Households' Inflation Expectations and Their Consumption Basket*

Clara Lindemann**

Job Market Paper

Click here for lastest version

January 5, 2025

Abstract

In this paper I study the pass-through from consumers' personal inflation rates to their inflation expectations using a German household dataset on consumer expectations. Exploiting information on individual consumption baskets and macro data on goods inflation rates I calculate a personal inflation rate and estimate the effect of the personal inflation rate on inflation expectations. I find a time-varying dispersion of the personal inflation rate across consumers and a significant positive effect of an increase in the personal inflation rate on consumers inflation expectations. This effect is stable across different socioeconomic groups, but more pronounced in times of high inflation. I analyze the impact of my empirical findings using a New Keynesian model with sticky wages and a Lucas Island model. My model framework shows that the increase in inflation expectations due to an increase in personal inflation rates amplifies the reaction of inflation and dampens the reaction of output following a demand shock.

* I'm grateful for comments and suggestions I received from colleagues, the participants of the Berkeley Graduate Macro Seminar, Frankfurt Macro Modeling Seminar and, especially for the feedback I received from my supervisor Prof. Dr. Mathias Trabandt. I am very appreciative for the hospitality and advise from Yuriy Gorodnichenko at UC Berkeley where parts of this paper were written during a research visit in spring 2024. This paper uses data from the Bundesbank-Online-Panel-Households. The results published and the related observations and analysis may not correspond to results or analysis of the data producers.(Boddin et al.)

** Goethe University Frankfurt am Main, mail@claralindemann.com

1 Introduction

The formation of inflation expectations and its reaction to changes in the economic situation is an important determinant for the macroeconomy. When studying inter-temporal problems using quantitative macroeconomic models, economists always make implicit or explicit assumptions about expectations formation.

In this paper, I analyze the impact of households' personal inflation rate using their consumption basket on their aggregate inflation expectations. I incorporate my empirical findings into a New Keynesian and Lucas Island-type model to analyze how they impact the propagation of shocks through the economy.

Using the Bundesbank dataset Online Panel on Households (BOP-HH)[1], I quantify the effect changes in personal inflation rates have on consumers' inflation expectations. The BOP-HH dataset is unique because it combines questions about household-specific consumption baskets with questions about their inflation expectations. In contrast to other regular surveys on consumers' inflation expectations, as the Michigan Consumer Survey or the Survey on Consumer Expectations, I can observe individual spending behavior in specific consumption categories as well as inflation expectations. The spending categories include a very diverse set of goods, and therefore cover a broader set of goods compared to data sets that are based on scanner data. The survey has been running since April 2020 and is still ongoing. For my analysis, I use the sample up to March 2024. Prices across different consumption categories evolve in distinctly different ways in the observed time period. This pattern allows me to identify the effect specific consumption goods and price changes have on consumers' inflation expectations. I use the consumption data of BOP-HH to construct each household's personal inflation rate. As my dataset covers the pre-Covid, Covid and post-Covid period, I can divide the sample into specific subsamples, to analyze the effects of times of low and high inflation. Additionally, I analyze if spending on specific consumption goods and increases in their inflation rates have different effects on consumers' inflation expectations.

I find that the personal inflation rate has a significant positive impact on consumers' inflation expectations. This result is robust across different socioeconomics groups. Additionally, I find evidence that specific prices are particularly important for the formation of inflation expectations. Exploiting different time subsamples I can show that there is evidence for state-dependency with respect to my main result. The influence of the personal inflation rate on inflation expectations is larger when inflation is high.

Using a 2-period model I show how changes in future prices are connected to the wage setting of consumers. With the 2-period model I find that wages increase following an increase in inflation expectations. I use a standard New Keynesian model with a wage Phillips curve to analyze the impact of higher inflation expectations of consumers on the propagation of shocks in the economy. Implementing my empirical findings in the New Keynesian environment I find

[1] Boddin et al.

that higher inflation expectations diminish the output effects of demand shocks and exacerbate the output effects of supply shocks. They amplify the reaction of inflation to both types of shocks.

To analyze the effects of the state-dependency I use a Lucas Island model. This allows me to incorporate the varying relevance of personal shocks compared to aggregate shocks. Using this set-up I can confirm my finding that in times of high inflation the output effects of aggregate demand shocks are diminished.

In the last years, an expanding strand of literature has started to explore the formation of expectations with respect to different geographical regions, times, and agents, especially through surveys. I am especially contributing to work that tries to understand how individual-specific inflation experiences impact consumers aggregate inflation expectations.

Recent micro evidence from US surveys by D'Acunto et al. (2021a) suggests that the price changes of the individual grocery bundle affect the overall inflation expectations of consumers. They also find that price increases are considered more important than price decreases. Binder and Makridis (2022) show that gas prices specifically impact consumers' sentiment about the economy. Binder (2018), however, does not find evidence that consumers overweight gas prices in their inflation expectations formation. Anesti et al. (2024) find that food prices matter more for household's inflation expectation dynamics. My paper is the first to document the impact of the household-specific inflation experience across their full consumption bundle on households aggregate inflation expectations. There is evidence that sociodemographic factors play a role in inflation expectations formation. D'Acunto et al. (2021b) document that women consistently report significantly higher inflation expectations than men. Additionally D'Acunto et al. (2023) show that cognitive abilities play an important role in forming inflation expectations. My estimations confirm the finding that consumption patterns influence the households' inflation expectations and the role of specific goods inflation rates for households inflation expectations. Also, I can document socioeconomic differences in inflation expectations formation. Verifying the findings from the literature I find that women have higher inflation expectations and a higher educational status reduces consumers' inflation expectations.

More recently a strand analyzing the state-dependence of inflation expectations has started forming. Using the circumstances of the Covid-19 pandemic, Coibion et al. (2022) analyze the connection between expected and perceived inflation of households, they find that in normal times, there are barely any differences, however the differences in perceived and realized inflation explain large parts of the differences in inflation expectations. Gennaioli et al. (2024) show that households' inflation expectations start de-anchoring heterogeneously once inflation starts rising. Weber et al. (2024) show that, in high-inflation environments, household start paying attention to inflation rates. On a macro level, Coibion et al. (2021) show that households take information about the future state of the economy into account when forming their inflation expectations. Dietrich et al. (2022) and Dietrich (2024) analyze the aggregation of consumers inflation expectations across different consumption goods in the US. My analysis tentatively

confirms that the level of inflation may be an important factor for consumers' inflation expectations, as I also find a state-dependence in my results. However, my pre-Covid sample is covering a shorter period and is smaller in the number of observations so that the results are less precise.

With respect to inflation expectations across firms there is mixed evidence how different firms expectations are to consumers expectations. There is substantive evidence that managers inflation expectations seem to be far form anchored and closer related to household inflation expectations than to professional forecaster expectations(Candia et al. (2022), Candia et al. (2024)). Coibion et al. (2020) and Yotzov et al. (2024) show that firms also react to changes in CPI inflation not only by changing expectations, but also by changing prices and other managerial decisions. Cornea-Madeira et al. (2019) show that there is heterogeneity across time of how firms set their prices with respect to expectations formation.

The paper is organized as follows: In the second section I introduce and explain the dataset I use for my analysis. In the third section I show the results of my empirical analysis separately for the personal inflation rate, as well as for the spending in specific consumption goods categories. Section 4 introduces the theoretical model set-ups. Section 5 discusses and concludes.

2 Data

I use survey data on German household expectations (BOP-HH) conducted by the Bundesbank to explore the impact of the recent inflation surge and the heterogeneity in price changes across consumption goods on consumer inflation expectations. The dataset is a monthly survey collected by the Bundesbank since April 2020. In each wave between 2000-4000 respondents are surveyed. It consists of a core questionnaire on households' expectations about different forward-looking variables, especially inflation expectations, interest rates, and housing prices. It also contains questions about consumption expenditures and their sociodemographic background. Additionally, each wave includes a varying number of other questions, partially conducted as randomized control trials. Very detailed information about the survey is provided by Beckmann and Schmidt (2020). The dataset has been used to analyze the effects of different monetary policy measures, with Hoffmann et al. (2022) using a RCT to estimate the effects of average inflation targeting and Dräger et al. (2022) evaluating the effects of central bank communication on inflation expectations during the post-Covid inflation surge. For my analysis, I focus on the questions that evaluate individuals one-year-ahead inflation expectations as well as their reported consumption expenditures in the different categories. I use the reported expenditures to construct a household-specific consumption basket. The survey asks about spending across eight consumption categories. These categories include spending on major goods, essential goods, clothing, recreation, mobility, services, travel, and housing, which can be matched to the European Classification of Individual Consumption according to Purpose (ECOICOP) Divisions and Groups. This is necessary to match each goods category to its specific inflation

rate. To make sure the reported consumption baskets are representative for the German population I compare the 2022 data to the consumption spending data reported by the German Statistical Office (Destatis). Figure 1 shows the shares of the consumption categories reported in BOP-HH relative to the official shares of Destatis. An observable difference is that the categories do not perfectly match across the different data sets. Communication and education are omitted in the BOP-HH survey, therefore I exclude these in the official data as well. The biggest differences are for food/essential goods and for housing. For the food/essential goods category a potential explanation is that the official category is only food, whereas BOP-HH asks for essential goods, including food, cleaning supplies, and other daily needs. Despite these differences, Figure 1 shows that both data sets align pretty well.

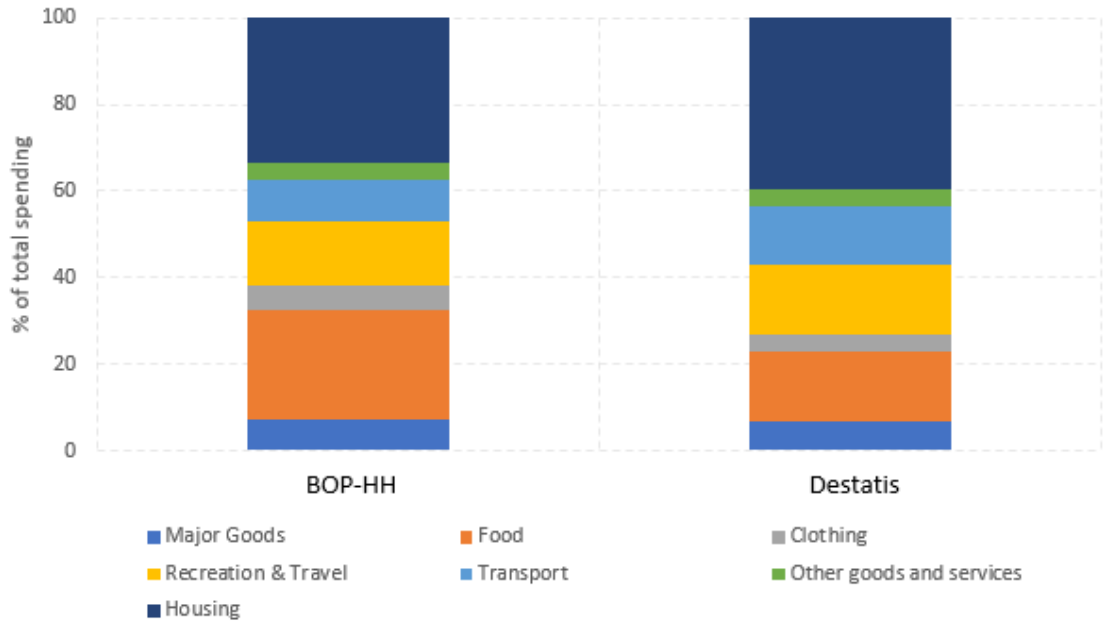


Figure 1: Comparison of the relative shares of the surveyed goods categories of the consumption basket between the BOP-HH (left) and the German representative consumption basket (right) in 2022.

