SFB/Transregio 266
ACCOUNTING FOR TRANSPARENCY

WORKING PAPER SERIES

No. 125 | July 2023

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TRR 266 Accounting for Transparency

Funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation): Collaborative Research Center (SFB/TRR) – Project-ID 403041268 – TRR 266 Accounting for Transparency

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Followers or Ignorants?

Inflation Expectations and Price Setting Behavior of Firms*

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July 24, 2023

Abstract

Using a randomized survey experiment, we investigate how firms' inflation expectations shape their price setting. We establish that firms fully pass through inflation expectations to prices in times of high inflation, consistent with Calvo pricing. When informed about central bank inflation forecasts, firms indicate significantly lower planned price increases than their untreated peers. Additionally, treated firms pass through less of their pre-treatment inflation expectations than control-group firms, even more so when additionally receiving central bank forecasts on energy and labor cost developments. Hence, communication of inflation forecasts can shift expectations and prices, and therefore serve as an effective policy tool.

Keywords: Price Setting, Firms, Inflation Expectations, Firm Survey
JEL classification: E31, E58

*We thank Julia Baarck, Sebastian Link, Michael Weber, Iván Werning and participants at seminars at Freie Universität Berlin, RWI Essen, the ifo conference on Macroeconomics and Survey Data, the Workshop on Empirical Macroeconomics in Ghent, the Behavioral Macroeconomics Workshop in Bamberg, the Advances with Field Experiments conference in Chicago, and the Next Generation Economics Workshop in Hohenheim for valuable comments. The study was pre-registered in the AEA RCT registry (RCT ID: AEARCTR-0009793). This experiment was reviewed by the Ethics Committee of the University of Mannheim (EC-53/2022). We declare that we have no interests, financial or otherwise, that relate to the research described in this paper. We are grateful to the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) for financial support through CRC *TRR 266 Accounting for Transparency* (Project-ID 403041268). Contact: †**doerrenberg@uni-mannheim.de** (University of Mannheim, CESifo, IZA, ZEW), ‡**fabian.eble@uni-mannheim.de** (University of Mannheim), ◇**christopher.karlsson@uni-mannheim.de** (University of Mannheim), ♯**rostam-afschar@uni-mannheim.de** (University of Mannheim, IZA, GLO), ∓**benjamin.toedtmann@uni-mannheim.de** (University of Mannheim), °**voget@uni-mannheim.de** (University of Mannheim, ZEW)

After all, it is the everyday economic decisions of people and companies that we seek to influence with our policy and communication.

(Lagarde, 2020)

1 Introduction

Firms' expectations of future inflation are believed to be a key determinant of actual inflation (Coibion et al., 2018, 2020b; Weber et al., 2022). If that is the case, it may pay off for central banks to keep close track of inflation expectations and to shape these expectations through improved communication. The follow-up question arising from that is whether information policy, e.g. communicating current and forecast inflation, can indeed affect firms' price-setting behavior.

Theoretical models like Werning (2022) show that firms' passthrough of inflation expectations to prices has wide-ranging implications for the persistence of inflation and the dynamics of key economic variables. However, empirical evidence on the causal effect of expectations on firms' price-setting is scarce due to challenges in obtaining exogenous variation in inflation expectations.

We aim to address this scarcity in the literature by providing causal evidence on how firms' inflation expectations shape their pricing plans in a high-inflation environment. To this end, we conduct a survey with 2,000 firms in Germany including an information provision experiment. We elicit firms' inflation expectations for different time horizons and their planned price changes. Firms in a treatment group are exposed to information about the central bank's inflation forecast after we elicit their inflation expectations and before they report planned price changes, while firms in a control group receive no such information.

There are two important findings besides the direct effect of the survey experiment itself. First, we observe a one-to-one relation between inflation expectations and prices. Therefore, in *high-inflation environments*, inflation expectations appear to be highly relevant for firms' planned price setting. Consistent with Calvo pricing (Calvo, 1983), this finding suggests that firms fully pass through expectations to prices. Thus, our results indicate that firms indeed *overshoot* their ideal price when expecting positive inflation. This *overshooting* mechanism lies at the heart of the transmission of inflation expectations to current inflation described theoretically by Werning (2022). Second, we find that passthrough differs depending on prior beliefs about the persistence of inflation. Firms which expect inflation to be transitory overshoot more compared to firms which expect inflation to be persistent. This finding lends support to the idea that firms which expect inflation to be transitory perceive limited opportunities for price increases in the future. Consequently, they increase prices more aggressively relative to their inflation expectations.

The randomized information treatments allow us to establish causal links beyond associations. First, providing information on the central bank's inflation forecasts for 2023—which are around 7 percentage points lower than average firm expectations—reduces planned prices of firms by 22%. Similarly, passthrough of pre-treatment expectations is reduced by 24%. Effects are stronger for firms with larger differences between their pre-treatment beliefs and the central bank forecasts. This indicates that the effects are due to firms updating their expectations in response to the information treatment. Hence, providing information on inflation dynamics can be an effective way for central banks to break the transmission from elevated prior inflation expectations to price setting and dampen upward inflation dynamics.

Second, based on two additional randomized groups, we further investigate if the extent and type of information matters for price-setting and passthrough of expectations. In additional treatments, firms receive information on single components of the central bank's inflation forecasts which are relevant to their perception of input cost developments. The first (second) randomly selected subset of firms is provided with detailed forecasts on energy prices (labor costs) in addition to the overall central bank's inflation forecasts. While the treatment effect of these additional treatments on planned price changes is similar to the simple information treatment with reductions of 19% (energy) and 22% (labor), respectively, the results on passthrough differ strongly. Passthrough of pre-treatment inflation expectations is reduced by 69% (energy) and 58% (labor) (compared to 24% in the simple information treatment). This suggests that the provision of incremental information on input cost developments is important to detach firms' pricing plans from their pre-treatment inflation expectations. Finally, we provide evidence for the observed pattern of reduced passthrough as a result of more information provision being robust to prior beliefs about the persistence of inflation, to the frequency of price adjustments, and to inattention with regard to inflation dynamics.

Our results speak to the literature on how inflation expectations of firms shape their economic decisions. Theory provides distinct predictions on how firms pass through their inflation expectations to the prices of their products. In the standard staggered price-setting model of Taylor (1980), firms set prices every fixed number of periods. In contrast, Calvo (1983) suggests a model with a constant probability of changing prices. Werning (2022) shows that—assuming reasonable parameters for the two models—the passthrough of future inflation expectations to current inflation in the Taylor model has an upper bound of 0.5 and is close to 1 in the Calvo model. To our knowledge, we are the first to explicitly test Werning's proposition empirically in a *high-inflation environment* and to find evidence supporting Calvo pricing in this setting. In contrast, prior studies that implicitly test Werning's proposition in low-inflation environments only document relatively small (Coibion et al., 2018, 2020b) or zero (Rosolia, 2021) passthrough. This difference in findings stresses the significance of the inflation environment firms find themselves in.

In low-inflation environments, the benefits of price changes due to rather small revisions in expected inflation might not outweigh price adjustment costs, which may explain the findings of a small or zero passthrough (Rosolia, 2021). In contrast, in our high-inflation setting, in which information about price dynamics is highly relevant, the revision of expectations translates into price changes because the benefits of price changes outweigh the price adjustment costs.

We further contribute to existing work along several dimensions. First, we contribute to literature assessing the role of expectation management as a suitable policy tool for central banks striving for price stability. The importance of communication strategies to dampen overall uncertainty with regard to economic and monetary policy has risen since the 1990s (Blinder et al., 2008). Nevertheless, empirical evidence on the success of communication strategies which affect firm decisions by shaping inflation expectations is still scarce (Coibion et al., 2020a). Testing this channel, we find that central bank communication can be a successful tool for dampening the transmission of high inflation expectations to higher prices. Thereby, central banks can control and curb inflation by breaking expectations-price spirals of price-setters. This is particularly relevant when traditional instruments such as interest rate changes are costly and take time to materialize in the economy.

Second, aside from information about past inflation, we provide firms with the most recent central bank forecasts and test if these forecasts are relevant for the planned price-setting decision of firms. Whereas previous firm surveys test the impact of central bank inflation targets or most recent annual realized inflation on inflation expectations (Coibion et al., 2018, 2020b, 2022a; Hunziker et al., 2022), we focus on inflation forecasts of the central bank which previous research has shown to be particularly useful in affecting household expectations (Coibion et al., 2022b). We test the relevance of central bank inflation forecasts for firms' price-setting in times of high uncertainty about future price developments, an environment in which inflation forecasts could become an even more important factor for firms' decision-making process.

Third, we add another layer of information to our experiment that features components of the overall central bank inflation forecasts which are relevant for firms' input cost developments. This allows us to make inferences about how information about input cost developments affects firms' planned price-setting and passthrough, thereby addressing a gap in the existing literature (Weber et al., 2022).

2 Data and Experimental Setup

Our analysis rests on survey data collected by the German Business Panel between July 26, 2022, and November 2, 2022. Bischof et al. (2022) provide a detailed description of the German Business Panel. Contact information of firms was obtained from the Bureau

van Dijk Orbis database and using web scraping techniques. The sample of firms that participated in our survey was drawn randomly from the overall address pool and invited to participate in our online survey via email. A total of 1,944 respondents completed our questionnaire. In the Online Appendix A and B, we offer comprehensive information on the variable definitions and survey questions, along with detailed summary statistics for both firm and manager characteristics of the participating firms. Our set of surveyed firms is largely representative of the underlying population of German firms in terms of industry sector and slightly larger with regard to the number of employees and revenues. Approximately 87% of survey respondents are the owner or CEO of the corresponding firm.

For the survey experiment, we assign respondents randomly to three treatment groups that receive information on the German central bank's inflation assessment and a control group which does not receive central bank information. The information underlying the three treatments was retrieved from the June 2022 report of the German central bank (Deutsche Bundesbank, 2022). The German central bank did not update these forecasts during our period of data collection.

Figure 1 presents an overview of the survey flow. At the start of the survey, all participants are asked to inform us about their inflation assessment for the year 2021 (realized at the time of the survey), and their inflation expectations for the years 2022 (current) and 2023 (future). This allows us to measure beliefs prior to providing participants with additional information. This practice is in line with suggestions on the design of information provision experiments by Haaland et al. (2023). Then we apply our information treatments.

[Figure 1 ABOUT HERE]

First, around one-quarter of survey participants receive our baseline **INFLATION treatment**. There, firms see their own inflation assessment from the previous question vis-à-vis the German central bank's inflation estimates for the three years (2021, 2022, 2023). The reported central bank estimates are 3.2% (2021), 7.1% (2022), and 4.5% (2023). Second, another quarter of participants receive the **ENERGY treatment**. Extending the information set provided in the INFLATION treatment, firms receive information on the central bank forecasts of energy prices for 2021 to 2023. These central bank estimates for energy price changes are 10.1% (2021), 27.2% (2022), and 8.5% (2023). A third group receives the **WAGE treatment**. This information treatment is very similar in structure to the previous ENERGY treatment. However, instead of energy prices, firms receive central bank estimates on the development of wages. These estimates are 3.5% (2021), 4.3% (2022), and 4.5% (2023). Finally, a **CONTROL group** is provided with an overview of their own inflation estimates originating from the first survey question.

Balancing tests (Online Appendix B) show that randomization worked well: Inflation expectations, firm and respondent characteristics are balanced across groups.

Our experimental design has several advantages. First, we avoid that CONTROL group firms reflect less on inflation than treatment firms by exposing firms in the CONTROL group to the same amount of survey steps covering the topic of inflation (rather than having CONTROL firms skip the treatment screen). Second, between subject designs like ours typically have no natural anchor and, therefore, results inherently have substantial noise. This is particularly the case with forecasts. We reduce this noise by asking for the 2021 inflation rate, which was realized at the time of the survey. This provides a natural anchor and allows within subject comparison of realized and expected inflation. Third, it would have been possible to measure updating directly using a design in which we elicit inflation expectations both before and after treatment exposure. However, this requires asking the same question twice and thus entails problems related to consistency bias, ordering, over-sensitivity to context, and experimenter demand (Haaland et al., 2023). The alternative of using a different question version to elicit post-treatment inflation expectations can lead to different answers solely due to the difference in question-wording.

