-rate Markets

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 (Baseline - Panel A) and for markets with a low ($20^{th}$ pct.=30%) vs. high ($80^{th}$ pct.=90%) share of floating-rate loans (Panel B) using the estimates from column (4) of Table 4. The sample consists of monthly observations at the market level from July 2021 until July 2023. Shaded areas represent 95% confidence bans.

Panel A. Baseline




Panel B. Floating vs. Fixed-rate Markets

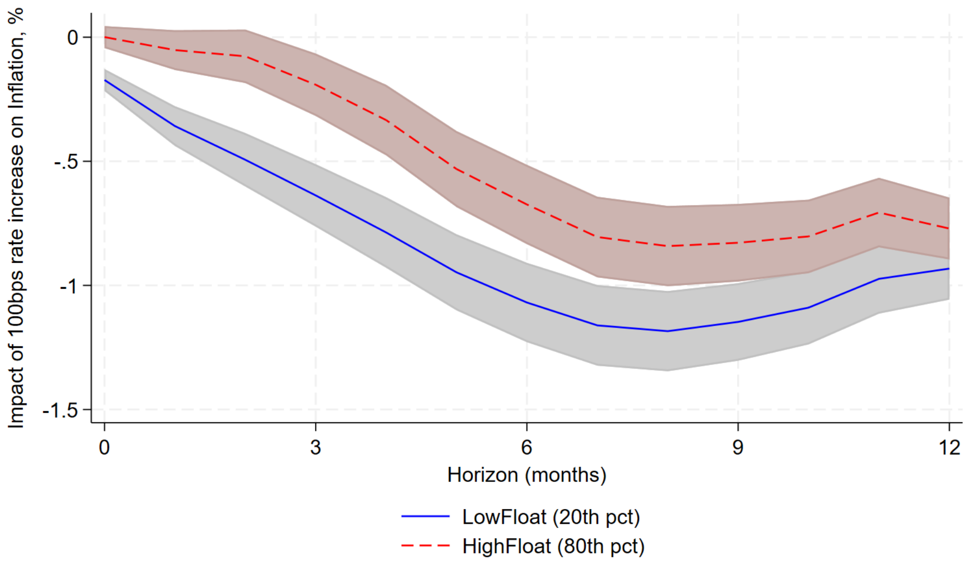
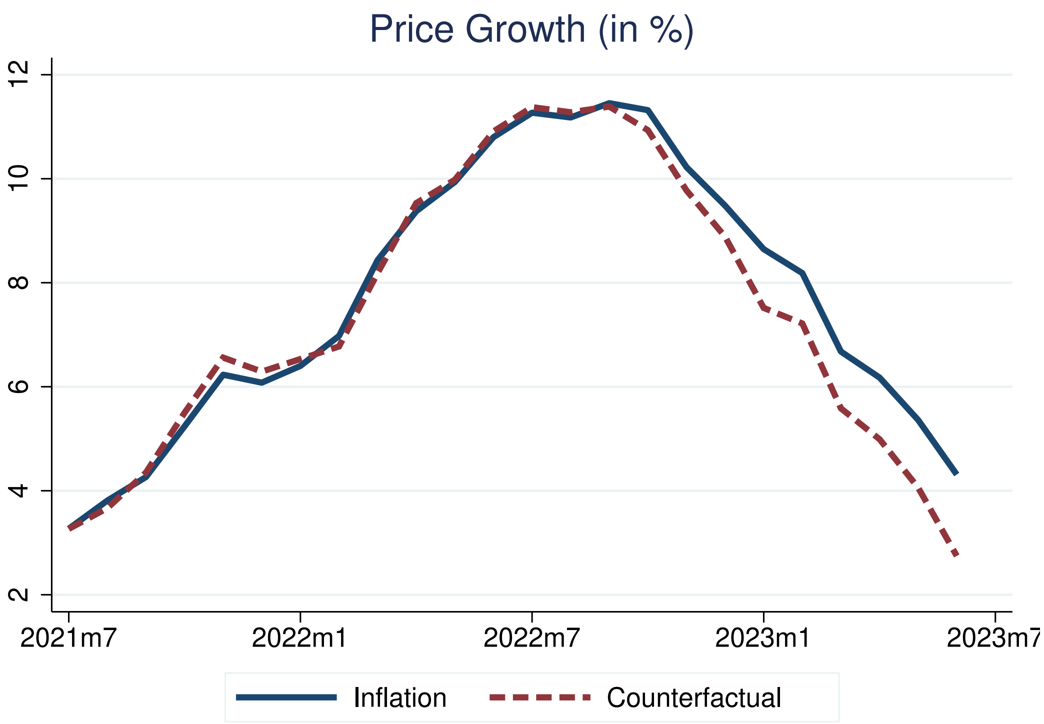