To calculate personal household-specific inflation rates, I use the monthly German inflation rate provided by the European Commission for the consumption categories that the BOP-HH surveys. As Figure 2 shows, during the surveyed period the overall inflation increased rapidly. The German inflation rate started increasing above the ECB's 2% inflation target around July 2021. It persistently increased until October 2022, reaching its maximum at 11.6 %. Since then the inflation rate has been steadily declining back to the ECB's inflation target. Noticeably this development has not been symmetric across different product prices. The inflation rates of housing, transport and food increased much stronger, and partially much earlier than the increase in inflation. Other prices, like clothing, recreation, and services increased much less during the observed time period.

Transport prices also include several exceptional situations as for example the Russian invasion

to Ukraine and the following government interventions, which were significantly driving inflation rates during my observed time period.

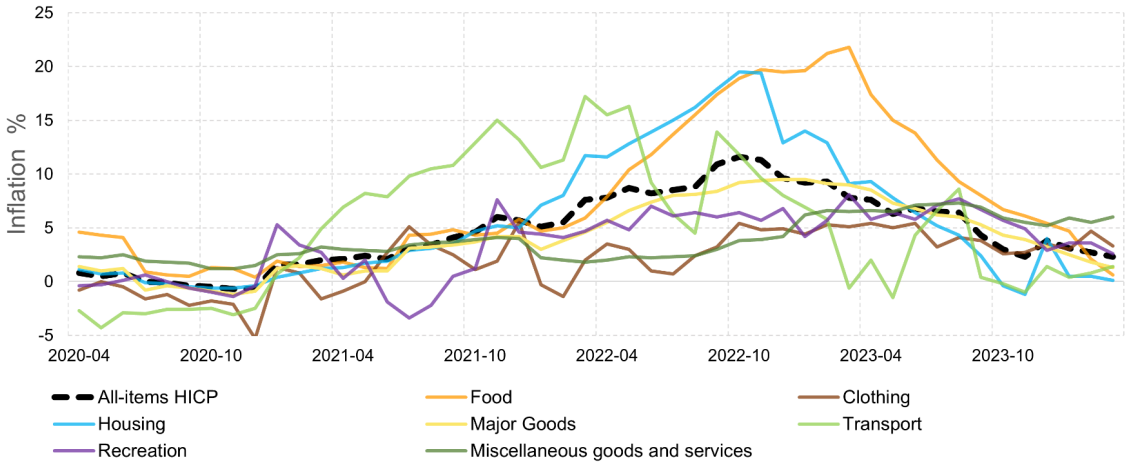


Figure 2: German inflation rate for different goods categories.

3 Empirical Analysis

3.1 Personal Inflation Rate

To analyze the impact of personal inflation rates on each individual's aggregate inflation expectations, I construct personal inflation rates using their reported consumption baskets and the relevant German inflation rates for the specific consumption categories. As the consumption expenditures in my sample vary across time as well as the goods inflation rates, I capture more time variation as the inflation rate because the representative consumption basket, used to construct official inflation rates is only updated once a year. Figure 3 displays average consumption shares from 2020 to 2024. It shows that consumption patters are rather stable over time, however, there are clear seasonal patterns for travel and also some disturbances due to the Covid-19 pandemic.

Using the data described above I can calculate the personal inflation rate, each respondent experienced taking into account their consumption basket. I construct their personal inflation rate as follows:

$$\pi_{i,t} = \sum_{j=1}^{8} \frac{spending\ good_{ji,t}}{\sum_{j=1}^{8} spending\ good_{ji,t}} \cdot \pi_{j,t} \tag{1}$$

Figure 4 shows how the estimated personal inflation rate and the heterogeneity across households changes over time. Until mid-2021 the 10th and the 90th percentile are fairly close to each other with a maximum distance of about 2 percentage points. In parallel to the officially measured HICP rate, my calculated personal inflation rates increase as well. This is reinforcing the evidence that my consumption baskets are comparable to what is officially measured for the calculation of the CPI. With the increase in inflation, the heterogeneity across households

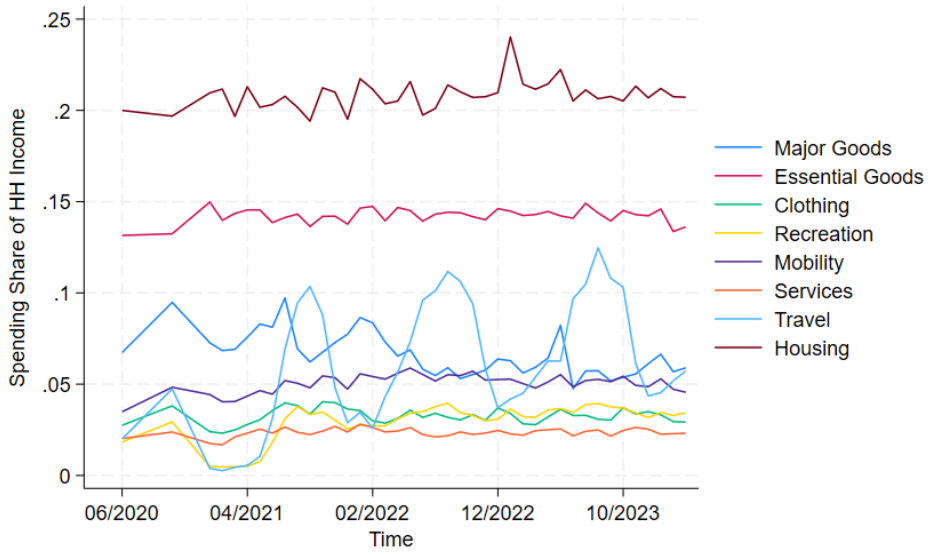


Figure 3: Households' spending share for different goods categories.

increases as well, reaching a 6 percentage points difference between the 10th and the 90th percentiles of households. Figure 4 shows how the heterogeneous consumption baskets and inflation rates across different goods categories translate into very different personal inflation rates. This is important as it allows me to identify the effect of the personal inflation rate in my empirical analysis.

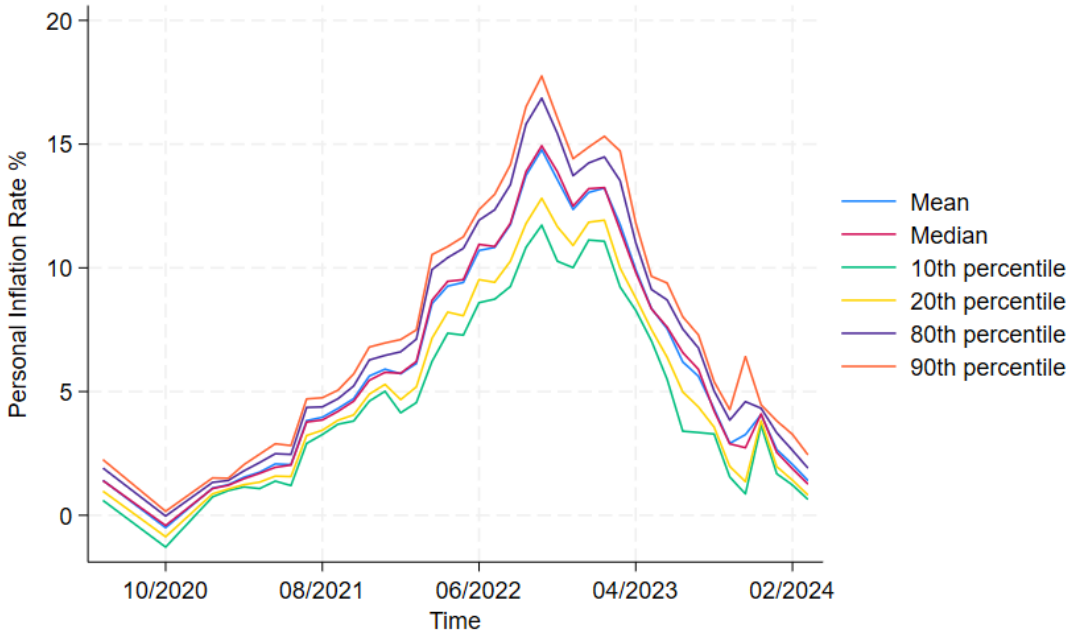


Figure 4: Personal inflation rate over time

Additionally, the survey collects information about the participants' inflation expectations on the aggregate economy. Figure 5 shows the relationship between the inflation rate and

households' inflation expectations. Median and mean inflation expectations start rising pretty simultaneously once the inflation rate surpasses the 2% inflation target. They both rise slower, but almost parallel to the inflation rate. They reach their maximum fairly below the maximum of the realized inflation rate. The 20th and 80th percentile also show that the increase in inflation expectations following the increase in the inflation rate is persistent across the distribution.

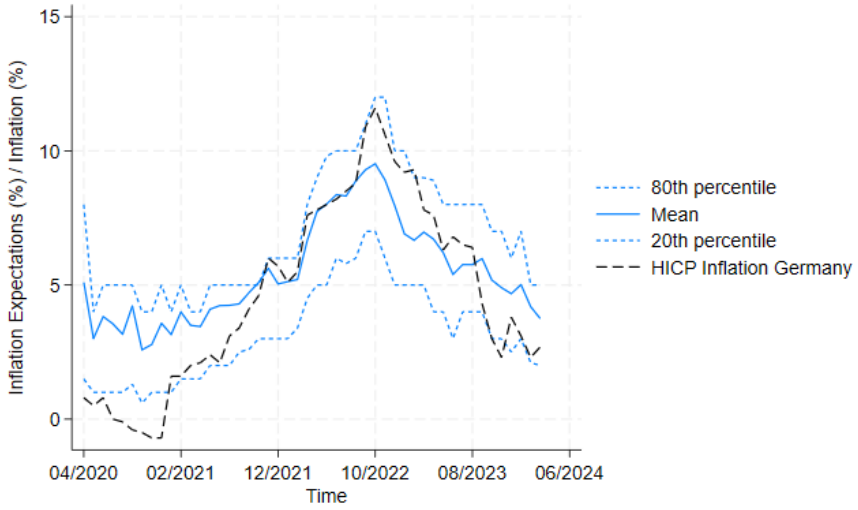


Figure 5: Inflation Rate vs. Inflation Expectations measured by Bundesbank Household Survey

As my main objective is to analyze the impact of the personal inflation rate on inflation expectations, the binscatter in Figure 6 shows descriptively that there is a positive relationship between the personal inflation rate and inflation expectations.