Finally, our setup combines three levels of information additions. These are participants' own estimates (CONTROL), plus inflation forecasts (INFLATION) plus forecast components (ENERGY, WAGE). We expect that firms revise their expectations and plans to a stronger degree when receiving more information. A second dimension is the kind of information. ENERGY and WAGE treatments have distinctly different properties. Energy prices are highly volatile key drivers of the current inflation rates and expectations (Wehrhöfer, 2023). They may decrease in the future as quickly as they have increased before, which is why they rather affect firms' short-term planning. Labor costs are predicted to be increasing at a much lower rate, but are rather stable and relevant for firms' long-term decisions.

3 Pre-treatment Beliefs on Inflation Expectations

As a first step, we study how well-informed firms are about realized inflation in 2021. We find that they are surprisingly well-informed. Figure 2a shows that 75% of respondents indicate inflation rates (measured before treatment) for 2021 that are within a 2-percentage-point range of the central bank's reported 3.2%. Firms in our high-inflation environment seem to be better informed about inflation dynamics compared to previous findings in low-inflation environments, presumably because higher inflation makes the topic more salient and increases the benefit of being informed.[1] Still, on average, firms

[1] Coibion et al. (2018) report a share of only 49% when inflation rates were relatively low. For Germany, Link et al. (2023) find that firms are better informed about macroeconomic indicators (e.g. inflation)

slightly overestimate inflation by around 1.5 percentage points (Mean: 4.7%), in line with previous results finding that firms overestimate inflation (Weber et al., 2022).

When assessing the current (2022) and future (2023) inflation rates, the distribution becomes wider and deviates more from the German central bank's forecasts. For 2022, firms are around 3 percentage points above the central bank's forecast of 7.1% (mean: 10.5%) with only 50% of firms indicating a value within the 2-percentage-point distance (see Figure 2b). Moreover, 81% of the firms in our sample have higher inflation expectations for 2022 than the central bank. For 2023, Figure 2c reveals that only 23% of respondents are somewhat close to the central bank's forecast of 4.5%. The mean firm expects inflation to be almost 7 percentage points higher (mean: 11.3%). Overall, 94% of our participants indicate inflation expectations, which are higher than the central bank's forecast. Thus, our results indicate that firms' inflation expectations appear to be de-anchored from the central bank's inflation target of 2% in our high-inflation environment. This is in line with results for households and firms in Germany (Coleman and Nautz, 2023; Wehrhöfer, 2023).

Finally, Figure 2d shows the distribution for planned price changes for firms in the CONTROL group, as they are not influenced by our treatments. On average, these firms plan to increase prices by 15.4% in the next 12 months. Approximately 90% of firms plan to increase prices and less than one percent plan price reductions.

[Figure 2 ABOUT HERE]

4 Results

4.1 Treatment Effects on Planned Price Changes

Next, we investigate how the information treatments affect firms' price-setting plans. The scope for change in beliefs is large, as the majority of firms (94%) have higher inflation forecasts for 2023 compared to the central bank's prediction. We hypothesize that in response to the information provision, firms will adjust their inflation expectations and therefore their pricing plans downward. To test this hypothesis, we estimate the following regression model:

$$\Delta Price_{i+12m} = \alpha + \beta_1 \times INFLATION_i + \beta_2 \times ENERGY_i + \beta_3 \times WAGE_i + X_i'\gamma + \varepsilon_i. \quad (1)$$

The dependent variable $\Delta Price_{i+12m}$ represents the planned change of firm i's main product's or service's price in the next 12 months. The binary variables $INFLATION_i$,

than households. Cavallo et al. (2017) show that the environment matters, as households in high-inflation environments (e.g., Argentina) are better informed about inflation than households in low-inflation environments (e.g., U.S.).

$ENERGY_i$ and $WAGE_i$ take the value of one, if firm i was allocated to the INFLATION, ENERGY or WAGE treatment, respectively, and zero otherwise. α represents the expected price change in the CONTROL group. β_1, β_2 and β_3 measure the incremental effect of the INFLATION, ENERGY and WAGE treatments, respectively, relative to the CONTROL group.

X_i is a vector of control variables which we include to enhance precision. It includes manager controls, firm controls, and time controls. Manager controls are the respondent's gender, education (no training, apprenticeship & other, master (crafts, technicians), University Degree or PhD), and the respondent's position in the company (owner/CEO, department head, other). Firm controls include the size group of the firm (micro-enterprise, small company, medium-sized company, large company)[2], the legal form of the firm (sole proprietor, private company, corporation, other), and the industry (NACE Revision 2 industry sections). As the survey is conducted on an ongoing basis, we also include the survey week into the vector of control variables. Descriptive statistics for the control variables can be found in Online Appendix B. The regression analysis employs ordinary least squares (OLS), and standard errors are clustered at the industry and survey-week level.

[Table 1 ABOUT HERE]

Results are summarized in Table 1. Column (1) presents the baseline experimental effects without conditioning on any control variable. Firms in the CONTROL group plan to increase prices of their main product or service by 15.4% in the 12 months ahead. Compared to the CONTROL group, firms that receive central bank forecasts in the INFLATION treatment plan to increase prices by 3.4 percentage points less, leading to a price increase of just 12%. This difference of 22% implies a strong economic effect of our treatment. Furthermore, we find reduced price changes of similar magnitude when providing firms additionally with energy price and labor cost developments as predicted by the central bank. Firms receiving the ENERGY (WAGE) treatment plan to increase prices by 19% (21%) less compared to the CONTROL group. All results are robust to including control variables, as shown in column (2).

We further investigate differences in treatment intensity conditional on the divergence between firms' pre-treatment expectations and the inflation forecast of the central bank for 2023 (4.5%). Following Coibion et al. (2018), we define firms to be close to the central bank's forecast if they deviate at most 2 percentage points upwards (low prior, n=447). Otherwise, firms are categorized as having a high prior (n=1,192). We estimate equation (1) separately for both groups. Results are displayed in columns (3) through (6) of Table

[2]Classification is in line with the European Commission's definition for small and medium-sized enterprises (SMEs).

1. We find that firms with a high prior show a larger reaction to the treatments compared to firms with a low prior (which exhibit no significant treatment effect).

Overall, three main insights emerge. First, inflation expectations matter for firms' price-setting plans. Providing firms with the inflation assessment of the central bank reduces planned prices of firms in a statistically and economically meaningful way. Second, firms update their price-setting plans towards the inflation forecasts of the central bank, and a larger divergence from this forecast results in stronger adjustment. This suggests that firms are responsive to the information provided. Thus, adequate communication policies towards firms can be an effective additional instrument for monetary policymakers to better control firms' inflation expectations, their price setting, and thereby inflation in the economy as a whole. Third, providing firms with additional information on energy price and wage developments does not lead to substantial differences in planned price-setting behavior as compared to providing information on inflation alone. One could argue that firms realize that energy price and wage developments are already reflected in the inflation forecasts of the central bank. However, results in Section 4.3 below imply that the three treatments have different effects on how firms pass through pre-treatment inflation expectations to their planned prices.

4.2 Inflation Expectations and Price Setting

How do expectations on future inflation affect current inflation? The rate at which firms pass through their inflation expectations to current inflation via their price setting is referred to as *passthrough*. Werning (2022) derives theoretical predictions for this passthrough, considering (among others) two canonical firm-pricing models by Taylor (1980) and Calvo (1983). Taylor assumes that firms adjust prices at a fixed frequency, while Calvo assumes that there is a constant probability of firms changing prices. Assuming reasonable parameters for both models, Werning concludes that in a Taylor world, passthrough will take at most a value of 0.5, while in a Calvo world, passthrough is likely around 1. The rationale for this conclusion lies in a mechanism called *price overshooting*. Price overshooting is higher in the Calvo model, as there is a right-hand tail risk to be stuck with the most recently set price for a prolonged period.

We empirically test, which of the two price-setting models can be observed in our setting. We estimate the relationship between future inflation and current inflation, as follows:

$$\Delta Price_{i+12m} = \alpha + \beta \times E_{2022} Inflation_{i2023} + X_i'\gamma + \varepsilon_i. \tag{2}$$

Again, $\Delta Price_{i+12m}$ indicates the planned change of firm i's main product's or service's price in the next 12 months. We interpret this variable to be the operationalization of

"current inflation", as firms' current price changes will mechanically and immediately affect current inflation rates. Further, $E_{2022}Inflation_{i2023}$ indicates firm i's expectation for the inflation rate for the year 2023. We interpret this variable to be the operationalization of "expectations on future inflation". We present results only for the CONTROL group. We do so, as the information treatments (potentially) update inflation expectations of firms. The vector X_i includes the same set of variables as described in Section 4.1. Standard errors are clustered at the industry and week level.

[Table 2 ABOUT HERE]

The results are reported in Table 2, columns (1) and (2). The coefficient estimates of β are very well-aligned with the Calvo prediction. Coefficients range between 1.00 (without controls) and 1.02 (with controls), implying that there is a one-to-one association between inflation expectations and today's prices. When testing whether the coefficient estimate is statistically significantly different from the values 0.5 (Taylor) and 1 (Calvo) in Table 2, we can reject Taylor's prediction (p-value: 0.041), while we cannot reject Calvo's (p-value: 0.994).[3] As a more general take-away, future inflation expectations appear to influence firms' price plans and thereby current inflation. This is not only in line with the quote at the start of our paper but also with the predictions by both Taylor (1980) and Calvo (1983).

Werning (2022) considers similar estimates by Coibion et al. (2020b) and Rosolia (2021) as potential empirical approaches for estimating passthrough. Both studies use planned and realized price changes from a dataset collected by the Italian central bank. Results by Coibion et al. (2020b) suggest a small passthrough rate ranging between 0.1 (for planned prices) and 0.2 (for realized prices). Rosolia (2021) does not observe a passthrough rate that significantly differs from zero. These findings may be due to the low-inflation environment in which their research was conducted.

4.3 Passthrough of Prices and Updating

Next, we test whether the passthrough of inflation expectations to current inflation via the price-setting behavior of firms is affected by our information treatments. The passthrough of expectations observed for the CONTROL group (Section 4.2) was one-to-one. As almost all firms in our sample have higher inflation forecasts for 2023 compared to the central bank prediction, we assume that firms will adjust their inflation expectations downward, leading to a reduced passthrough of the pre-treatment inflation expectations to planned prices (relative to CONTROL).[4] We estimate the following equation to measure updating in response to our treatments:

[3] We tend to observe larger passthrough in more energy-intensive sectors such as manufacturing (1.03), compared to less energy-intensive sectors like education (0.35).

[4] Henceforth, we will use the term "passthrough" to describe the relationship between price-setting and the pre-treatment inflation expectations.

$$\Delta Price_{i+12m} = \alpha + \beta \times E_{2022}Inflation_{i2023} + \sum_{k=1}^{3} \delta_k TREATMENT_{ik}$$
$$+ \sum_{k=1}^{3} \theta_k E_{2022}Inflation_{i2023} \times TREATMENT_{ik} + X_i'\gamma + \varepsilon_i. \quad (3)$$

This equation extends equation (2) by interacting the treatment-group variables with the inflation expectations. β estimates passthrough of the CONTROL group described in Section 4.2. The parameters θ_k capture if this passthrough is different among treated firms relative to the CONTROL group. We further define as φ the passthrough of pre-treatment inflation expectations to prices. For the CONTROL group, φ equals the point estimate of β, while φ equals the sum of β and θ_k for TREATMENT group k.

