The Credit Channel of Inflation*

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Abstract

This paper shows how inflation affects the real economy through bank balance sheets: unexpected inflation erodes banks' net worth by devaluing long-term assets relative to short-term liabilities, constraining lending and depressing real activity. Using a century of data for 18 advanced economies, I document that inflation surprises reduce aggregate loans and shrink bank balance sheets, even in absence of contractionary monetary policy. To shed light on the mechanism, I exploit rich micro-level data on bank-firm relationships, and show that inflation-exposed banks cut credit supply when inflation increases, and their borrower firms scale back investment due to credit rationing. As such, inflationary pressures on banks can offset the traditional debt-inflation benefits enjoyed by borrowers.

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1 Introduction

A century ago, Keynes (1923) and Fisher (1933) argued that a burst of inflation shifts wealth from creditors to debtors, easing the real burden of debt and thereby stimulating spending.[1] That intuition has returned to center stage after the sharp inflation spike of 2021. Standard models, and recent empirical work, embrace the idea that nominal frictions on debt contracts can have expansionary effects: when prices rise unexpectedly, the real value of nominal liabilities falls, giving leveraged firms a windfall that can boost real activity (Gomes, Jermann, and Schmid, 2016; Brunnermeier et al., 2025). This so-called *debt-inflation* channel, however, focuses on settings where firms are directly linked to debt markets, such as bond financing, abstracting from the balance-sheet frictions that may arise within banks. In reality, a large share of corporate debt is bank-intermediated,[2] and banks are naturally exposed to inflation via a maturity mismatch on their balance sheet. Banks "lend long and borrow short": their assets are dominated by long-dated, fixed-rate loans, whereas their liabilities are rather short-lived and reprice more quickly. An unexpected rise in the price level therefore erodes the real value of the asset side while leaving the liability side relatively less affected, possibly compressing their net worth and their capacity to supply new credit. Understanding this bank-side mechanism is key to assessing the overall impact of inflation on credit and real activity.

This paper shows that inflation can contract credit supply by weakening bank balance sheets, thereby constraining firm investment and economic activity. Using novel long-run aggregate data, I show that a one-percentage-point inflation surprise reduces bank capital and real loans in the economy by roughly three percent within five years. This result holds even in the absence of a typical contractionary monetary policy response to inflation, showing that inflation exerts real effects beyond those transmitted through monetary policy. At the micro level, using rich administrative bank–firm data, I find that inflation hits maturity-exposed banks, which cut credit supply to firms that subsequently reduce investment. Taken together, the evidence establishes a *credit channel of inflation*: by weakening bank balance sheets, inflation tightens credit and drags on real activity, offsetting – and possibly outweighing – the classical debt-inflation gains enjoyed by borrowers.

The analysis proceeds in three main steps that build on two complementary data sets and a model. First, in Section 2, I assemble a new dataset of inflation surprises for 18

[1] The original intuition was formulated in the symmetric case due to the deflationary episode of the Great Depression, i.e., a *debt-deflation* that increases the real debt burden for debtors.

[2] In developed economies, the majority of corporate debt, including drawn credit lines, is bank-intermediated: around 80% in Europe (Holm-Hadulla et al., 2022) and 50% in the US (Colla, Ippolito, and Li, 2020)

advanced economies over the period 1946–2020 from my earlier work (Kim, Ranaldi, and Schularick, 2025), constructed from digitized inflation forecasts published in the OECD's long-standing Economic Outlooks. I combine these surprises with macro-historical data from various sources (e.g., Jordà, Richter, et al., 2021; Baron, Verner, and Xiong, 2021). The dataset includes banking aggregates (loans, capital, deposits) and bank equity returns, together with key macroeconomic variables. Using local projections, I show that a one-percentage-point inflation surprise trims bank assets and loans by 3 percent after five years, a reduction comparable to roughly 60 percent of the contraction observed in a typical recession.[3] As a consequence, bank equity returns fall persistently and significantly more than the overall stock market.

These effects, however, may reflect the contractionary response of monetary policy rather than inflation itself. Central banks adjust policy rates to contain inflation, which indirectly curtails bank lending (e.g., Bernanke and Blinder, 1992; Jiménez, Ongena, et al., 2012). To isolate the effect of inflation without the accompanying monetary tightening, I exploit the long history of exchange-rate regimes in the sample. Due to the trilemma of international finance (Obstfeld, 1997; Obstfeld, Shambaugh, and Taylor, 2005), countries that maintain a hard currency peg while allowing free capital flows forgo monetary independence and cannot raise policy rates in response to domestic inflation.[4] Comparing these episodes to those under floating exchange rates allows me to estimate the effect of inflation surprises on bank aggregates absent the confounding influence of monetary policy. This *direct* effect explains nearly all of the credit response on impact and about half of the effect after three years, underscoring the importance of nominal frictions beyond the conventional monetary channel.

Time-series aggregates, however, cannot separate falling credit supply from contemporaneous dynamics of credit demand, nor can they track the direct consequences for firms. To fill that gap, Section 3 turns to administrative data from Portugal, which is particularly well suited for the empirical design for three reasons. First, Portugal is a small open economy – about two percent of euro-area GDP – and its business cycle correlates only weakly with that of the euro area (Oman, 2019). As a result, ECB policy is largely unresponsive to Portuguese-specific conditions, making the country an ideal setting to study the effects

[3]The consequences of inflation may depend on its underlying source. These baseline estimates should therefore be interpreted as *average* responses across episodes. In Kim, Ranaldi, and Schularick (2025), we show that demand- and supply-driven inflation surprises occurred with roughly equal frequency in the post-war period.

[4]I test this hypothesis and confirm that *open-peg* countries do not increase interest rates after an inflation surprise, unlike *float* countries.

of inflation while holding monetary policy constant.[5] Second, the detailed supervisory balance sheet data allow me to compute a measure of each bank's *maturity gap* (English, Van den Heuvel, and Zakrajšek, 2018). This measure captures banks' heterogeneous exposure to inflation through the maturity mismatch between their long-term assets and short-term liabilities. Third, firms in Portugal typically borrow from multiple banks at the same time, a feature that enables a powerful identification design (Khwaja and Mian, 2008). By exploiting within-firm variation across banks, I can include firm–time fixed effects to control for credit *demand* and isolate changes in credit *supply*. Merging the credit registry and balance sheet datasets, I can observe the near universe of banks and firms in Portugal between 2011 and 2023, and I use this framework to estimate how inflation affects bank lending behavior through the maturity-mismatch channel.

Banks with greater maturity gaps respond more sharply to inflation. After a one-percentage-point increase in local inflation, a bank with a one-standard-deviation larger maturity gap cuts lending by roughly two percent. The contraction is stronger for highly leveraged banks and for those banks that rely less on deposits as funding source, consistent with a mechanism where tighter balance-sheet constraints and less stable funding amplify the effect.[6] Most of the adjustment occurs along the intensive margin: exposed banks scale back the size of existing credit relationships rather than terminating them, although the probability of ending a relationship increases slightly. Finally, I exploit the recent 2021 inflation surge – where inflation was mostly unexpected, together with no imminent increase in policy rates – to run an event study. I show that maturity-exposed banks reduced credit supply by 5 percentage points within one year, even before the ECB was expected to raise interest rates. Overall, this evidence highlights a contractionary credit channel of inflation operating through banks' maturity mismatches and balance-sheet constraints.

I then study whether the reduction in corporate credit by banks has real effects on investment for its corporate borrowers. I compare firms borrowing from more maturity-exposed banks to firms borrowing from non-exposed banks.[7] I only compare firms in the same municipality×sector×time cell. They are therefore subject to the same common shocks, but differ in their exposure to inflation because they borrow from different sets of

[5]To strengthen this assumption, I extract the component of Portuguese inflation orthogonal to euro-area inflation and use it as a plausibly exogenous regressor with respect to euro-area monetary policy. In the aggregate data, I confirm that this *idiosyncratic* inflation component does not respond to euro-area monetary policy shocks and does not trigger ECB rate adjustments.

[6]This observation is also in line with the argument that the deposit franchise value (partially) insulates banks' cash flows (Drechsler, Savov, and Schnabl, 2021). Banks with lower deposit reliance and more wholesale funding policies cut credit supply more significantly.

[7]More precisely, I define firm-level exposure to the *credit-inflation* channel as the credit-share weighted average of its banks' maturity gap.

banks.[8] The identifying assumption is that, conditional on controls and within the same municipality×sector×time, there are no shocks to firm fundamentals correlated with bank affiliation. I perform several checks and find support for this assumption.

At the firm level, inflation surprises weakly reduce total credit available to the firm. This masks sharp heterogeneity across borrowers: smaller and younger firms – and, generally, more bank-dependent firms – experience significant contractions in borrowing, while leveraged firms and those reliant on short-term credit face more favorable conditions, consistent with a debt–inflation mechanism and with banks' incentives to shorten loan maturity (Agarwal and Baron, 2024). These patterns show that firms differ in their ability to substitute credit across relationships and that the reduced credit provision by banks cannot be entirely substituted away, hence firms can face credit rationing after an inflation spike. As a consequence, firms scale back investment by 0.24% of assets within a year. The magnitude is substantial, as inflation reduces the investment rate through the credit channel by $\approx 3\%$, comparable to a 50 basis point monetary policy shock (Ottonello and Winberry, 2020).

To rationalize these findings, I develop a stylized model in which inflation surprises generate opposing forces in the credit market. The firm block builds on Kang and Pflueger (2015): here, inflation surprises lower the real burden of firms' nominal long-term debt, relaxing their balance sheets and raising credit demand. At the same time, banks – financing long-term fixed rate loans with short-term liabilities – face tighter capital constraints after an inflation surprise, because they need to rollover their short-term debt at higher price, hence reducing credit supply. The model underscores the importance of controlling for credit demand in the empirical analysis of Sections 3 and 4, and formalizes the intuition that, even with flexible prices, inflation can affect credit supply and real activity when banks are exposed to a maturity mismatch in their balance sheets.

Taken together, these patterns trace a clear chain from inflation, through bank exposure, to tighter credit and weaker real activity that counterbalance the classic debt-inflation channel. Although some firms – i.e., the more leveraged ones – may initially benefit from lower real debt burdens, the generalized outcome may revolve around the deteriorating effects of credit rationing. As inflation erodes banks' balance sheets, their capacity to lend across the system diminishes, which in turn raises lending constraints and curbs corporate investment. While offering short-term gains to debt-heavy firms, inflation can ultimately suppress aggregate activity when financial intermediaries face balance sheet pressures. The *credit channel of inflation* highlights the central role of financial intermediary health in determining the

[8] I also control for an estimate of firm-level demand shocks obtained from the loan-level regression (Cingano, Manaresi, and Sette, 2016; Jiménez, Mian, et al., 2020; Pinardon-Touati, 2024).

macroeconomic consequences of inflation.

Other related literature The paper bridges the literature on inflation with macro-financial research on how banks and firms respond to macroeconomic shocks.

First, this study connects to the debt-inflation literature, whose roots trace back to Fisher (1933), for the deflationary episode during the Great Depression. This strand of work typically concludes that moderate inflation benefits highly leveraged firms by eroding the real value of their nominal liabilities and freeing capacity for new investment. Gomes, Jermann, and Schmid (2016) show theoretically that the nominal rigidity embedded in long-term debt can transmit real effects through the debt-inflation channel. Kang and Pflueger (2015) find that inflation risk is priced in corporate bond spreads. Brunnermeier et al. (2025) show empirically that highly leveraged firms benefited from the German hyperinflation. Finally, D'Andrea et al. (2025) provide empirical evidence that highly leveraged firms enjoyed higher stock returns than non-leveraged firms during the 2021 inflation surge. Both these studies focus on large, publicly listed firms, whereas I observe the full distribution of firms in the economy, including many small firms that are naturally more bank-dependent. My paper complements these findings by showing that inflation simultaneously weakens banks' balance sheets and contracts credit supply, offsetting the gains for firms – especially the ones with lower leverage and with high bank dependence.

Second, the paper is related to the recent literature that links banks and inflation.[9] Drechsler, Savov, and Schnabl (2022) link credit crunches to the onset of the Great Inflation. Banks can be naturally exposed to inflation through their maturity mismatch or, as shown by Bahaj et al. (2023), by selling inflation protection in the swaps market. Agarwal and Baron (2024) shows that inflation depressed bank balance sheets during the 1977 U.S. inflationary spike. Corhay and Tong (2025) develop a New-Keynesian model with banks that supports a credit channel also in sticky-price environments. These papers do not empirically distinguish between credit supply and demand and capture responses that can also reflect monetary policy effects.[10] In contrast, I provide empirical evidence that inflation itself has a significant negative effect on banks' credit supply, holding credit demand constant and beyond the contractionary effects of monetary policy.

[9] There is also a literature on inflation and the broader financial sector: Choi, Smith, and Boyd (1996) and Huybens and Smith (1999) argue theoretically that sustained inflation introduces credit market frictions that impair financial intermediation and slow capital formation. Boyd, Levine, and Smith (2001) find that higher long-run inflation is associated with less active banking sectors and stock markets, while English (1999) reports a positive cross-sectional link between inflation and financial sector size.

[10] A recent exception is Bergant et al. (2025), who provide suggestive evidence that bank *profitability* is on average insulated from inflation, though with significant heterogeneity. In contrast, I focus on bank *balance sheet position* and *credit supply*, and show that banks are significantly affected in their value.

Finally, the paper relates to the large literature on the economic costs of inflation. Early work (Fischer, Hall, and Taylor, 1981; Cooley and Hansen, 1989; Lucas, 1994) quantified the welfare loss from reduced money holdings, generally finding modest costs at moderate inflation rates. Subsequent research highlighted broader channels: inflation raises uncertainty and relative price variability (Ball, Cecchetti, and Gordon, 1990), distorts saving and investment decisions through unindexed tax systems (Feldstein, 1999), and generates misallocation under nominal rigidities (Dotsey and Ireland, 1996). More recent work (Nakamura et al., 2018) shows that the welfare costs of inflation from price dispersion may be lower than previously thought. My paper contributes to this literature by providing direct evidence that inflation reduces bank credit supply and firm investment, highlighting a concrete channel, beyond price distortions, through which inflation negatively influences real activity.

The remainder of the paper is organised as follows. Section 2 details the macro-historical data and presents the local projection evidence on aggregate credit. Section 3 describes the bank-firm data and shows the effect of inflation on banks' credit supply, while Section 4 tracks the consequences on borrower firms. Section 5 introduces a simple model to rationalize these findings. Section 6 concludes.

2 Inflation and credit in the long run

In this section, I provide long-run evidence that inflation surprises are followed by a contraction of aggregate credit, bank capital, and bank stock returns. The effect is economically large and not only the consequence of tightening monetary policy. These facts highlight that inflation can directly affect banks' balance sheets, motivating the micro evidence that disentangle credit demand from credit supply.

2.1 Data

I combine aggregate data from post-WWII and across 18 OECD countries on bank balance sheets and macro-financial aggregates with a novel measure of inflation surprises. This unique coverage allows me to provide the first long-run evidence on how unexpected inflation affects bank balance sheets and credit provision.

The baseline period is between 1946 and 2020. In Section 2.3 I will extend the available data series to 1870 to exploit variation in monetary policy regimes.[11] The complete set of

[11]The baseline sample (1946–2020) is chosen to ensure a relatively homogeneous monetary and financial environment across countries, avoiding regime breaks associated with the interwar period. In Section 2.3,

countries includes: Australia, Belgium, Canada, Switzerland, Spain, Finland, France, Denmark, Germany, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Sweden, the United Kingdom, and the United States.

Bank aggregates and macroeconomic controls Data for aggregate loans, deposits, capital and total assets come from Jordà, Richter, et al. (2021), available from 1870 to 2020. These are book values from banking sector balance sheets, where bank capital corresponds to the Basel III definition of Common Equity Tier 1 capital,[12] loans includes mortgages and business loans, while deposits correspond to both term and sight deposits, and both checking and savings accounts. I deflate each series with the national CPI and expressed in logarithms, and merge them with aggregate bank equity total-return indices, available since 1870 and provided by Baron, Verner, and Xiong (2021).
Finally, I complement the dataset with macroeconomic aggregates from the Macrohistory Database (Jordà, Schularick, and Taylor, 2017; Jordà, Knoll, et al., 2019), including GDP, short-term interest rates, CPI, and the aggregate stock market return.

Inflation surprises The core regressor is the one-year-ahead inflation surprise:

$$\varepsilon^{\pi}_{i,t} \;=\; \pi_{i,t} - \mathbb{E}_{t-1}[\pi_{i,t}]$$

where $\pi_{i,t}$ is CPI inflation realized in year t in country i and $\mathbb{E}_{t-1}[\pi_{i,t}]$ is the forecast for inflation made at the end of year $t-1$. I construct the inflation surprises in my earlier work (Kim, Ranaldi, and Schularick, 2025, KRS henceforth), where we digitize semi-annual forecasts from the OECD Economic Outlook for these 18 countries, starting in 1965. All forecasts are prepared using a unified methodology so that series are comparable across countries. Furthermore, the OECD leverages its local presence to engage with government experts and policymakers, resulting in forecasts that incorporate significant local knowledge and insights into future policy changes.[13] This measure provides a novel source for studying inflation dynamics in the long run for various developed economies. As commonly known, inflation expectations data begin to be available only from the late 20th century.[14] Previous

extending the sample back to 1870 yields similar qualitative results. In that case, years around the world wars (1914–19 and 1939–46) are always excluded.

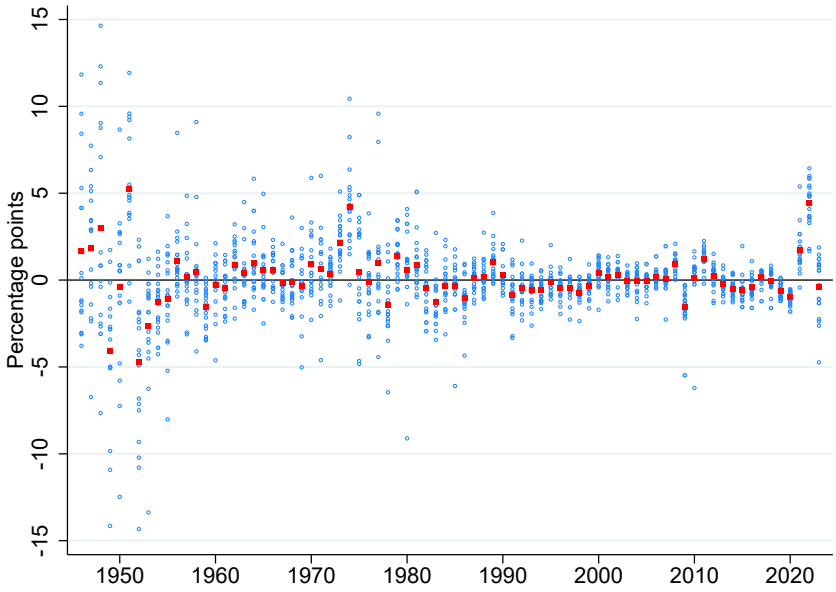
[12] This normally includes common stock (paid-up capital), reserves, and retained earnings.

[13] Reviews of the OECD's forecasts by Vogel (2007) report that they are comparable to private sector forecasts and have a number of desirable properties.

[14] The earliest comes from the Livingston survey that provides inflation forecast data for the USA from 1951 onward. For other countries, similar data start only in the 1990s (e.g., Consensus economics, central bank forecasts) or they are only in a qualitative format (e.g., EU Business and Consumer survey).

literature estimated inflation expectations for historical samples using models or financial markets data for limited time- or country-samples (Hamilton, 1992; Cieslak and Povala, 2015; Ellison, Lee, and O'Rourke, 2024).

Figure 1: Inflation surprises: 1946-2023



Notes: Inflation surprises from Kim, Ranaldi, and Schularick (2025), from 1-year-ahead forecasts, annual frequency, 1946-2020. Inflation surprises are computed as the difference between realized inflation and expectations from the end of the previous period, i.e. $\varepsilon^{\pi}_{it} = \pi_{it} - \mathbb{E}_{t-1y}[\pi_{it}]$. Inflation is measured in %, surprises in percentage points. Red dots represent the average surprise across the 18 OECD countries.

Figure 1 presents the inflation surprises for all countries (blue dots) in the period 1946-2023, together with the average across the 18 countries (red dots). In summary, over the past 80 years, only the Great Inflation episode in the 1970s was comparable to the recent inflation spike in terms of significant inflation surprises, while also the post-war decade shows large volatility. During the Great Moderation, inflation surprises have been relatively minor and more convergent across different countries. This is consistent with Blanco, Ottonello, and Ranošová (2025), who also observe that large surges in inflation or deflation are initially unexpected.

2.2 Benchmark results: inflation hurts the aggregate banking sector

I use this long-run dataset to estimate impulse response of aggregate bank balance sheet variables on inflation surprises via local projections. The results provide evidence that inflation significantly shrinks bank balance sheets and, therefore, can hurt their ability to supply

credit. These findings motivate Section 3, where I turn to bank-firm microdata to examine the underlying mechanism.

