Left-Digit Bias in Household Inflation Expectations*

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Abstract: People often process numbers in simplified ways. One such simplification is left-digit bias, the tendency to give more weight to the leftmost digit of a number. We study whether this bias affects how households process inflation numbers when forming inflation expectations. Using cross-country data and a regression discontinuity design, we show that expectations jump when inflation crosses round-number thresholds from below, particularly multiples of five, while crossings from above show no response. The increase comes from households that previously expected zero or negative inflation, and it is strongest among respondents with lower education and among men. A randomized controlled trial in which participants see an inflation rate just below or just above 10 percent confirms this pattern at the individual level. We then embed left-digit bias in a New Keynesian model. A cost-push shock yields weaker initial but more persistent output and inflation responses compared to the model without left-digit bias, requiring a more persistent monetary policy response. Left-digit bias also generates state dependence, a form of de-anchoring, where small shocks have large effects when inflation expectations are still elevated from past threshold crossings.

Keywords: Inflation expectations, Left-digit bias, Monetary policy, Randomized controlled trial

JEL classification: C83, D83, D84, E31

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1 Introduction

People often process numbers in simplified ways. One such imperfection is left-digit bias, the tendency to give more weight to the leftmost digits of a number than to the remainder. This behavioral pattern is robust, widespread, and well established. A classic example is 99-cent pricing, where consumers view $4.99 as meaningfully lower than $5.00 (e.g., Strulov-Shlain, 2023; Thomas and Morwitz, 2005). Left-digit bias has also been shown in various other contexts, including stock markets, used-car prices, and ride-sharing (Agarwal *et al.*, 2022; Lacetera *et al.*, 2012; List *et al.*, 2023). Yet we do not know whether households read inflation numbers through the same left-digit lens.

Inflation expectations are central for household and firm decisions, shape the propagation of shocks in modern macroeconomic models, and are therefore highly relevant for monetary policy. If households are subject to left-digit bias when processing inflation numbers, small changes around salient thresholds may have outsized effects on their expectations. For example, an increase in the inflation rate from 4.9 to 5.0 percent may lead to a larger increase in inflation expectations than an increase from 4.8 to 4.9 percent. Given the widespread prevalence of left-digit bias in other contexts and the importance of inflation expectations, it is surprising that this link has not been studied before. In this paper, we fill this gap by empirically and theoretically studying left-digit bias in household inflation expectations.

We first develop a regression discontinuity design to test for left-digit bias in household inflation expectations using aggregate cross-country data. Second, we conduct a randomized controlled trial (RCT) to evaluate under what conditions left-digit bias in inflation expectations occurs at the individual level. Lastly, we embed left-digit-biased inflation expectations into a New Keynesian model to study how the resulting nonlinearities alter the propagation of shocks and the monetary policy response.

Our starting point is that households form inflation expectations from current inflation numbers, along with other information. When this relationship exhibits a jump discontinuity at a threshold that inflation crosses from below, we call the crossing an *increasing-inflation threshold event*. Similarly, a crossing from above is a *decreasing-inflation threshold* *event*. We separate these two types of events because it is well-established that negative events often have a stronger impact on individual perceptions and behavior than positive events (e.g., Binder *et al.*, 2025; Chahrour *et al.*, 2025; D'Acunto *et al.*, 2021a). Thresholds may in principle take any value, but when expectations jump at round numbers, such as multiples of five, we speak of left-digit bias in inflation expectations.

Our regression discontinuity design tests for these jumps. The idea is to compare situations in which a country's inflation rate crosses a round number, such as 10 or 20 percent, with those that exhibit similar economic conditions without a crossing. The identifying assumption is that threshold events occur randomly, conditional on continuous changes in inflation.

To implement this design, we need many instances in which inflation surpasses thresholds, such as multiples of five. For most developed economies, those situations are rare in normal times. We therefore exploit the 2021–24 inflation episode, during which inflation moved strongly and repeatedly across round-number thresholds. More precisely, we combine monthly inflation and survey-based household expectations from 29 EU member states and candidate countries between 2016 and 2024.

We find that households' inflation expectations increase sizably when a country's inflation crosses a round-number threshold from below. On average, mean and median expectations increase by 0.7 and 0.9 percentage points, respectively, in response to an arbitrarily small increase in inflation that merely pushes the rate above the threshold. In contrast, we do not find effects that are significantly different from zero at decreasing-inflation thresholds. Hence, we find robust evidence of discontinuous updating only for increasing-inflation threshold events.

The change in average inflation expectations can be decomposed into an extensive margin—for example, when households previously expecting zero inflation now expect strictly positive inflation rates—and an intensive margin—for example, when households previously expecting strictly positive inflation now expect even higher inflation. We show that the extensive margin accounts for over half of the overall effect of an increasing-inflation threshold event on inflation expectations. More precisely, fewer individuals expect zero or negative inflation, while more individuals expect strictly positive inflation. The response is also uneven across groups. It is strongest among respondents with primary education, and median expectations respond more for men than for women, implying that a subpopulation of threshold-attentive households is driving the aggregate effect.

We further extensively test for left-digit bias at all possible thresholds, including randomly drawn rational numbers, integers, and multiples of five. We find that left-digit bias in inflation expectations is most pronounced at multiples of five, specifically at 5, 10, 15, 20, and 25 percent. This pattern aligns with well-documented numerical regularities, as human number perception relies on a sub-base-5 structure, making these values natural anchors for mental categorization. Outcomes, therefore, often cluster at multiples of five in settings ranging from age reporting and health self-assessments to survey-based inflation expectations (A'Hearn *et al.*, 2009; Houle *et al.*, 2013; Binder, 2017). In the context of inflation rates, which are often around 2 percent and rarely exceed 10 percent in most advanced economies, thinking in steps of five is more salient than rounding to single integers, which helps explain why these thresholds, rather than 1-percentage-point cutoffs, matter for expectation formation.

To evaluate under what conditions left-digit bias in inflation expectations occurs, we conduct an RCT that allows us to fully control the provision of information at the individual level. Participants were instructed to play an inflation-forecasting game (Salle *et al.*, 2026), in which they were repeatedly presented with annual inflation numbers and asked to forecast next year's inflation before seeing the actual inflation rate. We conducted the survey in Germany from August 11 to September 19, 2025, with 1,000 participants. Participants saw past inflation numbers from 2017 to 2022. For September 2022, the treatment group saw an inflation rate of 10.1 percent, while the control group saw 9.9 percent.

Participants respond unevenly to the two displayed rates. Among men, seeing 10.1 rather than 9.9 percent raises inflation forecasts for the following year by 0.7 percentage points; among participants with lower secondary education or less, by about 2 percentage points; and among the fastest respondents, who plausibly pay the least attention to the displayed numbers, by 1.3 percentage points. Among women, by contrast, the response merely matches the 0.2-percentage-point difference between the two displayed rates. The groups with the strongest experimental response are also the groups that respond most strongly to threshold events in the cross-country data. Because the experiment holds the information environment fixed, their responses likely reflect genuine left-digit bias in how they process inflation numbers, rather than media coverage or other factors that change when actual inflation crosses a threshold.

After establishing left-digit bias in inflation expectations both in cross-country data and in a controlled experiment, we study its macroeconomic and monetary policy implications. We embed left-digit-biased inflation expectations into an otherwise standard New Keynesian model, modifying only how individuals perceive inflation and how they form expectations. Households and firms assume that inflation and output follow simple AR(1) processes and update their beliefs using perceived current inflation rather than the actual inflation rate. When left-digit bias is present, households update their perceived inflation discretely at round-number thresholds and only gradually between them.

We then analyze how left-digit-biased inflation expectations change the propagation of a cost-push shock. Without left-digit bias, inflation and the nominal interest rate increase, while the output gap decreases on impact, before all converge back to the steady state. With left-digit bias, the dynamics differ markedly. Even though inflation expectations and inflation increase on impact because the shock is sufficiently large to push the economy above the 5-percent threshold, the immediate responses are less pronounced than they would be without left-digit bias. The reason is that, with left-digit bias, individuals' expectations always lag those in the unbiased economy, updating only once thresholds are crossed. This delayed updating reduces the initial amplification effect operating through higher inflation expectations, resulting in more muted initial responses in inflation, the nominal interest rate, and the output gap. Once inflation expectations are elevated because a threshold has been crossed, however, they remain elevated longer than in the economy without left-digit bias, because we plausibly assume that decreasing-inflation threshold events do not affect inflation expectations. Hence, with the asymmetric left-digit bias in inflation expectations, initial responses are more muted. However, once a shock is sufficiently large to cross a threshold, expectations remain elevated for longer, implying a more prolonged recession and requiring a more persistent monetary policy response.

Our model hence provides one explanation for still-elevated average inflation expectations in the U.S. and the euro area after the inflation surge in 2021 and 2022, which are argued to represent a form of de-anchored inflation expectations (Coibion and Gorodnichenko, 2025). Although not a full theory of de-anchoring, the model shows how transitory shocks can have prolonged effects on inflation and inflation expectations when left-digit bias is present. The key is that shocks are sufficiently large to push the economy across salient inflation thresholds. These inherent nonlinearities also imply that small shocks can have very different effects depending on the economy's current state. We demonstrate that small cost-push shocks can have much larger effects on the economy when inflation expectations are already elevated, compared to the steady-state case in which inflation expectations are zero. Applied to the current situation with still elevated inflation expectations, our model with left-digit-biased inflation expectations suggests that a small shock, such as a trade shock, can tip inflation across a salient threshold, leading to pronounced increases in inflation.

Related literature. Our work relates to the literature on inflation expectations and to the literature on left-digit bias. A large body of work studies household inflation expectations (see, for example, Weber *et al.*, 2022, for a recent survey). As that survey shows, many determinants have been argued to play a role in expectation formation. Two are closely connected to our work, past realized inflation and cognitive ability.

Past realized inflation affects households' expectations of future inflation. Coibion *et al.* (2023) find that Dutch households who receive information about recent inflation adjust their expectations accordingly, consistent with many other studies (e.g., Bracha and Tang, 2025; Coibion *et al.*, 2022; Weber *et al.*, 2025). We contribute to this literature by examining how household inflation expectations respond differently to current inflation when it crosses a round-number threshold.

Cognitive ability also shapes inflation expectations. Studying the male Finnish population, D'Acunto *et al.* (2022) find that only high-IQ men behave mostly like rational-expectations agents, with small forecast errors, consistent expectations, and behavior in line with the Euler equation (see also Cavallo *et al.*, 2017; D'Acunto *et al.*, 2019). We show that left-digit bias, potentially a cognitive factor, affects inflation expectations.

We also relate to work on (rational) inattention to inflation (e.g., Sims, 2003; Cavallo *et al.*, 2017; Weber *et al.*, 2025). Two recent studies estimate an attention threshold beyond which attention to inflation strengthens, typically at country-specific values between 2 and 4 percent (Korenok *et al.*, 2026; Pfäuti, 2026). Our theory of left-digit-biased inflation expectations instead generates thresholds at salient round numbers, where inflation expectations jump discontinuously while changing modestly in between. We compare the two approaches in detail at the end of section 4.1. Moreover, Korenok *et al.* (2026) document that news coverage of inflation exhibits the same threshold as search behavior, so part of the attention response may reflect the supply of information. Our experiment holds the supply of information fixed, so the responses we identify there cannot reflect increased information supply at thresholds.

Binder (2017) documents that many households report inflation expectations at multiples of five and uses this rounding behavior to construct a measure of inflation uncertainty. Her approach exploits variation in bunching at multiples of five of reported expectations, while we study how actual inflation numbers crossing multiples of five affect expectation formation.

We also relate to the work on left-digit bias. Left-digit bias is best documented in the context of 99-cent pricing (e.g., Thomas and Morwitz, 2005; Strulov-Shlain, 2023). It also shapes prices and choices in other markets, including used cars (Lacetera *et al.*, 2012), apartments (Repetto and Solís, 2019), and ride-sharing (List *et al.*, 2023). Closest to our paper, Garz (2018) and Garz and Martin (2021) show that round-number events in the unemployment rate shift household perceptions of the economy and voting for incumbent politicians. We contribute to this research by studying left-digit bias in inflation expectations theoretically and empirically.

Layout. The paper proceeds as follows. Section 2 presents the empirical evidence based on cross-country data. Section 3 provides complementary evidence from an RCT. Section 4 studies left-digit bias in a New Keynesian model. Section 5 concludes.

2 Cross-country evidence

2.1 Data

We compile a dataset on consumer prices and household inflation expectations across 29 European countries from January 2016 to December 2024. This period encompasses the 2021–24 inflation episode, characterized by large swings in inflation rates. Such fluctuations are essential for identifying inflation threshold events. We focus on 29 European economies because comparable monthly data are available for a large set of countries and over an extended period. The set of countries is determined by the European Commission's inflation expectations surveys, which include all EU member states and candidate countries.[1] In turn, the start of the sample period in 2016 is determined by the availability of the consumer price index as first published, as described below.

Consumer prices and inflation threshold events

We obtain the monthly year-on-year change in the Harmonized Index of Consumer Prices (HICP) for all countries in our sample from Eurostat. The data underlying this index are collected by the national statistical offices and transmitted to Eurostat. The HICP is the key indicator used to communicate inflation trends to the public. Eurostat and most national offices regularly report it in their monthly press releases and on their websites and social media channels.[2] We use the initially published index and inflation rate, before any subsequent statistical revisions, to capture the information available to the public at the time of release. These data are available from January 2016 onward (Eurostat, 2018).

A country experiences an *increasing-inflation threshold event* in month t when its inflation rate reaches or exceeds an inflation threshold, having been below it in month $t-1$. Conversely, a *decreasing-inflation threshold event* occurs when the inflation rate falls below a

[1] We exclude Turkey because its persistently high inflation rate makes it an outlier in this group of countries.
[2] Most national statistical offices also publish a national consumer price index (CPI). However, data on the CPI are not consistently available in unrevised form (i.e., as first published), which is why we use the HICP in our main analysis and rely on the CPI only for robustness checks.

threshold, having been at or above it in the previous month. For each country i and month t, we code two binary indicators, $e^{\uparrow}_{i,t}$ and $e^{\downarrow}_{i,t}$, that equal one when the respective event occurs and zero otherwise.

In our baseline estimations, we test whether inflation thresholds exist at multiples of five: 5, 10, 15, 20, and 25 percent. We focus on this range because most observations in our sample fall between 0 and 25 percent. The value of 0 percent is not considered a threshold, as households are likely less interested in price developments during low-inflation periods, and crossing this value has theoretically ambiguous implications.[3] We run extensive tests on other potential inflation thresholds in section 2.5, showing that inflation threshold events are most pronounced at multiples of 5.

Based on these definitions, we identify 170 inflation threshold events, with 85 increasing- and 85 decreasing-inflation threshold events. As shown in Figure A.1a in the Online Appendix, these events occurred during the 2021–2024 inflation episode, with increasing-inflation threshold events concentrated in 2021–2022 and decreasing-inflation threshold events in 2023–2024. This timing underscores that our identification exploits this exceptional period of high and volatile inflation. Inflation threshold events differ markedly across countries and over time, with 40 distinct month–year occurrences and at least one event in every country in our sample.

Inflation expectations

Data on households' inflation expectations come from the European Business and Consumer Surveys, administered by the European Commission. These surveys are conducted by national institutes in the EU member states and candidate countries and have been previously used in several studies (for example, Andrade *et al.*, 2023; Bracha and Tang, 2025; Chen *et al.*, 2022; D'Acunto *et al.*, 2022, 2019; Dräger, 2015). We primarily use two variables: a qualitative and a quantitative measure of households' inflation expectations for the next 12 months.

The qualitative measure is based on the question: "By comparison with the past 12

[3] Other possible thresholds observed in the data, such as 30 and 35 percent, are also excluded because these are rare and collinear with the fixed effects in the regression models.

months, how do you expect that consumer prices will develop in the next 12 months?" Survey respondents can choose one of the following answers: "increase more rapidly" (PP), "increase at the same rate" (P), "increase at a slower rate" (E), "stay about the same" (M), "fall" (MM), or "do not know" (N).