Table 2 presents the results. Columns (3) and (4) present the passthrough estimates of the INFLATION treatment. Comparing columns (1) and (3), we observe a reduction of the passthrough relationship of approximately 24% (relative to CONTROL passthrough). This magnitude is in line with the general updating of pricing plans in the INFLATION group observed in Table 1. Both results in conjunction suggest that firms in this group only update their inflation expectations, but not the magnitude with which they pass through inflation expectations to their pricing plans. The idea behind this interpretation is that equation (1) estimates only the mean updating of inflation expectations, while equation (3) estimates both the mean updating of expectations and the change in the passthrough of inflation expectations to pricing plans jointly.

Columns (5) to (8) in Table 2 present the passthrough coefficients for our extended information treatments ENERGY and WAGE. Compared to the CONTROL group and the INFLATION treatment, passthrough coefficients are lower. For the ENERGY treatment, we observe a reduction in passthrough of around 69%, comparing columns (5) and CONTROL column (1). Similarly, comparing column (7) with column (1), we find a difference of 58% for the WAGE treatment. In line with the interpretation in the previous paragraph and combined with the results of Table 1, these results indicate that firms in the WAGE and ENERGY group adjust both mean prior inflation expectations and the way they incorporate their expectations in their price setting. Hence, the extended information treatments appear to be more capable of breaking the relationship between pre-treatment expectations and price setting. We provide a more detailed discussion on whether passthrough is constant in Online Appendix D.

Our results can be viewed from the lens of the learning model proposed in Cavallo et al. (2017). The updating coefficient proposed by Cavallo et al. (2017) is calculated by dividing the coefficient $-\theta$ by β. In our case, β is approximately one, such that updating is $-\theta$, that is 24% (INFLATION), 58% (WAGE), and 69% (ENERGY). These effects are in the range of those reported by Cavallo et al. (2017) for the United States and Argentina.

In sum, our information treatments reduce the overall passthrough of pre-experimental inflation expectations to planned prices.[5] In addition, the provision of incremental information (ENERGY, WAGE) relevant for the input cost developments of firms can have an incremental effect on the extent to which firms pass through their pre-treatment inflation expectations to prices, relative to only providing central bank inflation forecasts.[6] That is, incremental information can help in detaching firms' pricing plans from their inflation expectations. A potential channel explaining this finding is that additional information increases the credibility of the central bank's forecasts and reduces the uncertainty with regard to the economic and monetary outlook.

4.4 Prior Beliefs on Persistence, Frequency of Price Changes, and Inattention

Prior Beliefs on Persistence. The notion of overshooting is rooted in firms' beliefs regarding sustained price increases. However, if firms anticipate that price increases are only temporary, the passthrough and the effects of our treatments may vary. To examine this, we categorize firms as *transitory* believers if they indicate a lower inflation rate for 2023 than for 2022. On the other hand, firms that project stable or higher inflation rates for 2023 compared to 2022 are labeled as *persistent* believers.[7]

We examine two aspects related to prior beliefs on persistence. First, do prior beliefs influence the magnitude of passthrough absent any information treatment? Transitory believers perceive high inflation as temporary, in contrast to their peers with persistent beliefs. Therefore, the former perceive the time window to justify price increases to be shorter than the latter and could therefore increase prices more, relative to their inflation expectations. Second, we investigate whether the treatments have differential effects on the two groups. Two hypotheses come to mind. First, transitory believers could be more willing to adjust their beliefs as they align better with the central bank forecasts. Conversely, transitory believers could react less to treatments as they hold, on average, lower inflation expectations ex-ante.

Building on equation (3), we estimate a triple interaction model of expectations, treatment indicators and a dummy indicating persistent beliefs, which will allow us to test both questions.[8] Results are reported in Table 3. First, we observe that passthrough in

[5]Our findings remain robust across alternative specifications, such as including firms' estimates for realized inflation (2021) as a control variable, limiting the sample to firms with non-negative inflation expectations, or excluding firms with exceptionally high inflation expectations (>80%).

[6]P-values of t-tests for differences in passthrough across the treatments INFLATION vs. ENERGY (vs. WAGE) are 0.093 (0.110).

[7]This classification is highly correlated with the survey's question "How satisfied are you with economic policy" on a scale from zero (dissatisfied) to ten (satisfied). Among the persistent (transitory) believers, the share indicating zero is 33% (17%).

[8]More detailed elaborations of our hypotheses, the estimation equation, and results can be found in Online Appendix C.1. There, we also demonstrate robustness of the results shown in Table 3 by

the CONTROL group is substantially higher for transitory believers than for persistent believers (2.602 vs. 0.929, p-value: 0.096). This indicates that transitory believers in the CONTROL group exhibit a stronger passthrough of their inflation expectations to planned prices than persistent believers. This observation aligns with the notion that transitory firms believe that the opportunity to increase prices may be limited in the future. Consequently, they overshoot inflation expectations more aggressively in order to account for rising costs.

Second, we observe that treatment effects are stronger for transitory believers than for persistent believers. For transitory believers in the INFLATION treatment, we observe a reduction of the passthrough relationship of approximately 1.661 (relative to transitory believers in CONTROL). In contrast, persistent believers receiving the INFLATION treatment do not revise their price plans significantly (relative to persistent believers in CONTROL). The difference in updating between persistent and transitory believers is significant (p-value: 0.066). Moreover, for either input cost component treatment (ENERGY, WAGE), updating is weaker for persistent believers than for transitory believers.[9] Recall that we hypothesized that mainly transitory believers might adjust their prices following an information treatment as the central bank's predictions align with their beliefs. Our findings indicate that this is the case, as the downward shift in the passthrough coefficient is far stronger and significant for transitory believers compared to persistent believers.

[Table 3 ABOUT HERE]

Frequency of Price Changes. An increase in the average level of inflation should lead to an increase in the share of firms changing prices more frequently. As the price level rises, the benefits of a price change exceed the expected costs of not changing prices (Ball et al., 1988). However, as Werning (2022) demonstrates theoretically, the increase in the frequency of price changes should not influence the passthrough of inflation expectations to current inflation (via prices). The reason for this is the following. Firms increasing the frequency with which they raise their prices overshoot inflation less strongly compared to firms with larger intervals between price changes. Therefore, a higher overshoot of inflation expectations to current prices for firms with a lower frequency of price changes is offset by a lower passthrough of firms with a higher frequency of setting prices. This finding holds for Calvo (1983) as well as for Taylor (1980).

To empirically test the theoretical result proposed by Werning (2022), we again bring equation (3) to the triple interaction with an indicator that takes a value of zero if a firm

controlling for firm and manager characteristics.

[9]From the perspective of the approach in Cavallo et al. (2017), updating coefficients for transitory (persistent) believers are: INFLATION: 1.661/2.602=0.64 (0.166/0.929=0.18), ENERGY: 0.90 (0.62), WAGE: 0.81 (0.57), see Table 3.

indicates to accelerate price setting compared to the past and takes a value of one if not. In our sample, 62% (N=1,198) of firms indicate their intention to increase the frequency of price changes. The detailed results (Online Appendix C.2) consistently demonstrate the expected pattern: increased information leads to lower passthrough for both groups. Our findings align with Werning's theoretical prediction by providing evidence of absence: The frequency of price changes does not have a significant impact on the passthrough mechanism.

Inattention. Another important factor that could influence price setting and passthrough is inattention with regard to inflation. Coibion et al. (2018) show that firms in New Zealand, which were initially uninformed about the inflation target of the Reserve Bank of New Zealand, did revise their employment and investment decisions to a significant extent when provided with information on the inflation target compared to firms which did not receive any information. However, they did not observe any revision with respect to prices. To assess the effect of any updating of inattentive firms with regard to planned prices, we measure inattention by using the prior beliefs for realized inflation in 2021. We calculate inattention as the absolute difference between firms' stated inflation for 2021 and actual inflation in 2021 (which had been realized at the time of the survey).

The results, displayed in Online Appendix C.3, show that over- or underestimating realized inflation of 2021 by 1 percentage point corresponds to approximately 2 percentage point higher price increases in the CONTROL group. Furthermore, the treatments demonstrate greater effectiveness when directed towards firms characterized by higher levels of inattention to inflation rates in 2021. Firms receiving the INFLATION treatment and deviating by 1 percentage point in their past inflation assessment from the realized inflation show price increases that are 0.9 percentage points lower than their peers in the CONTROL group that are equally uninformed. The corresponding values are 1.4 percentage points and 1.9 percentage points for the ENERGY and WAGE treatment, respectively. In sum, these results imply that central bank communication can be an effective tool to dampen price increases in high-inflation environments, particularly for inattentive firms. Our findings complement the previous results found by Coibion et al. (2018) who find a revision effect for inattentive firms for employment and investment decisions but not for prices.

5 Conclusion

Our findings bear several key implications for monetary policymaking. First, we show that central bank communication can be an effective tool to shape firms' price setting plans. Therefore, central bank information policies targeted toward firms can effectively be used to break an inflation spiral. An improved information provision would also allow keeping

interest rates on a lower path, thereby decreasing the risk of a hard landing. Second, we show that the provision of more detailed information on central bank expectations with regard to firms' input price developments further facilitates weakening the link between firms' pre-treatment inflation expectations and their intended price setting. Third, we observe that the credibility of the central bank's forecasts to firms can depend on firms' prior inflation expectations and how well-informed firms are about inflation dynamics. Our information treatments have a stronger impact on firms with higher inflation expectations or limited knowledge with regard to realized inflation, precisely the types of firms that central bank communication aims to target during periods of high inflation.

In sum, adequate information policies towards firms can be an effective additional instrument for monetary policy allowing better guidance of firms' inflation expectations, their price-setting, and thereby inflation in the economy as a whole.

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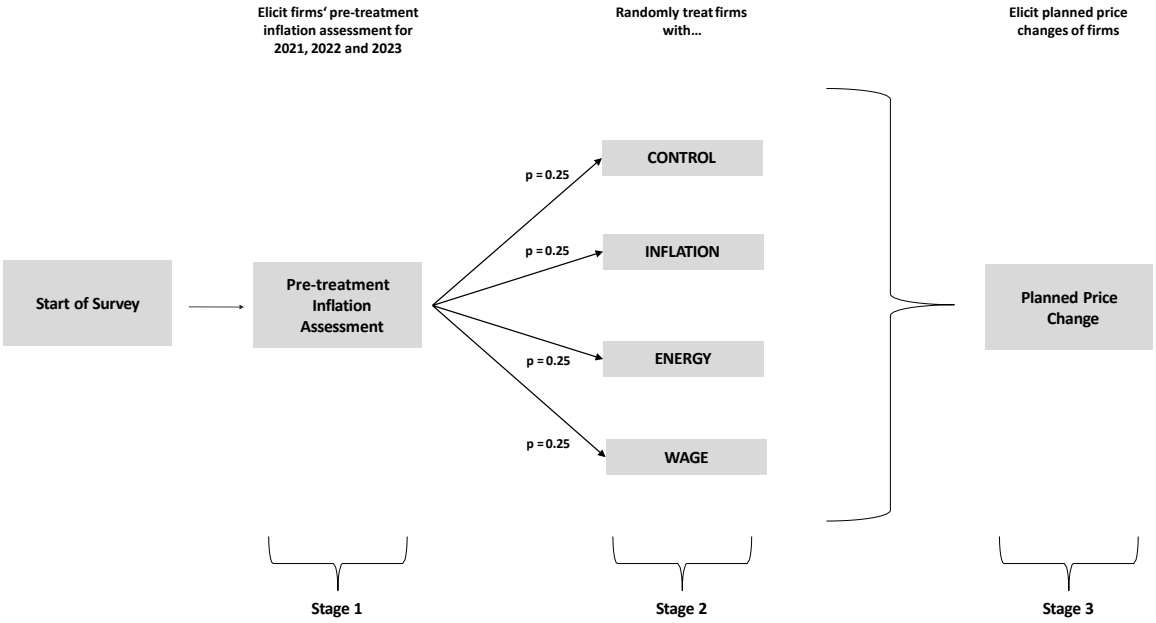
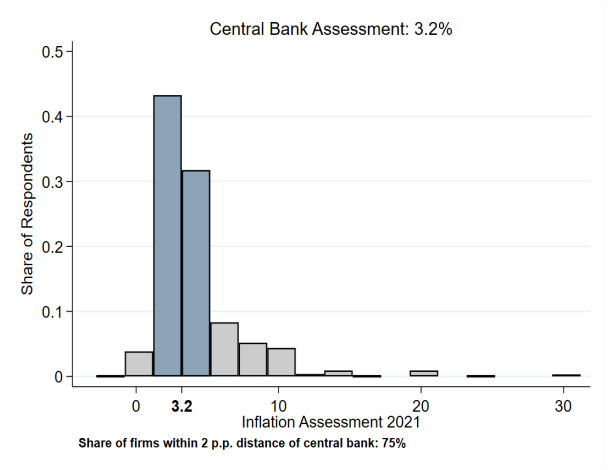
Figures and Tables