Empirical framework To trace the dynamic response of aggregate bank balance sheets to inflation surprises, I estimate panel local projections à la Jordà (2005):

$$\Delta^h y_{i,t+h} = \beta_h \, \varepsilon^{\pi}_{i,t} + \Psi_h(L) \, \mathbf{X}_{i,t-1} + \delta_{i,h} + \delta_{t,h} + u_{i,t+h}, \qquad h = 0, 1, 2, \ldots \tag{1}$$

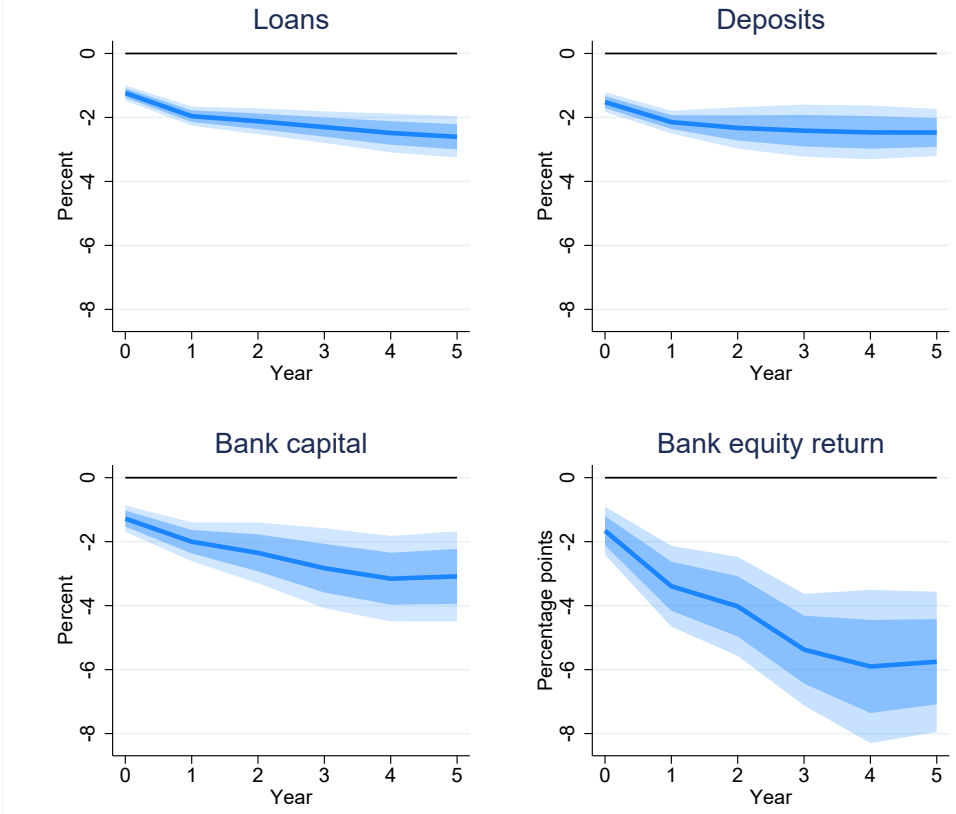
where $\Delta^h y_{i,t+h} \equiv y_{i,t+h} - y_{i,t-1}$ is the h-year log-difference in the outcome variable y in country i.[15] $\varepsilon^{\pi}_{i,t}$ is the inflation surprise defined in Section 2.1. $\mathbf{X}_{i,t-1}$ collects two lags of $\varepsilon^{\pi}_{i,t}$ and changes in the dependent variable, short-term interest rate, real GDP, the stock market index, and inflation. $\delta_{i,h}$ and $\delta_{t,h}$ denote horizon-specific country and year fixed effects and control for time-invariant country characteristics and common shocks, respectively. Lagged shocks and controls are included to account for any serial correlation and to improve inference, as prescribed by Montiel Olea and Plagborg-Møller (2021). I include the inflation level because both inflation and its surprises are more volatile in high-inflation states. The stock-market index proxies for high-frequency information that may not yet be reflected in inflation forecasts. Other macroeconomic variables are included to control for business cycle conditions. I use in every specification the Driscoll and Kraay (1998) heteroskedasticity- and autocorrelation-consistent standard errors. Equation (1) yields a sequence $\{\beta_h\}_{h=0}^{H}$ that maps a one-percentage-point inflation surprise into percentage responses of each balance-sheet item.

Results Figure 2 plots the impulse responses of real loans, deposits, bank capital and *cumulative* equity returns to a 1 p.p. inflation surprise. Unexpected inflation cuts real loans by 1% on impact and by more than 2% after five years, in line with cross-sectional estimates in Agarwal and Baron (2024), while bank capital declines more steadily by up to 3% in five years. Bank equity returns fall sharply after an inflation surprise, with long-lasting effects that hurt banks more than the rest of the corporate non-financial sector (see Appendix Figure A.2).[16] This fact is in line with the idea that banks are particularly exposed to inflation given the maturity structure of their balance sheet, with long-term nominal assets matched with

[15] In the case of equity returns, $y_{i,t}$ is the real total return index, so that $y_{i,t+h} - y_{i,t-1}$ can be interpreted as the h-period *cumulative* real return.

[16] There is a rich literature that finds extensive evidence that inflation hurts stock market returns, see e.g., Fama and Schwert (1977), Cieslak and Pflueger (2023), and Kim, Ranaldi, and Schularick (2025). The evidence in Appendix Figure A.2 shows that bank returns are significantly more affected than the average market. This is in line with results in Corhay and Tong (2025) who find the same results on disaggregated data and controlling for other firm-specific factors, e.g., leverage.

Figure 2: Response of bank balance sheet items to inflation surprises, 1946-2020



Notes: Impulse responses for aggregate loans, deposits, bank capital and cumulative bank equity returns on inflation surprises, estimated with panel-LP as in eq. (1). 1946-2020, annual frequency, 18 countries. All variables are expressed in real terms. Driscoll and Kraay (1998) standard errors. Bands are at the 68% and 90% confidence level.

short-term liabilities.

In the aggregate, I also find that real deposits decline after an inflation surprise. While deposits account for about 60% of total bank liabilities, the remainder consists mainly of wholesale funding (*non-core funding*) which is contractually and de facto short term. Indeed, banks' reliance on non-core funding increases after an inflation surprise (see Appendix Figure A.3), as wholesale funding is of shorter maturity and its value is therefore less impaired. The contraction in real deposits is therefore consistent with banks' overall balance-sheet compression.[17]

[17]There is a long debate around the nature of deposits (e.g., Drechsler, Savov, and Schnabl (2021), Greenwald, Schulhofer-Wohl, and Younger (2023), and DeMarzo, Krishnamurthy, and Nagel (2024)), either as short-term liabilities, per their contractual maturity, or as de facto longer-run liabilities, because deposit rates are sticky and depositors are slow to withdraw from low-yielding accounts. Drechsler, Savov, and

All in all, much of the effect on the aggregate bank balance sheet materializes not only on impact but also steadily over the five-year horizon. The contraction is not a price-level artifact but reflects a genuine reduction in aggregate credit, also in nominal terms (see Appendix Figure A.1). Overall, the whole aggregate bank balance sheet tends to shrink more than one-to-one after an inflation surprise. The magnitude of these responses (-3%) is economically large. For example, during the average recession in this sample, real loan growth slows by roughly 5% – a figure nearly matched by a two-percentage-point inflation surprise.

2.3 It's not all about monetary policy

An inflation surprise typically triggers central banks to raise interest rates, which in turn reduces bank lending (Bernanke and Blinder, 1992; Jiménez, Ongena, et al., 2012). This makes it difficult to disentangle the direct effect of inflation from the consequences of monetary policy. To address this empirical challenge, I exploit variation in exchange rate regimes to separate the two mechanisms. I show that much of the immediate contraction in bank balance sheets is due to inflation itself, confirming that inflation surprises can hurt banks even in the absence of contractionary monetary policy responses.

Exploiting historical data permits comparison of episodes in which central banks faced different, plausibly exogenous, degrees of policy autonomy. The key source of variation is the exchange rate regime. Governments adopt pegs to anchor prices or ease trade with a major partner, but doing so tightens their monetary policy margin. By the trilemma of international finance, a country cannot simultaneously enjoy a fixed exchange rate, open capital markets, and an independent monetary policy (Obstfeld, 1997; Obstfeld, Shambaugh, and Taylor, 2005).[18] Therefore, a peg with open capital accounts forces the central bank to align with the base country's rates and limits its ability to raise short-term rates after a *local* inflation surprise. On the other hand, countries with float exchange rate regimes may tighten after an inflation surprise as they see fit.[19] Therefore, I interpret the effect of an inflation

Schnabl (2021) argue that this *deposit franchise* helps banks insulate their *cash flows* from interest rate risk. However, in line with DeMarzo, Krishnamurthy, and Nagel (2024), banks' *value* can still be affected by interest rates. My results extend this point to inflation: even if cash flows can be partially insulated (Bergant et al., 2025), the real value of bank balance sheets compresses after an inflation surprise.

[18] See e.g., Bazot, Monnet, and Morys (2024) for an empirical confirmation of the trilemma over history and across countries. Other empirical studies use this setting to control for the endogenous response of monetary policy, see e.g., Andersen et al. (2023). Also, I verify in Appendix Figure A.5 that *open peg* countries do not raise their short-term interest rate in response to an inflation surprise.

[19] The constraint is short-run: hard pegs still deliver low and stable inflation, see e.g., Ghosh, Qureshi, and Tsangarides (2014) and Bleaney and Francisco (2005) for evidence that hard pegs anchor inflation in the medium run.

surprise in an *open peg* country as the direct effect of inflation controlling for endogenous interest rates response. On the other hand, the response in the *float* country shows the total effect of inflation, including the consequences of tighter monetary policy.

Empirical framework I modify equation (1) using the extended 1870–2020 sample separately for pegs and floats.[20] The estimating equation is now a state-dependent panel local projections framework in the spirit of Ramey and Zubairy (2018), where the states are (i) pegged countries with open capital accounts and (ii) float countries:

$$\begin{aligned}\Delta^h y_{i,t+h} = \mathcal{I}_{i,t-1}\Big\{\beta_{A,h}\varepsilon^{\pi}_{it} + \Psi_{A,h}(L)\mathbf{X}_{i,t-1} + \delta_{A,i,h} + \delta_{A,t,h}\Big\} \\ +(1-\mathcal{I}_{i,t-1})\Big\{\beta_{B,h}\varepsilon^{\pi}_{it} + \Psi_{B,h}(L)\mathbf{X}_{i,t-1} + \delta_{B,i,h} + \delta_{B,t,h}\Big\} + \epsilon_{i,t+h} \quad \text{for} \quad h = 0,1,2,\dots\end{aligned} \tag{2}$$

where $\mathcal{I}_{i,t-1}$ is a dummy variable that indicates whether a country is pegged in t and $t-1$ and in both times it has open capital accounts. The capital-account openness variable $q_{i,t-1}$ is taken from Quinn, Schindler, and Toyoda (2011), where $q_{i,t-1} = 1$ when the country completely allows free capital movements.[21] I condition on being an *open peg* in both time periods t and $t-1$ to avoid cases where the decision to peg is endogenously determined by economic conditions.[22] The main distinction between the two states lies in the monetary policy conduct: whenever countries have their currency pegged while maintaining their capital accounts open, they are not able to freely react to an inflation surprise by raising interest rates. The rest of the specification and estimation details mirror those in equation (1).[23]

Results Figure 3 shows the responses for both states and compares the effect of an inflation surprise with and without a reaction of the central bank. In pegs (red line), a 1 p.p. inflation surprise cuts real loans and the other bank balance sheet items by 1 % on impact, but slowly converges back to steady state within 5 years. In floats (blue dashed line), the contraction is

[20] The need for exploiting the full-sample in this exercise comes from the fact that the balance of pegs and floats in the post-1946 period is dramatically skewed towards float countries, especially after the collapse of the Bretton-Woods system in 1973.

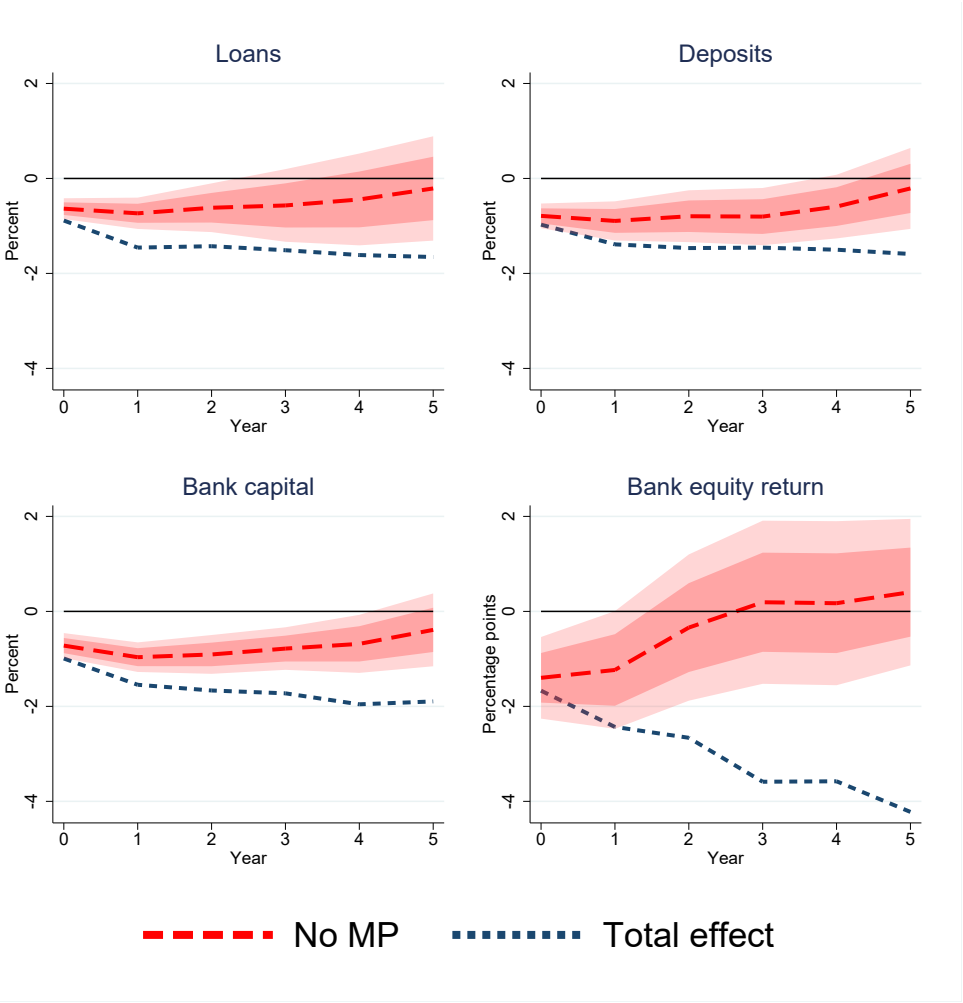
[21] This index is available until 2012, at most. I merge this with the capital account openness index from Chinn and Ito (2006), up to 2020. Note that the two variables are very close in the recent overlapping period.

[22] As noted in Jordà, Schularick, and Taylor (2020), restrictions on capital mobility have not been used as a high-frequency policy tool by pegging economies since the index is very slow-moving in advanced economies.

[23] I also add the inflation rate in the *base* country as additional control in $\mathbf{X}_{i,t-1}$, to exclude the cases where the peg country raises interest rates to an inflation surprise in the base country. Results are robust to a variety of alternative specifications.

approximately the same on impact but losses are persistent within the five-year horizon.[24] A similar picture applies to banks' cumulative equity returns, falling on impact with the same magnitude across pegs and float countries but quickly offsetting losses in the former, while in floats real returns continue to drop steadily.

Figure 3: Direct effect of inflation surprises, 1870-2020



Notes: Impulse responses for aggregate loans, deposits, bank capital, cumulative bank equity returns on inflation surprises, estimated with panel-LP as in eq. (2). The red solid line represents the "direct" effect of inflation, i.e., the response of outcome y_t in open peg countries ($\beta_{A,h}$), where monetary policy cannot respond to inflation. The blue dashed line shows the "total" effect of inflation, i.e., the response of outcome y_t in float countries ($\beta_{B,h}$). 1870-2020, annual frequency, 18 countries. Driscoll and Kraay (1998) standard errors. Bands are at the 68% and 90% confidence level.

[24]The total response is more muted compared to Figure 2, which uses the post-1946 sample only. The reason lies in the different volatility of surprises in the pre-1946 sample, where surprises were historically stronger (SD: 5.1 in pre-1946 vs. 2.78 in post-1946). This fact mechanically leads to a milder overall response to an *average* 1 p.p. surprise. Rather than the overall magnitude, this section focuses on the fraction of the total effect explained by inflation per se, without contractionary policy responses.

Overall, these dynamics suggest that inflation has a large direct impact on the banking sector even controlling for the indirect response of monetary policy. Roughly 90% of the impact response can be attributed to the direct effect of inflation. However, much of the persistence of these effects is due to the contractionary response of monetary policy: at $h = 3$, approximately 50% of the total response of bank balance sheet items is due to inflation directly; at $h = 5$, this direct effect of inflation has vanished, while the overall response remains significantly negative, drawn down by the contractionary rise in interest rates. This result is also in line with the literature on the long-run non-neutrality of monetary policy (Mankiw, 2001; Jordà, Singh, and Taylor, 2024).

Inflation can directly, substantially, and persistently affect banks. However, this section showed that failing to control for the countercyclical reaction of monetary policy can bias the results. When turning to the micro data, in Section 3, I exploit the case of Portugal as a laboratory to study a small country in a monetary union, to keep fixed the fluctuations in the monetary reaction.

Additional exercises In Appendix C, I provide suggestive evidence that the debt–inflation channel can, in the aggregate, be offset by the credit channel of inflation. Specifically, I show that when corporate indebtedness is high, i.e. when the debt-inflation channel should have its higher positive effects on firms' real debt burden, inflation surprises trigger sharper declines in bank fundamentals, and are also followed by lower aggregate investment.

3 Micro-data: the effect of inflation on credit supply

In this section, I turn to micro data to establish whether the contraction of credit after inflation surprises reflects supply (from banks) rather than demand (from firms). To do so, I exploit administrative data on the universe of bank–firm credit relationships in Portugal, where monetary policy is fixed at the euro-area level. Banks that are more exposed to inflation through the maturity gap in their balance sheets cut lending more to the same firm. This provides evidence that the contraction documented in the aggregate data can operate through a bank credit-supply channel.

3.1 Institutional background

Portugal provides an ideal setting to study the credit channel of inflation, since local inflation surprises do not trigger monetary policy responses by the ECB. This ensures that the micro

evidence identifies the *direct* effect of inflation on banks and credit supply, cleaned of any indirect outcome due to the response of the central bank.

Portugal accounts for only 2% of euro-area GDP, and its business cycle correlates weakly with the aggregate euro-area cycle (Giannone, Lenza, and Reichlin, 2008; Oman, 2019). Because the ECB targets euro-area inflation as a whole, Portuguese-specific inflation surprises do not elicit a country-specific monetary policy response.[25] This identifying strategy is similar to Jiménez, Ongena, et al. (2012), who apply it to Spain.[26] To further support this assumption, the analysis uses idiosyncratic Portuguese inflation, net of euro-area inflation, as the main regressor, which strengthens the credibility of treating monetary policy as exogenous in this environment.

Specifically, to capture the component of Portuguese inflation that is unrelated to area-wide monetary policy, I construct an orthogonalized series. Aggregate inflation across euro-area countries π_{it} is decomposed into a common component, π_{it}^{Common}, and a residual country-specific component, $\pi_{it}^{\perp}$:

$$\pi_{it} = \pi_{it}^{Common} + \pi_{it}^{\perp} = \Gamma_i F_t + \pi_{it}^{\perp} \tag{3}$$

where π_{it} is the inflation rate in country i at time t, F_t is the common factor, and Γ_i are country loadings.[27] The common component π_{it}^{Common} captures euro-area inflation that guides ECB policy, while the orthogonalized component $\pi_{it}^{\perp}$ reflects local country-specific inflation fluctuations that do not trigger monetary tightening. Appendix Figure A.6 plots the decomposition for Portugal.

I further test the credibility of this assumption with two separate exercises. First, I estimate impulse response functions of the orthogonalized inflation $\pi^{\perp}$ for Portugal on the Jarociński and Karadi (2020) euro-area monetary policy shocks. $\pi_{it}^{\perp}$ does not respond to monetary policy shocks within the first three years, unlike euro-area and overall Portuguese inflation, see Appendix Figure A.7.[28] Second, I estimate impulse response functions of the

[25] See Article 127(1) TFEU: "*implementing the monetary policy of the Union.*" The 2021 ECB strategy review makes this scope explicit: "The ECB's inflation target makes clear that the focus of the ECB's monetary policy is on the euro area as a whole. Therefore, the 2% inflation target is assessed on the basis of inflation developments in the euro-area economy."

[26] In Jiménez, Ongena, et al. (2012), Spain accounts for approximately 10% of euro-area GDP, with higher business-cycle convergence compared to Portugal.

[27] Specifically, I use year-over-year CPI inflation at monthly frequency for all euro-area countries, 1999m1-2024m12. F_t and Γ_i are estimated using the first principal component, which captures $\approx 90\%$ of overall variation in π_{it}.

[28] Specifically, using the Jarociński and Karadi (2020) monetary policy shocks as instruments for changes in the three-month EONIA rate, I estimate a local projection instrumental variable framework (LP-IV) over the 1999m1–2024m12 period. The results in Appendix Figure A.7 show that both euro-area π_t^{Common} and Portuguese inflation π_t fall significantly after a contractionary monetary policy shock, as theory predicts, but the orthogonalized Portuguese inflation $\pi_t^{\perp}$ does not respond within the first three years.

short-term interest on $\pi^{\perp}$ in a similar fashion and find that it does not trigger any significant movement within three years, see Appendix Figure A.8. This alleviates concerns that my measure might still reflect euro-area policy reactions, showing that it can be used in my main regressions as proxy for the *direct* effect of inflation.

These institutional features make Portugal a perfect laboratory to identify the direct effect of inflation on banks and credit supply. The next subsections introduce the data (Section 3.2), outline the empirical strategy (Section 3.3), and present the results (Section 3.4). Finally, Section 3.5 exploits the 2021 inflation surge as a clean inflationary episode for an event study.

3.2 Data

The analysis relies on exceptionally rich administrative data from Banco de Portugal, covering the entire universe of banks and firms in the country. This unique feature allows me to observe every bank–firm credit relationship together with detailed balance sheet information on both sides.

