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Ugo Albertazzi, James 't Hooft, Lucas ter Steege

The causal effect of inflation on financial stability, evidence from history

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Abstract

In contrast to the conventional Fisherian view that inflation reduces real debt positions, we show that significant increases in inflation are strongly associated with financial crises. In the spirit of Jordà et al. (2020), countries with free and fixed exchange rates can be compared to difference out the confounding reaction of monetary policy. Across a dataset of 18 advanced economies over 151 years, we show that the impact of inflation extends beyond its indirect effect via monetary policy. To further corroborate causality, we instrument inflation with oil supply shocks, finding that a 1pp rise in inflation doubles the probability of financial crisis from its sample average. We give evidence for the redistribution channel, where inflationary shocks directly cut real incomes, as a possible mechanism. In conjunction with recent literature on the dangers of rapidly tightening monetary policy, our results point to a difficult trade-off for central banks once inflation has risen.

JEL Classification: E31, E44, E58, G01

Keywords: inflation, monetary policy, financial crises, oil supply, currency pegs

Non-technical summary

It is often thought that large rises in inflation, like that of 2022, are dangerous for financial stability because they give rise to higher interest rates. There is a wide literature on the many patterns for rates that can distort the financial industry. However, there is little attention given to how inflation itself may directly affect financial stability.

Theoretically, it is possible that inflation improves solvency because it reduces the real value of debt. On the other hand, inflation may activate other potentially destabilising channels via its adverse redistributive and confidence effects, as well as by possibly interfering with the solidity of the banking sector. The causal effects of inflation on financial stability should therefore be assessed empirically. This paper does so and finds that increases to the annual inflation rate raise the probability of crisis.

The methodology relies on a macro-financial historical dataset of 18 advanced economies going back to 1870. A financial crisis is defined as a systemic banking crisis with multiple bank failures. A key empirical obstacle is that monetary policy, an important determinant of financial stability in the literature, reacts to inflation. This confounds estimates of inflation's direct effect. We overcome this by comparing financial stability outcomes among countries with free and fixed exchange rates. These countries share the same monetary policy shocks while facing potentially different conditions for inflation. This framework is used to find that the effect of inflation goes above and beyond simply prompting higher interest rates, and also that this effect holds regardless of whether inflation is driven by aggregate demand or aggregate supply shocks.

To further corroborate the causal interpretation of the findings, we use a dataset of oil supply shocks going back to 1975. Instrumenting inflation with these shocks, it can be shown that a 1 percentage point rise in annual inflation doubles the probability of financial crisis from what it would otherwise be. This result holds while controlling for simultaneous developments in the real economy or in monetary policy.

Rises in inflation are strongly linked to financial crisis in countries with large amounts of long-term household debt and low wage growth. This suggests that household insolvency, possibly brought on by the adverse redistributive implications of inflation by a mechanical cut to real incomes, is a relevant transmission mechanism. Some indications of a role for low central bank credibility and fragile bank funding structure in contributing to the inflation-financial stability nexus are also provided.

Overall, these findings suggest that once inflation is rising, central banks concerned with financial stability face a difficult trade-off between the destabilising effects of higher inflation on the one hand and higher interest rates on the other. Allowing inflation to surge is not inherently the most supportive strategy for financial stability.

1 Introduction

The year 2022 saw the beginning of a rapid change in monetary policy around the world. This renewed an interest in the trade-off between rising interest rates and financial stability. New research began to unearth a pattern of interest rates that was particularly destabilising, that is, rates rising after a period of low or declining rates. Such a pattern has been proven to facilitate an unravelling of previously built-up financial vulnerabilities and therefore typifies many financial crises throughout history (Schularick et al., 2021; Jiménez et al., 2023).

Such a reversal in the monetary policy stance, however, is predominantly thought of occurring after a rise in inflation rates, and thus is an endogenous response in line with the central banks' reaction function. Indeed, inflation rises 3pp on average in the four years before financial crises (Table 1). After 1945 this pattern is stronger still, with 92% of crises following a rise in inflation.

Focussing on this post-WWII sub-sample in Figure 1, the cross-country average inflation rate tends to rise in the years preceding a crisis, sharply declining thereafter. Panel (b) illustrates this point more formally, replicating a regression from Jiménez et al. (2023), which control for country and decade fixed effects.

This raises several important questions: Do these patterns suggest a direct causal and adverse effect of higher inflation on financial stability? If so, how does this impact compare to that resulting from interest rate hikes? In other words, would keeping rates constant while allowing inflation to rise inherently support financial stability? In this paper we shed light on these crucial aspects by providing novel evidence for the causal effects of inflation on financial instability.

Table 1: Change in inflation 4 years before crisis events

	Unconditional		Crisis (JST)		Crisis (BVX)		Recesssion	
	1870-2020	1945-2020	1870-2020	1945-2020	1870-2020	1945-2020	1870-2020	1945-2020
$\pi_t > \pi_{t-4}$	0.48	0.42	0.56	0.92	0.54	0.79	0.26	0.35
$\pi_t - \pi_{t-4}$	-0.2	-0.5	3.3	5.3	3.9	4.3	-1.2	-0.2

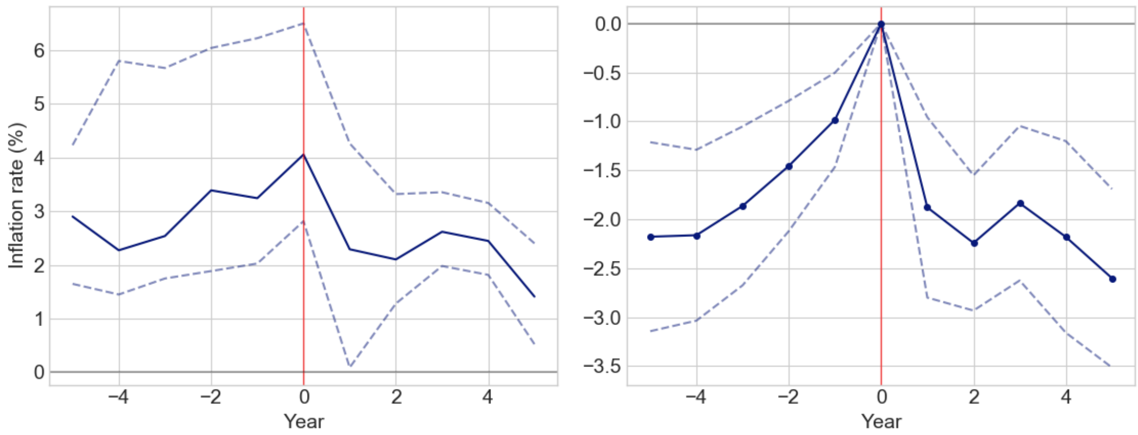
Notes: This table shows the average frequency for a 4-year rise in inflation ($\pi_t > \pi_{t-4}$) and the average 4-year change in inflation ($\pi_{i,t} - \pi_{i,t-4}$) in percentage points for all countries at year t of a country-specific event. This event refers to the financial crisis chronology defined in Jordà et al. (2017) in the case of *Crisis (JST)*, to the banking crisis defined in Baron et al. (2021) in the case of *Crisis (BVX)*, and to years of negative real GDP per-capita growth in the case of *Recession*.

From a theoretical standpoint, one significant channel through which high inflation contributes to financial instability is its pronounced adverse redistributive repercussions (Auclert, 2019). According to this perspective, inflationary shocks can create financial vulnerabilities for households by reducing real income through the so-called inflation tax. This income erosion hampers households' ability to meet debt obligations, particularly affecting the poorest groups, whose consumption is more sensitive to income changes due to the larger share of basic necessities in their consumption basket. As a result, these households may struggle financially until their incomes gradually recover through second-round effects.[1]

[1]As noted by Agarwal and Baron (2024), factors such as uncertainty, fiscal distortions, or the presence of nominal contracts can cause inflation spikes to be associated with a worsening growth outlook, deviating from the standard Phillips' curve relationship. This is consistent with theoretical models, including those of Auerbach (1979), Ball et al. (1990), and Feldstein (1997). Empirically, studies such as Bruno and Easterly (1998) and Fischer (1993), among others, provide evidence that inflation exceeding certain thresholds negatively impacts economic growth.

Figure 1: Inflation around financial crises - post-WWII

(a) Cross-country average (b) Window regression



Notes: Panel (a) shows the cross-country average of inflation rates before and after a financial crisis. Crisis events, centred on year 0, are the years defined in Jordà et al. (2017). Dotted lines denote the cross-sectional 25% and 75% quantiles in each year. Panel (b) runs the Equation 1 regression from Jiménez et al. (2023): $\pi_{i,t+h} - \pi_{i,t} = \alpha_{i,h} + \alpha_{d,h} + \beta_h \mathbb{1}_{Crisis_{i,t}=1} + \epsilon_{i,t+h}$ and plots the result of β_h and its 90% confidence interval for each integer value of h from -5 to 5.