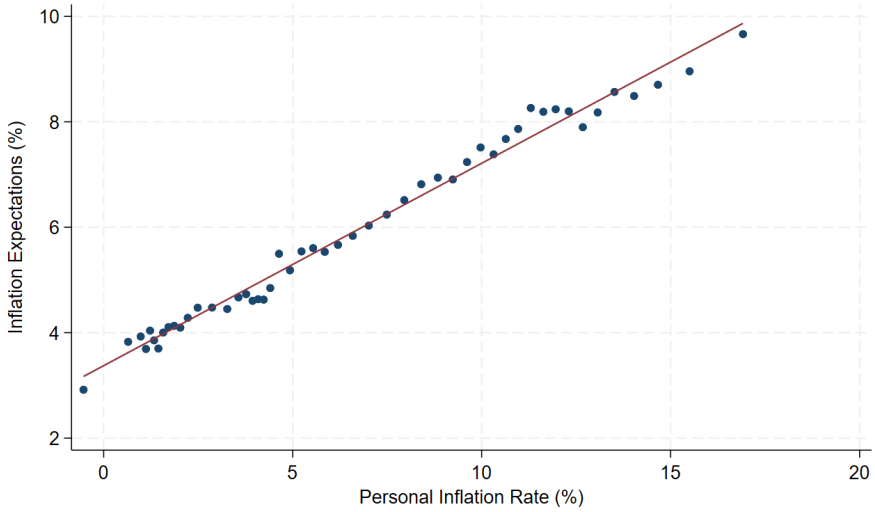


Figure 6: Binscatter showing the relationship between the personal inflation rate (%) and the one-year-ahead inflation expectations (%).

To confirm these findings I run a regression using the following specification:

$$E_{i,t}\pi_{t+12} = a_0 + \beta_1 \pi_{i,t} + \text{Controls}_{i,t} + \text{Wave FE}_t + \epsilon_{i,t} \tag{2}$$

I regress the personal inflation rate on each household's inflation expectations, controlling for different socio-economic factors available: age, gender, income, education, region, and wave-fixed effects, to control for the state of the economy.

Table 1: Regression results: Inflation Expectations

	Baseline $E_{i,t}\pi_{t+12}$	Robust weights $E_{i,t}\pi_{t+12}$
Personal Inflation Rate (β_1)	0.0442**	0.0367***
	(2.64)	(6.73)
Age	0.0525***	0.0294***
	(5.53)	(9.50)
Age^2	-0.000691***	-0.000247***
	(-7.81)	(-8.55)
Gender	1.220***	0.476***
	(26.88)	(32.20)
Years of Schooling	-0.250***	-0.0993***
	(-16.39)	(-20.01)
HH-Size	0.225***	0.0533***
	(9.07)	(6.60)
Region FE	✓	✓
HH Income FE	✓	✓
Wave FE	✓	✓
_cons	5.166***	2.537***
	(14.12)	(21.29)
N	88816	88816
R^2	0.100	0.510

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As shown in Table 1, I find a significant positive relationship between the personal inflation rate and the reported inflation expectations. The coefficient is significant at a significance level of 0.1% and my regression results show that an increase of the personal inflation rate by 1 percentage points is causing an 0.03 to 0.05 percentage point increase in one-year ahead aggregate inflation expectations. This results is calculated using robust regression weights, using a standard regression even increases the size of the point estimate. The results displayed in Table 7 (Appendix) shows that this is about 10% of the reaction to changes in the aggregate inflation rate captured by the wave fixed effects. The regression results also show that my dataset replicates known features of the distribution of inflation expectations across different groups of agents. Similar to D'Acunto et al. (2021b) I find that women have significantly higher inflation expectations then men and more schooling significantly reduces inflation expectations.

I show that there is a pass-through from the personal inflation rate to consumers' inflation expectations. The estimation shows a significant increase of inflation expectations that is robust to all available controls and different estimation methods. Using the wave fixed effect can be interpreted as controlling for all other macroeconomic variations. Therefore my estimation results show the additional effect of personal inflation experiences on consumers' aggregate inflation expectations. This is additional to the effect caused by economy-wide change in inflation expectations or other aggregate effects as changes in employment, aggregate output, or other macroeconomic determinants. In the Appendix I show that the variance of spending on specific goods categories from one month to another is not changing systematically with inflation expectations only using the observations of the sample that participate in two consecutive waves. Therefore, my full sample estimation results can be interpreted as an additional increase in consumers' aggregate inflation expectations, taking changes in their personal inflation rate specifically into account. My regression results show that households inflation expectations react to ad-hoc changes in their personally experienced inflation rate.

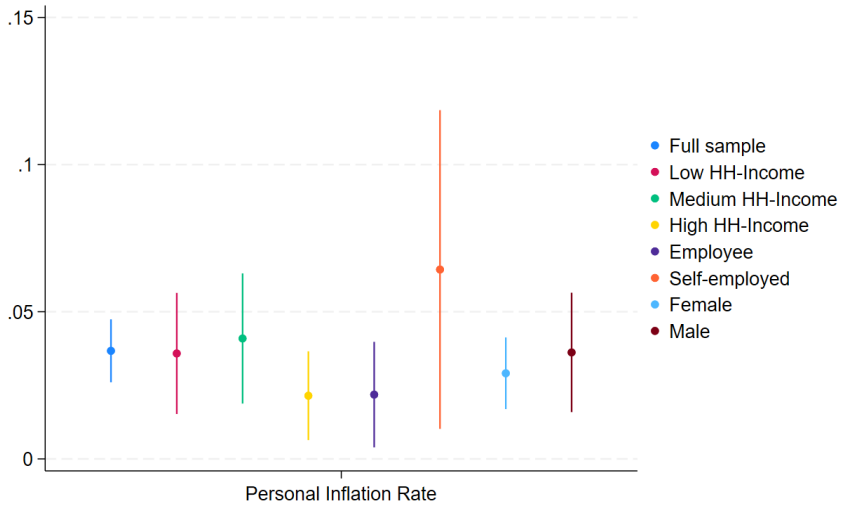


Figure 7: Estimation results across different socio-economic groups

Figure 7 shows that there are some variations of the size of the point estimate across different socio-economic groups, but all of the coefficients are significantly larger than zero and their confidence interval overlaps with the baseline regression. The estimated effect persists across all income groups the point estimate decreases for the highest income group, but is still significantly positive. Interestingly, the effect is also similar across men and women. For the differences between employees and self-employed, the point estimates are different, but it is important to note, that the number of observations is very low for self-employed which partially explains the large confidence interval for this subsample. Ultimately, the subsample regressions show, that even though the personal inflation rates may differ between socioeconomic groups, the effect of the personal inflation rate on households' inflation expectations is persistent and robust across different groups.

3.2 Impact of spending on specific consumption goods

The construction of the survey allows me to identify the effect of price increases in specific consumption goods groups on consumer inflation expectations. There is a literature trying to identify the influence of specific prices on inflation expectations. Using the survey's information about spending in specific goods categories and the corresponding inflation rates I can analyze whether increases in specific goods prices or increases in consumption in specific goods categories have disproportionately large or small effects on consumer inflation expectations.
To analyze this phenomenon I run a regression using the following specification:

$$E_{i,t}\pi_{t+12} = a_0 + \sum_{j=1}^{8} \beta_j \frac{spending\ good_{ji,t}}{HH\ income_{i,t}}\ \pi_{j,t} + \text{Controls}_{i,t} + \text{Wave FE}_t + \epsilon_{i,t}. \tag{3}$$

Figure 8 shows that for some variables there is a positive relationship between inflation expectations and higher consumption or higher inflation rates in these goods categories.

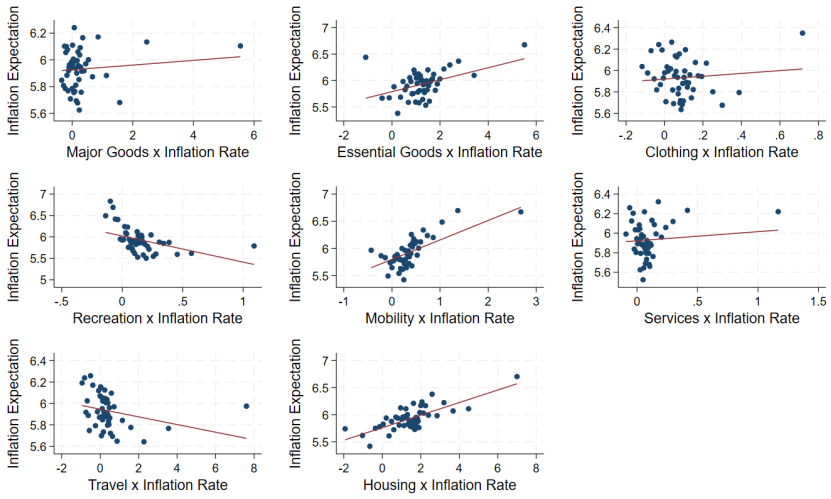


Figure 8: Binscatter plotting the self-reported one-year ahead inflation expectations against the share of consumption spending in a specific category x inflation rate

Table 2 shows that there are specific consumption categories that exhibit a significantly larger impact on inflation expectations than their expenditure weight would predict. This is specifically spending on essential goods, mobility, and housing. More spending on recreation appears to significantly decrease inflation expectations. However, in the appendix (Table 9) I show that this phenomenon can be mainly attributed to underlying sociodemographic factors of agents spending a lot on recreation. There are three main hypothesis explaining the disproportionately large impact of specific consumption goods and their inflation rates on inflation expectations. The first hypotheses is that consumer purchases are more frequent in the categories that have significant effects on their inflation expectations. The dataset I use does not provide any information on the frequency of purchases but especially purchases in the food and

mobility sector, which includes gas purchases, are performed several times a month. In contrast, most households buy major goods, as new furniture, on a less frequent basis. Another potential hypothesis also explored by Dietrich (2024) is that the categories that exhibit disproportional large effects on inflation expectations also have a higher variation of inflation rates over time. A third possible explanation is that agents perceive the shocks impacting the inflation rates of food, mobility, and housing to be more persistent. Therefore they react by adapting their inflation expectations, whereas prices in other goods categories may be perceived as more idiosyncratic shocks, that do not necessarily change their one-year ahead inflation expectations. Unfortunately, the data available in this dataset and on the German economy do not allow me to identify the cause of my findings.