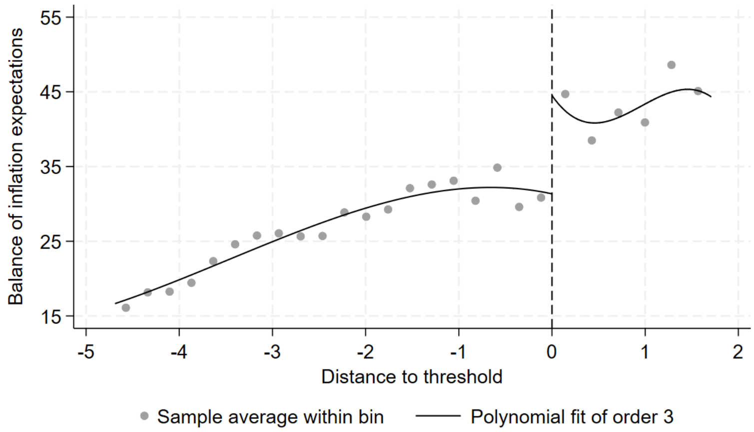
In our main specification, we use the balance of inflation expectations as provided by the European Commission, $(PP+0.5P)-(0.5M+MM)$, which ranges from -100 to +100. We also consider each single category in extensions. The balance is a weighted difference between households that expect weakly higher future inflation and those that expect zero or negative inflation. Simply put, a larger balance indicates that more households expect inflation to rise. As shown in Figure A.1b in the Online Appendix, the average balance of inflation expectations increased during the 2021–24 inflation episode. The aggregate balances within each country are representative of a country's population (European Commission, 2023).

The quantitative measure is based on the question, "By how many percent do you expect consumer prices will go up/down in the next 12 months?" and allows survey respondents to enter a number. We use this data to calculate the mean and median. Here we exclude country-months with fewer than 800 interviews and responses with estimates below -5 or above 30 percent, following the truncation approach of Huber *et al.* (2023).

2.2 Estimation strategy

When inflation increases, for example, from 3.8 to 5.1 percent, two simultaneous effects on households' inflation expectations might occur. First, the substantial price increase leads to higher expected future inflation. Second, crossing the 5 percent threshold may affect expectations beyond the price increase itself, due to left-digit bias. We employ a regression discontinuity-like design to disentangle these two effects on inflation expectations. This approach allows us to capture households' discontinuous responses to inflation changes when a threshold is crossed, as formalized in section 4.

A conventional regression-discontinuity design (RDD) involves an assignment variable that determines which units receive treatment based on a specific cutoff value. In our case,



Notes: The x-axis measures a country's distance of inflation in period $t-1$ from its next upper threshold from period $t-2$: $\pi_{t-1} - 5\left\lceil \frac{\pi_{t-2}}{5} \right\rceil$. This way, we pool all increasing-inflation threshold events at multiples of five (5%, 10%, 15%, 20%, and 25%). By definition, values on the x-axis < 0 refer to situations without increasing-inflation threshold events, whereas values ≥ 0 depict increasing-inflation threshold events. The figure excludes the 10% of observations farthest from the cutoff on each side, where thin support makes the local polynomial fit unreliable; Figure A.2 in the Online Appendix shows the full range together with observation counts.

Figure 1: Inflation expectations around increasing-inflation thresholds

assignment into treatment and control observations depends on two variables: the level of and the monthly change in the inflation rate.[4]

While RDDs have been extended to accommodate multiple assignment variables (e.g., Cattaneo *et al.* 2020), we adopt a slightly different approach because our assignment variables lack fixed cutoffs, and treatment status depends on their interplay. For example, if a country's inflation in the current month is 9.6 percent, an increase of 0.4 percentage points or more would be necessary to reach the 10 percent round-number threshold in the next month. The larger the initial distance between the inflation rate and the next threshold, the greater the monthly change in the inflation rate needed to cross the threshold. Hence, the treatment assignment is a function of the distance between the inflation rate and the next round-number threshold, as well as the size of the change in the rate between the current and next month. In addition, a conventional RDD has the disadvantage that we could not simultaneously estimate the impact of increasing- versus decreasing-inflation threshold events.

[4]The following two studies have used an RDD to study left-digit bias. Repetto and Solís (2019) estimate discontinuous jumps in the final price as a function of the asking price for apartments, while Heraud and Page (2024) estimate discontinuities between the transaction price and the expected payoff of foreign exchange options. We study inflation and inflation expectations, and adopt a more dynamic setup that accounts for both the level and the change in the inflation rate.

To visualize the underlying discontinuity, we plot the balance of inflation expectations against the distance of the inflation rate from its next upper threshold in Figure 1. If the inflation rate in period $t-1$ is above the next upper threshold based on the inflation rate in period $t-2$, an increasing-inflation threshold event has occurred, and the value on the x-axis is positive. In contrast, if the inflation rate in period $t-1$ is below the next upper threshold based on the inflation rate in period $t-2$, no increasing-inflation threshold event has occurred, and the value on the x-axis is negative. The balance of expectations jumps upward at the cutoff, where the inflation rate crosses a multiples-of-five threshold from below, consistent with left-digit bias. To the left of the cutoff, the balance of expectations increases as the distance to the threshold decreases. This is plausible because observations closer to the cutoff correspond to higher inflation levels or stronger inflation increases, both of which should continuously raise households' inflation expectations.

To formally estimate the impact of round-number threshold events, we specify a two-way fixed effects model in which inflation expectations $\pi^e_{i,t}$ in country i and month t are regressed on the binary indicators $e^{\uparrow}_{i,t-1}$ and $e^{\downarrow}_{i,t-1}$ of inflation threshold events, defined in section 2.1, while controlling for actual inflation development $Z_{i,t-1}$:

$$\pi^e_{i,t} = \alpha_1 e^{\uparrow}_{i,t-1} + \alpha_2 e^{\downarrow}_{i,t-1} + \alpha_3 Z_{i,t-1} + \theta_i + \rho_t + \epsilon_{i,t} \tag{1}$$

We consider the balance of qualitative inflation expectations, as well as the mean and median of quantitative inflation expectations, as outcome variables $\pi^e_{i,t}$, denoting future inflation expectations reported in period t. The country fixed effects θ_i control for time-invariant differences in expectations between states, whereas the time fixed effects ρ_t account for overall trends in Europe. This specification is identical to the model proposed by Garz and Martin (2021), except that their assignment variables are the level and change of the unemployment rate. Apart from that, we specify the vector of controls $Z_{i,t-1}$ in the same way: bin dummies for the level of the inflation rate as well as a polynomial of order 3 of the monthly change in a country's inflation rate.

The bin dummies account for real price effects and differences in the baseline probability of crossing a round-number threshold at different inflation rate levels. The closer the inflation rate is to the next round number, the more likely it is to cross this round number in the next month. While it would be possible to include the inflation rate level as a continuous variable, bin dummies have the advantage of accounting for possible nonlinear effects. Adjusting the bandwidth of the bin dummies is equivalent to selecting the bandwidth in standard regression discontinuity designs. Eurostat and its national counterparts measure the inflation rate with a precision of one decimal place. We include one bin dummy for each possible value, with a bandwidth of 0.1 percentage points. For example, we include separate bin dummies for inflation rates between 3.8 and 3.9 percent, and between 3.9 and 4.0 percent. This allows us to control for the rate level in the most fine-grained way possible. In Section 2.5, we verify that our results remain similar when we use other possible bandwidths, such as intervals of 0.2 and 0.5 percentage points.

The polynomial of the rate change controls for the mathematical fact that threshold events are more likely the greater the change in inflation from the previous to the next month. The results are generally not sensitive to the choice of the polynomial order, such as 2, 3, or 4, as we show in Section 2.5. The same applies when we substitute the rate change polynomial with rate change bin dummies and when we interact the rate change with the inflation level bin dummies.

Equation (1) examines how changes in inflation rates in month $t-1$, not in month t, affect expectations. This timing reflects the data's structure. Consumer surveys eliciting inflation expectations are conducted during the first two to three weeks of each month (European Commission, 2023). In contrast, Eurostat and the national statistical offices release their initial consumer price index estimates between the end of the reference month and the middle of the following one (Eurostat, 2018). Consequently, when households are surveyed, they do not yet have the current month's inflation estimate. We therefore link their expectations to the inflation rate and to possible threshold events from the previous month, while avoiding potential reverse causality in which households' expectations affect current inflation rates.

Equation (1) yields causal estimates of α_1 and α_2 as long as threshold events occur randomly, conditional on continuous changes in inflation. The balance checks reported in

Table A.1—which show that threshold events are uncorrelated with population size, GDP, interest rates, unemployment, and the balance of payments—support the assumption of random assignment.

The surveys underlying our outcome variables are representative of each country's population. However, estimates that ignore differences in population size across countries would be misleading. We therefore weight all regressions by each country's population share in the sample and compute standard errors robust to clustering by country and autocorrelation (Cameron and Miller, 2015).

2.3 Main results

The estimation results are summarized in Table 1. According to Column (1), increasing-inflation threshold events significantly increase the balance of inflation expectations. The point estimate suggests an increase of 4.2 percentage points, corresponding to approximately one quarter of the standard deviation of the balance of expectations, as $4.191/17.479 = 0.240$. Hence, the effect of an increasing-inflation threshold event is sizable. The coefficient on the decreasing-inflation threshold dummy is small and not significant at conventional levels. However, we cannot reject the null hypothesis that the effects of increasing- and decreasing-inflation threshold events are symmetric, $\alpha_1 + \alpha_2 = 0$ in equation (1), with a p-value of 0.107.

Turning to mean and median expectations shows similar results. An increasing-inflation threshold event raises the mean of inflation expectations significantly by 71 basis points, corresponding to 0.20 standard deviations of this variable; see Column (2). Similarly, as Column (3) shows, the median of expected future inflation also increases significantly by 93 basis points, or 0.22 standard deviations, in response to an increasing-inflation threshold. In contrast, the effect of decreasing-inflation threshold events on households' quantitative expectations is not statistically different from zero. For the median expectation, we reject the null hypothesis of symmetric effects at the 10-percent level ($p = 0.082$).

To illustrate the magnitude of the threshold effect, consider a case in which the median expected inflation is 4.00 percent and current inflation rises from 4.99 to 5.00 percent,

	(1) Qualitative expectations	(2) Mean estimate	(3) Median estimate
Increasing-infl. threshold	4.191**	0.710***	0.934**
	(1.965)	(0.199)	(0.396)
Decreasing-infl. threshold	0.886	-0.283	0.081
	(2.006)	(0.270)	(0.396)
H_0: symmetric effects (p-value)	0.107	0.160	0.082
Mean of dependent variable	20.831	6.302	4.301
SD of dependent variable	17.479	3.606	4.230
Observations	3085	2647	2647

Notes: Qualitative expectations refer to weighted difference between households that expect higher future inflation and those that expect zero or negative inflation. The mean and median expectations are based on households' point estimates of the future inflation rate. All specifications include time and country fixed effects, a 3rd order polynomial of the change in inflation rate, and inflation rate bin dummies with a bandwidth of 0.1. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.
** $p<0.10$, ** $p<0.05$, *** $p<0.01$*

Table 1: Inflation threshold events and inflation expectations

crossing the 5 percent threshold. This one-basis-point change is negligible and well within typical measurement error. Yet, households' median inflation expectations jump discontinuously from 4.00 to 4.90 percenta sizable shift. Because inflation thresholds occur at multiples of five, this effect implies that when inflation increases by five percentage points over several months, almost one-fifth of the total adjustment in median expectations happens discontinuously at the threshold. Hence, the results in Table 1 show that inflation threshold events have pronounced effects on mean and median inflation expectations, consistent with evidence from qualitative expectations.

2.4 Heterogeneity

How are changes in the quantitative measure of inflation expectations related to changes in the qualitative measure? We decompose the change in average expected inflation into an extensive margin, movements of respondents between the five response categories of the qualitative question, and an intensive margin, changes in expected inflation within those categories. Online Appendix B in the Online Appendix derives the decomposition and describes its measurement.

To estimate the extensive margin, we estimate equation (1) for each of the five groups separately, with the share of households in a given group as the dependent variable (Table A.2 in the Online Appendix). In response to an increasing-inflation threshold event, the share of households expecting prices to stay about the same falls by 3.5 percentage points, and the share expecting prices to fall declines by 0.4 percentage points. These respondents move into the groups expecting strictly positive inflation, most visibly the group expecting prices to increase at the same rate, whose share rises by 1.9 percentage points. Weighting these share changes by within-group average expectations, the extensive margin accounts for 39 basis points of the 71 basis point total change estimated in Table 1, Column (2), with the remaining 32 basis points attributed to the intensive margin and the interaction term. Within-group expectations themselves respond only weakly to a threshold event, as shown in Table A.3 in the Online Appendix, where the coefficients are small and mostly insignificant.[5]

The decomposition shows that the aggregate response is concentrated, as average expectations move mostly because some households leave the zero- or negative-inflation categories, and less because all households raise their expectations. We now ask which demographic groups respond most strongly.

As Table A.4 shows, increasing-inflation threshold events raise mean expectations by 0.74 percentage points for both men and women. Median expectations also increase for both groups, with a larger estimate for men (1.11 percentage points) than for women (0.76 percentage points). Gender differences in inflation expectations are documented more broadly by D'Acunto *et al.* (2021b), who link them to differential exposure to grocery prices. According to Table A.5, increasing-inflation threshold events significantly raise both mean and median expectations across all education groups, with the largest effects among respondents with primary education (1.3 percentage points for the mean and 1.6 percentage points for the median). These effects are more than twice as large as those among respondents with further education, whose mean and median expectations increase by 0.5

[5]These results align with Andrade *et al.* (2023), who find that most of the variation in inflation expectations in France between 2004 and 2018 is driven by changes at the extensive margin. We show that the extensive margin changes substantially due to inflation threshold events.

and 0.6 percentage points, respectively.

Hence, the expectation response to threshold events is strongest among respondents with primary education, and median expectations respond more for men than for women. This pattern is consistent with a subpopulation of threshold-attentive households driving the aggregate effect. The experiment in section 3 returns to this heterogeneity at the individual level.

2.5 Robustness and placebo tests

We now test for alternative inflation thresholds. Table A.6 in the Online Appendix shows that we do not find a discontinuity when considering integers rather than multiples of five. To assess whether multiples of five are more relevant thresholds for left-digit bias than arbitrary inflation values, we compare the baseline estimate with the distribution of estimates from 1,000 placebo regressions. In each iteration, we randomly draw one non-integer threshold, measured to one decimal place, from each of the intervals 0.1-4.5, 5.5-9.5, 10.5-14.5, 15.5-19.5, and 20.5-24.5 percent.[6] The results are summarized in Figure A.4. The distribution of coefficients from these placebo regressions is centered around zero, indicating null effects, while the estimate for multiples of five lies far in the right tail. Only 1.8 percent of the placebo estimates exceed the multiples-of-five estimate, placing it at the 98.2nd percentile of the placebo distribution. This finding supports the interpretation that multiples of five, rather than arbitrary values, are relevant thresholds for left-digit bias.

The prominence of thresholds at multiples of five is consistent with well-documented numerical and behavioral regularities. Human number perception is shaped by a sub-base-5 structure that originates from finger counting, making values such as 5, 10, 15, and 20 natural categorical anchors in mental representation and reporting (e.g., Domahs *et al.*, 2010). Across diverse contexts, from demographic age reporting and medical self-reports such as headache frequency to survey-based inflation expectations, outcomes often system-

[6]Drawing one threshold from each interval ensures that every placebo set spans an inflation range similar to that of the true multiples-of-five definition and avoids accidental clustering within a narrow range, such as 3.1, 3.3, 3.4, 3.6, and 3.8 percent. Excluding values within 0.5 percentage points of multiples of five reduces contamination from true threshold events; for example, an increase in inflation from 4.9 to 5.4 percent crosses not only 5 percent but also non-integers at 5.1, 5.2, 5.3, and 5.4 percent.

atically cluster at multiples of five (A'Hearn *et al.*, 2009; Houle *et al.*, 2013; Binder, 2017). Our finding that inflation threshold effects occur at 5-percentage-point intervals, therefore, aligns with a broader regularity in human numerical cognition and behavior rather than being specific to the inflation domain.

We run several other robustness checks. The detailed results are available in the Online Appendix. Figure A.5 shows the results when we replace the multiples-of-five treatment dummy with separate dummies for individual thresholds. Accordingly, effect sizes tend to increase with larger threshold values. We also include a dummy variable for the 2 percent threshold in the regression. While this value is not a multiple of five, it may be psychologically relevant given the European Central Bank's inflation target. However, as the figure shows, crossing this threshold does not induce a discontinuous change in inflation expectations.