Figure 1: Experimental Design

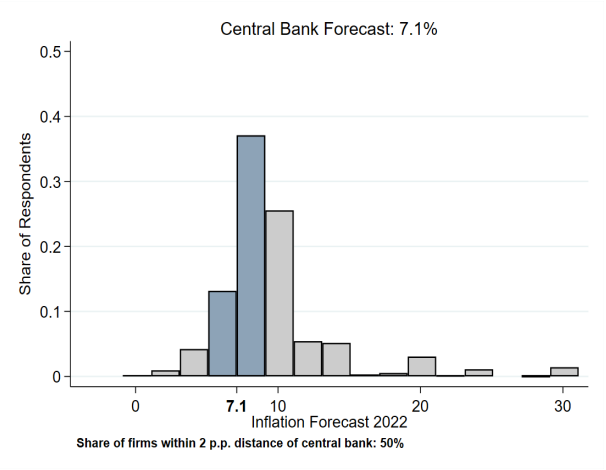


Note: Figure 1 presents the experimental design of our survey experiment.

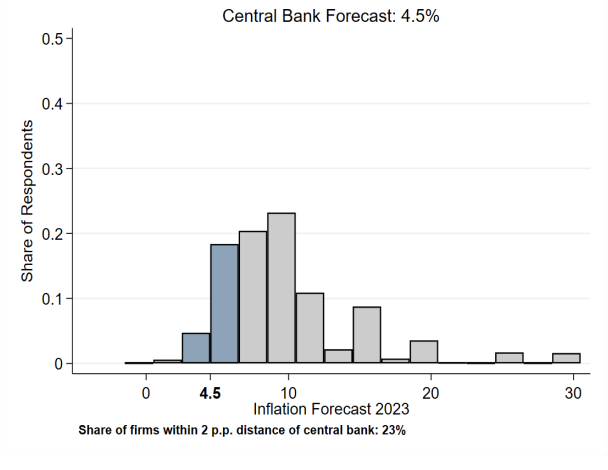
Figure 2: Firms' Inflation Assessment and Price Setting Plans



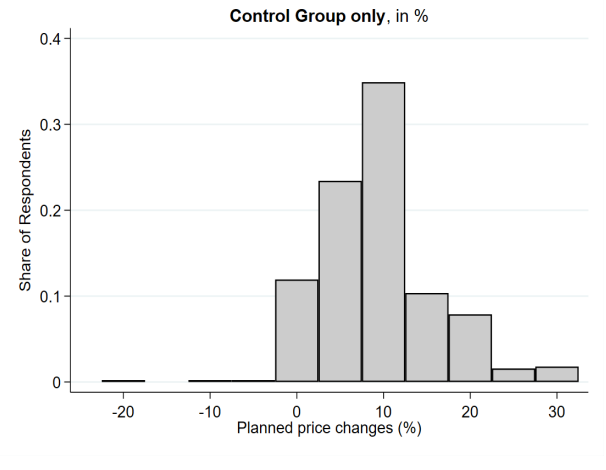
(a) Firms' 2021 Inflation Assessment



(b) Firms' 2022 Inflation Assessment



(c) Firms' 2023 Inflation Assessment



(d) Planned Price Changes in Next 12 Months

Note: Figure 2a, Figure 2b and Figure 2c present histograms of firms' inflation assessments for 2021 (N = 1,872), 2022 (N = 1,898) and 2023 (N = 1,883). Horizontal axis: indicated inflation rate (question: "How high do you estimate the inflation rate for 2021/2022/2023?"). Vertical axis: Share of survey respondents. Blue bars: answers in range of 2 percentage points distance to German central bank's inflation assessment (2021: 3.2%; 2022: 7.1%; 2023: 4.5%). Figure 2d shows surveyed firms' indicated price changes for the next 12 months. Horizontal axis: indicated price change (question: "Compared to today, how do you plan to adjust the selling price of your main product or service in the next 12 months (in %)?") Vertical axis: Share of survey respondents. Control group only (N = 444).

Table 1: Experimental Groups and Planned Price Changes

Exp. Group:	**All**		**Low Prior**		**High Prior**	
Dependent Variable:						
$\Delta Price_{i+12m}$	(1)	(2)	(3)	(4)	(5)	(6)
INFLATION	-3.380**	-3.257*	-1.205	-1.748	-3.760**	-3.605**
	(1.421)	(1.701)	(2.762)	(3.593)	(1.710)	(1.677)
ENERGY	-2.973***	-2.693***	-2.392	-1.677	-3.265**	-3.203**
	(0.644)	(0.652)	(2.002)	(2.481)	(1.365)	(1.384)
WAGE	-3.313**	-3.326**	-1.909	-1.580	-3.894*	-3.848*
	(1.351)	(1.464)	(3.018)	(3.044)	(2.019)	(2.096)
Constant (Baseline CONTROL)	15.368***	15.268***	9.986***	9.910***	17.098***	17.031***
	(1.388)	(0.689)	(2.763)	(1.599)	(1.824)	(0.891)
Controls	No	Yes	No	Yes	No	Yes
N	1912	1912	449	447	1411	1411
R^2	0.004	0.051	0.002	0.160	0.004	0.058

Note: OLS estimates from the regression of firms' planned price change in the next 12 months on experimental group dummies: $\Delta Price_{i+12m} = \alpha + \beta_1 \times INFLATION_i + \beta_2 \times ENERGY_i + \beta_3 \times WAGE_i + X_i'\gamma + \varepsilon_i$. Columns (1) and (2) include all observations. Columns (3) and (4) include only firms with forecasts of inflation for 2023 $\leq$ 6.5% (i.e., 2 p.p. above central bank forecast and lower). Columns (5) and (6) include only firms with forecasts of inflation for 2023 $>$ 6.5%. Controls as indicated in each column. Controls include firm controls (size groups, legal forms and 1-digit industries (WZ08 classification)), manager controls (education, position in the firm and the gender of the decision-maker) and week fixed effects. Standard errors clustered on industry and survey-week level. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 2: Passthrough of Inflation Expectations by Experimental Group

Exp. Group:	**CONTROL**		**INFLATION**		**ENERGY**		**WAGE**	
Dependent Variable:								
$\Delta Price_{i+12m}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Passthrough (φ)	1.002***	1.020***	0.758***	0.749***	0.311*	0.319*	0.422*	0.418**
	(0.223)	(0.228)	(0.109)	(0.095)	(0.146)	(0.159)	(0.199)	(0.183)
Updating			-0.243	-0.271	-0.691**	-0.702**	-0.579*	-0.602*
(relative to CONTROL)			(0.251)	(0.255)	(0.263)	(0.265)	(0.305)	(0.299)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
N	436	436	486	486	470	470	468	468
P(φ) = 0.5 [Taylor]	0.041	0.039	0.033	0.020	0.216	0.273	0.702	0.662
P(φ) = 1.0 [Calvo]	0.994	0.930	0.044	0.019	0.000	0.001	0.011	0.007
Mean($\Delta Price_{i+12m}$)	15.304	15.304	12.138	12.138	12.400	12.400	12.076	12.076

Note: OLS estimates from the regression of equation (3): $\Delta Price_{i+12m} = \alpha + \beta \times E_{2022}Inflation_{i2023} + \sum_{k=1}^{3} \delta_k TREATMENT_{ik} + \sum_{k=1}^{3} \theta_k E_{2022}Inflation_{i2023} \times TREATMENT_{ik} + X_i'\gamma + \varepsilon_i$. Coefficients are taken from the regressions in columns (1) and (2) of Table C.1 in Online Appendix C. Dependent variable: planned price change in the next 12 months. Independent variables: respondent's inflation forecast 2023, experimental group indicator, controls if indicated and a constant. Controls include firm controls (size groups, legal forms and 1-digit industries (WZ08 classification)), manager controls (education, position in the firm and the gender of the decision-maker) and week fixed effects. Separate display of coefficient estimates for experimental groups, as indicated in the model title. Standard errors clustered on industry and survey-week level. Bottom rows: two-sided t-test for the coefficient estimate on Passthrough (φ) equaling 1 and $\frac{1}{2}$, respectively. Mean of dependent variable ($\Delta Price_{i+12m}$) by experimental group. Standard errors in brackets. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3: Prior Beliefs on Persistence

	Transitory (Inflation 2023 < Inflation 2022)				**Persistent** (Inflation 2023 ≥ Inflation 2022)			
Exp. Group:	CONTROL	INFLATION	ENERGY	WAGE	CONTROL	INFLATION	ENERGY	WAGE
Dependent Var.: $\Delta Price_{i+12m}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Passthrough (φ)	2.602***	0.941***	0.253	0.503*	0.929**	0.763***	0.354	0.402*
	(0.737)	(0.222)	(0.226)	(0.263)	(0.316)	(0.148)	(0.211)	(0.215)
Updating		-1.661**	-2.350***	-2.100***		-0.166	-0.575*	-0.527
(relative to CONTROL)		(0.563)	(0.677)	(0.626)		(0.362)	(0.295)	(0.430)
Controls	No	No	No	No	No	No	No	No
N	170	184	176	182	265	302	294	286
P(φ) = 0.5 [Taylor]	0.013	0.067	0.292	0.992	0.196	0.097	0.501	0.656
P(φ) = 1.0 [Calvo]	0.047	0.795	0.005	0.080	0.826	0.131	0.009	0.015
Mean($\Delta Price_{i+12m}$)	13.279	8.788	11.388	9.580	16.736	14.179	13.005	13.664

Note: OLS estimates from the regression in column (3) of Table C.1 in Online Appendix C for **Transitory Believers** and **Persistent Believers**: $\Delta Price_{i+12m} = \alpha + \beta \times E_{i2022} Inflation_{2023} + \sum_{k=1}^{3} \delta_k \times TREATMENT_{ik} + \sum_{k=1}^{3} \theta_k \times E_{i2022} Inflation_{2023} \times TREATMENT_{ik} + \lambda \times Persistent_i + \zeta \times E_{i2022} Inflation_{2023} \times Persistent_i + \sum_{k=1}^{3} \kappa_k \times Persistent_i \times TREATMENT_{ik} + \sum_{k=1}^{3} \tau_k \times E_{i2022} Inflation_{2023} \times Persistent_i \times TREATMENT_{ik} + \varepsilon_i$. Dependent variable: planned price change in the next 12 months. Independent variables: respondent's inflation forecast 2023, experimental group indicator, a dummy indicating persistent believers (Inflation 2023 ≥ Inflation 2022 = 1) and a constant. Separate display of coefficient estimates for experimental groups as indicated in the model title. Standard errors clustered on industry and survey-week level. Bottom rows: two-sided t-test for the coefficient estimate on Passthrough (φ) equaling 1 and $\frac{1}{2}$, respectively. Mean of dependent variable ($\Delta Price_{i+12m}$) by experimental group. Standard errors in brackets. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Online Appendix for Followers or Ignorants?

Inflation Expectations and Price Setting Behavior of Firms*.