The study combines four datasets. The *Harmonized Central Credit Responsibility Database* (HCRC, 2009–2023, monthly) records all bank–firm credit exposures above €50, including credit lines, overdue or written-off loans, and whether the exposures have short original or residual maturity (below one year). The *Monetary Financial Institutions Balance Sheet Database* (BBS, 1997–2023, monthly) reports the assets and liabilities of all monetary financial institutions at the item–counterparty level. Finally, the *Central Balance-Sheet Database* (CB, 2006–2022, annual) covers the universe of non-financial firms with mandatory accounting and tax information.[29]

I apply conservative sample restrictions to avoid outliers. Overall, I restrict the sample to start in 2011, as in 2010 the CB database undergoes a change in reporting standards for firms, reflecting a significant structural change. On the firm side, I exclude liquidated or inactive firms, financial and public administration firms, those with missing or zero assets, firms with no employees, firms located outside mainland Portugal, firms that are directly controlled by foreign groups, and firms without any bank relationship. On the bank side, I retain only monetary financial institutions present in the BBS and exclude credit exposures within two years of major corporate events such as mergers, resolutions, or sales.

The resulting dataset includes 385,255 unique firms and 72 banks, linked by 900,138

[29]Banco de Portugal Microdata Research Laboratory (BPLIM), 2023; Banco de Portugal Microdata Research Laboratory (BPLIM), 2024a; Banco de Portugal Microdata Research Laboratory (BPLIM), 2024b.

unique bank–firm relationships. I winsorize all variables in the sample at the 1st and 99th percentile. On average, firms borrow from 3 different banks (median = 2), and 60% maintain multiple bank relationships—a share substantially higher than in other European countries.[30] This dense network of multibank lending enables the use of firm–time fixed effects while maintaining a wide representativeness. Table 1 reports loan-level characteristics (Panel A) and firm-level characteristics (Panel B). Notice that the distributions of the variables at the loan level are similar between multibank relationships and the unconditional case. Moreover, the firm data covers a significant share of small firms, with the majority of companies having less than 10 employees. These facts confirm the broad representativeness of the data and capture the broad structure of the Portuguese corporate sector.

3.3 Empirical strategy: banks are exposed to inflation

The goal is to identify how different banks adjust lending to the same firm after an increase in inflation. The empirical strategy exploits multibank firms to hold credit demand fixed and to identify credit-supply effects of inflation through banks' balance-sheet exposures.

I estimate the following specification:

$$\begin{aligned} L_{bft} =& \beta \left[\pi_t^{\perp} \times \sigma_{b,t-1}\right] + \alpha_{ft} + \alpha_{bf} \\ &+ \gamma_1' \mathbf{X}_{bf,t-1} \times \pi_t^{\perp} + \gamma_2' \mathbf{X}_{bf,t-1} + \gamma_3' \sigma_{b,t-1} + u_{bft} \end{aligned} \tag{4}$$

where b indexes banks, f indexes firms, and t indexes time in months. L_{bft} is the log-level of credit between bank b and firm f.[31] I focus on long-term credit, defined as loans with original maturity above one year, following the theoretical insights of Gomes, Jermann, and Schmid (2016), who show that inflation has real effects only when debt has long maturity.[32] $\pi_t^{\perp}$ is the local inflation in Portugal, as described in Section 3.1.[33] α_{ft} and α_{bf} are firm-time and bank-firm fixed effects, respectively. $\mathbf{X}_{t-1}$ is a rich vector of controls. It includes the lag of the dependent variable to control for autocorrelation, the share of loans in a bank with

[30] In France, only about 30% of firms have multiple banks, while in Germany and Belgium the share is below 50%. Appendix Figure A.9 shows the distribution of bank relationships per firm in the sample.

[31] This specification exploits the same within-bank–firm variation as a log-difference formulation in two-period designs, but does so more efficiently once the bank–firm fixed effect α_{bf} is included. Differencing introduces additional noise and mean reversion, and mechanically excludes newly established relationships when $L_{t-1} = 0$. For these reasons, I work with log-levels as the baseline and report results using log-differences as a robustness check.

[32] In robustness, I show that results are qualitatively similar when extending L_{bft} to measure overall credit.

[33] In the baseline specification, this is the orthogonalized series from year-over-year CPI inflation, similar to other studies in the literature (Core et al., 2025). Results are robust to using higher-frequency measures, although these introduce additional volatility and seasonality that can bias estimates.

Table 1: Summary statistics

Panel A: Firm×bank-level variables

	All					Multibank				
	Mean	SD	p10	p50	p90	Mean	SD	p10	p50	p90
Credit growth ΔL_{bft}(%)	-2.18	18.20	-11.78	-1.62	1.49	-2.11	18.62	-12.15	-1.59	2.58
Credit outstanding L_{bft} (€)	395,544	4,051,223	7,506	50,560	568,991	473,177	4,630,339	8,446	62,340	711,212
Length of relationship$_{bft}$ (months)	40.69	33.92	5.00	31.00	93.00	41.40	34.24	6.00	32.00	95.00
Maturity gap σ_{bt} (years)	4.05	0.82	3.17	4.12	4.88	4.01	0.86	2.98	4.06	4.89
Assets$_{bt}$ (€Mn)	10.17	1.39	7.84	10.73	11.34	10.04	1.47	7.63	10.67	11.34
Overdue ratio$_{bt}$	0.03	0.03	0.00	0.02	0.07	0.03	0.03	0.00	0.02	0.07
Liquidity ratio$_{bt}$	0.04	0.03	0.00	0.04	0.08	0.04	0.03	0.00	0.04	0.08
Deposit ratio$_{bt}$	0.20	0.12	0.02	0.20	0.33	0.19	0.12	0.00	0.19	0.33
Loan ratio$_{bt}$	0.65	0.11	0.54	0.63	0.85	0.66	0.12	0.54	0.63	0.88
Leverage$_{bt}$	0.11	0.05	0.06	0.11	0.16	0.11	0.05	0.06	0.11	0.16
Observations	40,488,265					26,488,990				

Panel B: Firm-level variables

	Mean	SD	p10	p50	p90
Inflation surprise, p.p.	0.59	1.88	-0.76	0.14	1.46
Firm-banks avg maturity exposure (θ_{ft}, in years)	7.61	6.04	3.18	4.99	15.43
Δ Investment (%)	0.92	21.11	-14.22	0.00	14.00
Δ Revenues (%)	28.18	143.94	-46.41	2.18	99.42
Δ Profits (%)	4.87	49.61	-23.42	0.14	31.38
Δ Interest expenses (%)	-0.00	0.97	-0.74	-0.00	0.76
Δ Number of employees (%)	1.80	25.43	-28.77	0.00	33.65
Δ Hours worked (%)	4.03	51.40	-37.76	0.00	48.03
Δ Credit (%)	2.52	38.15	-24.80	-0.87	33.69
Assets (€)	1,629,126	58,759,630	13,426	122,259	1,331,360
Number of employees	9.14	100.42	1.00	3.00	13.00
Firm age (years)	13.15	12.64	1.00	10.00	30.00
Loan-Assets ratio	0.54	0.67	0.01	0.32	1.32
Ratio of short-term loans	0.49	0.37	0.00	0.45	1.00
Return on Assets (ROA)	-0.13	0.95	-0.44	0.05	0.31
Capital per worker (€)	304.79	923.25	0.00	45.61	593.32
Exporting firm (dummy)	0.19	0.39	0.00	0.00	1.00
Observations	3,461,350				

Notes: This table reports summary statistics of the variables used in the micro analysis. Panel A presents firm–bank level variables from the HCRC database. Panel B reports firm-level characteristics from the CB database. Statistics are reported as mean, standard deviation (SD) and percentiles. All variable definitions are presented in Appendix Table B.1.

payments past due ($\geq$ 90 days) to measure loan portfolio risk, and the length of the credit relationship. I further control for the deposit ratio (deposits over assets), the loan ratio (loans over assets), and the short-term loan ratio (share of loans with maturity $\leq$ 1 year) to capture funding structure and maturity composition. Finally, I include other determinants emphasized in the bank-lending literature: size (Kashyap and Stein, 1995), leverage (Kishan and Opiela, 2000), and the share of liquid assets (Kashyap and Stein, 2000). Following Gomez et al. (2021) and English, Van den Heuvel, and Zakrajšek (2018), these controls enter both

directly and interacted with current inflation $\pi^{\perp}$.[34] Results are robust to excluding these measures one by one.

I measure a bank's exposure to inflation through its *maturity gap*, $\sigma_{b,t-1}$. This variable captures the extent to which a bank borrows short and lends long, and has been widely used in the banking literature as a core characteristic of maturity transformation. A larger gap implies greater sensitivity of the balance sheet to nominal shocks, since liabilities reprice faster than assets. Prior work shows that the maturity gap is a strong predictor of banks' responses to monetary policy shocks (English, Van den Heuvel, and Zakrajšek, 2018; Drechsler, Savov, and Schnabl, 2021), which makes it well-suited to study the effect of inflation. I construct the measure using the BBS dataset, which reports the maturity class of most balance-sheet items (e.g., loans with maturity between one and five years). I assign each item the midpoint of its maturity interval and compute the average maturity of assets and liabilities. The maturity gap $\sigma_{b,t}$ is then defined as the difference between the weighted average maturity of assets and that of liabilities. The complete classification of maturity categories is reported in Appendix Table A.1, following the methodology in English, Van den Heuvel, and Zakrajšek (2018). $\sigma_{b,t-1}$ enters equation (4) as predetermined with respect to $\pi_t^{\perp}$, to avoid endogenous adjustments of the bank's maturity position caused by higher inflation: in the baseline, this is the average maturity gap of bank b in the last 12 months.[35] Figure 4 depicts the median maturity gap in the sample, together with its cross-sectional dispersion. The median is stable over time and fluctuating between 3 and 4 years, similar to what English, Van den Heuvel, and Zakrajšek (2018) report for the US.

Identifying assumptions The goal is to identify effects of inflation to credit supply through banks' maturity gap, i.e. the coefficient β in (4). My empirical design will be valid if the standard orthogonality condition is satisfied:[36]

$$\mathbb{E}\left[(\pi_t^{\perp} \times \sigma_{b,t-1})\ u_{bft} \mid \mathbf{X}_{bf,t-1}, \mathbf{X}_{bf,t-1} \times \pi_t^{\perp}, \sigma_{b,t-1}, \alpha_{ft}, \alpha_{bf}\right] = 0 \tag{5}$$

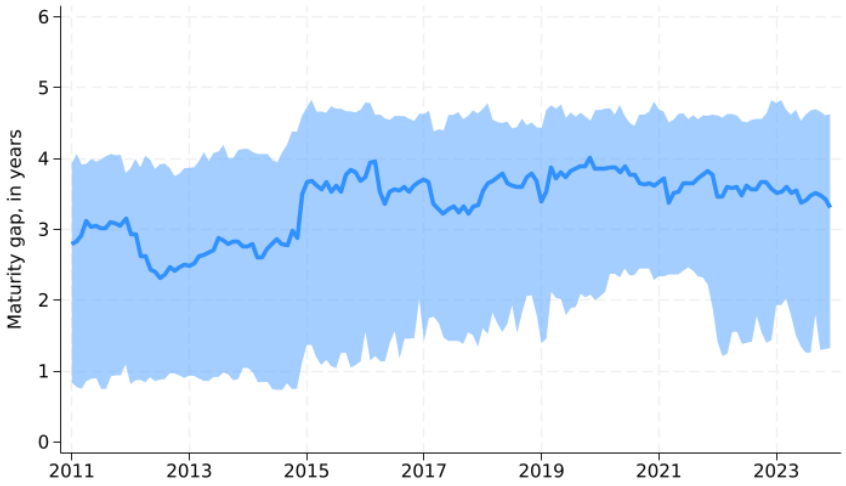
Intuitively, conditional on firm–time and bank–firm fixed effects and rich bank controls,

[34] To clarify why the inclusion of the interaction term is crucial, suppose we exclude the interaction term $\mathbf{X}_{t-1} \times \pi_t^{\perp}$ from the specification, i.e., $L_{bft} = \beta\left[\pi_t^{\perp} \times \sigma_{b,t-1}\right] + \gamma_2 \mathbf{X}_{b,t-1} + \gamma_3 \sigma_{b,t-1} + \alpha_b + \alpha_{ft} + \underbrace{\gamma_1 \mathbf{X}_{b,t-1} \times \pi_t^{\perp} + u_{bft}}_{v_{bft}}$. If v_{bft} is correlated with $\pi_t^{\perp} \times \sigma_{b,t-1}$ — e.g., if $\mathrm{Cov}(\text{Deposit ratio}, \sigma_b) < 0$ — the OLS estimator becomes $\hat{\beta} = \beta + \frac{\mathrm{Cov}(\pi_t^{\perp} \times \sigma_{b,t-1}, v_{bft})}{\mathrm{Var}(\pi_t^{\perp} \times \sigma_{b,t-1})}$ and is biased towards zero.

[35] This is robust to both using time $t-1$ or time $t-12$.

[36] More formally, let $Z_{bft} \equiv \pi_t^{\perp} \times \sigma_{b,t-1}$ and $W_{bft} \equiv \{X_{t-1}, X_{t-1} \times \pi_t^{\perp}, \sigma_{b,t-1}, \alpha_{ft}, \alpha_{bf}\}$. The key assumption is the conditional mean independence $\mathbb{E}[u_{bft} \mid Z_{bft}, W_{bft}] = 0$ which implies the conditional moment (5).

Figure 4: Maturity gap



Notes: Sample period: 2011m1 - 2023m12. The solid blue line depicts the median maturity gap for the sample of 72 banks; the shaded blue band depicts the corresponding inter-quartile range. The maturity gap is defined as the weighted average maturity time of assets less the weighted average maturity time of liabilities. For details on each balance sheet item reported maturity, see Table A.1

the remaining variation in the interacted exposure $\pi_t^{\perp} \times \sigma_{b,t-1}$ is uncorrelated with the residual lending shock. This design is meant to address three main threats to identification that can arise in this framework.

First, credit demand shocks could confound the estimates if banks reduce lending simply because firms lower their borrowing needs. I address this identification problem by focusing on firms with multiple lending relationships and adding firm-time fixed effects α_{ft}. Any firm-level demand shock that is symmetric across lenders will be absorbed by the fixed effects (Khwaja and Mian, 2008). This assumption entails little costs in the Portuguese setting: the majority of firms maintain multibank relationships, providing high representativeness.

Second, an increase in Portuguese inflation might be correlated with a contemporaneous reaction of monetary policy. I alleviate this concern by exploiting both firm-time fixed effects and the fact that movements in Portuguese (idiosyncratic) inflation $\pi_t^{\perp}$ do not trigger a response from the ECB, which sets monetary policy at the Euro area level, as in Jiménez, Ongena, et al. (2012) (see Appendix Figure A.7 and A.8 for an empirical validation).[37]

The final identification threat is anticipation: banks might anticipate higher inflation and

[37]Firm–time fixed effects only absorb shocks that affect *homogeneously* all banks lending to the same firm. If the policy rate R_t affects banks differentially through the maturity gap $\sigma_{b,t-1}$, the term $R_t\sigma_{b,t-1}$ survives the within transformation. English, Van den Heuvel, and Zakrajšek (2018) show empirically that the coefficient on $R_t\sigma_{b,t-1}$ is indeed positive ($\delta > 0$), implying that OLS estimates of β would be biased towards zero when $\text{Cov}(\pi_t, R_t) > 0$. Therefore, other maintained assumptions are essential to disentangle the direct impact of inflation from monetary policy.

adjust their maturity gaps σ_b before the shock occurs. However, such behavior could bias the estimate only if banks react heterogeneously. If all banks uniformly shorten asset duration in anticipation, the *relative* maturity gap across banks remains intact and identification still follows. On the other hand, if for example only more exposed banks adjust, then the relative maturity gap used in the interaction $\pi_t^{\perp} \times \sigma_{b,t-1}$ becomes endogenous, biasing $\hat{\beta}$.[38] It can be shown that in case of anticipation, $\hat{\beta}$ represents an attenuated response, i.e., a lower bound (in absolute value) of the effect. One way to deal with this threat would be to use inflation surprises, which are unfortunately not available for Portugal at the monthly or quarterly frequency.[39] To mitigate this concern, I use the predetermined average $\sigma_{b,t-1}$ in the last 12 months, and use the 12-month lag in robustness specifications, with comparable results.

3.4 Results: inflation shrinks credit supply

Table 2 presents the estimation results of equation (4). A 1p.p. increase in inflation reduces the supply of long-term credit by a 1SD more maturity-exposed bank already after 1 month, by 0.22%.[40] The results are robust to the inclusion of various fixed effects and set of controls. Importantly, in column (2)-(5), I exploit *within firm across banks* variation through firm-time fixed effect: the effect controls for any demand variation, as it compares different banks lending to the same firm in the same month. The effect is persistent and grows with time: after 12 months, inflation reduces the supply of long-term credit by 1.52%.

There is no direct comparison in the literature to contrast this results. The closest instance is Agarwal and Baron (2024), who estimate a reduction in total lending during the 1977 inflationary episode (an increase in inflation from 5% to 7%) by roughly 3p.p.. However, their estimates do not identify purely credit supply effects and cannot disentangle from the effects caused by contractionary monetary policy. The results of Table 2 draw a stronger picture once these two elements are taken into account. Results are robust to using alternative lags of σ_b (Table C.1). Appendix Table C.2 reports alternative more granular specifications that support the main results: columns (1)-(2) further interact the firm-time fixed effect with a dummy equal to 1 if the bank is specialized in the firm's industry; columns

[38] More formally, suppose the data-generating process is $y_{bft} = \beta\pi_t^{\perp} \times \sigma_{b,t-1} + \delta\Delta\sigma_{b,t-1} + \alpha_{ft} + u_{bft}$ where $\Delta\sigma_{b,t-1}$ is an anticipated change in the maturity gap for some banks. If $\Delta\sigma_{b,t-1}$ correlates with both $\pi_t^{\perp}$ and $\sigma_{b,t-1}$, the OLS estimate mixes the true inflation-supply effect β with the anticipation effect δ, leading to attenuation bias, i.e., if $\beta < 0$, then $\hat{\beta} > \beta$.

[39] The only sources for inflation expectations in Portugal target annual inflation, even though they are updated more frequently during the year. Other methodologies (e.g., implied forecasts through the TIPS market) are not directly available in Portugal.

[40] $\beta \times \text{SD}(\sigma_b) = 0.28 \times 0.77 = 0.22$

Table 2: Inflation effect on banks' credit supply

	$\ln(\text{Credit}_{bf,t+h})$				
	$h=0$			$h=3$	$h=12$
	(1)	(2)	(3)	(4)	(5)
Inflation $\times$ $\bar{\sigma}_{b,t-1}$	-0.39*	-0.43**	-0.28*	-0.90**	-1.98***
	(0.22)	(0.19)	(0.14)	(0.42)	(0.74)
Controls	No	No	Yes	Yes	Yes
Time FE	Yes	No	No	No	No
Bank-firm FE	Yes	Yes	Yes	Yes	Yes
Firm-time FE	No	Yes	Yes	Yes	Yes
N	26,995,370	16,465,587	16,465,545	14,854,041	11,014,677
R^2	0.98	0.98	0.98	0.96	0.93

Notes: This table reports the results of estimating specification (4). The dependent variable is the log-level of long-term credit (maturity above one year) between bank b and firm f. The main explanatory variable is the interaction between orthogonalized Portuguese inflation $\pi_t^{\perp}$ and the bank's maturity gap $\sigma_{b,t-1}$. Controls include lagged credit, loan portfolio risk (share of overdue loans), relationship length, deposit ratio, loan ratio, short-term loan ratio, size, leverage, and liquidity, as well as their interactions with inflation. Firm–time and bank–firm fixed effects are included throughout. Standard errors are double-clustered at the bank and time level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

(3)-(4) interact the firm-time fixed effect with a dummy equal to 1 if the bank is specialized in the firm's geographical area; moreover, results are strong also when restricting the set of banks to main entities (column (5)), when using a minimal set of controls (e.g., excluding leverage; column (6)) and when further controlling for changes in interest rates interacted with inflation – to explicitly control for interest rate risk – (column (7)). Estimation results with loan growth as dependent variables or using raw inflation as main regressor are more modest in magnitude (Table C.3 and Table C.4). In Section 3.5, I will provide clean evidence that during the 2021 inflation surge credit supply declined by about 5% for more exposed banks.

Extensive vs. intensive margin The previous framework can analyze the reduction in the intensive margin of the credit relationship. To investigate if the mechanism works also through the extensive margin, i.e., banks' establishment of new lending relationships or the closure of existing ones, I use the strategy proposed by Bittner et al. (2022). For each firm f that has an outstanding loan from bank b at some point in time t, I fill the respective bft panel with zeros for all other periods (indicating no credit exposure). This allows to examine the timing of new bank-firm relationships or of existing relationships that eventually terminate. The specification is similar to equation (4) but includes as dependent variable a dummy NewEntry_{bft} that equals one when a new relationship starts, and a dummy NewExit_{bft} that

equals one when an existing relationship ends. The coefficient β can be interpreted as the additional probability of starting or ending a credit relationship with a 1SD more maturity-exposed bank, following an increase in inflation.

Table 3: Extensive margin: Effect of inflation on bank-firm relationships

	New Entry			New Exit		
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation $\times$ $\bar{\sigma}_{b,t-1}$	-0.00028	-0.00004	0.00000	0.00034*	0.00033**	0.00038***
	(0.00129)	(0.00086)	(0.00004)	(0.00019)	(0.00013)	(0.00009)
Controls	No	No	Yes	No	No	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	No	No	Yes	No	No
Time FE	Yes	No	No	Yes	No	No
Firm-Time FE	No	Yes	Yes	No	Yes	Yes
N	32,515,619	25,187,982	24,309,387	32,515,619	25,187,982	24,309,387
R^2	0.29	0.54	0.30	0.02	0.30	0.30

Notes: This table reports estimates of specification (4) for extensive-margin outcomes. The dependent variable is either NewEntry$_{bft}$, a dummy equal to one when a new bank–firm relationship is formed, or NewExit$_{bft}$, a dummy equal to one when an existing relationship ends. The main explanatory variable is the interaction between orthogonalized Portuguese inflation $\pi_t^{\perp}$ and the bank's maturity gap $\sigma_{b,t-1}$. Controls and fixed effects are as in Table 2. Standard errors are double-clustered at the bank and time level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3 reports the estimates for the contemporaneous response after a rise in inflation. Inflation pushes maturity-exposed banks to terminate existing credit relationships, although the magnitude is rather small. After a 1p.p. increase in inflation, a 1SD more maturity-exposed bank is only 0.03 percentage points more likely to terminate a credit relationship. By contrast, there is no significant effect on the creation of new lending relationships. These findings suggest that the credit-supply effect of inflation operates primarily through the intensive margin: banks tend to scale back lending volumes within existing relationships rather than frequently initiating or terminating ties. The extensive margin plays a secondary role, reflecting that banks usually adjust quantities before resorting to relationship termination.