According to Table A.7, our results are robust to specifying alternative bandwidths for the bin dummies that control for the level of the inflation rate. While the baseline model includes one bin for each possible step in the inflation rate, equal to 0.1 percentage points, the alternative specifications use bandwidths of 0.2 and 0.5 percentage points, respectively, which produce slightly smaller effect sizes but otherwise similar results. In Table A.8, we change the polynomial order of the change in the inflation rate from third to second and fourth order and find no noticeable differences. Another alternative for accounting for changes in the inflation rate is to include bin dummies rather than a polynomial. According to Table A.9, this modification indicates slightly larger effect sizes than the baseline models. We also estimate models with interactions between the absolute change in the inflation rate and the individual bin dummies for the rate level. This specification accounts for the possibility that households react differently to rate changes of equal magnitude when they occur at different inflation rates. As Table A.10 indicates, the results remain qualitatively similar, though.

As discussed in Section 2.1, we use the HICP to measure inflation and define threshold events because this index is available for all countries in the sample as initially published. While a country's consumer price index (CPI) might be slightly more important when national statistical offices and news sites report on inflation, the CPI data are mostly available only in revised form. Hence, we cannot accurately evaluate the impact of CPI-based threshold events on inflation news coverage and expectations. Results in Table A.11 indicate that the effects on mean and median expectations remain similar when we use CPI-based measures. However, the estimated effect of increasing-inflation threshold events on qualitative expectations is substantially smaller, likely because CPI data revisions introduce measurement error in the occurrence of such events.

In Table A.12, we use the wild cluster bootstrap method (Cameron *et al.*, 2008). The resulting p-values confirm the statistical significance of the relevant coefficients, even given the relatively small number of clusters (i.e., 29 countries).

Table A.13 presents results for inflation perceptions. Increasing-inflation threshold events raise the balance of perceptions by 3.0 points, although the effect is only marginally significant. This increase is driven primarily by a decline in the share of households reporting that prices have stayed about the same, accompanied by positive but imprecisely estimated shifts toward the categories indicating that prices have risen. Decreasing-inflation threshold events, in contrast, reduce the balance of perceptions by 4.3 points. Households shift away from reporting that prices have risen moderately and toward reporting that they have risen only slightly, stayed about the same, or fallen. Hence, inflation perceptions respond to threshold crossings in both directions, with the evidence being particularly pronounced for decreasing-inflation events. This contrasts with the results for inflation expectations, which respond primarily to increasing-threshold events. One reading is that households acknowledge that price pressure has eased when inflation falls below a threshold, but this does not translate into lower expected inflation.

While our estimation strategy exploits households' discontinuous responses to changes in inflation, we do not rely on a conventional RDD because we have two assignment variables—the monthly change and the level of inflation—that lack fixed cutoffs for treatment assignment. To assess robustness, we also estimate a standard RDD using a combined assignment variable, $\pi_{t-1} - 5\lceil \pi_{t-2}/5 \rceil$, which measures the distance of the inflation rate in $t-1$ from the next upper round-number threshold in $t-2$. The results, reported in

Table A.14, yield substantially larger effect sizes than our baseline specification. Hence, the evidence for discontinuities at multiples of five is robust and, if anything, understated in our main estimates.

3 Experimental evidence

3.1 Design and participants

While cross-country evidence reveals clear discontinuities in aggregate expectations, it cannot explain why these jumps occur, as we observe only national inflation rates and country-level averages of expectations. We do not see what information individual households receive, nor how they process it. Threshold events may trigger direct number-processing responses, but they may also induce changes in media coverage that shift expectations for different reasons. To study the isolated, direct left-digit mechanism at the individual level, we complement the cross-country analysis with a randomized controlled trial. The experiment was preregistered at the American Economic Association's registry for randomized controlled trials and approved by the Swedish Ethical Review Authority (Garz and Larin, 2025).

The experimental design followed guidelines for information-provision experiments on economic expectations (Fuster and Zafar, 2023) and took the form of an inflation-forecasting exercise (Salle *et al.*, 2026), consisting of several rounds of forecasting. Table 2 summarizes the survey design, which we now explain in detail. The precise wording of the survey can be found in Online Appendix C.1 of the Online Appendix.

Over three rounds, participants saw information about past inflation in Germany and were asked to forecast the future inflation rate. We ran the survey experiment in Germany for three main reasons. First, it is the largest economy in Europe, making its households' inflation perceptions particularly relevant. Second, our fluency in German ensured accurate and precise wording of the survey instructions and information treatments. Third, the inflation rate in Germany recently exceeded the 10-percent threshold, allowing us to design the experiment around a realistic setting.

Forecasting round		Control	Treatment
1	Sep 2017	1.8%	1.8%
	Sep 2018	2.2%	2.2%
	Sep 2019	0.9%	0.9%
	Sep 2020	-0.4%	-0.4%
2	Sep 2021	4.1%	4.1%
3	Sep 2022	9.9%	10.1%

Table 2: Experimental design

In the first round, all participants saw year-on-year inflation rates of 1.8, 2.2, 0.9, and -0.4 percent for September 2017 to September 2020.[7] They were then asked to forecast the September 2021 inflation rate. In the second round, participants were shown the realized inflation rate of 4.1 percent in September 2021 and asked to forecast the inflation rate for September 2022. In the third and last round, participants in the control group saw an inflation rate of 9.9 percent, while participants in the treatment group saw a value just above this threshold, 10.1 percent. We hence used an active control group design, in which all participants received some, but different, information (Haaland *et al.*, 2023).

The preregistered design also included a second treatment arm in which participants, in addition to seeing an inflation rate of 10.1 percent, were told that this was the highest value in 30 years. We included this arm because the experiment was designed to serve two projects: this paper studies the direct number-processing response, while the second treatment arm examines whether framing inflation as a historical record amplifies or dampens left-digit reactions, as discussed in our companion paper (Garz and Larin, 2026). Any incremental effect of this framing beyond the 10.1-percent value would not be attributable to left-digit bias, so we exclude this arm from the baseline analysis and report results that include it in Table C.2.

The experiment was conducted on Prolific between August 11 and September 19, 2025. Potential participants were informed about the purpose of the research, the voluntary nature of participation, and their right to withdraw at any time. Explicit consent was required

[7] We also considered presenting year-on-year inflation rates at a monthly frequency, in line with the cross-country data. However, we discarded this option after receiving feedback during the piloting phase that this setup might confuse participants.

to proceed; otherwise, the survey was terminated. Each participant received a payment of 0.61 EUR. Given an average completion time of 147.4 seconds, this corresponds to an hourly rate of 14.90 EUR (about 17.44 USD), consistent with Prolific's recommended compensation and above Germany's minimum wage of 12.82 EUR. Based on power calculations, the target sample included 1,000 gender-balanced participants. As specified in the pre-analysis plan, we excluded non-consenting respondents, incomplete surveys, and inflation forecasts below −5 percent or above 30 percent, as well as the top and bottom 1 percent by completion time.

The design of our experiment was based on two requirements. First, because participants are more likely to update their beliefs in response to credible information, testing for left-digit bias required embedding the experiment in a realistic context. Second, we needed to present the control group with a value just below the threshold and the treatment group with a value just above it. Given these requirements, we selected the values of 9.9 and 10.1 percent, which are the closest values around the inflation rate of 10.0 percent published in September 2022 by the Federal Statistical Office of Germany. The alternatives would have been to present, for example, the initially published figure of 10.0 percent and the value of 8.6 percent provided by the Federal Statistical Office after they revised their data, or to present entirely hypothetical values. The first option would not have allowed identification of left-digit bias because 8.6 and 10.0 percent are too far apart. The second option would have been to use an entirely hypothetical scenario with artificial statistics, which could have reduced participants incentives to treat the information as a credible signal about inflation and update their beliefs accordingly. Hence, even though the two values of 9.9 and 10.1 percent we presented do not exactly match the published value of 10.0 percent, they are the only feasible way to test for left-digit bias in a realistic context.

At any point in time, several conceptually distinct inflation measures coexist, and the appropriate measure depends on the economic question. For instance, the current-month value of any specified official index may be uncertain before the final release and may later be affected by benchmark changes, as the revision of the CPI-based measure by the Federal Statistical Office from 10.0 percent (9.99 percent before rounding) to 8.6 percent shows, both of which differ from Germany's September 2022 HICP-based inflation rate of 10.9 percent published by Eurostat. Given the uncertainty and multiplicity of official inflation measures, our choice of 9.9 and 10.1 percent lies within the range of published values. Furthermore, the survey experiment attributed the values to no institution or index, announcing only "data on consumer prices in Germany." The minimal deviation from the published record is the price of identifying the discontinuity. We minimized the potential impact on participants' confidence in the research process through i) informed consent, ii) preregistration and ethical approval, iii) a between-subject design with one-time participation, so that no participant could detect the variation, and iv) a debriefing screen showing the current official rate (Online Appendix C.1).

3.2 Analysis and results

We estimate the effect of the information treatment on participant p's quantitative inflation expectation π_p^e in the final, third round of the forecasting exercise:

$$\pi_{p,3}^e = \alpha + \beta \mathbb{I}(\pi_{p,3} = 10.1) + \pi_{p,2}^e + X_p + \gamma + \delta + \varepsilon_p$$

where $\pi_{p,2}^e$ controls for participant p's inflation forecast made in the second round, prior to the treatment, $\mathbb{I}(\pi_{p,3} = 10.1)$ is the treatment indicator, X_p includes pre-registered controls for legal sex, age, education, and nationality, and γ and δ are date and hour-of-the-day fixed effects. The β coefficient measures the impact of the information treatment on the outcome variable relative to the control group.

Table 3 summarizes the estimation results. According to Column (1), participants exposed to the 10.1-percent inflation rate report final-round inflation forecasts that are, on average, 0.32 percentage points higher than those of participants exposed to 9.9 percent. A difference of 0.20 percentage points is expected from the information treatment alone, so the point estimate indicates a stronger adjustment than the numerical difference between the two inflation rates. Adding hour-of-the-day and date fixed effects leaves the estimate almost unchanged at 0.36 percentage points, as shown in Column (2). When the preregis-

	(1)	(2)	(3)
Treatment: increasing-infl. threshold	0.323	0.355	0.448
	(0.289)	(0.289)	(0.291)
Hour and date fixed effects	No	Yes	Yes
Demographic controls	No	No	Yes
Mean of dependent variable	7.498	7.498	7.496
SD of dependent variable	4.603	4.603	4.605
Observations	955	955	954

Notes: OLS estimates. The dependent variable is participants' inflation forecast in the final round in percentage points, truncated at -5 and +30%. All models control for the inflation forecast in the second round. The demographic controls are legal sex, age, education, and German nationality. Heteroskedasticity-robust standard errors are in parentheses.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 3: Results from the survey experiment

tered demographic controls are added in Column (3), the estimated effect increases to 0.45 percentage points. This increase may reflect chance differences in demographic composition between the treatment and control groups, combined with heterogeneous treatment responses across demographic groups. For example, Table C.1 shows that participants in the treatment group are slightly more highly educated. The estimates are consistently positive and exceed the 0.20-percentage-point information difference across specifications, but none is statistically significant at conventional levels.

As Table C.2 in the Online Appendix shows, we obtain similar results when we include the second treatment arm and when we use non-truncated inflation forecasts as the outcome. Forecasts in Treatment 2, where participants were additionally told that inflation was at its highest level in 30 years, decreased by 0.55 percentage points relative to the control group, likely because participants interpreted such statements as a signal that inflation had peaked and would subsequently decline. In addition, Column (3) of Table C.2 provides no evidence that the treatment affects qualitative inflation expectations. This null result likely reflects saturation, as only 3 percent of respondents held zero or negative expectations in round 2, leaving little scope for the threshold treatment to move participants into higher qualitative categories.

Next, we examine how the estimated treatment effect varies across our preregistered moderators, including participants demographic characteristics, inflation perception gaps, forecast errors, and survey completion times.[8] As Panel (a) of Figure C.1 in the Online Appendix shows, the treatment has virtually no effect among women. The estimated 0.20-percentage-point effect merely matches the numerical difference between 9.9 and 10.1 percent. Among men, by contrast, it raises inflation forecasts by 0.66 percentage points, an effect that is statistically significant at the 10-percent level. According to Panel (b), none of the estimated treatment effects is statistically significant across the age groups. As Panel (c) shows, the treatment raises inflation forecasts by approximately 2 percentage points among participants with lower secondary education or less, corresponding to a substantial effect of 0.43 standard deviations and statistically significant at the 10-percent level. There are no significant effects for the other education groups. According to Panel (d), the treatment has no significant effect among German nationals. In contrast, it raises inflation forecasts by approximately 1.2 percentage points among non-German nationals, a difference that is statistically significant at the 10-percent level.

As Panel (a) of Figure C.2 shows, also in the Online Appendix, the treatment raises inflation forecasts by 1.5 percentage points among participants who most strongly overestimated current inflation, statistically significant at the 10-percent level, while no significant effects emerge for the other perception-gap categories. According to Panel (b), the treatment raises inflation forecasts by 4 percentage points among participants who overestimated inflation in round 2, a difference that is statistically significant at the 10-percent level. There are no significant effects for participants who underestimated inflation. Panel (c) indicates that the treatment effect is concentrated among the fastest respondents. For those in the shortest completion-time group, forecasts increase by 1.3 percentage points, significant at the 5-percent level, whereas the estimates for the remaining groups are small and insignificant. Because completion time is measured after treatment, this pattern should be interpreted descriptively rather than as causal heterogeneity.

Overall, we find significant treatment effects among men, participants with lower ed-

[8] Employment status and place of birth were also preregistered as controls but are excluded because employment status, as provided by Prolific, is missing for approximately half of the sample, and place of birth is highly collinear with nationality. All heterogeneity regressions include the remaining preregistered demographic controls to account for chance differences in demographic composition between the treatment and control groups.

ucation, those who substantially overestimate inflation, and the fastest respondents. For the most part, these patterns are consistent with the idea that the 10-percent threshold exerts greater influence when respondents have weaker prior knowledge, answer more intuitively, or with less deliberation. One possible explanation for the particularly strong response among those who substantially overestimate inflation is that they distrust official inflation statistics but nevertheless extract information from them. For these respondents, an official rate above 10 percent may be especially salient because it confirms their prior belief that inflation is considerably higher than the officially reported rate.

These patterns mirror the cross-country evidence. In aggregate data, increasing-inflation threshold events raise median expectations by more for men (1.11 percentage points) than for women (0.76 percentage points). They raise mean and median expectations by more than twice as much for respondents with primary education as for those with further education (Tables A.4 and A.5). The groups that respond to the threshold in the experiment are thus the groups that respond in the field: men and respondents with lower education. Two designs, one with full control over the information provided and one with real-world variation across 29 countries, locate left-digit bias in the same part of the population.

4 A New Keynesian model with left-digit-biased inflation expectations

To study how left-digit-biased inflation expectations affect the dynamics of inflation and the output gap in general equilibrium and what the implications for monetary policy are, we now embed a parsimonious specification of left-digit-biased inflation expectations in a simple New Keynesian model (Galí, 2015). To keep the exposition concise, we follow our empirical results and focus on inflation thresholds that are multiples of 5 percent, even though the model can be generalized to thresholds of any multiple, such as full integers or multiples of 10.

