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Dario Bonciani,[1] Riccardo M Masolo[2] and Silvia Sarpietro[3]

Abstract

Food price changes have a strong and persistent impact on UK consumers' inflation expectations. Over 60% of households report that their inflation perceptions are heavily influenced by food prices and display a stronger association between their inflation expectations and perceptions. We complement this finding with a Structural Vector Autoregression (SVAR) analysis, illustrating that food price shocks have a larger and more persistent effect on expectations compared to a 'representative' inflation shock. Finally, we augment the canonical New-Keynesian model with behavioural expectations that capture our empirical findings and show that monetary policy should respond more aggressively to food price shocks.

Key words: Inflation expectations, inflation perceptions, monetary policy.

JEL classification: D10, D84, E31, E52, E58, E61.

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(1) Sapienza University of Rome. Email: dario.bonciani@uniroma1.it
(2) Universitá Cattolica del Sacro Cuore, Milano. Email: riccardomaria.masolo@unicatt.it
(3) University of Bologna. Email: silvia.sarpietro@unibo.it

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Bank of England, Threadneedle Street, London, EC2R 8AH
Email: enquiries@bankofengland.co.uk

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1 Introduction

Food prices are known to be salient to households, despite representing a relatively modest share of total expenditures (see, e.g., Coibion and Gorodnichenko, 2015). However, the impact of food prices on perceived and expected inflation, and their dynamics, remains largely unexplored. Understanding how price experiences influence inflation expectations is crucial for determining the appropriate monetary policy response. In particular, it is critical to understand whether monetary policy should respond to food price shocks differently compared to generic "representative" inflation shocks and, more generally, whether central banks should target a core inflation index (e.g., Blinder and Reis, 2005, Mishkin, 2007, Bodenstein et al., 2008). This paper contributes to this debate by showing that a decisive monetary policy response to food price shocks is recommended despite their well-known volatility, due to their outsized impact on inflation expectations.

We provide empirical evidence that changes in food prices significantly shape perceptions about current inflation and expectations about future inflation. First, we use repeated cross-sectional survey data for the UK, specifically the Bank of England/Ipsos Inflation Attitudes Survey (BIAS), covering the period from 2008 to 2013.[1] We document the role that individual experiences, including exposure to food prices, play in forming inflation perceptions and expectations. We also assess whether the transmission of inflation perceptions to expectations is influenced by the importance attributed to different individual experiences. Second, we conduct a Structural Vector Autoregression (SVAR) analysis to assess whether inflation expectations respond differently to a food price shock compared to generic "representative" inflation shocks. Finally, we make a simple behavioural modification to the canonical three-equation New Keynesian model, disciplined by our empirical findings, to evaluate whether monetary authorities should respond differently to food price shocks.

We find that not only consumer inflation expectations are highly responsive to food price changes, but they also display a particularly high degree of persistence for those individuals attributing a key role to food prices when forming their perceptions. This makes the transmission of food price shocks to the economy peculiar. We show that monetary policy should respond more aggressively to food-price shocks, which calls for a re-evaluation of the emphasis that is given to measures of core inflation

[1] This sample period is determined by the availability of our questions of interest, as explained later.

as a guide to monetary policy decisions.

Our *first step* explores the mechanism underlying the persistence of inflation expectations. We do so exploiting a set of questions from the BIAS survey concerning consumers' perceived and expected inflation, as well as the salience of different item prices in forming their inflation perceptions. These questions were included in the survey between 2008 and 2013. The majority of households, around 61%, report that food prices are a key determinant of their perception of overall price changes over the last 12 months, suggesting that food prices play an outsized role in shaping inflation perceptions. This contrasts with media reports, which are deemed very important by only about 24% of respondents. Results from an ordered probit regression indicate that households who place greater emphasis on food prices when forming their inflation perceptions are more likely to be women, older, and less educated. Moreover, individuals who consider food prices to be particularly important tend to attach a significantly higher weight to their own perceptions of current inflation when forming their expectations about inflation for the next 12 months. In other words, their inflation expectations tend to be more backward-looking. We shed light on how heterogeneity in observable characteristics and individual experiences shape inflation perceptions and expectations, emphasizing the crucial role played by food prices, and adding this channel to the growing literature on how people form expectations and process information (see, for instance, Bordalo et al., 2020, and, for a survey, Coibion et al., 2018a). We perform several robustness checks to address common issues of using survey data to the analysis of inflation expectations and perceptions, such as question wording, priming, learning, as outlined in Weber et al. (2022). Our main findings remain qualitatively robust to these checks. Finally, note that existing studies either use cross-sectional data or suffer from bias from respondents' learning experiences in panel data. We propose controlling for unobserved heterogeneity via the fuzzy C-means (FCM) clustering algorithm following the approach proposed by Lewis et al. (2023), which is particularly suited to our empirical analysis with repeated cross-sectional data. Thus, an important contribution of our work is that, beyond accounting for observable heterogeneity, we also control for unobserved heterogeneity while addressing the learning challenges associated with panel data.

Given these micro-level results, our *second step* is to investigate whether similar patterns emerge

at the macro level. To this end, we run a Structural Vector Autoregression (SVAR) analysis and find that consumer inflation expectations respond more strongly to a food price shock than to an average (or "representative") shock to prices. Importantly, the response of inflation expectations to a food price shock is strikingly persistent, suggesting that food price shocks leave a lasting impression on households.

In particular, our SVAR analysis builds on work by Peersman (2022), who constructs a narrative series of international food price shocks to estimate their impact on Euro Area inflation. We follow the same approach and use the same narrative series as an external instrument in a Proxy SVAR. Additionally, our SVAR includes measures of subjective and market-based expectations, and we focus our attention on their responses to food price shocks. Moreover, we compare the responses to a food price shock with those to a "representative" shock to inflation, which we define in an agnostic way, as the shock explaining the largest share of the one-step-ahead forecast-error variance for inflation. This approach relates to the max-share identification method of Uhlig (2004) and Angeletos et al. (2020), and parallels the definition of an unemployment shock in Del Negro et al. (2020).

The results from our SVAR analysis are consistent with the micro evidence, suggesting the following underlying mechanism. When faced with an exogenous food price increase, individuals who find food prices particularly salient immediately adjust their inflation perceptions upwards. Moreover, because they heavily weigh their own perceptions when forming expectations, inflation expectations increase more in response to a food price shock compared to a generic "representative" price shock. These high expectations turn out to also be particularly persistent, as a result of the high weight attached to own price perceptions.

Finally, in our *third step* we formalise the mechanism just outlined and draw normative implications for monetary policy in a tractable three-equation New Keynesian model (Galí, 2015). We model food price shocks as a first-order autoregressive (AR(1)) cost-push disturbance and assume a minimal behavioural twist to the canonical rational expectation-formation process. Under rational expectations, inflation expectations in this model economy are proportional to current inflation, $\mathbb{E}_t \pi_{t+1} = \rho_e \pi_t$, with the coefficient of proportionality equal to the degree of autocorrelation in the

underlying cost-push process (ρ_e). In light of our empirical findings, we posit a simple behavioural expectation-formation process of the form $\mathbb{E}_t^B \pi_{t+1} = \rho_e^B \pi_t$, for some $\rho_e \leq \rho_e^B < 1$. In sum, we model a food price shock as a cost-push shock, which households perceive to be more persistent than it actually is. Based on this, we derive two simple but noteworthy results. First, the effect of a food price shock on inflation is larger than that of other cost-push shocks. Second, a central bank would have to respond more strongly to inflation to deliver the same inflation profile when faced with a food price shock compared to another similarly-sized cost-push shock. Most importantly, this stronger reaction to inflation would result in a larger deviation of output from its potential level, but would be well worthy from a welfare-maximizing perspective.

