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# Discussion Paper

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## Energy prices and inflation expectations: Evidence from households and firms

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# Non-technical summary

### Research Question

Inflation in Germany and globally has risen to levels unseen in decades since mid-2021. The increase in the overall consumer price index has largely been driven by rising energy prices in many European countries, especially in the wake of the Russian invasion of Ukraine. At the same time, inflation expectations of firms and households have also trended upward. What role do energy prices play in the formation of households' and firms' inflation expectations? Do they extrapolate personal experience of an energy price increase to the aggregate economy? Are households and firms reacting differently to energy price shocks?

### Contribution

This paper is the first to estimate the effect of energy price increases on the inflation expectations of both households and firms in a quasi-experimental setup. The previous literature has focused on other salient prices such as supermarket prices or house prices. Using monthly panel survey data in combination with a difference-in-difference approach, I am able to separate the experience effect from other macro trends to estimate the causal impact of energy price hikes. Another unique contribution of the paper is to compare the expectation formation of households and firms in response to a real-world shock.

### Results

The results show that households increase their inflation expectations when they personally experience an increase in their electricity prices when compared to households that have not experienced a price increase yet. This result is inconsistent with full-information rational expectations and points to households extrapolating their personal experience to the macroeconomy. The effect is driven by low-income households, households who are uninformed about past inflation, and those not trusting the ECB. Due to households extrapolating, their inflation forecasts become less accurate and diverge more from professional forecasts. Contrary to households, firms do not adjust their inflation expectations differentially when being hit by energy price increases. Thus, decision-makers in firms form their expectations similarly to high-income households.

# Nichttechnische Zusammenfassung

### Fragestellung

Die Inflation ist seit Mitte 2021 sowohl in Deutschland als auch global sehr stark angestiegen. Ein Großteil des Anstiegs der Verbraucherpreise wurde in vielen europäischen Ländern, insbesondere nach dem russischen Angriffskrieg auf die Ukraine, durch Energiepreise getrieben. Im gleichen Zeitraum sind auch die Inflationserwartungen von Haushalten und Firmen stark gestiegen. Welche Rolle spielen Energiepreise in der Erwartungsbildung von Haushalten und Firmen? Extrapolieren ökonomischen Akteure ihre persönliche Erfahrung mit Energiepreisen auf die Makroökonomie? Reagieren Haushalte und Firmen unterschiedlich in ihrer Erwartungsbildung auf einen Anstieg in den Energiepreisen?

### Beitrag

In diesem Forschungspapier wird erstmals der Effekt von Energiepreiserhöhungen auf die Inflationserwartungen von Haushalten und Firmen in einem quasi-experimentellen Setup geschätzt. Die vorherige Literatur hat sich größtenteils auf andere saliente Preise, wie zum Beispiel Supermarktpreise oder Hauspreise fokussiert. Ich kombiniere monatliche Panelbefragungsdaten und einen Differenzen-in-Differenzen Ansatz, um den Effekt einer Preiserhöhung von anderen makroökonomischen Trends zu separieren. Ein weiterer Beitrag dieses Forschungspapiers ist der Vergleich der Erwartungsbildung von Haushalten und Firmen, wenn sie einen vergleichbaren Preisschock erleben.

### Ergebnisse

Die Ergebnisse des Forschungspapiers zeigen, dass die Inflationserwartungen von Haushalten, die einen Anstieg in ihren Elektrizitätspreis erleben, relativ zu den Inflationserwartungen von Haushalten, die noch keinen Anstieg erlebt haben, deutlich ansteigen. Dieses Resultat ist inkonsistent mit rationalen Erwartungen von voll informierten Haushalten und impliziert, dass Haushalte ihre persönliche Erfahrung auf die Makroökonomie extrapolieren. Der Effekt ist durch Haushalte mit niedrigem Einkommen, Haushalten, welche weniger gut über vergangene Inflation informiert sind und Haushalten, welche der EZB wenig vertrauen, getrieben. Haushalte, die ihre persönliche Erfahrung extrapolieren, machen größere Vorhersagefehler und weichen stärker von professionellen Vorhersagen ab. Im Gegensatz zu Haushalten verändern Firmen, deren Energiepreise gestiegen sind, ihre Inflationserwartungen nicht relativ zu anderen Firmen deren Energiepreise nicht gestiegen sind. Demnach bilden Entscheidungsträger in Firmen ihre Erwartungen ähnlich wie reichere Haushalte.

Deutsche Bundesbank Discussion Paper No 28/2023

# Energy Prices and Inflation Expectations: Evidence from Households and Firms*

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**Abstract**

I investigate how households and firms adjust their inflation expectations when experiencing an increase in their energy prices. I use monthly panel survey data in combination with a difference-in-difference approach to show that households increase their inflation expectations when they personally experience an increase in their electricity prices. This result is inconsistent with full-information rational expectations but can be rationalized by households extrapolating their personal experience. The effect is driven by low-income households, households who are uninformed about past inflation, and those not trusting the ECB. Due to households extrapolating, their inflation forecasts become less accurate and diverge more from professional forecasts. Contrary to households, firms do not extrapolate energy price increases to their inflation expectations. Thus, decision-makers in firms form their expectations similarly to high-income households.

**Keywords:** inflation expectations, households, firms, energy prices, extrapolation

**JEL classification:** D14, D22, D84, E31, Q41

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# 1 Introduction

Inflation has risen globally, including in Germany, since mid-2021 to levels unseen in decades. The increase in the overall CPI has largely been driven by rising energy prices in many European countries, especially in the wake of the Russian invasion of Ukraine (see, for example, Bunn et al. (2022)). At the same time, inflation expectations of firms and households have also trended upward. This raises concerns about price-wage spirals and a potential de-anchoring of inflation expectations (see, for example, Powell, 2022).

In this paper, I analyze how households and firms form their inflation expectations when they experience energy price changes at the micro-level. The existing literature has focused on aggregate shocks to energy prices, mainly oil prices (Coibion and Gorodnichenko, 2015). However, aggregate energy price changes are usually correlated with many other macroeconomic variables and as a result, identifying their unique impact is challenging. I use a different identification strategy to overcome this issue by focusing on energy price changes that do not occur simultaneously for everybody. More specifically, I exploit that the timing of price changes at the individual level depends on the tenure and duration of contracts households and firms have signed. Households and firms whose contracts have just ended will experience the impact of an aggregate price change immediately, whereas others will not experience the price change until their contract runs out. Therefore, I can compare households that experience a price change with households that have not experienced a price change yet in a difference-in-difference setup. In a world of full-information rational expectations, households and firms that experience a price change should not react differently from those that did not experience the price change since both are forming expectations for the overall economy. If there is a differential change between these two groups, agents are either not fully informed or not fully rational when forming their expectations.

For households, I elicit monthly information on whether and when they experienced an electricity price change. Using that information, households are grouped into a control group that did not experience a price change over the whole sample period and into a treatment group that did experience a price change at a certain point in time. This gives

rise to a difference-in-difference setup which I estimate with the imputation method by Borusyak et al. (2022) to account for potential heterogeneous treatment effects. I find that households do increase their inflation expectations differentially when they are faced with an electricity price increase. This experience effect is sizeable and particularly strong for large price increases, which have a lasting impact on inflation expectations. The effect is driven by households with low incomes and high electricity spending relative to their income. I also find stronger effects for uninformed households, proxied by an above-median perception error of past inflation, and those who have lower trust in the ECB. These results are consistent with uninformed households using their personal experience as a source for aggregate expectation formation. I show that the treatment and control group exhibit parallel trends in their inflation expectation before the price increase and that there is no evidence of selective recall inducing reverse causality. Similar to Kuchler and Zafar (2019), I find that there is no spillover on expectations of other variables, such as interest rate expectations, income expectations, or house price expectations.

For firms, I employ an analogous difference-in-difference strategy. The only difference is that firms are asked for price changes in any of their energy inputs (electricity, natural gas, oil, coal) instead of only their electricity price since the energy mix of firms is quite heterogeneous. Firms' own-price expectations do increase significantly when a firm is hit by a price increase as firms expect to shift some of the change in their input price to their own prices. They are also more likely to report problems with high production costs. However, there is no differential effect on the inflation expectations of firms. Importantly, this does not mean that firms' expectations change when market prices change, but rather that both affected and not (yet) affected firms change their expectations similarly. Therefore, firms' expectation formation appears consistent with full-information rational expectations. Thus, while there is evidence that firms extrapolate industry conditions (Andrade et al., 2022), they do not extrapolate firm-specific shocks to aggregate outcomes. This result holds even for sub-samples of particularly energy-intensive firms and sectors as well as firms of different sizes.

Comparing the results for households and firms shows that the former do extrap-

olate their personal experience, whereas firms do not extrapolate firm-specific shocks. Therefore, firms seem to have a more sophisticated expectation formation process than households. My results are consistent with households using their personal experience when forming expectations because they lack other sources of information as only uninformed households extrapolate their personal experience. This interpretation can also explain why firms react differently than households. Decision-makers within firms likely have higher incomes and are well-informed. Consequently, they form their expectations similarly to households who have high incomes and are well-informed. Last, I show that households extrapolating their personal experience makes their inflation forecasts less accurate and causes them to deviate further from professional forecasters.

I add to several strands of the literature. First, the paper contributes to the literature that explores how households form their inflation expectation. Regarding the role of energy prices, there are only a few correlational papers. Coibion and Gorodnichenko (2015) show that aggregate oil prices correlate strongly with US households' inflation expectations and attribute this to households paying disproportional attention to oil prices due to their high visibility. Aastveit et al. (2023) show similar results using a structural VAR model of the global oil market. In contrast, Binder (2018) and Kilian and Zhou (2022) argue that households do not overweight gas prices when forming their inflation expectations. In contrast to earlier papers, I do not rely on vector autoregressive models or a correlational approach. Instead, I adopt a quasi-experimental method, which can effectively control for other macroeconomic shocks that might be correlated with energy prices. Households' inflation expectations react strongly to a rise in their personal electricity price. While previous literature has emphasized the importance of goods that households frequently observe, such as supermarket prices (D'Acunto et al., 2021), I show that large shocks to energy prices also play a role. This result is consistent with Goldfayn-Frank and Wohlfart (2020), who show that a different large shock, the division of Germany, had a lasting impact on the inflation expectations of East Germans.

Second, I add to the literature on how households and firms form their inflation expectations more generally (see Weber et al. (2022) for an extensive literature review).

There is mounting evidence that households do not form their inflation expectations rationally incorporating all prices in the economy. For example, D'Acunto et al. (2021) show that frequency-weighted supermarket prices are a good predictor of households' inflation expectations. They argue that the frequency and visibility of prices matter more than their expenditure share. Cavallo et al. (2017) provide evidence via survey experiments that households have weak priors when inflation is low and value supermarket prices over official statistics when forming their expectations. Life experiences, such as experiencing periods of high inflation, also play an important role (Malmendier and Nagel, 2016). Furthermore, Kuchler and Zafar (2019) show that households also extrapolate local house prices to their expectations about national house prices. There is less work about decision-makers in firms extrapolating the experience. One exception is Andrade et al. (2022) who show that the dispersion in firm expectations is partly driven by industry conditions that firms extrapolate to their aggregate expectations. I add to this literature by highlighting that households extrapolate energy prices they personally experience. This behavior is consistent with households facing information constraints since the effect is driven by less-informed households. Importantly, extrapolation does lead households to form less accurate forecasts both in comparison to realized outcomes and professional forecasters.

Last, I also contribute to a recent literature that studies the differences in expectation formation between households and firms. Coibion et al. (2018) find that firms in New Zealand have similarly dispersed beliefs as households. In contrast, a number of other papers find that firms' expectations are less dispersed than those of households in the case of French (Savignac et al., 2021), US (Candia et al., 2021), and German firms (Link et al., 2023). Link et al. (2023) also show that firms update their expectations less than households when they are provided with an expert forecast. To the best of my knowledge, this paper is the first to compare the expectation formation of households and firms when facing an analogous real-world shock using the same empirical setting. Therefore, I can compare the formation of inflation expectations of households and firms directly. My results suggest that households extrapolate their personal experience to aggregate

inflation expectations whereas firms act more consistent with full-information rational expectations. My results also shed light on the reasons for the different expectation formation processes of households and firms. In particular, high-income, well-informed households update their expectations very similarly to firms. Thus, one reason for the average differences between the two groups could be that decision-makers in firms are better-informed and have higher incomes than the general population.