Table 2: Spending on specific consumption categories

	Baseline	Robust weights
	$E_t\pi_{t+12}$	$E_t\pi_{t+12}$
Major goods x Inflation rate	0.0154	0.00477
	(0.65)	(0.63)
Essential goods x Inflation rate	0.0994***	0.0973***
	(4.47)	(13.50)
Clothing x Inflation rate	0.167	0.0487
	(1.02)	(0.92)
Recreation x Inflation rate	-0.660***	-0.441***
	(-6.31)	(-12.99)
Mobility x Inflation rate	0.334***	0.148***
	(7.36)	(10.09)
Services x Inflation rate	0.0905	-0.00390
	(0.93)	(-0.12)
Travel x Inflation rate	-0.0261	-0.0229***
	(-1.56)	(-4.25)
Housing x Inflation rate	0.116***	0.0525***
	(7.30)	(10.24)
Socio-Economic Controls	✓	✓
Wave FE	✓	✓
_cons	6.323***	3.183***
	(24.15)	(37.52)
N	88909	88909
R^2	0.101	0.514

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.3 Subsamples by time

Even though the data set I use is limited in the time period it covers, I am able to distinguish between two major time periods as shown in Figure 9. Until June 2021 the inflation rate persisted below and very close to the inflation target of 2%. In July 2021 the inflation rate increased to 3.1% for the first time, then peaking in October 2022 at 11.6 % and then declining rather steadily until the end of the sample period.

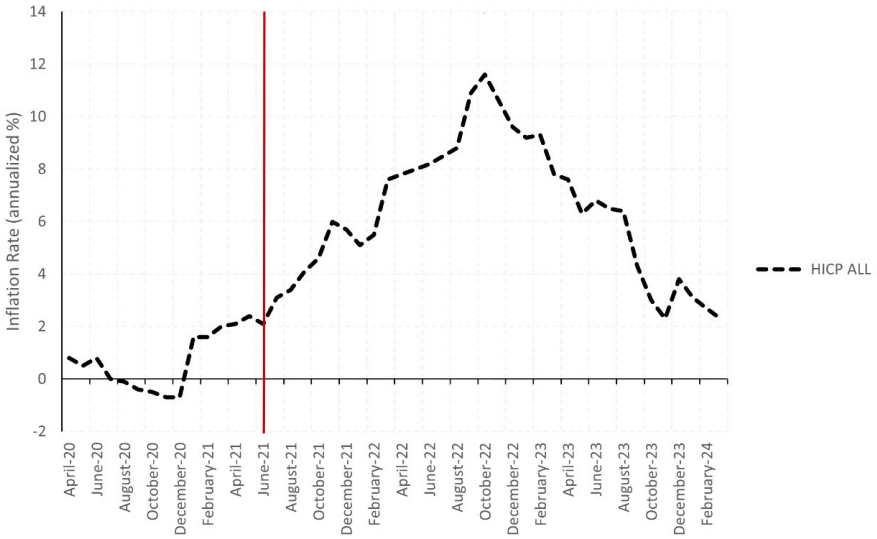


Figure 9: HICP - Time subsample

Looking at the data on inflation rates, in the low inflation time period, the goods inflation rates all fluctuates around the overall inflation rate. Assessing the distribution of the personal inflation rate, most agents experienced an inflation rate of around 2% in the period up to July 2021. Table 8 (Appendix) shows that the relationship between the personal inflation rate and consumers' inflation expectations is significant and positive only for the time periods when inflation is high. My regression results show, that in times of high inflation an increase in the personal inflation rate by 1 percentage point causes an increase in inflation expectations by 0.02 to 0.05 percentage points. In times of low inflation, no significant influence from personal inflation rates on inflation expectations can be found. Summarizing this shows that there is some evidence for state-dependence with respect to my main result.

4 Theoretical Analysis

In this section I want to explore the effects of my empirical results on the propagation of shocks through the economy. As my regression results show, agents consider increases in their personal inflation rate additionally to changes is aggregate variables in their inflation expectations formation and react stronger by changing their inflation expectations when their personal inflation rate increases. To analyze the impact of these findings in a general equilibrium model I use a New Keynesian model following Bilbiie and Trabandt (2024) where wages are set in a wage Phillips curve using a model with sticky wages and flexible prices. This is most suitable for including my empirical results, as it allows me to include consumer's inflation expectations explicitly. In this model framework I can include the detected non-rationality in a general equilibrium context. To get a first understanding of the impact of inflation expectations on wage setting I start by analyzing my problem in a 2-period model.

4.1 Two-period model

To get an understanding how inflation expectations affect consumers optimal wage setting I use the following two-period model:

4.1.1 Household

Households solve the following optimization problem, with C_t as consumption in period t, N_t labor in period t, W the wage paid in both periods and P_t the goods price in period $t = 1, 2$.

$$\underset{C_1,C_2,W}{max} \ln C_1 - \frac{1}{2}N_1^2 + \beta\left(\ln C_2 - \frac{1}{2}N_2^2\right) \tag{4}$$

subject to

$$P_1C_1 + \frac{P_2C_2}{1+r_1} = WN_1 + \frac{WN_2}{1+r_1} \tag{5}$$

$$N_1 = \left(\frac{\alpha}{W/P_1}\right)^{\frac{1}{1-\alpha}} \tag{6}$$

$$N_2 = \left(\frac{\alpha}{W/P_2}\right)^{\frac{1}{1-\alpha}} \tag{7}$$

Solving the optimization problem we get the standard consumption Euler equation:

$$\frac{1}{C_1} - \lambda P_1 = 0 \tag{8}$$

$$\frac{\beta}{C_2} - \lambda\frac{P_2}{1+r_1} = 0 \tag{9}$$

$$\beta \frac{C_1}{C_2} \frac{1+r_1}{P_2/P_1} = 1 \tag{10}$$

4.1.2 Firms

For each period the firm faces the following maximization problem, with Π_t equal to firms profits,

$$\Pi_1 = P_1 Y_1 - W N_1 \quad \text{for} \quad t = 1, 2 \tag{11}$$

where

$$Y_1 = N_1^{\alpha} \quad \text{for} \quad t = 1, 2. \tag{12}$$

maximizing with respect to Y_1 give the optimal labor supply:

$$N_1 = \left(\frac{\alpha}{W/P_1} \right)^{\frac{1}{1-\alpha}} \quad \text{for} \quad t = 1, 2 \tag{13}$$

4.1.3 Wage setting

Optimizing with respect to W using $C_2 = Y_2$ and (7), (10) yields the following equilibrium condition:

$$W = \left[\alpha\beta(1+r_1) P_1 P_2^{-1} (\alpha P_2)^{\frac{-\alpha}{1-\alpha}} P_1^{\frac{\alpha-2}{1-\alpha}} \frac{\alpha^{\frac{1}{1-\alpha}} + \frac{1}{1+r_1} \left(\alpha \frac{P_2}{P_1} \right)^{\frac{1}{1-\alpha}}}{\alpha^{\frac{2}{1-\alpha}} + \beta \left(\alpha \frac{P_2}{P_1} \right)^{\frac{2}{1-\alpha}}} \right]^{-\frac{1-\alpha}{2}} \tag{14}$$

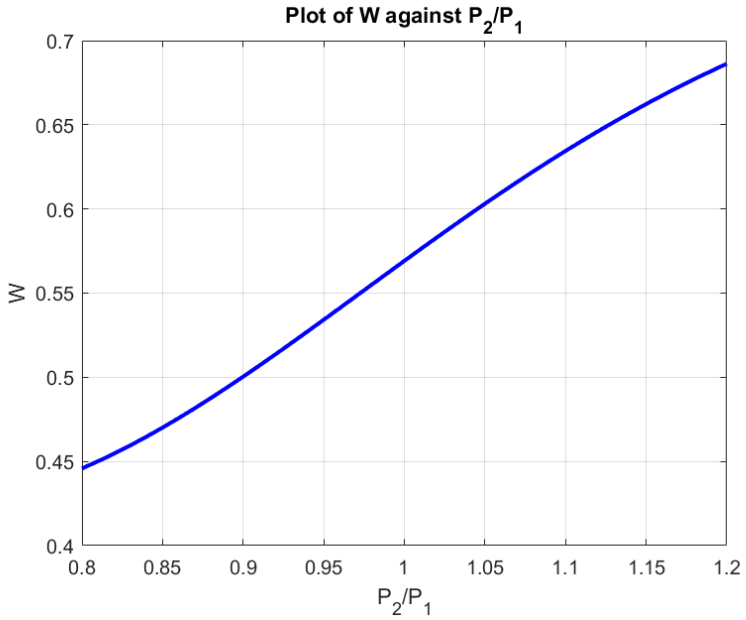


Figure 10: Plotting $\frac{P_2}{P_1}$ against W

In Figure 10, I plot the wage W depending on $\frac{P_2}{P_1}$, which can be interpreted as inflation expectations. I use a standard calibration, with $\alpha = 0.66$, $\beta = 0.99$, $r_1 = 0.01$ and $P_1 = 1$. In

this partial equilibrium setting Figure 10 shows that an increase in inflation expectations causes an increase in the optimal wage W. Taking my empirical results into account this means that, wages are increasing in inflation expectations. So higher inflation expectations of consumers increase the wage setting of consumers today. Relating to my empirical results a higher increase in inflation expectations due to the increase in personal inflation rates, lead to a larger increase in the consumer optimal wage.

4.2 New Keynesian Model

To analyze the effects of my empirical findings in a general equilibrium model I adapt a New Keynesian Model with a wage Phillips curve as in Bilbiie and Trabandt (2024). The wage Phillips curve allows me to model consumer inflation expectations explicitly and examine their effects on the propagation of shocks through the economy. In a model set-up with sticky wages and flexible prices, the pricing decision is based on the wage maximization of the worker's union. This is where consumer inflation expectations explicitly enter the New Keynesian model.
Bilbiie and Trabandt (2024) show in their analysis that under the assumption that the slopes of the price and the wage Phillips curve are equal, the equilibrium allocations are equal as well, independent if prices are sticky and wages are flexible or vice versa. I make use of these equivalence results to analyze what higher inflation expectations of consumers imply for the macro-economy. I use their proposed three-equation model, where π_t^w is the wage inflation rate, c_t equals consumption, and i_t the nominal interest rate. The parameters are set to standard values: $\beta = 0.99$, $\lambda_w = 0.0215$, $\kappa_w = 6$ and, $\phi_\pi = 1.25$. I use german data shown in Figure 3 to calibrate the model to match long-term data moments. Following the AR(1)-parameters of the shocks are $\rho_\delta = 0.7$ and $\rho_m = 0.85$. The standard deviation of the shocks are set to $\sigma_\delta = 0.3$ and $\sigma_m = 2.4$ with m_t^w being the mark-up shock, as a form of a supply shock and δ_t the discount factor shock, as a demand shock. Taking into account λ_w both shocks contribute similarly to long-term moments of the macro economy. I use the following small New Keynesian model to explore the general equilibrium effects of my empirical findings:

$$\text{Wage Phillips Curve} \quad : \quad \pi_t^w = \beta E_t \pi_{t+1}^w + \lambda_w \kappa_w c_t + \lambda_w m_t^w \tag{15}$$