This suggests that it may not be advisable to focus primarily on measures of core inflation, which exclude food and energy prices. This policy strategy is often recommended due to the high volatility of commodity prices and them largely being determined on global markets, which makes them relatively insensitive to monetary policy interventions. These considerations, based on the statistical properties of the series, disregard the peculiar impact of food prices on expectations. Their large and long-lasting impact on household inflation expectations puts further upward pressure on inflation, which requires a stronger monetary policy reaction.

With our first set of empirical results, we contribute to the growing literature on inflation expectations. First, we speak to the body of research analysing the formation of individual expectations about inflation, which mainly focused on the role played by either grocery experience, media reports, or house and energy prices. We highlight the key role played by food prices, as documented, among others, by Coibion and Gorodnichenko (2015), Cavallo et al. (2017), Berge (2018), D'Acunto et al. (2021) and Coibion et al. (2022a).[2] With respect to them, we exploit direct questions asked to respon-

[2]Coibion and Gorodnichenko (2015) find that households' inflation expectations are more sensitive to gasoline prices than those of professionals, suggesting that consumers' expectations are influenced by frequently observed goods, including food and energy prices. Cavallo et al. (2017) presents survey evidence suggesting that personal experiences, such as memories of price changes in supermarkets, significantly affect expectations even when reliable sources of information are available. Berge (2018) show that consumers' inflation expectations critically depend on food and energy prices as well as on income and consumer sentiment. Using scanner data, D'Acunto et al. (2021) find that consumers, when forming their expectations about the inflation rate, place a large weight on the prices observed in their daily grocery shopping. Their results suggest that in their expectation formation process, the frequency and size of price changes matter more than the share of groceries in their consumption bundle. Coibion et al. (2022a) find that prices of frequently observed goods, like food and energy, are key determinants of inflation perceptions in low-and-stable inflation environments, possibly due to successful monetary policy regimes, which, by stabilizing inflation,

dents to infer the relative importance of the different item prices, including food prices, on inflation expectations. In particular, the survey we use *directly* asks respondents what mattered the most in forming the inflation perceptions and encompass almost all individual experiences that have been separately considered in the literature. This gives us a comprehensive and direct evidence of inflation experiences, complementing studies that infer experiences from shopping data (D'Acunto et al., 2021) or employ experimental analysis (Bruine de Bruin et al., 2011). In terms of other item experiences, we document a quite limited role of media in line with Dräger (2015), and a sizeable impact of gasoline prices, although smaller compared to that of food, in line with Aidala et al. (2024). Moreover, our survey allows us to study the direct impact of heterogeneity in observable characteristics and all items experiences on perceptions about current inflation and their transmission on expected inflation. We contribute to the literature on the transmission of inflation perceptions to expectations with novel evidence on the importance of different good-price experiences on the backward-looking nature on inflation expectations. With respect to Axelrod et al. (2018), which finds that inflation perceptions and expectations are very similar using the University of Michigan Survey of Consumers, we provide evidence of the heterogeneity in the correlation between perceptions and expectations depending on the importance attributed to individual experiences.[3] On the importance of individual experiences, Kuchler and Zafar (2019) show that individuals extrapolate from personal experiences when forming expectations about aggregate macroeconomic variables, but their focus is on local house price changes and unemployment.[4] Malmendier (2021) highlights the role of past experiences in shaping individuals' perceptions and expectations of future inflation rates, impacting their economic choices.[5]

The most closely related paper to ours is Huber et al. (2023), which uses German household-level data to document a strong relationship between perceptions of past inflation and expectations of future inflation. Their research highlights the role of shopping experiences and media reports in

have reduced the agents' need for close scrutiny of inflation.

[3]By relating the perceived importance of some good prices on the overall inflation perception, our work also relates to the literature that studies the relationship between inflation expectations and households' consumption choices (e.g., Bachmann et al., 2015; D'Acunto et al., 2018; and Goldfayn-Frank and Wohlfart, 2020).

[4]The prominent role of extrapolation for inflation expectations has been previously documented in an experimental setting by Thesmar et al. (2017). Extrapolation, which is individual-level overreaction to news relative to full-information rational expectations, is confirmed by the theoretical work of Bordalo et al. (2020).

[5]We abstract from the analysis of other factors that may contribute to the inflation expectations formation process, such as the different forms of communication (Coibion et al., 2022b), and solely focus on consumers, as opposed to other agents (see for instance, Coibion et al., 2018b on how firms form their expectations).

shaping inflation perceptions, with significant implications for managing inflation expectations. Aside from focusing on UK rather than German households, our empirical goal is different from theirs, with our main focus being on how food prices affect inflation perceptions and expectations. Our work differs from theirs in two additional dimensions. Firstly, we complement micro-data analysis with macroeconomic evidence based on a SVAR, showing that household inflation expectations respond more strongly and persistently to food price shocks than to other inflationary shocks. Moreover, we discuss monetary policy implications through the lenses of a standard New Keynesian model.

Our work also speaks to the literature on the determinants of cross-sectional variation in inflation expectations. We investigate the influence of observable characteristics (age, gender, education, among others), and emphasise the importance of gender as documented, among others, in the seminal contribution by Jonung (1981) and by Malmendier et al. (2020).[6] Importantly, Michelacci and Paciello (2024) study cross-sectional differences in expectations from the same BIAS survey we use, though their focus is on differences in wealth, labour market status and transfers received by households.

Finally, our model-based analysis contributes to the literature concerning the identification of the most suitable inflation index that central banks should target. Previous research by Blinder and Reis (2005) and Mishkin (2007) advocates for core inflation (i.e. excluding food and energy prices) as the optimal operational guide for monetary policy since it better predicts future inflation by excluding the most volatile items from the reference basket. Bodenstein et al. (2008) argues that core inflation is the welfare-relevant measure of inflation due to the flexible nature of energy prices. Nevertheless, the large literature mentioned above and our own empirical findings have shown that prices typically excluded from core inflation calculations significantly impact consumers' inflation expectations. Motivated by these empirical findings, we assess their implications for monetary policy. Our modelling approach is similar in spirit to Dhamija et al. (2023), which empirically finds

[6] Malmendier et al. (2020) uses novel data that contains information about the distribution of shopping duties in couples and finds that the experiences women make due to their gender role distort their perception of key economic variables. Carvalho and Nechio (2014) provide evidence that some households form their expectations in a way that is consistent with a Taylor (1993)-type rule. Using longitudinal data on household inflation expectations, Vellekoop and Wiederholt (2019) find these to be fairly stable at individual-specific levels and document a negative correlation between higher inflation expectations and household's net worth. D'Acunto et al. (2019), D'Acunto et al. (2021) and D'Acunto et al. (2023) present evidence that cognitive abilities and IQ are important factors in individuals' expectation formation process and in the way they act upon these expectations.

that households overweigh house price expectations when forming inflation expectations, and then shows with a two-sector New Keynesian model that central banks should take into account that some sectors are overweighed. Similarly, we use the empirical evidence to discipline a behavioural expectation-formation process that we then embed into an otherwise standard macroeconomic model. Once we appropriately account for the peculiar transmission of food price shocks to the economy, then the normative implications for monetary policy change substantially and call for a re-evaluation of the focus on core inflation as the main target of central banks. Closely related to our paper is also recent work by Dietrich (2024), which provides survey evidence indicating that US consumers' non-core inflation forecasts disproportionately influence their headline inflation expectations. In a New Keynesian model with bounded rationality, it demonstrates that targeting headline inflation is preferable to core inflation. Our contribution is complementary to this work, as we focus on the backward-looking nature of consumer inflation expectations and their sluggish response to food price shocks, which further calls for an adjustment of the monetary policy reaction function.