Figure 7: Counterfactual Inflation growth with Low Floating-Rate Loans

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

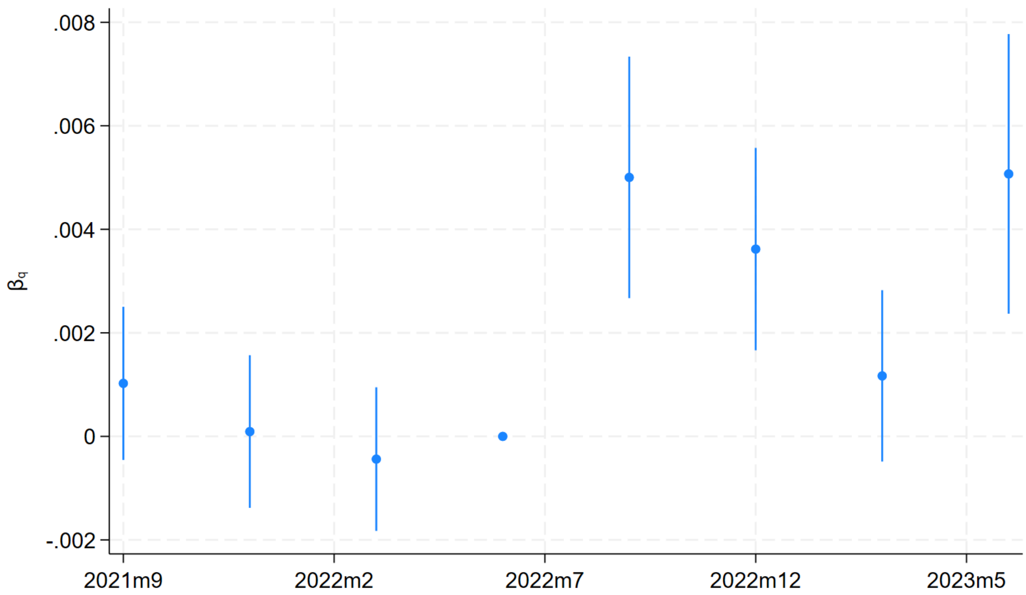


## Figure 8: Dynamic DiD - Renegotiation

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

$$y_{fbt} = \sum_{t=2021Q2}^{t=2023Q2} \beta_t \times ShareFloat_{\text{fb}} \times D_{\text{t}} + \delta_{ict} + \gamma_{bt} + \epsilon_{ijt}, \tag{7}$$

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 quater 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 month $t$. $ShareFloat_{fb}$ is the ratio of floating-rate loans over total loans during the first 6 months of 2021 for firm $f$ with bank $b$. $\delta_{ict}$ and $\gamma_{bt}$ 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 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. $\Delta$ *Deposit Facility Rate* is the year-over-year change in the ECB's Deposit Facility Rate. *Share of floating rate* is the ratio of the total amount of floating-rate loans over the total amount of loans during the first 6 months of 2021, calculated using AnaCredit data. *Post* is a dummy equal to one after July 2022. *HHI* is the Herfindahl-Hirschman-Index of a market in 2021, calculated using firm-level turnover data from Orbis. *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. 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 contains product-level prices from IRi.

| | Observations | Mean | Std.dev. | $1^{st}$ pct. | Median | $99^{th}$ pct. |
|---|---|---|---|---|---|---|
| Panel A | 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 |
| Panel B | Market level, Jul2021-Jul2023 | | | | | |
| Inflation rate (%) | 13,944 | 6.53 | 6.11 | -6.11 | 4.94 | 24.78 |
| ShareFloat (%) | 13,944 | 58.98 | 29.87 | 2.83 | 61.00 | 100.00 |
| $\Delta$ Deposit Facility Rate | 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 |
| Cash ratio | 13,728 | 0.12 | 0.09 | 0.01 | 0.10 | 0.43 |
| Leverage ratio | 13,728 | 0.56 | 0.20 | 0.09 | 0.56 | 1.26 |
| Energy cost | 11,544 | 4.00 | 9.28 | 0.02 | 0.92 | 47.25 |
| Panel C | Bank-firm level, Jul2021-Jul2023 | | | | | |
| Loan amount (th. EUR) | 110,311,249 | 660.88 | 8338.32 | 3.44 | 110.45 | 8831.70 |
| Interest rate (%) | 110,311,249 | 2.19 | 1.67 | 0.00 | 1.75 | 8.22 |
| Share of floating rate (%) | 110,311,249 | 0.25 | 0.41 | 0.00 | 0.00 | 1.00 |
| Initial loan maturity (days) | 110,311,249 | 3341.95 | 2251.78 | 0.00 | 2526.03 | 10974.00 |
| Renegotiation dummy | 35,064,673 | 0.01 | | 0 | 0 | 1 |
| Panel D | Product level, Jul2021-Jul2023 | | | | | |
| Price growth (YoY) | 5,441,550 | 0.04 | 0.11 | -0.27 | 0.02 | 0.44 |
| ShareFloat | 5,441,550 | 0.37 | 0.38 | 0.00 | 0.25 | 1.00 |