# 2 Data & Institutional Background

I employ two survey data sets in my analysis, the Bundesbank Online Panel Households (BOP-HH) and the Bundesbank Online Panel Firms (BOP-F). The advantage of these two data sets is that they are set up to have a high degree of comparability between them with respect to the framing of expectation questions (see de Bruin et al., 2012, for potential framing effects in the context of inflation expectations). This section describes both data sets and the questions I added to them in turn. The exact construction of all variables used can be found in Appendix Tables A.1 and A.2.

## 2.1 Bundesbank Online Panel: Households

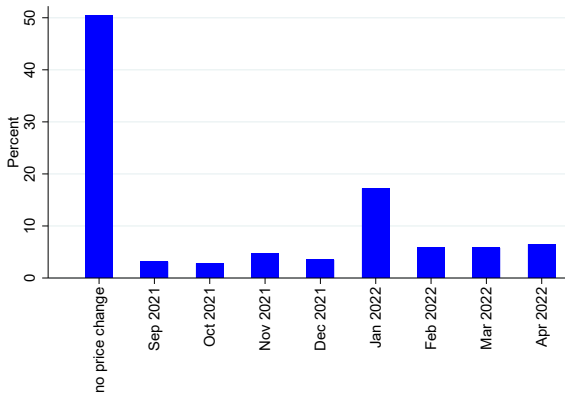
The BOP-HH is a monthly online survey representative of the German population, which use the internet. The survey's focus is on subjective expectations and perceptions of macroeconomic variables, particularly inflation rates.[1] It includes between 2000 and 5000 respondents per wave and follows a rotating panel structure, in which respondents are interviewed for three consecutive months and then take a three-month break before returning to the sample for another three months. After two years in the sample, households leave the panel and are no longer interviewed to reduce learning effects (Kim and Binder, 2023). This data structure allows tracking households over time and exploiting changes in their inflation expectations.

I added a number of supplementary questions to the April 2022 wave of the BOP-HH. The first question asks respondents whether and in which month they experienced an

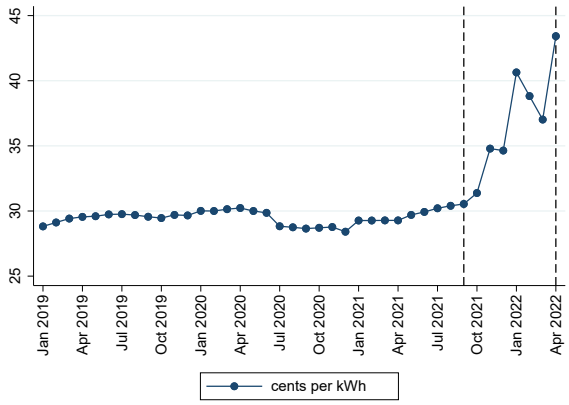
[1] See Beckmann and Schmidt (2020) for more details on the BOP-HH.

Figure 1: Price increases of households

(a) timing of price changes




(b) electricity prices




Source: BOP-HH, Verivox

electricity price change between September 2021 and March 2022. Asking this question retrospectively ensures that households are not primed to think about energy prices when they are asked for their inflation expectations in the prior survey waves. I did not ask for natural gas prices for heating due to the unique institutional features of natural gas contracts in Germany. These contracts are usually struck between the provider and the building owner. However, a large proportion of German households are renting and do not own houses (Kaas et al., 2021). Therefore, these households are not directly informed about price changes and can usually only observe all changes once a year in spring when the utility cost accounting (*Nebenkostenabrechnung*) is sent out. Furthermore, only about half of German households use natural gas for heating, further reducing the potential sample size.[2] I chose September 2021 as the start date of my sample since it coincides with a sharp increase in prices for new electricity contracts as data from Verivox, a large price comparison website, show (see Figure 1b). As Figure 1a shows, about 50% of households did not experience a price increase during these eight months. A likely reason is that they have long-term contracts with their electricity provider which temporarily shields them from price changes. These households will constitute the control group in my empirical analysis. The group of households experiencing a change will be my treatment

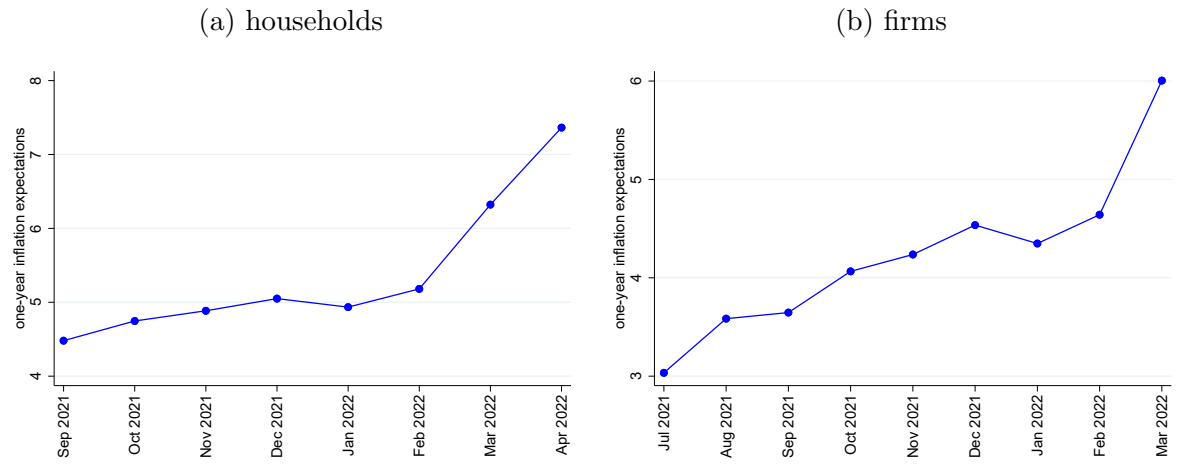
[2] See the annual report of the German Association of Energy and Water Industries (*Bundesverband der Energie- und Wasserwirtschaft*) at this link for more details.

group. Price changes are distributed relatively evenly over my sample period except for the spike in January 2022. The next question asks for the size and sign of the price change households experienced. All households that report a price decrease (3% of the sample) are dropped from the sample. The remaining households report an average price increase of 13%. I also elicit the reasons for the price increase. This helps me to identify households that changed providers deliberately themselves, in comparison to those that stayed with the same provider who increased their price. Only 7% of households switched providers deliberately, which are dropped in a robustness check. The last question asks households about their monthly electricity spending which I use to determine the share of households' income spent on electricity. I match these questions to the regular questions from all waves between September 2021 and April 2022. The exact wording of these questions and a translation are provided in Appendix C.1.

My main outcome variable is households' 1-year inflation expectation, which is elicited as a point estimate in every wave from all respondents. The question asks specifically about inflation (or deflation) over the next 12 months instead of prices following the New York Fed Survey of Consumer Expectations to avoid priming individuals to think about specific prices they can easily recall. As Figure 2a shows, individuals' 1-year inflation expectations rose from 4.5% to over 7% during the sample period. The BOP-HH data also contain other, less frequently asked, expectation variables. These include quantitative 5-year and 10-year inflation expectations, interest rate expectations, house price expectations, and income expectations. Furthermore, I use qualitative expectations for the unemployment rate, economic growth rate, the stock market, rents, and taxes. Respondents are asked whether they believe the respective variables will (strongly) decrease, stay the same, or (strongly) increase. All outcomes measured on categorical scales are transformed into z-scores using the respective sample mean and standard deviation.

Furthermore, I compute how accurately households perceive past inflation by calculating their average perception error of inflation in the last year. To that end, I take the absolute difference between their perception of inflation in the last year and the official inflation rate. I classify households as having a low inflation perception accu-

Figure 2: Inflation expectations over time




Notes: This figure plots the average one-year inflation expectation of households and firms at the monthly frequency in the sample.

racy if their average perception error is above the sample median. Similarly, I create a dummy for households having below-median trust in the ECB. Importantly, I only use inflation perceptions and trust in the ECB before households are treated because both are potentially endogenous variables. Last, the BOP-HH also collects demographic and economic variables including the respondents' gender, age, household size, marital status, education level, employment status, local labor market, net household income, and their liquid wealth. I only keep households that I observe for more than one wave in my final sample, which yields about 4300 unique households. In Appendix Table A.1, the source and construction of all household-level variables are detailed. Summary statistics for all variables at the household level can be found in Appendix Table A.3.

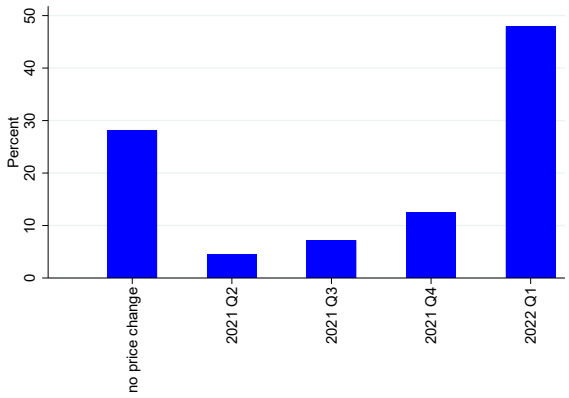
## 2.2 Bundesbank Online Panel: Firms

The BOP-F is a quarterly firm survey, which is representative of German firms along sectoral, size, and regional characteristics.[3] The median (average) firm has 11 (101) employees and a turnover of €0.40 million (€53.86 million). The survey covers firms from all sectors. About 17% are manufacturing firms, 13% are construction firms, 13% are retail firms, 51% are other service firms, and 6% are located in the remaining sectors (agriculture, forestry, mining, sewerage). A vast majority of the respondents, about 89%,

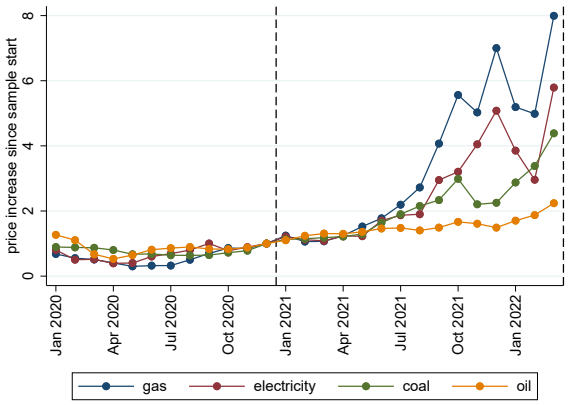
[3] See Boddin et al. (2022) for further details on the sampling and structure of the survey.

Figure 3: Price increases of firms

(a) timing of price changes




(b) energy prices




Source: BOP-F, ICE, SMARD, FRED Notes: The prices in panel (b) are all normalized to January 2021.

are either the owner, executive director, or a board member and thus have significant decision-making power within the firm. Each quarterly sample contains about 9000 firms and is split into three monthly waves, in which one-third of the firms are surveyed. The BOP-F follows a panel structure, such that each firm is surveyed every three months. The survey's focus is on subjective expectations and perceptions related to the business environment of the firm and macroeconomic variables. I added a number of supplementary questions to the waves in the second quarter of 2022, which are comparable to the questions I added to the BOP-HH. I ask whether and in which quarter the firm first experienced a significant change, defined as larger than 5%, in their energy input prices since the first quarter of 2021. Slightly less than 30% of firms do not report price changes during the sample period and thus form the control group. The share of firms experiencing a price change rises over time and peaks in the first quarter of 2022, coinciding with the price shocks related to the Russian invasion of Ukraine (see Figure 3a). This pattern tracks the development of market prices for natural gas, electricity, coal, and oil depicted in Figure 3b. The heterogeneity in the increase of different energy inputs constitutes another source of variation. The price of natural gas increased more than sixfold during my sampling period, whereas prices for electricity, coal, and oil only increased five-, four-, and twofold, respectively. I also ask firms for their energy mix, meaning the share of energy expenditures for each of these inputs. In my empirical analysis, I will

use this information in a robustness check to only compare firms with a similar energy mix. Next, firms are asked about the sign and magnitude of the price change. Similar to households, I drop firms that experienced a price decrease, which make up 4% of the sample. The average price increase firms experience over the sample period amounts to 36%. The exact wording of these questions and a translation are provided in Appendix C.2.