4.1 The model

A representative household[9] perceives inflation with a left-digit bias according to:

$$\begin{aligned}\overbrace{\pi_t^p}^{\text{Perception}} = \overbrace{\pi_{t-1}^p}^{\text{Perception } t-1} + \overbrace{d(\pi_t, \pi_{t-1})}^{\text{Discontinuous updating}} &+ \overbrace{(1-\theta)[\Delta\pi_t - d(\pi_t, \pi_{t-1})]}^{\text{Attention to inflation changes}} \\ &+ \underbrace{(1-\lambda)\left[\pi_{t-1} - \pi_{t-1}^p\right]}_{\text{Attention to inflation level}},\end{aligned} \tag{2}$$

where $\theta \in [0,1]$ captures the degree of left-digit bias, or inattention to inflation[10], $d(\pi_t, \pi_{t-1})$ captures discontinuous updating, $\lambda \in [0,1]$ inattention to the level of inflation, and $\Delta\pi_t \equiv \pi_t - \pi_{t-1}$ is the change in the actual inflation rate. Households update their perceived inflation only discontinuously according to

$$d(\pi_t, \pi_{t-1}) = \Delta\left\lfloor \frac{\pi_t}{0.05} \right\rfloor 0.05 \times \begin{cases} 1 & \text{if } \Delta\left\lfloor \frac{\pi_t}{0.05} \right\rfloor \geq 0 \\ \chi & \text{else }, \end{cases} \tag{3}$$

with $\lfloor\rfloor$ being the floor operator, $\Delta\left\lfloor \frac{\pi_t}{0.05} \right\rfloor \equiv \left\lfloor \frac{\pi_t}{0.05} \right\rfloor - \left\lfloor \frac{\pi_{t-1}}{0.05} \right\rfloor$, and $\chi \in [0,1]$. The difference $\Delta\left\lfloor \frac{\pi_t}{0.05} \right\rfloor$ is one if inflation crosses a threshold from below, negative one if inflation crosses a threshold from above, and zero if no threshold is crossed.

To gain intuition for this formulation, consider first the case of symmetric left-digit bias, $\chi = 1$, and no attention to the level of inflation, $\lambda = 1$. Then, equation (2) simplifies to

$$\underbrace{\pi_t^p}_{\text{Perception}} = \underbrace{\left\lfloor \frac{\pi_t}{0.05} \right\rfloor \times 0.05}_{\text{Round numbers}} + \underbrace{(1-\theta)\left(\pi_t - \left\lfloor \frac{\pi_t}{0.05} \right\rfloor \times 0.05\right)}_{\text{Attention to values between round numbers}}, \tag{4}$$

Perceived inflation is a round number plus a fraction $1-\theta$ of the distance between the actual inflation rate and the round number, reflecting attention to these in-between values.

[9]The assumption of a representative household is without loss of generality. As shown in Online Appendix D.1, if we assume that households differ in their attention parameter θ_i, average perceptions and expectations still satisfy equations (2) and (6) evaluated at the mean $\bar{\theta}$. For example, with one always-attentive type and one type attentive only at thresholds, $\bar{\theta}$ corresponds to the share of threshold-attentive households, consistent with the extensive-margin evidence in section 2.

[10]We use the term *inattention* when referring to left-digit bias, but left-digit bias might also be the result of imperfect price recall, a tendency to choose round numbers to represent reference prices, or price categorization (Strulov-Shlain, 2023).

For example, if inflation is 9.8 percent and households are fully inattentive, $\theta = 1$, then perceived inflation is 5 percent. If instead households are fully attentive, $\theta = 0$, then perceived inflation is 9.8 percent, while if households are partially inattentive, $\theta = 0.5$, then perceived inflation is 7.4 percent. This formulation follows the literature on 99-cent pricing, see, for example, List *et al.* (2023) and Strulov-Shlain (2023).

If inflation surpasses a threshold—a multiple of 0.05—and if the change itself is infinitesimally small, perceived inflation jumps discontinuously by $0.05 \times \theta$, exactly the discontinuity we discover in our regression discontinuity design in section 2.

The common formulation equation (4) implies that these discontinuous jumps are symmetric. If inflation crosses a threshold from below, perceived inflation jumps up, and if inflation crosses a threshold from above, perceived inflation jumps down by the same amount. Since our empirical results in section 2 provide robust evidence of discontinuous updating only when inflation crosses a threshold from below, we allow for asymmetric left-digit bias with $\chi < 1$ in equation (2). For example, assume fully inattentive households, $\theta = \lambda = 1$ and asymmetric left-digit bias, $\chi = 0$. If inflation moves from $\pi_{t-1} = 0.048$ to $\pi_t = 0.049$, the floor function returns 0 for both, and the household does not update its perceived inflation, $d(\pi_t, \pi_{t-1}) = 0$. However, if inflation moves from $\pi_{t-1} = 0.049$ to $\pi_t = 0.050$, the floor function returns 0 for π_{t-1} and 1 for π_t. Since the household pays attention only to the leftmost digit, it will update its perceived inflation by 5 percentage points: $d(\pi_t, \pi_{t-1}) = 0.05$. If, however, inflation moves from $\pi_{t-1} = 0.050$ to $\pi_t = 0.049$, perceived inflation does not jump downwards. For perceived inflation also adjusting downwards over time, however, the household has to pay some attention to the level of actual inflation, that is, $\lambda < 1$. Otherwise, with $\chi < 1$ and $\lambda = 1$, perceived inflation would increase in discrete jumps forever, never converging back to actual inflation. We, therefore, include the last term in equation (2).

Based on their perception of inflation, equations (2) and (3), households form inflation expectations. The representative household assumes that inflation π_t evolves according to an AR(1) process

$$\pi_{t+1} = \rho \pi_t + (1-\rho)\pi^* + \epsilon_{t+1}, \tag{5}$$

where $\rho \in (0,1)$ is the perceived inflation persistence, π^* is the perceived long-run inflation rate, and ϵ_{t+1} denotes a white-noise shock with mean zero. Inflation might evolve differently, but the household believes it follows this process. In a given month t, households then form inflation expectations based on perceived inflation from period $t-1$ and the AR(1) process in equation (5):

$$\mathbb{E}_t^b \pi_{t+1} = \rho^2 \pi_{t-1}^p + (1-\rho^2)\pi^*, \tag{6}$$

where the superscript b indicates *behavioral* expectations that may deviate from rational expectations. Jump discontinuities in perceived inflation, as described in equation (2), directly translate into jump discontinuities in inflation expectations. The timing, as previously described, takes account of the empirically plausible information lag. However, the main results of this section would not change if households observed current inflation π_t when forming expectations.

Our parsimonious modeling of left-digit-biased inflation expectations relates to existing approaches as follows. Like the empirical literature on left-digit bias (Lacetera *et al.*, 2012; Strulov-Shlain, 2023), we treat the degree of bias θ as a primitive. The perception function is an instance of anchoring to a default (Gabaix, 2019, ch. 2.3.15): perceived inflation equals a default value plus partial attention $1-\theta$ to the remainder, where our default is the focal round number below actual inflation rather than the leading-digit truncation. This choice of default produces jumps at multiples of five and nowhere else, which is the pattern our placebo tests support. Following Gabaix (2019), attention could be endogenized with cognitive costs, so that households choose θ themselves, and the asymmetry $\chi < 1$ would additionally require attention that responds to adverse news. Neither derivation has been worked out, and we take the documented bias as given. Within the rational-inattention literature on inflation expectations, the closest approach is Pfäuti (2026), where a fixed information cost makes attention jump once inflation crosses an endogenous threshold. His model, therefore, also generates a discrete response of expectations when inflation rises past a threshold and a muted response once it falls back below. The thresholds differ, however. Estimated freely, his threshold is unique and lies at about 4 percent, and information criteria reject specifications with multiple thresholds. Korenok *et al.* (2026) estimate similar country-specific attention thresholds, typically between 2 and 4 percent, for 38 economies. Such thresholds reflect the cost-benefit trade-off of paying attention, so their location depends on a country's inflation environment rather than on particular numbers. Left-digit bias instead places thresholds at salient round numbers, and the resulting jumps do not decline at higher thresholds and arise only when inflation rises. The two mechanisms are complementary, as an attention threshold determines when households start paying attention to inflation, while left-digit bias influences how they process the numbers they attend to.

The remaining model elements follow a standard New Keynesian model and are described in detail in Online Appendix D.2 of the Online Appendix. The following three standard equations summarize the entire economy:

$$\pi_t = \beta \mathbb{E}_t^b \pi_{t+1} + \kappa \tilde{y}_t + z_t \tag{7}$$

$$\tilde{y}_t = \mathbb{E}_t^b \tilde{y}_{t+1} - \frac{1}{\sigma}\left(\hat{i}_t - \mathbb{E}_t^b \pi_{t+1}\right) \tag{8}$$

$$\hat{i}_t = \phi_\pi \pi_t + \phi_y \tilde{y}_t, \tag{9}$$

together with equations (2), (3) and (6) for inflation expectations and output-gap expectations[11]

$$\mathbb{E}_t^b \tilde{y}_{t+1} = \rho_y^2 \tilde{y}_{t-1}.$$

See Online Appendix D.2 for details and the derivation.

Equation (7) is the New Keynesian Phillips curve (NKPC) with π_t denoting the inflation rate, β the household's subjective discount factor, $\mathbb{E}_t^b \pi_{t+1}$ are *behavioral* inflation expectations, κ the slope of the Phillips curve, $\tilde{y}_t$ the output gap, and z_t a cost-push shock following an AR(1) process with persistence ρ_z. It describes how firms set current prices and determine inflation based on their expectations of future inflation and the current output gap. Equation (8) is the aggregate Euler equation with $\frac{1}{\sigma}$ the intertemporal elasticity of sub-

[11]Consistent with the information lag in inflation perceptions and expectations, households form output-gap expectations based on last period's output gap.

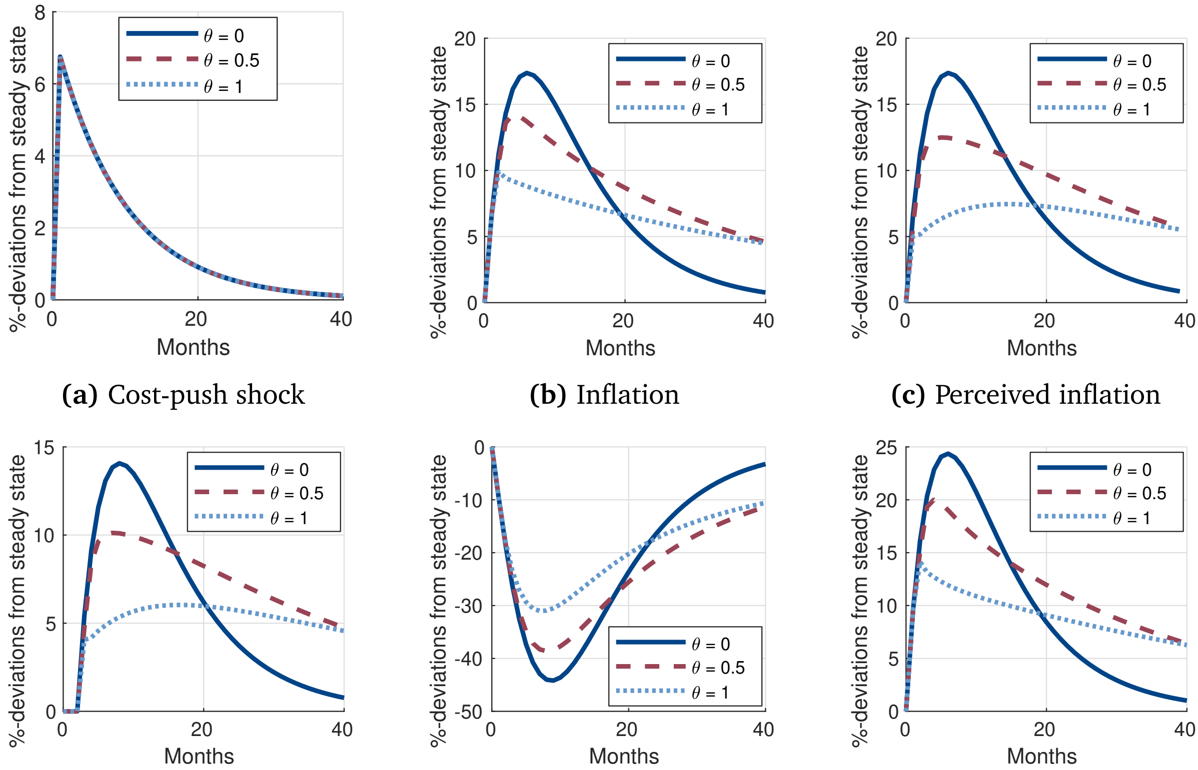
stitution, and $\hat{i}_t$ the difference of the nominal interest rate and its steady-state value. It describes how households choose current relative to expected future consumption based on the next-period real interest rate. Finally, equation (9) is a simple Taylor rule with inflation coefficient ϕ_π and output gap coefficient ϕ_y. This monetary policy rule captures how the central bank sets the nominal interest rate in response to inflation and the output gap.

This model differs from the standard New Keynesian model in two ways. First, households believe that consumption and inflation follow AR(1) processes, and firms have forecasters identical to households in forming expectations about inflation and the output gap. Second, households do not perfectly observe inflation but instead have left-digit-biased perceptions and expectations of inflation. Perceived inflation can differ from actual inflation, affecting a household's forecast of future inflation.

4.2 How left-digit bias changes the propagation of a cost-push shock

We now examine how left-digit-biased inflation expectations shape the propagation of a cost-push shock. The system is solved by forward iteration, given initial values for the nominal interest rate, the lagged output gap, and past inflation, as well as an exogenous shock sequence $\{z_t\}$. At each step, this requires solving a nonlinear system of equations. The nonlinearity arises from the left-digit-biased formation of inflation expectations.

We calibrate the model at a monthly frequency, setting the following parameters to standard values from the literature (Galí, 2015): β is set to 0.9967, resulting in a 4 percent real annual interest rate, κ is set to 0.01, σ is set to 1, ϕ_π is set to 1.5, and ϕ_y is set to $0.50/12 = 0.042$. We will study different values for the inattention to the right digits in inflation, θ. Following our findings from the empirical analysis, we set $\chi = 0$, implying asymmetric left-digit bias. For inflation perceptions to converge to the steady-state inflation rate of 0 percent, households must still pay some attention to the current inflation level, $\lambda < 1$, as discussed above. We set $\lambda = 0.9$. The parameters for the subjective persistence of inflation and consumption are set to $\rho_\pi = 0.9$ and $\rho_y = 0.9$. Lastly, we consider a cost-push shock that causes inflation to exceed the 5-percent threshold on impact and then revert to zero with persistence $\rho_z = 0.9$. The implied impact shock size is 0.0675. Since



(a) Cost-push shock **(b)** Inflation **(c)** Perceived inflation

(d) Expected inflation **(e)** Output gap **(f)** Nominal interest rate

Notes: The cost-push shock is of size 0.0675 on impact and follows an AR(1) process with persistence 0.9. The panels show impulse-response functions for different degrees of left-digit bias, $\theta \in \{0, 0.5, 1\}$, where $\theta = 0$ corresponds to no left-digit bias, $\theta = 1$ to full left-digit bias, and $\theta = 0.5$ to intermediate left-digit bias.

Figure 2: Impulse-response to a cost-push shock

this is a comparatively simple model, the results shown are not intended to be *quantitatively* accurate but to illustrate the *qualitative* effects of left-digit-biased inflation expectations on inflation dynamics and the output gap.

Figure 2 shows the impulse response functions to the same cost-push shock for different degrees of left-digit bias, $\theta \in \{0, 0.5, 1\}$. The dynamics can be understood step by step by tracing how the shock propagates through the system of equations.

The cost-push shock directly increases inflation in period 1 through the New Keynesian Phillips curve (7). Given the Taylor rule (9), higher inflation leads the central bank to raise the nominal interest rate. The higher nominal rate in turn reduces aggregate demand and thus the output gap through the Euler equation (8). The negative output gap then feeds back into the NKPC and dampens the inflationary pressure somewhat. In equilibrium, inflation jumps from 0 to 6.7 percent, surpassing the 5-percent threshold. The output gap declines by 9.6 percent, and the nominal interest rate rises by 9.6 percentage points. Because expectations are backward-looking, inflation expectations for the second period have not yet adjusted when the shock hits. Hence, in period 1, the responses are identical across all degrees of left-digit bias, θ.

In period 2, households receive information about actual inflation in period 1 and update their perceived inflation accordingly. Since inflation has crossed the 5-percent threshold, perceived inflation jumps to a value slightly above 5 percent for all θ. With weaker left-digit bias (that is, lower θ), households pay more attention to the exact inflation rate and therefore revise their perceived inflation more strongly upward. However, because the threshold crossing dominates perception, these differences are small in absolute terms. The higher perceived inflation in period 1 raises expected inflation for period 3. Since households have backward-looking expectations, this amplification occurs with a one-period delay: when households form expectations in period 2, they take into account the higher perceived inflation from period 1. As a result, inflation expectations for period 3 rise above zero for all θ. Higher inflation expectations in period 2 feed back into the NKPC (7), as firms anticipating higher future inflation set prices more aggressively. The same mechanism appears in the Euler equation (8), where households, expecting higher future inflation, postpone consumption, reducing the current output gap. Inflation thus increases again, and the output gap becomes more negative in period 2.