Another hypothesis we can consider involves the credibility of central banks. In the aftermath of significant inflation surges, the risk of inflation spiraling out of control and leading to a full fledged de-anchoring of expectations becomes tangible, particularly if the central bank lacks strong credibility (Blinder, 2000). When inflation expectations become de-anchored, the effectiveness of monetary policy interventions is severely effected. This can undermine the central bank's ability to fulfill its critical role as the "lender of last resort", as bank runs might swiftly escalate into runs on the domestic currency (Kaminsky & Reinhart, 1999). Consequently, the economy is left without a crucial financial stability backstop (Freixas, 1999; Robatto, 2019; Albertazzi et al., 2022).

Other factors that might theoretically explain the link between inflation and financial stability pertain to the conditions of the banking sector, aligning with the established bank-lending channel paradigm (Kashyap & Stein, 2000). Specifically, it has been suggested that higher nominal rates resulting from increased inflation could impair banks, either due to the duration gap typical of their balance sheets or through other mechanisms (Agarwal & Baron, 2024).

Empirically testing the causal effects of inflation on financial stability presents a significant challenge, primarily due to the confounding influence of simultaneous interest rate hikes. To control for this indirect effect we exploit that, under certain conditions, countries are forced to track the monetary policy of another country. The monetary policy reaction from an inflationary shock should therefore be experienced across multiple countries. By comparing countries with differing inflation outlooks but the same monetary policy, we can gauge the causal effects of inflation on financial stability.

We extend this methodology to examine whether the effect of inflation is driven by aggregate supply or aggregate demand shocks. We do so by relying on a decomposition of inflation into demand and supply shocks, standard in the literature. The underlying assumption is that aggregate supply (demand) side inflationary shocks are contractionary (expansionary). To investigate the inflation-financial stability link further, we also adopt an alternative approach considering exogenous oil supply shocks as an instrument for inflation. Finally, to deepen our understanding of the underlying transmission mechanisms, we investigate the heterogeneity of our findings across various relevant dimensions.

Our findings indicate that inflationary shocks generally increase the probability of financial crises. Additionally, this effect holds for inflation arising from both supply and demand-side shocks. The effect is economically significant and, in some circumstances, more than offsets the indirect one produced by the corresponding hike in interest rates. The magnitude is significantly exacerbated in episodes where the mortgage-to-GDP ratio is high and wage growth is low. This supports the idea that a key transmission channel for this effect involves the redistributive consequences of high inflation, which makes it more challenging for households to meet their debt obligations. Other factors also tend to amplify the impact, albeit to a lesser extent. These include low central bank independence, which we consider as a proxy for its credibility, and a fragile bank-funding structure.

The remainder of the paper is organised as follows. We investigate three key strands of literature relevant to inflation and financial instability in Section 2. We go on to describe the dataset we will be using in Section 3 and the methodology in Section 4. We present the results of this analysis in Section 5, demonstrating the financially destabilising effect of inflation. Heterogeneity is explored in Section 6. Section 7 gives concluding remarks and discusses the policy implications.

2 Literature

In answering whether inflation causally affects financial instability, this paper is related to multiple strands of literature. The first concerns the causal mechanisms of financial crises. As explained by Ajello et al. (2022), the interaction of the financial system with information asymmetries and other frictions leads to the build-up of financial vulnerabilities. The speed and likelihood that these vulnerabilities emerge can be affected by monetary policy. In theory, low rates enforce a "search for yields" behaviour, creating a growth in credit and asset prices that may become unsustainable once rates return to high levels (Jiménez et al., 2023; Grimm et al., 2023). A sudden reversal in policy and thus market rates can materialise these vulnerabilities with harmful implications for financial stability (Schularick et al., 2021).

Jiménez et al. (2023) combines these two ideas in identifying a U-shaped interest rate path before financial crises. Using the same Jordà-Schularick-Taylor Macrohistory Database that our paper uses, the authors are able to consider exogenous monetary policy by using the Trilemma IV from Jordà et al. (2020). Together with an interaction variable that identifies a U-shaped interest rate path, the paper estimates that, once in this state, a 1pp increase in interest rates increases the probability of financial crisis in the coming years by 7pp. Despite the common theme of rising policy rates in the literature of financial crises, there is little attention given to the largest cause of rising rates, inflation. Boissay et al. (2023) show that rate hikes following supply-side inflation are particularly dangerous. However, no paper has estimated the direct effect of inflation on financial stability, which this paper aims to do.

The second strand of related papers considers the financial effect of inflation. Fisher (1933) first theorised that dramatic declines in inflation may lead to insolvency as a result of higher real values of debt. Originally applied to the Great Depression, a version of this so-called Fisherian effect has also been used to explain the Global Financial Crisis, debt conditions, and its subsequent impact on economic activities such as investments (Quiviger, 2020; Brunnermeier et al., 2023; Bernanke, 1999). Our paper contributes to this strand of literature by adopting a methodology stressing exogenous variation in inflation and by focusing on its consequent effect for overall financial stability.

Our paper also contributes to the strand of the literature focusing on the effect of inflation on the banking sector. Agarwal and Baron (2024) note that throughout history, large (>10pp) rises in inflation lead to contractions of bank credit. This effect is identified in greater detail by investigating a one-off inflation rise in 1977 and differences in state-level reserve requirements in the US. The authors conclude that through both a net wealth channel and a loan misallocation channel, inflation-exposed banks are more likely to restrict lending following an increase in inflation. In comparison, this paper takes a broader, systematic look at the consequences of inflation. It does so, first, by examining a longer sample with multiple countries. Second, it adopts a financial stability perspective as it assesses whether these implications for banks from inflation ultimately raise the probability of a financial crisis.

Another strand of literature to which this paper contributes is the study of oil supply shocks. We utilise the dataset from Baumeister and Hamilton (2019), which provides global supply and demand shock estimates derived from a model that implicitly incorporates a wide range of countries through its construction of global economic activity. This dataset is grounded in an extensive body of research on supply and demand elasticities, which the authors leverage to establish priors on the interaction between oil prices, demand, and supply within a Bayesian SVAR framework. Baumeister and Hamilton (2019) further illustrate how oil supply shocks propagate, leading to higher inflation. Building on their contribution, this paper employs their dataset as a source of exogenous variation in inflation, applied within an instrument variable framework.

3 Data

3.1 The baseline macroeconomic dataset

In this paper we make use of the Jordà-Schularick-Taylor Macrohistory Database (Jordà et al., 2017), which combines many different historical sources to form a continuous, annual record of macro-finance from 1870 to 2020 for 18 advanced economies. The countries are

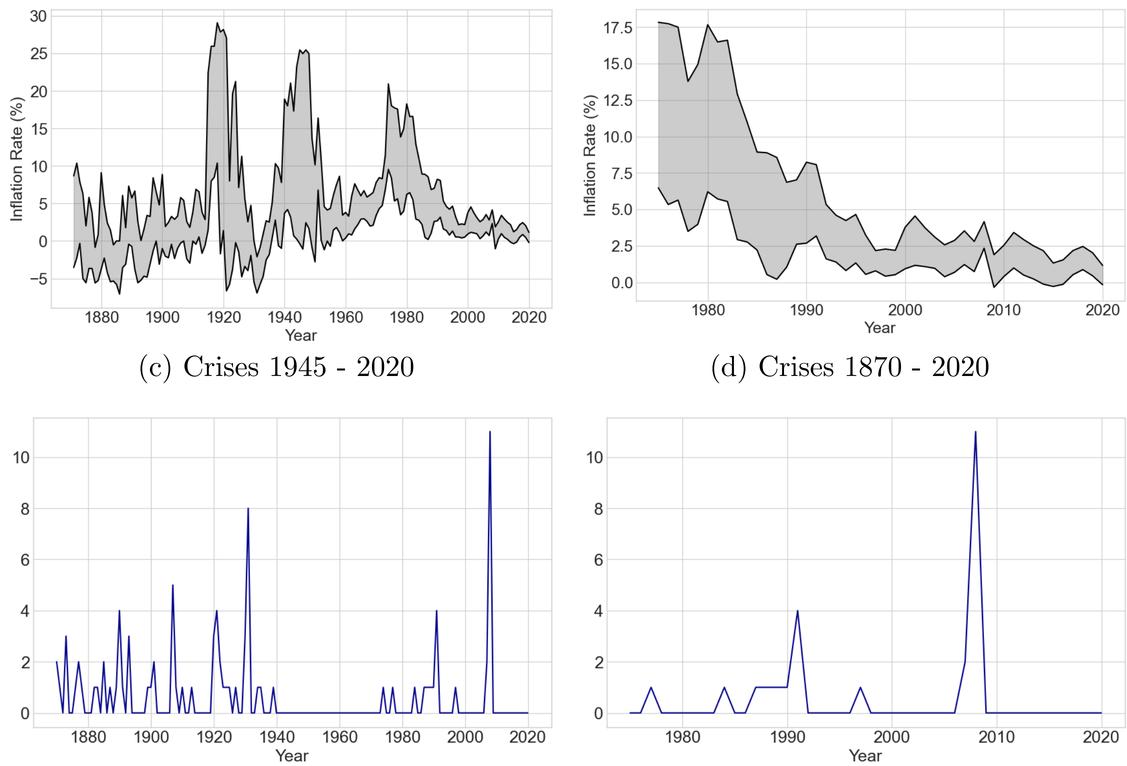
Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The dataset includes variables describing the real economy; money, prices & interest rates; currency pegs; credit and asset prices; and financial crises. The addition of bank balance sheet ratios is made possible by Jordà et al. (2021). We defer a detailed description of the underlying sources to the documentation of the database and only comment on the main ingredients for our analysis here. Our financial crisis variable is the *crisisJST* dummy provided in the database. Whereas inflation and local economic conditions are measured by growth rates in consumer price indices and real per-capita GDP respectively. Two data manipulations, common in the literature, are used to limit the effect of outliers. Inflation is winsorized at the 95% and 5% level and years falling in either WWI and WWII are removed.