The main firm outcomes are their quantitative inflation and own-price expectations for the next twelve months. Both expectations are elicited as a point estimate in every wave from all firms. The question text is analogous to the BOP-HH question on inflation expectations ensuring their comparability. As Figure 2b shows, firms' 1-year inflation expectations doubled from three to six percent during the sample period. I use firms' own-price expectations to test how much of the energy price increase firms expect to shift onto their own prices. I also test whether firms were hit with a different confounding shock at the same time. To that end, I exploit a battery of qualitative questions regarding potential problems the firms could face. In particular, they are asked on a scale from 1 (no problem at all) to 5 (very serious problem) about the following issues: production costs, availability of personnel, regulations, Covid-19 restrictions, customer demand, competitive pressures, credit supply, or supply chain disruptions. I also test whether other firm expectations were affected by the price shock. These include quantitative interest rate expectations and qualitative expectations about firms' access to supply chains, short-term claims and liabilities, liquidity, credit demand and supply, and inventory. As with households, all outcomes measured on categorical scales are transformed into z-scores using the respective sample mean and standard deviation.

Additionally, I use further information from the regular BOP-F waves in the heterogeneity analysis. Firms with 50 or fewer employees are classified as small firms. Furthermore, I use the information on the percentage share of firms' energy cost in their total costs to classify firms into below- and above-median energy-intensive firms. Last, I only keep firms that I observe for more than one wave in my final sample, which yields about 5900 unique firms. In Appendix Table A.2, the source and construction of all firm-level

variables are detailed. Summary statistics for all variables at the firm level can be found in Appendix Table A.4.

# 3 Empirical strategy

In this section, I describe my empirical strategy to identify the effect of experiencing an energy price increase. I employ very similar strategies for households and firms which I describe in turn. For both strategies, the identifying variation comes from a comparison over time of households or firms that have already experienced a price increase to households or firms that have not experienced a price increase yet. Importantly, I control for aggregate time trends in both specifications such that I only compare households or firms at the same point in time. This ensures that both the macroeconomic environment, for example, aggregate inflation and growth, is the same for units in the treatment and control group. Therefore, the only differential change over time between treatment and control units is having experienced an actual energy price increase. For households, I estimate the following equation:

$$y_{it} = \alpha_i + \gamma_t + \beta Treat_i \cdot Post_{it} + \varepsilon_{it} \tag{1}$$

where $y_{it}$ is the outcome of household $i$ in month $t$, $\alpha_i$ represent household fixed effects, controlling for all time-invariant household characteristics, $\gamma_t$ are month fixed effects, and $\varepsilon_{it}$ is the error term clustered at the household level. $Treat_i$ is a dummy taking the value one if household $i$ experienced a price increase over my sample period and $Post_{it}$ is a dummy taking the value one after the price increase of household $i$. Then, the coefficient $\beta$ identifies the causal effect of an electricity price increase for households. My estimation equation on the firm level is displayed below:

$$y_{it} = \alpha_i + \gamma_{st} + \delta_{et} + \beta Treat_i \cdot Post_{it} + \varepsilon_{it} \tag{2}$$

where $y_{it}$ is the outcome of firm $i$ in month $t$, $\alpha_i$ are firm fixed effects, which control for all time-invariant firm characteristics, $\gamma_{st}$ are 1-digit NACE sector x month fixed effects, which control for all sector-specific shocks, and $\varepsilon_{it}$ is the error term which I cluster at the firm level. $\delta_{et}$ are the energy expenditure shares of all energy inputs $e \in E = \{\text{oil, natural gas, coal, electricity}\}$ separately interacted with month fixed effects. These fixed effects ensure that only firms with a similar energy input mix are compared to each other. Similar to above, $Treat_i$ is a dummy equaling one if firm $i$ experienced a price increase during the sample period and $Post_{it}$ is a dummy taking the value one after the price increase of firm $i$. Again, $\beta$ identifies the causal effect of an energy price increase for firms.

There is a recent literature showing that difference-in-difference setups that exploit differential treatment timing can be biased by treatment effect heterogeneity (Goodman-Bacon, 2021; Borusyak et al., 2022). Therefore, I employ the imputation estimator developed by Borusyak et al. (2022) which consistently identifies the treatment effect even in the presence of treatment effect heterogeneity. The estimation follows a three-step procedure. First, one estimates all fixed effects, i.e. $\{\alpha_i, \gamma_t\}$ for households and $\{\alpha_i, \gamma_{st}, \delta_{et}\}$ for firms, on the sample of untreated and not-yet-treated units ($Treat_i \cdot Post_{it} = 0$). Second, I impute the estimated fixed effects for the treated units, that is when $Treat_i \cdot Post_{it} = 1$. Third, I compute the difference between the actual outcomes for the treated units and their implied counterfactual obtained through the imputation procedure and take the overall average to get the average treatment effect. I also take the average at different points in time relative to treatment such that I can identify dynamic effects.[4] As a robustness check, I also show the results of a standard two-way fixed effect estimation. Furthermore, I replace $Treat_i$ with $Treat_i \cdot PriceIncrease_i$, the product of being treated, and the stated increase in the price, to estimate how much a 100% price increase contributes to inflation expectations.

The identifying assumption of my empirical strategy is parallel trends between the treatment and control units. That is, if a household had not experienced a price increase,

[4] Since each individual firm is sampled every three months, I identify the effects for firms at the quarterly frequency.

Table 1: Effect of electricity price increase on households' inflation expectations

| | (1) 1-year inflation expectation | (2) 1-year inflation expectation | (3) 1-year inflation expectation | (4) 1-year inflation expectation |
|---|---|---|---|---|
| price increase x post | 0.186*** | 0.186*** | | |
| | (0.072) | (0.069) | | |
| 100% price increase x post | | | 1.438*** | |
| | | | (0.438) | |
| below-median price increase x post | | | | 0.013 |
| | | | | (0.084) |
| above-median price increase x post | | | | 0.379*** |
| | | | | (0.107) |
| estimator | BJS | TWFE | TWFE | BJS |
| household FE | yes | yes | yes | yes |
| month FE | yes | yes | yes | yes |
| mean | 5.532 | 5.518 | 5.485 | 5.532 |
| N | 13575 | 14382 | 14116 | 13565 |
| # cluster | 3860 | 4192 | 4112 | 3860 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the household level are in parenthesis. The regression results are based on estimating equation (1) using either the imputation method by Borusyak et al. (2022) (BJS) or a standard two-way fixed model (TWFE).

its inflation expectation would have changed similarly to a household that has not experienced a price increase yet. I test this assumption with the placebo test suggested by Borusyak et al. (2022), which is run on the sample of non-treated units and estimates a placebo trend before treatment. The pre-trend coefficients are normalized to the period directly preceding treatment.

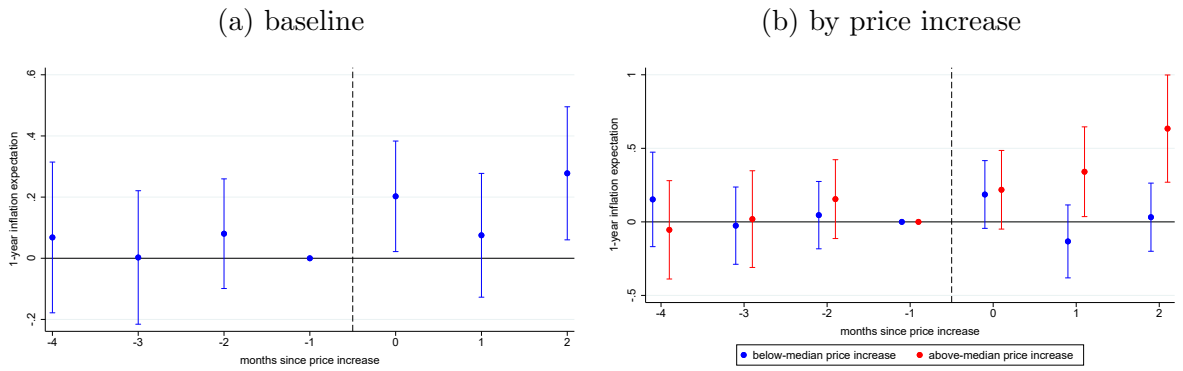
# 4 Results

This section presents the results for both households and firms in turn. Furthermore, I discuss possible threats to identification and present a number of robustness tests. Last, I compare the results for households and firms and discuss their interpretation.

## 4.1 Household Expectations

Table 1 presents the baseline results of estimating equation (1). Households increase their inflation expectations by 0.186 percentage points ($p < 0.01$) after they personally experience a price increase compared to other households that have not experienced a price increase yet. The point estimate is virtually the same when using a standard difference-in-difference estimator (see column (2) of Table 1). To put this estimate in perspective, when scaling the treatment dummy with the price increase, a 100% price increase causes

Figure 4: Event study of electricity price increases on households' inflation expectations

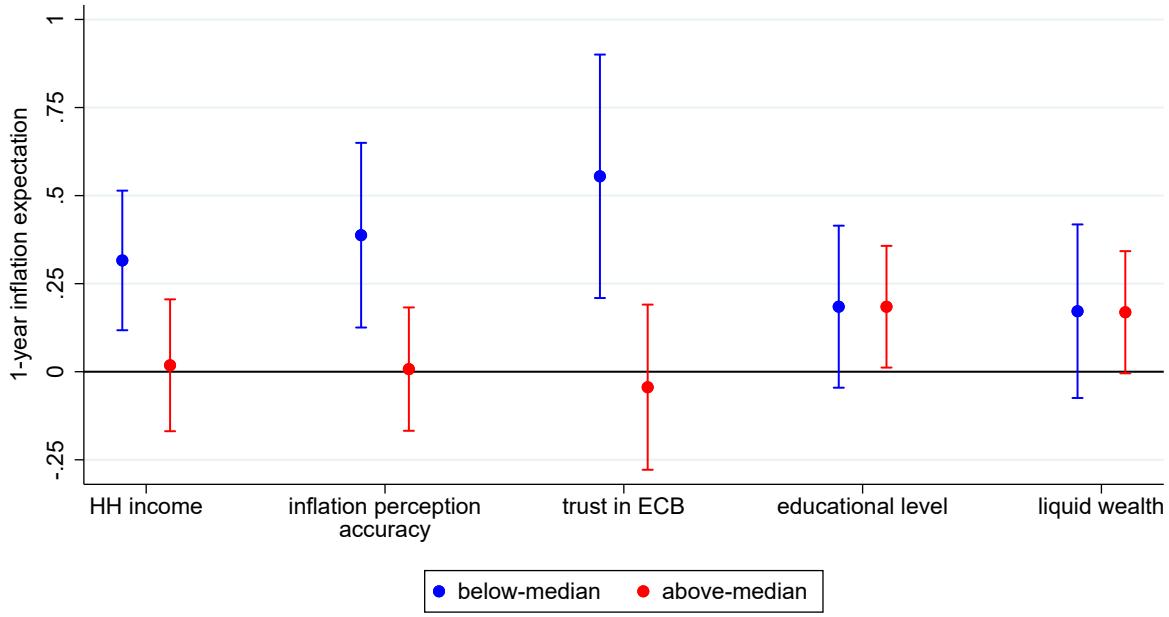



Notes: Panel (a) of this figure plots point estimates and 95% confidence bands from estimating a dynamic version of equation (1) using the imputation method by Borusyak et al. (2022). Panel (b) of this figure plots point estimates and 95% confidence bands from estimating a dynamic version of equation (1), keeping only below or above median price increases in the sample, using the imputation method by Borusyak et al. (2022). The pre-trends are re-normalized to the month before treatment happens.

inflation expectations to rise by 1.438 percentage points. In column (4), the sample is limited to households experiencing either a below- or above-median price increase, respectively. The results are clearly driven by large price increases, which lead to a statistically significant increase in inflation expectations of 0.371. In contrast, small price increases do not have a statistically significant effect. These results are inconsistent with models of full-information rational expectations since both households that are subject to the price increase and those who are not in theory have the same information set. One implication of this result is that households are not perfectly informed about aggregate electricity prices and extrapolate their personal experience to macroeconomic variables.