$$\text{IS Curve} \quad : \quad c_t = E_t c_{t+1} - (i_t - E_t \pi_{t+1}^w) + \delta_t \tag{16}$$

$$\text{Taylor rule} \quad : \quad i_t = \phi_\pi \pi_t^w \tag{17}$$

$$\text{Demand shock} \quad : \quad \delta_t = \rho_\delta \delta_{t-1} + \epsilon_{delta} \tag{18}$$

$$\text{Cost push shock} \quad : \quad m_t^w = \rho_m m_{t-1}^w + \epsilon_m \tag{19}$$

using the properties of Bilbiie and Trabandt (2024) showing that under certain circumstances:

$$\pi_t^w = \pi_t^p \tag{20}$$

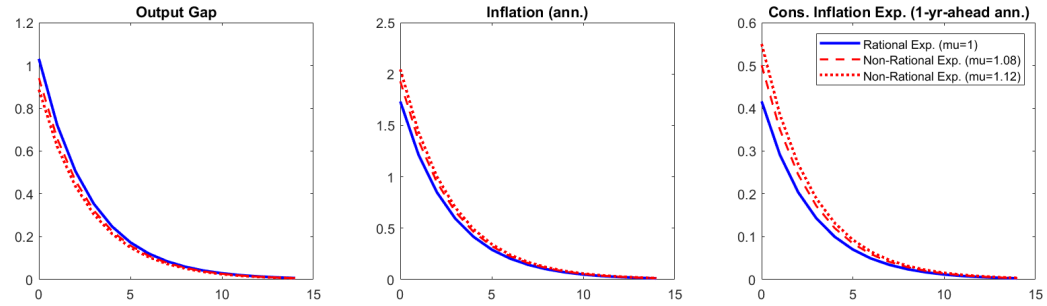


Figure 11: Response to a 1 standard deviation demand shock

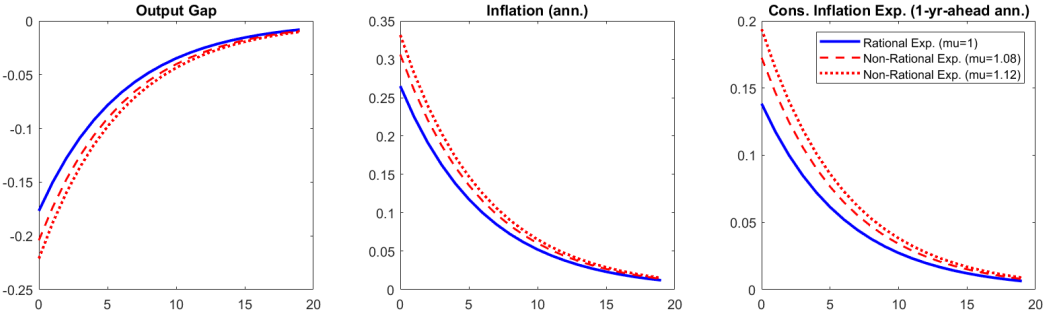


Figure 12: Response to a 1 standard deviation supply shock

To implement my estimation results use the following variant of the Wage Phillips Curve:

$$\pi_t^w = \beta\mu E_t\pi_{t+1}^w + \lambda_w\kappa_w c_t + \lambda_w m_t^w \tag{21}$$

with $\mu = 1.08$ to match the point estimate of my estimation results. I introduce μ following the idea of Gabaix (2020).

Table 3: Data vs. Model

	Data	Model
Standard deviation π	1.57	1.5
Standard deviation c	1.1	0.9
Correlation π,c	0.48	0.55

Contrary to his proposed calibration, to model my main empirical result that inflation expectations are higher if consumers' personal inflation rate increases μ needs to be larger than one. $\mu = 1.08$ is matched to the point estimate of my baseline regression. However, there is some uncertainty around the exact size of the effect. Using the 95% confidence interval μ lies in the range between 1.06 and 1.12. In section 7.1 (Appendix) I discuss in detail how to calibrate μ and how the confidence interval is calculated.

Figure 11 and Figure 12 show the reaction of the economy following a demand and supply shock. As the graphs show the overestimation of the inflation expectations of consumers

increases the reaction of inflation following a positive demand and supply shock and additionally dampens the positive reaction of output following a demand shock, and strengthens the negative reaction of output following a supply shock. As consumers and therefore the wage optimizing workers' union expect higher future inflation it demands higher wages, therefore inflation today increases by more more. This causes the central bank to react by hiking the nominal interest rate more and diminishing the positive output effects of a demand shock and amplifying the negative output effects of a supply shock. Following a demand shock the increase in the output gap is by about 10% lower than in the rational expectations model. On the other hand inflation increases by about 15% more than in the rational expectations model. My model calibration allows me to account for the increased pass-through from experienced inflation to inflation expectations. The general equilibrium analysis shows that this changes the reaction of inflation and output to aggregate shocks, because inflation expectations increase more instantaneously.

4.3 Lucas Island Model

Additionally, I want to explore the state-dependence of my empirical results. As shown in section 3.3 there is some state-dependence with respect to the effects of their personal inflation rate on inflation expectations. I use a model first introduced by Lucas (1973) and further refined by Lorenzoni (2009). One central assumption of the model introduced by Lucas (1973) is that agents live on separate islands, being subject to aggregate and local shocks. Using past information they form expectations about the distribution of shocks across local and aggregate shocks and adapt their quantity supplied. Agents form their local price expectations $P_t(z) = P_t + z$ using information on price level P_t with a known normal distribution with mean equal to $\bar{P}_t$ and variance σ^2 and z being a local deviation from the economy wide average, which is independent of P_t, normally distributed with mean zero and variance r^2. So agents estimate the distribution of P_t with the information they have on $\bar{P}_t$ and $P_t(z)$. This distribution is equal to:

$$\mathbb{E}(P_t|P_t(z), \bar{P}_t) = \left(1 - \frac{r^2}{(\sigma^2 + r^2)}\right) P_t(z) + \frac{r^2}{(\sigma^2 + r^2)} \bar{P}_t \tag{22}$$

and $\theta = \frac{r^2}{(\sigma^2+r^2)}$.

My dataset allows me to estimate θ as well as r^2 and σ^2. I can estimate these parameters using my dataset because it allows me to differentiate between the effect of local price changes, estimated using the personal inflation rate and aggregate price changes using the HICP. Using the mechanism I developed in the empirical part of the paper I estimate θ rerunning estimation (2) using the inflation rate as a control instead of time-fixed effects following:

$$E_t \pi_{t+12} = a_0 + \beta_1 \pi_{i,t} + \beta_2 \text{HICP}_t + Controls_{i,t} + \epsilon_{i,t}. \tag{23}$$

with Table 4 showing the results.

Table 4: Regression results: Local vs. Aggregate Effect

	(1)
	$E_{i,t}\pi_{t+12}$
Personal Inflation Rate (β_1)	0.123***
	[0.113,0.132]
HICP Inflation (β_2)	0.497***
	[0.482,0.511]
Age	0.0223***
	[0.0158,0.0288]
Age^2	-0.000197***
	[-0.000258,-0.000136]
Gender	0.464***
	[0.433,0.495]
Years of Schooling	-0.107***
	[-0.117,-0.0961]
Income FE	✓
Region FE	✓
_cons	1.939***
	[1.710,2.168]
N	88816
R^2	0.458

95% confidence intervals in brackets

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Using the estimated coefficients [2] across the full sample $\theta \approx 0.8$ as it displays the relative share of the total reaction with respect to the aggregate shock .

To estimate r^2 i use the property that some consumers participated twice in the survey:

$$\pi_{i,t} = \gamma_{PIR} + \ \rho_{PIR}\ \pi_{i,t-1} + \epsilon_{PIR,t} \tag{24}$$

where ρ_{PIR} is equal to the AR(1)-factor of the personal inflation rate, and r^2 can be estimated by calculating the variance of the residual $\epsilon_{PIR,t}$. And similarly to estimate σ^2 I use the inflation rate:

$$\pi_t = \gamma_{HICP} + \ \rho_{HICP}\ \pi_{t-1} + \epsilon_{HICP,t} \tag{25}$$

with ρ_{HICP} being equal to the AR(1)-factor of the personal inflation rate, and σ^2 can be

[2] Using the baseline estimation of Section 1, $\theta \approx 0.9$

estimated by calculating the variance of the residual $\epsilon_{HICP,t}$.
To correct for the fact that the two series have very different persistence parameters I use the estimated persistence parameters and calculate θ following $\theta = \frac{\frac{r^2}{1-\rho^2_{PIR}}}{\frac{r^2}{1-\rho^2_{PIR}}+\frac{\sigma^2}{1-\rho^2_{HICP}}}$.

	Full sample(BOP-HH)	High Infl.	Low Infl.
r^2	4.03	4.2	0.32
ρ_{PIR}	0.9	0.89	0.49
σ^2	0.88	0.9	0.13
ρ_{HICP}	0.95	0.9	0.94
θ	0.7	0.75	0.9

Table 5: Estimation results

My estimations confirm that the consumers in my sample use the proposed expectations formation approach as the results from estimating θ directly and estimating the value of θ based on the difference in variance and persistence between local and aggregate shocks are very similar. The direct estimation approach gives $\theta \approx 0.8$ and the indirect method using regressions (24) and (25) gives a $\theta \approx 0.7$. Given the completely different approaches, these results are reasonably close. Looking into the timing effects, both methods show that θ is increasing in normal times. Using the direct method, with the results from Table 8 (Appendix) θ increases to one as no significant effect of the personal inflation rate is identified. With regressions (24) and (25) the θ raises to about 0.9. Economically, this means that agents adapted the shares of changes they allocate to a local vs. an aggregate shock between the two different time periods. Table 5 shows that this result is driven by the changes in the persistence of the shocks. With the increase in inflation local shocks become relatively more persistent compared to aggregate shocks and therefore agents place a higher weight on local information compared to aggregate information. This means θ decreases and following agents perceive shock to be more local shocks than aggregate shocks.

Following (Lucas (1973)) the aggregate supply function takes the following form:

$$y_t = y_{nt} + \theta\gamma(P_t - \bar{P}_t) + \lambda[y_{t-1} - y_{n,t-1}] \tag{26}$$

with y_t being total output, y_{nt} being the aggregate component in output fluctuations, $y_{c,t}$ the local cyclical component and $y_{t-1} - y_{n,t-1}$ the past deviation, caused by the local component of output fluctuations. The demand function follows the form:

$$y_t + P_t = x_t \tag{27}$$

with x_t being an exogenous demand variable like a demand shock. Δx_t has mean δ and variance σ^2_x.