Up to this point, the responses are qualitatively similar across degrees of left-digit bias. The main differences emerge from period 3 onwards. In period 3, households observe inflation in period 2. If they are subject to left-digit bias, they disregard small changes as long as inflation does not surpass another threshold, meaning perceived inflation stays at about 5 percent. Without left-digit bias ($\theta = 0$), households pay full attention to the actual inflation rate, which has increased further to about 8.5 percent. Hence, perceived inflation now diverges strongly across degrees of bias. This difference carries forward to expectations. When forming expectations in period 3, unbiased households expect a higher future inflation rate for period 4, whereas biased households still expect roughly 5 percent inflation. These differences in expectations directly feed back into inflation dynamics. Without left-digit bias, higher expected inflation raises current inflation through the NKPC and leads to a stronger monetary tightening via the Taylor rule, which further depresses output through the Euler equation. With left-digit bias, however, the muted increase in expected inflation leads to a smaller rise in current inflation, a milder monetary policy response, and a less pronounced output contraction in period 3 and onward. Because of backward-looking expectations, this feedback loop produces a delayed amplification. Even though the initial shock is already decaying, inflation and the interest rate continue to rise, while the output gap keeps declining. This mechanism generates the hump-shaped impulse response of inflation and the nominal interest rate in the unbiased case ($\theta = 0$).

As time passes, the cost-push shock itself fades out. In all cases, inflation, the output gap, and the nominal interest rate gradually converge back toward their steady-state values. However, with left-digit bias, the adjustment path differs markedly. Since households ignore small decreases in inflation as long as it remains above 5 percent, their perceived inflation and expectations decline only very slowly. When actual inflation eventually falls below the 5-percent threshold, there is no corresponding downward jump in perceived inflation, because the updating rule in equation (2)—governed by $\chi = 0$—prevents symmetric adjustments. Consequently, inflation perceptions and expectations remain elevated even as actual inflation declines. This slow downward adjustment implies that firms continue to expect moderate inflation and keep prices somewhat elevated, while households maintain subdued consumption, leading to a prolonged negative output gap. Monetary policy reacts to the still-high inflation expectations by keeping the nominal interest rate elevated for longer.

In sum, left-digit bias alters the transmission of cost-push shocks in two ways. It dampens the initial response of inflation because expectations do not fully adjust upward, but it also increases persistence once a threshold is crossed because inflation perceptions and expectations adjust downward only sluggishly when inflation declines. As a result, the economy with left-digit-biased expectations exhibits weaker short-run inflation responses but more persistent inflation, a more prolonged output contraction, and a longer period of tight monetary policy. The case of intermediate bias ($\theta = 0.5$) lies between these two extremes, as initial reactions are slightly dampened, and the return to steady state is slower than without bias but faster than under full left-digit bias.

4.3 Discussion: de-anchoring and nonlinearities

As the impulse responses in Figure 2 show, when a shock is large enough for inflation to exceed a salient threshold such as 5 percent, left-digit-biased expectations cause inflation expectations to remain persistently elevated even after the shock itself has faded. After three years and four months, the shock has largely vanished, yet inflation expectations with left-digit bias remain just below 5 percent, while they have returned close to zero without bias. This persistence arises because households update their inflation perceptions and expectations asymmetrically. They react when inflation crosses a threshold from below, but not when it falls below a threshold from above. The strength of this persistence depends on the level-inattention parameter λ, and the exercise here serves to illustrate the mechanism rather than to quantify it.

These persistently higher inflation expectations after a large shock can be interpreted as a form of de-anchoring. In the model, inflation ultimately returns to its steady state of zero percent, but the adjustment takes considerably longer with left-digit-biased expectations, requiring monetary policy to keep interest rates higher for longer.[12] Empirically, several recent findings suggest that expectations did not become fully anchored during the recent disinflation, with some measures still showing de-anchoring and elevated expectations among US consumers (Coibion and Gorodnichenko, 2025), European firms (Baumann *et al.*, 2025), and European consumers (D'Acunto *et al.*, 2024). Our model provides a complementary explanation for why inflation expectations can stay elevated after initial shocks have dissipated. In short, the "last mile" is long, and policy must remain restrictive to bring expectations back down.

Left-digit-biased inflation expectations introduce strong nonlinearities into the New Keynesian model that depend on the size of a shock and the state of the economy. Without left-

[12]The literature on de-anchoring, however, goes further by allowing agents to hold beliefs about future inflation that diverge from the central bank's target under imperfect information (see Bocola *et al.*, 2025; Carvalho *et al.*, 2023; Dupraz and Marx, 2023 for recent examples).

digit bias, the model is linear by construction, because it was linearized around its steady state when deriving equations (7) to (9), and responses scale proportionally with the size of the shock. With left-digit-biased expectations, the responses depend on whether inflation crosses a threshold, which creates implicit threshold values for the shock size. Small increases in the shock size have small effects on inflation, the output gap, and the nominal interest rate, but once the shock is large enough for inflation to cross a threshold, the cumulative responses jump to distinctly higher levels, and monetary policy has to react more aggressively and persistently (Figure D.1 in the Online Appendix). The same logic applies when several medium-sized shocks, for example, a fiscal demand shock and an energy cost-push shock, occur in close succession and jointly push inflation over a threshold.

Relatedly, equally sized shocks can have very different effects depending on the state of the economy. When inflation expectations are low, a small shock has limited effects, similar to the case without left-digit bias. When inflation and inflation expectations are already elevated but just below a threshold, the same shock can push the economy across that threshold and trigger a much stronger cumulative response. This state dependence underscores the risk associated with elevated inflation expectations. Our model suggests that still elevated inflation expectations in both the euro area and the United States increase the likelihood that even small shocks, such as those from trade policy, could push inflation over a threshold again, generating a disproportionately strong inflationary response.[13] Our model thus provides a formal framework for a concern raised in recent discussions (Coibion and Gorodnichenko, 2025).

5 Conclusion

Households read inflation numbers with a left-digit bias. Using data from 29 European countries between 2016 and 2024, our regression discontinuity design shows that mean and median inflation expectations jump by 0.7 and 0.9 percentage points when inflation crosses a multiple of five from below, while we find no robust response when inflation

[13]Different indicators of household inflation expectations exist across surveys, horizons, and summary statistics. Mean one-year-ahead inflation expectations in both the United States and the euro area remain above their pre-surge levels (Coibion and Gorodnichenko, 2025; European Central Bank, 2025).

falls back below a threshold. More than half of the jump comes from households that previously expected zero or negative inflation and now expect strictly positive inflation, and the response is strongest among respondents with lower education and among men.

A preregistered experiment in Germany studies the mechanism at the individual level. Participants forecast next year's inflation after seeing a rate just below or just above 10 percent, while holding the supply of other information fixed. The treatment raises forecasts among men, respondents with lower education, and the fastest respondents. Field data and experiment thus locate left-digit bias in the same part of the population, which points to a genuine number-processing bias rather than to changes in media coverage.

Embedded in a New Keynesian model, left-digit-biased expectations dampen the initial response to a cost-push shock but keep inflation and expectations elevated for longer once a threshold has been crossed, so the recession lasts longer and monetary policy must remain restrictive for an extended period. The model economy is also state dependent. A small shock has modest effects when expectations are low but large effects when expectations are still elevated near a threshold, which offers one account of de-anchored inflation expectations after the 2021-22 surge.

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Online Appendix for "Left-Digit Bias in Household Inflation Expectations"

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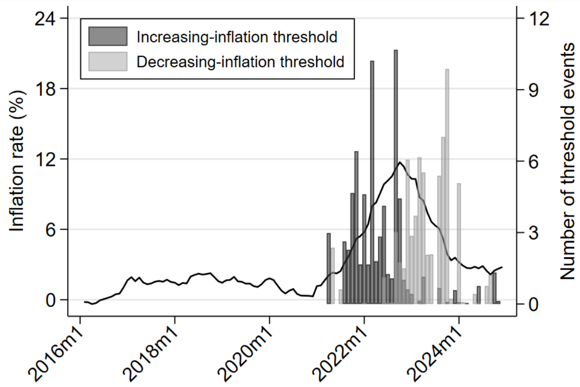
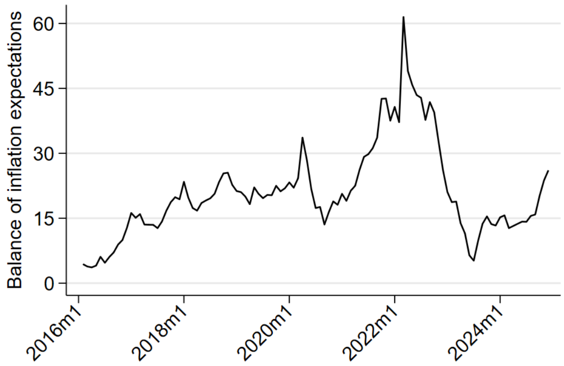
A Additional figures and tables



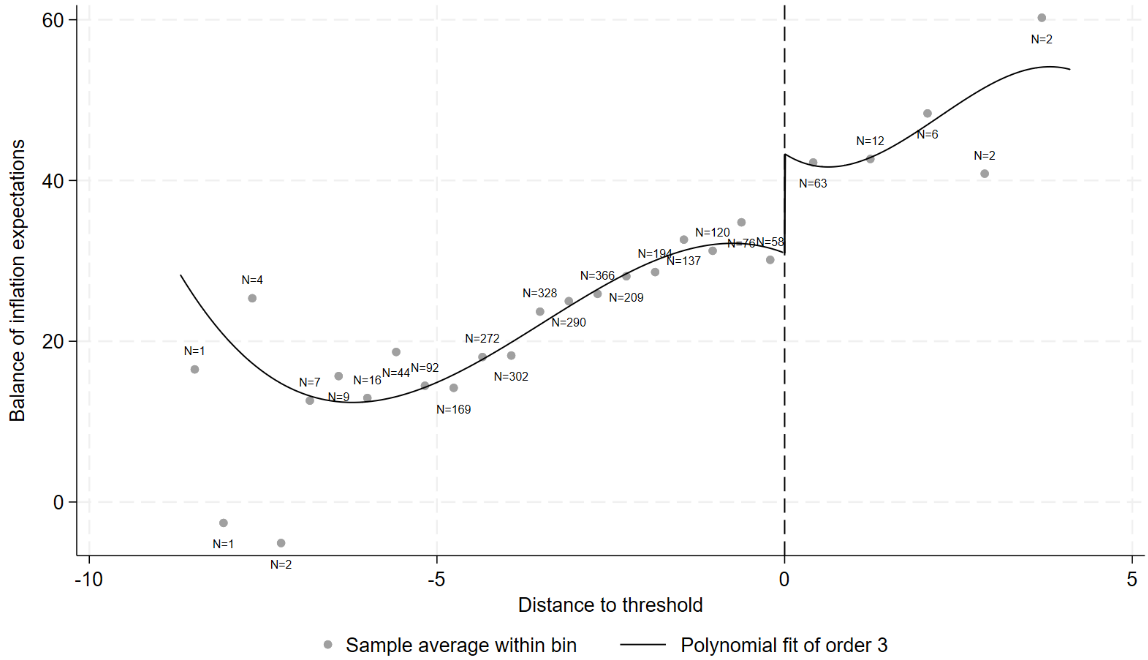
(a) Inflation rate



(b) Inflation expectations

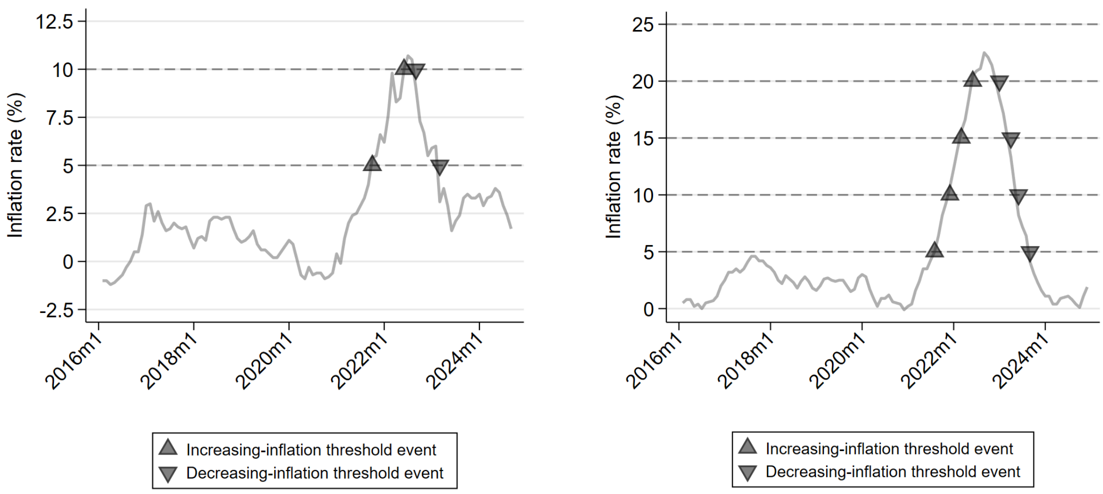
Notes: Panel (a): the solid line shows the monthly year-on-year HICP inflation rate, as first published, averaged across the countries in our sample and weighted by countries' population shares (left axis); the bars show the number of increasing-inflation (dark gray) and decreasing-inflation (light gray) threshold events per month, summed across the sample countries (right axis). Panel (b): the line shows the balance of household inflation expectations for the next 12 months from the European Business and Consumer Surveys, defined in section 2.1 in the main text, averaged across the same countries and weighted by countries' population shares.

Figure A.1: Inflation and inflation expectations in Europe from January 2016 to December 2024



Notes: The x-axis measures a country's distance of inflation in period $t-1$ from its next upper threshold from period $t-2$: $\pi_{t-1} - 5\left\lceil \frac{\pi_{t-2}}{5} \right\rceil$. This way, we pool all increasing-inflation threshold events at multiples of five (5%, 10%, 15%, 20%, and 25%). By definition, values on the x-axis < 0 refer to situations without increasing-inflation threshold events, whereas values ≥ 0 depict increasing-inflation threshold events. The labels "$N = \ldots$" report the number of observations used to calculate each binned mean.

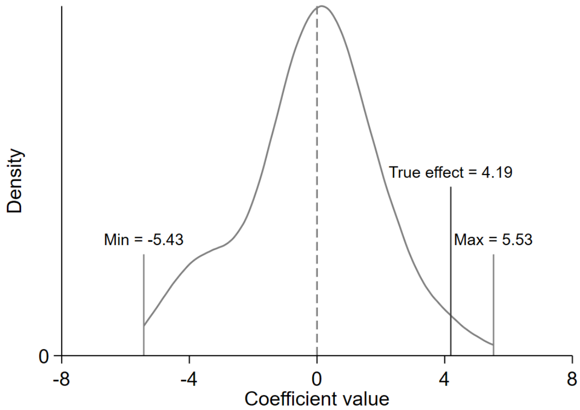
Figure A.2: Inflation expectations around increasing-inflation thresholds (over full range of assignment variable)



(a) Spain **(b)** Lithuania

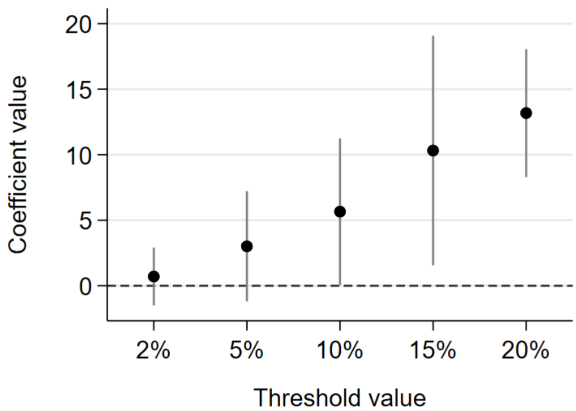
Notes: An increasing-inflation threshold event refers to a situation where a country's inflation rate reaches or exceeds a value of 5, 10, 15, 20, or 25%, compared to the previous month. A decreasing-inflation threshold event refers to a situation where a country's inflation rate falls below a value of 5, 10, 15, 20, or 25%, compared to the previous month.