## Table 2: Loan Interest Rates

The sample consists of monthly observations at the firm-bank level from July 2021 until July 2023. The regression specification is as follows:

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

where $f$ indicates a firm, $b$ a bank, $c$ a country, $i$ an industry and $t$ a month. The dependent variable $LoanRate_{fbt}$ is the monthly average interest rate on credit by bank $b$ to firm $f$ in month $t$. $ShareFloat_{fb}$ is the ratio of floating rate loans over total credit between firm $f$ and bank $b$ during the first 6 months of 2021. $\Delta$ *DFR* is the year-over-year change in the ECB's Deposit Facility Rate. Standard errors clustered at the industry-country level are in parentheses.

| | Interest rate (%) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Δ DFR | 0.0937*** | | | |
| | (0.0061) | | | |
| $\text{ShareFloat}_{fb} \times \Delta$ DFR | 0.609*** | 0.609*** | 0.539*** | 0.576*** |
| | (0.0092) | (0.0097) | (0.0079) | (0.0082) |
| Observations | 110,253,844 | 110,253,844 | 110,252,694 | 110,238,610 |
| Bank-Firm FE | Y | Y | Y | Y |
| Month FE | N | Y | - | - |
| Country-industry-month FE | N | N | Y | Y |
| Bank-month FE | N | N | N | 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 total amount of floating-rate loans over the total amount of loans during the first 6 months of 2021 in market. $\Delta$ *DFR* 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) |
| $\Delta$ DFR$_t$ $\times$ ShareFloat$_f$ | 0.0028$^{**}$ | 0.0023$^{*}$ | 0.0023$^{*}$ | 0.0019$^{***}$ |
| | (0.0012) | (0.0012) | (0.0012) | (0.0007) |
| $\Delta$ DFR$_t$ | -0.0051$^{***}$ | -0.0057$^{***}$ | | |
| | (0.00062) | (0.0006) | | |
| ShareFloat$_f$ | -0.0019 | | | |
| | (0.0018) | | | |
| Observations | 5,441,550 | 5,441,550 | 5,441,550 | 5,435,164 |
| Adjusted R-sq. | .052 | .352 | .355 | .398 |
| Firm-Product FE | N | Y | Y | Y |
| Month FE | N | N | Y | N |
| Country-ProductCategory-Month FE | N | N | N | Y |

Table 4: 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 $ic$. $\Delta$ *DFR* 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) |
| $\Delta$ DFR | -0.338*** | -0.645*** | | | |
| | (0.0916) | (0.194) | | | |
| ShareFloat$_{ic}$ $\times$ $\Delta$ DFR | | 0.0052* | 0.0108*** | 0.0099*** | |
| | | (0.0029) | (0.0031) | (0.0032) | |
| High Share$_{ic}$ $\times$ $\Delta$ DFR | | | | | 0.347** |
| | | | | | (0.165) |
| Energy cost | | | | 0.0414 | 0.0392 |
| | | | | (0.0466) | (0.0476) |
| Observations | 13,944 | 13,944 | 13,920 | 11,544 | 11,544 |
| R-squared | 0.565 | 0.566 | 0.821 | 0.837 | 0.836 |
| 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 5: Heterogeneity: Working Capital and Customer Capital

The sample consists of monthly market-level data, from July 2021 until July 2023. Columns (1) and (3) show results for markets where respectively Working Capital and the HHI based on Sales, in 2021 was below the sample median, and columns (2) and (4) above the median. $ShareFloat_{ic}$ 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 $ic$. $\Delta DFR$ is the year-over-year change in the ECB's Deposit Facility Rate. *Energy cost* is calculated using a country-level CPI index for energy and the total energy use in a market. Standard errors clustered at the market level are in parentheses.

| | Working Capital | | HHI | |
|---|---|---|---|---|
| | Low | High | Low | High |
| | (1) | (2) | (3) | (4) |
| $\text{ShareFloat}_{ic}$ | 0.0059 | 0.0167*** | -0.0027 | 0.0164*** |
| $\times$ Δ DFR | (0.0049) | (0.0043) | (0.0044) | (0.0045) |
| Observations | 5,784 | 5,328 | 5,634 | 5,670 |
| R-squared | 0.831 | 0.897 | 0.893 | 0.812 |
| Country-Ind FE | Y | Y | Y | Y |
| Ind-month FE | Y | Y | Y | Y |
| Country-month FE | Y | Y | Y | Y |