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Davud Rostam-Afschar♯, Benjamin Tödtmann∓, Johannes Voget°

July 24, 2023

A Survey and Experimental Design

Our experimental design incorporates several stages, which are visually depicted in Figure 1 in the main text. In the initial stage, participants are requested to provide their inflation estimates for the years 2021, 2022, and 2023. This stage yields two essential pieces of information. First, we obtain participants' prior expectations regarding future inflation, specifically for the years 2022 and 2023. Notably, the expectation for 2022 is partially realized at the time of the survey, while the expectation for 2023 remains entirely in the future. Second, by soliciting firms' assessment of past inflation in 2021, we can gauge the level of knowledge of each firm concerning inflation in general. This serves as a natural anchor point and enables within-subject comparisons between realized and expected inflation.

In the second stage, after indicating their inflation assessment, firms are randomly assigned to one of four groups. Depending on the assignment to one of the four groups, firms see different information displayed on the next page of the survey. The exact layout including the information displayed in German (the original survey language) can be seen for each group in Figure A.1. All firms, including the CONTROL group, see their own inflation assessment for the three years as indicated in the first question. Firms in the INFLATION, ENERGY and WAGE group see, in addition, the German central bank's

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inflation assessment for the respective year. Finally, the ENERGY (WAGE) group is additionally informed about the central bank's assessment of energy cost (labor cost) development for all three years. All mentioned information is displayed adjacently for the respective group. Hence, participants can compare their own estimates to the displayed information. The CONTROL group only sees its own estimates. The INFLATION group receives the same screen as the CONTROL group with inflation forecasts added. Further, ENERGY and WAGE see the same information as the INFLATION group with single cost components added. This step-wise addition of information allows us to measure the incremental effect of additional information.

In the third stage, we ask participants about their pricing plans for their main product in the upcoming twelve months. Thereby, we indirectly measure posterior beliefs with regard to inflation expectations. That is, we omit the direct measurement of posterior beliefs. It is important to note that we purposely avoid directly measuring these beliefs due to various reasons, such as the desire to minimize potential experimenter demand effects, as explained in Section 2 of the main paper. Following the completion of the third stage, participants proceed to the remaining questionnaire of the German Business Panel. From this questionnaire, we extract relevant firm and manager characteristics based on the provided questions. For our analyses, we utilize variables associated with specific survey questions, and a comprehensive description of these variables can be found in Table A.1 below.

B Descriptive Characteristics and Balancing Tests

A key assumption of randomized control trials is that a random assignment of participants to treatments leads to balanced participant characteristics across treatment groups. In this section, we investigate whether this key assumption holds for our experiment, i.e., whether firms in our different experimental groups have comparable prior inflation expectations. In other words, our tests show whether we were successful in randomizing firms in our different experimental arms. This ensures that participating firms do not exhibit systematic differences in their inflation assessment prior to receiving the information treatment.

Table B.1 shows descriptive statistics for each experimental group's inflation assessment for 2021, 2022, and 2023. We perform a Wald chi-square test for equality of means across all four experimental groups. P-values are displayed in the last column of Table B.1 and support that inflation expectations among the four groups do not significantly differ from each other, confirming the effectiveness of our randomization procedure. Table B.2 displays descriptive statistics for firm and manager characteristics we use in our analyses by experimental group. Again, the last column of Table B.2 displays the p-values of Wald chi-square tests for equality of means across all four experimental groups for each

Figure A.1: Screenshots - Experimental Treatment

(a) CONTROL (b) INFLATION

(c) ENERGY (d) WAGE

Note: Screenshots of the experimental information treatment in the online survey for the four experimental groups. Top left: **CONTROL** group is shown their own inflation estimates they indicated in the previous survey question. Top right: firms in baseline **INFLATION** treatment are shown their own inflation estimates contrasted with the forecasts of the German central bank (Bundesbank) at the time of the survey. Bottom left: firms in extended **ENERGY** treatment are shown their own inflation estimates contrasted with the forecasts of the German central bank (Bundesbank) on both inflation rates and energy price development at the time of the survey. Bottom right: firms in extended **WAGE** treatment are shown their own inflation estimates contrasted with the forecasts of the German central bank (Bundesbank) on both inflation rates and wage development at the time of the survey.

variable. P-values demonstrate that our randomization was also successful regarding firm characteristics, as the distributions do not display systematic differences.

Finally, Table B.3 shows that the industry composition of our firm sample is largely

Table A.1: Key Variables

Panel A: Outcome Variables	
Inflation	"How high do you estimate the inflation rate for the respective years?" (2021, 2022, 2023) (*Hint: The inflation rate is defined as the change in the average price development of all goods and services that private households in Germany buy for consumption purposes. It is measured as the average change compared to the previous year.*)
Price Change	"Compared to today, how do you plan to adjust the selling price of your main product or service in the next 12 months (in %)?"
Panel B: Manager Characteristics	
Education	"Please indicate your highest level of education completed."
Position	"What is your current position within your organization?"
Gender	"What is your preferred salutation?"
Panel C: Firm Characteristics	
Revenues	"Please indicate the annual revenue (in EUR) of your company in the previous calendar year."
Employees	"How many employees (in full-time positions) subject to social insurance contributions does your company have?"
Legal Form	"What is the legal form of your company?"
Industry	"Please select the most important industry sector in which your company is active, by selecting the corresponding category."

Note: Questions of the fifth survey wave of the German Business Panel used in the empirical analyses.

comparable to the industry composition of the overall German firm population (German Federal Statistical Office, 2021). Our sample includes more firms from the manufacturing and information sector and fewer firms from the hospitality and health service industry, in contrast to the German firm population in 2021. Moreover, firms in our sample are slightly larger with regard to employees and revenues compared to the German firm population.

C Supplementary Analyses

In this section, we offer more detailed and comprehensive analyses of the impact of our treatments on inflation expectations, passthrough, and price setting. We aim to provide a thorough understanding of these effects by presenting extended discussions and additional results related to our main finding. The following supplementary analyses first present details on these results. Subsequently, we dive even deeper to explore how additional characteristics of participating firms such as frequency of price changes, inattention and

Table B.1: Descriptive Statistics and Balancing Tests – Inflation Assessment

	Total	CONTROL	INFLATION	ENERGY	WAGE	P-value for equality across groups
Inflation 2021 (in %)						
Mean	4.68	4.53	5.03	4.37	4.74	0.25
SD	(4.93)	(3.72)	(6.28)	(4.42)	(4.76)	
N	1,872	437	496	474	465	
Inflation 2022 (in %)						
Mean	10.48	10.09	10.80	10.22	10.78	0.25
SD	(7.14)	(5.47)	(8.49)	(6.33)	(7.68)	
N	1,898	441	504	480	473	
Inflation 2023 (in %)						
Mean	11.31	10.75	11.80	10.89	11.75	0.21
SD	(10.06)	(7.58)	(12.02)	(9.32)	(10.51)	
N	1,883	440	494	477	472	

Note: Descriptive statistics for prior inflation assessment for 2021, 2022 and 2023 in % for the total sample and the experimental groups, respectively. *P*-values in the last column from a Wald chi-square test for equality of means across all four experimental groups. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

input costs affect firms' reaction to our treatments.

We first summarize the main results in Table C.1. The table reports the experimental results on passthrough of inflation expectations (columns (1) and (2); Table 2 in the main text). Further, we look at firms' prior beliefs on the persistence of high inflation rates in column (3) (Table 3 in the main text) and (4), and how results differ depending on the relative frequency of price changes (columns (5) and (6)). We estimate these effects by introducing a binary split variable to extend equation (3) in the main text, as follows:

$$\begin{aligned}\Delta Price_{i+12m} = \alpha + \beta \times E_{i2022}Inflation_{2023} + \sum_{k=1}^{3} \delta_k \times TREATMENT_{ik} \\ + \sum_{k=1}^{3} \theta_k \times E_{i2022}Inflation_{2023} \times TREATMENT_{ik} \\ + \lambda \times Split_i + \zeta \times E_{i2022}Inflation_{2023} \times Split_i \\ + \sum_{k=1}^{3} \kappa_k \times Split_i \times TREATMENT_{ik} \\ + \sum_{k=1}^{3} \tau_k \times E_{i2022}Inflation_{2023} \times Split_i \times TREATMENT_{ik} \\ + X_i'\gamma + \varepsilon_i. \end{aligned} \tag{4}$$

A new addition to our analysis is the introduction of the binary variable $Split_i$, that is introduced on a standalone basis, and interacted with the treatment dummies, firms' inflation expectations for 2023, and the interaction term of the two. This approach allows

Table B.2: Descriptive Statistics and Balancing Tests – Firm and Manager Characteristics

	Total Sample	CONTROL	INFLATION	ENERGY	WAGE	P-value for equality across groups
Size groups - Revenues/Employees						
Very Small	0.68	0.65	0.69	0.67	0.70	0.36
Small	0.24	0.26	0.24	0.25	0.21	0.30
Medium	0.06	0.05	0.05	0.06	0.07	0.64
Large	0.02	0.03	0.01	0.02	0.01	0.07*
Missing	0.01	0.00	0.01	0.00	0.01	0.57
Legal Forms						
Sole Proprietorship	0.23	0.22	0.23	0.21	0.24	0.65
Partnerships	0.13	0.14	0.15	0.12	0.11	0.12
Corporations	0.56	0.56	0.52	0.59	0.58	0.13
Other	0.07	0.07	0.08	0.07	0.06	0.63
Missing	0.01	0.00	0.01	0.00	0.01	0.76
Economic Sector (1-digit WZ08)						
A Agriculture	0.01	0.02	0.01	0.02	0.01	0.54
B Mining and quarrying†	0.00	0.00	0.00	0.00	0.00	-
C Manufacturing	0.14	0.15	0.14	0.13	0.14	0.88
D Energy Supply	0.01	0.01	0.01	0.00	0.01	0.41
E Water supply	0.00	0.01	0.00	0.00	0.00	0.34
F Construction	0.10	0.10	0.11	0.09	0.09	0.44
G Trade	0.14	0.15	0.14	0.14	0.12	0.54
H Transport and Storage	0.03	0.02	0.02	0.03	0.04	0.49
I Accommodation/Food	0.04	0.04	0.04	0.03	0.04	0.93
J Information	0.08	0.08	0.05	0.08	0.10	0.07*
K Financial/Insurance	0.03	0.02	0.02	0.03	0.03	0.82
L Real Estate	0.03	0.03	0.02	0.03	0.02	0.66
M Professional, scientific, and technical activities	0.14	0.12	0.16	0.15	0.14	0.34
N Other econ. services	0.04	0.04	0.05	0.04	0.04	0.79
O Public administration	0.00	0.00	0.00	0.00	0.00	0.86
P Education	0.02	0.02	0.01	0.03	0.01	0.52
Q Health/Social Services	0.03	0.03	0.03	0.03	0.03	0.91
R Arts/Entertainment	0.03	0.02	0.04	0.03	0.02	0.66
S Other services	0.04	0.04	0.04	0.04	0.04	0.92
Missing	0.10	0.08	0.08	0.11	0.12	0.11
Gender						
Male	0.75	0.78	0.74	0.73	0.74	0.28
Missing	0.08	0.07	0.08	0.09	0.09	0.65
Education						
Apprenticeship (voc.)	0.13	0.14	0.12	0.13	0.14	0.69
Bachelor Degree	0.06	0.04	0.06	0.05	0.07	0.16
Master (voc.)	0.14	0.15	0.15	0.12	0.13	0.46
Master Degree or higher	0.37	0.40	0.39	0.38	0.32	0.05*
Missing/Other/No degree	0.31	0.27	0.28	0.32	0.34	0.08*
Position						
Clerk	0.02	0.02	0.01	0.02	0.02	0.40
Department Head	0.02	0.02	0.03	0.03	0.02	0.83
Owner/CEO	0.87	0.88	0.87	0.86	0.88	0.72
Missing/Other	0.09	0.09	0.10	0.09	0.07	0.59
N	1,944	449	515	499	481	