Next, I inspect the dynamics of inflation expectations before and after a price increase to test the parallel trends assumption. Figure 4a shows that in the months preceding a price increase, the treatment and control group exhibited similar trends in inflation expectations. In the month of the price increase, there is an immediate increase in inflation expectations, which is muted one month after and becomes larger and significant three months afterward. The somewhat surprising pattern can be explained if one considers small and large price increases separately. As Figure 4b shows, it is driven by small price increases which only have an effect in the month of the price increase and then revert back to zero. Contrary to that, large price increases lead to a persistent increase in inflation expectations. This temporal pattern strongly suggests that large electricity price increases cause the higher inflation expectations of households. However, one potential

Figure 5: Effect of electricity price increase on households' inflation expectations: heterogeneous effects

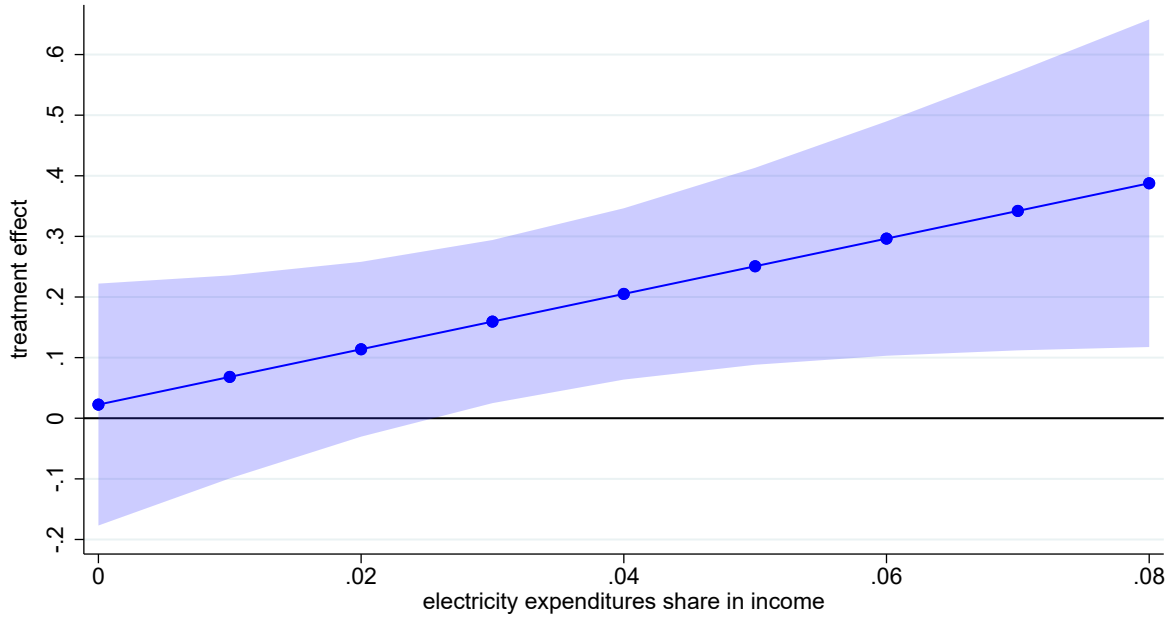



Notes: This figure plots point estimates and 95% confidence bands from estimating equation (1) using the imputation method by Borusyak et al. (2022) on different sub-samples. The groups are always divided at the median value. For education, respondents with a higher education entrance qualification (*Fachhochschule* or *Abitur*) are classified as above the median. Inflation perception accuracy and trust in the ECB are only measured before the treatment occurs. The point estimates are displayed in Appendix Table B.3.

threat to this interpretation arises from the possibility of reverse causality as households are asked to recall whether and when the price increase happened. This could potentially cause only households with high inflation expectations to recall the price increase causing a selection effect. I test for this possibility by regressing the eventual treatment status, i.e. a dummy for eventually experiencing a price increase, on inflation expectations prior to treatment. If households with high inflation expectations select into treatment, their prior inflation expectations should predict the treatment status. As Appendix Table B.1 shows, prior inflation expectations, as well as other prior expectations, such as house price, interest rate, or income expectations, and a host of demographic variables, cannot predict the treatment status.

I conduct a number of additional robustness checks to ensure the validity of the baseline results. First, I drop all households that stated that their price increase was due to them switching their provider. Second, I use Huber regressions as an alternative way to control for outliers. Third, I drop households that interrupted the survey to account for them potentially not paying sufficient attention to the survey. Fourth, I include fine-

Figure 6: Effect of electricity price increase on households' inflation expectations by spending on electricity




Notes: This figure plots point estimates and 95% confidence bands from estimating equation (1) interacted with the share of income spent on electricity.

grained local labor market x month fixed effects to account for differential regional trends in electricity prices as well as other economic decisions.[5] Last, I account for a number of potentially time-varying demographic control variables, including dummies for marital status, household size, age, and a number of time-varying income control variables, including dummies for full-time employment, part-time employment, unemployment, retirement, as well as six household income dummies. As Appendix Table B.2 shows, none of these tests change the results discussed above. To investigate which groups show a disproportionately large response to energy prices, I conduct a heterogeneity analysis along several dimensions (see Figure 5). First, splitting households at the median household income into low- and high-income groups shows that the effect is almost entirely driven by low-income households, whereas high-income households show no response. This result is consistent with households putting more weight on their personal experience if electricity expenses matter to them financially. Indeed, low-income households spend a significantly higher share of their income on electricity and those who spend a higher share of their

[5] In the sample, 221 of the 223 local labor markets in Germany are represented.

Table 2: Effect of energy price increase on firms' own-price and inflation expectations

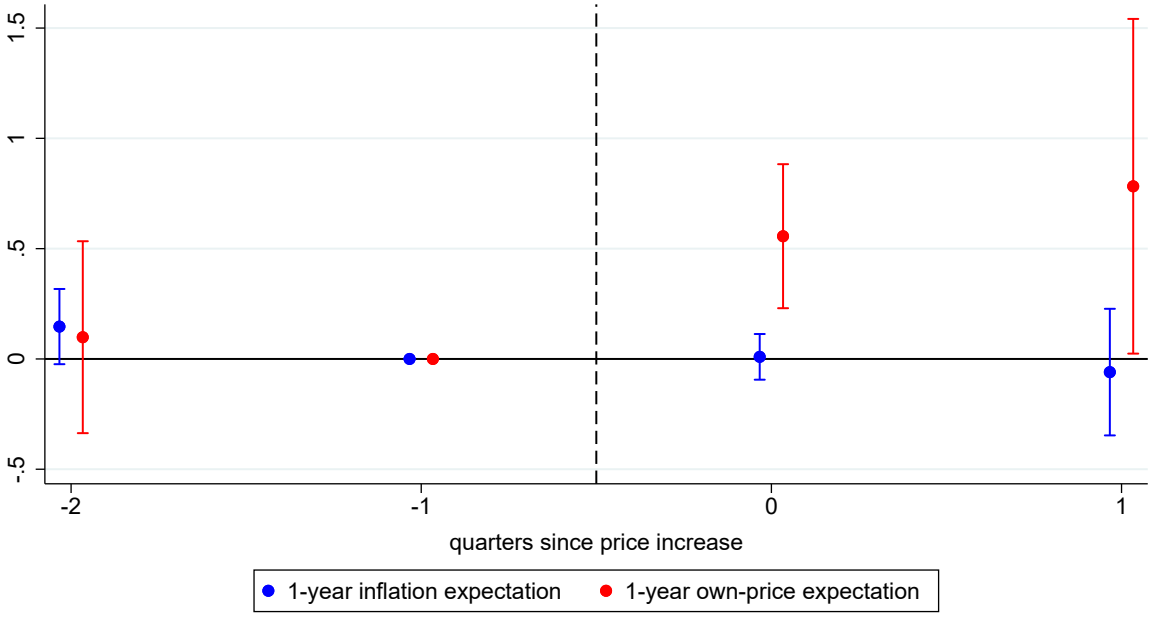
| | (1) 1-year own-price expectation | (2) 1-year own-price expectation | (3) 1-year own-price expectation | (4) 1-year inflation expectation | (5) 1-year inflation expectation | (6) 1-year inflation expectation |
|---|---|---|---|---|---|---|
| price increase x post | 0.585*** | 0.483*** | 0.410** | 0.004 | 0.012 | 0.006 |
| | (0.171) | (0.177) | (0.192) | (0.053) | (0.055) | (0.058) |
| firm FE | yes | yes | yes | yes | yes | yes |
| month FE | yes | | | yes | | |
| sector x month FE | | yes | yes | | yes | yes |
| energy share x month FE | | | yes | | | yes |
| mean | 5.662 | 5.620 | 5.708 | 4.324 | 4.314 | 4.327 |
| N | 10613 | 10169 | 9534 | 8402 | 8042 | 7530 |
| # cluster | 4619 | 4444 | 4148 | 4124 | 3959 | 3690 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the firm level are in parenthesis. The regression results are based on estimating equation (2) using the imputation method by Borusyak et al. (2022).

income on electricity react more strongly to the price increase (see Figure 6). Therefore, it seems likely that price increases are more salient for low-income households. I also do find evidence that households react differently based on how informed they are about past inflation and how much they trust the ECB. More specifically, the effect is driven by households that have a less accurate perception of past inflation and have low trust in the ECB (see Figure 5). These results are consistent with households using their personal experience to forecast future inflation because they are less informed and do not trust the forecasts provided by the ECB. In contrast, there is no evidence that households with a higher level of education are driving the effect. Respondents with varying education levels, those with and without a higher education entrance qualification, show virtually the same response. The same holds for households with below- and above-median levels of liquid wealth. Thus, liquidity constraints are also an unlikely explanation for the heterogeneity by income.

I also test whether an increase in electricity prices has an effect on long-term inflation expectations and other economic expectations. Appendix Table B.4 shows that the coefficients for the 5-year and 10-year inflation expectations are positive, but not statistically significant. Moreover, I do not find evidence of an effect on households' quantitative expectations of interest rates, house prices, or income. Last, I test for changes in qualitative expectations. There is no effect on expectations of the aggregate growth rate, the stock market, the unemployment rate, rents, or tax rates (see Appendix Table B.4).

Figure 7: Effect of energy price increase on firm expectations




Notes: This figure plots point estimates and 95% confidence bands from estimating a dynamic version of equation (2) using the imputation method by Borusyak et al. (2022). The pre-trends are normalized to the quarter before treatment happens.

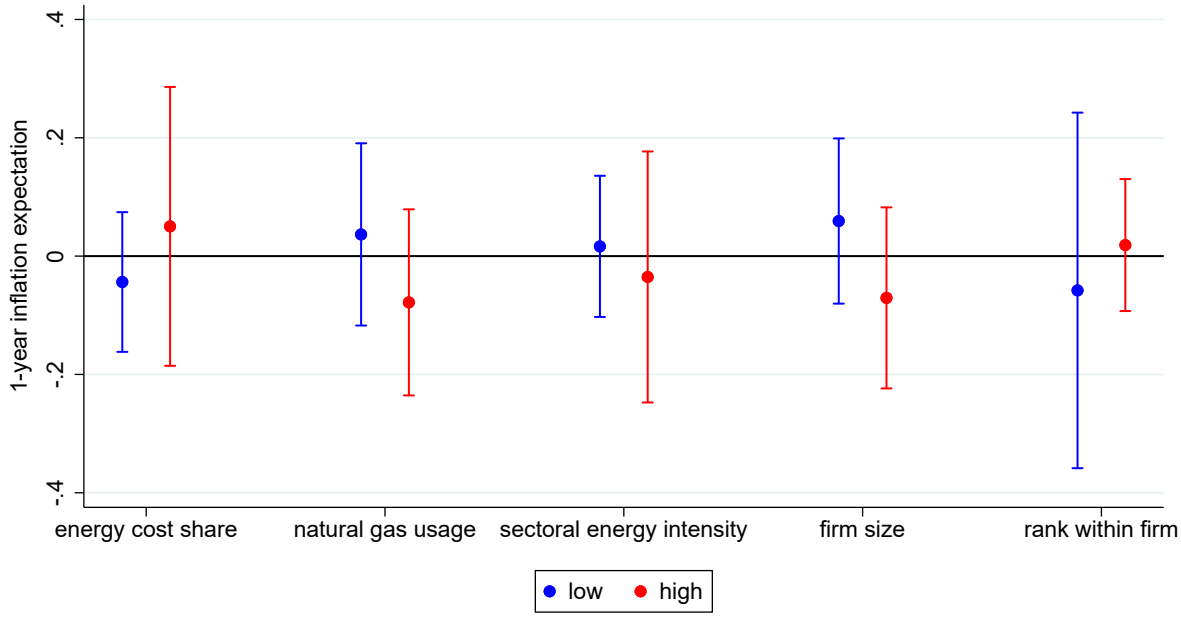
## 4.2 Firm Expectations

In this section, I turn to the results on firm expectations. As a first step, I test whether firms expect to shift some of the increase in their energy input prices into their own prices. As Table 2 shows, firms expect to increase their own prices by 0.59 percentage points ($p < 0.01$) in response to a firm-specific energy price increase.[6] It holds even when including sector x month and energy expenditure share x month fixed effects such that the remaining identifying variation stems from the differential timing of energy contracts running out. This result demonstrates the energy price increase constitutes a sizeable cost shock that is large enough to impact pricing decisions. Importantly, this is only a partial-equilibrium medium-term result and can not be easily used to quantify the pass-through of energy price shocks on price plans.[7] In contrast to their own prices, firms that experience an energy price shock do not differentially adjust their inflation

[6] Relatedly, Dörrenberg et al. (2023) show that German firms also update their own price plans when they are informed about general energy price developments.