Section 2 presents our empirical analysis: in Section 2.1, we describe the survey microdata we use, the econometric framework, and our findings on the heterogeneous importance of individual experiences on inflation perceptions and expectations; in Section 2.2, we investigate with aggregate data the response of inflation expectations to an identified food-price shock via a Structural VAR. Section 3 illustrates the implications of our empirical findings for monetary policy through the lens of the canonical three-equation New Keynesian model. Finally, Section 4 concludes.

2 Empirical Analysis

Our empirical analysis studies how salient food prices are to the inflation-perception formation process of UK consumers. In Section 2.1, we exploit individual-level survey responses to study the inflation expectation formation process of UK households, with a particular focus on the drivers of inflation perceptions, as reported by consumers themselves. We show that the inflation expectations of consumers who report food being important to the formation of their inflation perceptions display a peculiar form of persistence: they depend more strongly on inflation perceptions than is generally

the case.

This finding is complemented, in Section 2.2, by the study of the response of inflation expectations to an identified food-price shock. Using aggregate data and a Structural VAR, we demonstrate that indeed consumer inflation expectations respond in a peculiar manner to shock to food prices. The consumer inflation expectation response is more persistent in response to a food-price shock compared to a generic "representative"inflation shock. This is not the case when we consider financial-market inflation expectations. Therefore, we attribute the excess persistence in the response of consumer expectations to a departure from rational expectations.

2.1 Survey Analysis

2.1.1 The BoE Inflation Attitude Survey

For our empirical analysis, we use the Bank of England's BIAS data, a quarterly survey conducted since February 2001 by TNS Omnibus on behalf of the Bank of England (BoE) to assess public attitudes toward inflation and the BoE's policy. The survey is carried out by interviewing a randomly selected sample of individuals above the age of 16, designed to be representative of the adult population in the UK, with individuals in each sampling point selected by quota and sampling points selected according to probabilistic models. Given that some quotas are flexible to timely conduct the survey and since not all quotas are interlocked, the survey provides sample post-survey weights to ensure that the final demographics are in line with national population profiles. Interviews were conducted on a face-to-face basis until May 2020, and online since then. In each quarterly survey, a new sample of interviewees is considered, making it a repeated cross-sectional survey rather than panel data. The set of questions has changed over the years. The main questions of interest for our analysis were asked in the first quarter of the years 2008, 2010, 2011, and 2013.

The first set of questions we consider directly asks interviewees to provide their estimate of inflation perceptions and expectations. Specifically, the survey asks respondents to quantify how prices have evolved over the past 12 months, which we refer to as inflation *perceptions*, and how prices will change over the next 12 months, which we denote as inflation *expectations*. Possible answers range

from −5% (or less) to +10% (or more), with one percentage-point intervals, e.g. "between 1 and 2 per cent". For each range, we assume their perception/expectation to be the midpoint of the interval, e.g. 1.5 if the range is "between 1 and 2 per cent". Our analysis excludes those respondents who were not able to provide a numerical answer to this question. The second set of questions we consider relates to the determinants of inflation perceptions. Indeed, one key advantage of this survey is that it directly asks respondents about the importance they attribute to specific factors when forming their perceptions about inflation over the last 12 months. In particular, the survey asks about the importance of (their experience about) food, transport, housing, clothing, and energy prices, reports on inflation and value-added tax changes in the media, or other factors. We refer to these factors as *experiences*. To each experience, the respondent can attach six different degrees of importance: (*i*) very important, (*ii*) fairly important, (*iii*) not very important, (*iv*) not at all important, (*v*) don't know, (*vi*) refuse to answer. For our analysis, we exclude the last two possible answers from our dataset.[7] Table 1 summarises the importance that respondents attribute to each experience. Food, transport and household energy prices are considered very important by more than 60% of respondents, and at least fairly important by more than 85%. Only a minimal share, between two and six per cent, consider these experiences not to be important at all. A smaller share of respondents consider clothing (34%) and housing prices (32%) to be very important for their inflation perception, and they are considered fairly important by 33% and 23% of respondents. Media reports are considered very and fairly important by 23% and 37% of respondents only.

Table 2 reports the correlation between inflation experiences. Respondents who consider food prices to be important tend to give a larger weight to clothing (41.5% correlation) and household energy (31.8% correlation). The correlation between food prices and transport, housing prices, and media reports is significantly lower (22.5%, 14.1%, and 11.3%). Respondents who find media reports to be important in shaping their inflation perceptions tend to find housing prices more important (21.7% correlation), whereas the correlation with other experiences is relatively small, between 13.1% and 16.2%.

This preliminary evidence highlights that the vast majority of respondents form their perceptions

[7]Further details on the questions we use in our analysis and how we clean the data are left to the appendix.

Table 1: Importance of Experiences

	Very	Fairly	Not very	Not at all
Food	60.74	29.94	7.35	1.98
Media	23.53	40.51	22.68	13.28
Transport	67.15	20.20	7.05	5.60
Housing	32.34	24.55	21.32	21.80
Hh Energy	66.02	23.55	6.85	3.58
Clothing	33.42	33.77	25.19	7.63

Notes: The table displays the percentage of individuals reporting that experience i, with i $\in \{Food, Media, Transport, Housing, HhEnergy, Clothing\}$, was "Very", "Fairly", "Not very", "Not at all" important in forming their inflation perceptions. Values are adjusted using survey weights. Sample size is $N = 5528$.

Table 2: Correlation between inflation experiences

	Food	Media	Transport	Housing	Hh Energy	Clothing
Food	1					
Media	0.113^{***}	1				
Transport	0.225^{***}	0.147^{***}	1			
Housing	0.141^{***}	0.217^{***}	0.178^{***}	1		
Hh Energy	0.318^{***}	0.162^{***}	0.306^{***}	0.255^{***}	1	
Clothing	0.415^{***}	0.131^{***}	0.162^{***}	0.300^{***}	0.240^{***}	1

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

Notes: The table displays the correlations between inflation experiences. Values are adjusted using survey weights. Sample size is $N = 5528$.

based on daily experiences such as groceries, transport, or energy bills rather than on media sources, which are expected to provide a more accurate signal of current inflation levels. This result is consistent with what has been documented in other settings when separately considering the different item experiences: for instance, D'Acunto et al. (2021) shows that households' expectations overweight the prices they experience in their daily grocery shopping, while Dräger (2015) shows that media reports generally have small effects on inflation perceptions and expectations, with their impact being asymmetric based on the direction of inflation news. These findings further motivate our focus on exposure to food prices as a key individual experience.

2.1.2 Heterogeneity in the Importance of Food on Inflation Perceptions

In this section, we investigate whether the importance attributed to food and other individual experiences in forming inflation perceptions varies by individual characteristics.

Figure 1 plots the conditional importance of food by gender and education. We show the number of respondents reporting food prices to be very, fairly, not very, or not at all important by a gender dummy and low-, medium-, and high- level of education. The figure suggests that the importance of food for perceived inflation is higher for less educated individuals and it is slightly more pronounced for female respondents. We leave to Appendix A.2, Figures A.1 and A.2, which graphically summarise the importance of all experiences conditional on gender and education. It is interesting to see that there are noteworthy differences in the reported relevance of the different items prices across individual characteristics. For instance, the figure suggests that less educated people place less weight on transport prices when forming their perceptions. This appears to be the case for both men and women, although the difference is more pronounced for female respondents. Additionally, women put slightly more weight on food and significantly more weight on clothing than men.