The equilibrium equations of price and output are given by:

$$P_t = \frac{\theta\gamma\delta}{1+\theta\gamma} - \lambda\beta + \frac{1}{1+\theta\gamma}x_t + \frac{\theta\gamma}{1+\theta\gamma}x_{t-1} - \lambda y_{t-1} - (1-\lambda)y_{nt} \tag{28}$$

$$y_t = -\frac{\theta\gamma\delta}{1+\theta\gamma} + \lambda\beta + \frac{\theta\gamma}{1+\theta\gamma}\Delta x_t + \lambda y_{t-1} + (1-\lambda)y_{nt} \tag{29}$$

$$\Delta P_t = -\beta + \left(1 - \frac{\theta\gamma}{1+\theta\gamma}\right)\Delta x_t + \frac{\theta\gamma}{1+\theta\gamma}\Delta x_{t-1} - \lambda\Delta y_{c,t-1} \tag{30}$$

$$y_{ct} = -\frac{\theta\gamma}{1+\theta\gamma}\delta + \frac{\theta\gamma}{1+\theta\gamma}\Delta x_t + \lambda y_{c,t-1} \tag{31}$$

This model shows that following a demand shock, a lower θ means that consumption reacts less following an aggregate shock, as agents perceive shocks to be more caused by local shocks. Prices, however react more instantaneously following an aggregate demand shock in a situation with a lower θ. This means that in times of high inflation and therefore lower θ agents consumption reacts less to aggregate demand shocks, both negative and positive demand shocks. This is due to the shift in weighting from aggregate to local information. The higher weight put on local information in times of high inflation can be interpreted as a form of de-anchoring as households inflation expectations about aggregate inflation developments become more dependent on local information about price changes. This has consequences for the pass-through of aggregate shocks as for example monetary policy shocks, because the observed changes will be considered to be relatively more local than before even though they are caused by aggregate shocks.

5 Discussion and Conclusion

In this paper I show that there is a significant positive impact of the personal inflation rate on consumers inflation expectations. I document that there is a strongly significant positive relationship between the inflation rate of the consumer's basket and their inflation expectations. Using German household survey data I can quantify the effect an increase in the personal inflation rate has on consumers inflation expectations. I show that a 1 percentage point increase in their personal inflation rate results in an about 0.02 to 0.05 percentage point additional increase in one-year ahead aggregate inflation expectations.

I show that these effects differ across states of the economy but are stable across different socio-economic groups. As long as inflation rates are close to the inflation target, I am not able to detect a significant relationship between personal inflation rates and expected inflation. Once the inflation rate increases I can find a pass-through from personal inflation rates to inflation expectations.

Additionally, I show that increases in inflation rates or increased spending on specific consump-

tion goods results in significantly higher aggregate inflation expectations. These categories are spending on food, mobility, and housing. Consumers who increase their spending in these categories or experience an increase in inflation rates in these categories report significantly higher inflation expectations. For future analysis it will be very interesting to analyze the underlying reason for this observed salience of specific goods prices.

Using a New Keynesian model with a non-rational wage Phillips curve I show that this amplified reaction to inflation expectations changes the aggregate reaction to demand and supply shocks. It amplifies the reaction of inflation following a demand and supply shock and amplifies the reaction of output following a supply shock, but dampens the reaction of output following a demand shock. Intuitively the pass-through from inflation to inflation expectations is larger and this reinforces the inflation reaction following a shock ceteris paribus. In the general equilibrium analysis the central banks reaction limits the inflation response and determines the change in the reaction of the output gap. The dampened output reaction to an a demand shock when agents take their personal shocks more into consideration is confirmed by my analysis using a Lucas Island model. The analysis shows that in times of high inflation agents consider local shocks to be relatively more important therefore the reaction to a aggregate demand shocks is dampened. This phenomenon can be considered a form of de-anchoring as agents aggregate inflation expectations are now to a lower share depending on aggregate inflation developments. As agents react less to aggregate demand shocks, this also impacts the transmission of aggregate monetary policy or fiscal policy shocks. The positive output effects of expansionary monetary or fiscal policy shocks are dampened as agents interpret them as more local in times of high inflation. Therefore, further investigations how this relationship evolves over time and whether this extends to other countries are critical to understand the importance of this phenomenon. All told, my empirical findings show that in times of high inflation, there is a significant pass-through of the personal inflation rate to consumers' aggregate inflation expectations. My theoretical analysis shows that this changes the overall pass-through of shocks. Specifically, the effects of aggregate demand shocks on output are dampened and the reaction of inflation is amplified.

6 References

Nikoleta Anesti, Vania Esady, and Matthew Naylor. Food prices matter most: Sensitive household inflation expectations. *LSE Centre for Macro Paper*, 2024. doi: https://www.lse.ac.uk/CFM/assets/pdf/CFM-Discussion-Papers-2024/CFMDP2024-34-Paper.pdf.

Elisabeth Beckmann and Tobias Schmidt. Bundesbank online pilot survey on consumer expectations. *Technical Paper No. 01/2020*, 2020. doi: https://hdl.handle.net/10419/283321.

Florin Bilbiie and Mathias Trabandt. Sticky prices or sticky wages? an equivalence result. *The Review of Economics and Statistics*, 2024. doi: https://cepr.org/publications/dp18542.

Carola Binder and Christos Makridis. Stuck in the seventies: Gas prices and consumer sentiment. *The review of economics and statistics*, 104(2):293–305, 2022. ISSN 0034-6535.

Carola Conces Binder. Inflation expectations and the price at the pump. *Journal of macroeconomics*, 58:1–18, 2018. ISSN 0164-0704.

Dominik Boddin, Mona Köhler, Tobias Schmidt, Susanne Helmschrott, and Anne-Kathrin Fischer. Bundesbank-online-panel-households (bop-hh). doi: https://doi.org/10.12757/Bbk.BOPHH.202402.

Bernardo Candia, Olivier Coibion, and Yuriy Gorodnichenko. The macroeconomic expectations of firms. *NBER Working Paper Series*, 2022. ISSN 0898-2937.

Bernardo Candia, Olivier Coibion, and Yuriy Gorodnichenko. The inflation expectations of u.s. firms: Evidence from a new survey. *Journal of monetary economics*, 145:103569, 2024. ISSN 0304-3932.

Olivier Coibion, Yuriy Gorodnichenko, and Tiziano Ropele. Inflation expectations and firm decisions: New causal evidence. *The Quarterly journal of economics*, 135(1):165–219, 2020. ISSN 0033-5533.

Olivier Coibion, Yuriy Gorodnichenko, and Michael Weber. Fiscal policy and households' inflation expectations: Evidence from a randomized control trial. *NBER Working Paper Series*, 2021. ISSN 0898-2937.

Olivier Coibion, Yuriy Gorodnichenko, and Michael Weber. The expected, perceived, and realized inflation of u.s. households before and during the covid19 pandemic. *IDEAS Working Paper Series from RePEc*, 2022.

Adriana Cornea-Madeira, Cars Hommes, and Domenico Massaro. Behavioral heterogeneity in u.s. inflation dynamics. *Journal of business and economic statistics*, 37(2):288–300, 2019. ISSN 0735-0015.

Francesco D'Acunto, Ulrike Malmendier, Juan Ospina, and Michael Weber. Exposure to grocery prices and inflation expectations. *Journal of Political Economy*, 129(5):1615–1639, 2021a.

Francesco D'Acunto, Ulrike Malmendier, and Michael Weber. Gender roles produce divergent economic expectations. *Proceedings of the National Academy of Sciences - PNAS*, 118(21): 1, 2021b. ISSN 0027-8424.

Alexander Dietrich, Edward S Knotek, Kristian Ove R Myrseth, Robert W Rich, Raphael Schoenle, and Michael Weber. Greater than the sum of the parts: Aggregate vs. aggregated inflation expectations. *IDEAS Working Paper Series from RePEc*, 2022.

Alexander M. Dietrich. Consumption categories, household attention, and inflation expectations: Implications for optimal monetary policy. *Journal of monetary economics*, page 103594, 2024. ISSN 0304-3932.

Lena Dräger, Michael J Lamla, and Damjan Pfajfar. How to limit the spillover from the 2021 inflation surge to inflation expectations? *IDEAS Working Paper Series from RePEc*, 2022.

Francesco D'Acunto, Daniel Hoang, Maritta Paloviita, and Michael Weber. Iq, expectations, and choice. *The Review of economic studies*, 90(5):2292–2325, 2023. ISSN 0034-6527.

Xavier Gabaix. A behavioral new keynesian model. *The American economic review*, 110(8): 2271–2327, 2020. ISSN 0002-8282.

Nicola Gennaioli, Marta Leva, Raphael Schoenle, and Andrei Shleifer. How inflation expectations de-anchor: The role of selective memory cues. *NBER Working Paper*, 2024. doi: 10.3386/w32633.

Mathias Hoffmann, Emanuel Moench, Lora Pavlova, and Guido Schultefrankenfeld. Would households understand average inflation targeting? *Journal of monetary economics*, 129: S52–S66, 2022. ISSN 0304-3932.

Guido Lorenzoni. A theory of demand shocks. *The American economic review*, 99(5):2050–2084, 2009. ISSN 0002-8282.

Robert E. Lucas. Some international evidence on output-inflation tradeoffs. *The American economic review*, 63(3):326–334, 1973. ISSN 0002-8282.

Michael Weber, Bernardo Candia, Hassan Afrouzi, Tiziano Ropele, Rodrigo Lluberas, Serafin Frache, Brent Meyer, Saten Kumar, Yuriy Gorodnichenko, Dimitris Georgarakos, Olivier Coibion, Geoff Kenny, and George Ponce. Tell me something i don't already know: earning in low and high-inflation settings. 2914, 2024. ISSN 1725-2806.

Ivan Yotzov, Nicholas Bloom, Philip Bunn., Paul Mizen, and Gregory Thwaites. The speed of firm response to inflation. *CFM-Discussion-Papers*, 2024.

7 Appendix

7.1 How to calibrate μ ?

The parameter μ defines how much more inflation expectations of agents increase if their inflation rate increases by one percent. In a representative agent model the personal inflation rate is equal to the aggregate rate because their is only one representative basket and only one consumption good. In general the relationship between the increase in inflation and inflation expectations is mainly determined by the nature of the shock, more specifically the AR(1) coefficient. Figure 13 depicts how the pass-through defined as $\frac{\pi_{t+12}}{\pi_t}$ is dependent on the AR(1)-factor of the shock. Using my results shown in Table 7 an increase of aggregate inflation by 1% caused an increase of about 0.4, and an increase in the personal inflation rate increases the inflation expectations by an additional 0.036. This is equivalent to an about 8.5 % increase compared to the initial reaction. Using the model described in section 4.2. this is equivalent to $\mu = 1.08$. Within this estimation there is already uncertainty about the value of the point estimate. Taking the 95% confidence interval into account $1.06 < \mu > 1.12$ would be reasonable. Additionally, taking into account my estimation results from Table 4 there is a significant upside risk. Instead of using wave fixed effects I use the HICP Inflation rate as a control directly. Then the increase in inflation expectations due to an increase in the personal inflation rate accounts for an increase of about 22 % additional to the reaction to increase in aggregate inflation. This is equivalent to $\mu = 1.17$. All told, the conservative estimate from my regression results would suggest a $1.06 < \mu > 1.12$. However one should acknowledge the significant upside risk taking into account the estimation results displayed in Table 4 and the general robustness of the estimated coefficient.