[7] For example, if all firms were price-takers and thus change their prices simultaneously irrespective of their treatment status, the difference-in-difference approach would not pick this general equilibrium effect up. Also, it measures the price plans only for six months after the shock which means that firms that are not flexible price setters might react even later than that.

Figure 8: Effect of energy price increase on firms' inflation expectations: heterogeneous effects




Notes: This figure plots point estimates and 95% confidence bands from estimating equation (2) using the imputation method by Borusyak et al. (2022) on different sub-samples. Firms are split with respect to the energy cost share and natural gas expenditure share at the sample median. Manufacturing & mining firms are classified as sectors with high energy intensity, and firms with 50 or fewer employees are classified as small firms. Respondents are classified as having a high position within the firm when they are either on the board, the executive director, or the owner of the firm. The point estimates are displayed in Appendix Table B.8.

expectations for the whole economy. The point estimate is quite small and consistent across all specifications. Importantly, this result does not mean that firms do not adjust their inflation expectations to overall energy market prices. In contrast, both firms that experienced a price shock and those that did not change their expectations similarly. This result is in stark contrast to the average reaction of households and consistent with firms having full-information rational expectations. The fact that firms adjust their own and aggregate expectations differentially shows that they are not extrapolating firm-specific shocks to the overall economy. This result complements the findings of Andrade et al. (2022) who show that French firms do extrapolate industry conditions to the aggregate level.

As a robustness check, I test whether the energy price increase is confounded by other potential shocks at the firm level. In Appendix Table B.5, I show that firms hit being an energy price increase do not differently state having problems with the availability of personnel, regulations, corona restrictions, customer demand, competitive pressures,

credit supply, or supply chains. However, as expected, I find that there is a 0.061 standard deviation increase in firms reporting problems with production costs. This implies that there was no other firm-level shock correlated with the price shock. Furthermore, as Appendix Table B.6 shows, restricting the sample to either small or large price increases, using a standard two-way fixed effects estimator, or a continuous treatment variable does not yield significant results either. I test the parallel trends assumption underlying my difference-in-difference setup by conducting placebo tests and estimating dynamic effects. Figure 7 demonstrates that treatment and control firms were on similar trends before the price increase both in terms of their own-price and inflation expectations. Only after the price increase, own-price expectations jump upwards and stay higher for two quarters afterward. I also test whether the price shock had an effect on other expectations of firms. As Appendix Table B.7 shows, I cannot detect an effect on other firm expectations about macroeconomic variables, such as, for example, interest rate expectations. Interestingly, firms do report 0.071 standard deviations lower liquidity expectations following the energy price increase which suggests that they expect to be negatively impacted by the price shock.[8]

Next, I test whether there is any subset of firms that do adjust their inflation expectations. One might suspect that firms would react differently to the price increase depending on their energy intensity. I use several proxies to test this hypothesis. First, I use the energy cost share to split firms at the median into low- and high-energy-intensive firms. Second, I distinguish between firms with a lower and higher dependency on natural gas by splitting them at the sample median of the share of energy expenditure that have in natural gas. Third, I classify all firms operating in manufacturing or mining sectors as energy-intensive. For all of these measures, I do not find a difference between more or less energy-intensive firms (see Figure 8). I also test whether there is a group of firms that is less sophisticated and might be closer in behavior to households. To this end, I classify firms with 50 or fewer employees as small firms. Moreover, I use information about the respondent's rank within the firm and differentiate between owners, executive directors,

[8] Appendix Figure B.1 shows that firms were on parallel trends with respect to their liquidity expectations prior to the energy price shock.

or board members and other lower-ranking positions. As Figure 8 shows, I cannot detect a significant difference between any of these groups. This lack of heterogeneity between more and less sophisticated groups of firms is consistent with Link et al. (2023) showing that the expectations of firms informed and uninformed firms are not very different.

## 4.3 Discussion

The results presented in Sections 4.1 and 4.2 show that households and firms form their inflation expectations differently when they face a similar real-world shock, namely an energy price increase. Households adjust their inflation expectations upwards, whereas firms do not extrapolate firm-specific shocks to the overall economy. One reason why households would use their personal experience when forming expectations is that they lack other sources of information. This interpretation is consistent with the heterogeneity analysis presented in Figure 5. Informed households, proxied by their knowledge about past inflation, do not extrapolate their personal experience, whereas uninformed households do extrapolate their personal experience. A similar result also holds for high-income households, who tend to be better informed than low-income households. This heterogeneity also provides an explanation for the differential response from households and firms. The decision-makers within firms who respond to the survey are likely disproportionally rich and well-informed when compared to the general public. Therefore, they respond similarly to households who have high incomes and are well-informed. This result is consistent with the findings of Link et al. (2023) who show that the expectations of well-informed households, proxied by cognitive skill, age, and financial wealth, are very similar to those of firms. Given that less-informed households seem to rely on their experience to form their expectations, the question remains whether their personal experience contains valuable information. Are households improving their expectation accuracy through the use of personal experience? To answer this question, I compare households' expectations to both realized future outcomes and the expectations of professional forecasters at the same time. More specifically, I compute both the absolute difference between the 1-year inflation expectations of households and realized CPI inflation over the same time period.

Table 3: Effect of energy price increase on households' forecast errors and deviations from professionals

| | (1) absolute forecast error | (2) absolute forecast error: personal inflation | (3) absolute difference to professional forecasters |
|---|---|---|---|
| price increase x post | 0.058** | 0.060** | 0.059** |
| | (0.029) | (0.027) | (0.025) |
| household FE | yes | yes | yes |
| month FE | yes | yes | yes |
| z-score | yes | yes | yes |
| mean | 0.000 | 0.000 | 0.000 |
| N | 13575 | 13175 | 13575 |
| # cluster | 3860 | 3703 | 3860 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the household level are in parenthesis. The regression results are based on estimating equation (1) using the imputation method by Borusyak et al. (2022). Z-scores are computed by subtracting the sample mean and dividing by the standard deviation.

To test whether households are misunderstanding aggregate inflation for their personal inflation experience, I also compute a personalized inflation measure (Weber et al., 2023; Dietrich et al., 2022). To that end, I use spending questions on eight broad spending categories to construct individual spending weights which I multiply with the corresponding CPI subcategories.[9] Aggregating over all categories yields a measure of personal inflation as an alternative benchmark for households' inflation expectations.[10] As a measure of professional forecasts, I rely on the data from Consensus Economics, a company that regularly conducts a survey of experts from banks, investment firms, and economic think tanks asking them for their forecast of macroeconomic variables, including inflation and GDP. I use the so-called consensus forecast of 1-year ahead inflation for German, which is the mean of all expert forecasts at the time. To determine how far off households were from professional forecasters, I determine the absolute difference between households' 1-year inflation expectations and the consensus forecast. To make the different forecast errors and forecast differences comparable, they are transformed into z-scores. As Table 3 shows, households' forecast errors increase by 0.058 standard deviations when they are hit by an energy price shock. Given that the energy price increase leads households to increase their inflation expectations, this implies that they become too pessimistic about future inflation. This increase in the forecast error is not driven by households confus-

[9] See Appendix Table A.1 for a more detailed description of how personal inflation is constructed.

[10] The absolute production error of aggregate inflation explains about 78% of the variation in the absolute forecast error of personal inflation.

ing aggregate inflation with their personal inflation as forecast errors increase similarly when one compares households' expectations to their personally realized inflation. Last, households are not only making larger mistakes when compared to ex-post realized data but also when compared to ex-ante forecasts by professionals. When comparing their forecasts to the consensus forecast, there is also an increase in their absolute difference of 0.059 standard deviations.[11]

Thus, households are not only getting less accurate in their forecasts when compared to realized outcomes but are also deviating more from the forecasts of professional forecasters. Therefore, it seems like households extrapolating their personal experience are not incorporating the new information in a way that improves their forecasts. In contrast, firms' forecast errors and forecast differences to professionals are unaffected by energy price increases as one would expect since they did not adjust the expectations on average (see Appendix Table B.10).

# 5 Conclusion

In this paper, I investigate how households and firms form their inflation expectations when experiencing an increase in their energy prices. Using a novel approach, I combine monthly survey data with a difference-in-difference setup to control for aggregate trends and only exploit the differential timing of energy price shocks. I show that households increase their inflation expectations significantly when they experience an increase in their electricity prices, compared to households that have not experienced a price increase yet. This result is inconsistent with full-information rational expectations but can be rationalized by households extrapolating energy prices to the aggregate level. Consistent with models featuring information frictions, the effect is driven by households who are less informed about inflation. Moreover, by extrapolating households' expectations diverge more from realizations as well as expert forecasts.

Contrary to households, firms do not adjust their inflation expectations differentially

[11] All results are robust using to using the squared difference which puts more weight on large deviations than the absolute difference (see Appendix Table B.9).

when being hit by energy price increases. However, firms do increase their own-price expectations significantly as one would expect. This implies that firms can differentiate between firm-level shocks and aggregate shocks and do not simply extrapolate idiosyncratic firm-specific shocks to the aggregate economy. This result holds even for sub-samples of small and large firms as well as for firms that are more or less energy-intensive. In contrast, there are groups of households that act quite similar to firms. In particular, well-informed and high-income households also do not extrapolate their personal experience. Therefore, one potential reason for the differences between households and firms is that decision-makers in firms are more likely to be well-informed and have incomes than the general population. My results have important implications for modeling choices in macroeconomics. In particular, they suggest modeling varying degrees of information frictions with households facing more frictions than firms. This implies that households take longer to incorporate new information and adjust more slowly to macroeconomic or policy shocks.

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# A Data, Sources, and Summary Statistics

Table A.1: Definition of variables and data sources: households

| | description | source |
|---|---|---|
| 1-year inflation expectation | Point estimate of the 1-year inflation rate expectation trimmed at the 2nd and 98th percentile to account for outliers. | BOP-HH waves 21 - 28 |
| 5-year inflation expectation | Point estimate of the 5-year inflation rate expectation trimmed at the 2nd and 98th percentile to account for outliers. Every wave only half the sample is asked the question. | BOP-HH waves 21 - 28 |
| 10-year inflation expectation | Point estimate of the 10-year inflation rate expectation trimmed at the 2nd and 98th percentile to account for outliers. Every wave only half the sample is asked the question. | BOP-HH waves 21 - 28 |
| 1-year interest rate expectation | Point estimate of the 1-year expectation of the average interest rate on savings accounts trimmed at the 2nd and 98th percentile to account for outliers. | BOP-HH waves 21 - 23; 26 - 28 |
| 1-year house price expectation | Point estimate of the 1-year expectation of the percent change in house prices trimmed at the 2nd and 98th percentile to account for outliers. | BOP-HH waves 21 - 28 |
| 1-year house price expectation | Point estimate of the 1-year expectation of the percent change in house prices trimmed at the 2nd and 98th percentile to account for outliers. | BOP-HH waves 21 - 28 |
| 1-year income expectation | Probabilistic forecast of households' own net income over the next year. The intervals are [< -2000€], (-2000€, -1500€], (-1500€, -1000€], (-1000€, -500€], (-500€, -250€], (-250€, 0€] (0€, 250€], (250€, 500€], (500€, 1000€], (1000€, 1500€], (1500€, 2000€], and [> 2000€]. To calculate the average income expectation, the probability-weighted average is calculated by imputing the midpoint of each interval and assigning the endpoints for the open intervals. | BOP-HH waves 21 - 28 |
| macroeconomic expectations | Households are asked for a qualitative forecast of the German unemployment rate, growth rate, stock market index (DAX), their local rents, or the level of taxation over the next year. The possible answers are 1 (strongly decrease), 2 (decrease), 3 (stay the same), 4 (increase), and 5 (strongly increase). The variables are transformed into a z-score by subtracting the mean and dividing them by their standard deviation. | BOP-HH waves 21 - 28 |
| absolute and squared forecast error | Absolute (squared) difference between households' 1-year inflation expectations and realized German CPI inflation over the same time period. The variables are transformed into a z-score by subtracting the mean and dividing them by their standard deviation. | BOP-HH waves 21 - 28; Federal Statistical Office |
| absolute and squared forecast error: personal inflation | Absolute (squared) difference between households' 1-year inflation expectations and personal realized CPI inflation over the same time period. Personal inflation is calculated as the weighted sum of spending shares and the corresponding CPI subcomponents. The spending shares are calculated as the average share of spending on durable goods, food & drinks, clothes & shoes, leisure, mobility, services, vacations, or housing in total spending over the sample period. The variables are transformed into a z-score by subtracting the mean and dividing them by their standard deviation. | BOP-HH waves 21 - 28; Federal Statistical Office |