Note: Descriptive statistics of firm and manager characteristics for the total sample and the experimental groups, respectively. *P*-values in the last column from a Wald chi-square test for equality of means across all four experimental groups. Sizegroups - Revenues/Employees (SME- EU Definition 2003/361): Very small ($\leq$ 9 employees & $\leq$ 2 mio. revenues), Small ($\leq$ 49 employees & $\leq$ 10 mio. revenues), Medium ($\leq$ 249 employees & $\leq$ 50 mio. revenues), Large ($>$ 249 employees or $>$ 50 mio. revenues). The economic sector classification follows the classification of economic activities from the German statistical office (2008 edition; WZ 2008). †: Due to missing observations in the experimental group ENERGY for the sector B, no test for equality of means across experimental groups can be conducted. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

us to explore the impact of heterogeneity of firm and manager characteristics on our results. To illustrate, we examine how our findings are influenced by beliefs regarding the persistence of inflation. In this case, we replace $Split_i$ with a binary indicator representing firms that hold the belief that inflation in 2023 will be equal to or higher than in 2022. We analyze these results in conjunction with the question whether passthrough remains

Table B.3: Firm Characteristics - Sample vs. Population

	Total Sample	Company Register 2021
No. of Employees		
0-9	0.72	0.87
10-49	0.22	0.10
50-249	0.04	0.02
>250	0.01	0.00
Missing	0.01	-
Revenues (in million €)		
0-2	0.80	0.93
2-10	0.13	0.06
10-50	0.04	0.01
>50	0.01	0.00
Missing	0.03	-
Economic Sector (1-digit WZ08)		
A Agriculture	0.01	- †
B Mining and quarrying	0.00	0.00
C Manufacturing	0.14	0.06
D Energy Supply	0.01	0.02
E Water supply	0.00	0.00
F Construction	0.10	0.11
G Trade	0.14	0.17
H Transport and Storage	0.03	0.03
I Accommodation/Food	0.04	0.07
J Information	0.08	0.04
K Financial/Insurance	0.03	0.02
L Real Estate	0.03	0.06
M Professional, scientific, and technical activities	0.14	0.15
N Other econ. services	0.04	0.07
O Public administration	0.00	- ‡
P Education	0.02	0.02
Q Health/Social Services	0.03	0.08
R Arts/Entertainment	0.03	0.03
S Other services	0.04	0.06
Missing	0.10	-
N	1,944	3,390,704

Note: Firm characteristics of the total sample and the German company register for 2021 for comparison (German Federal Statistical Office, 2021). †, ‡: Information on marginal distributions for these industries not available from German company register.

constant or varies depending on the belief regarding inflation dynamics or price adjustment frequency.

Table C.1: Main Experimental Results - Interaction Specifications

Split Variable:	-	-	Persistent	Persistent	Steady Price Setting	Steady Price Setting
Dependent Variable: $\Delta Price_{i+12m}$	(1)	(2)	(3)	(4)	(5)	(6)
Infl. 2023	1.002***	1.020***	2.602***	2.552***	0.936***	0.950***
	(0.223)	(0.228)	(0.737)	(0.696)	(0.265)	(0.267)
INFLATION (I)	-1.236	-0.936	6.822*	7.211	-1.572	-1.066
	(2.828)	(2.996)	(3.768)	(4.246)	(4.348)	(4.648)
ENERGY (E)	4.462*	4.814*	14.071**	15.305***	4.842*	4.530
	(2.172)	(2.293)	(4.701)	(4.310)	(2.696)	(3.176)
WAGE (W)	2.572	2.733	10.286*	10.758*	0.741	0.661
	(2.787)	(2.788)	(5.002)	(5.658)	(3.547)	(3.680)
I × Infl. 2023	-0.243	-0.271	-1.661**	-1.575***	-0.164	-0.190
	(0.251)	(0.255)	(0.563)	(0.519)	(0.329)	(0.318)
E × Infl. 2023	-0.691**	-0.702**	-2.350***	-2.351***	-0.735**	-0.727**
	(0.263)	(0.265)	(0.677)	(0.581)	(0.287)	(0.306)
W × Infl. 2023	-0.579*	-0.602*	-2.100***	-2.102***	-0.454	-0.464
	(0.305)	(0.299)	(0.626)	(0.648)	(0.371)	(0.364)
Split			8.622	9.878	-5.161	-5.890
			(7.656)	(7.647)	(4.086)	(4.169)
Split × Infl. 2023			-1.673*	-1.640*	-0.039	0.050
			(0.938)	(0.897)	(0.458)	(0.540)
I × Split			-8.275	-9.435	1.619	1.785
			(6.266)	(6.251)	(4.540)	(4.848)
E × Split			-10.342	-12.702*	-3.178	-0.910
			(6.372)	(5.941)	(3.144)	(3.651)
W × Split			-6.954	-7.859	4.261	5.160
			(8.487)	(9.077)	(4.899)	(5.414)
I × Split × Infl. 2023			1.495*	1.419*	-0.216	-0.292
			(0.751)	(0.709)	(0.483)	(0.532)
E × Split × Infl. 2023			1.775*	1.826**	0.468	0.334
			(0.826)	(0.734)	(0.577)	(0.694)
W × Split × Infl. 2023			1.573	1.579	-0.188	-0.261
			(0.926)	(0.951)	(0.646)	(0.728)
Constant	4.543*	4.306*	-4.229	-4.752	7.006*	6.804**
	(2.237)	(2.206)	(4.470)	(4.916)	(3.265)	(3.112)
Controls	No	Yes	No	Yes	No	Yes
N	1,860	1,860	1,859	1,859	1,852	1,852
R^2	0.083	0.127	0.092	0.136	0.096	0.139

Note: OLS estimates from the regression of equation (3) (columns: (1) - (2)) and equation (4) ((columns: (3) - (6))). Split variable as indicated in the first row of the table. Split variable: (i) Transitory Believers (Inflation 2023 < Inflation 2022 = 0) or Persistent Believers (Inflation 2023 ≥ Inflation 2022 = 1). (ii) Steady Price Setting = 0: Firms indicate to increase prices in the future more frequently than in the past. Steady Price Setting = 1: Firms indicate to increase prices in the future equally or less frequently than in the past. Dependent variable: planned price change in the next 12 months. Further independent variables: respondent's inflation forecast 2023, experimental group indicator, controls if indicated, and a constant. Controls include firm controls (sizegroups, legal forms and 1-digit industries (WZ08 classification)), manager controls (education, position in the firm and the gender of the decision-maker) and week fixed effects. Standard errors clustered on industry and survey-week level. Standard errors in brackets. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

C.1 Prior Beliefs on Persistence

Will the rise in inflation in most advanced economies be temporary or more persistent? This debate has raged for the past year, but now it is largely settled: "Team Persistent" won, and "Team Transitory"—which included most central banks and fiscal authorities—has now admitted to having been mistaken.

(Roubini, 2022)

As Roubini (2022) notes, central banks adhered to their position that high inflation rates are a transitory phenomenon until late 2022. So did the German central bank, by not providing an update to their mid-2022 forecasts (2022: 7.1%; 2023: 4.5%) at the time of our experiment. We capitalize on this circumstance to explore how beliefs regarding inflation dynamics influence the relationship between pre-experimental inflation expectations and firms' planned price setting. To do so, we classify firms into those that share the central bank's belief and those that do not. Firms are labeled as *transitory* believers if they indicate a lower inflation rate for 2023 than for 2022. Firms with stable or higher inflation rates for 2023 compared to 2022 are labeled *persistent* believers. We find that 38% of firms (n=715) are transitory believers, while 62% (n=1,167) are not. Transitory believers indicate, on average, inflation forecasts for 2023 of 6.6% (median: 6%). Persistent believers' forecast an average rate of 14.2% (median: 11%). In this section, we expand upon the findings presented in Section 4.4 of the main text by providing a more comprehensive discussion and presenting additional results.

Like briefly described in Section 4.4 of the main text, we address two key questions regarding prior beliefs on persistence. First, we investigate whether prior beliefs have an impact on the magnitude of passthrough in the absence of any information treatment. We consider the possibility that firms with transitory beliefs, perceiving inflation as a temporary phenomenon, may capitalize on the high inflation environment by increasing prices even more than their own inflation expectations suggest.[1] Thereby, they free-ride on price increases by their peers holding persistent beliefs. This behavior could result in a passthrough larger than one for transitory believers. Second, we examine whether the treatments have varying effects on transitory and persistent believers. Building on the hypothesis outlined by Roubini (2022), we expect persistent believers to remain steadfast in their prior beliefs even when confronted with the central bank's transitory forecasts. In contrast, transitory believers may exhibit stronger reactions to our treatments, as the central bank's inflation dynamics align with their existing beliefs but at lower absolute levels. The credibility of the inflation forecasts may be particularly reinforced for transitory believers when they receive additional information about energy cost developments. Notably, our survey indicates that energy costs are the primary factor considered by firms

[1] Notably, a study by Ragnitz (2022) found that firms in Germany took advantage of rising price levels to expand their profits.

when setting prices. It is important to highlight that the central bank's energy price forecast, although lower than the actual energy price changes at the time of the survey, is significantly higher than forecasts for inflation and wages.[2] Therefore, we expect transitory believers to react most strongly to the ENERGY treatment by adjusting their expectations regarding energy input costs downward.

To address these two questions, we build on equation (4), which estimates a triple interaction model involving expectations, treatment indicators, and a binary variable indicating persistent beliefs. In this model specification, we substitute the variable $Split_i$ with a binary indicator that represents firms holding the belief that inflation in 2023 will be equal to or higher than in 2022, indicating persistent believers. The findings are presented in column (4) of Table C.1. Notably, in contrast to the main text, we include regression results that control for firm and manager characteristics. Firm and Manager characteristics are described in more detail in this Online Appendix, Section B.

First, similar to the results found in Table 3 in the main text, we find that passthrough in the CONTROL group is substantially higher for transitory believers than for persistent believers (2.552 vs. 0.912, p-value: 0.089). Our finding, which remains robust even after incorporating firm and manager controls, highlights that transitory believers in the CONTROL group demonstrate a stronger passthrough of their inflation expectations to planned prices when compared to persistent believers. This observation aligns with the notion that transitory firms perceive a limited window of opportunity for price increases. Consequently, they surpass their inflation expectations and more vigorously incorporate them into prices as a means to capitalize on justifying price hikes with rising costs.

Furthermore, our second finding, which emphasizes that treatment effects are more pronounced for transitory believers compared to persistent believers, remains robust even after including our control variables. For the INFLATION treatment, we observe a notable reduction in the passthrough relationship of approximately 1.575 for transitory believers relative to the CONTROL group. In contrast, persistent believers receiving the INFLATION treatment do not significantly revise their price plans compared to persistent believers in the CONTROL group (coefficient: -0.156; p-value: 0.663). Additionally, the difference in updating between the CONTROL and INFLATION group is statistically significant when comparing persistent and transitory believers (p-value: 0.065). Similar to the main results presented in Table 2 of the main text (and columns (1) and (2) in Table C.1), the passthrough coefficient for both input cost treatments (ENERGY, WAGE) is lower compared to the INFLATION group. It is worth recalling that we hypothesized that primarily transitory believers would adjust their prices in response to an information treatment. Our findings, while controlling for firm and manager characteristics, support this hypothesis, as the downward shift in the passthrough coefficient is significantly

[2]E.g., energy prices in Germany grew by 36% in August compared to the same month in the previous year (German Federal Statistical Office, 2022).

stronger and significant for transitory believers compared to persistent believers. This further supports the results presented in the main text.