The distribution of annual inflation rates can be seen in Figure 2a. The financial crisis variable is a dummy variable that equals 1 for the first year of a systemic banking crisis and 0 otherwise. Figure 2c shows the number of countries in the dataset in the first year of a financial crisis. The GFC is clearly visible by how many countries fell into crisis simultaneously. This period of global financial instability necessarily requires consideration when using a panel regression. Figure B.1 illustrates the evolution of currency pegs across time. In particular, it shows which country each country's currency is pegged to. In the early section of the sample the base country was the country most credibly aligned with the gold standard, thus explaining Britain's global prominence as a base.

Figure 2: Inflation rates and financial crises over time

(a) Inflation 1870 - 2020 (b) Inflation 1975 - 2020

(c) Crises 1945 - 2020 (d) Crises 1870 - 2020



Notes: Panels (a) and (b) show the .1 and .9 quantiles of inflation, while Panels (c) and (d) show the summation of the *crisisJST* dummy variable across all countries.

Table 2: Annual data for 18 advanced economies for 1870-2020 and 1945-2020

	1975-2020				1870-2020		
	crisis freq.	π (%)	$\Delta\pi$ (pp)	oil supply shock	crisis freq.	π (%)	$\Delta\pi$ (pp)
mean	0.029	4.06	-0.30	-0.35	0.033	3.78	0.43
std	0.17	4.55	1.94	5.23	0.18	6.79	3.475.23
minimum	0	-1.88	-18.06	-12.34	0	-8.36	-18.06
25%	0	1.35	-1.02	-3.08	0	0.22	-1.65
50%	0	2.44	-0.19	-0.77	0	2.22	0
75%	0	4.90	0.62	-2.84	0	5.37	1.91
max	1	32.97	12.33	-13.76	1	39.54	30.20

Notes: Crisis frequency describes the *crisisJST* dummy. π is the annual inflation rate, while $\Delta\pi$ denotes the change in inflation in percentage points. *Oil Supply Shock* is the annualised supply shocks to oil production, as estimated by Baumeister and Hamilton (2019).

Table 3: Definitions of key variables

Variable	Definition
Inflation (π)	Annual growth in consumer price index
Crisis	Dummy for the first year of a systematic banking crisis, as defined by Jordà et al. (2017)
GDP growth (Δy)	Annual growth in real GDP per capita
Change in interest rates (ΔR)	Annual change in short-term interest rates
BASE	Dummy for if a country's currency is the base of another currency's peg
KAOPEN	Standardised measure of the degree of capital account openness, between 0 and 1
Oil supply shock (ϵ^{OIL})	Annualised shock to oil production as estimated by Baumeister and Hamilton (2019)

3.2 Oil supply shocks

To augment our baseline dataset, we incorporate variables that allow us to estimate the causal impact of inflation on financial stability. Specifically, we utilize the oil supply shock series developed by Baumeister and Hamilton (2019). Using a monthly structural VAR approach, the authors decompose oil price growth rates into structural supply and demand shocks, from which we adopt their oil supply shock series, available from 1975. To align with our analysis, we aggregate the monthly shocks into annual frequency by summing the values within each year. This series offers two key advantages: first, it provides shocks with a clear and well-defined economic interpretation; second, the model used to identify these shocks incorporates an economic activity variable that captures a significant portion of global petroleum product consumption and world GDP. Consequently, for each country included in our analysis, local economic conditions are effectively accounted for during the shock identification process, enabling us to treat these shocks as exogenous to local economic conditions when interpreting our results.

4 Methodology

4.1 Matched pegged-base countries comparison

Inflation, as previously demonstrated, typically rises before financial crises. However, given that a rise in interest rates usually follows, there is a key confounding effect inhibiting the identification of inflation's effect on financial stability. To estimate the direct effect of inflation we will exploit situations in which multiple countries receive the same monetary policy shock but different inflation shocks. This approach resembles, in spirit, a difference-in-differences exercise, although is technically quite different.

In particular, we will be considering the difference in outcomes between countries with pegged currencies and the corresponding base countries, hereby referred to as PEG and BASE. Jordà et al. (2020) utilises the same insight in order to instrument monetary policy. Under the monetary trilemma, a country cannot simultaneously have fixed exchange rates, open capital accounts and independent monetary policy (Mundell, 1963). As a result, if the BASE country raises interest rates, a PEG country wanting to maintain its currency peg to the BASE country, while keeping free capital movement, has to raise interest rates, regardless of its domestic inflation situation. Therefore, in a situation where the BASE country is facing an increase in domestic inflation and thus its central bank reacts with tighter monetary policy, the PEG country finds itself with tighter monetary policy but no inflationary shock. Consequently, the effect of inflation on financial stability over and above that of monetary policy, can be inferred by comparing the two countries. Namely, such an effect is present if, after its domestic inflationary shock, the BASE country is observed to have a greater frequency of financial crises than the PEG country.

In line with the monetary trilemma, when conducting this examination, we need to consider that a PEG country's monetary policy will be fully constrained by that of the BASE country only under perfect capital mobility. We therefore introduce $\Delta\pi_{i,t}^{trilemma}$ to represent the monetary policy reaction to inflation in the BASE country which is transmitted to the PEG country depending on its level of capital mobility.

$$\Delta\pi_{i,t}^{trilemma} = \begin{cases} \Delta\pi_{i,t} & \text{if country i is a BASE country,} \\ \Delta\pi_{base,t} \times KAOPEN_{i,t} & \text{if country i is a PEG country.} \end{cases}$$

where $\pi_{base,t}$ refers to the inflation rate in the BASE country at time t and $KAOPEN$ is a measure of capital mobility in the range from 0, no capital mobility, to 1, perfect movement of capital (from Chinn and Ito (2006)). The following panel regression then specifies the model:

$$\begin{aligned} crisis_{i,(t,t+2)} = \alpha_i + \beta_0 + \beta_1\Delta_4\pi_{i,t-1}^{trilemma} \times \text{BASE}_{it} + \beta_2\text{BASE}_{it} + \beta_3\Delta_4\pi_{i,t-1}^{trilemma} \\ + \sum_{j=0}^{4}\beta_{4,j}\Delta y_{i,t-j} + \sum_{j=0}^{4}\beta_{5,j}\Delta\pi_{i,t-j} + \epsilon_{it} \end{aligned} \tag{1}$$

where $crisis_{i,(t,t+2)}$ equals 1 if a financial crisis started in year $t, t+1$ or $t+2$ in country i, $\Delta y_{i,t-j}$ are lagged values of real GDP per capita growth and BASE_{it} is a dummy variable equal to 1 if country i is a BASE country at time t. The interaction variable $\Delta_4\pi_{i,t-1}^{trilemma} \times \text{BASE}_{it}$ describes the effect that an increase in inflation has on the probability of financial crisis in the BASE currency country conditional on the effect it has on the PEG country. In other words, the variable captures the effect of inflation on financial stability over and above the possible effect produced by the endogenous monetary policy reaction. This specification crucially controls for macroeconomic conditions. In particular, for current and lagged (four periods) domestic inflation and the growth rate in domestic real-GDP per capita.

Two remarks are in order. First, the underlying identification assumption is conditional on the validity of the monetary trilemma theory. In this respect, we align with what has already been done in recent papers (Jordà et al., 2020; Jiménez et al., 2023) though our analysis differs from theirs in the objective pursued (here the causal effect of inflation) and in the chosen specification (the previous authors construct an IV). Second, our methodology is applicable to the extent that inflation in BASE and PEG countries are significantly driven by domestic factors. Naturally, inflation is affected by global factors, as suggested by Figure 2a. However, significant dispersion across BASE and capital-mobile PEG countries is visually observable, even when considering yearly changes in inflation (Figure B.2). Relatedly, a potential concern would be if an inflationary shock in the BASE country somehow improves financial stability in the PEG country through trade spillovers, which underlines the importance of controlling for macroeconomic conditions.

In principle, the indirect effects of inflation may depend on what its source is. While demand-side inflation is often seen as the consequence of strong economic growth, supply-side inflation is regarded as an adverse shock. For example, cost-push shocks can lower disposable income and therefore reduce the ability of households to pay back debts. We therefore extend the above methodology in order to explore whether the financial stability effects of inflation depend on whether the inflationary shocks are driven by aggregate demand vis-à-vis aggregate supply fluctuations.