Heterogeneous effects on banks The impact of inflation on credit supply need not be uniform across banks. Differences in size, capitalization, liquidity, and business models shape how strongly banks are exposed to maturity transformation and thus to inflation risk. Identifying such heterogeneity is important both to understand the transmission mechanism and to assess potential financial stability implications. In this subsection, I investigate

whether the credit-supply effect of inflation varies systematically with bank characteristics beyond the maturity gap, focusing on balance-sheet strength and funding structure.

Table 4: Heterogeneity: Effect of inflation on credit supply by bank characteristics

	$\ln(\text{Credit}_{t+1y})$					
	Large	Small	Lev.	Non-lev.	High Dep.	Low Dep.
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation $\times$ $\bar{\sigma}_{b,t-1}$	0.91	-4.26***	-2.47**	-1.87**	-0.85	-6.59***
	(3.64)	(0.83)	(0.96)	(0.90)	(1.48)	(1.05)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	3,204,948	4,134,107	3,398,625	3,962,225	4,453,330	4,860,882
R^2	0.93	0.95	0.95	0.95	0.94	0.95

Notes: This table reports the results of estimating specification (4) at horizon $h = 12$ months, allowing for heterogeneity across banks. The dependent variable is the log-level of long-term credit. The main explanatory variable is the interaction between orthogonalized Portuguese inflation $\pi_t^{\perp}$, the bank's maturity gap $\sigma_{b,t-1}$, and bank characteristics. Small bank is a dummy equal to one if total assets are below the sample median. High leverage is a dummy equal to one if the capital ratio (equity/assets) is below the median. Low deposit reliance is a dummy equal to one if the deposit ratio (deposits/assets) is below the median. Controls and fixed effects are as in Table 2, with the exception that I exclude the control used to split the distribution, e.g., in column (1) and (2) I exclude log(Assets) from $\mathbf{X}_{t-1}$, and so on. Standard errors are double-clustered at the bank and time level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 4 presents the results at horizon $h = 12$ months. Banks with size below the median reduce particularly their credit supply. This is in line with Kashyap and Stein (1995), who rationalize the opposite sign response along the size distribution by acknowledging frictions for small banks in raising non-deposit external finance. Column (3) and (4) show that highly leveraged banks have higher balance sheet pressures when inflation rises, forcing them to reduce credit supply relatively more. The model in Section 5 exploits this financial constraint as part of the transmission mechanism. Finally, banks with low deposit reliance (defined as a deposit ratio below the median) drastically cut their lending when inflation increases. This result connects to the aggregate evidence in Section 2.2: while deposits decline after an inflation surprise, banks with weaker deposit franchises are especially vulnerable because they rely more heavily on wholesale funding, which depreciates less relative to their asset side. This perspective helps reconcile the evidence with the argument of Drechsler, Savov, and Schnabl (2021): the stabilizing role of deposits is limited, but when this buffer is thin, inflation translates more directly into credit-supply contractions.

Appendix Table A.2 explores further dimensions of heterogeneity: banks with a higher re-

liance on loans in their asset portfolio and with longer average loan maturities cut lending more sharply, consistent with their greater maturity-gap exposure to inflation. Finally, the effect of inflation on bank credit supply appears broadly symmetric across positive and negative fluctuations.

3.5 Event study: the 2021 inflation surge

The 2021 inflation surge provides a clean setting for an event study, as the spike in CPI was mostly unexpected and policy rates did not rise until the second half of 2022. I exploit this episode to show that more maturity-exposed banks cut lending sharply even before markets anticipated any monetary tightening, confirming the relevance of the credit channel in cleaner and more parsimonious settings.

The surge of inflation in 2021 was largely unforeseen by professional forecasters, with prices increasing by more than 10% within few months and forecasts lagging behind at 3-4%.[41] Furthermore, expectations of an interest-rate hike by the ECB did not materialize until mid-2022 (see Appendix Figure A.10). This ensures that the first year of the inflation spike was not contaminated by actual or expected policy tightening.

I estimate the following event-study regression for the period 2021m1–2022m12:

$$L_{bft} = \sum_{t \neq \text{June 2021}} \beta_t \times \sigma_{b,2020} \times D_t + \gamma \mathbf{X}_{b,t-1} + \alpha_{ft} + \alpha_b + u_{bft}, \tag{6}$$

where $\sigma_{b,2020}$ is the pre-determined maturity gap of bank b, measured as the average between July and December 2020,[42] and D_t are month dummies. The coefficients β_t trace the differential response of more maturity-exposed banks relative to less exposed ones in each month after the shock. Identification is therefore obtained by comparing lending patterns before and after June 2021, within the same firm, across banks with different maturity gaps.

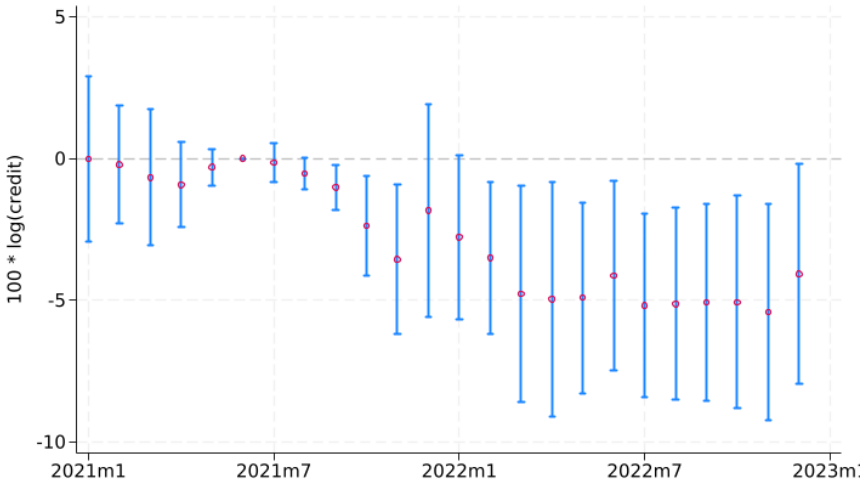
Figure 5 plots the estimated coefficients of the event study around the spike in June 2021.[43] Banks one standard deviation more exposed to inflation reduce their credit supply by about 2 percentage points within six months of the surge, with the effect reaching 5 percentage points at the onset of the tightening cycle (July 2022). The decline is statistically

[41] These dynamics are not new to this episode, as Blanco, Ottonello, and Ranošová (2025) show that large inflation surges are usually unexpected.

[42] I exclude the previous period of 2020 to limit as much as possible the influence of the COVID shock on bank exposure. Results are robust to using alternative time periods.

[43] The results are robust to different starting periods of the inflation spike, from February 2021 to September 2021.

Figure 5: Event study: credit supply during the 2021 inflation surge



Notes: This figure reports the coefficients β_t from the event-study specification in equation (6). The dependent variable is the log-level of long-term credit at the bank–firm level. The sample covers 2021m1–2022m12. $\sigma_{b,2020}$ is the bank average maturity gap measured pre-sample (July–December 2020). Dotted red circles denote point estimates, vertical bars the 90% confidence intervals. Standard errors are clustered at the bank level.

and economically significant, and it arises well before policy rates or expectations adjust, pointing to a direct credit-supply effect of inflation.

Overall, the event study validates the baseline evidence of Section 3.4: inflation erodes bank balance sheets and tightens credit supply. Crucially, this contraction is visible even in the absence of monetary tightening, underscoring that inflation itself operates as a distinct credit-supply shock. This evidence complements also the aggregate results in Section 2.2, showing that the contraction in credit supply following inflation surprises also emerges clearly in a clean, higher-frequency setting.

4 Micro-data: the consequences on borrower firms

This section shows that the contraction in credit supply after an inflation surprise spills over to borrower firms. Firms more exposed to inflation-sensitive banks cannot fully substitute credit from other lenders and cut back investment, with particularly sharp effects for smaller and younger firms. These findings confirm that the credit-supply mechanism can counteract the traditional debt-inflation channel and transmit inflation surprises to real activity.

4.1 Empirical strategy: firms' exposure through their lenders

The aim of this step is to assess how the contraction in bank credit supply transmits to firms. I measure each firm's exposure to inflation through the credit-weighted exposure of its lending banks:

$$\theta_{ft} = \sum_{b \in B_{ft}} w_{bft}\, \sigma_{b,t}, \tag{7}$$

where B_{ft} denotes the set of banks lending to firm f at time t, w_{bft} is the share of bank b in the firm's outstanding credit, and σ_{bt} is the maturity gap of bank b. Because the data are annual, both weights and exposures are averaged within the year.

Firm outcomes are modeled as

$$\frac{Y_{f,t+h} - Y_{f,t-1}}{\text{Assets}_{f,t-1}} = \beta \left[\pi_t^{\perp} \times \theta_{f,t-1}\right] + \gamma' \mathbf{X}_{f,t-1} + \hat{\alpha}_{ft} + \alpha_{g(f),t} + u_{f,t}, \tag{8}$$

where $Y_{f,t}$ is either total credit or investment.[44] The key regressor is the interaction between a measure of Portuguese inflation and lagged firm exposure $\theta_{f,t-1}$. In the baseline, I use the idiosyncratic inflation $\pi^{\perp}$, as in Section 3, while robustness exercises show the results using the inflation surprise ε_t^{π} (constructed from OECD forecasts, see Section 2), given the annual frequency of firms' balance sheet data. The coefficient β measures whether firms borrowing from more maturity-exposed banks perform worse after an increase in inflation.

The identification builds on the bank–firm regression in Equation (4). At that level, firm–time fixed effects α_{ft} absorb firm-specific credit demand shocks. Aggregating to the firm level introduces a challenge: if bank exposures $\sigma_{b,t}$ correlate with the firm–time shock α_{ft}, then the portfolio measure $\theta_{f,t}$ is also correlated with it. In addition, the firm-level specification cannot include firm-time fixed effects to absorb the firm-specific shocks. To address this, I follow Cingano, Manaresi, and Sette (2016), Jiménez, Mian, et al. (2020), and Pinardon-Touati (2024), and use as control $\hat{\alpha}_{ft}$, the estimated firm–time fixed effect from the bank–firm regression (4).[45] This control captures the firm-specific component of credit demand, ensuring that identification of β inherits from the bank–firm level strategy

[44] Investment is defined as the change in tangible and intangible capital plus depreciation. Credit is measured as total bank credit, matched from the credit registry. At the firm level, I express outcomes such as investment and profits as changes relative to lagged total assets, $\frac{Y_{f,t+h}-Y_{f,t-1}}{\text{Asset}_{f,t-1}}$. This scaling follows the standard approach, as in Gomez et al. (2021), and allows comparing firms of different sizes.

[45] Because I use lagged exposure $\theta_{f,t-1}$, I also use the lagged estimated fixed effect from regression (4) at horizon $h = 12$. Results are robust also estimating $\hat{\alpha}_{ft}$ directly from a regression of L_{bft} on firm-time and bank-time fixed effects only, as in Pinardon-Touati (2024), and averaging it within the calendar year.

in Section 3.3.

$\alpha_{g(f),t}$ are firm fixed effects and sector–municipality–year fixed effects that absorb local and sectoral shocks. As a consequence, I only compare firms in the same municipality-sector-year cell. These firms are therefore subject to the same common shocks, but differ in their exposure to inflation because they borrow from different sets of banks. The vector $\mathbf{X}_{f,t-1}$ includes lagged firm-level controls: (i) log assets and firm age; (ii) leverage (debt-to-assets ratio), to account for the direct debt-inflation channel; (iii) turnover growth scaled by assets and return on assets (ROA), as proxies for demand conditions; (iv) capital intensity; (v) liquidity (cash and short-term assets relative to total assets); (vi) collateral capacity (tangible assets over total assets); and (vii) an export dummy.

A negative β implies that credit constraints at more maturity-exposed banks are transmitted to their borrowing firms, reducing firms' real activity after an inflation surprise.

4.2 Results: borrower firms cut back on investment

The response of firms' total credit Table 5 shows the estimated results of equation (8) on firm's total credit. Panel A reports the average effects. The results across all specifications indicate that firms borrowing from more exposed banks reduce credit after an increase in local inflation. After 1 year from a 1 p.p. increase in inflation, firms see their total credit reduced by $0.15 \times 6.04 = 0.9$ percentage points of assets, a decline of roughly 1.5%, close to the estimates in the loan-level regression. This fact highlights how firms cannot easily substitute their main lenders and are affected by shocks to banks' balance sheets.

The average response may mask significant heterogeneity. In Panel B, I explore ex-ante heterogeneity that reveals where the transmission mechanism of the credit channel of inflation concentrates. The negative effect on credit is sizable and precisely estimated in groups with tighter financing needs, e.g., (i) smaller firms and (ii) younger firms. These are firms with more difficulties in accessing other financing instruments, thus struggling to substitute the reduced credit provision by banks. On the other hand, highly leveraged firms and firms that rely on short-term financing face better credit conditions: leveraged firms benefit from a lower real debt burden, they appear as safer borrowers, and banks are more willing to roll over or even increase lending to them; short-term credit-reliant firms benefit from the fact that more maturity-exposed banks are incentivized to reduce loan maturity to hedge against inflation.[46] Together, these dynamics create a clear picture of where the credit reduction hits: while some firms see their credit contract sharply due to exposure of their lenders,

[46] This mechanism is in line with predictions in the bank model of Agarwal and Baron (2024).

others experience offsetting gains that dilute the mean effect. The heterogeneity thus helps reconcile the credit supply channel of inflation from banks to firm-level credit rationing.

Table 5: Effect of inflation on firms' total credit

Panel A: Benchmark: average effect

	$\frac{\text{Credit}_{f,t+h}-\text{Credit}_{f,t-1}}{\text{Assets}_{f,t-1}}$			
	$h=0$			$h=1$
	(1)	(2)	(3)	(4)
Inflation $\times$ $\theta_{f,t-1}$	-0.1016***	-0.0723***	-0.0762***	-0.1551***
	(0.0083)	(0.0173)	(0.0180)	(0.0270)
Firm FE	No	No	Yes	Yes
Sector-Municipality-Year FE	Yes	Yes	Yes	Yes
Firm Demand	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
N	1,766,226	358,565	338,049	278,872
R sq.	0.08	0.17	0.50	0.65

Panel B: Heterogeneity: effects by firm characteristics

	$\frac{\text{Credit}_{f,t+1}-\text{Credit}_{f,t-1}}{\text{Assets}_{f,t-1}}$							
	Large	Small	Lev.	Non-Lev.	Short	Long	Young	Old
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflation $\times$ $\theta_{f,t-1}$	-0.0699***	-0.2925***	0.2019***	-0.0317	0.0634**	-0.0275	-0.2429***	-0.0106
	(0.0180)	(0.0623)	(0.0266)	(0.0196)	(0.0322)	(0.0214)	(0.0697)	(0.0164)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Municipality-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Demand	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	164,484	78,922	104,989	126,532	63,094	168,735	41,223	203,291
R sq.	0.68	0.75	0.76	0.68	0.73	0.71	0.83	0.66

Notes: This table reports the results of estimating specification (8) with the dependent variable equal to the annual change in firms' bank credit scaled by lagged assets. The key explanatory variable is the interaction between the idiosyncratic Portuguese inflation $\pi_t^{\perp}$ and the firm's loan-weighted exposure to banks' maturity gaps $\theta_{f,t-1}$. Panel A shows the benchmark estimates of the average effect. Panel B allows for heterogeneity by splitting firms' sample by the relevant distribution at horizon $h = 1$ year. Size (Large/Small) is measured above/below the 75th percentile of the asset distribution. Leverage (Lev./Non-Lev.) is measured above/below the 75th percentile of the Loan/Asset ratio distribution. Maturity structure of borrowing (Short/Long) is measured above/below the median of the Short-Loan/Asset distribution. Age (Young/Old) is measured below/above 8 years since the foundation – this is done to keep the sample balanced. Controls include lagged firm-level covariates (log assets, age, leverage, turnover growth, return on assets, capital intensity, liquidity, collateral ratio, export dummy), excluding one-by-one the covariate used to split the sample, and the lagged firm–time demand component $\hat{\alpha}_{ft}$. All regressions include firm fixed effects and sector–municipality–year fixed effects. Standard errors are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The response of firms' investment Table 6 reports the estimated effects on firms' investment. Panel A shows that, on average, investment declines significantly for firms borrowing from more inflation-exposed banks. Notice that the coefficient is initially positive when credit demand is not controlled for by $\hat{\alpha}_{ft}$, in line with a debt-inflation intuition. I formalize this opposing forces in the credit market in the model in Section 5, which highlight the importance of controlling for credit demand when assessing the effects of the credit channel of inflaton. Overall, after a 1 p.p. increase in local inflation, a firm one standard deviation more exposed through its banks reduces investment by about $0.04 \times 6.04 = 0.24$ percentage points of assets within 1 year. Relative to an average investment rate of 8% in the sample, this corresponds to a decline of about 3%, comparable to the effects of a 50 basis point monetary policy shock (Ottonello and Winberry, 2020). This results confirms that the contraction in bank credit supply translates into lower real investment at the firm level.

Panel B highlights the heterogeneity behind these results. The negative effect is strongest for firms that rely on banks to finance investment: those borrowing primarily through long-term credit—consistent with theoretical insights (Gomes, Jermann, and Schmid, 2016)—and young firms, which face limited access to financial markets.[47] For leveraged firms, the pattern is different. Although they do not reduce borrowing when attached to maturity-exposed banks – consistent with a debt-inflation mechanism – they still cut investment. This suggests that credit flows to leveraged firms are redirected toward rollover rather than new capital expenditures. The evidence underscores that the credit channel of inflation operates not only through the volume of credit but also through its allocation to productive investment.

In Appendix E, I confirm the results above for credit and investment (Table D.1 and D.2) using as regressor the inflation surprise ε_t^π, rather then realized idiosyncratic. Then I present additional evidence that firms borrowing from maturity-exposed banks experience weaker fundamentals after an inflation surprise, facing higher interest expenses (Table D.3), lower revenues (Table D.4), and reduced profits (Table D.5). Moreover, the adverse effect on investment remains strong when focusing only on tangible investment (Table D.6).

Taken together, the firm-level evidence shows that inflation-induced credit supply shocks do not stop at the balance sheets of banks but propagate to the real economy by curtailing firms' borrowing and investment. The transmission is highly heterogeneous: while some borrowers manage to offset tighter bank lending, smaller, younger, and more bank-dependent firms face sharp investment cuts. These findings provide the motivation for the theoretical model that formalizes the credit channel of inflation in the next section.

[47] Young firms often drive innovation, so credit rationing via inflation could carry broader welfare consequences (Kim, 2025).

Table 6: Effect of inflation on firms' investment

Panel A: Benchmark: average effect

	$\frac{\text{Investment}_{f,t+h}-\text{Investment}_{f,t-1}}{\text{Assets}_{f,t-1}}$			
	$h=0$			$h=1$
	(1)	(2)	(3)	(4)
Inflation × $\theta_{f,t-1}$	0.0094**	-0.0060	-0.0219**	-0.0420***
	(0.0045)	(0.0079)	(0.0091)	(0.0106)
Firm FE	No	No	Yes	Yes
Sector-Municipality-Year FE	Yes	Yes	Yes	Yes
Firm Demand	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
N	1,397,137	332,212	312,166	256,843
R sq.	0.06	0.13	0.33	0.40

Panel B: Heterogeneity: effects by firm characteristics

	$\frac{\text{Investment}_{f,t+1}-\text{Investment}_{f,t-1}}{\text{Assets}_{f,t-1}}$							
	Large	Small	Lev.	Non-Lev.	Short	Long	Young	Old
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflation × $\theta_{f,t-1}$	-0.0122	-0.0114	-0.0382***	-0.0286***	-0.0172	-0.0226**	-0.0686**	-0.0113
	(0.0080)	(0.0311)	(0.0122)	(0.0104)	(0.0108)	(0.0104)	(0.0349)	(0.0073)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Municipality-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Demand	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	157,320	66,464	95,935	116,627	58,112	155,099	36,194	188,562
R sq.	0.42	0.55	0.50	0.50	0.54	0.46	0.61	0.41

Notes: This table reports the results of estimating specification (8) with the dependent variable equal to the annual change in firms' investment (Capital expenditure) scaled by lagged assets. The key explanatory variable is the interaction between the Portuguese inflation surprise $\pi_t^{\perp}$ and the firm's loan-weighted exposure to banks' maturity gaps $\theta_{f,t-1}$. Panel A shows the benchmark estimates of the average effect. Panel B allows for heterogeneity by splitting firms' sample by the relevant distribution. Size (Large/Small) is measured above/below the 75th percentile of the asset distribution. Leverage (Lev./Non-Lev.) is measured above/below the 75th percentile of the Loan/Asset ratio distribution. Maturity structure of borrowing (Short/Long) is measured above/below the median of the Short-Loan/Asset distribution. Age (Young/Old) is measured below/above 8 years since the foundation – this is done to keep the sample balanced. Controls include lagged firm-level covariates (log assets, age, leverage, turnover growth, return on assets, capital intensity, liquidity, collateral ratio, export dummy), excluding one-by-one the covariate used to split the sample, and the lagged firm–time demand component $\hat{\alpha}_{ft}$. All regressions include firm fixed effects and sector–municipality–year fixed effects. Standard errors are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

5 A stylized model of inflation in the credit market

To rationalize the findings in Section 3 and 4, I develop a stylized model in which inflation surprises generate opposing forces in credit markets. Here, inflation surprises reduce the real burden of firms' nominal long-term debt while simultaneously eroding the real value of banks' long-term assets. As a result, firms would like to increase leverage and credit demand, but banks – financing long-term loans with short-term liabilities – face tighter capital constraints because they need to rollover their short-term debt at higher price, hence reducing credit supply. The model underscores the importance of controlling for credit demand in the empirical analysis of Sections 3 and 4, and formalizes the intuition that, even with flexible prices, inflation can affect credit supply and real activity when banks are exposed to a maturity mismatch in their balance sheets.