We then quantify the importance of food and the other experiences conditional on individual characteristics by running ordered probit regressions. This methodology generalises the conventional probit regression to allow for more than two values of the dependent variable. More specifically, we regress each possible experience on a set of demographic characteristics: (i) *sex* is a dummy variable

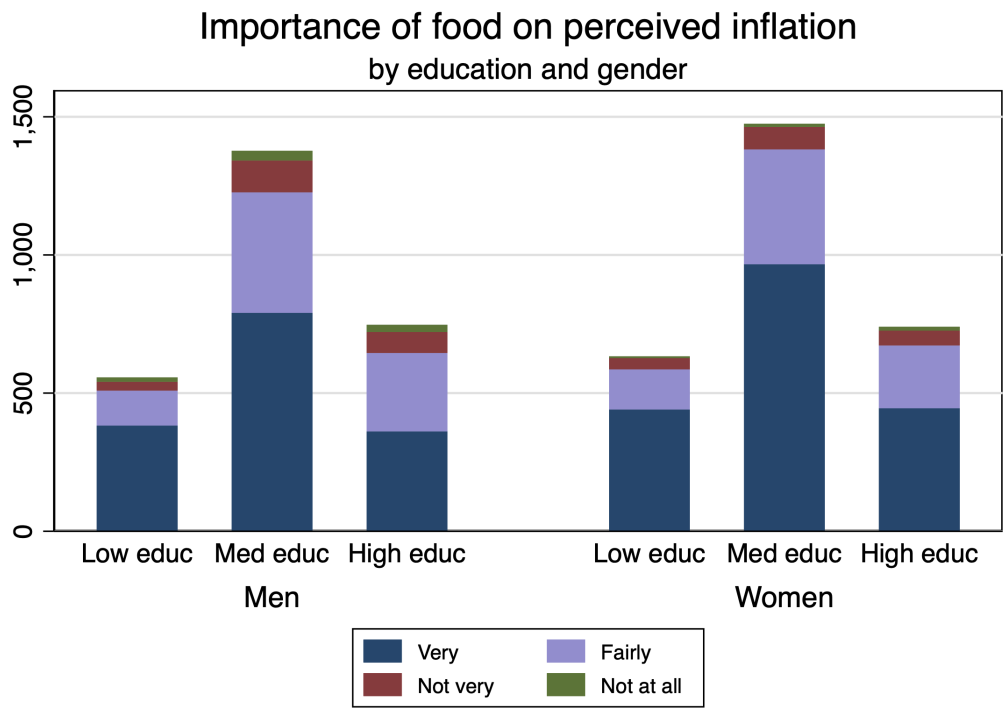

Figure 1: Importance of food experience on inflation perception by education and gender. Sample size is $N = 5528$.

that takes value 0 if the respondent is male and 1 if female; (ii) *age* is a categorical variable taking values between 1 and 6, representing different (increasing) age brackets $15-24$ to over 65; (iii) *class* is a categorical variable taking value 1 for upper and middle class, 2 for lower middle class, 3 for skilled working class, and 4 for working class[8]; (iv) *work* is a dummy variable equal to 0 if employed and 1 if unemployed; (v) *educ* is a categorical variable taking values between 1 and 3 for different educational levels (low, medium, high[9]); (vi) *tenure* represents the possible housing status (1 for ownership, 2 for mortgage, 3 for council rent, and 4 for other).

Table 3 reports the estimation results. First, we note that the suggestive description discussed above in Figures 1, A.1, and A.2 is confirmed by the regressions. The regression shows that the older, less educated, and lower class a respondent is, the more likely they will report food to be

[8]Based on the NRS social grades classification, upper class identifies with higher managerial roles, administrative or professional. Middle class represents intermediate managerial roles, administrative or professional. Lower middle class represents supervisory or clerical, and junior managerial roles, administrative or professional. Skilled working class represents skilled manual workers, whereas working class are semi-skilled and unskilled manual workers.

[9]Specifically, 1 (low) refers to a general certificate of secondary education (GCSE), 2 (medium) to Advanced Level (i.e. completion of secondary and pre-university education), and 3 (high) to a university degree.

an important experience. We also find a statistically significant difference by gender, with women having a higher probability of considering food important. This finding is consistent with previous studies: Malmendier et al. (2020) documents that perception of key economic variables are distorted by the gender role using novel data that contains information about the distribution of shopping duties in couples. We also find that women, older people, unemployed workers are associated with a significantly lower probability of considering transport important. The probability of energy prices being considered important increases for women, older people, lower social classes, and employed workers. Men, younger people, employed workers and homeowners assign a higher probability of transport being important. Finally, it is interesting to note that higher education and class, which are positively associated with income, significantly reduce the probability of considering food and clothing prices as important determinants of inflation perceptions. However, they are associated with an increase, although not statistically significant, in the probability of media reports being considered important.

2.1.3 Inflation Perceptions and Expectations

The unique sets of questions in our survey data allows us to address important questions, i.e. to what extent differences in individual experiences associate with differences in inflation expectations? Does attaching importance to food prices or another experience affect the relationship between inflation perceptions and expectations? To this end, we formally investigate whether the importance of experience in forming perception can be associated with a stronger correlation between inflation perceptions and expectations. With the notable exception of Huber et al. (2023), investigation of the heterogeneity in the inflation perceptions-expectations link has been largely unexplored. We consider as outcome variable the individual one and two-year ahead inflation expectations. The regression equation for the one-year ahead inflation expectations for individual i at time t, denoted as $\mathbb{E}_{i,t}\pi_{t+1}$, writes as follows:

$$\mathbb{E}_{i,t}\pi_{t+1} = \beta_0 + \beta_1\pi_t + \beta_2\mathbb{E}_{i,t}\pi_t + \sum_{j\in J}\beta_j D^{\text{very}}_{j,i,t} \times \mathbb{E}_{i,t}\pi_t + \sum_{j\in J}\alpha_j D^{\text{very}}_{j,i,t} + X'_{i,t}\gamma + \epsilon_{i,t} \tag{1}$$

	(1) Food	(2) Media	(3) Transport	(4) Housing	(5) Hh Energy	(6) Clothing
Sex	.233***	-.045	-.077*	.076*	.114**	.279***
	(.035)	(.031)	(.035)	(.032)	(.036)	(.032)
Age	.044***	-.009	-.036	-.060***	.132***	-.053***
	(.013)	(.011)	(.013)	(.012)	(.014)	(.012)
Class	.092***	-.011	-.005	.083***	.092***	.111***
	(.019)	(.017)	(.019)	(.017)	(.020)	(.017)
Work	-.060	-.079*	-.461***	-.311***	-.257***	-.012
	(.038)	(.034)	(.038)	(.035)	(.039)	(.035)
Educ	-.096**	.048	.000	-.016	-.048	-.130***
	(.032)	(.028)	(.032)	(.028)	(.032)	(.029)
Tenure	.039*	-.022	-.116***	.178***	.017	.048**
	(.019)	(.017)	(.019)	(.017)	(.020)	(.017)
N	5528	5528	5528	5528	5528	5528

t statistics in parentheses

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

The table display the outcomes of the ordered probit regressions on a set of demographic regressors of the importance of an individual's personal experience of the change in the price of different goods on his perception of change of prices in the last twelve months. All the regressions include regional and time fixed effects, and account for probability weights. Heteroskedasticity robust standard errors are reported.