## Table 6: Firm-level Outcomes

The sample consists of yearly observations at the firm level from 2020 until 2023 (currently with incomplete coverage of 2023 because of Orbis reporting lag). The regression specification is as follows:

$$y_{ft} = \beta ShareFloat_f \times \Delta DFR_t + \alpha X_{it} + \delta_{ict} + \gamma_f + \epsilon_{ft},$$

where $f$ indicates a firm, and $t$ a year. The dependent variable $y_{ft}$ is either a mark-up proxy (EBIT/Sales), return on assets (ROA) or the average interest paid by the firm on its debt (interest expenses divided by financial debt). $ShareFloat_f$ is the ratio of floating rate loans over total loans during the first 6 months of 2021 for firm $f$. $\Delta$ *DFR* 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 $Ln(total\ assets)_{f,t}$. $\delta_{ict}$ is an industry-country-year fixed effect, $\gamma_f$ is a firm fixed effect. Standard errors clustered at the firm level are in parentheses.

| | Mark-up proxy | | ROA | | Interest paid | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Δ DFR | -0.0016*** | | -0.0006*** | | 0.202*** | |
| | (0.0002) | | (0.0001) | | (0.0018) | |
| $\text{ShareFloat}_f \times \Delta$ DFR | | 0.0011** | | 0.0005 | | 0.099*** |
| | | (0.0005) | | (0.0003) | | (0.0124) |
| Observations | 153,642 | 141,217 | 153,641 | 141,216 | 141,191 | 130,591 |
| 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 7: Loan Renegotiation

The sample consists of quarterly observations at the firm-bank level from the third quarter of 2021 until the third quarter of 2023. The regression specification is as follows:

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

where $f$ indicates a firm, $b$ a bank and $t$ a quarter. The dependent variable $y_{fbt}$ 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 during the first 6 months of 2021 for firm $f$ with bank $b$. $\Delta$ *DFR* is the year-over-year change in the ECB's Deposit Facility Rate. Standard errors clustered at the industry-country level are in parentheses.

| | Renegotiation dummy | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\Delta$ DFR | -0.0002 | | | |
| | (0.0002) | | | |
| ShareFloat$_{fb}$ $\times$ $\Delta$ DFR | 0.0015*** | 0.0015*** | 0.0017*** | 0.0007*** |
| | (0.0004) | (0.0004) | (0.0005) | (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 |

## Table 8: Loan Terms after Renegotiation

The sample consists of quarterly observations at the loan level for floating-rate loans that were renegotiated from July 2021 until July 2023. The regression specification is as follows:

$$y_{lbcit} = \beta Post_{\mathrm{t}} + \delta_{cbi} + \epsilon_{lt},$$

where $l$ indicates a loan, $b$ a bank, $c$ a country, $i$ an industry and $t$ a quarter. The dependent variable $y_{lt}$ is a dummy equal to 1 if: the loan spread was reduced in column (1); the loan switched from being floating-rate to fixed rate in column (2); the maturity of the loan was reduced in column (3) or the committed amount of the loan was reduced in column (4). *Post* is a dummy equal to one after July 2022, zero otherwise. Standard errors clustered at the bank level are in parenthesis.

| | Spread decrease (1) | Float to fixed (2) | Maturity decrease (3) | Loan volume decrease (4) |
|---|---|---|---|---|
| Post | 0.0253** | 0.0099*** | 0.0078 | -0.0026 |
| | (0.0111) | (0.0031) | (0.0127) | (0.00251) |
| Constant | 0.120*** | 0.0039** | 0.127*** | 0.0093*** |
| | (0.0062) | (0.0017) | (0.0069) | (0.0012) |
| Observations | 208,500 | 224,041 | 204,773 | 184,478 |
| R-squared | 0.350 | 0.287 | 0.796 | 0.313 |
| Country-industry-bank FE | Y | Y | Y | Y |