*continued*

*Table A.1 continued*

| | description | source |
|---|---|---|
| absolute and squared difference to professional forecasters | Absolute (squared) difference between households' 1-year inflation expectations and professionals' consensus estimate of 1-year inflation expectations at the same point in time. The professional forecast is taken from the quarterly report of Consensus Economics, a private firm, which calculates the average expert forecast of large financial firms. In order to have monthly estimates, I interpolate the forecast for the missing months. The variables are transformed into a z-score by subtracting the mean and dividing them by their standard deviation. | BOP-HH waves 21 - 28; Consensus Economics |
| inflation perception error | Every quarter households are asked for a point estimate of their perception of the official inflation rate over the last 12 months. The variable is trimmed at the 2nd and 98th percentile and then the absolute difference with the official inflation rate over the last 12 months is taken. Last, the variable is averaged for each household before they are treated. | BOP-HH waves 21 - 28; Federal Statistical Office |
| trust in the ECB | In wave 22 of the BOP-HH, households were asked how much they trust that the ECB will fulfill its mandate of price stability. Answers range from 0 (no trust at all) to 10 (full trust). The variable is set missing for all households that were already treated in wave 22. | BOP-HH wave 22 |
| household income | Net household income is elicited in the intervals [0, 500€), [500€, 1000€), [1000€, 1500€), [1500€, 2000€), [2000€, 2500€), [2500€, 3000€), [3000€, 3500€), [3500€, 4000€), [4000€, 5000€), [5000€, 6000€), and [6000€, .). Household income is determined by imputing the midpoint of each interval and assigning the endpoints to the open intervals. | BOP-HH waves 21 - 28 |
| household liquid wealth | Household liquid wealth is calculated as the sum of bank deposits and securities. All asset values are elicited in the intervals [0, 2500€), [2500€, 5000€), [5000€, 10000€), [10000€, 25000€), [25000€, 50000€), [50000€, 100000€), [100000€, 250000€), [250000€, 500000€), and [500000€, .). Their value is determined by imputing the midpoint of each interval and assigning the endpoints to the open intervals. Asset values are only elicited when individuals join the sample and thus are not time-varying. | BOP-HH waves 23 - 28 |
| share of electricity expenditures in net income | Estimate of average monthly expenditure on electricity divided by household net income trimmed at the 98th percentile to account for outliers. | BOP-HH wave 28 |
| female | Dummy that equals one if the respondent is female | BOP-HH waves 21 - 28 |
| age | Age of the respondent | BOP-HH waves 21 - 28 |
| East Germany | Dummy that equals one if the respondent currently lives in East Germany | BOP-HH waves 21 - 28 |
| household size | Number of household members | BOP-HH waves 21 - 28 |
| married | Dummy that equals one if the respondent is either married or cohabiting. | BOP-HH waves 21 - 28 |
| educational level | Dummies that equal one if the respondent either has no degree, a secondary school degree (*Hauptschule*), an intermediate secondary school degree (*Realschule*), a technical school degree (*Fachhochschule*), or a high school degree (*Abitur*). | BOP-HH waves 21 - 28 |
| employment status | Dummies that equal one if the respondent either is working full-time, is working part-time, is unemployed, is retired, or has some other employment status (mini-job, internship, federal voluntary service year, maternity/paternity leave, in education, out of the labor force). | BOP-HH waves 21 - 28 |

Notes: This table provides details on the definition and sources for all household variables used.

Table A.2: Definition of variables and data sources: firms

| | description | source |
|---|---|---|
| 1-year inflation expectation | Point estimate of the 1-year inflation rate expectation trimmed at the 2nd and 98th percentile to account for outliers. | BOP-F waves 6 - 14 |
| 1-year own-price expectation | Point estimate of the 1-year own-price expectation trimmed at the 2nd and 98th percentile to account for outliers. | BOP-F waves 6 - 14 |
| 1-year interest rate expectation | Probabilistic forecast of the ECB's policy rate over the next year. The intervals are [., -2%], (-2%, -1.5%], (-1.5%, -1%], (-1%, -0.5%], (-0.5%, -0.25%], (-0.25%, 0%] (0%, 0.25%], (0.25%, 0.5%], (0.5%, 1%], (1%, 1.5%], (1.5%, 2%], [2%, .]. To calculate the interest rate expectation, the probability-weighted average is calculated by imputing the midpoint of each interval and assigning the endpoints for the open intervals. | BOP-F waves 6 - 14 |
| firm-specific expectations | Qualitative expectations of firm-specific access to supply chains, short-term claims, short-term liabilities, liquidity, credit demand, credit supply, and inventory over the next year. The possible answers are 1 (strongly decrease), 2 (decrease), 3 (stay the same), 4 (increase), and 5 (strongly increase). The variables are transformed into a z-score by subtracting the mean and dividing them by their standard deviation. | BOP-F waves 6 - 14 |
| perceived problems | Qualitative expectations of firm-specific problems with customer demand, competitive pressure, credit supply, production costs, availability of personnel, Covid-19 restrictions, and other regulations over the next six months. The possible answers range from 1 (no problem at all) to 5 (very serious problem). The variables are transformed into a z-score by subtracting the mean and dividing them by their standard deviation. | BOP-F waves 4 - 14 |
| absolute and squared forecast error | Absolute (squared) difference between firms' 1-year inflation expectations and realized German CPI inflation over the same time period. The variables are transformed into a z-score by subtracting the mean and dividing them by their standard deviation. | BOP-F waves 6 - 14; Federal Statistical Office |
| absolute and squared difference to professional forecasters | Absolute (squared) difference between firms' 1-year inflation expectations and professionals' consensus estimate of 1-year inflation expectations at the same time. The professional forecast is taken from the quarterly report of Consensus Economics, a private firm, which calculates the average expert forecast of large financial firms. In order to have monthly estimates, I interpolate the forecast for the missing months. The variables are transformed into a z-score by subtracting the mean and dividing them by their standard deviation. | BOP-F waves 6 - 14; Consensus Economics |
| number of employees | The number of employees currently employed at the firm. | BOP-F waves 4 - 8; 12 - 14 |
| quarterly turnover | Firms' turnover in the last quarter. Every wave only half the sample is asked the question. | BOP-F waves 4 - 14 |
| energy expenditure share for different energy inputs | Percent of energy expenditures spent on oil, coal, natural gas, electricity (both conventional and renewable), or other energy inputs in 2021 | BOP-F waves 15 - 17 |
| share energy in total costs | Share of energy cost in total costs elicited in the intervals 0%, (0%, 10%), [10%, 20%), [20%, 30%), [30%, 40%), [40%, 50%), [50%, 60%), [60%, 70%), [70%, 80%), [80%, 90%), [90%, 100%), and 100%. To calculate the share of energy costs in total costs is calculated by imputing the midpoint of each interval. | BOP-F waves 12 - 14 |
| rank within the firm | Dummy that equals one when the respondent is either the owner, executive director, or a member of the board. | BOP-F waves 4 - 14 |
| sector | 1-digit NACE sector (20 sectors) of the firm. | BOP-F waves 4 - 14 |

Notes: This table provides details on the definition and sources for all firm-level variables used.

Table A.3: Descriptive statistics: households

| | mean | median | sd | N |
|---|---|---|---|---|
| 1-year inflation expectation | 5.53 | 5.00 | 3.01 | 14447 |
| 5-year inflation expectation | 5.08 | 4.00 | 3.63 | 4843 |
| 10-year inflation expectation | 5.31 | 4.00 | 4.62 | 4860 |
| 1-year interest rate expectation | 0.37 | 0.10 | 0.65 | 8272 |
| 1-year house price expectation | 9.49 | 8.00 | 8.22 | 14345 |
| 1-year income expectation | 49.61 | 125.00 | 485.28 | 7201 |
| unemployment rate expectation | 3.29 | 3.00 | 0.92 | 14864 |
| growth rate expectation | 2.85 | 3.00 | 1.07 | 14864 |
| stock market expectation | 3.08 | 3.00 | 0.98 | 14806 |
| rent expectation | 4.13 | 4.00 | 0.70 | 14860 |
| taxation expectation | 4.00 | 4.00 | 0.83 | 14863 |
| absolute forecast error | 3.63 | 3.70 | 2.15 | 14447 |
| squared forecast error | 17.80 | 13.69 | 19.62 | 14447 |
| absolute forecast error: personal inflation | 4.46 | 4.60 | 2.46 | 14031 |
| squared forecast error: personal inflation | 25.99 | 21.20 | 23.72 | 14031 |
| absolute difference to professional forecasters | 3.41 | 2.90 | 2.78 | 14447 |
| squared difference to professional forecasters | 19.34 | 8.41 | 39.90 | 14447 |
| inflation perception error | 1.93 | 1.80 | 1.07 | 13407 |
| trust in the ECB | 4.41 | 5.00 | 2.60 | 7159 |
| household income (in 1000€) | 3.53 | 3.25 | 1.91 | 14306 |
| household liquid wealth (in 1000€) | 64.09 | 18.75 | 109.78 | 12170 |
| monthly electricity expenditures (in 100€) | 1.26 | 0.86 | 2.32 | 14524 |
| female | 0.50 | 1.00 | 0.50 | 14882 |
| age | 50.90 | 54.00 | 17.52 | 14882 |
| East Germany | 0.19 | 0.00 | 0.39 | 14882 |
| household size | 2.24 | 2.00 | 1.10 | 14835 |
| married | 0.60 | 1.00 | 0.49 | 13455 |
| education: no degree | 0.03 | 0.00 | 0.18 | 14876 |
| education: secondary school | 0.30 | 0.00 | 0.46 | 14876 |
| education: intermediate secondary school | 0.31 | 0.00 | 0.46 | 14876 |
| education: technical school | 0.06 | 0.00 | 0.24 | 14876 |
| education: high school | 0.30 | 0.00 | 0.46 | 14876 |
| employment status: full-time | 0.43 | 0.00 | 0.49 | 14868 |
| employment status: part-time | 0.12 | 0.00 | 0.33 | 14868 |
| employment status: unemployed | 0.02 | 0.00 | 0.13 | 14868 |
| employment status: retired | 0.31 | 0.00 | 0.46 | 14868 |
| employment status: other | 0.12 | 0.00 | 0.32 | 14868 |

Table A.4: Descriptive statistics: firms

| | mean | median | sd | N |
|---|---|---|---|---|
| 1-year own-price expectation | 5.83 | 5.00 | 5.78 | 12247 |
| 1-year inflation expectation | 4.39 | 4.00 | 1.85 | 10342 |
| 1-year interest rate expectation | -0.00 | 0.00 | 0.68 | 12310 |
| supply chain expectations | 2.63 | 3.00 | 0.86 | 10222 |
| short-term claims expectations | 3.14 | 3.00 | 0.62 | 11843 |
| short-term liabilities expectations | 3.08 | 3.00 | 0.56 | 11837 |
| liquidity expectations | 2.99 | 3.00 | 0.75 | 12269 |
| credit demand expectations | 3.07 | 3.00 | 0.78 | 8773 |
| credit supply expectations | 2.94 | 3.00 | 0.60 | 9113 |
| inventory expectations | 3.01 | 3.00 | 0.76 | 9396 |
| problems with customer demand | 2.57 | 2.00 | 1.26 | 19914 |
| problems with competitive pressure | 2.88 | 3.00 | 1.13 | 19719 |
| problems with credit supply | 2.31 | 2.00 | 1.18 | 15838 |
| problems with supply chains | 3.03 | 3.00 | 1.23 | 16897 |
| problems with production costs | 3.22 | 3.00 | 1.13 | 19154 |
| problems with availability of personnel | 3.63 | 4.00 | 1.22 | 19503 |
| problems with regulations | 3.29 | 3.00 | 1.26 | 19486 |
| problems with Covid-19 restrictions | 2.92 | 3.00 | 1.32 | 19537 |
| absolute forecast error | 4.05 | 4.20 | 1.55 | 10342 |
| squared forecast error | 18.80 | 17.64 | 11.61 | 10342 |
| absolute difference to professional forecasters | 2.46 | 2.10 | 1.75 | 10342 |
| squared difference to professional forecasters | 9.11 | 4.41 | 16.64 | 10342 |
| energy cost share: oil | 0.20 | 0.00 | 0.31 | 23754 |
| energy cost share: coal | 0.00 | 0.00 | 0.03 | 23754 |
| energy cost share: natural gas | 0.23 | 0.05 | 0.30 | 23754 |
| energy cost share: electricity | 0.45 | 0.45 | 0.33 | 23754 |
| energy cost share: other | 0.11 | 0.00 | 0.25 | 23754 |
| share energy in total costs | 0.10 | 0.05 | 0.10 | 19981 |
| owner, executive director, member of board | 0.89 | 1.00 | 0.31 | 25294 |
| number of employees | 101.11 | 11.00 | 689.59 | 10437 |
| turnover (in million €) | 53.86 | 0.40 | 1245.59 | 6497 |
| sector: manufacturing | 0.17 | 0.00 | 0.38 | 24893 |
| sector: construction | 0.13 | 0.00 | 0.33 | 24893 |
| sector: retail | 0.13 | 0.00 | 0.34 | 24893 |
| sector: other services | 0.51 | 1.00 | 0.50 | 24893 |
| sector: other | 0.06 | 0.00 | 0.24 | 24893 |