Table 3: Experiences and Individual Characteristics: Ordered Probit Regression

where $\mathbb{E}_{i,t}\pi_t$ denotes the individual's i inflation perception at time t, π_t is the actual level of inflation over the past year, defined as the percentage change in CPI over the last 12 months, $D^{\text{very}}_{j,i,t}$ is a dummy equal to one when experience j is considered very important by individual i at time t, with $j \in J$ and $J = \{food, hhenergy, transport, media, housing\}$, and $\sum_{j \in J} D^{\text{very}}_{j,i,t} \times \mathbb{E}_{i,t}\pi_t$ are the interactions between the importance dummies and perception. We control for the same set, $X_{i,t}$, of demographic characteristics described in Section 2.1.2. It is important to note that the survey is not a panel but a repeated cross-section. The coefficient β_2 can be interpreted as the degree of backward-lookingness of inflation expectations. The parameters β_j indicate whether individuals who consider a certain experience to be very important have marginally more or less backward-looking inflation expectations. We leave the full set of estimated coefficients to the appendix, while we report the key coefficient estimates in Table 4. The first four columns display the baseline results. Variable "1y

exp" refers to one-year-ahead inflation expectations, "realised inflation" is year-on-year inflation as measured in January, "perception" is the inflation perception, "perception x food" is the interaction term between perception and the dummy indicating that food is very important. The same holds for the interaction terms with the other experiences.

First of all, the estimated coefficient associated with inflation perceptions is positive and significant, even after controlling for the realised level of inflation and individual characteristics. This result suggests that respondents display a significant degree of backward-lookingness in their inflation expectations, in line with Coibion and Gorodnichenko (2015)'s evidence on information rigidities in the households' expectation formation process. Second, looking at the second and third column, we observe that certain experiences are associated with a significantly larger degree of backward-lookingness. In particular, the estimated association between perceptions and expectations is higher for those respondents reporting food and, to a minor extent, energy and clothing to be very important factors in forming their inflation perceptions. Other experiences such as housing and media reports do not significantly affect this association. Huber et al. (2023), in a different setting, find that the shopping experience, as captured by the salient prices of frequently bought products, affects inflation expectations indirectly through inflation perceptions, while news play only a marginal role as a source of information acquisition. Third, our fourth column replaces "realised inflation" with time dummies. Results are substantially unchanged compared to the third column. It is important to note that all the results above are conditional on individual characteristics such as age, education, class, gender and region.

Our main empirical finding is that the importance attributed to food prices when forming inflation perceptions significantly affects the strength of the correlation between perceived and expected inflation.

2.1.4 Robustness Checks

Using survey data to elicit subjective inflation perceptions and expectations poses numerous challenges. We confirm the validity of our main findings by running a series of robustness checks to address the most concerning issues of using survey data to the analysis of inflation expectations and perceptions, as outlined in Weber et al. (2022).

Table 4: Expectations, Perceptions, and Individual Experiences

	1y exp I	1y exp II	1y exp III	1y exp IV	1y exp V
constant	0.7495***	1.0120***	0.9762***	1.2459***	1.2910***
	(0.1905)	(0.1949)	(0.2009)	(0.1228)	(0.2683)
realised inflation	0.1069**	0.1141***	0.1264***		0.1255***
	(0.0443)	(0.0443)	(0.0446)		(0.0447)
200801				0.0128	
				(0.0494)	
201001				-0.1679***	
				(0.0597)	
201101				0.7878***	
				(0.0689)	
201301				0.6132***	
				(0.0608)	
perception	0.5158***	0.4302***	0.4255***	0.3873***	0.3702***
	(0.0161)	(0.0273)	(0.0351)	(0.0354)	(0.0590)
perception x food		0.1290***	0.1081***	0.1169***	0.2100***
		(0.0330)	(0.0376)	(0.0371)	(0.0721)
perception x clothing			0.0599*	0.0570	0.0555
			(0.0361)	(0.0353)	(0.0359)
perception x hh energy			0.0658*	0.0642*	0.0649*
			(0.0375)	(0.0366)	(0.0376)
perception x transport			-0.0472	-0.0482	-0.0447
			(0.0381)	(0.0374)	(0.0380)
perception x housing			-0.0036	-0.0065	-0.0085
			(0.0348)	(0.0344)	(0.0351)
perception x media			-0.0696*	-0.0623	-0.0683*
			(0.0392)	(0.0385)	(0.0394)
perception x Knows BoE					0.0755
					(0.0648)
Knows BoE					-0.3984*
					(0.2212)
food x Knows BoE					0.5479*
					(0.2864)
perception x food x Knows BoE					-0.1375*
					(0.0788)
controls	✓	✓	✓	✓	✓
N	5528	5528	5528	5528	5528
R^2	0.35	0.35	0.35	0.37	0.35

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

Notes: The table displays the estimates from a regression of inflation expectations on inflation perceptions and their interaction with the importance of individual experiences, including our main set of control variables. All the regressions account for probability weights. Standard errors are in parentheses. Sample size is $N = 5528$.

Question wording Survey respondents might not be able to correctly understand the concepts of inflation and change in the general level of prices, especially as for whether the prices should refer to non-durables in their consumption bundle. A proposed solution in the literature is to exclude individuals lacking economic and financial literacy, though this approach could introduce a selection bias. As a first extension of our baseline exercise, described above, we include a variable aimed at capturing the basic knowledge of respondents about monetary policy in the UK. In particular, one question survey respondents are asked is whether they know which group of people sets the basic interest rate level each month in the UK. Based on the answers to this question, we construct a dummy variable taking value 1 if the answer was either Monetary Policy Committee or the Bank of England and 0 otherwise. The new regression includes two additional variables: the dummy variable "Knows BoE", described above, and the interaction between "Knows BoE" and inflation perception. The last column of Table 4 reports the results of this regression. First of all, we find that individuals that know about the Bank of England tend to report a significantly smaller inflation expectation, however the coefficient associated with the inflation perception remains affected (first two columns). Including the interaction term shows that individuals who know about the Bank of England tend to have a relatively smaller correlation between expectations on future inflation and perceptions about current inflation. In other words, individuals who have at least a basic knowledge about monetary policy tend to have less backward-looking inflation expectations. Finally, adding a triple interaction of perception, food and "Know BoE", we see that knowledge about the Bank of England reduces the association between inflation expectation and perception when attributing more importance to food with respect to those that do not know the Bank of England but this difference is not statistically significant.

Priming The interview structure and question format may influence respondents to tailor their responses, a phenomenon known as priming. One form of priming arises when preceding questions provide information that could impact subsequent responses, such as presenting recent inflation data in questions preceding those about inflation expectations. Another form of priming could occur through pre-set answer options or limited lists of possible choices. However, the design of the BIAS survey addresses these concerns. Firstly, it refrains from presenting recent inflation figures. Additionally, the key questions we use to elicit perceptions and expectations offer many options,

which can be further explored with follow-up questions if responses exceed certain thresholds. For example, if an expectation exceeds 5%, respondents are prompted, in subsequent questions, with ranges like 5% to 6%, 6% to 7%, and so on, up to more than 10%.

Sampling Decaying rates in survey responses could represent a challenge to the representativeness of the sample. To tackle this issue, we use survey weights throughout the analysis. We further note that prior to 2020 the survey was conducted via face-to-face interviews.

Panel Conditioning Panel conditioning refers to the phenomenon where respondents gain knowledge about the survey topic through repeated participation, which can significantly affect the representativeness of the sample. This effect can be quite large especially in surveys of inflation expectations among households and firms Kim and Binder (2023). In the BIAS survey, data are in the form of repeated cross-sections, thus tackling this issue. The limitation of having repeated cross-sections, instead of panel data, might be the inability to account for unobserved heterogeneity. We provide further robustness by controlling for unobserved heterogeneity via the following clustering analysis. In this way, we are able to account for both panel conditioning and unobservable individuals' traits that might affect inflation expectations.