# Online Appendix

Figure A1: 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

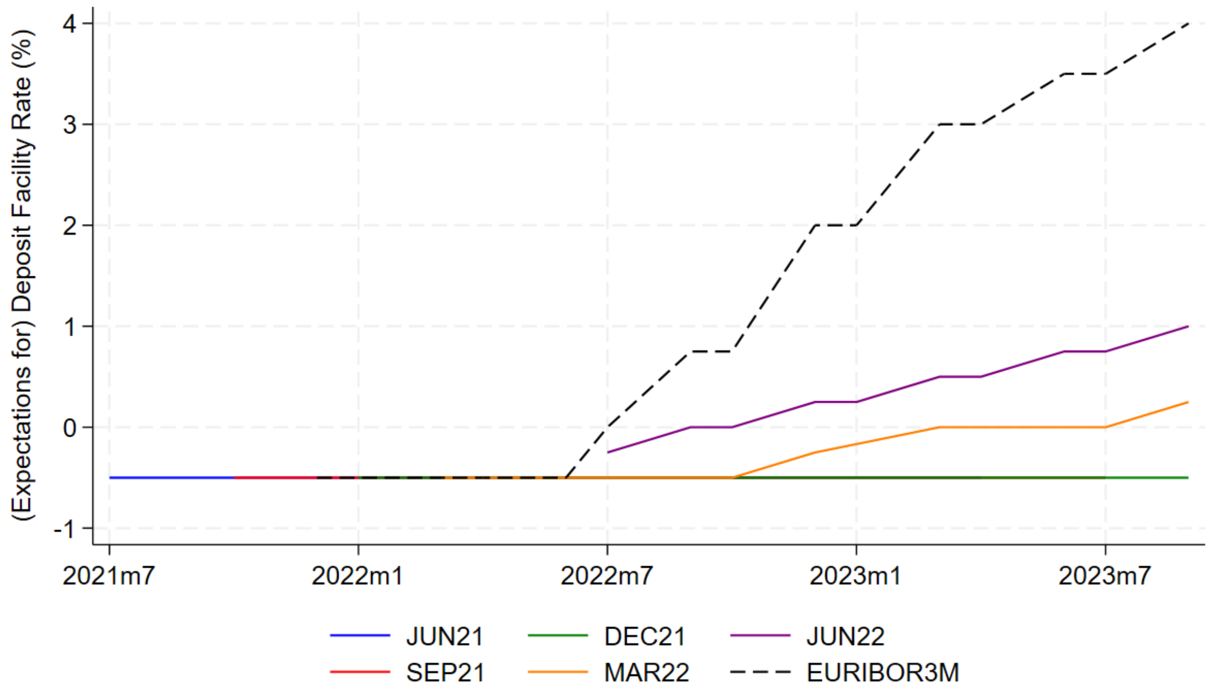


Figure A2: Example of COICOP-CPA transition matrix

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

| CPA x COICOP | | 01.1 Food | 02.2 Tobacco | 04.5 Electricity, gas and other fuels | 09.3 Other recreational items and equipment, gardens and pets | Total |
|---|---|---|---|---|---|---|
| 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 A3: 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).

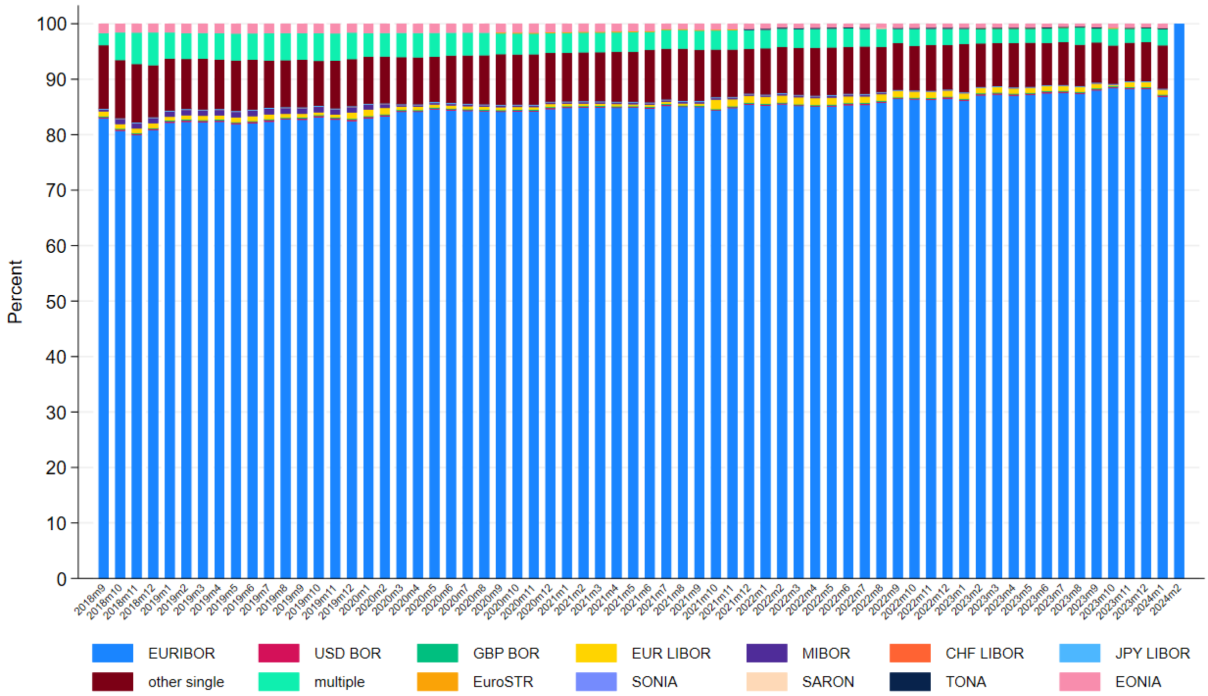


Figure A4: Floating-rate Loans: Reference Rate Maturity

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).