# B Additional Tables and Figures

Table B.1: Predicting the treatment status of households

| | (1) experiences price change | (2) experiences price change | (3) experiences price change |
|---|---|---|---|
| prior inflation expectation | -0.001 | 0.000 | 0.001 |
| | (0.003) | (0.004) | (0.004) |
| prior interest rate expectation | | -0.002 | -0.005 |
| | | (0.014) | (0.014) |
| prior house price expectation | | -0.000 | 0.000 |
| | | (0.001) | (0.001) |
| prior income expectation (in 100€) | | 0.002 | 0.002 |
| | | (0.002) | (0.002) |
| female | | | 0.006 |
| | | | (0.019) |
| age | | | -0.000 |
| | | | (0.001) |
| East Germany | | | -0.029 |
| | | | (0.023) |
| household size | | | -0.007 |
| | | | (0.011) |
| married | | | 0.001 |
| | | | (0.022) |
| education: secondary school | | | 0.102 |
| | | | (0.092) |
| education: intermediate secondary school | | | 0.077 |
| | | | (0.090) |
| education: technical school | | | 0.067 |
| | | | (0.091) |
| education: high school | | | 0.048 |
| | | | (0.089) |
| employment: full-time | | | -0.003 |
| | | | (0.041) |
| employment: part-time | | | -0.009 |
| | | | (0.045) |
| employment: unemployed | | | 0.054 |
| | | | (0.075) |
| employment: retired | | | 0.034 |
| | | | (0.046) |
| household income: 1000 - 1999€ | | | -0.028 |
| | | | (0.060) |
| household income: 2000 - 2999€ | | | -0.025 |
| | | | (0.059) |
| household income: 3000 - 3999€ | | | 0.021 |
| | | | (0.060) |
| household income: 4000 - 4999€ | | | 0.043 |
| | | | (0.062) |
| household income: 5000 - 5999€ | | | 0.017 |
| | | | (0.064) |
| household income: > 6000€ | | | 0.051 |
| | | | (0.064) |
| mean | 0.544 | 0.551 | 0.554 |
| N | 14479 | 13966 | 12199 |
| # cluster | 4177 | 3994 | 3920 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the household level are in parenthesis. The results are based on a regression of a dummy, which takes the value one if the household experiences a price increase in the sample period, on prior expectations and observable household characteristics.

Table B.2: Effect of electricity price increase on households' inflation expectations: robustness

| | (1) 1-year inflation expectation | (2) 1-year inflation expectation | (3) 1-year inflation expectation | (4) 1-year inflation expectation | (5) 1-year inflation expectation | (6) 1-year inflation expectation |
|---|---|---|---|---|---|---|
| price increase x post | 0.113** | 0.182** | 0.213*** | 0.176** | 0.175** | 0.192** |
| | (0.051) | (0.072) | (0.082) | (0.083) | (0.076) | (0.078) |
| household FE | yes | yes | yes | yes | yes | yes |
| month FE | yes | yes | yes | | yes | yes |
| Huber robust estimation | yes | | | | | |
| drop HHs that switch provider | | yes | | | | |
| drop HHs that interrupted the survey | | | yes | | | |
| local labor market x month FE | | | | yes | | |
| demographic controls | | | | | yes | yes |
| income controls | | | | | | yes |
| mean | 5.374 | 5.537 | 5.566 | 5.540 | 5.573 | 5.538 |
| N | 13481 | 13301 | 10680 | 11690 | 12127 | 11703 |
| # cluster | 3855 | 3770 | 3644 | 3316 | 3817 | 3723 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the household level are in parenthesis. The regression results are based on estimating equation (1) as described in Section 3. The demographic control variables include dummies for marital status as well as household size, and age. The income control variables include dummies for full-time employment, part-time employment, unemployment, and retirement, as well as six household income dummies.

Table B.3: Effect of electricity price increase on households' inflation expectations: heterogeneous effects

| | (1) 1-year inflation expectation | (2) 1-year inflation expectation | (3) 1-year inflation expectation | (4) 1-year inflation expectation | (5) 1-year inflation expectation |
|---|---|---|---|---|---|
| price increase x post x low-income HH | 0.316*** | | | | |
| | (0.101) | | | | |
| price increase x post x high-income HH | 0.018 | | | | |
| | (0.095) | | | | |
| price increase x post x high inflation perception accuracy | | 0.388*** | | | |
| | | (0.134) | | | |
| price increase x post x low inflation perception accuracy | | 0.007 | | | |
| | | (0.089) | | | |
| price increase x post x low trust in ECB | | | 0.555*** | | |
| | | | (0.176) | | |
| price increase x post x high trust in ECB | | | -0.044 | | |
| | | | (0.120) | | |
| price increase x post x low education level | | | | 0.185 | |
| | | | | (0.117) | |
| price increase x post x high education level | | | | 0.185** | |
| | | | | (0.088) | |
| price increase x post x low liquid wealth | | | | | 0.172 |
| | | | | | (0.126) |
| price increase x post x high liquid wealth | | | | | 0.169* |
| | | | | | (0.088) |
| household FE | yes | yes | yes | yes | yes |
| group x month FE | yes | yes | yes | yes | yes |
| p-value of group difference | 0.030 | 0.018 | 0.005 | 1.000 | 0.985 |
| mean | 5.504 | 5.463 | 5.840 | 5.533 | 5.491 |
| N | 13092 | 13166 | 6042 | 13571 | 11114 |
| # cluster | 3773 | 3704 | 2346 | 3859 | 3088 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the household level are in parenthesis. The regression results are based on estimating equation (1) as described in Section 3 for different sub-samples.

Table B.4: Effect of electricity price increase on households' other expectations

| | (1) 5-year inflation expectation | (2) 10-year inflation expectation | (3) 1-year interest rate expectation | (4) 1-year house price expectation | (5) 1-year income expectation |
|---|---|---|---|---|---|
| price increase x post | 0.296 | 0.322 | 0.020 | -0.207 | -36.931 |
| | (0.180) | (0.285) | (0.031) | (0.193) | (25.386) |
| household FE | yes | yes | yes | yes | yes |
| month FE | yes | yes | yes | yes | yes |
| mean | 5.024 | 5.225 | 0.370 | 9.240 | 52.64 |
| N | 4268 | 4238 | 7738 | 13479 | 6632 |
| # cluster | 2557 | 2533 | 3782 | 3854 | 3684 |
| | (6) unemployment rate expectation | (7) growth rate expectation | (8) stock market expectation | (9) rent expectation | (10) taxation expectation |
| price increase x post | 0.003 | -0.015 | 0.003 | 0.017 | -0.021 |
| | (0.031) | (0.029) | (0.031) | (0.030) | (0.029) |
| household FE | yes | yes | yes | yes | yes |
| month FE | yes | yes | yes | yes | yes |
| z-score | yes | yes | yes | yes | yes |
| mean | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 13971 | 13972 | 13914 | 13966 | 13970 |
| # cluster | 3906 | 3906 | 3902 | 3905 | 3906 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the household level are in parenthesis. The regression results are based on estimating equation (1) as described in Section 3. Z-scores are computed by subtracting the sample mean and dividing by the standard deviation.

Table B.5: Effect of energy price increase on firms' reported problems

| problems with | (1) production costs | (2) availability of personnel | (3) regulations | (4) Covid-19 restrictions |
|---|---|---|---|---|
| price increase x post | 0.060** | -0.033 | 0.025 | 0.009 |
| | (0.029) | (0.029) | (0.027) | (0.029) |
| firm FE | yes | yes | yes | yes |
| month FE | yes | yes | yes | yes |
| z-score | yes | yes | yes | yes |
| mean | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 18770 | 19146 | 19129 | 19180 |
| # cluster | 5478 | 5490 | 5527 | 5539 |
| problems with | (5) customer demand | (6) competitive pressure | (7) credit supply | (8) supply chains |
| price increase x post | -0.012 | -0.023 | 0.012 | 0.043 |
| | (0.029) | (0.028) | (0.031) | (0.033) |
| firm FE | yes | yes | yes | yes |
| month FE | yes | yes | yes | yes |
| z-score | yes | yes | yes | yes |
| mean | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 19563 | 19368 | 15478 | 16522 |
| # cluster | 5576 | 5550 | 5089 | 5160 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the firm level are in parenthesis. The regression results are based on estimating equation (2) as described in Section 3. Z-scores are computed by subtracting the sample mean and dividing by the standard deviation.

Table B.6: Effect of energy price increase on firms' inflation expectations

| | (1) 1-year inflation expectation | (2) 1-year inflation expectation | (3) 1-year inflation expectation | (4) 1-year inflation expectation |
|---|---|---|---|---|
| price increase x post | 0.004 | 0.048 | | |
| | (0.053) | (0.047) | | |
| 100% price increase x post | | | 0.166 | |
| | | | (0.121) | |
| below-median price increase x post | | | | -0.044 |
| | | | | (0.059) |
| above-median price increase x post | | | | 0.059 |
| | | | | (0.069) |
| estimator | BJS | TWFE | TWFE | BJS |
| household FE | yes | yes | yes | yes |
| month FE | yes | yes | yes | yes |
| mean | 4.324 | 4.384 | 4.382 | 4.322 |
| N | 8402 | 8960 | 8946 | 8399 |
| # cluster | 4124 | 3882 | 3877 | 4124 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the household level are in parenthesis. The regression results are based on estimating equation (2) using either the imputation method by Borusyak et al. (2022) (BJS) or a standard two-way fixed model (TWFE).

Table B.7: Effect of energy price increase on firms' other expectations

| | (1) 1-year interest rate expectation | (2) supply chains expectations | (3) short-term claims expectations | (4) short-term liabilities expectations |
|---|---|---|---|---|
| price increase x post | 0.008 | -0.046 | -0.005 | 0.002 |
| | (0.024) | (0.041) | (0.037) | (0.038) |
| firm FE | yes | yes | yes | yes |
| month FE | yes | yes | yes | yes |
| z-score | | yes | yes | yes |
| mean | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 10672 | 8660 | 10226 | 10232 |
| # cluster | 4592 | 3979 | 4498 | 4508 |
| | (5) liquidity expectations | (6) credit demand expectations | (7) credit supply expectations | (8) inventory expectations |
| price increase x post | -0.070** | 0.004 | -0.009 | 0.009 |
| | (0.035) | (0.039) | (0.041) | (0.045) |
| firm FE | yes | yes | yes | yes |
| month FE | yes | yes | yes | yes |
| z-score | yes | yes | yes | yes |
| mean | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 10640 | 7397 | 7676 | 7947 |
| # cluster | 4637 | 3543 | 3685 | 3690 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the firm level are in parenthesis. The regression results are based on estimating equation (2) as described in Section 3. Z-scores are computed by subtracting the sample mean and dividing by the standard deviation.

Table B.8: Effect of energy price increase on firms' inflation expectations: heterogeneous effects

| | (1) 1-year inflation expectation | (2) 1-year inflation expectation | (3) 1-year inflation expectation | (4) 1-year inflation expectation | (5) 1-year inflation expectation |
|---|---|---|---|---|---|
| price increase x post x low energy cost share | -0.044 | | | | |
| | (0.060) | | | | |
| price increase x post x high energy cost share | 0.050 | | | | |
| | (0.120) | | | | |
| price increase x post x low natural gas usage | | 0.037 | | | |
| | | (0.079) | | | |
| price increase x post x high natural gas usage | | -0.078 | | | |
| | | (0.080) | | | |
| price increase x post x non-energy-intensive sector | | | 0.016 | | |
| | | | (0.061) | | |
| price increase x post x energy-intensive sector | | | -0.035 | | |
| | | | (0.108) | | |
| price increase x post x small firm | | | | 0.059 | |
| | | | | (0.071) | |
| price increase x post x large firm | | | | -0.071 | |
| | | | | (0.078) | |
| price increase x post x other respondent | | | | | -0.058 |
| | | | | | (0.153) |
| price increase x post x owner/executive director/member of board | | | | | 0.019 |
| | | | | | (0.057) |
| firm FE | yes | yes | yes | yes | yes |
| group x month FE | yes | yes | yes | yes | yes |
| p-value of group difference | 0.484 | 0.306 | 0.677 | 0.218 | 0.638 |
| mean | 4.358 | 4.336 | 4.324 | 4.348 | 4.334 |
| N | 7301 | 7881 | 8402 | 8217 | 8328 |
| # cluster | 3281 | 3849 | 4124 | 4061 | 4108 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the firm level are in parenthesis. The regression results are based on estimating equation (2) as described in Section 3 for different sub-samples.