Clustering Some individuals might have a systematic tendency to report higher or lower inflation expectations due to unobserved personal traits. To control for these unobservable characteristics in our survey, we implement a clustering procedure. Specifically, we account for unobserved heterogeneity using the fuzzy C-means (FCM) algorithm following the approach proposed by Lewis et al. (2023) and Lewis et al. (2024). We assume that there are G groups of individuals that differ only in unobserved characteristics. The algorithm assigns individuals to each group $g = 1, ..., G$ with a certain probability: in FCM, each individual is allowed to have a probability, not necessarily equal to 0 or 1, of belonging to a given group; hence, there is room for uncertain group assignment. This is the main difference between fuzzy (soft) clustering and hard clustering (standard K-means): unlike hard clustering, where individuals are assigned to groups in a binary fashion, in FCM, individuals instead have continuous weights.

This procedure allows recovering unobserved heterogeneous effects when dealing with cross-sectional data, repeated cross-sections, or panel data, available only for a small number of periods. Therefore, it is particularly suited to our empirical analysis.

The FCM approach can be extended to a regression setting by considering the model:

$$y_{it} = \alpha_{g_i t} + \theta' x_{it} + \epsilon_{it} \qquad i = 1, ..., N \qquad t = 1, ..., T \tag{2}$$

where $\alpha_{g_i t}$ is the group-time effect capturing unobserved heterogeneity clustered by group g_i for each time period t. Thus, in our setting, we modify model 1 to account for group-fixed effects, $\alpha_{g_i t}$, as follows:

$$\mathbb{E}_{i,t}\pi_{t+1} = \alpha_{g_i t} + \beta_2 \mathbb{E}_{i,t}\pi_t + \sum_{j \in J} \beta_j D^{\text{very}}_{j,i,t} \times \mathbb{E}_{i,t}\pi_t + \sum_{j \in J} \alpha_j D^{\text{very}}_{j,i,t} + X'_{i,t}\gamma + \epsilon_{i,t} \tag{3}$$

where all other variables are defined in Section 2.1.3. We assume that individuals in each group differ in unobserved characteristics that might result in consistently higher or lower inflation expectations over different years, i.e., the G groups differ for the intercept $\alpha_{g_i t}$ in the regression model. We assume $G = 2$ and examine the sensitivity of the results to three choices of the clustering exponent $m \in \{1.001, 1.8, 5\}$.[10] Note that with $m = 1.001$ the fuzzy clustering objective converges to the criterion function of the "grouped fixed effects" (GFE) estimator of Bonhomme and Manresa (2015). We consider 50 different starting values and obtain bootstrap estimates of the standard errors with $B = 500$ bootstrap replications.

The results in Table 5 confirm our main finding that the interaction coefficient of perception and food importance is positive and statistically significant. This is robust to the fact that we run a pooled OLS regression in our baseline model. The regression coefficients carry the same interpretation as above, but now we are controlling for unobserved heterogeneity. Bootstrap standard errors are in parentheses. The estimated intercepts for the G=2 groups when $m = 1.8$ vary over time with one group tending to have systematically lower inflation expectations in 2008, while overstating their expectations in the last three periods, and vice-versa for the second group, ceteris paribus. Similar patterns emerge for the other choices of the clustering exponent, with the difference in the coefficients estimates between the two groups vanishing as m increases.

In terms of weights, we get that cluster sizes in the two groups are similar (when $m = 1.001$ 45%

[10] There are two parameters that the researcher has to decide on: the tuning parameter, m, which is a "fuzziness parameter" that determines the deviation from binary assignment of the optimal weights, and the number of groups, G. For the optimal choice of G, one could use for instance the Bayesian Information Criterion (BIC); for optimal m, see Lewis et al. (2023) and Lewis et al. (2024). We leave the optimal choice of m and G for future research.

of the respondents belongs to the first group, while with the other two choices of m around 50% of the sample is in each of the two groups).[11]

2.2 Food Prices and Inflation Expectations: a VAR analysis

We now turn to the dynamic impact of identified shocks to food prices on inflation expectations. Using a Proxy SVAR augmented with expectations, we compare and contrast the effect of a food price shock on inflation expectations, relative to a "representative" shock to aggregate prices.

We approach the problem from two complementary perspectives. First, we show that household inflation expectations respond more persistently to food price shocks than to a "representative" inflation shock. Second, we show that household expectations respond to food price shocks more persistently than market-participant expectations. This suggests a behavioural interpretation for the persistent response of consumer inflation expectations in the wake of a food-price shock.

We begin by estimating a 4-lag quarterly VAR with Minnesota priors over the sample 1986Q4 to 2019Q4. Our baseline VAR includes: (i) International food prices; (ii) OECD composite lead indicator; (iii) Oil price expressed in US dollars (Brent); (iv) British Pound Sterling to US dollar nominal exchange rate; (v) UK real GDP; (vi) 1 year Gilt yield; (vii) Households inflation expectations; (viii) CPI; (ix) Unit labour costs.

where international food prices, Brent price, and CPI are expressed in year-on-year inflation rates, to allow for comparisons with the inflation expectations measure. Households inflation expectations are taken from the BIAS (see Section 2.1.1) and Barclay's BASIX surveys (for observations prior to December 1999). Details on how the two measures of inflation expectations are spliced together, as well as the complete set of impulse responses, can be found in Appendix C. In the main text we focus our attention on the main variables of interest.

Figure 2 presents the responses of UK CPI inflation, and consumer inflation expectations to two different inflation shocks. The black lines represent the response to a "representative" shock to inflation, defined as the disturbance that explains most of the one-step ahead forecast error variance of CPI inflation, with the size of the shock rescaled so that the median response of CPI inflation peaks

[11] Note that it is possible to obtain the cross-sectional distribution of the weighted intercepts by combining the group-specific intercepts with the estimated individual weights.

Table 5: Expectations, Perceptions, and Individual Experiences, with FCM

	m=1.001	m=1.8	m=5
200801 x g_1	.2623	.8735	1.1035
	(.1627)	(.1141)	(.1277)
201001 x g_1	2.3930	1.7082	1.3373
	(.1749)	(.1273)	(.1249)
201101 x g_1	2.8913	2.1906	1.9111
	(.1884)	(.1335)	(.1253)
201301 x g_1	2.7814	2.2975	1.8309
	(.1947)	(.1290)	(.1247)
200801 x g_2	1.6313	1.0104	1.2004
	(.1728)	(.1153)	(.1274)
201001 x g_2	.3115	.5337	1.3556
	(.1625)	(.1268)	(.1245)
201101 x g_2	.9358	1.1385	1.8576
	(.1683)	(.1205)	(.1272)
201301 x g_2	.7682	.9657	1.8330
	(.1670)	(.1283)	(.1247)
perception	.4180	.4142	.3904
	(.0361)	(.0321)	(.0320)
perception x food	.1023	.1127	.1194
	(.0444)	(.0395)	(.0406)
perception x clothing	.0361	.0625	.0747
	(.0438)	(.0423)	(.0408)
perception x hh energy	.0424	.0549	.0645
	(.0429)	(.0399)	(.0437)
perception x transport	-.0396	-.0438	-.0333
	(.0469)	(.0442)	(.0438)
perception x housing	-.0340	-.0173	-.0207
	(.0400)	(.0402)	(.0401)
perception x media	-.0390	-.0596	-.0565
	(.0452)	(.0443)	(.0422)
controls	✓	✓	✓
N	5528	5528	5528

Notes: The table displays the estimates from a regression of inflation expectations on inflation perceptions and their interaction with the importance of individual experiences, including our main set of control variables and when controlling for time-varying unobserved heterogeneity via a fuzzy C-means clustering algorithm with different values of the clustering exponent $m \in \{1.001, 1.8, 5\}$ and assuming the existence of $G = 2$ groups. Bootstrap standard errors are in parentheses. Sample size is $N = 5528$.

at 1 percentage point. This is an agnostic benchmark for the dynamic impact of a typical, "representative", shock to prices. From an econometric perspective this corresponds to a Generalised Impulse Response Function estimation (Pesaran and Shin (1998)) or a one-step ahead max-share identification approach (Uhlig, 2004, Angeletos et al., 2020). Del Negro et al. (2020) use this identification scheme to study an unemployment shock.