To disentangle demand and supply side factors in observed inflation rates, we estimate bivariate country-specific VAR models, of order four, and use sign-restrictions to decompose the reduced-form residuals into demand and supply shocks:

$$w_{i,t} = A_{i,0} + \sum_{j=1}^{4} A_{i,j} w_{i,t-j} + D_i e_{i,t}, \;\; w_{i,t} = \left(\begin{smallmatrix} \pi_{i,t} \\ \Delta y_{i,t} \end{smallmatrix} \right) \tag{2}$$

The matrix D_i measures the impact responses of the endogenous variables to structural shocks in $e_{i,t}$. As is customary in the literature, a demand shock raises inflation and GDP growth, whereas supply shocks move both variables in opposite directions. Applying this sign restriction to the reduced form errors from Equation 2, we can estimate the structural supply and demand shocks and use both in our specification from Equation 1. Shapiro (2024) recently used the signs of the reduced form residuals as a classification mechanism but, as he also points out, this method cannot rule out that both types of shock are active in any given period, and can only speak to which shock is more dominant. In practice, such an approach assumes that the two shocks are mutually exclusive as only of them can materialise in any period. Instead, our procedure provides us with estimates of both structural shocks without having to rely on such assumption.

Regarding the sign restriction, we take a hybrid approach between the often used Bayesian framework outlined in Arias et al. (2018) and a frequentist estimation. Specifically, we draw a large number (1000) of parameters from the posterior distribution implied by an uninformative prior distribution and Gaussian shocks, which is a Normal-Inverse-Wishart distribution centred at the OLS quantities. For each draw, we find a rotation matrix consistent with the sign restrictions, based on Theorem 1 of Arias et al. (2018). This forms a structural shock series for each draw. Lastly, we perform the Equation 1 regression for each structural shock series and make a random draw of the coefficients from a normal distribution with moments given by the regression point estimate and its standard error. This produces a distribution of regression parameters that we use for inference.

4.2 Instrumented inflation

The inflation-financial stability nexus is also explored based on an instrumental variables (IV) approach. This is done for robustness purposes as well as in order to further corroborate the causal interpretation of the findings obtained with the specification above. The matched pegged-base countries comparison is effective in filtering out the possibly confounding role played by monetary policy in driving the positive relation between inflation and crisis probability. Yet, it cannot be ruled out that other sources of heterogeneity are affecting our results. We therefore also present evidence based on exogenous variations in the domestic inflation rate related to oil supply shocks which we take as instruments in a two-stage least squares (2SLS) setup. A limitation of this IV approach is that it primarily addresses supply-side inflation. However, as will be demonstrated in Section 5.1, this is not a critical constraint. Letting ϵ_t^{OIL} denote the oil supply shock in year t, in the first stage we estimate:

$$\Delta\pi_{i,t} = \alpha_i + \beta_0 + \beta_1\epsilon_t^{OIL} + \sum_{j=0}^{4}\beta_{2,j}\Delta\mathrm{R}_{i,t-j} + \sum_{j=0}^{4}\beta_{3,j}\Delta y_{i,t-j} + u_{i,t} \tag{3}$$

where $\Delta R_{i,t-j}$ are contemporaneous and lagged values of changes in short-term interest rates. Hence in the first stage, we extract the exogenous component from changes in inflation rates after current and lagged shocks affecting interest rates and economic activity have materialised. We then use the predicted values of this regression in the second stage linear probability model:

$$\mathrm{crisis}_{i,t} = \alpha_i + \beta_0 + \beta_1\widehat{\Delta\pi}_{i,t-1} + \sum_{j=0}^{4}\beta_{2,j}\Delta R_{i,t-j} + \sum_{j=0}^{4}\beta_{3,j}y_{i,t-j} + \epsilon_{i,t} \tag{4}$$

In line with the shorter sample-period for which oil supply shocks are available from, we reduce the time window considered both for the change in inflation and the crisis horizon to 1 year. Below we conduct sensitivity tests that verifies the robustness of our results to this choice.

A potential concern is that oil supply shocks, which often coincide with broader supply disruptions, may also lead to contractions in economic growth, which presumably may in itself affect financial stability. This illustrates how, for the exclusion restriction to be met, it is important to control for real GDP growth. In addition, it can be pointed out that, once controlling for interest rates and inflation, the effect of oil supply shocks on GDP growth is not significant in this sample. Moreover, the strong first stage results rule out the presence of weak-instrument issues (Table 5).

5 Results

5.1 Matched pegged-base countries comparison

Our results show that a rise in inflation has a direct effect on financial stability above and beyond its indirect effect on monetary policy (Table 4). Mirroring the pattern documented in Figure 1, a rise in inflation from $t-5$ to $t-1$ significantly predicts crises starting in t to $t+2$. This effect on the probability of financial crisis is also visible with a narrower crisis window for crises starting exclusively in year t. The results are also robust to the chosen inflation window. Table B.9 confirms that the key predictor of crises is that inflation rises in the 5 years before a crisis period.

Inflationary shocks may originate from either aggregate demand or aggregate supply fluctuations, with opposite implications for growth. Therefore, to dissect the direct effect of inflation from the concomitant indirect effect of growth we must exploit our estimated structural demand and supply shocks. Both shocks are plotted in Figure B.3, where the rise in supply constraints during the 1970s is clearly visible.

The results indicate that this effect holds regardless of the type of inflation (Table 4). Specifically, a test for size difference between the coefficients of demand and supply shocks does not reject the null of same size, visually confirmed in Figure B.4. The magnitude of either coefficient is larger than that of the first column on the left because these shocks have a comparatively smaller distribution (the four-year sum of either shock has an average standard deviation of 2.2 in comparison to 33.7 for $\Delta_4\pi$). Below we will investigate the mechanisms underlying our finding about the link between inflation and crisis probability as well as the role played by aggregate demand and supply shocks. For now, it is useful to stress how these findings are not in contrast with previous evidence indicating that supply-side inflation intensifies financial stress while demand-side does not, as in Boissay et al. (2023). The focus of those analyses is on the effect of the monetary policy reaction to inflation rather than on the direct effect of inflation.

Table 4: Effect of inflation after controlling for the monetary policy effect

	Full sample	1870-2000	$crisis_{i,t}$	Shock decomposition
$\Delta_4\pi^{trilemma}_{i,t-1} \times BASE_{i,t}$	0.012*** (0.003)	0.010** (0.005)	0.005* (0.003)	
demand shock				0.043***
supply shock				0.040**
R^2	0.030	0.041	0.038	0.045
observations	1463	1262	1463	1290
sample	1870-2020	1870-2000	1870-2020	1884-2020
crisis variable	$crisis_{i,(t,t+2)}$	$crisis_{i,(t,t+2)}$	$crisis_{i,t}$	$crisis_{i,(t,t+2)}$

Notes: This table shows the outcome of a linear probability model for a systemic banking crisis. In particular, the result from the regression of Equation 1 for varying samples and crisis variables. $\Delta_4\pi^{trilemma}_{i,t-1} \times BASE_{i,t}$ describes the effect of a four-year change in inflation conditional on the monetary policy, lagged by 1 year. $crisis_{i,(t,t+2)}$ is a dummy variable that equals 1 if $crisis_{i,t}$ equals 1 in periods $t, t+1$ or $t+2$. The final column on the right compares the relative impact of demand and supply inflation jointly within the same regression. The demand and supply shock variables represent the 4-year sum of structural shocks (in order to reflect $\Delta_4\pi$) interacted with a dummy for the BASE country: $\sum^{4} e^{trilemma}_{i,t-1} \times BASE_{i,t}$, where $e_{i,t}$ are the structural shocks for country i at time t estimated according to Equation 2. Significance tests are performed non-parametrically from the simulated parameter estimates that are shown in Figure B.4. For all other regressions, country-clustered standard errors are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively

5.2 Instrumented inflation

As explained above, a second methodology we follow to explore the inflation and financial stability nexus relies on an IV approach. Starting with the first stage, as expected and in line with extensive literature on this topic, we find a strong and significant negative effect of oil supply shocks on changes in inflation rates. Namely, a decrease in the supply of oil leads to an acceleration of prices (Table 5). In the second stage, we find that a 1pp increase in exogenous inflation leads to a 4.6pp increase in the crisis probability in the next year. This is a quantitatively strong impact; for reference, over this sample, financial crisis years account for roughly 2.9% percent of observations. This estimate is higher than that of the matched pegged-base countries comparison, a distinction we elaborate on in Section 7.

Table 5: Instrumenting inflation with oil supply shocks

First stage	
ϵ_t^{OIL}	-0.060*** (0.012)
contemporaneous and 4 lags of ΔR and Δy	Yes
R^2	0.23
F-Stat	23
Prob >F	0.0001
Kleibergen-Paap	23.59
country fixed effects	Yes
observations	808
sample	1975-2020

Second stage	
$\widehat{\Delta\pi}_{i,t-1}$	0.046*** (0.017)
contemporaneous and 4 lags of ΔR and Δy	Yes
R^2	0.046
country fixed effects	Yes
observations	808
sample	1975-2020

Notes: This table shows the outcome of a linear probability model for a systemic banking crisis. The left panel refers to the result of the first stage of the 2SLS, defined in Equation 3 whereas the rightward panel refers to the second stage defined in Equation 4. Country-clustered standard errors are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

This result is consistent across a range of crisis indicators. Using a significant loss in bank equity as our crisis definition achieves a similarly strong result (Table B.10). The coefficient increases in magnitude, though this possibly reflects the slightly higher frequency of crises when considering such definition. Similarly, we observe significance with the longer crisis horizon from the previous method (Table 7).