The framework builds on Kang and Pflueger (2015), who study firms with long-term nominal debt in an overlapping-generations environment that captures infrequent refinancing under flexible prices. In their setup, higher inflation lowers default risk and raises optimal leverage. I add a parsimonious bank block with a binding capital (leverage) constraint and costly external financing to show how inflation can contract credit supply and limit firms' effective leverage. In this literature, Agarwal and Baron (2024) develop a static partial equilibrium model to study how inflation affects banks. I extend this perspective, using a dynamic model and by emphasizing the interaction between bank balance sheets and credit demand from firms, which is essential to fully capture the impact of inflation on credit dynamics. In contrast, Corhay and Tong (2025) propose a full New Keynesian model with a banking sector, where inflation driven by monetary policy shocks constrains credit supply. My model is deliberately simpler and does not require that banks are subject to liquidity shocks. It highlights that the contractionary effect of inflation on credit supply is not necessarily tied to monetary policy and can arise even in flexible-price environments, isolating the mechanism underlying the *credit channel of inflation*.

5.1 Firm problem

In this subsection, I simply sketch the firm problem, describing the timing and main objects. I defer the overall derivation and discussion of the firm block in Appendix F, while focusing on the bank block in the next subsection.

A. Firm timeline

Figure 6: Timeline of firm i in cohort t

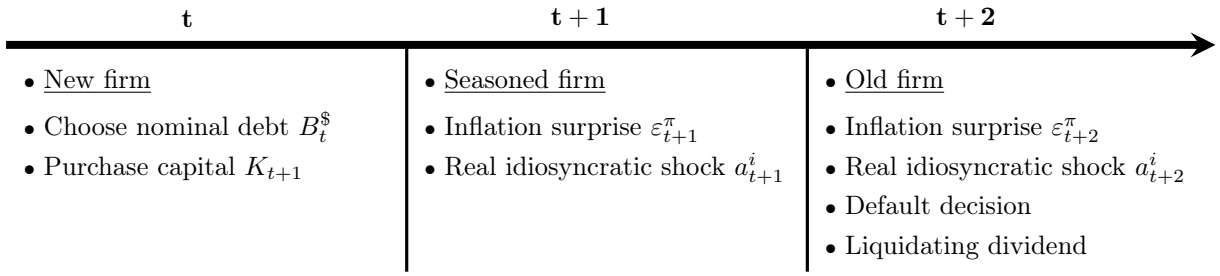


Figure 6 illustrates the timing for a firm that enters at the end of period t and produces for two periods. At the end of period t, the firm chooses the face value of nominal two-period debt $B_t^{\$}$ provided by the bank and purchases capital K_{t+1}, which becomes available for production at time $t+1$. The firm's corporate debt then has two periods remaining until maturity.

In period $t+1$, an aggregate inflation shock realizes, the firm experiences an idiosyncratic shock to its capital stock, and it produces. The firm cannot modify its capital structure, so leverage is sticky. The firm's seasoned corporate debt has one period remaining until maturity.

In period $t+2$, the firm again receives shocks and produces. At the end of period $t+2$, equity holders decide whether to default. Equity and debt holders then receive payments.

B. Inflation, stochastic discount factor and prices of loans

Let P_t denote the price level at time t and π_t the log-inflation from $t-1$ to t, $\pi_t = \log(P_t/P_{t-1})$. Consistent with Stock and Watson (2007), I let log inflation follow a random walk.

$$\begin{aligned} \pi_{t+1} &= \pi_t + \varepsilon_{t+1}^{\pi}, \\ \mathbb{E}_t[\pi_{t+1}] &= \pi_t. \end{aligned} \tag{9}$$

The two-period stochastic discount factors for pricing two-period real and nominal payoffs are, respectively,[48]

$$M_{t,t+2}\,, \quad M_{t,t+2}^{\$} = \frac{M_{t,t+2}}{\exp(\pi_{t+2} + \pi_{t+1})} = \frac{M_{t,t+2}}{\exp(2\pi_t + 2\varepsilon_{t+1}^{\pi} + \varepsilon_{t+2}^{\pi})}. \tag{10}$$

[48] As in Kang and Pflueger (2015), I can explicitly model the SDF using a representative consumer with

The price for a new corporate loan q_t^{new}, issued at time t with no partial repayment at $t+1$ and full repayment at $t+2$, is derived as the present value of the expected repayment, weighted by the probability of not defaulting in $t+2$. This is presented in Equation (29) in Appendix F. There, I formally derive the following prediction:

Prediction 1. After a positive inflation shock, firms increase their credit demand.

A positive inflation shock ε_{t+1}^{π} affects the first-order condition for firm leverage (32) through the default threshold a_{t+2}^{*}: higher inflation lowers the probability of default, so the marginal benefit of debt increases. Firms therefore wish to raise leverage (i.e., issue more debt) after a positive inflation shock. This implication motivates the need in the empirical analysis of Section 3 and 4 to control for credit demand when assessing the impact of inflation on credit supply.

5.2 Bank problem

In this subsection, I show how banks with a positive maturity gap—financing long-term nominal loans through short-term liabilities—and a leverage constraint reduce credit supply after an inflation shock ε_{t+1}^{π}. This ultimately implies that firms end up with a suboptimal level of debt after the inflation shock.

A. Bank timeline and environment

A representative, competitive bank intermediates between international capital markets and firms. At each period t, it (i) grants two-period nominal loans to the new cohort with face value $B_t^{\$}$ at price $q_t^{\text{corp,new}}$, and (ii) raises short-term one-period nominal funding L_t at price $q_t^D = \mathbb{E}_t[M_{t,t+1}^{\$}]$ from international markets. Assets and liabilities are carried at face value; the bank receives cash funding $D_t = q_t^D L_t$ from its liabilities L_t. Balance-sheet items are recorded in real units by dividing by the price level P_t. The bank is price taking, distributes zero dividends in equilibrium, and is subject to a leverage constraint.

At $t+1$, the inflation shock ε_{t+1}^{π} realizes. The bank then repays L_t and rolls it over, adjusts its funding mix with costly external equity financing, and—before granting new two-period

expected power utility over consumption, risk aversion γ, and discount rate β,

$$U_t = \mathbb{E}_t \sum_{s=t}^{\infty} \exp(\beta(s-t)) \frac{C_s^{1-\gamma}}{1-\gamma}.$$

Then, the SDF is $M_{t,t+2} = \exp(-2\beta)(C_{t+2}/C_t)^{-\gamma}$.

loans $B^{\$}_{t+1}$ to cohort $t+1$—faces again the leverage constraint.

B. Credit provision

At the beginning of period t, the bank is endowed with (real) equity E_t. It lends a nominal fixed-rate two-period loan $B^{\$}_t$ to firms, which will repay $B^{\$}_t/q^{new}_t$ in $t+2$, with no partial repayments in $t+1$,[49] and raises the remaining funds via international markets as one-period short-term debt with face value L_t—to be repaid in $t+1$—hence receiving cash $D_t = q^D_t L_t$ in period t. The balance-sheet identity, evaluated in nominal terms, is $B^{\$}_t = \underbrace{E^{nom}_t}_{=P_t E_t} + L_t$.

As in Iacoviello (2015), I assume that the bank is constrained in its ability to issue new loans by the amount of equity: $E^{nom}_t \geq \gamma B^{\$}_t$ with $\gamma \in (0,1)$. This constraint on the capital ratio can be motivated by standard limited-commitment problems or by regulatory concerns. Under competitive equilibrium, the capital ratio binds

$$\gamma B^{\$}_t = E^{nom}_t \implies L_t = (1-\gamma) B^{\$}_t \tag{11}$$

Notice that, in equilibrium at t, the change in credit supplied by the bank is proportional to its change in equity, i.e., $\Delta \text{Credit}_{t+1} \propto \Delta E_{t+1}$, yielding a *quantity cap* on new lending. No residual cash is carried over to $t+1$.

In $t+1$, the new price level P_{t+1} realizes, together with the inflation shock ε^{π}_{t+1}. No cash flow enters from the loan, while the one-period debt L_t is to be repaid. To do so, the bank rolls it over by raising new short-term debt L^{roll}_{t+1} at the new price $q^D_{t+1} = \mathbb{E}_t[M^{\$}_{t+1,t+2}]$, which needs to be repaid in $t+2$. By (11), the bank effectively borrows $L^{roll}_{t+1} = (1-\gamma)B^{\$}_t/q^D_{t+1}$ to roll over the initial short-term debt. Before any new lending and funding decision, at the beginning of $t+1$, real equity is therefore evaluated at the new price level as follows

$$E^{pre}_{t+1} = \frac{B^{\$}_t}{P_{t+1}} - \frac{L^{roll}_{t+1}}{P_{t+1}} = \frac{B^{\$}_t}{P_{t+1}}\left(1 - \frac{1-\gamma}{q^D_{t+1}}\right) \tag{12}$$

This is the core maturity-gap object: while long-term assets are nominally fixed and do not reprice in $t+1$, short-term liabilities are rolled over and embed the new price level through q^D_{t+1}.

C. Credit provision at $t+1$ and funding mix

[49] This formulation without partial repayments is due to the *sticky leverage* of firms, which allows having firms defaulting only in $t+2$.

During $t+1$, the bank lends a new two-period loan $B^{\$}_{t+1}$ to the $t+1$ cohort of new firms. It finances the loan through a mix of new external equity and short-term debt financing, since no internal financing is available from period t.[50] Define the debt share of the new lending as

$$\theta \equiv \frac{q^D_{t+1} L^{new}_{t+1}}{B^{\$}_{t+1}} \in [0,1] \implies L^{new}_{t+1} = \frac{\theta}{q^D_{t+1}} B^{\$}_{t+1} \tag{13}$$

Resources raised by new equity financing, used for new lending, is therefore $X_{t+1} = (1-\theta)B^{\$}_{t+1}$. However, external equity financing is particularly costly for the bank. Let $\bar{E}$ denote *gross* external equity issued at t+1. Only a fraction $1-\rho$ arrives as deployable cash, i.e., $X_{t+1} = (1-\rho)\,\bar{E}$ with $\rho \in (0,1)$, where $\bar{E}$ represents a clear supply capacity, i.e. the bank cannot issue more new external equity financincg than $\bar{E}$.

After choosing the new lending and new funding, equity evolves as[51]

$$E^{post}_{t+1} = E^{pre}_{t+1} + \frac{B^{\$}_{t+1}}{P_{t+1}} - \frac{L^{new}_{t+1}}{P_{t+1}} \tag{14}$$

with the new capital constraint on total assets, binding in equilibrium:

$$E^{post}_{t+1} = \gamma\Big(\frac{B^{\$}_{t}}{P_{t+1}} + \frac{B^{\$}_{t+1}}{P_{t+1}}\Big). \tag{15}$$

Substitute (12) and (13) into (14), and impose (15). Rearranging terms by $(B^{\$}_t, B^{\$}_{t+1})$ yields

$$\Big[(1-\gamma) - \frac{\theta}{q^D_{t+1}}\Big] B^{\$}_{t+1} \;=\; (1-\gamma)\,\frac{1-q^D_{t+1}}{q^D_{t+1}}\,B^{\$}_t. \tag{16}$$

Since $B^{\$}_t \geq 0$ and $\frac{1-q^D_{t+1}}{q^D_{t+1}} \geq 0$ for $q^D_{t+1} \in (0,1]$, the right-hand side is nonnegative. Feasibility requires $B^{\$}_{t+1} \geq 0$, which in turn implies that the bracket on the left-hand side must be nonnegative, i.e., $\theta \;\leq\; q^D_{t+1}(1-\gamma)$. Therefore the *maximal feasible debt share* at t+1 is $\theta^{\max}(q^D_{t+1}) \equiv q^D_{t+1}(1-\gamma)$, and the corresponding *minimal equity share* per unit of new lending is

$$s_{\min}(q^D_{t+1}) \;\equiv\; 1 - \theta^{\max}(q^D_{t+1}) \;=\; 1 - q^D_{t+1}(1-\gamma) \;\in (0,1) \tag{17}$$

Intuitively, after the rollover tightens the bank's balance-sheet position, a fraction $s_{\min}$ of every euro of new loans must be financed with equity to satisfy the new capital constraint. To

[50] This is due to the absence of partial repayment of $B^{\$}_t$ and zero profits of the competitive bank.

[51] Notice that the book equity increment $B^{\$}_{t+1} - L^{new}_{t+1} = \big(1 - \frac{\theta}{q^D_{t+1}}\big)B^{\$}_{t+1}$ is generally different from the resources raised through equity $X_{t+1} = (1-\theta)B^{\$}_{t+1}$. Only when $q^D_{t+1} = 1$ (par funding) and $\rho = 0$ (no wedge) do they coincide.

maximize feasible lending at $t{+}1$ for given (q^D_{t+1}, γ), the bank chooses the most debt-intensive feasible mix, $\theta = \theta^{\max}$, so that equity use per unit is minimized:

$$X_{t+1} \;=\; s_{\min}(q^D_{t+1})\, B^{\$}_{t+1} \tag{18}$$

Using the wedge $X_{t+1} = (1-\theta)B^{\$}_{t+1}$, and allowing at most $\bar{E}$ of gross issuance, we get $s_{\min}(q^D_{t+1})\, B^{\$}_{t+1} \;\le\; (1-\rho)\,\bar{E}$, so that the new lending supply at $t{+}1$ is

$$B^{\$}_{t+1} \;=\; \frac{(1-\rho)\,\bar{E}}{s_{\min}(q^D_{t+1})} \;=\; \frac{(1-\rho)\,\bar{E}}{1-q^D_{t+1}(1-\gamma)}\,. \tag{19}$$

Notice that the price level P_{t+1} drops out of (19) and the maturity-mismatch transmission at $t{+}1$ operates entirely through q^D_{t+1} (liability repricing and rollover), not through pure price-level scaling or net nominal position.[52]

D. Inflation, maturity gap, and credit supply

In this paragraph, I show that, when a bank has a maturity gap, the period t short-term liability *rolls* at $t{+}1$ into the new price q^D_{t+1}. Hence, an inflation surprise lowers q^D_{t+1} and tightens new credit supply.

First, notice that $\frac{\partial q^D_{t+1}}{\partial \varepsilon^{\pi}_{t+1}} \;<\; 0$: an inflation shock decreases the price of short-term debt (raises short-term funding interest rates) because, intuitively, it is inversely related to the nominal discount factor, i.e., $q^D_{t+1} = \mathbb{E}_{t+1}[M^{\$}_{t+1,t+2}] = \mathbb{E}_{t+1}\big[\frac{M_{t+1,t+2}}{\exp(\pi_{t+2})}\big] = \mathbb{E}_{t+1}\big[\frac{M_{t+1,t+2}}{\exp(\pi_t+\varepsilon^{\pi}_{t+1}+\varepsilon^{\pi}_{t+2})}\big]$.

The next proposition shows that an inflation shock that decreases the price of short-term debt pushes the bank to contract credit supply.

Proposition 1 (Inflation shock constrains credit supply)**.** *After an inflation shock ε^{π}_{t+1} that raises the price level P_{t+1} and satisfies $\frac{\partial q^D_{t+1}}{\partial \varepsilon^{\pi}_{t+1}} \;<\; 0$, the change in new lending at $t{+}1$ is negative:*

$$\frac{\partial B^{\$}_{t+1}}{\partial \varepsilon^{\pi}_{t+1}} < 0$$

Proof. From (19), $B^{\$}_{t+1} = \frac{(1-\rho)\,\bar{E}}{1-q^D_{t+1}(1-\gamma)}$. Differentiate with respect to $q \equiv q^D_{t+1}$:

$$\frac{\partial B^{\$}_{t+1}}{\partial q} \;=\; (1-\rho)\,\bar{E} \;\cdot\; \frac{1-\gamma}{[1-q(1-\gamma)]^2} \;>\; 0.$$

[52] In this baseline case, there is no internal financing for the bank in $t{+}1$, so external issuance is the only source for X_{t+1}. If one allowed retained earnings or a carried buffer, this would simply add to the numerator, leaving intact the main intuition.

Therefore, an inflation shock that *lowers* q^D_{t+1} implies $\frac{\partial B^{\$}_{t+1}}{\partial \varepsilon^{\pi}_{t+1}} < 0$. □

The mechanism is transparent: inflation forces short-term liability rollover at a worse price for the bank ($q^D_{t+1} \downarrow$), which raises the minimal equity share $s_{\min} = 1 - q^D_{t+1}(1-\gamma)$ required by the capital constraint; with costly equity, each euro of issuance yields only $1-\rho$ euros of usable cash, so lending capacity contracts.

Now, I compare the effects of an inflation shock on a *maturity-mismatched* bank ("MM"; two-period loan; one-period funding rolled at t+1) and a *non-mismatched* bank ("NM"; one-period loan; one-period funding repaid at t+1), under the same costly external equity wedge $1-\rho$ and the same equity issuance capacity $\bar{E}$. With a gross issuance capacity $\bar{E}$ and wedge $1-\rho$, the new lending capacities are

$$B^{\$,\,\mathrm{MM}}_{t+1} \;=\; \frac{(1-\rho)\,\bar{E}}{s_{\min}(q)}, \qquad B^{\$,\,\mathrm{NM}}_{t+1} \;=\; \frac{X^{\mathrm{int}}_{t+1} + (1-\rho)\,\bar{E}}{s_{\min}(q)} \tag{20}$$

where $s_{\min} = 1 - q^D_{t+1}(1-\gamma)$ and, in the non-mismatched case, the period t-position produces internal financing at t+1,

$$X^{\mathrm{int}}_{t+1} \;=\; \Big(\frac{1}{q^{\mathrm{new}}_t} - (1-\gamma)\Big) B^{\$}_t, \tag{21}$$

because both the loan the debt are repaid after one period, in $t+1$. Notice that the internal financing does not depend on $q \equiv q^D_{t+1}$, as it is fixed at origination in t.
Let $\bar{E} = \bar{E}\big(E^{pre}_{t+1}\big)$ with $\partial\bar{E}/\partial E^{pre} \geq 0$, capturing that a stronger pre-lending equity position relaxes market access for additional equity financing. From (12), the equity positions before lending in $t+1$ are

$$E^{pre,\,\mathrm{MM}}_{t+1} = \frac{B^{\$}_t}{P_{t+1}}\Big(1 - \frac{1-\gamma}{q}\Big), \qquad E^{pre,\,\mathrm{NM}}_{t+1} = \frac{B^{\$}_t}{P_{t+1}}\Big(\frac{1}{q^{\mathrm{new}}_t} - (1-\gamma)\Big), \tag{22}$$

so only the mismatched case has *direct* q-sensitivity in E^{pre}.

Proposition 2 (Milder credit contraction without maturity mismatch)**.** *Suppose* $\bar{E} = \bar{E}\big(E^{pre}_{t+1}\big)$ *with* $\partial\bar{E}/\partial E^{pre} > 0$*, and let* $B^{\$,\,\mathrm{MM}}_{t+1}$ *and* $B^{\$,\,\mathrm{NM}}_{t+1}$ *be given by* (20)*. After an inflation shock* ε^{π}_{t+1} *that raises the price level* P_{t+1} *and satisfies* $\frac{\partial q^D_{t+1}}{\partial \varepsilon^{\pi}_{t+1}} < 0$*, the change in new lending at* t+1 *is more negative for the mismatched bank than for the non-mismatched bank:*

$$\frac{\partial B^{\$,\,\mathrm{MM}}_{t+1}}{\partial \varepsilon^{\pi}_{t+1}} \;<\; \frac{\partial B^{\$,\,\mathrm{NM}}_{t+1}}{\partial \varepsilon^{\pi}_{t+1}},$$

Proof. See Appendix F.3. □

In the mismatched case, the period-t short-term liability rolls at $t{+}1$ into the new price q^D_{t+1}, so an inflation surprise that lowers q^D_{t+1} tightens two margins at once: (i) it raises the minimal equity share $s_{\min} = 1 - q(1-\gamma)$ required by the capital constraint (so every euro of new lending needs more equity financing), and simultaneously (ii) it erodes pre-new lending equity E^{pre} via rollover, which contracts external equity issuance capacity $\bar{E}$ when market access is linked to the bank's net worth. The non-mismatched bank, by contrast, has no need to rollover debt at $t{+}1$: both asset and liability positions settle and even generate internal cash, so the inflation surprise affects it only by raising $s_{\min}$; it does *not* worsen $\bar{E}$ through a contemporaneous hit to E^{pre}_{t+1} via higher q^D_{t+1}. Hence, the credit contraction is milder without maturity mismatch.

Overall, the model rationalizes the main intuition of the credit channel of inflation: while inflation reduces firms' real debt burden and stimulates credit demand, it simultaneously weakens banks' balance sheets, leading them to restrict lending and constrain firm investment.

6 Conclusion

This paper shows that inflation can operate through a *credit channel*. When prices spike, banks with a maturity gap suffer equity losses and tighter capital constraints. They curtail lending, and firms borrowing from these banks reduce investment. In macro data for advanced economies, a 1 p.p. inflation surprise is followed by a contraction in loans and bank capital of about 3%, even in the absence of monetary policy moves. In micro data from Portugal, more exposed banks supply less credit, consistent with evidence during the 2021 inflation surge. At the firm level, this has real effects, forcing firms to cut their investment rate. These findings highlight a new cost of inflation: it reallocates and compresses credit through banks, offsetting the debt–inflation relief for borrowers and dampening real activity.