This "representative" inflation shock serves as an agnostic benchmark that we compare to a food price shock (red lines). The latter is identified using the external instrument approach proposed by Peersman (2022), which we describe in more detail in the Appendix C.

In response to our "representative" shock, inflation jumps on impact, which reflects our identification assumption. Expectations rise too but less substantially.

When we overlay the responses to a food price shock, in red, we find that the response of inflation is more hump-shaped, in line with Peersman (2022), which estimates his model on EU data.[12] The unwinding of inflationary pressures is otherwise in line with that of our "representative" shock. Strikingly, though, the response of inflation expectations is both larger and more persistent than in the case of a "representative" inflation shock.

Our estimates suggest that, in the UK, food price shocks impact inflation first and foremost through their effect on expectations. In light of our survey evidence, we trace this effect back to the salience of food prices. Changes in food prices are readily noticed by consumers. Moreover, they appear to have a lasting impact on their inflation-expectation formation process.

Indeed, our micro-data evidence suggests that the persistence of the response of inflation expectations to a price shock exceeds what would be warranted by the persistence in the underlying disturbance.

We put this claim to the test by studying how market inflation expectations respond to the two shocks we just considered. Market-participant expectations are considered rational and thus provide a useful benchmark to test our working assumption of excess persistence in the response of consumer inflation expectations to food price shocks.

We thus run another VAR, where we replace the measure of consumer inflation expectations with those of financial market participants derived from swaps. Data availability limits our sample to the

[12] By rescaling the shocks, we obviously do not imply that shocks of the same size are equally likely.

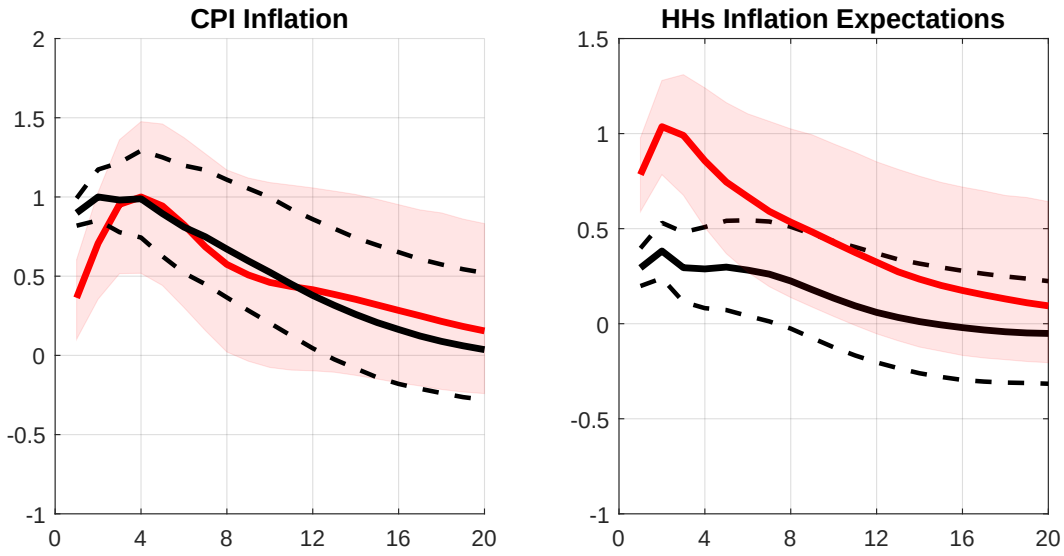

Figure 2: Responses of UK CPI inflation and household inflation expectations to a "representative" inflation shock (black lines with 90 percent credible sets delimited by dashed lines) and to a food-price shock (red lines with 90 percent credible set shaded). Responses are rescaled such that the CPI inflation increase peaks at 1.

period 2004Q1-2019Q4. This, together with the different measure of inflation expectations, limits our ability to make a direct comparison. However, we can still compare and contrasts the responses of inflation expectations to the two shocks under consideration.

Figure 3 displays the results. As above, black lines represent the response to a "representative" inflation shock and red lines those of a food price shock. Responses are re-scaled so that the CPI inflation response peaks at 1 percentage point.[13]

It is immediately evident that, when it comes to market participants, there are no significant differences in the inflation-expectation response brought about by food price shocks, relative to that induced by our "representative" inflation shock. The response is about the same on impact and, for both shocks, reverts back to zero almost immediately. Comparing these responses to those for consumer expectations, the key difference in expectations responses is in the speed with which they revert back to zero, while the impact response is not significantly different.

This empirical finding has a direct bearing on the conduct of monetary policy. Policymakers

[13]In the appendix, we also show the responses of our baseline VAR with household expectations estimated over the shorter sample and find the results to be in line with those using the longer sample.

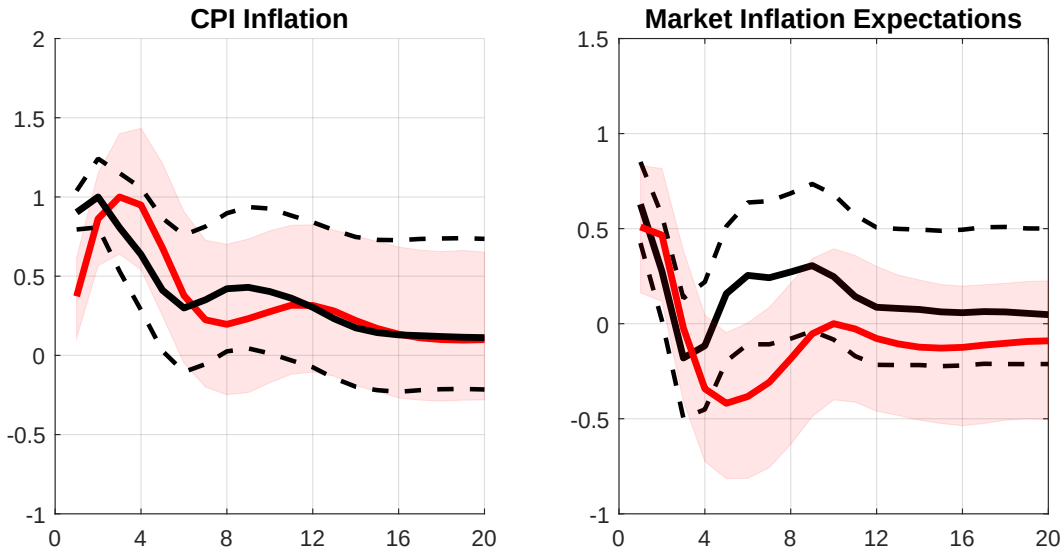

Figure 3: Responses of UK CPI inflation and financial markets (swaps-implied) inflation expectations to a "representative" inflation shock (black lines with 90 percent credible sets delimited by dashed lines) and to a food-price shock (red lines with 90 percent credible set shaded). Responses are rescaled such that the CPI inflation increase peaks at 1.

tend to focus on "core" measures of inflation, which do not include food and energy-price inflation, the idea being that these components are volatile and not very responsive to monetary policy interventions. Once we account for their peculiar effect on household inflation expectations, things change though. These transitory shocks punch above their weight when it comes to their impact on household expectations. As a result, a prompt policy response is warranted. We illustrate this in the next section, in the context of the well-known three-equation New Keynesian model.