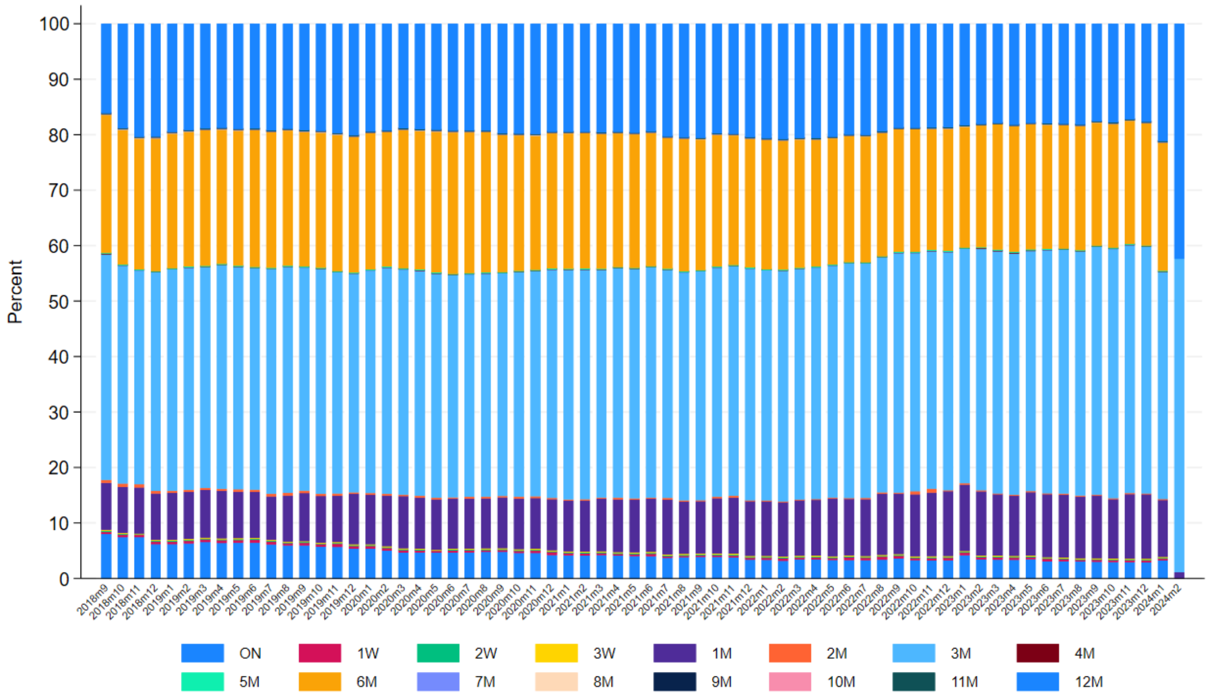
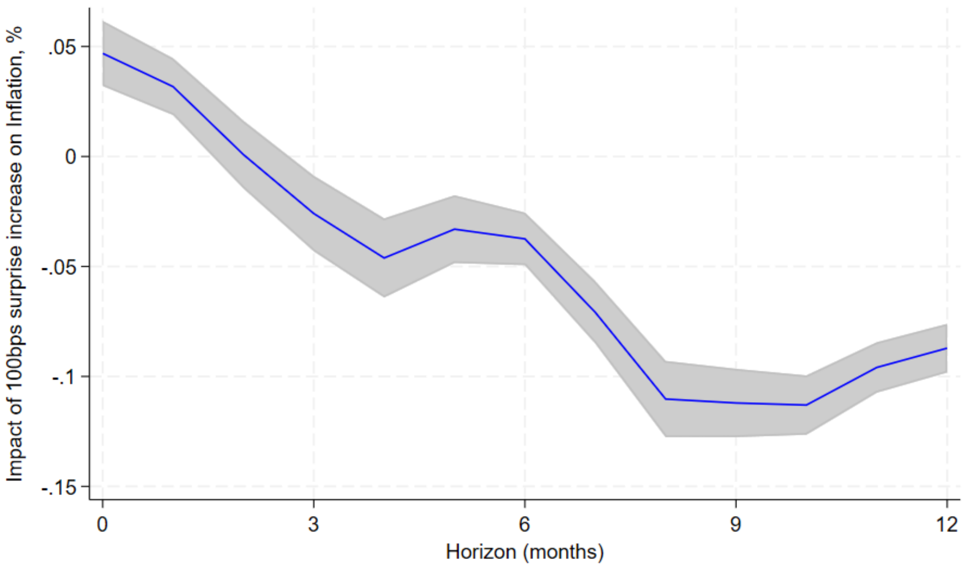


Figure A5: Monetary Policy Surprises and Inflation: Floating and Fixed-rate Markets

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 ($20^{th}$ pct.=30%) vs. high ($80^{th}$ pct.=90%) share of floating-rate loans (Panel B) using the estimates from column (4) of Table 4. The sample consists of monthly observations at the market level from July 2021 until July 2023. Shaded areas represent 95% confidence bans.