This channel has several implications. First, assessments of inflation shocks should account for bank capital and maturity-transformation exposures. Macroprudential buffers and banks' funding structure shape the strength of the channel and therefore the transmission of inflation to the real economy. Moreover, the heterogeneity of the effects – stronger for younger, bank-dependent firms – points to distributional and welfare consequences beyond aggregates. Taken together, this paper shows that controlling inflation is also a financial-stability policy: the consequences of inflation for the macroeconomy can crucially depend on the health of financial intermediaries.

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Appendix for "The Credit Channel of Inflation"

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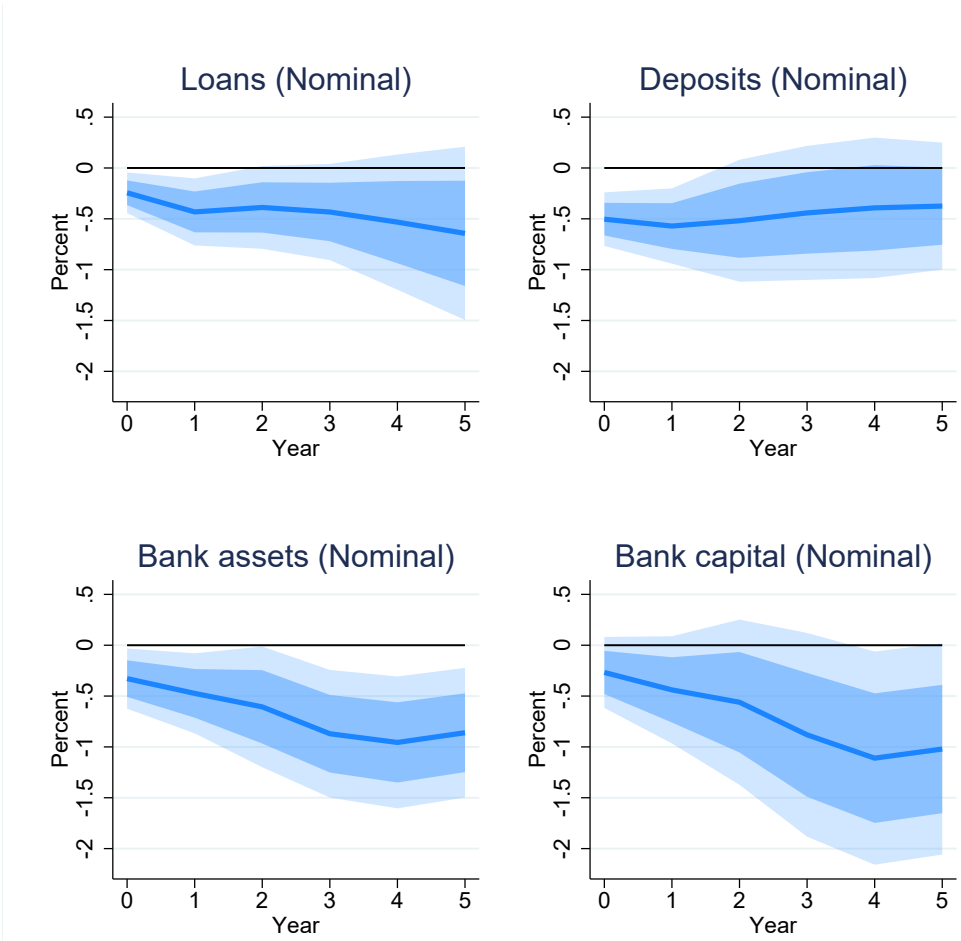
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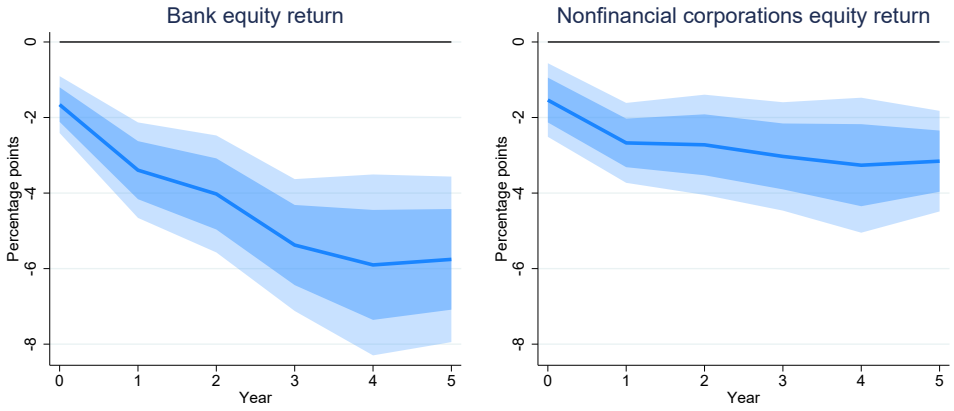
A.1 Figures

Figure A.1: Response of *nominal* bank balance sheet items to inflation surprises, 1946-2020



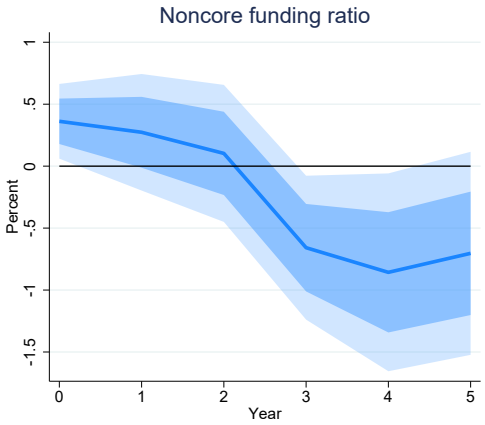
Notes: Impulse responses for aggregate loans, deposits, bank capital and cumulative equity returns on inflation surprises, estimated with panel-LP as in eq. (1). 1946-2020, annual frequency, 18 countries. All variables are expressed in nominal terms. Driscoll and Kraay (1998) standard errors. Bands are at the 68% and 90% confidence level.

Figure A.2: Response of equity returns to inflation surprises, 1946-2020



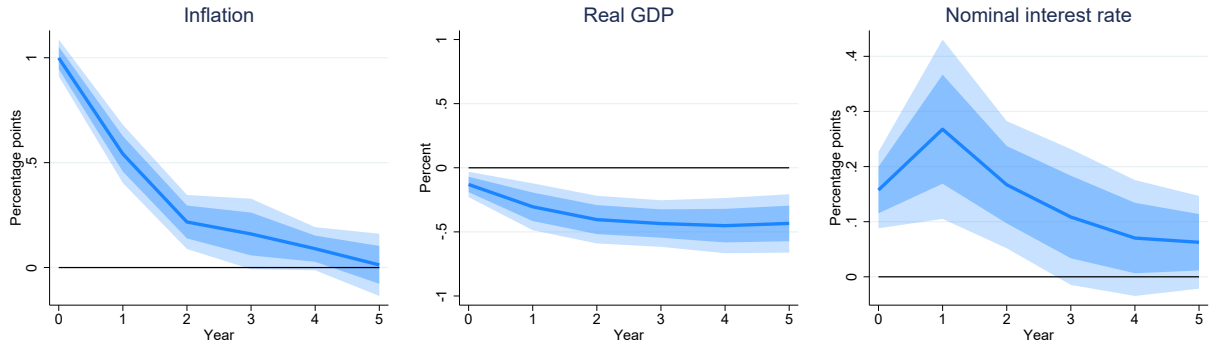
Notes: Impulse responses for banks' and non-financial corporations' cumulative real equity returns on inflation surprises, estimated with panel-LP as in eq. (1). 1946-2020, annual frequency, 18 countries. Driscoll and Kraay (1998) standard errors. Bands are at the 68% and 90% confidence level.

Figure A.3: Response of non-core funding to inflation surprises, 1946-2020



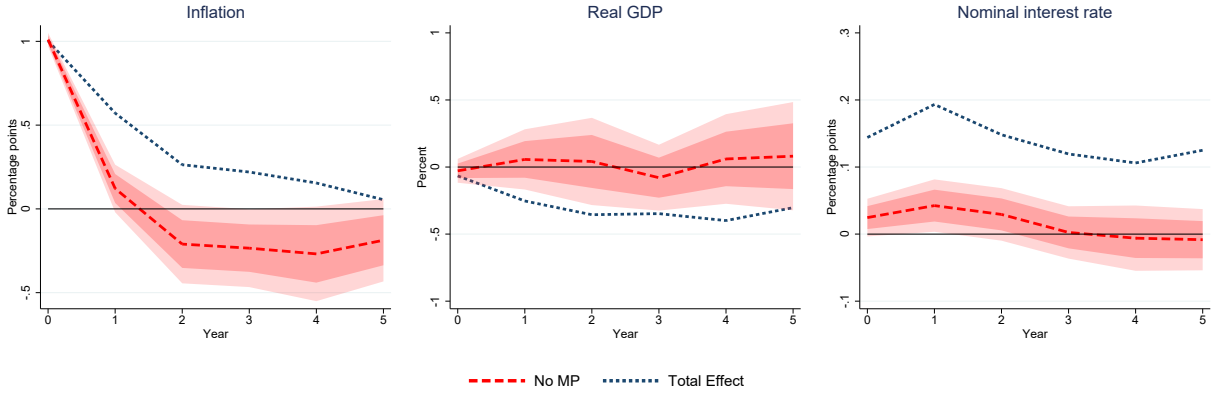
Notes: Impulse responses of banks' non-core funding ratio on inflation surprises, estimated with panel-LP as in eq. (1). 1946-2020, annual frequency, 18 countries. Non-core funding ratio is defined as $\frac{\text{Non-core}_{it}}{\text{Non-core}_{it}+\text{Deposits}_{it}}$, where Non-core_{it} includes wholesale funding and interbank lending. Driscoll and Kraay (1998) standard errors. Bands are at the 68% and 90% confidence level.

Figure A.4: Effect of inflation surprises on the macroeconomy, 1946-2020



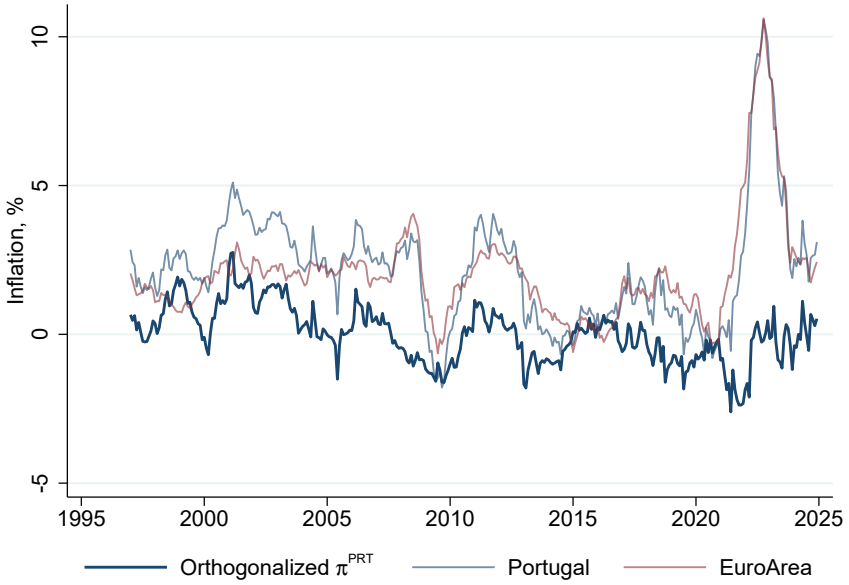
Notes: Impulse responses for inflation, real GDP and nominal short-term interest rates on inflation surprises, estimated with panel-LP as in eq. (1). 1946-2020, annual frequency, 18 countries. Driscoll and Kraay (1998) standard errors. Bands are at the 68% and 90% confidence level.

Figure A.5: Direct effect of inflation surprises on the macroeconomy, 1870-2020



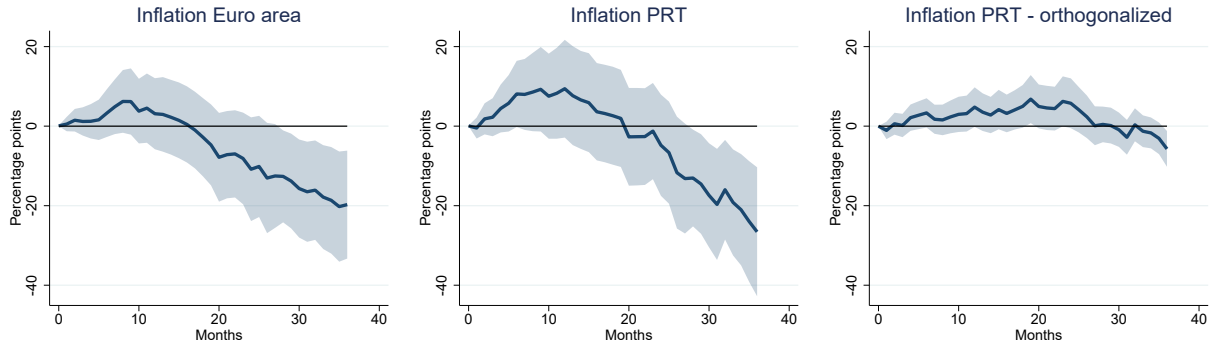
Notes: Impulse responses for inflation, real GDP and nominal short-term interest rates on inflation surprises, estimated with panel-LP as in eq. (2). The red solid line represent the "direct" effect of inflation, i.e., the response of outcome y_t in open peg countries ($\beta_{A,h}$). The blue dashed line shows the "total" effect of inflation, i.e., the response of outcome y_t in float countries ($\beta_{B,h}$). 1870-2020, annual frequency, 18 countries. Driscoll and Kraay (1998) standard errors. Bands are at the 68% and 90% confidence level.

Figure A.6: Orthogonalized inflation in Portugal, $\pi_t^{\perp}$



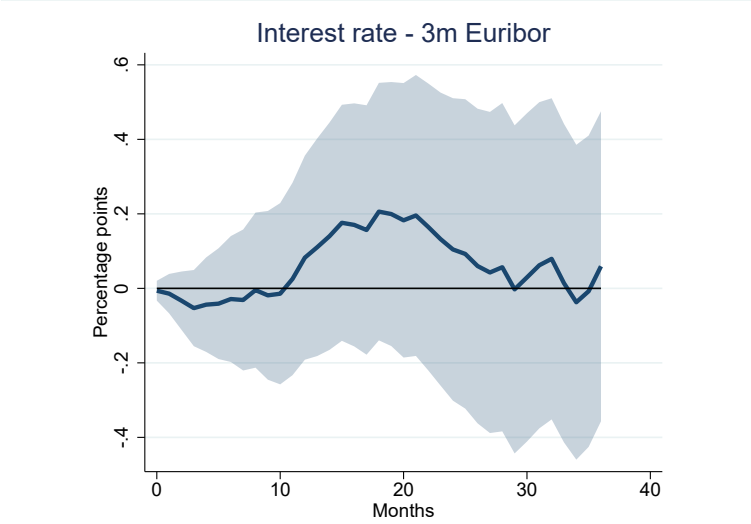
Notes: Orthogonalized Portugues inflation $\pi_t^{\perp}$, Euro-area aggregate inflation π_t^{EA} and raw Portuguese inflation π_t^{PT}. 1999m1-2024m12, year-over-year CPI inflation, monthly frequency.

Figure A.7: Response of inflation to monetary policy shocks, 1999-2024



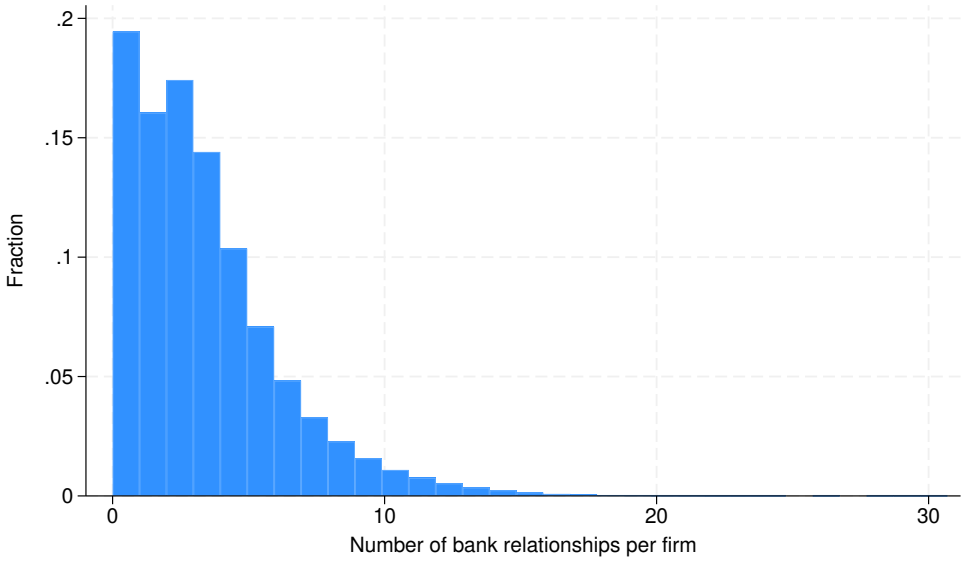
Notes: Impulse responses for euro area inflation, portuguese inflation and orthogonal portuguese inflation on Jarociński and Karadi (2020) monetary policy shocks, estimated with LP-IV, instrumenting the 3-month interest rate with the contemporaneous shock. 1999m1-2024m12, monthly frequency. Bands are at the 90% confidence level.

Figure A.8: Response of the short-term interest rate to $\pi^{\perp}$, 1999-2024



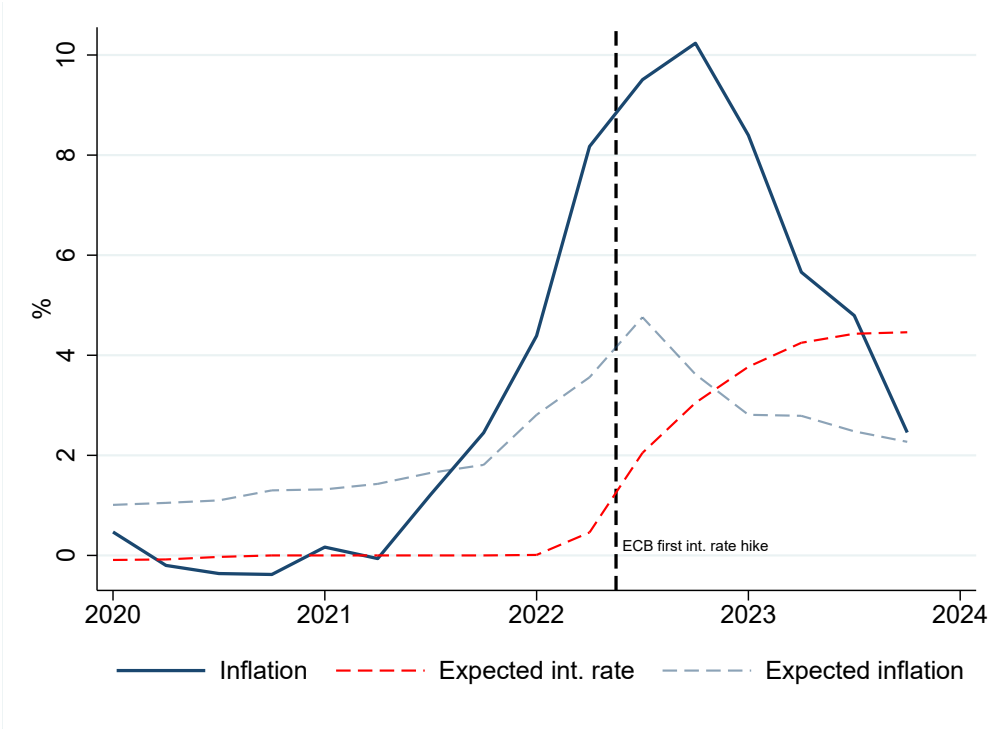
Notes: Impulse responses for the 3-months EURIBOR on the orthogonalized Portuguese inflation $\pi^{\perp}$ estimated with local projections. Controls include the 12-month lags of: $\pi^{\perp}$, euro-area inflation, 3m EURIBOR, real GDP growth of Portugal, real GDP growth of the aggregate Euro Area. 1999m1-2024m12, monthly frequency. Bands are at the 90% confidence level.

Figure A.9: Firms with multibank relationships



Notes: Histogram of the number of multibank relationships. HCRC dataset. Portugal, 2011-2022.

Figure A.10: Event study: Expectations during the 2021 inflation surge



Notes: Inflation (blue solid line) shows the year-over-year inflation rate in Portugal. Expected inflation (light blue dashed line) reports the forecasted inflation for the next 12 months (data source: Survey of Professional Forecasters, ECB). Expected interest rate (red dashed line) reports the forecasted average interest rate for the next 3 months (data source: Survey of Professional Forecasters, ECB). Sample period: 2020Q1 - 2023Q4.

A.2 Tables

Table A.1: Maturity of bank balance sheet items

Balance-sheet item	Assigned maturity (years)
Cash	0
Loans $\leq$ 1 y	0.5
Loans 1–5 y	3
Loans $\geq$5 y	10
Bonds $\leq$ 1y	0.5
Bonds 1-2y	1.5
Bonds $\geq$ 2y	5
Stocks	10
Properties/Equipments	10
Demand & Reedemable deposits ($\leq$ 3 m)	0.25
Deposits $\leq$ 1y	0.5
Deposits 1-2y	1.5
Deposits $\geq$ 2y	5
Trading liabilities	1

Notes: Assigned maturity for each balance sheet item, in the computation of the *maturity gap*. *Notes:* Stocks and properties have no contractual maturity but are generally treated as long-term, illiquid assets funded by equity, which itself is permanent capital. Banking practice and regulation (e.g., Basel NSFR, IRRBB) classify them as requiring stable, long-term funding and often assign them behavioral maturities of 5–10 years in asset–liability management.