Figure A.3: Examples of round-number thresholds in the inflation rate



Notes: The figure shows the kernel density of the coefficients obtained by re-estimating the baseline specification 1,000 times with increasing-inflation placebo thresholds. The dependent variable is qualitative inflation expectations. In each iteration, we randomly draw one non-integer threshold, measured to one decimal place, from each of the intervals 0.14.5, 5.59.5, 10.514.5, 15.519.5, and 20.524.5 percent. The resulting placebo indicator equals one when inflation crosses one of these five thresholds from below and replaces the multiples-of-five treatment indicator; all other elements of the baseline specification remain unchanged. The "true" effect is the multiples-of-five estimate reported in Column (1) of Table 1, while "Min" and "Max" denote the smallest and largest estimates obtained in the placebo exercise.

Figure A.4: Regression results with placebo thresholds



Notes: The graph shows regression coefficients from estimating equation (1) with separate dummy variables for the increasing-inflation threshold values shown on the x-axis. The y-axis measures the reduced-form effect of the threshold events on qualitative inflation expectations (i.e., the balance of inflation expectations defined in section 2.2 of the main text). The vertical bars denote the 90% confidence interval based on standard errors clustered by country.

Figure A.5: Individual inflation thresholds and inflation expectations

	(1) Population size	(2) GDP	(3) Interest rate	(4) Unemployment rate	(5) Balance of payments
Increasing-infl. threshold	-4.83	-0.54	0.02	-0.22	-462.49
	(3.17)	(1.36)	(0.09)	(0.17)	(547.29)
Decreasing-infl. threshold	1.86	-1.24	-0.03	0.17	-1699.42
	(1.71)	(1.36)	(0.09)	(0.15)	(1268.69)
Country fixed effects	no	yes	yes	yes	yes
Observations	3085	3079	2807	2859	2450

Notes: Population size is based on yearly observations and refers to the number of inhabitants (in million) of a country on 1 January. GDP is based on quarterly observations and refers to chain linked volumes. Interest rate is based on monthly observations and refers to long-term government bonds yield. Unemployment rate is based on monthly observations. Balance of payments (current account) is based on monthly observations and measured in million euro. All specifications include time fixed effects, a 3rd order polynomial of the change in inflation rate, and inflation rate bin dummies with a bandwidth of 0.1. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. The regressions are weighted by countries' population share in the sample. Standard errors (in parentheses) are clustered by country.
** p<0.10, ** p<0.05, *** p<0.01*

Table A.1: Balance checks

	Share of households expecting prices to...				
	(1)	(2)	(3)	(4)	(5)
	...increase more rapidly	...increase at same rate	...increase at slower rate	...stay about same	...fall
Increasing-infl. threshold	0.934	1.869**	1.144	-3.504***	-0.446**
	(1.771)	(0.782)	(1.273)	(0.850)	(0.175)
Decreasing-infl. threshold	1.332	-0.805	-2.022	1.828	-0.329
	(1.472)	(0.890)	(1.290)	(1.099)	(0.354)
Mean of dependent variable	17.783	36.953	17.310	25.634	2.319
SD of dependent variable	9.965	11.460	9.169	14.578	2.302
Observations	2647	2647	2647	2647	2647

All specifications include time and country fixed effects, a 3rd order polynomial of the change in inflation rate, and inflation rate bin dummies with a bandwidth of 0.1. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.
** p<0.10, ** p<0.05, *** p<0.01*

Table A.2: Inflation threshold events and qualitative inflation expectations (decomposed by answer options)

	Mean inflation expectations of households expecting prices to...			
	(1)	(2)	(3)	(4)
	...increase more rapidly	...increase at the same rate	...increase at a slower rate	...fall
Increasing-infl. threshold	0.429*	0.159	-0.273	0.057
	(0.216)	(0.200)	(0.182)	(0.223)
Decreasing-infl. threshold	-0.278	-0.278	-0.139	-0.397**
	(0.278)	(0.213)	(0.224)	(0.174)
Mean of dependent variable	12.243	9.787	6.951	-3.213
SD of dependent variable	5.028	4.171	2.856	1.008
Observations	2646	2646	2646	2460

All specifications include time and country fixed effects, a 3rd order polynomial of the change in inflation rate, and inflation rate bin dummies with a bandwidth of 0.1. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.
** p<0.10, ** p<0.05, *** p<0.01*

Table A.3: Inflation threshold events and quantitative inflation expectations (decomposed by answer options)

	(1)	(2)	(3)	(4)
	Mean estimate (male respondents)	Mean estimate (female respondents)	Median estimate (male respondents)	Median estimate (female respondents)
Increasing-infl. threshold	0.737***	0.737***	1.112**	0.762*
	(0.205)	(0.230)	(0.467)	(0.406)
Decreasing-infl. threshold	-0.208	-0.478	-0.149	-0.672
	(0.283)	(0.306)	(0.430)	(0.453)
H_0: symmetric effects (p-value)	0.110	0.443	0.069	0.877
Mean of dependent variable	5.990	6.628	4.156	4.448
SD of dependent variable	3.515	3.690	3.993	4.524
Observations	2638	2637	2638	2637

Notes: The mean and median expectations are calculated separately for male and female respondents based on households' point estimates of future inflation. Respondents who did not report their gender are excluded. All specifications include time and country fixed effects, a 3rd order polynomial of the change in inflation rate, and inflation rate bin dummies with a bandwidth of 0.1. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.
** p<0.10, ** p<0.05, *** p<0.01*

Table A.4: Inflation threshold events and inflation expectations, by gender

	(1) Mean estimate (primary education)	(2) Mean estimate (secondary education)	(3) Mean estimate (further education)	(4) Median estimate (primary education)	(5) Median estimate (secondary education)	(6) Median estimate (further education)
Increasing-infl. threshold	1.279***	0.624**	0.488**	1.565***	1.366**	0.649*
	(0.314)	(0.234)	(0.223)	(0.517)	(0.533)	(0.359)
Decreasing-infl. threshold	-0.723**	-0.246	-0.191	-1.130**	-0.052	-0.352
	(0.286)	(0.326)	(0.257)	(0.449)	(0.504)	(0.322)
H_0: symmetric effects (p-value)	0.156	0.309	0.300	0.482	0.056	0.381
Mean of dependent variable	6.291	6.619	5.949	4.060	4.534	4.154
SD of dependent variable	3.622	3.664	3.568	4.387	4.400	4.080
Observations	2647	2646	2646	2647	2646	2646

Notes: The mean and median expectations are calculated separately for education groups based on households' point estimates of future inflation. Respondents who did not report their education are excluded. All specifications include time and country fixed effects, a 3rd order polynomial of the change in inflation rate, and inflation rate bin dummies with a bandwidth of 0.1. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table A.5: Inflation threshold events and inflation expectations, by education

	(1) Qualitative expectations	(2) Mean estimate	(3) Median estimate
Increasing-infl. threshold	0.798	-0.064	-0.056
	(0.915)	(0.132)	(0.270)
Decreasing-infl. threshold	-0.046	0.046	0.282*
	(0.903)	(0.060)	(0.164)
H_0: symmetric effects (p-value)	0.500	0.888	0.348
Mean of dependent variable	20.831	6.302	4.816
SD of dependent variable	17.479	3.606	5.173
Observations	3085	2647	2647

Notes: Qualitative expectations refer to weighted difference between households that expect higher future inflation and those that expect zero or negative inflation. The mean and median expectations are based on households' point estimates of the future inflation rate. All specifications include time and country fixed effects, a 3rd order polynomial of the change in inflation rate, and inflation rate bin dummies with a bandwidth of 0.1. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses any integer between 1 and 29 other than multiples of five. Standard errors (in parentheses) are clustered by country.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table A.6: Inflation threshold events and inflation expectations (integers as thresholds)

	(1) Qualitative expectations	(2) Mean estimate	(3) Median estimate	(4) Qualitative expectations	(5) Mean estimate	(6) Median estimate
Increasing-infl. threshold	3.455*	0.557***	0.825	3.364**	0.599***	0.530
	(1.764)	(0.184)	(0.516)	(1.593)	(0.167)	(0.363)
Decreasing-infl. threshold	-0.436	-0.443	-0.106	-1.618	-0.471	-0.149
	(1.690)	(0.263)	(0.558)	(2.075)	(0.280)	(0.525)
H_0: symmetric effects (p-value)	0.253	0.682	0.276	0.486	0.602	0.428
Bandwidth of inflation rate bin dummies	0.2	0.2	0.2	0.5	0.5	0.5
Mean of dependent variable	20.830	6.315	4.840	20.868	6.340	4.881
SD of dependent variable	17.497	3.622	5.207	17.507	3.653	5.271
Observations	3085	2647	2647	3085	2647	2647

Notes: Qualitative expectations refer to weighted difference between households that expect higher future inflation and those that expect zero or negative inflation. The mean and median expectations are based on households' point estimates of the future inflation rate. All specifications include time and country fixed effects and a 3rd order polynomial of the change in inflation rate. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table A.7: Inflation threshold events and inflation expectations (alternative bandwidths for inflation rate bin dummies)

	(1) Qualitative expectations	(2) Mean estimate	(3) Median estimate	(4) Qualitative expectations	(5) Mean estimate	(6) Median estimate
Increasing-infl. threshold	3.957**	0.675***	0.899*	4.189**	0.711***	0.981*
	(1.925)	(0.200)	(0.484)	(1.928)	(0.199)	(0.492)
Decreasing-infl. threshold	0.984	-0.268	0.010	1.128	-0.291	-0.047
	(2.070)	(0.275)	(0.563)	(2.108)	(0.276)	(0.538)
H_0: symmetric effects (p-value)	0.121	0.190	0.162	0.098	0.183	0.151
Change of inflation rate, order of polynomial	2	2	2	4	4	4
Mean of dependent variable	20.831	6.302	4.816	20.831	6.302	4.816
SD of dependent variable	17.479	3.606	5.173	17.479	3.606	5.173
Observations	3085	2647	2647	3085	2647	2647

Notes: Qualitative expectations refer to weighted difference between households that expect higher future inflation and those that expect zero or negative inflation. The mean and median expectations are based on households' point estimates of the future inflation rate. All specifications include time and country fixed effects and inflation rate bin dummies with a bandwidth of 0.1. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.

* *p<0.10,* ** *p<0.05,* *** *p<0.01*

Table A.8: Inflation threshold events and inflation expectations (alternative polynomial orders for inflation rate change)

	(1) Qualitative expectations	(2) Mean estimate	(3) Median estimate
Increasing-infl. threshold	4.224**	0.824***	1.135**
	(1.622)	(0.210)	(0.441)
Decreasing-infl. threshold	-0.360	-0.320	0.101
	(1.809)	(0.305)	(0.364)
H_0: symmetric effects (p-value)	0.093	0.153	0.047
Mean of dependent variable	20.835	6.285	4.286
SD of dependent variable	17.457	3.600	4.221
Observations	3085	2647	2647

Notes: Qualitative expectations refer to weighted difference between households that expect higher future inflation and those that expect zero or negative inflation. The mean and median expectations are based on households' point estimates of the future inflation rate. All specifications include time and country fixed effects and bin dummies of bandwidth 0.1 for the inflation rate and inflation rate change. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table A.9: Inflation threshold events and inflation expectations (bin dummies for inflation rate change)

	(1) Qualitative expectations	(2) Mean estimate	(3) Median estimate
Increasing-infl. threshold	3.717	0.849***	1.175**
	(2.306)	(0.275)	(0.459)
Decreasing-infl. threshold	0.015	-0.372	-0.172
	(1.524)	(0.311)	(0.383)
H_0: symmetric effects (p-value)	0.229	0.232	0.038
Inflation rate bin dummies (bandwidth = 0.1) × absolute change in the inflation rate	yes	yes	yes
Mean of dependent variable	20.831	6.302	4.301
SD of dependent variable	17.479	3.606	4.230
Observations	3085	2647	2647

Notes: Qualitative expectations refer to weighted difference between households that expect higher future inflation and those that expect zero or negative inflation. The mean and median expectations are based on households' point estimates of the future inflation rate. All specifications include time and country fixed effects. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.
** p<0.10, ** p<0.05, *** p<0.01*

Table A.10: Inflation threshold events and inflation expectations (interactive specification)

	(1) Qualitative expectations	(2) Mean estimate	(3) Median estimate
Increasing-infl. threshold	0.813	0.650***	0.592*
	(1.913)	(0.224)	(0.313)
Decreasing-infl. threshold	-1.295	-0.320	-0.197
	(2.288)	(0.255)	(0.410)
H_0: symmetric effects (p-value)	0.868	0.297	0.469
Mean of dependent variable	20.978	6.304	4.297
SD of dependent variable	17.368	3.568	4.175
Observations	2933	2517	2517

Notes: Qualitative expectations refer to weighted difference between households that expect higher future inflation and those that expect zero or negative inflation. The mean and median expectations are based on households' point estimates of the future inflation rate. All specifications include time and country fixed effects, a 3rd order polynomial of the change in inflation rate, and inflation rate bin dummies with a bandwidth of 0.1. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.
** p<0.10, ** p<0.05, *** p<0.01*

Table A.11: Inflation threshold events and inflation expectations (CPI-based regressions)

	(1)	(2)	(3)
	Qualitative expectations	Mean estimate	Median estimate
Increasing-infl. threshold	4.191	0.710	0.934
	[0.079]	[0.002]	[0.036]
Decreasing-infl. threshold	0.886	-0.283	0.081
	[0.653]	[0.313]	[0.976]
H_0: symmetric effects (p-value)	[0.190]	[0.216]	[0.141]
Mean of dependent variable	20.831	6.302	4.301
SD of dependent variable	17.479	3.606	4.230
Observations	3085	2647	2647

Notes: Qualitative expectations refer to weighted difference between households that expect higher future inflation and those that expect zero or negative inflation. The mean and median expectations are based on households' point estimates of the future inflation rate. All specifications include time and country fixed effects, a 3rd order polynomial of the change in inflation rate, and inflation rate bin dummies with a bandwidth of 0.1. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. P-values are in brackets.

Table A.12: Inflation threshold events and inflation expectations (p-values based on wild cluster bootstrap)

		Share of households thinking prices have...				
	(1)	(2)	(3)	(4)	(5)	(6)
	Balance of perceptions	...risen a lot	...risen moderately	...risen slightly	...stayed about same	...fallen
Increasing-infl. threshold	2.958*	0.756	1.442	0.480	-2.653**	-0.030
	(1.642)	(1.730)	(1.590)	(1.030)	(0.957)	(0.135)
Decreasing-infl. threshold	-4.313***	-1.808	-2.646*	1.582**	2.654***	0.217*
	(1.435)	(1.182)	(1.403)	(0.690)	(0.883)	(0.122)
Mean of dependent variable	31.802	28.311	27.302	25.990	17.178	1.218
SD of dependent variable	29.501	22.690	8.527	13.338	13.903	1.513
Observations	3085	2647	2647	2647	2647	2647

All specifications include time and country fixed effects, a 3rd order polynomial of the change in inflation rate, and inflation rate bin dummies with a bandwidth of 0.1. The regressions are weighted by countries' population share in the sample. A threshold event refers to a situation where a country's inflation rate crosses a value of 5, 10, 15, 20, or 25%. Standard errors (in parentheses) are clustered by country.
** $p<0.10$, ** $p<0.05$, *** $p<0.01$*

Table A.13: Inflation threshold events and inflation perceptions

	(1) Qualitative expectations	(2) Mean estimate	(3) Median estimate
Increasing-infl. threshold	14.618***	1.042***	2.185***
	(0.509)	(0.176)	(0.130)
Original number of obs. left of the cutoff	2696	2355	2355
Original number of obs. right of the cutoff	85	76	76
Local number of obs. left of the cutoff	39	50	50
Local number of obs. right of the cutoff	34	29	29
Regression function: order of polynomial	1	1	1
Regression function: bandwidth	0.350	0.460	0.390
Bias function: order of polynomial	2	2	2
Bias function: bandwidth	1.538	1.340	1.425

Notes: The table shows regression discontinuity estimates based on mean squared error-optimal bandwidth selection, using the estimation implementation provided by Calonico et al. (2017). The assignment variable is defined as: $\pi_{t-1} - 5\lceil \frac{\pi_{t-2}}{5} \rceil$*. We exclude observations with* $\pi_{t-2} < 0$*, because zero would otherwise be treated as the next upper multiple-of-five threshold, even though it is not included in the analysis. All specifications include time fixed effects, country fixed effects, and a binary decreasing-inflation threshold event indicator. The regressions are weighted by countries' population share in the sample. Standard errors (in parentheses) are clustered by country.*
* *p<0.10,* ** *p<0.05,* *** *p<0.01*

Table A.14: Inflation threshold events and inflation expectations (regression discontinuity estimates)

B Decomposition of inflation expectations into extensive and intensive margins

This section derives the decomposition used in section 2.4 and describes how we measure each term. With a slight abuse of notation, let $\bar{\pi}^e_t$ denote the mean over households' inflation expectations. This mean can be decomposed into a sum of within-group mean inflation expectations weighted by group sizes:

$$\bar{\pi}^e_t = \sum_{j=1}^{J} \omega_j \times \bar{\pi}^e_{t,j},$$

where ω_j is the representative share of respondents in group j, such that $\sum_{j=1}^{J} \omega_j = 1$, and $\bar{\pi}^e_{t,j}$ is the mean inflation expectation of group j for a total of J groups. We consider $J = 5$ groups, corresponding to the five possible responses to the qualitative question on inflation expectations: "increase more rapidly," "increase at the same rate," "increase at a slower rate," "stay about the same," and "fall." [1] A change in average expected inflation can be decomposed into changes along the intensive and extensive margins as follows:

$$\underbrace{\Delta\bar{\pi}^e_t}_{\text{total change}} = \underbrace{\sum_{j=1}^{J} \Delta\omega_j \times \bar{\pi}^e_{t,j}}_{\text{extensive margin}} + \underbrace{\sum_{j=1}^{J} \omega_j \times \Delta\bar{\pi}^e_{t,j}}_{\text{intensive margin}} + \underbrace{\sum_{j=1}^{J} \Delta\omega_j \times \Delta\bar{\pi}^e_{t,j}}_{\text{interaction term}} \tag{B.1}$$

where $\Delta\bar{\pi}^e_{t,j}$ is the change in the mean inflation expectation of group j, and $\Delta\omega_j$ is the change in the share of respondents in group j in response to a threshold event. The first term on the right-hand side of equation (B.1) captures changes in inflation along the extensive margin, the second term captures the intensive margin, and the third term is the interaction term.