Additionally, the results are robust to a number of tests that vary the econometric specification adopted. Table B.11 confirms the main findings when considering a logit model or when allowing for white standard errors. We may also consider that some countries will be less sensitive to a global shock to oil supply. The same table shows that after excluding oil producing countries (USA, Canada and Norway), the main findings are confirmed and, as expected, even reinforced in magnitude. A further extension of the econometric specification considers the inclusion, as additional control variables, of four lags of credit growth. This well-known crisis indicator was initially laid out by Schularick and Taylor (2012) who first documented that growth in these variables strongly predicted a crisis. The results are quantitatively robust to this extension, suggesting that financial exuberance is not the culprit of the identified relation between inflation and financial instability.

The main objective of our methodological efforts is to ensure that our results remain unaffected by monetary policy, which often reacts endogenously to inflationary shocks and has been shown to impair financial stability. We do this either by comparing matched base-pegged countries or by instrumenting inflation with oil supply shocks. However, given the literature's emphasis on the non-linear relationship between monetary policy and financial stability, we extend our regressions to account for so-called U-shaped monetary policy episodes. This interest rate path is defined by Jiménez et al. (2023) as an interaction between a dummy variable indicating a previous trend of low or declining rates and the three-year change in rates. Including this control in our baseline regression specification has a negligible effect on our results, reinforcing the notion that we are capturing a distinct and separate effect (Table B.11).

One constraint of this analysis is that the 1975-2020 sample contains too few financial crises to test sub-sample sensitivity. As a result, periods of global financial instability, such as 2007-8, cannot simply be removed from the estimation. Utilising a longer sample, the matched pegged-base countries comparison is able to perform this sub-sample analysis and finds robustness to excluding the 2000-2020 period (Table 4).

6 Heterogeneity and transmission mechanisms

To better understand why inflationary shocks are detrimental to financial stability we may investigate cross-country heterogeneity. To do this, we interact instrumented inflation from Equation 4 with a number of other macro-financial variables and indicators capturing features of the domestic financial sector. A first channel we explore is inspired by the literature on the redistributive effects of inflation. According to this view, inflationary shocks may create financial vulnerabilities for households as real income is cut by the inflation tax and only gradually recovers once second-round effects kick in (Auclert, 2019). Consistent with this view, we document that countries with previously low wage growth have a greater risk of crisis following a rise in inflation (Table 6).

A related additional finding is that the inflation-financial instability link is intensified for countries characterised by a high level of household debt. This corroborates the view that inflation interferes with financial stability by weakening the solvency of the household sector. Indeed, the regression results indicate that the same conclusion does not carry over to other forms of debt, including corporate and public sector debt.

Table 6: The heterogeneous impact of inflation

	Wage growth	Debt	Central bank independence
$\widehat{\Delta\pi_{it-1}}$	0.052***	-0.008	0.044**
	(0.02)	(0.038)	(0.02)
wage growth$_{it-2}$	-0.001		
	(0.001)		
wage growth$_{it-2} \times \widehat{\Delta\pi_{it-1}}$	-0.001**		
	(0.0006)		
public debt$_{it-2}$		-0.030	
		(0.021)	
mortgages$_{it-2}$		0.057	
		(0.046)	
corporate debt$_{it-2}$		0.059*	
		(0.036)	
public debt$_{it-2} \times \widehat{\Delta\pi_{it-1}}$		0.007	
		(0.019)	
mortgages$_{it-2} \times \widehat{\Delta\pi_{it-1}}$		0.084***	
		(0.024)	
corporate debt$_{it-2} \times \widehat{\Delta\pi_{it-1}}$		0.012	
		(0.010)	
central bank independence$_{it-2}$			0.021
			(0.04)
central bank independence$_{it-2} \times \widehat{\Delta\pi_{it-1}}$			-0.073*
			(0.04)
R^2	0.047	0.076	0.050
observations	808	801	808

Notes: This table shows the outcome of a linear probability model for a systemic banking crisis, defined in Equation 4, where instrumented inflation is interacted with key macro-financial variables, controlling for lags of real per-capita GDP growth and changes in policy rates. Central bank independence refers to the financial independence estimate from Romelli (2022, 2024), for which the cross-sectional median is subtracted for each year to remove the trend. Public debt refers to the public-debt-to-GDP ratio, corporate debt refers to the corporate debt-to-GDP ratio and business loans refer to the business loans-to-GDP ratio. Country-clustered standard errors are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Other factors may also play a role. As introduced in Section 1, it can be theorised that the adverse consequences of inflation on financial stability depend on market expectations about the ability of the central bank to rein in second-round effects, therefore preventing a strongly destabilising outright de-anchoring of inflation expectations. There is some evidence of this channel, with a low level of central bank financial independence magnifying the inflation's financial instability effect. However, it must be noted that there were no other significant interactions with other components of central bank independence in the dataset by Romelli (2022, 2024).

Finally, additional exercises look into the presence of a bank lending channel in our context. One relevant finding in this respect indicates stronger detrimental consequences from inflation depending on domestic banks' funding structure, in particular for intermediaries with higher funding gaps or reliance on wholesale (unstable) funding (Table B.12).

7 Conclusions and Policy Considerations

Our analysis demonstrates that rises in inflation cause financial instability, confirmed with multiple econometric methodologies. The impact is also quantitatively relevant. A one-standard deviation shock in the change in inflation (equal to 1.9pp in our sample) explains more than half of the standard deviation the crisis probability (17%), according to our IV estimates. Both supply and demand-side inflation contribute to this instability. These results run counter to the Fisherian ideas of debt deflation.[2]

Concerning the transmission mechanism at work, our results are inconsistent with the

[2] As previously explained, Fisher proposed that declines in the price level increase the real value of debt and subsequently debtor insolvency (Fisher, 1933). Recent empirical analyses produced results consistent with the Fisherian hypothesis (Brunnermeier et al., 2023). Interestingly, such evidence refers to the experience of German firms during hyper-inflation period of 1919-1923, which epitomises financial instability. All together, we interpret this as indicating that, even if present at the micro-level, Fisherian effects may be countered by broader, opposing forces that tend to dominate.

view that the inflation-financial instability relation is purely driven by the economic stress associated with adverse (inflationary) energy price shocks, as demand side inflation is documented to be relevant as well. Symmetrically, the relevance of supply-side inflationary shocks rules out that the inflation-financial stability relation can solely be explained by the financial imbalances associated with a high-inflation booming economy stimulated by financial exuberance (in line with this, lending growth does not play a significant role in our results).

In differencing out monetary policy responses, we are also able to confirm that the financial stability effect exists separate from simply prompting a monetary policy reaction to a spike in inflation. Instead, our evidence is consistent with the idea that inflation impairs financial stability due to its redistributive repercussions. Inflation erodes households' real income, hindering their ability to meet debt obligations, especially in low-income groups where basic necessities dominate consumption. This is evident in the stronger inflation-crisis link when wage growth is low or the mortgage ratio is high.[3]

Also other factors contribute to shape the inflation financial stability link. One interesting finding is that inflation's impact on crisis probability is intensified when central banks have limited independence, possibly reflecting heightened risks of de-anchoring and the related broad-based instability implications. Inflation is also particularity harmful when banks face fragile funding, larger funding gaps and higher exposure to wholesale (unstable) funding, indicating that the the inflation-induced instability activates a bank-lending channel.

[3]For instance, in countries with an 80% mortgage-to-GDP ratio (which corresponds to the 90th percentile of the distribution in the estimation sample but is still lower than levels reached in the more recent past in some advanced economies), a 1pp rise in inflation results in a 7pp rise in the crisis probability (Table 6).

In terms of policy implications, our findings, together with those available from the related literature, indicate that both higher inflation and higher rates are detrimental to financial stability. This raises the question of what effect might dominate. Comparing estimates from Jiménez et al. (2023) and Schularick et al. (2021), both based on the same dataset as this paper, offers some insights. In Table 7, we adjust our IV estimation by redefining a crisis as occurring in the next 3 years, aligning it with the definition used in Jiménez et al. (2023). This shows that a 1pp increase in inflation will raise the probability of a financial crisis in the coming 3 years by 7pp. This needs to be compared to the increase in rates that would be large enough to offset the 1pp increase inflation. According to Schularick and Taylor (2012), this required rate hike is roughly equivalent to 1pp, though it should be acknowledged that literature estimates vary and often suggest smaller elasticity coefficients. Jiménez et al. (2023) finds that such a 1pp rate hike (occurring over a 3-year horizon) leads to an increase in the probability of a crisis in the next 3 years equal to 7pp, if rates had previously cumulatively fallen (in the years $t-8$ to $t-3$); otherwise the effect is 3pp.