Table A.2: Heterogeneity: Effect of inflation on credit supply by bank characteristics

	High loans	Low loans	Short	Long	Positive	Negative
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation $\times$ $\bar{\sigma}_{b,t-1}$	-2.69***	-1.03	1.84	-4.73***	-2.86***	-2.19***
	(0.73)	(2.11)	(1.38)	(1.45)	(1.07)	(0.81)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	3,718,703	3,843,317	3,730,395	4,146,349	5,457,807	5,532,399
R^2	0.96	0.94	0.95	0.95	0.93	0.94

Notes: This table reports the results of estimating specification (4) at horizon $h = 12$ months, allowing for heterogeneity across banks. The dependent variable is the log-level of long-term credit. The main explanatory variable is the interaction between orthogonalized Portuguese inflation $\pi_t^{\perp}$ and the bank's maturity gap $\bar{\sigma}_{b,t-1}$ averaged in past 12 months. Sample are split according to the following bank characteristics. *High Loans* restricts the sample to banks with the share of loans to total assets that is above the sample median. *Short* restricts the sample to banks with the share of short-term loans to total loans that is above the sample median. Positive restricts the sample to positive variations of $\pi^{\perp}$. Controls and fixed effects are as in Table 2, with the exception that I exclude the control used to split the distribution, e.g., in column (1) and (2) I exclude the Loan ratio from $\mathbf{X}_{t-1}$, and so on. Standard errors are double-clustered at the bank and time level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Appendix B Data description

Table B.1: Variable Definitions

Variable Name	Definition
Panel A: Bank–firm (loan-level) variables	
Credit outstanding L_{bft} (€)	Credit with original maturity above 1 year (euros)
Length of relationship$_{bft}$ (months)	Duration of the bank–firm relationship (b, f) up to t, in months
Maturity gap σ_{bt} (years)	Bank-level maturity gap for bank b, as midpoint of item-level maturity (Table A.1).
Assets$_{bt}$ (€Mn)	Total assets, in €millions.
Overdue ratio$_{bt}$	Share of overdue credit (more than 90 days) over total credit.
Liquidity ratio$_{bt}$	Liquid assets (cash and short-term bonds) divided by total assets
Deposit ratio$_{bt}$	Customer deposits (Demand, sight, savings) divided by total assets
Loan ratio$_{bt}$	Total loans divided by total assets
Leverage$_{bt}$	Capital ratio (i.e., equity over total assets).
Firm-level variables	
Inflation surprises	CPI inflation surprise in Portugal, $\pi_t - \mathbb{E}_{t-1}\pi_t$, from Kim, Ranaldi, and Schularick (2025)
Firm-banks avg maturity exposure (θ_{ft}, in years)	Lender-weighted average maturity gap of firm f's banks, as in 7
Investment	CapEX: change in fixed tangible and intangible assets + depreciation
Revenues	Turnover
Profits	Total income − Total expenses
Interest expenses	Interest expenses
Hours worked	Hours worked by paid employees
Credit	Total bank credit over total lagged assets
Assets (€)	Total assets, in euros
Number of employees	Headcount of paid employees
Firm age (years)	Years since foundation of the firm
Loan-Assets ratio	Total bank credit divided by total assets
Ratio of short-term loans	Share of outstanding bank credit with original (or residual) maturity ≤ 1 year
Return on Assets (ROA)	Profits divided by total assets
Capital per worker (€)	Fixed capital stock divided by number of employees; euros per worker
Exporting firm (dummy)	Indicator equal to 1 if the firm reports positive exports in year t, 0 otherwise.

Appendix C Additional macro-level impulse responses

This section provides a back-of-the-envelope exercise to evaluate whether the debt–inflation channel can, in the aggregate, be offset by the credit channel of inflation and become contractionary. I show that when corporate indebtedness is high, inflation surprises trigger sharper declines in bank fundamentals, and are also followed by lower investment. These results suggest that the credit channel of inflation can more than offset the debt-relief benefits for firms.

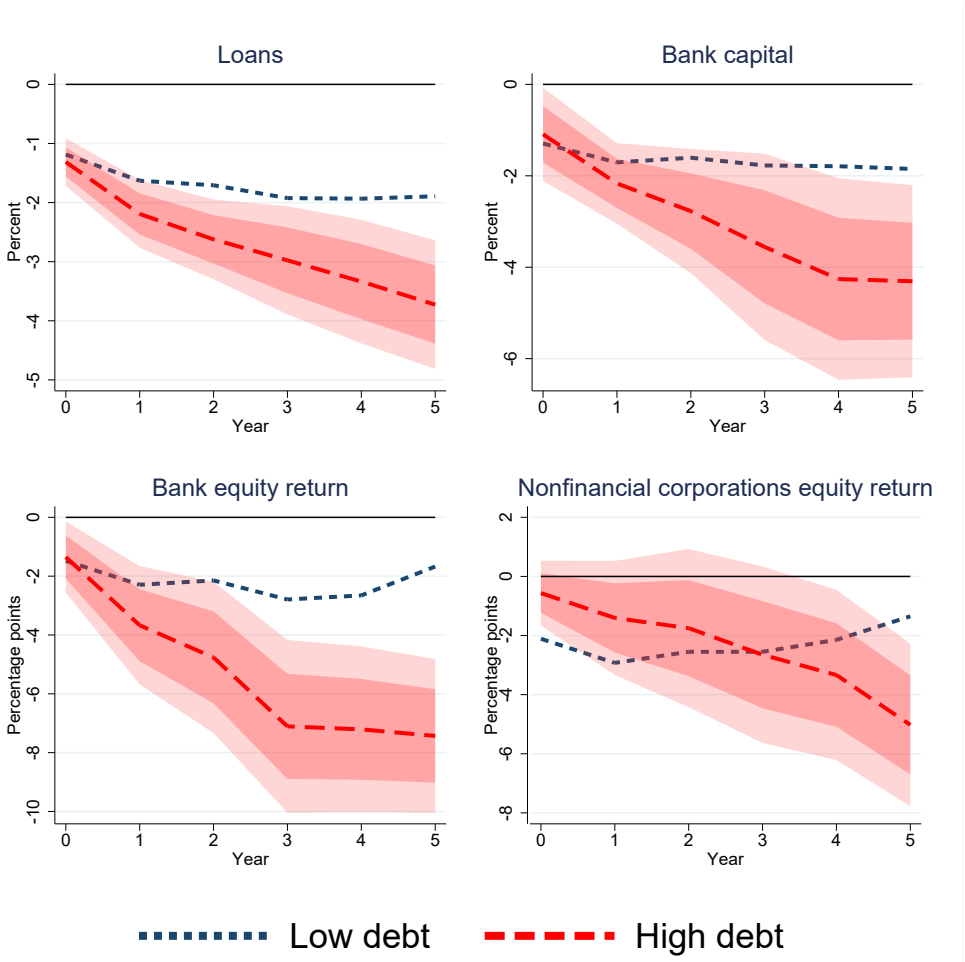
The *debt–inflation* channel argues that higher inflation reduces the real debt burden of leveraged firms, freeing up additional resources to invest and produce. Especially when corporate debt is at high levels, we should expect inflation to particularly boost economic activity via higher investment. I test this argument by implementing a state-dependent local projection on the macro data of Section 2, using the specification (2), where the state $\mathcal{I}$ is defined by the level of corporate debt relative to GDP. Country–years with debt above the country median are classified as high-debt states.[53] The debt–inflation mechanism would predict that inflation surprises should be least contractionary in these states, as the real burden of nominal liabilities falls most strongly.

Figure C.1 shows the main results. In high-debt states, aggregate credit and bank capital decline significantly more after an inflation surprise than in low-debt states, and bank equity returns also register larger losses. The response of non-financial corporations' equity returns is partially in line with a debt–inflation mechanism: firms benefit initially from the reduction in real debt burdens (as in D'Andrea et al. (2025)) when debt levels are high, yet the cumulative response turns significantly negative in the long run.

What do these dynamics imply for aggregate investment? I show in Figure C.2 that aggregate investment also contracts more strongly in high-debt states. This provides suggestive evidence that, even in periods of elevated corporate leverage, the contraction in bank credit supply can dominate the debt-relief channel and can depress real activity. More broadly, it illustrates that inflation can undermine the very mechanism often thought to make it expansionary. Inflation does not simply redistribute between creditors and debtors; it destabilizes banks' balance sheets and tightens financing conditions – an insight that underscores the importance of recognizing the credit channel as a central cost of inflation.

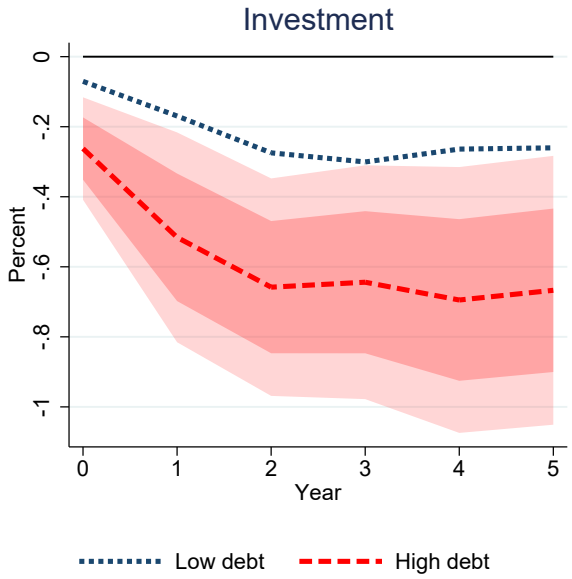
[53] As prescribed by Gonçalves et al. (2022), I test for the state variable $\mathcal{I}$ to be independent from the inflation surprise. In a regression of the state on the surprises, the coefficient of interest is always statistically insignificant, confirming the validity of the state-dependent exercise.

Figure C.1: Effect of inflation surprises with high corporate debt



Notes: Impulse responses for aggregate loans, bank capital, cumulative bank equity returns and cumulative non-financial corporations equity returns on inflation surprises, estimated with panel-LP as in eq. (2). The red dashed line represents the effect of inflation when corporate debt-over-GDP is above the median. 1946-2020, annual frequency, 18 countries. Driscoll and Kraay (1998) standard errors. Bands are at the 68% and 90% confidence level.

Figure C.2: Effect of inflation surprises with high corporate debt



Notes: Impulse responses for aggregate investment (measured as the logarithm of real investment) on inflation surprises, estimated with panel-LP as in eq. (2). The red dashed line represents the effect of inflation when corporate debt-over-GDP is above the median. 1946-2020, annual frequency, 18 countries. Driscoll and Kraay (1998) standard errors. Bands are at the 68% and 90% confidence level.

Appendix D Robustness: loan-level regressions

Table C.1: Inflation effect on banks' credit supply: lag of σ_b

	$\ln(\text{Credit}_{bf,t+h})$					
	$h=0$				$h=12$	
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation $\times\sigma_{b,t-1}$	-0.43**	-0.31*			-2.49***	
	(0.18)	(0.17)			(0.79)	
Inflation $\times\sigma_{b,t-12}$			-0.23	-0.07		-1.79**
			(0.15)	(0.16)		(0.73)
Controls	No	Yes	No	Yes	Yes	Yes
Time FE	No	No	No	No	No	No
Bank-firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	18,174,350	18,174,185	12,819,261	12,819,237	11,859,962	8,280,271
R^2	0.98	0.98	0.99	0.99	0.93	0.94

Notes: This table reports the results of estimating specification (4). The dependent variable is the log-level of long-term credit (maturity above one year) between bank b and firm f. The main explanatory variable is the interaction between orthogonalized Portuguese inflation $\pi_t^{\perp}$ and the bank's maturity gap σ_b. The first line reports the 1-month lag, i.e., $\sigma_{b,t-1}$. The second line reports the 12-month lag, i.e., $\sigma_{b,t-12}$. Controls include lagged credit, loan portfolio risk (share of overdue loans), relationship length, deposit ratio, loan ratio, short-term loan ratio, size, leverage, and liquidity, as well as their interactions with inflation. Firm–time and bank–firm fixed effects are included throughout. Standard errors are double-clustered at the bank and time level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table C.2: Inflation effect on banks' credit supply: more granular specifications

	$\ln(\text{Credit}_{bf,t+12})$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Inflation $\times\bar{\sigma}_{b,t-1}$	-3.73**	-1.88**	-4.05**	-2.00**	-1.45*	-2.90**	-1.99***
	(1.69)	(0.77)	(1.74)	(0.78)	(0.77)	(1.21)	(0.74)
Controls	No	Yes	No	Yes	Yes	Yes	Yes
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	No	No	No	No	Yes	Yes	Yes
Firm-Ind. spe.-Time FE	Yes	Yes	No	No	No	No	No
Firm-Loc. spe.-Time FE	No	No	Yes	Yes	No	No	No
N	9,660,033	9,660,033	10,104,051	10,104,051	6,386,256	11,660,269	11,014,677
R^2	0.94	0.94	0.93	0.94	0.94	0.91	0.93

Notes: This table reports the results of estimating specification (4) with the dependent variable equal to the log-level of long-term credit (maturity above one year) between bank b and firm f. The main explanatory variable is the interaction between orthogonalized Portuguese inflation $\pi_t^{\perp}$ and the bank's average maturity gap in the last 12 months $\bar{\sigma}_{b,t-1}$. Columns (1)–(2) interact the firm–time fixed effect with a dummy equal to one if the firm's industry belongs to the top 3 industries for the bank; columns (3)–(4) interact the firm–time fixed effect with a dummy equal to one the firm's municipality belongs to the top 10 municipalities for the bank. Column (5) restricts the sample to main banking entities of the banking group, column (6) uses a reduced set of controls (size, overdue ratio, liquidity, share of short loans, length of the bank-firm relationship), and column (7) additionally controls for changes in interest rates interacted with inflation $\bar{\sigma}_{b,t-1}$, to control explicitly for interest rate risk. Standard errors are double-clustered at the bank and time level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table C.3: Inflation effect on banks' credit supply: using ΔL_{bft}

	ΔL_{bft}			$L_{bf,t+3} - L_{bf,t-1}$	$L_{bf,t+12} - L_{bf,t-1}$
	(1)	(2)	(3)	(4)	(5)
Inflation $\times\bar{\sigma}_{b,t-1,t-12}$	-0.14	-0.16	-0.08	-0.21	-0.19
	(0.11)	(0.12)	(0.11)	(0.40)	(1.10)
Controls	No	No	Yes	Yes	Yes
Time FE	Yes	No	No	No	No
Bank FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	No	No	No	No
Firm-time FE	No	Yes	Yes	Yes	Yes
N	27,001,834	16,476,181	16,476,139	14,863,657	11,024,475
R^2	0.04	0.37	0.37	0.39	0.43

Notes: This table reports the results of estimating specification (4). The dependent variable is the log-difference of long-term credit (maturity above one year) between bank b and firm f. The main explanatory variable is the interaction between orthogonalized Portuguese inflation $\pi_t^{\perp}$ and the bank's average maturity gap in the last 12 months $\bar{\sigma}_{b,t-1}$. Controls include lagged credit, loan portfolio risk (share of overdue loans), relationship length, deposit ratio, loan ratio, short-term loan ratio, size, leverage, and liquidity, as well as their interactions with inflation. Firm–time and bank–firm fixed effects are included throughout. Standard errors are double-clustered at the bank and time level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table C.4: Inflation effect on banks' credit supply: using raw inflation π_t

	$h=0$			$h=3$	$h=12$
	(1)	(2)	(3)	(4)	(5)
Inflation $\times\bar{\sigma}_{b,t-1,t-12}$	0.01	-0.00	-0.07	-0.25	-0.96
	(0.04)	(0.04)	(0.05)	(0.17)	(0.75)
Controls	No	No	Yes	Yes	Yes
Time FE	Yes	No	No	No	No
Bank FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	No	No	No	No
Firm-time FE	No	Yes	Yes	Yes	Yes
N	27,001,834	16,476,181	16,476,139	14,863,657	11,024,475
R^2	0.98	0.98	0.98	0.95	0.89

Notes: This table reports the results of estimating specification (4). The dependent variable is the log-level of long-term credit (maturity above one year) between bank b and firm f. The main explanatory variable is the interaction between raw Portuguese inflation π_t and the bank's average maturity gap in the last 12 months $\bar{\sigma}_{b,t-1}$. Controls include lagged credit, loan portfolio risk (share of overdue loans), relationship length, deposit ratio, loan ratio, short-term loan ratio, size, leverage, and liquidity, as well as their interactions with inflation. Firm–time and bank–firm fixed effects are included throughout. Standard errors are double-clustered at the bank and time level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Appendix E Robustness: firm-level regressions

Table D.1: Effect of inflation on firms' interest expenses

	$\frac{\text{Credit}_{f,t+h}-\text{Credit}_{f,t-1}}{\text{Assets}_{f,t-1}}$			
	$h=0$			$h=1$
	(1)	(2)	(3)	(4)
Inflation × $\theta_{b,t-1}$	-0.0936***	-0.0218***	0.0024	-0.0166
	(0.0026)	(0.0049)	(0.0044)	(0.0162)
Firm FE	Yes	Yes	Yes	Yes
Sector-Municipality-Year FE	Yes	Yes	Yes	Yes
Firm Demand	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
N	1,713,367	371,460	324,511	264,653
R sq.	0.28	0.44	0.55	0.67

Notes: This table reports the results of estimating specification (8) with the dependent variable equal to the annual change in total bank credit scaled by lagged assets. The key explanatory variable is the interaction between the Portuguese inflation surprise ε_t^π and the firm's loan-weighted exposure to banks' maturity gaps $\theta_{f,t-1}$. All regressions include firm fixed effects and sector–municipality–year fixed effects. Firm demand is proxied by the estimated firm–time demand component $\hat{a}_{ft}$ from the credit supply regression (4). Controls include lagged firm-level covariates (log assets, age, leverage, turnover growth, return on assets, capital intensity, liquidity, collateral ratio, export dummy). Standard errors are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table D.2: Effect of inflation on firms' interest expenses

	$\frac{\text{Investment}_{f,t+h}-\text{Investment}_{f,t-1}}{\text{Assets}_{f,t-1}}$			
	$h=0$			$h=1$
	(1)	(2)	(3)	(4)
Inflation $\times$ $\theta_{b,t-1}$	-0.0155***	-0.0253***	-0.0141***	-0.0205***
	(0.0013)	(0.0024)	(0.0024)	(0.0073)
Firm FE	Yes	Yes	Yes	Yes
Sector-Municipality-Year FE	Yes	Yes	Yes	Yes
Firm Demand	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
N	1,352,414	303,048	300,830	243,988
R sq.	0.16	0.27	0.34	0.42

Notes: This table reports the results of estimating specification (8) with the dependent variable equal to the annual change in firm's investment (capital expenditure) by lagged assets. The key explanatory variable is the interaction between the Portuguese inflation surprise ε_t^π and the firm's loan-weighted exposure to banks' maturity gaps $\theta_{f,t-1}$. All regressions include firm fixed effects and sector–municipality–year fixed effects. Firm demand is proxied by the estimated firm–time demand component $\hat{a}_{ft}$ from the credit supply regression (4). Controls include lagged firm-level covariates (log assets, age, leverage, turnover growth, return on assets, capital intensity, liquidity, collateral ratio, export dummy). Standard errors are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table D.3: Effect of inflation on firms' interest expenses

	$\frac{\text{Int. expenses}_{f,t+h}-\text{Int. expenses}_{f,t-1}}{\text{Assets}_{f,t-1}}$			
	$h=0$			$h=1$
	(1)	(2)	(3)	(4)
Inflation $\times$ $\theta_{f,t-1}$	0.0012***	0.0007***	0.0006***	0.0020***
	(0.0001)	(0.0001)	(0.0001)	(0.0004)
Firm FE	Yes	Yes	Yes	Yes
Sector-Municipality-Year FE	Yes	Yes	Yes	Yes
Firm Demand	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
N	1,246,436	346,785	304,042	245,928
R sq.	0.23	0.35	0.35	0.49

Notes: This table reports the results of estimating specification (8) with the dependent variable equal to the annual change in firms' interest expenses scaled by lagged assets. The key explanatory variable is the interaction between the Portuguese inflation surprise ε_t^π and the firm's loan-weighted exposure to banks' maturity gaps $\theta_{f,t-1}$. All regressions include firm fixed effects and sector–municipality–year fixed effects. Firm demand is proxied by the estimated firm–time demand component $\hat{a}_{ft}$ from the credit supply regression (4). Controls include lagged firm-level covariates (log assets, age, leverage, turnover growth, return on assets, capital intensity, liquidity, collateral ratio, export dummy). Standard errors are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table D.4: Effect of inflation on firms' revenues

	$\frac{\text{Revenues}_{f,t+h}-\text{Revenues}_{f,t-1}}{\text{Assets}_{f,t-1}}$			
	$h=0$			$h=1$
	(1)	(2)	(3)	(4)
Inflation $\times$ $\theta_{b,t-1}$	0.0606***	-0.0277***	-0.0168**	-0.0127
	(0.0055)	(0.0078)	(0.0077)	(0.0274)
Firm FE	Yes	Yes	Yes	Yes
Sector-Municipality-Year FE	Yes	Yes	Yes	Yes
Firm Demand	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
N	1,798,127	371,456	324,510	265,164
R sq.	0.34	0.44	0.47	0.61

Notes: This table reports the results of estimating specification (8) with the dependent variable equal to the annual change in firms' turnover scaled by lagged assets. The key explanatory variable is the interaction between the Portuguese inflation surprise ε_t^π and the firm's loan-weighted exposure to banks' maturity gaps $\theta_{f,t-1}$. All regressions include firm fixed effects and sector–municipality–year fixed effects. Firm demand is proxied by the estimated firm–time demand component $\hat{a}_{ft}$ from the credit supply regression (4). Controls include lagged firm-level covariates (log assets, age, leverage, turnover growth, return on assets, capital intensity, liquidity, collateral ratio, export dummy). Standard errors are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table D.5: Effect of inflation on firms' profits

	$\frac{\text{Profits}_{f,t+h}-\text{Profits}_{f,t-1}}{\text{Assets}_{f,t-1}}$			
	$h=0$			$h=1$
	(1)	(2)	(3)	(4)
Inflation $\times$ $\theta_{b,t-1}$	-0.0067***	-0.0087***	-0.0012	-0.0142***
	(0.0019)	(0.0024)	(0.0020)	(0.0055)
Firm FE	Yes	Yes	Yes	Yes
Sector-Municipality-Year FE	Yes	Yes	Yes	Yes
Firm Demand	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
N	1,798,163	371,460	324,511	265,165
R sq.	0.21	0.33	0.64	0.69

Notes: This table reports the results of estimating specification (8) with the dependent variable equal to the annual change in firms' profits scaled by lagged assets. The key explanatory variable is the interaction between the Portuguese inflation surprise ε_t^π and the firm's loan-weighted exposure to banks' maturity gaps $\theta_{f,t-1}$. All regressions include firm fixed effects and sector–municipality–year fixed effects. Firm demand is proxied by the estimated firm–time demand component $\hat{a}_{ft}$ from the credit supply regression (4). Controls include lagged firm-level covariates (log assets, age, leverage, turnover growth, return on assets, capital intensity, liquidity, collateral ratio, export dummy). Standard errors are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table D.6: Effect of inflation on firms' tangible investment

	$\frac{\text{Tang. Investment}_{f,t+h} - \text{Tang. Investment}_{f,t-1}}{\text{Assets}_{f,t-1}}$			
	$h = 0$			$h = 1$
	(1)	(2)	(3)	(4)
Inflation $\times$ $\theta_{b,t-1}$	-0.0153***	-0.0253***	-0.0146***	-0.0233***
	(0.0012)	(0.0023)	(0.0023)	(0.0070)
Firm FE	Yes	Yes	Yes	Yes
Sector-Municipality-Year FE	Yes	Yes	Yes	Yes
Firm Demand	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
N	1,352,380	303,048	300,830	243,988
R sq.	0.16	0.27	0.33	0.41

Notes: This table reports the results of estimating specification (8) with the dependent variable equal to the annual change in firms' tangible investment scaled by lagged assets. The key explanatory variable is the interaction between the Portuguese inflation surprise ε_t^π and the firm's loan-weighted exposure to banks' maturity gaps $\theta_{f,t-1}$. All regressions include firm fixed effects and sector–municipality–year fixed effects. Firm demand is proxied by the estimated firm–time demand component $\hat{a}_{ft}$ from the credit supply regression (4). Controls include lagged firm-level covariates (log assets, age, leverage, turnover growth, return on assets, capital intensity, liquidity, collateral ratio, export dummy). Standard errors are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix F Model derivations

F.1 Firm problem

This part borrows heavily from Kang and Pflueger (2015). I continue the description of the firm block of the model from Section 5.