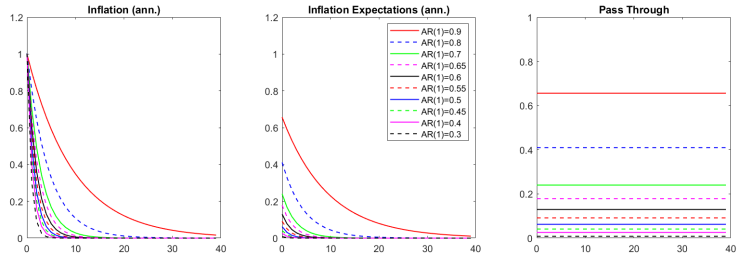
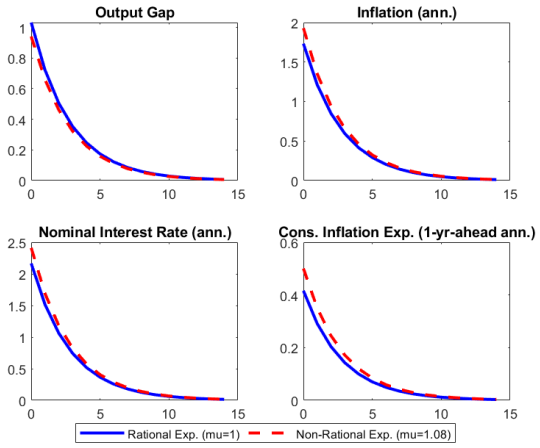
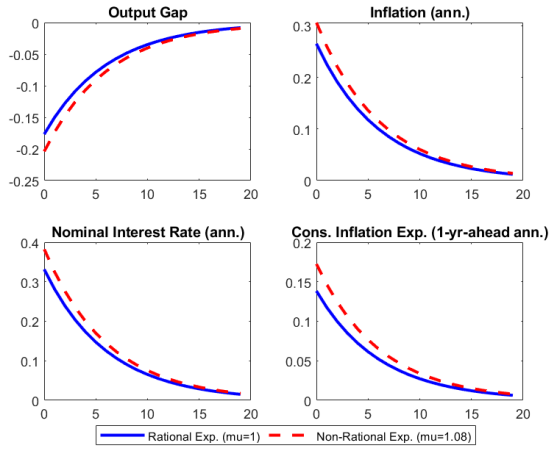


Figure 13: Relationship between Inflation and Inflation Expectations dependent on AR(1)

7.2 IRFs New Keynesian Model

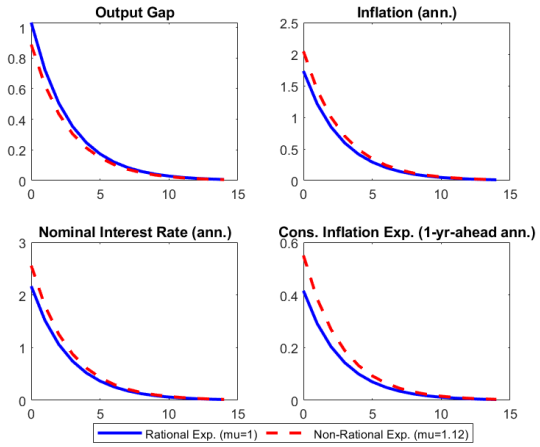


(a) Response to a demand shock

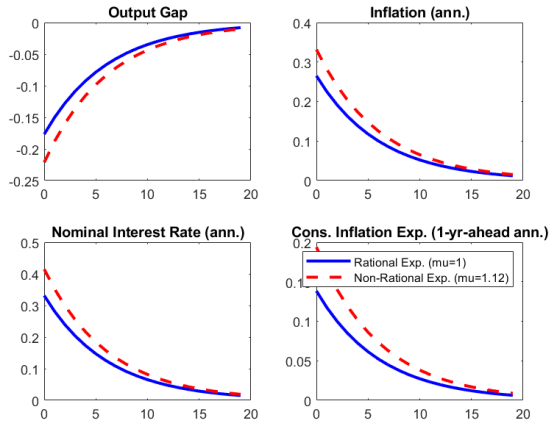


(b) Response to a wage mark-up shock

Figure 14: IRFs to a demand and supply shock with $\mu = 1.08$



(a) Response to a demand shock

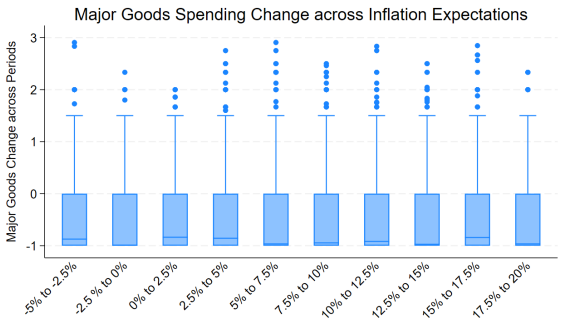


(b) Response to a wage mark-up shock

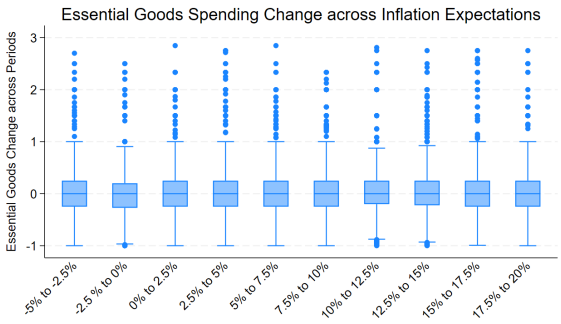
Figure 15: IRFs to a demand and supply shock with $\mu = 1.12$

7.3 Consumption Changes across Inflation Expectation Level

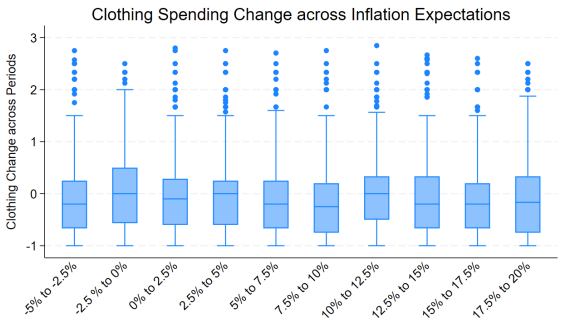
To make sure that the changes in the personal inflation rate not due to changes in the consumption basket that are dependent on inflation expectations I analyze the variance of changes in spending on the specific goods categories for different levels of inflation expectations. For this exercise I use the subsample of observations of households that participated in the survey to two month following each other. These are about a 15% of the total sample size. The following Figure shows that the variance of change in spending compared to the previous period is good specific and for some goods rather high, but there is no systematic relationship connected to the level of inflation expectations.



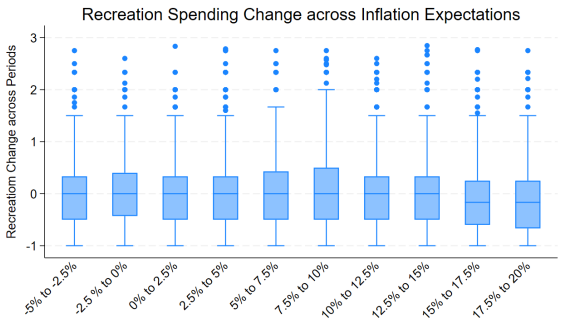
(a) Change in Spending on Major Goods



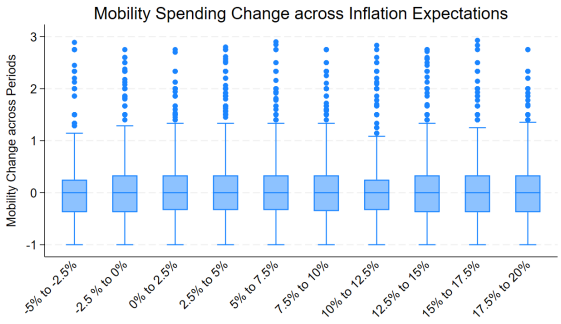
(b) Change in Spending on Essential Goods



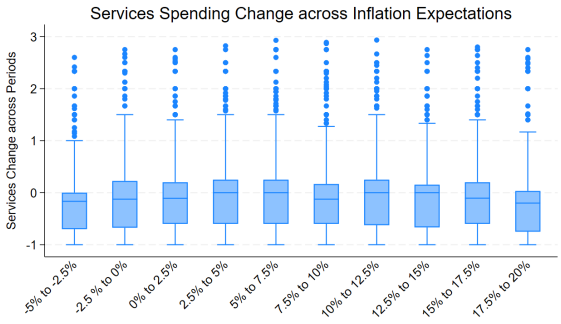
(c) Change in Spending on Clothing



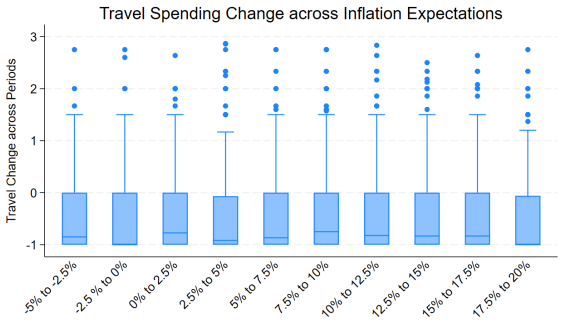
(d) Change in Spending on Recreation



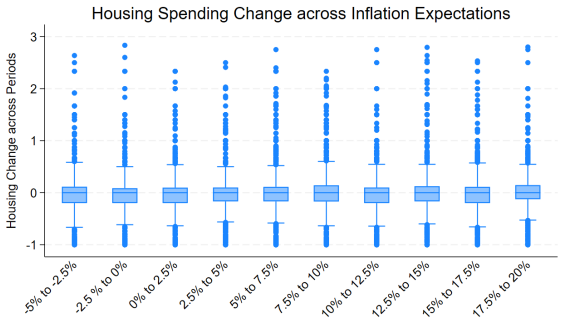
(e) Change in Spending on Mobility



(f) Change in Spending on Services



(g) Change in Spending on Travel



(h) Change in Spending on Housing

Figure 16

7.4 Estimation Tables

Table 6: Inflation Expectations: Differences across socio-economic groups

	(1) $E_t\pi_{t+12}$	(2) $E_t\pi_{t+12}$	(3) $E_t\pi_{t+12}$	(4) $E_t\pi_{t+12}$	(5) $E_t\pi_{t+12}$	(6) $E_t\pi_{t+12}$	(7) $E_t\pi_{t+12}$	(8) $E_t\pi_{t+12}$
Personal Infl. Rate	0.0367***	0.0358***	0.0409***	0.0215**	0.0218*	0.0644*	0.0291***	0.0362***
Age	0.0294***	0.0489***	0.0335***	0.0147***	0.00487	0.00805	0.0168***	0.0534***
Age^2	-0.000247***	-0.000415***	-0.000317***	-0.000109*	0.00000778	-0.0000596	-0.000133***	-0.000463***
Gender	0.476***	0.562***	0.439***	0.427***	0.447***	0.460***	0	0
Yrs of Schooling	-0.0993***	-0.0814***	-0.0919***	-0.111***	-0.123***	-0.180***	-0.0902***	-0.108***
HH Size	0.0533***	0.164***	0.0884***	-0.00429	0.0532***	0.0674*	0.0522***	0.0664***
HH Income FE	✓	✓	✓	✓	✓	✓	✓	✓
Wave FE	✓	✓	✓	✓	✓	✓	✓	✓
Region FE	✓	✓	✓	✓	✓	✓	✓	✓
_cons	2.537***	2.039***	2.128***	2.940***	3.513***	3.710***	3.058***	3.437***
N	88816	32341	20679	35796	39025	3432	52385	36429
R^2	0.510	0.475	0.514	0.535	0.466	0.496	0.545	0.453