Discussion A first observation is that firms holding transitory inflation beliefs in the CONTROL group pass through their inflation expectations not only fully, but with a passthrough coefficient higher than 2. Instead, firms with persistent beliefs show a passthrough close to one. Theory predicts that passthrough has an upper bound of one (Werning, 2022). What are potential explanations for our observation of values that more than double this upper bound? Our argument goes as follows: Firms with transitory beliefs generally expect lower inflation rates for 2023 (median: 6%) compared to their peers holding persistent beliefs (median: 11%). Note that persistent believers do pass through their comparatively high beliefs with a near 1:1 relationship to their prices. If transitory believers were to do the same, they only would increase their prices by approximately half the amount that their competitors with persistent beliefs do. Therefore, we argue that transitory believers (being the minority of firms) 'free ride' on their competitors' price increases and simply increase their prices by comparable absolute amounts. This overshooting is similar to the overshooting in standard pricing models. An important difference is though that firms believe that it becomes harder to increase prices for a while, because they expect price increases to be short-lived. Therefore, they overshoot. Even though being equal in absolute terms, transitory believers' price increases are double as high when seen relative to their comparatively low inflation expectations, leading to a passthrough far above the theoretical upper bound of one.

C.2 Frequency of Price Changes

In Section 4.4 of the main text, we explore the relationship between the frequency of price changes and the passthrough of pre-experimental inflation expectations to firms' planned price setting behavior. This investigation is motivated by the following factors: as the average level of inflation increases, there tends to be a rise in the proportion of firms that change prices more frequently. This can be attributed to the notion that, with a higher price level, the benefits of adjusting prices outweigh the anticipated costs of not doing so (Ball et al., 1988).[3] However, according to theoretical findings by Werning (2022), an increase in the frequency of price changes should not impact the passthrough of inflation expectations to current inflation (through prices). The rationale behind this is as follows: firms that increase the frequency of price adjustments tend to exhibit less pronounced overshooting of inflation expectations to prices compared to firms with longer intervals between price changes. As a result, the higher degree of overshooting of inflation expectations for firms with lower price change frequencies is counterbalanced by a lower

[3] In our sample, 62% (N=1,198) of firms indicate their intention to increase the frequency of price changes.

passthrough for firms with more frequent price adjustments. This conclusion is consistent with the works of Calvo (1983) and Taylor (1980).

Columns (5) and (6) in Table C.1 examine the theoretical proposition by Werning (2022) regarding the impact of different price setting frequencies. These regressions are conducted without and with firm and manager controls, respectively. In both cases, the variable $Split_i$ is replaced with a binary variable indicating whether firms indicate an equal or less frequent increase in future prices compared to the past. The results reveal that varying price setting frequencies do not lead to significant differences in passthrough for the CONTROL group, nor do they alter the responsiveness to our treatments. Furthermore, the results remain largely consistent across specifications with and without control variables. For instance, in column (5), the passthrough coefficient for firms in the CONTROL group that increase their price setting frequency compared to the past is 0.936 (0.950 in column (6)). Similarly, firms in the CONTROL group that *do not* increase their price setting frequency exhibit a similar level of passthrough, with a coefficient of 0.897 (column (6): 1.000). In both specifications, the difference in passthrough coefficients between the two groups is not statistically significant at conventional levels (p-value: 0.934 - column (5); 0.928 - column (6)). Based on these findings, we conclude that the frequency of price changes does not have a significant impact on the passthrough mechanism.

C.3 Inattention

Lastly, in Section 4.4 in the main text, we investigate whether inattention with regard to inflation influences passthrough and price setting. A key advantage of our survey design is that we ask firms not only about their inflation expectations, but also about their perception of inflation in the year of 2021 that was realized at the time of the survey. This natural anchor allows us to measure firms' inattention with regard to inflation dynamics. In this section, we exploit this trait of our survey by estimating how inattention to inflation dynamics influences firms' price planning and the effectiveness of our information treatments. The idea and our implementation closely follow Coibion et al. (2018) and makes our results even more comparable to theirs. Similar to Coibion et al. (2018), we find in Figure 2a of our main paper that there is a portion of firms that is not well-informed about inflation dynamics. We conjecture that well-informed firms will exhibit less adjustment in their inflation expectations upon receiving our information treatment, compared to those with relatively limited knowledge. To explore this, we commence by estimating the following equation by OLS.

$$\Delta Price_{i+12m} = \alpha + \beta \times Inattention2021_i + \sum_{k=1}^{3} \delta_k TREATMENT_{ik} + \sum_{k=1}^{3} \theta_k Inattention2021_i \times TREATMENT_{ik} + X_i'\gamma + \varepsilon_i. \quad (5)$$

We define $Inattention2021_i$ as the absolute difference between firms' perceived inflation for 2021 and the realized inflation rate following the central bank (3.2%). To explore the impact of inattention on future pricing decisions, we include $Inattention2021_i$ both as a standalone variable and in interaction with our three treatments. The coefficient estimate, denoted as β, allows us to quantify the effect of higher levels of inattention on pricing decisions in the CONTROL group, in the absence of any information treatment. In Table C.2, Column (1), we observe that firms in the CONTROL group who possess perfect knowledge of inflation dynamics ($Inattention2021_i = 0$) have an average planned price adjustment of 11.1%. For each one percentage point deviation in inflation assessment from the realized inflation rate in 2021 ($Inattention2021_i = 1$), firms, on average, increase their prices by an additional 2.1 percentage points (13.2%).

Next, coefficient estimates on θ_k can be interpreted as the incremental effect of a one percentage point larger inattention on the effectiveness of our treatments, while coefficient estimates δ_k show the effects of the information treatments on perfectly informed firms in the respective treatment group. Results presented in column (1) of Table C.2 indicate that the information treatments do not have a statistically significant effect on firms that are well-informed. However, as firms become more inattentive to inflation rates in 2021, the treatments become more effective. For firms receiving the INFLATION treatment and deviating by one percentage point in their past inflation assessment from the realized inflation rate, their price increases are 0.9 percentage points lower compared to their equally uninformed peers in the CONTROL group. The corresponding values for the ENERGY and WAGE treatments are 1.4 percentage points and 1.9 percentage points, respectively. In sum, this means that not only is an information treatment more effective when firms are less informed. In addition, a more detailed information provision has a stronger effect than a less detailed one, when firms are uninformed.

C.4 Input Cost Heterogeneity

In the ENERGY and WAGE treatments of our study, we additionally inform firms with detailed information regarding the energy and wage components of the central bank's inflation forecasts. These treatments allow us to make inferences about how information about input cost developments affects firms' planned price-setting and passthrough on

top of pure information about general inflation, thereby addressing a gap in the existing literature (Weber et al., 2022). Furthermore, the significance of energy/material costs and labor costs in the pricing decisions of companies is evident from the responses to one of our survey questions. The data presented in Table C.3 reveals that approximately 69% of firms consider energy/material costs, while 64% take labor costs into account when making pricing decisions. In comparison, other factors such as legal regulations (26%), customer demand (25%), and competitor prices (19%) appear to have less impact. Importantly, this pattern holds true across all experimental groups, indicating that energy/material costs and labor costs are consistently regarded as among the most crucial factors in the price-setting process.

Table C.2: Inflation Inattention (Absolute Difference) and Planned Price Changes

Dependent Variable:	$\Delta Price_{i+12m}$ (1)	$\Delta Price_{i+12m}$ (2)
INFLATION	-1.963	-2.266
	(1.814)	(1.947)
ENERGY	-0.226	-0.427
	(1.677)	(1.557)
WAGE	0.486	0.142
	(2.035)	(1.875)
Inattention 2021	2.104***	1.966***
	(0.515)	(0.520)
INFLATION × Inattention 2021	-0.891*	-0.717
	(0.468)	(0.467)
ENERGY × Inattention 2021	-1.403**	-1.192*
	(0.649)	(0.641)
WAGE × Inattention 2021	-1.902***	-1.786***
	(0.545)	(0.544)
Constant	11.13***	11.37***
	(1.398)	(1.237)
Controls	No	Yes
N	1848	1848
R^2	0.056	0.103

Note: OLS estimates from equation (5): $\Delta Price_{i+12m} = \alpha + \beta \times Inattention2022_i + \sum_{k=1}^{3} \delta_k TREATMENT_{ik} + \sum_{k=1}^{3} \theta_k Inattention2022_i \times TREATMENT_{ik} + X_i'\gamma + \varepsilon_i$. Dependent variable: planned price change in the next 12 months. Independent variables: Experimental group dummies, absolute difference between firms' perceived inflation for 2021 and actual inflation in 2021 (i.e. inattention), constant, and controls. Controls include firm controls (size groups, legal forms and 1-digit industries (WZ08 classification)), manager controls (education, position in the firm and the gender of the decision-maker) and week fixed effects. Standard errors clustered on industry and survey-week level. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table C.3: Descriptive Statistics and Balancing Tests – Factors Influencing Prices

	Total	CONTROL	INFLATION	ENERGY	WAGE	P-value for equality across groups
Which factors have the greatest influence on pricing in your company?						
Energy/Material Costs						
Mean	0.69	0.70	0.68	0.67	0.70	0.77
SD	(0.46)	(0.46)	(0.47)	(0.47)	(0.46)	
Labor Costs						
Mean	0.64	0.64	0.64	0.64	0.63	0.94
SD	(0.48)	(0.48)	(0.48)	(0.48)	(0.48)	
N	1,934	445	515	495	479	

Note: Descriptive statistics of firms naming energy and labor costs as having the greatest influencing on their price setting behavior for the total sample and the experimental groups, respectively. *P*-values in the last column from a Wald chi-square test for equality of means across all four experimental groups. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

How information on energy and wage components of the central bank's inflation forecast is perceived by firms could depend on the industry a particular firm is in. For example, industries that heavily rely on energy and labor inputs may exhibit a stronger passthrough effect from prior inflation expectations to planned prices. This is because higher input costs for energy and labor have a more significant influence on their price-setting behavior compared to firms in other sectors. To test for heterogeneous reactions with regard to information on energy and wage components of the central bank's inflation forecast, we estimate equation (3) from the main text by OLS for two different samples separately.[4] First, we estimate equation (3) using the sample of firms that have identified energy/material costs as one of the most influential factors impacting their pricing decisions. This enables us to examine the reactions of firms that are potentially more energy-intensive and assess how they respond to the provided information on energy and wage components. Second, we estimate equation (3) using the separate sample of firms that have indicated labor costs as a primary factor in their pricing decisions. By doing so, we investigate the reactions of firms that we assume to be more labor-intensive and evaluate their response to the information on energy and wage components of the central bank's inflation forecast. This approach allows us to examine the specific reactions within these different samples and gain insights into the nuanced effects of energy and wage components on firms' pricing behavior.

Results are presented in Table C.4. Notably, two findings stand out from these results. First, in the CONTROL group where no information treatment was given, energy-intensive and labor-intensive firms exhibit comparable passthrough rates from expecta-

[4]See also the table notes of Table C.4 for the exact specification of equation (3).

tions to planned price setting. Specifically, energy-intensive firms display a passthrough coefficient of 0.839, while labor-intensive firms exhibit a similar coefficient of 0.897.[5] Second, both types of firms demonstrate a strong reaction to the ENERGY treatment. When firms that indicated energy and material costs as major factors of their price setting were exposed to this treatment, a downward adjustment of passthrough occurs, reducing the influence of pre-experimental inflation expectations on planned prices by 0.545. A similar reduction in passthrough can be observed for firms that identified labor costs as a significant driver of price setting.[6] In contrast, no significant adjustments in firm behavior are observed when firms are provided with information on general inflation dynamics or labor cost developments (although coefficients are larger for the WAGE treatment).

What could explain the strong effect of the ENERGY treatment on energy- and labor-intensive firms? A potential explanation could lie in the chosen components having distinctly different properties. Energy prices are highly volatile key drivers of current inflation rates. As fast as they increased, they might be reduced in the future, which is why they rather affect firms' planning in the short term. The opposite holds for labor costs that are also predicted to be increasing but at a much lower rate, suggesting that labor costs might be rather stable and relevant for firms' long-term decisions. Our results suggest that short-term concerns of firms with regard to energy price developments seem to dominate in our setting. As highlighted in Table C.3, our survey indicates that energy costs are currently the primary factor considered by firms when setting prices. Interestingly, it is worth mentioning that our treatment's central bank energy price forecast for 2022 (27.2%) was actually lower than the realized energy price changes at the time of the survey. For instance, energy prices in Germany experienced a growth of 36% in August compared to the same month in the previous year (German Federal Statistical Office, 2022). Therefore, the information we provide may have led to a downward adjustment in energy price expectations, resulting in a lower passthrough to planned prices. Moreover, as energy prices are the key drivers of current inflation rates, the credibility of the inflation forecasts may be particularly reinforced when firms receive additional information about energy cost developments. This highlights the importance of providing firms with insights into factors that are relevant for their current pricing plans.