C. Production

Firm i has a standard Cobb–Douglas production function with capital (K_t^i) and labor (N_t^i) inputs to produce output (Y_t^i).[54]

$$Y_t^i = (N_t^i)^{1-\alpha}(K_t^i)^{\alpha} \tag{23}$$

Firm i chooses labor to maximize single-period operating revenue, taking the aggregate wage as given. I assume the aggregate supply of labor is fixed at one, abstracting from unemployment. The equilibrium wage adjusts to clear the labor market. Capital depreciates at a constant rate δ, and I impose the resource constraint that total output equals aggregate consumption plus investment,[55]

$$\begin{aligned} K_{t+1} &= I_t + (1-\delta)K_t, \\ Y_t &= C_t + I_t. \end{aligned}$$

Young and old firms are heterogeneous in their capital stocks, but constant returns to scale imply that, for any firm, the gross real return on capital from time t to $t+1$ equals

$$R_{t+1}^K = \left[\alpha\left(\frac{1}{K_{t+1}}\right)^{1-\alpha} + (1-\delta)\right]. \tag{24}$$

D. Firm default

A firm's default decision depends on the initial level of debt, aggregate nominal shocks, and

[54] Differently from Kang and Pflueger (2015), who are interested in the correlation of the inflation shock with an aggregate real shock, I assume TFP is at steady state throughout, i.e., $z = 1$.

[55] I can formally define aggregate output, capital, labor, and investment at time t by integrating over all firms,

$$Y_t = \int_i Y_t^i \mathrm{d}i, \quad K_t = \int_i K_t^i \mathrm{d}i, \quad N_t = \int_i N_t^i \mathrm{d}i, \quad I_t = \int_i I_t^i \mathrm{d}i.$$

idiosyncratic real shocks.

Corporate debt promises a fixed nominal payment after two periods, when the firm pays a liquidating dividend. I denote logs by small letters throughout. All firms in cohort t are identical ex ante. Denote the initial log nominal face value of debt by $b_t^{\$}$ and initial log leverage adjusted for expected inflation by l_t. Then firms choose

$$l_t = b_t^{\$} - 2\pi_t - k_{t+1}. \tag{25}$$

Inflation persistence implies that the inflation shock in period $t+1$ enters twice into the real log liabilities of the old firm:

$$b_{t+2}^{real,old} = l_t + k_{t+1} - 2\varepsilon_{t+1}^{\pi} - \varepsilon_{t+2}^{\pi}. \tag{26}$$

Firm i in cohort t experiences independent idiosyncratic shocks to log capital at times $t+1$ and $t+2$, $a_{t+1}^{i,1}$ and $a_{t+2}^{i,2}$, with $a_{t+2}^{i,id} = a_{t+1}^{i,1} + a_{t+2}^{i,2}$. Using (24), the log real value of an old firm at the end of period $t+2$ equals

$$v_{t+2}^{i,old} = k_{t+1} + r_{t+1}^{K} + r_{t+2}^{K} + a_{t+2}^{i,id}. \tag{27}$$

Equity holders have the option to default on debt payments and receive a zero liquidating dividend. They optimally default if and only if the real value of the firm (27) is less than its real liabilities (26).[56] Firms with the most adverse idiosyncratic shocks default if

$$a_{t+2}^{i,id} < \underbrace{l_t - 2\varepsilon_{t+1}^{\pi} - \varepsilon_{t+2}^{\pi} - r_{t+1}^{K} - r_{t+2}^{K}}_{\text{survival threshold } a_{t+2}^{*}}. \tag{28}$$

Equation (28) formalizes the debt–inflation channel: positive inflation shocks ε_{t+1}^{π} and ε_{t+2}^{π} lower the survival threshold a_{t+2}^{*} and, in turn, defaults.

E. Corporate loan prices

Let $H(a_{t+2}^{*})$ and $\Omega(a_{t+2}^{*})$ denote the time $t+2$ default probability and the average defaulted firm value conditional on the survival threshold a_{t+2}^{*}, respectively. Let $G(a_{t+1}^{*}, a_t^{i,1})$ and $W(a_{t+1}^{*}, a_t^{i,1})$ denote the time $t+1$ default probability and the average defaulted firm value of a cohort $t-1$ firm conditional on both the survival threshold a_{t+1}^{*} and the firm's first-period

[56] The firm never finds it optimal to default in its intermediate period because no debt payments are due then.

idiosyncratic shock $a_t^{i,1}$.

$$H\left(a_{t+2}^*\right) = \mathbb{P}\left(a_{t+2}^{i,id} < a_{t+2}^*\right), \quad \Omega\left(a_{t+2}^*\right) = \mathbb{E}\left(\exp\left(a_{t+2}^{i,id}\right)\mathbb{I}\left(a_{t+2}^{i,id} < a_{t+2}^*\right)\right),$$
$$G\left(a_{t+1}^*, a_t^{i,1}\right) = \mathbb{P}\left(a_{t+1}^{i,id} < a_{t+1}^* \mid a_t^{i,1}\right), \quad W\left(a_{t+1}^*, a_t^{i,1}\right) = \mathbb{E}\left(\exp\left(a_{t+1}^{i,id}\right)\mathbb{I}\left(a_{t+1}^{i,id} < a_{t+1}^*\right) \mid a_t^{i,1}\right).$$

where $\mathbb{I}$ denotes the indicator function. The prices for a new corporate loan and a seasoned corporate loan at time t then equal

$$q_t^{\text{corp,new}} = \mathbb{E}_t\left[M_{t,t+2}^{\$}\left(1 - \underbrace{H\left(a_{t+2}^*\right)}_{\text{Default Rate}} + \underbrace{\theta\frac{\Omega\left(a_{t+2}^*\right)}{\exp\left(a_{t+2}^*\right)}}_{\text{Expected Recovery Payment}}\right)\right], \tag{29}$$

$$q_t^{i,\text{ seas}} = \mathbb{E}_t\left[M_{t,t+1}^{\$}\left(1 - \underbrace{G\left(a_{t+1}^*, a_t^{i,1}\right)}_{\text{Cond. Def. Rate}} + \underbrace{\theta\frac{W\left(a_{t+1}^*, a_t^{i,1}\right)}{\exp\left(a_{t+1}^*\right)}}_{\text{Cond. Recovery}}\right)\right], \tag{30}$$

where $\theta < 1$ is the fraction recovered by the bank when the firm is in bankruptcy.[57]

F. Capital structure choice

Firms choose leverage according to a standard trade-off view of capital structure. Following Gourio (2013), firms receive benefits $\chi > 1$ for each dollar of debt issued. Equity holders of cohort t firms choose capital K_{t+1} and nominal liabilities $B_t^{\$}$ subject to the budget constraint

$$K_{t+1} = \underbrace{S_t}_{\text{Value of new equity}} + \chi \times \underbrace{q_t^{\text{corp,new}}}_{\text{New nominal debt price}} \times B_t^{\$}. \tag{31}$$

Higher χ increases the incentive to raise leverage.[58] Equity holders trade off the benefits of debt with expected bankruptcy costs. I assume the bank recovers only a constant fraction $\theta < 1$ of firm value in bankruptcy. A lower recovery rate reduces the incentive to lever up. There exists an interior optimal leverage ratio if bankruptcy costs are sufficiently large relative to debt benefits. Following Gourio (2013), I formally assume $\theta\chi < 1$.

Define the marginal probability of default as $h(a_{t+2}^*) = H'(a_{t+2}^*)$. Solving the first-order

[57] All derivations are presented in Appendix F.

[58] There is a debate over whether tax benefits are sufficiently large to explain observed leverage ratios (Graham, 2000; Almeida and Philippon, 2007). χ is interpreted to include broader benefits and costs of debt, such as constraining managers from empire-building and reducing informational asymmetries (Meckling and Jensen, 1976; Jensen, 1986).

condition for leverage (see Appendix F for derivations) yields

$$0 = \underbrace{-\chi(1-\theta)\mathbb{E}_t\left(M^{\$}_{t,t+2}h\left(a^*_{t+2}\right)\right)}_{\text{Marginal Bankruptcy Cost (MBC)}} + \underbrace{(\chi-1)\mathbb{E}_t\left(M^{\$}_{t,t+2}\left(1-H\left(a^*_{t+2}\right)\right)\right)}_{\text{Marginal Benefit of Debt (MBD)}}. \tag{32}$$

Equation (32) shows that equity holders equate the marginal benefit of issuing an additional dollar of debt with the marginal increase in bankruptcy costs.

Prediction 1. After a positive inflation shock, firms increase their credit demand.

A positive inflation shock ε^{π}_{t+1} affects the first-order condition (32) through the default threshold a^*_{t+2}: higher inflation lowers a^*_{t+2} and the probability of default $H\left(a^*_{t+2}\right)$, so the marginal benefit of debt increases. Firms therefore wish to raise leverage (i.e., issue more debt) after a positive inflation shock. This implication motivates the need in the empirical analysis of Section 3 and 4 to control for credit demand when assessing the impact of inflation on credit supply.

F.2 Derivations for firm problem

F.2.1 Optimal choice of labor

Firm i chooses labor optimally to maximize single period operating revenue, while taking the aggregate wage W_t as given:

$$N^i_t = \arg\max_{N^i_t}\left\{\underbrace{Y^i_t - W_t N^i_t}_{\text{Operating Revenue}}\right\}. \tag{33}$$

From the firm's single period optimization we obtain the first-order condition with respect to labor:

$$(1-\alpha)\left(\frac{K^i_t}{N^i_t}\right)^{\alpha} = W_t. \tag{34}$$

The capital to labor ratio is constant across firms and equal to K_t. Substituting back into operating revenue gives firm i's one-period equilibrium revenue as $\alpha K^i_t\left(\frac{1}{K_t}\right)^{1-\alpha}$. The expression for the equilibrium return on capital follows as:

$$R^K_{t+1} = \left[\alpha\left(\frac{1}{K_{t+1}}\right)^{1-\alpha} + (1-\delta)\right]. \tag{35}$$

F.2.2 Debt price

The time $t+2$ real cash flow of a corporate bond issued by firm i at time t is:

$$\frac{\left(1-\mathbb{I}\left\{a_{t+2}^{i,id}<a_{t+2}^{*}\right\}\right)}{\exp\left(2\pi_t+2\varepsilon_{t+1}^{\pi}+\varepsilon_{t+2}^{\pi}\right)}+\theta\frac{K_{t+1}^{y}}{B_t^{\$}}R_{t+1}^{K}R_{t+2}^{K}\exp\left(a_{t+2}^{i,id}\right)\mathbb{I}\left\{a_{t+2}^{i,id}<a_{t+2}^{*}\right\} \tag{36}$$

The time t price of the bond is given by the expected stochastic discounted value of real cash flows:

$$q_t^{\text{corp,new}}=\mathbb{E}_t\left[M_{t,t+2}^{\$}\left(1-H\left(a_{t+2}^{*}\right)\right)\right]+\theta\mathbb{E}_t\left[M_{t,t+2}\frac{K_{t+1}^{y}}{B_t^{\$}}R_{t+1}^{K}R_{t+2}^{K}\Omega\left(a_{t+2}^{*}\right)\right] \tag{37}$$

The expression for the survival threshold then implies:

$$q_t^{\text{corp,new}}=\mathbb{E}_t\left[M_{t,t+2}^{\$}\Big(1-\underbrace{H\left(a_{t+2}^{*}\right)}_{\text{Default Rate}}+\underbrace{\theta\frac{\Omega\left(a_{t+2}^{*}\right)}{\exp\left(a_{t+2}^{*}\right)}}_{\text{Recovery Rate}}\Big)\right] \tag{38}$$

as in (29) in the main text.

F.2.3 First-order conditions

Equity holders maximize:

$$\mathbb{E}_t\left[M_{t,t+2}\max\left(V_{t+2}^{i,old}-B_t^{\$}\exp\left(-2\pi_t-2\varepsilon_{t+1}^{\pi}-\varepsilon_{t+2}^{\pi}\right),0\right)\right]-S_t \tag{39}$$

subject to:

$$v_{t+2}^{i,old}=k_{t+1}^{y}+r_{t+1}^{K}+r_{t+2}^{K}+a_{t+2}^{i,id}, \tag{40}$$

$$K_{t+1}^{y}=S_t+\chi q_t^{corp,new}B_t^{\$}. \tag{41}$$

Given constant returns to scale and no equity issuance costs, the net equity value (39) will equal zero in equilibrium, reflecting free entry. Substituting the constraints and (38) into (39) we can rewrite the firm's problem as maximizing:

$$\exp\left(2\pi_t\right)K_{t+1}^{y}L_t\mathbb{E}_t\left[M_{t,t+2}^{\$}\begin{pmatrix}\exp\left(-a_{t+2}^{*}\right)+(\chi-1)\left(1-H\left(a_{t+2}^{*}\right)\right)\\+(\chi\theta-1)\Omega\left(a_{t+2}^{*}\right)\exp\left(-a_{t+2}^{*}\right)\end{pmatrix}\right]-K_{t+1}^{y} \tag{42}$$

Differentiating (42) with respect to leverage L_t while holding constant the level of capital K_{t+1} gives:

$$0 = \left(1 + \frac{\partial}{\partial a^*_{t+2}}\right) \mathbb{E}_t \left[M^{\$}_{t,t+2} \left(\exp(-a^*_{t+2}) + (\chi - 1) \left(1 - H(a^*_{t+2})\right) + (\chi\theta - 1)\, \Omega(a^*_{t+2}) \exp(-a^*_{t+2}) \right) \right] \tag{43}$$

Using $\frac{\partial}{\partial a^*_{t+2}} \Omega(a^*_{t+2}) = \exp(a^*_{t+2}) h(a^*_{t+2})$ gives the first-order condition with respect to leverage:

$$0 = -\chi(1-\theta)\, \mathbb{E}_t \left(M^{\$}_{t,t+2} h(a^*_{t+2}) \right) + (\chi - 1)\, \mathbb{E}_t \left(M^{\$}_{t,t+2} \left(1 - H(a^*_{t+2})\right) \right) \tag{44}$$

F.3 Derivations for the bank problem

F.3.1 Proof of proposition 2

By the chain rule and (20),

$$\frac{\partial B^{\$,\,\mathrm{MM}}_{t+1}}{\partial \varepsilon^{\pi}_{t+1}} = \underbrace{\frac{(1-\rho)}{s_{\min}(q)} \frac{\partial \bar{E}_{t+1}}{\partial E^{pre}} \frac{\partial E^{pre,\,\mathrm{MM}}_{t+1}}{\partial q} \frac{\partial q}{\partial \varepsilon^{\pi}_{t+1}}}_{\text{issuance-capacity channel}} + \underbrace{(1-\rho)\, \bar{E}_{t+1} \frac{\partial}{\partial q}\Big(\frac{1}{s_{\min}(q)}\Big) \frac{\partial q}{\partial \varepsilon^{\pi}_{t+1}}}_{\text{capital-share (denominator) channel}}. \tag{45}$$

Using $s_{\min}(q) = 1 - q(1-\gamma)$ and $E^{pre,\,\mathrm{MM}}_{t+1}$ from (22),

$$\frac{\partial}{\partial q}\Big(\frac{1}{s_{\min}(q)}\Big) = \frac{1-\gamma}{[1-q(1-\gamma)]^2} > 0, \qquad \frac{\partial E^{pre,\,\mathrm{MM}}_{t+1}}{\partial q} = \frac{B^{\$}_t}{P_{t+1}} \cdot \frac{1-\gamma}{q^2} > 0, \tag{46}$$

and $\frac{\partial q}{\partial \varepsilon^{\pi}_{t+1}} < 0$. Hence both terms in (45) are *negative*: the inflation surprise (i) worsens the equity-per-euro requirement via $s_{\min}$, and (ii) directly depresses issuance capacity by lowering E^{MM}_{t+1}, which tightens $\bar{E}_{t+1}$ when $\partial \bar{E}/\partial E > 0$.

For the non-mismatched bank,

$$\frac{\partial B^{\$,\,\mathrm{NM}}_{t+1}}{\partial \varepsilon^{\pi}_{t+1}} = \underbrace{\frac{1}{s_{\min}(q)} \frac{\partial\big((1-\rho)\bar{E}\big)}{\partial E^{pre}} \frac{\partial E^{pre,\,\mathrm{NM}}_{t+1}}{\partial q} \frac{\partial q}{\partial \varepsilon^{\pi}_{t+1}}}_{=0 \;\text{ since } E^{pre,\,\mathrm{NM}} \text{ does not depend on } q} + \underbrace{\big(X^{\mathrm{int}}_{t+1} + (1-\rho)\bar{E}\big) \frac{\partial}{\partial q}\Big(\frac{1}{s_{\min}(q)}\Big) \frac{\partial q}{\partial \varepsilon^{\pi}_{t+1}}}_{<0}. \tag{47}$$

Thus the non-mismatched bank is hit only through the denominator channel; it *avoids* the

extra issuance-capacity deterioration term that is present under mismatch. This establishes the ordering stated in Proposition 2. □

F.3.2 Other derivations

(i) Derivative of E with respect to q. From (22),

$$\frac{\partial E_{t+1}^{pre,\,\mathrm{MM}}}{\partial q} = \frac{B_t^{\$}}{P_{t+1}} \cdot \frac{1-\gamma}{q^2} \;>\; 0, \qquad \frac{\partial E_{t+1}^{pre,\,\mathrm{NM}}}{\partial q} = 0.$$

(ii) Derivative of $1/s_{\min}(q)$. With $s_{\min}(q) = 1 - q(1-\gamma)$,

$$\frac{\partial}{\partial q}\Big(\frac{1}{s_{\min}(q)}\Big) = \frac{1-\gamma}{[1-q(1-\gamma)]^2} \;>\; 0.$$

(iii) Chain rule with issuance capacity. Assuming $\bar{E} = \bar{E}\big(E_{t+1}^{pre}\big)$,

$$\frac{\partial \bar{E}}{\partial \varepsilon_{t+1}^{\pi}} = \frac{\partial \bar{E}}{\partial E^{pre}} \frac{\partial E_{t+1}^{pre}}{\partial q} \frac{\partial q}{\partial \varepsilon_{t+1}^{\pi}}.$$

(iv) Putting the pieces together. Plugging (i)–(iii) yields the claimed ordering in the proof of proposition 2:

$$\frac{\partial B_{t+1}^{\$,\,\mathrm{MM}}}{\partial \varepsilon_{t+1}^{\pi}} = \underbrace{\frac{(1-\rho)}{s_{\min}} \frac{\partial \bar{E}}{\partial E} \frac{B_t^{\$}}{P_{t+1}} \frac{1-\gamma}{q^2} \frac{\partial q}{\partial \varepsilon_{t+1}^{\pi}}}_{\text{extra negative term (mismatch only)}} + \big[\text{common negative denominator term}\big],$$

while

$$\frac{\partial B_{t+1}^{\$,\,\mathrm{NM}}}{\partial \varepsilon_{t+1}^{\pi}} = \big[\text{common negative denominator term}\big].$$

Since $\partial \bar{E}/\partial E \geq 0$ and $\partial q/\partial \varepsilon_{t+1}^{\pi} < 0$, the extra term is strictly negative, implying a larger drop in credit for the mismatched bank.