95% confidence intervals in brackets

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Inflation Expectations

	(1)	(2)	(3)
	$E_t\pi_{t+12}$	$E_t\pi_{t+12}$	$E_t\pi_{t+12}$
Personal Inflation Rate	0.441***	0.439***	0.0367***
	[0.438,0.445]	[0.436,0.443]	[0.0260,0.0474]
Age		0.0221***	0.0294***
		[0.0153,0.0289]	[0.0233,0.0354]
Age^2		-0.000191***	-0.000247***
		[-0.000255,-0.000128]	[-0.000303,-0.000190]
Gender		0.480***	0.476***
		[0.447,0.512]	[0.447,0.505]
Years of Schooling		-0.0999***	-0.0993***
		[-0.111,-0.0890]	[-0.109,-0.0896]
HH-Size		0.0373***	0.0533***
		[0.0195,0.0551]	[0.0375,0.0691]
Wave FE			✓
HH Income FE		✓	✓
Region FE		✓	✓
_cons	2.281***	2.360***	2.537***
	[2.253,2.310]	[2.122,2.599]	[2.303,2.770]
N	88972	88816	88816
R^2	0.413	0.425	0.510

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Inflation Expectations: Time Subsamples

	05/2020 - 06/2021	07/2021 - 03/2024
	$E_t\pi_{t+12}$	$E_t\pi_{t+12}$
Personal Inflation Rate	0.0150	0.0332***
	[-0.0225,0.0526]	[0.0218,0.0445]
Age	0.0289***	0.0352***
	[0.0199,0.0379]	[0.0279,0.0424]
Age^2	-0.000252***	-0.000301***
	[-0.000337,-0.000167]	[-0.000368,-0.000233]
Gender	0.240***	0.521***
	[0.196,0.284]	[0.486,0.555]
Years of Schooling	-0.0713***	-0.0996***
	[-0.0861,-0.0565]	[-0.111,-0.0881]
Hh Size	0.0242*	0.0646***
	[0.000564,0.0479]	[0.0458,0.0834]
HH Income FE	✓	✓
Wave FE	✓	✓
Region FE	✓	✓
_cons	2.337***	2.693***
	[2.012,2.661]	[2.393,2.993]
N	18596	73557
R^2	0.068	0.403

95% confidence intervals in brackets

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9

	(1)	(2)	(3)	(4)	(5)	(6)
	$E_t\pi_{t+12}$	$E_t\pi_{t+12}$	$E_t\pi_{t+12}$	$E_t\pi_{t+12}$	$E_t\pi_{t+12}$	$E_t\pi_{t+12}$
Major goods x Infl.	0.00495	0.00491	0.00411	0.00411	0.00536	0.00440
	(0.65)	(0.65)	(0.54)	(0.54)	(0.70)	(0.58)
Essential goods x Infl.	0.0955***	0.0952***	0.0952***	0.0953***	0.0947***	0.0948***
	(13.20)	(13.16)	(13.15)	(13.17)	(13.07)	(13.08)
Clothing x Infl.	0.0211	0.0201	0.0215	0.0217	0.0245	0.0243
	(0.40)	(0.38)	(0.40)	(0.41)	(0.46)	(0.46)
Recreation x Infl.	-0.458***	-0.302***	-0.229***	-0.296**	-0.283***	-0.206
	(-13.49)	(-3.37)	(-3.73)	(-3.28)	(-3.30)	(-1.88)
Mobility x Infl.	0.141***	0.141***	0.140***	0.140***	0.141***	0.140***
	(9.52)	(9.52)	(9.47)	(9.47)	(9.55)	(9.48)
Services x Infl.	-0.00830	-0.00829	-0.0101	-0.00988	-0.00775	-0.00963
	(-0.26)	(-0.26)	(-0.32)	(-0.31)	(-0.24)	(-0.30)
Travel x Infl.	-0.0228***	-0.0228***	-0.0234***	-0.0234***	-0.0224***	-0.0231***
	(-4.23)	(-4.21)	(-4.32)	(-4.32)	(-4.14)	(-4.27)
Housing x Infl.	0.0498***	0.0499***	0.0488***	0.0487***	0.0495***	0.0484***
	(9.66)	(9.70)	(9.48)	(9.45)	(9.60)	(9.40)
Socio-Economic Controls	✓	✓	✓	✓	✓	✓
Wave FE	✓	✓	✓	✓	✓	✓
Recreation x Education		✓		✓		✓
Recreation x Workstatus			✓	✓		✓
Recreation x HH Income					✓	✓
_cons	1.544***	1.525***	1.576***	1.582***	1.510***	1.562***
	(15.01)	(14.76)	(14.80)	(14.84)	(14.49)	(14.53)
N	88909	88909	88585	88585	88909	88585
R^2	0.513	0.513	0.514	0.514	0.513	0.514

t statistics in parentheses

7.5 Robustness Checks

To address potential concerns sparked by Binder and Makridis (2022) I test whether the results I find is robust to only first-time participants or explicitly exclude first-time participants. I find that my results from the empirical analysis is independent of the participation frequency of the

Table 9: Only first-time participants

	Baseline	Robust Regression
	$E_t\pi_{t+12}$	$E_t\pi_{t+12}$
Personal Inflation Rate	0.0877*	0.0308**
	(2.15)	(3.00)
Age	0.00975	0.0163***
	(0.57)	(3.82)
Age^2	-0.000364*	-0.000148***
	(-2.24)	(-3.61)
Gender	1.693***	0.354***
	(19.61)	(16.26)
Years of Schooling	-0.366***	-0.0835***
	(-12.50)	(-11.31)
HH-Size	0.194***	0.0296**
	(4.27)	(2.58)
Region FE	✓	✓
HH-Income FE	✓	✓
Wave FE	✓	✓
_cons	8.092***	3.036***
	(11.68)	(17.37)
N	33052	33052
R^2	0.084	0.521

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10: Only non-first-time participants

	Baseline $E_t\pi_{t+12}$	Robust Regression $E_t\pi_{t+12}$
Personal Inflation Rate	0.0409*	0.0328***
	(2.43)	(5.26)
Age	0.100***	0.0454***
	(8.75)	(10.70)
Age^2	-0.00107***	-0.000380***
	(-10.16)	(-9.75)
Gender	0.979***	0.541***
	(18.91)	(28.19)
Years of Schooling	-0.193***	-0.101***
	(-11.13)	(-15.70)
HH-Size	0.236***	0.0677***
	(8.21)	(6.37)
Region FE	✓	✓
HH-Income FE	✓	✓
Wave FE	✓	✓
_cons	3.196***	2.019***
	(7.44)	(12.68)
N	59101	59101
R^2	0.108	0.450

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

7.6 2 period model

Taking the derivative of W wrt to P_2 and P_1

$$\frac{\partial W}{\partial P_2} = \frac{2\beta \cdot \left(\frac{\alpha P_2}{P_1}\right)^{\frac{3}{1-\alpha}} + (3r_1+3)\,\alpha^{\frac{1}{1-\alpha}}\beta \cdot \left(\frac{\alpha P_2}{P_1}\right)^{\frac{2}{1-\alpha}} + (r_1+1)\,\alpha^{\frac{3}{1-\alpha}}}{2P_2\left(\left(\frac{\alpha P_2}{P_1}\right)^{\frac{1}{1-\alpha}} + (r_1+1)\,\alpha^{\frac{1}{1-\alpha}}\right)\left(\beta \cdot \left(\frac{\alpha P_2}{P_1}\right)^{\frac{2}{1-\alpha}} + \alpha^{\frac{2}{1-\alpha}}\right) \cdot \left(\frac{P_1^{\frac{\alpha-2}{1-\alpha}+1}(r_1+1)\alpha\beta\left(\frac{\left(\frac{\alpha P_2}{P_1}\right)^{\frac{1}{1-\alpha}}}{r_1+1} + \alpha^{\frac{1}{1-\alpha}}\right)}{P_2(\alpha P_2)^{\frac{\alpha}{1-\alpha}}\left(\beta\cdot\left(\frac{\alpha P_2}{P_1}\right)^{\frac{2}{1-\alpha}} + \alpha^{\frac{2}{1-\alpha}}\right)}\right)^{\frac{1-\alpha}{2}}}$$

$$\frac{\partial W}{\partial P_1} = \frac{\left((r_1+1)\cdot\left(\frac{P_2\alpha}{P_1}\right)^{\frac{2}{\alpha-1}} + 2\alpha^{\frac{1}{\alpha-1}}\cdot\left(\frac{P_2\alpha}{P_1}\right)^{\frac{1}{\alpha-1}} + (-r_1-1)\,\alpha^{\frac{2}{\alpha-1}}\beta\right)\cdot\left(\frac{P_2\alpha}{P_1}\right)^{\frac{1}{\alpha-1}} \cdot \left(\frac{\alpha(P_2\alpha)^{\frac{\alpha}{\alpha-1}}\beta\left(\frac{1}{\left(\frac{P_2\alpha}{P_1}\right)^{\frac{1}{\alpha-1}}} + \frac{r_1+1}{\alpha^{\frac{1}{\alpha-1}}}\right)P_1^{\frac{1}{\alpha-1}}}{P_2\left(\frac{\beta}{\left(\frac{P_2\alpha}{P_1}\right)^{\frac{2}{\alpha-1}}} + \frac{1}{\alpha^{\frac{2}{\alpha-1}}}\right)}\right)^{\frac{\alpha-1}{2}}}{2\left((r_1+1)\cdot\left(\frac{P_2\alpha}{P_1}\right)^{\frac{1}{\alpha-1}} + \alpha^{\frac{1}{\alpha-1}}\right)\left(\left(\frac{P_2\alpha}{P_1}\right)^{\frac{2}{\alpha-1}} + \alpha^{\frac{2}{\alpha-1}}\beta\right)P_1}$$