While we can accurately estimate how an inflation threshold event changes the share of households that belong to certain inflation expectations groups, $\Delta\omega_j$, we can only provide an imprecise estimate of how the within-group average inflation expectation responds to an inflation threshold event, $\Delta\bar{\pi}^e_{t,j}$. Our treatment, current inflation surpassing a round-number threshold, also affects individuals' group assignments. Ideally, we would like to observe respondents' qualitative inflation expectations in the period before the treatment, while keeping the assignment of respondents to groups constant at the time of the treatment. This pre-treatment assignment is impossible since the European Business and Consumer Survey is a repeated cross-section. Therefore, we estimate the total change in average inflation expectations, the contribution from the extensive margin, and we calculate the sum of the intensive margin and the interaction term residually from equation (B.1).

To calculate how the extensive margin affects average inflation expectations, we multiply the change in the share of respondents in each group, estimated in Table A.2, by the average within-group inflation expectations, assigning a zero expectation to the group expecting prices to stay about the same. The sum of these values yields the extensive margin defined in equation (B.1) and equals 39 basis points. With a total change in average expected inflation of 71 basis points (Table 1, Column (2)), the residual sum of the intensive margin

[1] We ignore the share of respondents who answered the qualitative question with "do not know" because they cannot be used to calculate the mean expectation. On average, across countries and months, 6 percent of respondents answered "do not know," with a standard deviation of 0.24.

and the interaction term equals 32 basis points.

C Survey experiment

C.1 Detailed survey instructions

This appendix section shows the wording of the survey translated from German.

Introduction

Welcome! This scientific survey examines the influence of information about the inflation rate on inflation expectations. It takes approximately 3 minutes to fill out. During the survey, you will receive data on consumer prices in Germany. On this basis, you will be asked to make forecasts on future price developments.

The study comprises three forecasting rounds. In each round, you will receive data on consumer prices in previous years. On this basis, we ask you to forecast the future development of consumer prices.

However, we would like to start by asking you about your education. Please select the option that most closely matches your highest level of education.

- Without a degree or still in training
- Main or secondary school diploma
- (Fach-)Abitur
- University degree (e.g. diploma, bachelor, master)
- Doctorate or Habilitation

Inflation perceptions

We would also like to ask you for an assessment of the development of current consumer prices in Germany. How do you think that consumer prices have developed over the last 12 months? They have

- risen a lot
- risen moderately
- risen slightly
- stayed about the same
- fallen

Start of Block: Initiation increase
By how many per cent do you think that consumer prices have gone up over the past 12 months? _._%

Start of Block: Initiation decrease
By how many per cent do you think that consumer prices have gone down over the past 12 months? _._%

Round 1

Thank you for your assessment of the current situation. We are now looking back on the years 2017 to 2020, where the percentage change in consumer prices in Germany—in September each year—was between -0.4 and 2.2%.
2017: 1.8%
2018: 2.2%
2019: 0.9%
2020: -0.4%
On the next page, you will be asked to provide a forecast for 2021 based on this information.

Assuming it is 2020, how do you think consumer prices will develop in 2021 compared to the previous year? They will...

- increase more rapidly
- increase at the same rate
- increase at a slower rate
- stay about the same
- fall

Start of Block: Round 1 increase
By how many per cent do you expect consumer prices to go up in 2021? _._%

Start of Block: Round 1 decrease
By how many per cent do you expect consumer prices to go down in 2021? _._%

The actual development shows a 4.1% increase in consumer prices in 2021. You forecasted an increase / decrease of _._%. On the next page, you will be asked to provide a forecast for 2022 based on the new information.

Round 2

Assuming it is 2021, how do you think consumer prices will develop in 2022 compared to the previous year? They will...

- increase more rapidly
- increase at the same rate
- increase at a slower rate
- stay about the same
- fall

Start of Block: Round 2 increase
By how many per cent do you expect consumer prices to go up in 2022? _._%

Start of Block: Round 2 decrease
By how many per cent do you expect consumer prices to go down in 2022? _._%

Control

The actual development shows a 9.9% increase in consumer prices in 2022. You forecasted an increase / decrease of _._%. On the next page, you will be asked to provide a forecast for 2023 based on the new information.

Treatment 1

The actual development shows a 10.1% increase in consumer prices in 2022. You forecasted an increase / decrease of _._%. On the next page, you will be asked to provide a forecast for 2023 based on the new information.

Treatment 2

The actual development shows a 10.1% increase in consumer prices in 2022—at that time the highest price increase in over 30 years! You forecasted an increase / decrease of _._%. On the next page, you will be asked to provide a forecast for 2023 based on the new information.

Assuming it is 2022, how do you think consumer prices will develop in 2023 compared to the previous year? They will...

- increase more rapidly
- increase at the same rate
- increase at a slower rate
- stay about the same
- fall

Start of Block: Round 3 increase
By how many per cent do you expect consumer prices to go up in 2023? _._%

Start of Block: Round 3 decrease
By how many per cent do you expect consumer prices to go down in 2023? _._%

End

The actual development shows a 4.3% increase in consumer prices in 2023. You forecasted an increase / decrease of _._%.

The study is finished. Thank you very much! The current inflation rate is 2.0% (July 2025). Further information is available on the website of the Federal Statistical Office. Unlike in this survey, it can be helpful to use other information besides the current inflation rate to predict the future inflation rate. Forecasts of the inflation rate are also always subject to uncertainty.

C.2 Additional tables

	Control	Treatment	p-value
Male (yes/no)	0.54	0.54	0.949
Age (years)	30.96	31.27	0.599
Lower secondary education or less (yes/no)	0.12	0.07	0.014
Upper secondary education (yes/no)	0.32	0.31	0.757
University degree or higher (yes/no)	0.57	0.62	0.082
German nationality (yes/no)	0.80	0.82	0.409
Inflation perception gap (percentage points)	-7.76	-8.53	0.382
Round-2 forecast error (percentage points)	5.51	5.52	0.965
Survey completion time (seconds)	148.97	142.05	0.100
N	480	484	

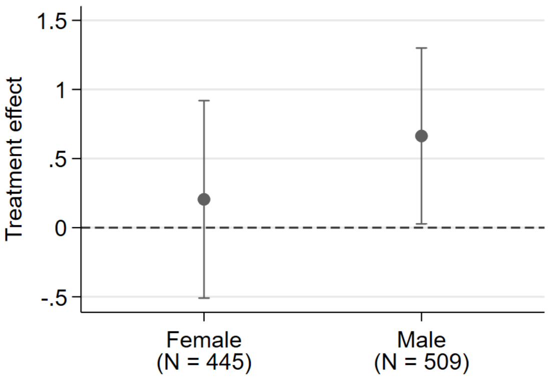
Notes: The p-values refer to t-tests on mean differences between groups.
** p<0.10, ** p<0.05, *** p<0.01*

Table C.1: Randomization balance

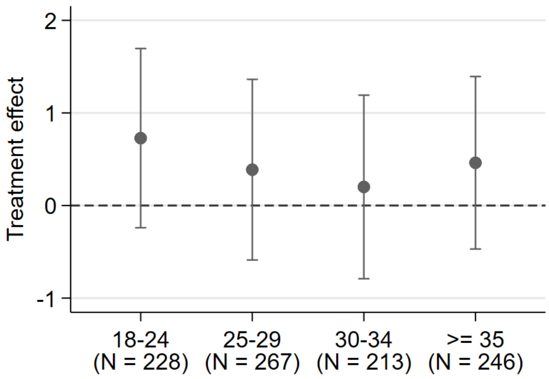
	(1) With second treatment arm	(2) Non-truncated forecast	(3) Qualitative expectations
Treatment 1: increasing-infl. threshold	0.394	0.366	-0.068
	(0.289)	(0.318)	(0.068)
Treatment 2: increasing-infl. threshold + historical record	-0.553**		
	(0.281)		
Hour and date fixed effects	Yes	Yes	Yes
Demographic controls	Yes	Yes	Yes
Mean of dependent variable	7.209	7.452	3.887
SD of dependent variable	4.673	5.100	1.065
Observations	1426	965	965

Notes: OLS estimates. All models control for the inflation forecast in the second round. In second treatment arm, participants saw an inflation rate of 10.1 percent and were additionally told that this was the highest value in 30 years. The demographic controls are legal sex, age, education, and German nationality. Heteroskedasticity-robust standard errors are in parentheses.
** p<0.10, ** p<0.05, *** p<0.01*

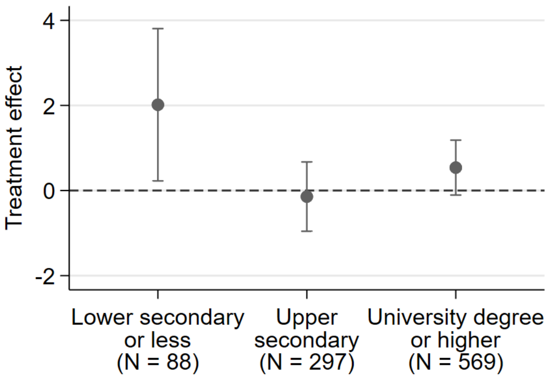
Table C.2: Results from the survey experiment (robustness)



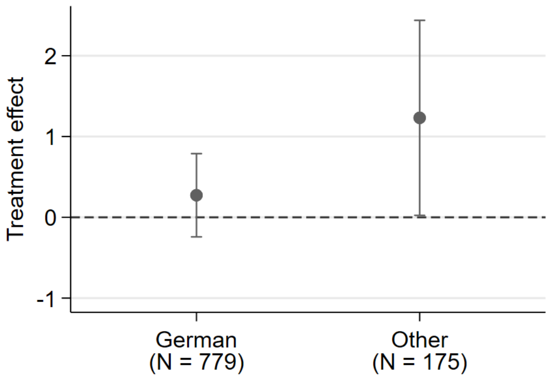
(a) Sex



(b) Age



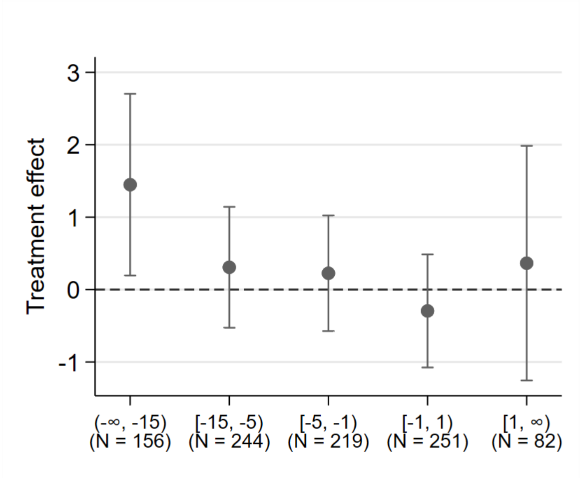
(c) Education



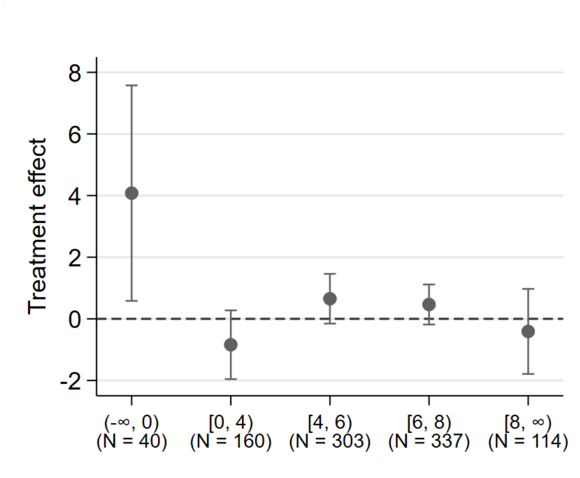
(d) Nationality

Notes: The figure reports estimated treatment effects by subgroups. Estimates are based on the specification reported in Column (3) of Table 3, with the treatment indicator interacted with the category indicators for the respective moderator. The capped vertical lines indicate 90-percent confidence intervals based on heteroskedasticity-robust standard errors.

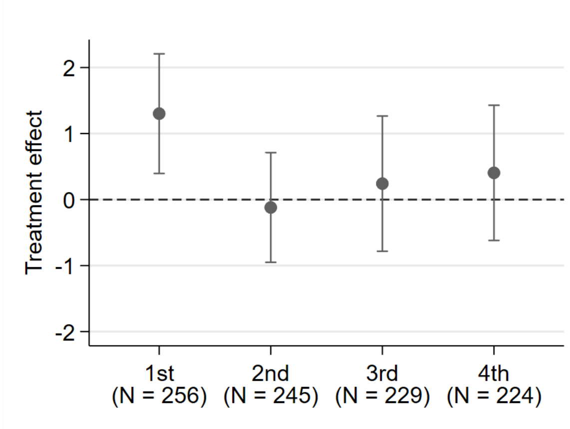
Figure C.1: Treatment effects by demographic characteristics



(a) Perception gap (pp.)



(b) Forecast error (pp.)



(c) Survey completion time (quartiles)

Notes: The figure reports estimated treatment effects by subgroups. Estimates are based on the specification reported in Column (3) of Table 3, with the treatment indicator interacted with the category indicators for the respective moderator. The capped vertical lines indicate 90-percent confidence intervals based on heteroskedasticity-robust standard errors. Categories were constructed to balance group sizes while preserving theoretically meaningful boundaries. The perception gap is defined as the inflation rate at the time of the survey, 2.1 percent, minus the participant's pre-treatment quantitative assessment of current inflation; positive values therefore indicate underestimation and negative values overestimation. Its categories are approximately equal in size but include a separate group for participants whose perceptions were approximately accurate, defined by a gap between -1 and 1 percentage points. The round-2 forecast error is defined as 9.9 percent, the value displayed to the control group, minus the participant's forecast for September 2022; positive values indicate underestimation and negative values overestimation. The categories preserve the theoretically meaningful distinction between overestimation and underestimation and use narrower intervals where observations are concentrated.

Figure C.2: Treatment effects by survey-response characteristics

D Model derivation

D.1 Aggregation of left-digit-biased beliefs across households

The perception and expectation block of section 4 is written for a representative household. Our empirical decomposition points instead to two groups, one attentive at all times and one attentive only around thresholds. The two descriptions coincide at the aggregate level, exactly rather than to first order.