In sum, our findings emphasize the significant influence of the ENERGY treatment on both energy-intensive and labor-intensive firms. Additionally, our results underscore the similarity in passthrough rates between the two types of firms in the absence of any information treatment.

[5] t-test comparing the differences between these coefficients: 0.740.

[6] The difference in updating coefficients between these two groups is not statistically significant, as indicated by a p-value of 0.768.

Table C.4: Passthrough and Planned Price Changes: Input Cost Factor (Full Interaction)

Sample :	Energy Factor = 1	Labor Factor = 1
Dependent Variable:		
$\Delta Price_{i+12m}$	(1)	(2)
Infl. 2023	0.839***	0.897***
	(0.141)	(0.171)
INFLATION (I)	-3.936	-0.032
	(3.843)	(2.752)
ENERGY (E)	5.570***	6.676***
	(1.586)	(1.698)
WAGE (W)	2.126	3.033
	(2.472)	(3.914)
I × Infl. 2023	0.119	-0.171
	(0.274)	(0.240)
E × Infl. 2023	-0.545***	-0.599***
	(0.149)	(0.181)
W × Infl. 2023	-0.396	-0.435
	(0.229)	(0.353)
Constant	5.838***	4.601*
	(1.603)	(2.159)
Controls	No	No
N	1,271	1,182
R^2	0.098	0.073

Note: OLS estimates from the regression of equation (3) for different samples. Equation (3): $\Delta Price_{i+12m} = \alpha + \beta \times E_{2022}Inflation_{i2023} + \sum_{k=1}^{3} \delta_k TREATMENT_{ik} + \sum_{k=1}^{3} \theta_k E_{2022}Inflation_{i2023} \times TREATMENT_{ik} + \varepsilon_i$. Column (1): Sample only consists of firms indicating that energy and material costs belong to the greatest factor influencing the price setting decision in the company. Column (2): Sample only consists of firms indicating that labor costs belong to the greatest factor influencing the price setting decision in the company. Dependent variable: planned price change in the next 12 months. Independent variables: respondent's inflation forecast 2023, experimental group dummies, and a constant. Standard errors clustered on industry and survey-week level. Standard errors in brackets. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

D Is Passthrough Constant?

Our treatment aimed to lower inflation expectations, but it could have also influenced the extent to which firms pass through inflation expectations to prices. There are several possible reasons for this. First, firm decision-makers may adjust prices based on the specific input factors driving their inflation expectations. For instance, if firms anticipate government subsidies to offset higher energy costs, they might not fully pass through those costs to consumers. Additionally, passthrough dynamics could be nonlinear and contingent on the magnitude of the change in inflation expectations. In other words, a more substantial downward revision of inflation expectations may result in a smaller proportion being passed on to consumers. These factors indicate that the relationship between inflation expectations and price passthrough is complex and influenced by various factors, including

the type of input factors driving inflation expectations and the magnitude of the change in those expectations.

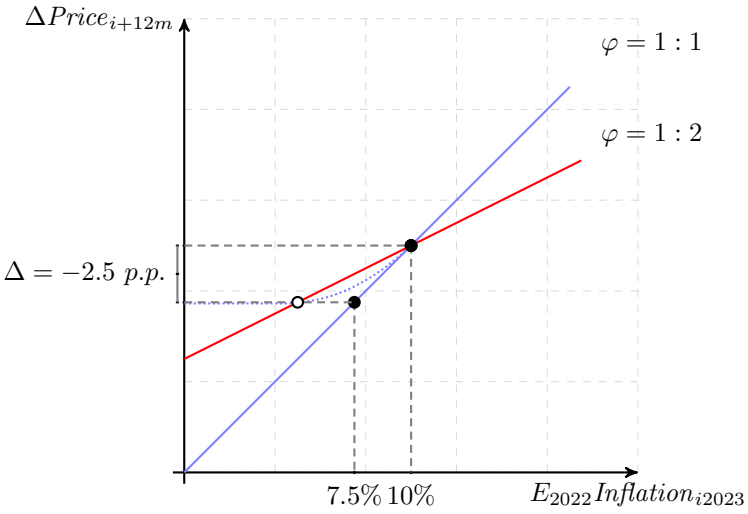
Figure D.1a shows passthrough according to Calvo ($\varphi = 1$) and Taylor ($\varphi = 1/2$) and a non-linear passthrough function that suggests that for higher inflation expectations (above 10%), passthrough is best described by Calvo pricing and that for lower inflation (around 5%), the Taylor model cannot be rejected. At very low levels, no passthrough can be observed, consistent with the evidence in Coibion et al. (2020, 2018) and Rosolia (2021). In the figure, we assume prior inflation expectations of 10% for simplification (below we use the actual mean of 11.3% for 2023) and take updating of inflation expectations by 0.25 from Table 2 (column (3): $10\% - 10\% \times 25\% = 7.5\%$). In column (1) of Table 1 in the main text, we find that the combined treatment effect in all three treatments amounts to a reduction in planned prices of about 3 percentage points. This is very close to the 2.5% shown in the figure, implied by a one-to-one relationship.

Figure D.1b shows the case in which our treatment would be ineffective on inflation expectations. Since we know that the treatments reduced price plans by around 3 percentage points, the assumption that inflation expectations remained unaffected (or only reduced marginally) is only possible with an extremely high passthrough. This would imply, for example, that a 1 percentage point downward revision of inflation expectations leads to a decrease of prices by an infinitely large value. This is clearly very unlikely and thus we conclude that the treatment had its intended effect to reduce expectations. Note that a passthrough of larger than one is not at all unrealistic.

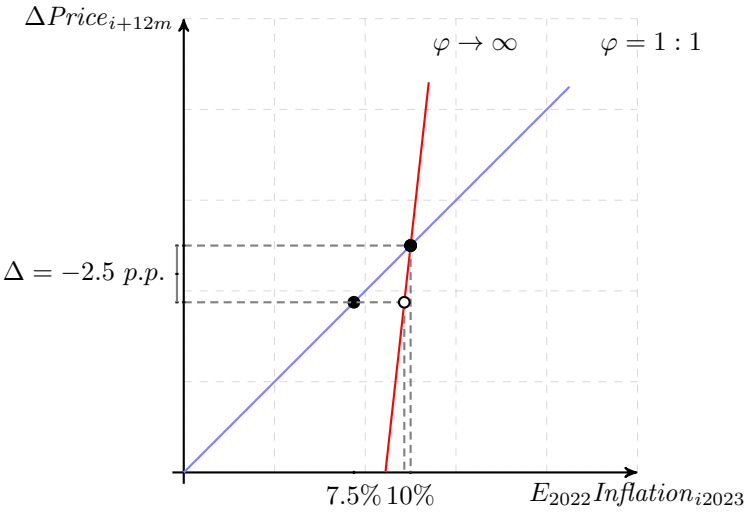
Finally, Figure D.1c reflects most closely our empirical results. It shows the degree of updating in the INFLATION treatment, the ENERGY treatment, and in the WAGE treatment. In fact, the revision of inflation expectations due to the INFLATION treatment amounts to about -2.75 percentage points (mean inflation expectation for 2023 of $11.3\% \times -24.3\%$) that corresponds to downward adjustment of price plans by 3.4 percentage points somewhat less than one-to-one[7]. The treatments ENERGY and WAGE induced stronger updating of inflation expectations, such that passthrough must have reduced as well. The reductions of ($11.3\% \times -0.69 = -7.8$ percentage points) imply that the absolute value of the expected inflation after updating is small (11.3% - 7.8% = 3.5%). For such low inflation, it may be too costly to increase prices, perhaps due to competitive pressure. Thus, the passthrough relationship between inflation expectations and price setting is non-linear. If true, this reconciles the results from the previous literature that did not find significant passthrough in low-inflation environments (Coibion et al., 2020, 2018; Rosolia, 2021) with our new results from a high inflation setting.

[7]More precisely, $2.75/3.4 = 0.81$. Cf. the point estimate of 0.758 in Table 2 in the main text.

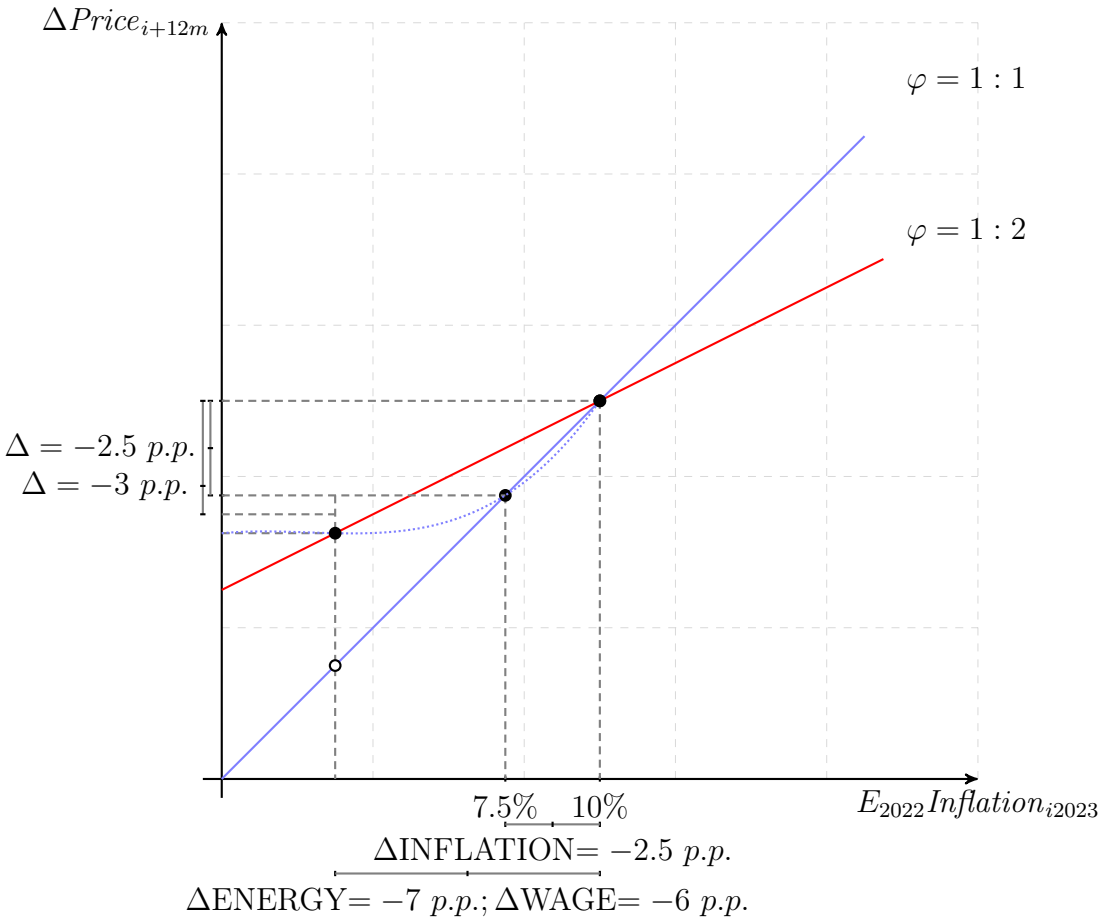
Figure D.1: Posterior Beliefs and Passthrough



(a) Passthrough Unchanged



(b) Expectations Unchanged



(c) Reduction in Passthrough Increases with Updating of Expectations

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