Panel A. Baseline




Panel B. Floating vs. Fixed-rate Markets

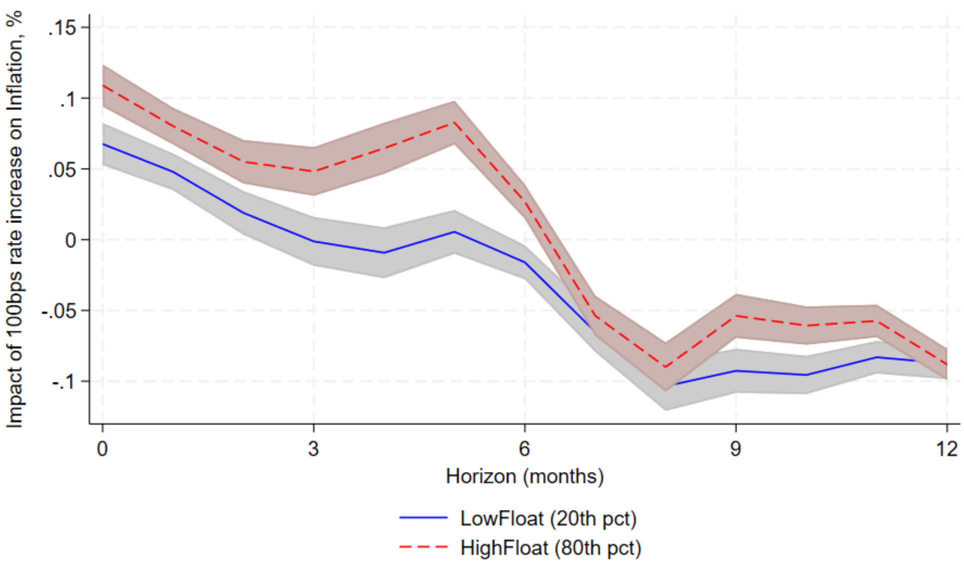
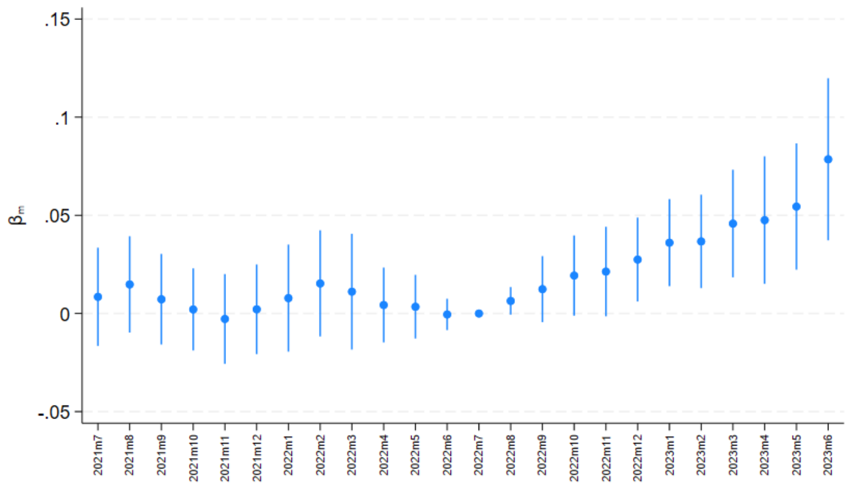


Figure A6: Dynamic DID: High vs. Low Working Capital

The figure shows the monthly $\beta$ coefficients and 90% confidence intervals when estimating equation (7) from Figure 5 in two sub-samples: markets with an above the median working capital as measured by the inventory+trade receivables to asset ratio in Panel A and markets with a below the median working capital ratio in Panel B.