Table B.9: Effect of energy price increase on households' squared forecast errors and deviations from professionals

| | (1) squared forecast error | (2) squared forecast error: personal inflation | (3) squared difference to professional forecasters |
|---|---|---|---|
| price increase x post | 0.067** | 0.065** | 0.058** |
| | (0.031) | (0.029) | (0.026) |
| household FE | yes | yes | yes |
| month FE | yes | yes | yes |
| z-score | yes | yes | yes |
| mean | 0.000 | 0.000 | 0.000 |
| N | 13575 | 13175 | 13575 |
| # cluster | 3860 | 3703 | 3860 |

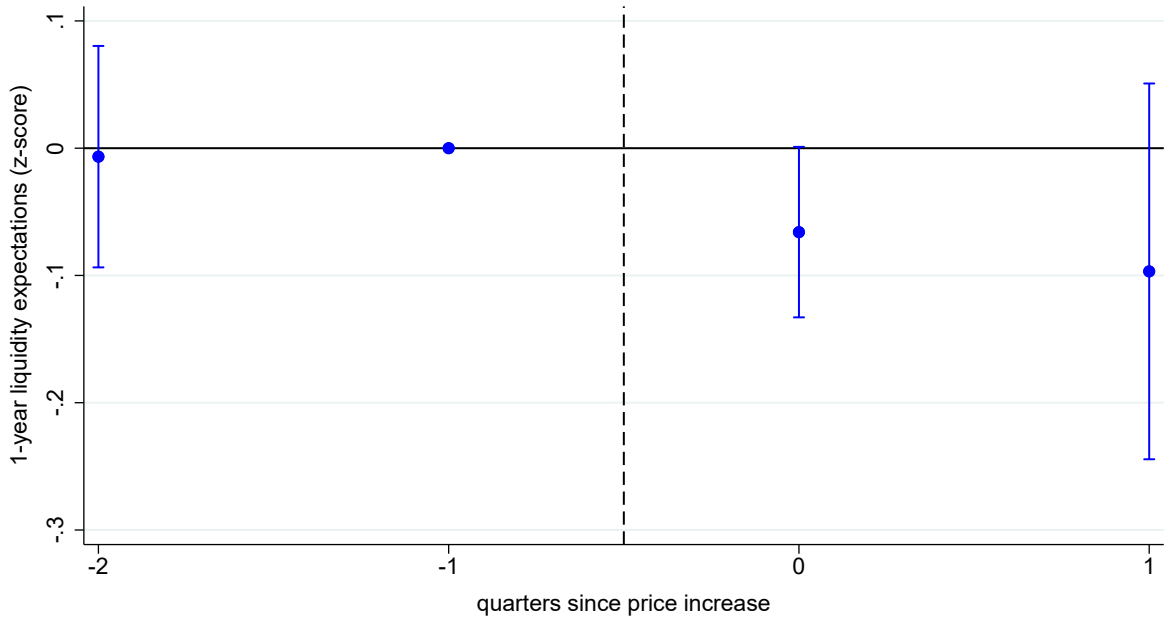
Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the household level are in parenthesis. The regression results are based on estimating equation (1) using the imputation method by Borusyak et al. (2022). Z-scores are computed by subtracting the sample mean and dividing by the standard deviation.

Table B.10: Effect of energy price increase on firms' forecast errors and deviations from professionals

| | (1) absolute forecast error | (2) squared forecast error | (3) absolute difference to professional forecasters | (4) squared difference to professional forecasters |
|---|---|---|---|---|
| price increase x post | -0.017 | -0.000 | 0.004 | -0.007 |
| | (0.030) | (0.031) | (0.031) | (0.032) |
| firm FE | yes | yes | yes | yes |
| month FE | yes | yes | yes | yes |
| z-score | yes | yes | yes | yes |
| mean | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 8402 | 8402 | 8402 | 8402 |
| # cluster | 4124 | 4124 | 4124 | 4124 |

Notes: Statistical significance denoted as: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered on the firm level are in parenthesis. The regression results are based on estimating equation on (2) using the imputation method by Borusyak et al. (2022). Z-scores are computed by subtracting the sample mean and dividing by the standard deviation.

Figure B.1: Event study of energy price increase on firms' liquidity expectations




Notes: This figure plots point estimates and 95% confidence bands from estimating a dynamic version of equation (2) using the imputation method by Borusyak et al. (2022). The pre-trends are normalized to the quarter before treatment happens. Z-scores are computed by subtracting the sample mean and dividing by the standard deviation.

# C Questionnaire

## C.1 Bundesbank Online Panel - Households

The full questionnaire of the BOP-HH wave 28 including the regular questions is available online in both German and English. The special questions added to wave 28 are presented below.

**Month price change**: Hat sich der Preis, den Ihr Haushalt für Strom bezahlt, seit September 2021 geändert? Falls ja, in welchem Monat fand erstmalig eine Preisänderung statt? (*Did the your household's electricity price change since September 2021? If yes, in which month did the price change take place?*)

- Nein, keine Preisänderung seit September 2021 (*No, my price did not change since September 2021*)
- Ja, im September 2021. (*Yes, in September 2021*)
- Ja, im Oktober 2021. (*Yes, in October 2021*)
- Ja, im November 2021. (*Yes, in November 2021*)
- Ja, im Dezember 2021. (*Yes, in December 2021*)
- Ja, im Januar 2022. (*Yes, in January 2022*)
- Ja, im Februar 2022. (*Yes, in February 2022*)
- Ja, im März 2022. (*Yes, in March 2022*)
- Ja, im April 2022. (*Yes, in April 2022*)

**Reason for change of electricity price**: Aus welchem Grund hat sich Ihr Strompreis geändert? (*Why did your electricity price change?*)

- Mein derzeitiger Anbieter hat den Strompreis angepasst (*My current provider has changed the price*)
- Ich habe den Anbieter gewechselt, weil mein vorheriger Anbieter meinen Vertrag gekündigt hat (*I changed my provider because my prior provider terminated my contract*)

- Ich habe den Anbieter gewechselt, weil mein vorheriger Anbieter den Preis erhöht hat (*I changed by provider because my prior provider increased prices*)
- Aus anderen Gründen (*For other reasons*)

**Electricity price change**: Wie stark hat sich Ihr Strompreis in etwa seit September 2021 verändert? (*How much did your electricity price change since September 2021?*)

- Um mehr als 10% gesunken (*Reduction of more than 10%*)
- Zwischen 1 und 10% gesunken (*Reduction between 1 und 10%*)
- Zwischen 1 und 10% gestiegen (*Increase between 1 und 10%*)
- Zwischen 11 und 20% gestiegen (*Increase between 11 und 20%*)
- Zwischen 21 und 30% gestiegen (*Increase between 21 und 30%*)
- Zwischen 31 und 40% gestiegen (*Increase between 31 und 40%*)
- Zwischen 41 und 50% gestiegen (*Increase between 41 und 50%*)
- Um mehr als 50% gestiegen (*Increase of more than 50%*)

**Spending on electricity**: Wie hoch sind derzeit in etwa die monatlichen Ausgaben Ihres Haushalts für Strom? (*How high is your household's monthly spending on electricity?*)

Hinweis: Falls Sie es nicht genau wissen, geben Sie bitte eine Schätzung an. (*If you do not know the exact number, please give your best estimate.*)

_____ Euro

## C.2 Bundesbank Online Panel - Firms

The full questionnaire of the BOP-F waves 15, 16, and 17 including the regular questions is available online in both German and English. The special questions added to wave 15, 16, and 17 are presented below.

**Energy price change**: Um wie viel Prozent haben sich die durchschnittlichen Energieeinkaufspreise Ihres Unternehmens seit 2020 verändert? (*How much have the average energy prices your firm faces changed since 2020?*)

Hinweis: Bitte berücksichtigen Sie nur den Preis der eingekauften Energie, nicht die eingekaufte Energiemenge. (*Please only take the energy price and not the quantity of energy into account.*)

a = im Jahr 2021 im Vergleich zum Jahr 2020 (*in 2021 relative to 2020*)

b = im 1. Quartal 2022 im Vergleich zum 4. Quartal 2021 (*in the first quarter of 2022 relative to the fourth quarter of 2021*)

- Rückgang um 20% (*Reduction of more than 20%*)
- Rückgang zwischen 11 und 20% (*Reduction between 11 und 20%*)
- Rückgang zwischen 5 und 10% (*Reduction between 5 und 10%*)
- Geringfügige Änderung zwischen -5% und 5% (*Little change between -5% and 5%*)
- Zwischen 5 und 10% gestiegen (*Increase between 5 und 10%*)
- Zwischen 11 und 20% gestiegen (*Increase between 11 und 20%*)
- Zwischen 21 und 30% gestiegen (*Increase between 21 und 30%*)
- Zwischen 31 und 40% gestiegen (*Increase between 31 und 40%*)
- Zwischen 41 und 50% gestiegen (*Increase between 41 und 50%*)
- Zwischen 51 und 60% gestiegen (*Increase between 51 und 60%*)
- Zwischen 61 und 70% gestiegen (*Increase between 61 und 70%*)
- Um mehr als 70% gestiegen (*Increase of more than 70%*)

**Quarter of change in energy prices**: In welchem Quartal seit dem Anfang des Jahres 2021 haben sich die Energieeinkaufspreise Ihres Unternehmens zum ersten Mal deutlich verändert? (*In which quarter since the beginning of 2021 have the energy prices of your firm changed significantly?*)

Hinweis: Bitte beachten Sie, dass sich die Frage nach der erstmaligen deutlichen Änderung der Preise richtet, auch wenn dieser weitere deutliche Änderungen gefolgt sind. (*Note that this questions refers to the first significant change in prices even when further price changes followed.*)

- erstmalig im 1. Quartal 2021: Januar bis März 2021 (*first change in the first quarter of 2021: January - March 2021*)
- erstmalig im 2. Quartal 2021: April bis Juni 2021 (*first change in the second quarter of 2021: April - June 2021*)
- erstmalig im 3. Quartal 2021: Juli bis September 2021 (*first change in the third quarter of 2021: July - September 2021*)
- erstmalig im 4. Quartal 2021: Oktober bis Dezember 2021 (*first change in the fourth quarter of 2021: October - December 2021*)
- erstmalig im 1. Quartal 2022: Januar bis März 2022 (*first change in the first quarter of 2022: January - March 2022*)

**Share energy type**: Welchen Anteil an den Jahresenergiekosten Ihres Unternehmens nahmen im Jahr 2021 die folgenden Energiequellen jeweils ein? (*What share of your firm's energy cost did the following energy sources take in 2021?*)

Hinweis: Bitte beachten Sie, dass sich die Angaben über alle Energiequellen auf 100 summieren müssen. Sie können auch Eingabefelder leer lassen, wenn eine Energiequelle in Ihrem Unternehmen nicht genutzt wird. Leere Felder werden automatisch mit dem Wert 0 abgespeichert. (*Note that the shares of all energy sources have to sum up to 100. You can leave a field empty if your firm does not use the energy source at all which will be interpreted as a value of zero.*)

- Erdöl (inkl. Kraftstoffe/Heizöl): _____ (*Oil*)
- Fernwärme aus erneuerbaren Quellen: _____ (*District heating from renewable sources*)

- Fernwärme aus konventionellen Quellen: _____ (*District heating from conventional sources*)
- Braun-/Steinkohle: _____ (*Brown and hard coal*)
- Erdgas oder Flüssiggas: _____ (*Natural gas or liquified natural gas*)
- Strom aus erneuerbaren Quellen: _____ (*Electricity from renewable sources*)
- Strom aus konventionellen Quellen: _____ (*Electricity from conventional sources*)
- Sonstige Energiequellen: _____ (*Other energy sources*)