Overall, our findings indicate that allowing inflation to rise is detrimental compared to the necessary rate hike to counter it, whenever the tightening does not induce a U-shaped rate pattern. If instead, financial imbalances are elevated due to the low rate period preceding the tightening, the financial stability implications of inaction versus action are broadly quantitatively similar. Consequently, central banks facing strong inflationary shocks that happen to materialise after years of monetary accommodation face a particularly harsh financial stability trade-off.

Table 7: Instrumented inflation against the effect of monetary policy

	$crisis_{i,t}$	$crisis_{i,(t,t+2)}$	$crisis_{i,(t,t+2)}$
$\Delta\widehat{\pi_{it-1}}$	0.046*** (0.017)	0.072** (0.028)	
$\Delta_3 R_t \times CutR_{t-8,t-3}$			0.07*** (0.03)
R^2	0.046	0.049	-
observations	808	808	1625

Notes: This table shows the outcome of two linear probability models in predicting systemic banking crises. The first two columns demonstrate the results from Equation 4 with varying horizons for financial crisis. The third column shows the result of a regression on instrumented U-shaped interest rates. $Crisis_{i,(t,t+2)}$ is a dummy variable that equals 1 if $Crisis_{i,t}$ equals 1 in the periods $t, t+1$ or $t+2$. $\Delta_3 R_t \times R_{t-8,t-3}$ refers to an interaction of the cumulative 3-year change in interest rates with a dummy for a preceding fall in cumulative 5-year rates. The variable is instrumented on the Trilemma IV from Jordà et al. (2020) and the results are taken from Jiménez et al. (2023). Country-clustered standard errors are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Three main caveats apply. First, a comprehensive assessment would require considering the indirect effects via economic growth. To the extent that stronger growth supports financial stability, the contractionary impact from the monetary policy tightening might favour inaction, particularly in U-shape tightening episodes where the balance of "direct" effects are already balanced. On the other hand, it is plausible that the high level of uncertainty typical of high-inflation episodes may also be detrimental to growth, especially if the central bank does not enjoy a strong credibility. This may be further compounded by the potential damage to credibility that significant deviations from inflation targets may create.[4]

[4]The contractionary effects of monetary policy tightening on output growth are of course well studied and reasonably consensual. Bauer and Granziera (2016) utilise a quarterly VAR model of 18 countries to show that a 1pp increase in rates leads to a 1.25% contraction in GDP. A similar method by Keating et al.

Second, the above quantification focuses on the financial stability impact estimated based on our IV approach, which is significantly stronger than that obtained from the matched pegged-base countries comparison. The latter, by construction, provides an estimated impact that specifically refers to base countries, by definition the most financially secure.

Third, other important factors, not captured in this paper due to data limitation, are presumably affecting the balance of such a trade-off. These include characteristics of the structure of the financial sector, such as the prevalence of fixed-rate mortgages, and the availability of other policies, namely of fiscal support to households facing strong inflationary pressure.

(2019) applied to the US delivers a smaller effect of -0.4% after one or two years. The size of this effect is more in line with the outcome of other methods including DSGE models (Alpanda & Zubairy, 2017) and linear projections (Jordà et al., 2020). As for the impact of GDP growth on financial stability, it is harder to identify a consensual view in the literature, with views ranging from those stressing the positive effect related to higher incomes, employment and stronger fiscal positions to those highlighting how rapid growth can actually be associated with financial exuberance and ultimately financial instability. Instead, much of the literature focuses on the opposite direction of causality: how financial stability stimulates growth.

References

Agarwal, I., & Baron, M. (2024). Inflation and disintermediation. *Journal of Financial Economics*, *160*, 103902.

Ajello, A., Boyarchenko, N., Gourio, F., & Tambalotti, A. (2022). Financial stability considerations for monetary policy: Theoretical mechanisms. *FRB of New York Staff Report*(1002).

Albertazzi, U., Burlon, L., Jankauskas, T., & Pavanini, N. (2022). The shadow value of unconventional monetary policy. *CEPR Discussion Paper*(DP17053).

Alpanda, S., & Zubairy, S. (2017). Addressing household indebtedness: Monetary, fiscal or macroprudential policy? *European Economic Review*, *92*, 47–73.

Arias, J. E., Rubio-Ramírez, J. F., & Waggoner, D. F. (2018). Inference based on structural vector autoregressions identified with sign and zero restrictions: Theory and applications. *Econometrica*, *86*(2), 685–720.

Auclert, A. (2019). Monetary policy and the redistribution channel. *American Economic Review*, *109*(6), 2333–2367.

Auerbach, A. J. (1979). Inflation and the choice of asset life. *Journal of Political Economy*, *87*(3), 621–638.

Ball, L., Cecchetti, S. G., & Gordon, R. J. (1990). Inflation and uncertainty at short and long horizons. *Brookings Papers on Economic Activity*, *1990*(1), 215–254.

Baron, M., Verner, E., & Xiong, W. (2021). Banking crises without panics. *The Quarterly Journal of Economics*, *136*(1), 51–113.

Bauer, G. H., & Granziera, E. (2016). Monetary policy, private debt and financial stability risks. *Private Debt and Financial Stability Risks (November 11, 2016)*.

Baumeister, C., & Hamilton, J. D. (2019). Structural interpretation of vector autoregressions with incomplete identification: Revisiting the role of oil supply and demand shocks. *American Economic Review*, *109*(5), 1873–1910.

Bernanke, B. (1999). The financial accelerator in a quantitative business cycle framework. *Handbook of Macroeconomics*, *1*.

Blinder, A. S. (2000). Central-bank credibility: Why do we care? how do we build it? *American economic review*, *90*(5), 1421–1431.

Boissay, F., Collard, F., Manea, C., & Shapiro, A. H. (2023). Monetary tightening, inflation drivers and financial stress..

Brunnermeier, M. K., Correia, S. A., Luck, S., Verner, E., & Zimmermann, T. (2023). *The debt-inflation channel of the german hyperinflation* (Tech. Rep.). National Bureau of Economic Research.

Bruno, M., & Easterly, W. (1998). Inflation crises and long-run growth. *Journal of Monetary economics*, *41*(1), 3–26.

Chinn, M. D., & Ito, H. (2006). What matters for financial development? capital controls, institutions, and interactions. *Journal of development economics*, *81*(1), 163–192.

Feldstein, M. S. (1997). The costs and benefits of going from low inflation to price stability. In *Reducing inflation: Motivation and strategy* (pp. 123–166). University of Chicago Press.

Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of monetary economics*, *32*(3), 485–512.

Fisher, I. (1933). The debt-deflation theory of great depressions. *Econometrica: Journal of the Econometric Society*, 337–357.

Freixas, X. (1999). Lender of last resort. *Financial Stability Review, November*.

Grimm, M., Jordà, Ò., Schularick, M., & Taylor, A. M. (2023). *Loose monetary policy and financial instability* (Tech. Rep.). National Bureau of Economic Research.

Institute, E. (2024). *Statistical review of world energy.* `https://ourworldindata.org/grapher/global-energy-substitution`. (Energy Institute - Statistical Review of World Energy (2024); Smil (2017) – with major processing by Our World in Data Accessed: 2024-10-24)

Jiménez, G., Kuvshinov, D., Peydró, J.-L., & Richter, B. (2023). Monetary policy, inflation, and crises: Evidence from history and administrative data. *Inflation, and Crises: Evidence From History and Administrative Data (June 6, 2023)*.

Jordà, Ò., Richter, B., Schularick, M., & Taylor, A. M. (2021). Bank capital redux: Solvency, liquidity, and crisis. *The Review of economic studies*, *88*(1), 260–286.

Jordà, Ò., Schularick, M., & Taylor, A. M. (2017). Macrofinancial history and the new business cycle facts. *NBER macroeconomics annual*, *31*(1), 213–263.

Jordà, Ò., Schularick, M., & Taylor, A. M. (2020). The effects of quasi-random monetary experiments. *Journal of Monetary Economics*, *112*, 22–40.

Kaminsky, G. L., & Reinhart, C. M. (1999). The twin crises: the causes of banking and balance-of-payments problems. *American economic review*, *89*(3), 473–500.

Kashyap, A. K., & Stein, J. C. (2000, June). What do a million observations on banks say about the transmission of monetary policy? *American Economic Review*, *90*(3), 407–428.

Keating, J. W., Kelly, L. J., Smith, A. L., & Valcarcel, V. J. (2019). A model of monetary policy shocks for financial crises and normal conditions. *Journal of Money, Credit and Banking*, *51*(1), 227–259.

Liddle, B., & Huntington, H. (2020). Revisiting the income elasticity of energy consumption: A heterogeneous, common factor, dynamic oecd &non-oecd country panel analysis. *The Energy Journal*, *41*(3), 207–230.

Mundell, R. A. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. *Canadian Journal of Economics and Political Science/Revue canadienne de economiques et science politique*, *29*(4), 475–485.

Quiviger, Z. (2020). Irving fisher, the debt-deflation theory, and the crisis of 2008-2009.