Panel A. High Working Capital




Panel B. Low Working Capital

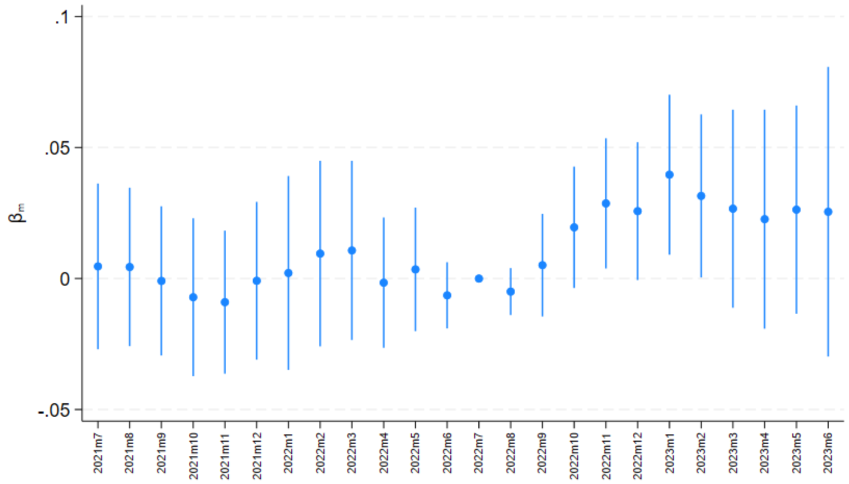
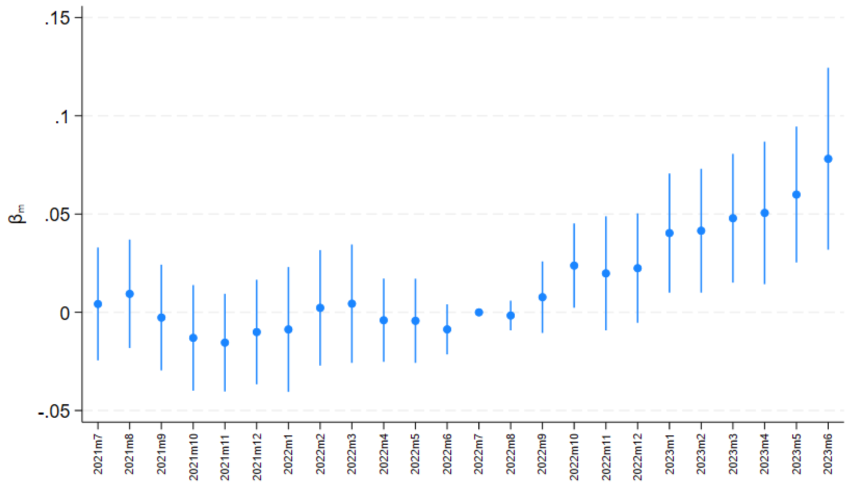


Figure A7: Dynamic DID: High vs. Low Concentration

The figure shows the monthly $\beta$ coefficients and 90% confidence intervals when estimating equation (7) from Figure 5 in two sub-samples: markets with an above the median concentration as measured by the HHI in Panel A and markets with a below the median concentration in Panel B.

Panel A. High concentration




Panel B. Low concentration

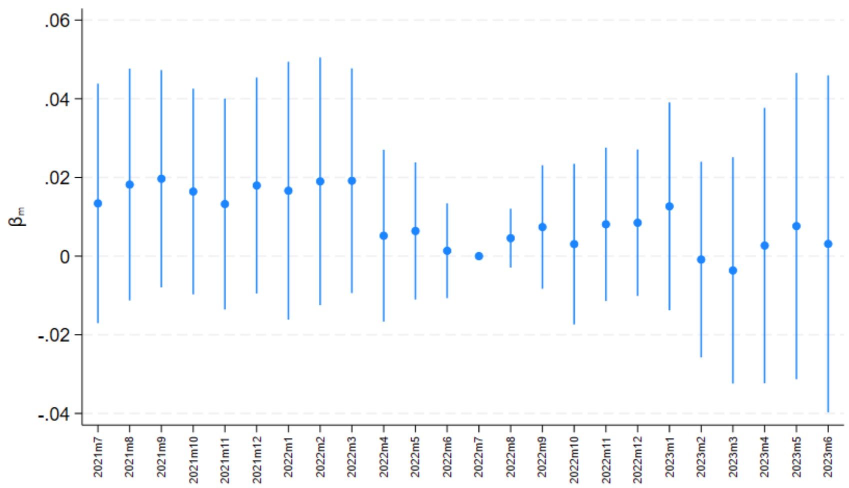


Table A1: Loan-level Summary Statistics: Floating-rate vs. Fixed-rate Loans

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: Floating-rate Determinants: Variance Decomposition

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

| | $\text{ShareFloat}_{fb}$ | | | | |
|---|---|---|---|---|---|
| | (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 |

Table A3: 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 A4: Upstream Input Prices and Floating-rate Loans

The sample consists of monthly market-level (i.e., industry-country pairs) data, from July 2021 until July 2023. The dependent variable is the weighted PPI of a market's upstream suppliers, where weights are constructed using the share of inputs provided by a given upstream market. $ShareFloat_{ic}$ 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 $ic$. $\Delta$ *DFR* is the year-over-year change in the ECB's Deposit Facility Rate. *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 Producer Prices (PPI) and GDP growth. Standard errors clustered at the market level are in parentheses.

| | Weighted Input PPI Index Growth (%) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| $\Delta$ DFR | -0.244*** | -0.195*** | | | |
| | (0.0335) | (0.0544) | | | |
| $\text{ShareFloat}_{ic} \times \Delta$ DFR | | -0.0837 | -0.109 | -0.117 | |
| | | (0.0677) | (0.0853) | (0.0921) | |
| $\text{High Share}_{ic} \times \Delta$ DFR | | | | | -0.0359 |
| | | | | | (0.0473) |
| Energy cost | | | | -0.122 | -0.122 |
| | | | | (0.0779) | (0.0780) |
| Observations | 11,405 | 11,405 | 11,405 | 10,480 | 10,480 |
| R-squared | 0.236 | 0.236 | 0.708 | 0.709 | 0.709 |
| 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 |

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