Let household i perceive inflation according to equation (2), with an individual bias parameter $\theta_i \in [0,1]$ and common (λ, χ):

$$\pi^p_{i,t} = \pi^p_{i,t-1} + d_t + (1-\theta_i)[\Delta\pi_t - d_t] + (1-\lambda)\left[\pi_{t-1} - \pi^p_{i,t-1}\right],$$

where $d_t \equiv d(\pi_t, \pi_{t-1})$ is defined in equation (3). Collecting terms gives

$$\pi^p_{i,t} = \lambda\pi^p_{i,t-1} + \theta_i(d_t - \Delta\pi_t) + \Delta\pi_t + (1-\lambda)\pi_{t-1}. \tag{D.1}$$

The lagged perception carries the common coefficient λ, and θ_i multiplies $d_t - \Delta\pi_t$, an aggregate object, since the discontinuous-update term depends only on current and lagged inflation and never on an individual state. Households differ in how strongly they load on a common nonlinearity, not in the nonlinearity they face.

Lemma D.1 (Exact aggregation of perceptions and expectations). *Let $\bar{\pi}^p_t \equiv \mathbb{E}_i\left(\pi^p_{i,t}\right)$ and $\bar{\theta} \equiv \mathbb{E}_i(\theta_i)$, where $\mathbb{E}_i$ averages over a population with finite first moments. If $(\lambda, \chi, \rho, \pi^*)$ are common across households, then*

$$\bar{\pi}^p_t = \lambda\bar{\pi}^p_{t-1} + \bar{\theta}\, d_t + (1-\bar{\theta})\Delta\pi_t + (1-\lambda)\pi_{t-1},$$

and mean inflation expectations satisfy

$$\mathbb{E}_i\left[\mathbb{E}^b_{i,t}(\pi_{t+1})\right] = \rho^2\bar{\pi}^p_{t-1} + (1-\rho^2)\pi^*. \tag{D.2}$$

The mean perception thus obeys equation (2) evaluated at $\theta = \bar{\theta}$, and mean expectations obey *equation* (6)*, for any joint distribution of* $(\theta_i, \pi^p_{i,0})$.

Proof. Apply $\mathbb{E}_i$ to equation (D.1). The terms $\Delta\pi_t$, d_t, and π_{t-1} are common and pass through unchanged, and linearity gives $\mathbb{E}_i(\lambda\pi^p_{i,t-1}) = \lambda\bar{\pi}^p_{t-1}$ and $\mathbb{E}_i[\theta_i(d_t - \Delta\pi_t)] = \bar{\theta}(d_t - \Delta\pi_t)$. No covariance term survives, because θ_i never multiplies an individual state and $\pi^p_{i,t-1}$ enters with a coefficient common across households. Equation (D.2) follows because equation (6) is linear in $\pi^p_{i,t-1}$ with common (ρ, π^*). □

With two types, $\theta_i \in \{0, 1\}$, each household is either fully attentive ($\theta_i = 0$) or attends only to the leading digit ($\theta_i = 1$), and $\bar{\theta} = \Pr(\theta_i = 1)$ is the population share of households that attend only to the leading digit. The parameter θ in section 4 therefore admits two readings, individual inattention or the share of inattentive households, and the aggregate dynamics cannot distinguish them. Studying mean expectations requires nothing about the distribution of attention beyond its mean. This is the sense in which the household is representative: not that all households are alike, but that aggregate dynamics can be studied without tracking who is attentive. Lemma D.1 covers the mean, and nonlinear functionals of the cross-section such as the median do not aggregate in this way. Branch and McGough (2009) treat aggregation of heterogeneous expectations in New Keynesian models more generally.

D.2 New Keynesian model with left-digit-biased inflation expectations

We use a standard New Keynesian model (see, e.g., Galí, 2015). Instead of assuming full rational expectations, we assume households have left-digit-biased inflation expectations to align with our results. We further abstract from long-run growth and consider only one exogenous shock, a cost-push shock, to illustrate the implications of left-digit-biased inflation expectations. The model environment is described next, with derivations identical to those in Galí (2015, ch. 3) omitted for brevity.

D.2.1 Households

A representative infinitely-lived household seeks to maximize intertemporal utility

$$\mathbb{E}_t^b \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\varphi}}{1+\varphi} \right), \tag{D.3}$$

where C is a consumption index, N denotes hours worked, $\beta \in (0,1)$ is the discount factor, and $\sigma \geq 0$ and $\varphi \geq 0$ determine the intertemporal elasticity of substitution and the Frisch elasticity of labor supply, respectively. The expectation operator $\mathbb{E}_t^b$ denotes *behavioral* expectations, which do not need to coincide with rational expectations. The consumption index is given by

$$C_t = \left(\int_0^1 C_t(i)^{1-\frac{1}{\epsilon_t}} di \right)^{\frac{\epsilon_t}{\epsilon_t - 1}},$$

where $\epsilon_t > 1$ is the elasticity of substitution between goods and $C_t(i)$ denotes the consumption of variety i. The elasticity of substitution can exogenously vary over time to generate fluctuations in mark-ups and hence cost-push shocks. The period budget constraint reads

$$\int_0^1 P_t(i) C_t(i) di + Q_t B_t \leq W_t N_t + B_{t-1} + D_t, \tag{D.4}$$

where $P_t(i)$ is the price of good i, Q_t is the nominal price of a risk-free bond, B_t is the stock of nominal bonds, W_t is the nominal wage, and D_t is dividends.

Household inflation expectations are explained in detail in section 4: A household perceives inflation, π_t^p, with a left-digit bias as specified in equations (2) and (3), believes that inflation follows an AR(1) process, equation (5), with steady-state inflation $\pi^* = 0$ and hence forms inflation expectations based on past-periods perceived inflation, equation (6).

The household chooses consumption/savings and labor supply to maximize intertemporal utility (D.3) subject to the budget constraint (D.4) and an optimal allocation of consumption expenditures among different goods. The resulting first-order conditions are

$$C_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\epsilon_t} C_t$$

$$
\begin{aligned}
P_t &\equiv \left(\int_0^1 P_t(i)^{1-\epsilon_t} di \right)^{\frac{1}{1-\epsilon_t}} \\
P_t C_t + Q_t B_t &\leq W_t N_t + B_{t-1} + D_t \\
C_t^{\sigma} N_t^{\varphi} &= \frac{W_t}{P_t} \\
Q_t &= \beta \mathbb{E}_t^b \left(\frac{C_t^{\sigma}}{C_{t+1}^{\sigma}} \frac{P_t}{P_{t+1}} \right) \qquad \text{(D.5)}
\end{aligned}
$$

The first equation is the demand for good i, the second defines the ideal price index, the third is the re-written budget constraint, the fourth is the labor supply equation, and the last is the Euler equation.

D.2.2 Firms

Risk-neutral firms indexed by $i \in [0,1]$ produce a differentiated good $Y_t(i)$ according to

$$
Y_t(i) = N_t(i),
$$

where $N_t(i)$ is labor demand. Marginal costs are then equal to the real wage $mc_t = W_t/P_t$. Each firm has two managers, one setting prices and one making forecasts (see, e.g., Pfäuti, 2026). We assume that the forecasters form expectations as households do. When setting prices, firms face quadratic price-adjustment cost (Rotemberg, 1982) such that per-period real profits are given by

$$
\frac{P_t(i)}{P_t} Y_t(i) - mc_t N_t(i) - \frac{\delta}{2} \left(\frac{P_t(i)}{P_{t-1}(i)} - 1 \right)^2 C_t - T_t,
$$

where $\delta > 0$ and T_t is a lump-sum tax. Using the production function and the demand for good i with $Y_t(i) = C_t(i)$ in equilibrium, the price-setter chooses the price $P_t(i)$ to maximize

$$
\begin{aligned}
\Pi_t(i) = \mathbb{E}_t^b \sum_{j=0}^{\infty} \beta^j \Bigg[& \frac{P_{t+j}(i)}{P_{t+j}} \left(\frac{P_{t+j}(i)}{P_{t+j}} \right)^{-\epsilon_{t+j}} C_{t+j} - mc_{t+j} \left(\frac{P_{t+j}(i)}{P_{t+j}} \right)^{-\epsilon_{t+j}} C_{t+j} \\
& - \frac{\delta}{2} \left(\frac{P_{t+j}(i)}{P_{t+j-1}(i)} - 1 \right)^2 C_{t+j} - T_{t+j} \Bigg].
\end{aligned}
$$

The FOC reads

$$
\begin{aligned}
(\epsilon_t-1)\left(\frac{P_t(i)}{P_t}\right)^{-\epsilon_t}\frac{C_t}{P_t} =& \epsilon_t mc_t\left(\frac{P_t(i)}{P_t}\right)^{-\epsilon_t-1}\frac{C_t}{P_t}-\delta\left(\frac{P_t(i)}{P_{t-1}(i)}-1\right)\frac{C_t}{P_{t-1}(i)} \\
&+\beta\delta\mathbb{E}_t^b\left[\left(\frac{P_{t+1}(i)}{P_t(i)}-1\right)\frac{P_{t+1}(i)}{P_t(i)}\frac{C_{t+1}}{P_t(i)}\right].
\end{aligned}
$$

Since all firms face the same profit-maximization problem, a symmetric equilibrium exists, implying $Y_t(i)=C_t(i)=C_t=Y_t$ and $P_t(i)=P_t$. The FOC then simplifies to

$$
\frac{1}{\mathscr{M}_t-1}Y_t = \frac{\mathscr{M}_t}{\mathscr{M}_t-1}mc_tY_t-\delta\pi_t(1+\pi_t)Y_t+\beta\delta\mathbb{E}_t^b[\pi_{t+1}(1+\pi_{t+1})Y_{t+1}] \tag{D.6}
$$

where $\pi_t\equiv\frac{P_t}{P_{t-1}}-1$ is the inflation rate and $\mathscr{M}_t\equiv\frac{\epsilon_t}{\epsilon_t-1}$ the desired mark-up.

D.2.3 Government and monetary policy

The government follows a balanced budget rule such that

$$
T_t=\frac{D_t}{P_t}=\left[\frac{P_t(i)^*}{P_t}-mc_t\right]Y_t(i)^*-\frac{\delta}{2}\left(\frac{P_t(i)^*}{P_{t-1}(i)^*}-1\right)^2C_t,
$$

where a star denotes the optimal price and quantity. Under the balanced budget rule, the government sets taxes (T_t) so that after-tax firm profits are zero, meaning that the government redistributes all profits to households. In equilibrium, bonds are in zero supply, $B_t=0$, and hence do not appear in the government budget.

Monetary policy is conducted by a central bank that sets the nominal interest rate according to a Taylor rule

$$
i_t=\rho+\phi_\pi\pi_t+\phi_y\hat{y}_t, \tag{D.7}
$$

where $\hat{y}_t\equiv y_t-y$ is the deviation of log-output from its steady state.

D.2.4 Three-equation New Keynesian model

A log-linear approximation of the Euler equation D.5 around the zero-inflation, zero-growth steady state yields

$$c_t = \mathbb{E}_t^b c_{t+1} - \frac{1}{\sigma}\left[i_t - \mathbb{E}_t^b \pi_{t+1} - \rho\right] \tag{D.8}$$

where lower-case variables are the logarithm of the uppercase variables and $i_t \equiv -\log Q_t$ and $\rho \equiv -\log \beta$ denote the nominal interest and discount rate, respectively.

Log-linearizing the firm's FOC (D.6) around the steady state yields

$$\pi_t = \beta \mathbb{E}_t^b \pi_{t+1} + \frac{\sigma + \varphi}{\delta(\mathcal{M} - 1)} \hat{y}_t + \frac{1}{\delta(\mathcal{M} - 1)} \hat{\mathcal{M}}_t, \tag{D.9}$$

where a hatted variable denotes the log deviation of the respective variable from its steady state value.

Next, we express the NKPC in terms of the output gap $\tilde{y}_t \equiv y_t - y^n$, where y^n is the natural output level in steady state. We calculate output under flexible prices with $\delta = 0$ to obtain it. The optimal price is then a mark-up over marginal cost, $\frac{P_t(i)}{P_t} = \mathcal{M}_t mc_t$, and natural output in logs is given by $y_t^n = \frac{1}{\sigma+\varphi} \log\left(\frac{1}{\mathcal{M}_t}\right)$. Since we define the output gap relative to natural output in steady state, we can replace $\hat{y}_t = \tilde{y}_t$ in equation (D.9), resulting in the NKPC, equation (7) in the main text:

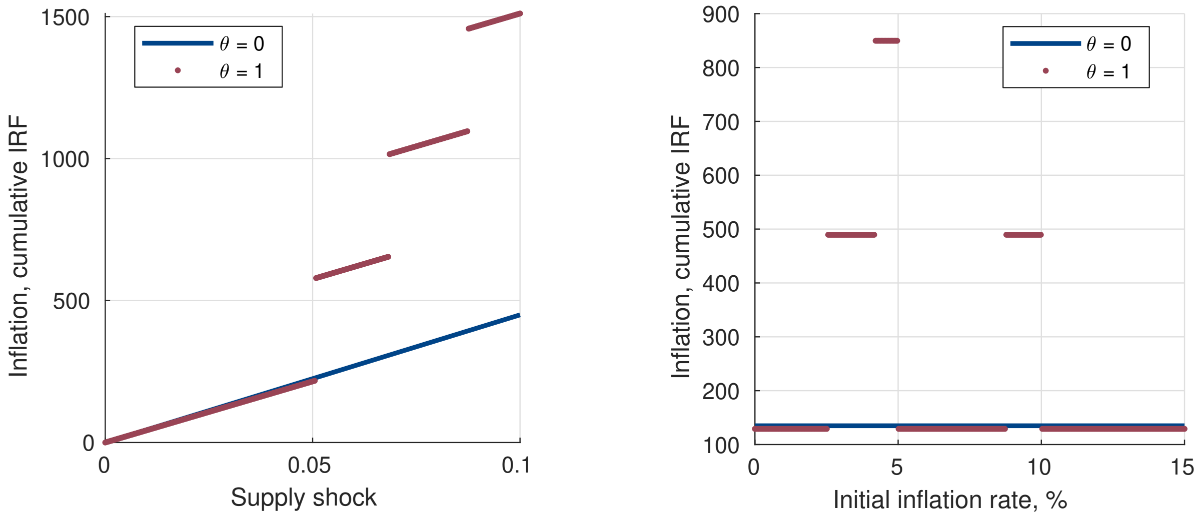
$$\pi_t = \beta \mathbb{E}_t^b \pi_{t+1} + \kappa \tilde{y}_t + z_t,$$

where $\kappa \equiv \frac{\sigma+\varphi}{\delta(\mathcal{M}-1)}$ and the cost-push shock is defined as $z_t \equiv \frac{1}{\delta(\mathcal{M}-1)} \hat{\mathcal{M}}_t$.

Given $\hat{y}_t = \tilde{y}_t$ and defining $\hat{i}_t = i_t - \rho$, the Euler equation (D.8) and the Taylor rule (D.7) can be rewritten as

$$\tilde{y}_t = \mathbb{E}_t^b \tilde{y}_{t+1} - \frac{1}{\sigma}\left[\hat{i}_t - \mathbb{E}_t^b \pi_{t+1}\right]$$
$$\hat{i}_t = \phi_\pi \pi_t + \phi_y \tilde{y}_t,$$

which are equations (8) and (9) in the main text.



(a) Shock-size dependence

(b) State-dependence

Notes: Both panels show results based on 300 simulations of 300-period impulse responses using the baseline parameterization. Both panels compare economies without left-digit bias ($\theta = 0$) and with full left-digit bias ($\theta = 1$). In the left panel, the horizontal axis shows the size of the supply shock, which is varied across the 300 simulations. For each simulation, we compute the cumulative inflation response of the inflation rate as the sum of deviations from the steady state over the entire transition. The right panel repeats this procedure for a fixed shock size ($z = 0.03$) but varies the initial inflation level. Specifically, inflation in the two pre-shock periods and perceived inflation are set to this initial level. The cumulative IRF then measures the total effect of the shock, computed as the difference between the transition with and without the shock, conditional on the same initial state away from steady state.

Figure D.1: Nonlinearities in the New-Keynesian model with left-digit-biased inflation expectations

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