Undergraduate Economic Review, *16*(1), 22.

Robatto, R. (2019). Systemic banking panics, liquidity risk, and monetary policy. *Review of Economic Dynamics*, *34*, 20-42.

Romelli, D. (2022). The political economy of reforms in central bank design: Evidence from a new dataset. *Economic Policy*, *37*(112), 641–688.

Romelli, D. (2024). Trends in central bank independence: a de-jure perspective. *BAFFI CAREFIN Centre Research Paper No. 217*.

Schularick, M., Steege, L. t., & Ward, F. (2021). Leaning against the wind and crisis risk. *American Economic Review: Insights*, *3*(2), 199–214.

Schularick, M., & Taylor, A. M. (2012). Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870–2008. *American Economic Review*, *102*(2), 1029–1061.

Shapiro, A. H. (2024). Decomposing supply-and demand-driven inflation. *Journal of Money, Credit and Banking*.

Appendices

A Surprise energy inflation

An additional variation tries to test the robustness of our IV estimations to the sample considered, which covers 1975-2020, the period for which oil supply shocks are available. This method considers an approach similar to the unpredictable interest rates IV in Jordà et al. (2020), using instead the unpredictable component of energy inflation.

Liddle and Huntington (2020) offers an estimate for annual real energy inflation for each country in each year from 1960 to 2016. We supplement the dataset with the OECD series CPI-ENERGY in order to extend our sample to 2020. We may also construct the global annual growth in consumption for the same energy sources for which we have inflation data as a measure of the growth in world demand (Institute, 2024). Similarly, we may utilise the growth in world GDP from the World Bank. This is measured as the log of the sum of real GDP across countries in each year, similar in spirit to the multi-country real activity index used in Baumeister and Hamilton (2019).

The assumption underlying this alternative approach is that surprise energy inflation is a proxy for energy supply shocks, as largely related to the intrinsic instability of cartel agreements among oil producers, for example in relation to geopolitical tensions. One advantage of the approach is that it allows the sample to extend by 10 more years, covering the period 1965-2020. A second benefit of this specification is that it allows us to absorb the global trend in financial stability, such as for instance the GFC, which could potentially produce spurious correlation. This is done by including time fixed effects, which forces the regression to identify the estimated effects by looking at the country cross-section.

Table A.8: Surprise energy inflation

First stage	
$\pi_{i,t}^{surprise,e}$	0.048** (0.024)
contemporaneous and 4 lags of ΔR and Δy	Yes
R^2	0.14
F-Stat	13
Prob >F	0.000
country fixed effects	Yes
time fixed effects	No
observations	957
sample	1965-2020

Second stage	
$\widehat{\Delta\pi}_{i,t-1}$	0.024* (0.015)
contemporaneous and 4 lags of ΔR and Δy	Yes
R^2	0.024
4 lags of GDP growth and	Yes
changes in interest rates	
country fixed effects	Yes
time fixed effects	Yes
observations	939
sample	1965-2020

Notes: Similarly to Table 5, this table shows the results from a TSLS regression on the change in inflation. However, here surprise energy inflation (defined in A.2) is used as a instrument instead of oil supply shocks and time fixed-effects are included in the second stage. Country-clustered standard errors in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

This requires extracting predictable factors related to domestic conditions from observed annual energy inflation. As a first step, we estimate the following predictive regressions for each country:

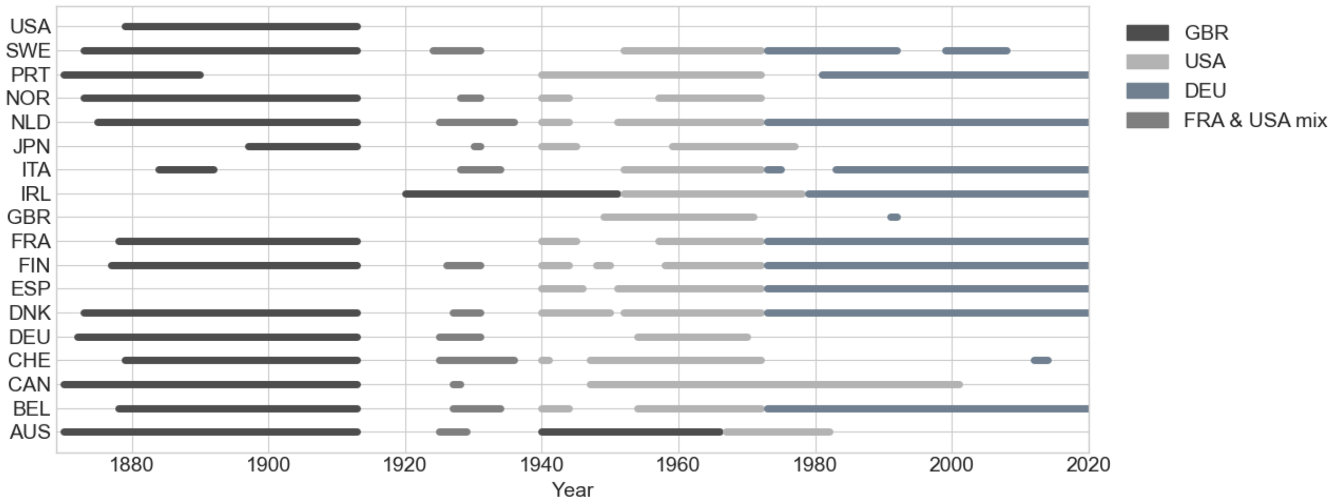
$$\pi_{i,t}^{e} = \alpha_i + \beta_0 + \sum_{j=1}^{2} \beta_{1,j}\pi_{i,t-j}^{e} + \sum_{j=0}^{2} \beta_{2,j}\Delta C_{t-j} + \sum_{j=0}^{2} \beta_{3,j}\Delta y_{t-j}^{w} + \epsilon_{i,t} \tag{A.1}$$

$$\pi_{i,t}^{surprise} \equiv \pi_{i,t}^{e} - \hat{\pi}_{i,t}^{e} \tag{A.2}$$

where $\pi_{i,t}^{e}$ is the real energy inflation rate for country i at year t, ΔC_t is the annual change in the global consumption for the same energy sources and Δy_{t-j}^{w} is the annual change in world GDP. That is, we presume that any country aims to predict energy prices using world economic demand/supply factors and past rates of inflation. The second step uses these fitted variables as an instrument for $\Delta\pi$ within a TSLS in a similar fashion to Equation 4. The results confirm that inflation creates heightened financial instability one year later (Table A.8). The effect remains statistically and economically important, though milder than that reported in Table 5.

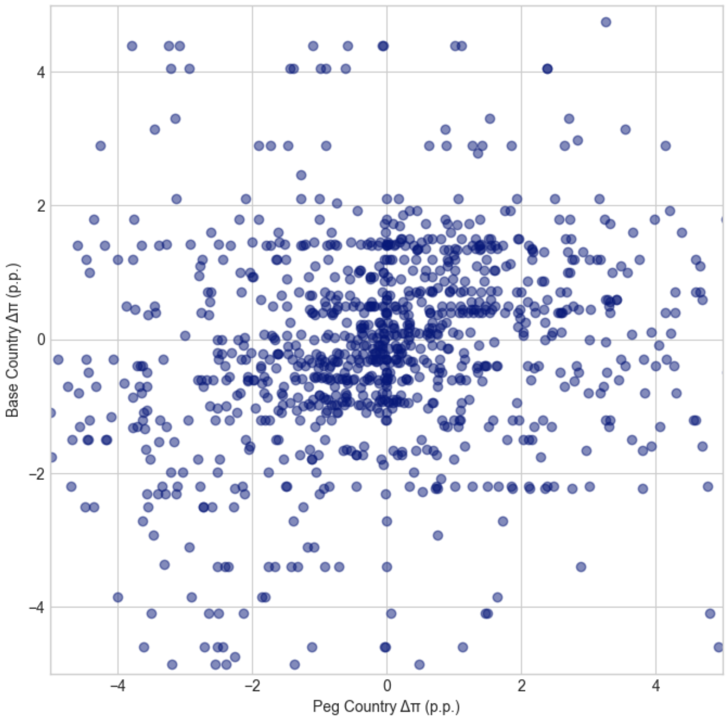
B Additional Results

Figure B.1: Base for each country's currency



Notes: This chart shows the currency base for each country with a pegged currency from 1870-2020, taken from Jordà et al. (2017).

Figure B.2: Inflation movements in peg vs. base currency countries



Notes: This scatter point represents the annual change in the inflation rate of a pegged-currency country (x-axis) versus in the country the currency is based on (y-axis) after removing pegged countries with constrained capital movement ($KAOPEN_{it} < 0.5$)

Table B.9: Effect of inflation of varying windows after controlling for monetary policy

	t - t-5	t-1 - t-5 (baseline)	t-2 - t-5	t-3 - t-5
$\Delta_5 \pi_{i,t}^{trilemma} \times BASE_{i,t}$	0.006* (0.003)			
$\Delta_4 \pi_{i,t-1}^{trilemma} \times BASE_{i,t}$		0.012*** (0.003)		
$\Delta_3 \pi_{i,t-2}^{trilemma} \times BASE_{i,t}$			0.017*** (0.005)	
$\Delta_2 \pi_{i,t-3}^{trilemma} \times BASE_{i,t}$				0.009* (0.005)
R^2	0.023	0.027	0.032	0.022
observations	1509	1463	1417	1373
sample	1870-2020	1870-2020	1870-2000	1870-2020
dependent variable	$crisis_{i,(t,t+2)}$	$crisis_{i,(t,t+2)}$	$crisis_{i,(t,t+2)}$	$crisis_{i,(t,t+2)}$

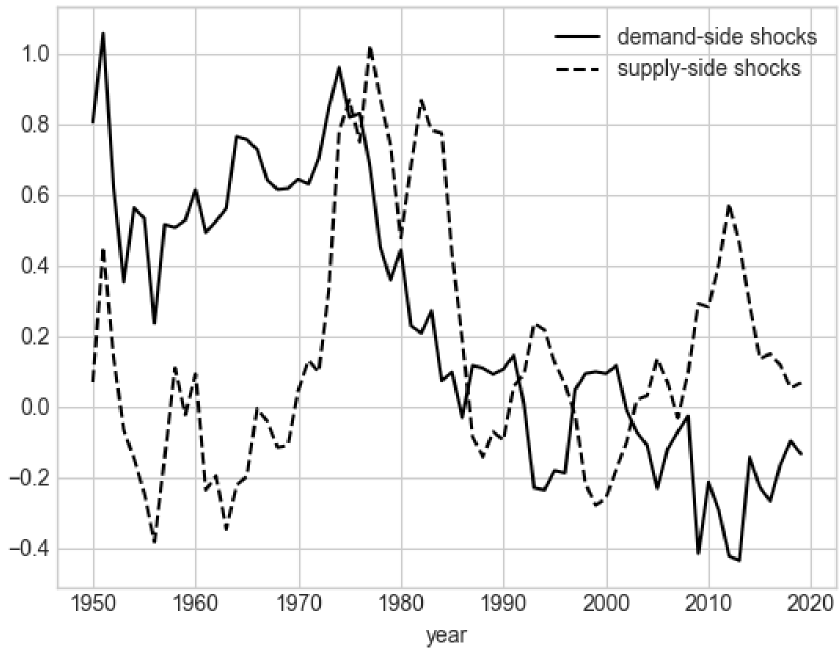
Notes: This table shows the outcome of a linear probability model for a systemic banking crisis. In particular, the result from the regression of Equation 1 for varying inflation windows. $\Delta_p \pi_{i,t-l}^{trilemma} \times BASE_{i,t}$ describes the effect of a p-year change in inflation conditional on the monetary policy reaction, lagged by l years. As shown by the column headings, the varying Δ_p represent varying windows for the difference between inflation in year t to $t-3$ and inflation in year $t-5$. $crisis_{i,(t,t+2)}$ is a dummy variable that equals 1 if $crisis_{i,t}$ equals 1 in periods $t, t+1$ or $t+2$. Country-clustered standard errors are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively

Table B.10: Instrumented inflation under different crisis definitions

	JST crisis definition	BVX crisis definition
$\widehat{\Delta\pi}_{it-1}$	0.046*** (0.017)	0.078*** (0.015)
R^2	0.046	0.044
observations	808	808

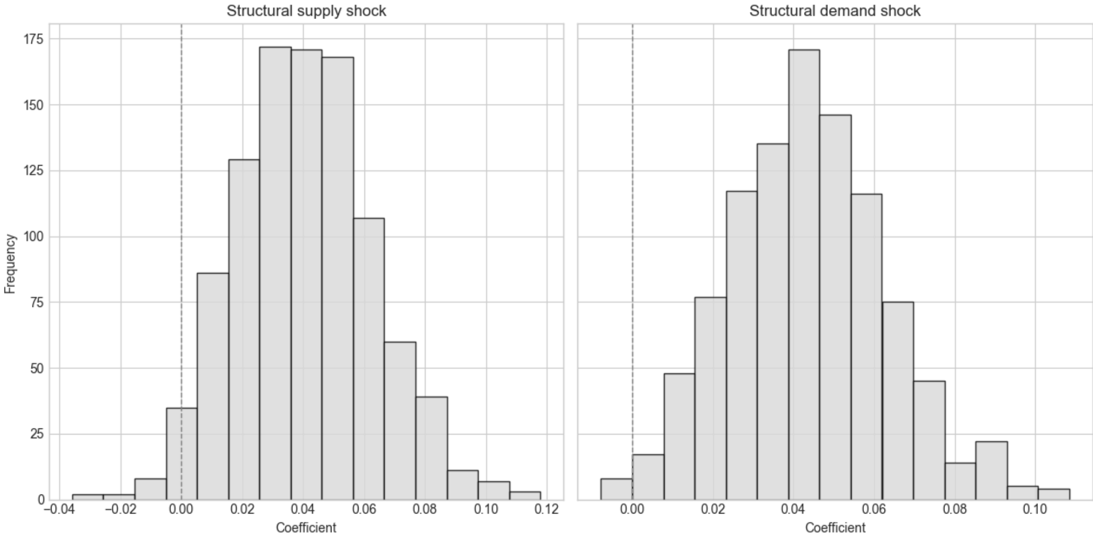
Notes: This table shows the outcome of a linear probability model for a banking crises, defined in Equation 4. JST crisis definition refers to the $crisis_{i,t}$ variable we have used throughout the analysis and is defined by Jordà et al. (2017). BVX crisis definition refers to the banking crisis coding by Baron et al. (2021). Country-clustered standard errors are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Figure B.3: Demand and supply shocks to inflation - post-WWII



Notes: This chart shows the moving average of demand and supply shocks from 1950 to 2019. Specifically, of the 1000 demand and supply shocks estimated according to the numerical method and Equation 2, the 5-year moving average of the cross-sample, cross-country median is found.

Figure B.4: Simulated distribution of the effect of supply and demand shocks



Notes: This chart shows the result of a numerical method to determine the effect of structural supply and demand shocks on financial stability. The shocks are identified according to Equation 2 and parameters are drawn according to the regression of Equation 1. The distribution of 1000 coefficients implies a p-value of 0.008 for demand and 0.021 for supply.

Table B.11: Instrumented inflation under alternative specifications

	Baseline	Logit model	White std errors	Excl. oil producers	With credit growth	With U Shapes
$\widehat{\Delta\pi}_{it-1}$	0.046***	1.96***	0.046**	0.055***	0.044**	0.048***
	(0.017)	(0.78)	(0.02)	(0.019)	(0.018)	(0.017)
baseline controls	Yes	Yes	Yes	Yes	Yes	No
Jiménez et al. controls	No	No	No	No	No	Yes
R^2	0.046	0.20	0.046	0.061	0.068	0.072
observations	808	828	808	673	805	808

Notes: This table shows the outcome of a linear probability model for a systemic banking crisis, defined in Equation 4. R^2 refers to the Pseudo R^2 in the case of the logit model. Oil producers are USA, Canada and Norway. The regression results shown on the two columns on the right include extra control variables. Credit growth is defined as $\Delta log(\frac{\text{total loans}}{CPI})$. Four lags of this variable are included in-line with Schularick and Taylor (2012). U Shapes refers to the U-shaped interest rate variables from Jiménez et al. (2023). Unless stated otherwise, country-clustered standard errors are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table B.12: The heterogeneous impact of inflation: bank characteristics

	Bank characteristics
$\widehat{\Delta\pi_{it-1}}$	-0.139*** (0.05)
capital ratio$_{it-1}$	0.005 (0.004)
loans to deposits$_{it-1}$	0.001* (0.0005)
non-core funding$_{it-1}$	0.002** (0.001)
capital ratio$_{it-1}$ $\times$ $\widehat{\Delta\pi_{it-1}}$	0.002 (0.005))
loans to deposits$_{it-1}$ $\times$ $\widehat{\Delta\pi_{it-1}}$	0.001** (0.0005))
non-core funding$_{it-1}$ $\times$ $\widehat{\Delta\pi_{it-1}}$	0.001* (0.0004)
R^2	0.11
observations	765

Notes: This table shows the outcome of a linear probability model for a systemic banking crisis, defined in Equation 4, where instrumented inflation is interacted with bank characteristics, controlling for growth and policy rates. Loans to deposits refers to the loans-to-deposits ratio. Non-core funding refers to the non-core funding ratio. Country-clustered standard errors are in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

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The conclusions are those of the authors only, and do not necessarily represent the views of (or imply any responsibility for) the European Central Bank.

Ugo Albertazzi
European Central Bank, Frankfurt am Main, Germany; email: ugo.albertazzi@ecb.europa.eu

James 't Hooft
European Central Bank, Frankfurt am Main, Germany; email: james.thooft@gmail.com

Lucas ter Steege
European Central Bank, Frankfurt am Main, Germany; email: lucas.ter_steege@ecb.europa.eu

Postal address 60640 Frankfurt am Main, Germany
Telephone +49 69 1344 0
Website www.ecb.europa.eu

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