3 Monetary Policy Implications

Our key empirical finding is that the inflation expectations of a significant portion of the population respond to a food price shock in what appears to be an overly persistent way - using market-expectations as a rational benchmark. We now explore the implications of this finding for monetary policy using a three-equation New Keynesian (NK) economy. We model a food price shock as an autoregressive cost-push shock that consumers perceive to be more persistent than it actually is. The simple autoregressive nature of the inflation-expectation formation process in this economy allows us

to characterize transparently the impact of their excess persistence in response to food-price shocks.

The standard (rational expectations) model is defined by the following IS, NK Phillips Curve, and policy rule equations:

$$x_t = E_t x_{t+1} - \frac{1}{\sigma}\left(i_t - E_t \pi_{t+1}\right), \tag{4}$$

$$\pi_t = \kappa x_t + \beta E_t \pi_{t+1} + e_t, \tag{5}$$

$$i_t = \phi_\pi^R \pi_t. \tag{6}$$

Here, x_t, π_t, and i_t represent the output gap, inflation, and nominal interest rate, respectively. The cost-push shock, e_t, follows an AR(1) process with persistence $\rho_e \in [0, 1)$. The inverse elasticity of substitution is denoted by σ, and $\kappa \equiv \frac{(1-\theta)(1-\theta\beta)}{\theta}(\sigma + \eta)$, where θ is the Calvo pricing parameter, β is the discount factor, and η is the inverse Frisch elasticity. Finally, E_t is the rational conditional expectations operator.

We then introduce a minimal deviation from the basic three-equation model, assuming that individuals are not fully rational when forming expectations about future inflation. For simplicity, we maintain that they are fully rational when forming expectations about the output gap, though this is not strictly necessary. The model equations become:

$$x_t = E_t x_{t+1} - \frac{1}{\sigma}\left(i_t - E_t^B \pi_{t+1}\right) \tag{7}$$

$$\pi_t = \kappa x_t + \beta E_t^B \pi_{t+1} + e_t \tag{8}$$

$$i_t = \phi_\pi^B \pi_t \tag{9}$$

Here, E_t^B is a "behavioural" conditional expectations operator. Under rational expectations $E_t \pi_{t+1} = \rho_e \pi_t$. Our behavioural assumption is that individuals perceive that the persistence of the cost-push shock is $\rho_e^B > \rho_e$, so that $E_t^B \pi_{t+1} = \rho_e^B \pi_t$. ϕ_π^B reflects our goal of showing how monetary policy can undo the impact of excess inflation expectation persistence on inflation by adjusting its policy rule. We will illustrate this more in detail below.

It can be shown that, under rational expectations, the solution of the model is given by:

$$\pi_t = \left[\frac{\sigma(1-\rho_e)}{\sigma(1-\rho_e)(1-\beta\rho_e)-(\rho_e-\phi_\pi^R)\kappa}\right] e_t \equiv a_1 e_t \tag{10}$$

$$x_t = -\left[\frac{\phi_\pi-\rho_e}{\sigma(1-\rho_e)(1-\beta\rho_e)-(\rho_e-\phi_\pi^R)\kappa}\right] e_t \equiv -a_2 e_t. \tag{11}$$

Under behavioural expectations, however, the model solution becomes:

$$\pi_t = \left[\frac{\sigma(1-\rho_e)}{\sigma(1-\rho_e)(1-\beta\rho_e^B)-(\rho_e^B-\phi_\pi^B)\kappa}\right] e_t \equiv a_1^B e_t \tag{12}$$

$$x_t = -\left[\frac{\phi_\pi-\rho_e^B}{\sigma(1-\rho_e)(1-\beta\rho_e^B)-(\rho_e^B-\phi_\pi^B)\kappa}\right] e_t \equiv -a_2^B e_t. \tag{13}$$

We calibrate most parameters using standard values in the literature: $\sigma = 1$, $\beta = 0.995$, $\theta = 0.75$, $\eta = 1$, $\phi_\pi^R = 1.5$. The autocorrelation coefficients, instead, are set in line with the evidence presented in Section 2.2 and Appendix C. In particular, we set $\rho_e = 0.79$, in line with the VAR response (Figure C.3) of international food price inflation to a food price shock, which has a half-life of 3 quarters.[14] We calibrate $\rho_e^B = 0.94$ in line with the VAR response of household inflation expectations to the same food price shock, with a half-life of 11 quarters. The shock size is set such that inflation in the rational-expectations model increases by 1 percentage point.

Figure 4 displays impulse responses (IRFs) to a food-price shock. The solid orange lines represent the responses under rational expectations. The dash-dotted black lines (labelled Behavioural I) are the IRFs from the behavioural model in which households display excess expectation persistence and policymakers respond to inflation according to their baseline rule, $i_t = \phi_\pi^R \pi_t$. Comparing the two lines shows that the inflation increase in the behavioural model is about 50% larger than under rational expectations. Moreover, the fall in the output gap is about 20% larger.

The excess inflation persistence has nefarious effects on the economy. We thus consider a scenario in which the central bank acts in such a way as to deliver the rational-expectations profile for inflation. This amounts to setting ϕ_π^B so that $a_1^B = a_1$. Our simple model enables us to compute ϕ_π^B analytically:

$$\phi_\pi^B = \phi_\pi^R + \frac{\sigma(1-\rho_e)\beta(\rho_e^B-\rho_e)}{\kappa} + (\rho_e^B+\rho_e) > \phi_\pi^R. \tag{14}$$

[14] Let h be the half-life of an AR(1) process and ρ_e its autocorrelation coefficient. Then $\rho_e = \exp\left(-\frac{\ln(2)}{h}\right)$.

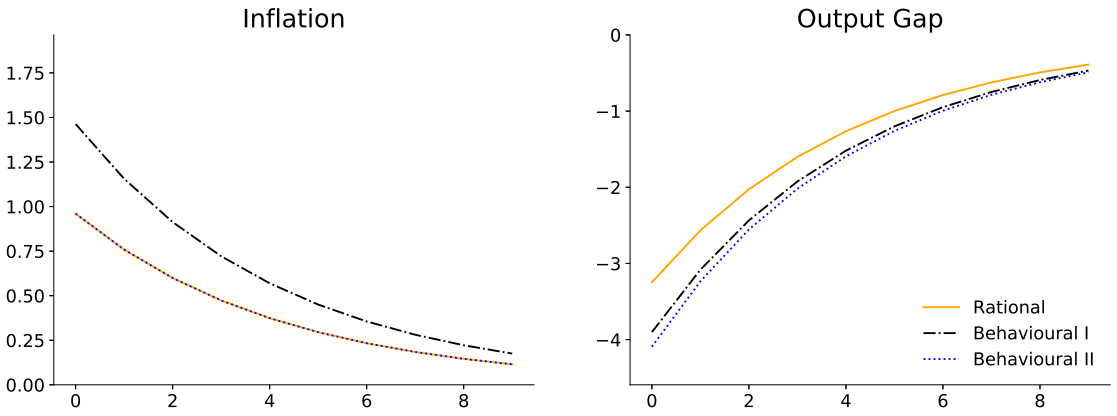

Figure 4: Model responses to a cost-push shock

Delivering the same inflation profile under excess inflation-expectation persistence requires a stronger response to inflation, $\phi_\pi^B > \phi_\pi^R$. Given the calibration above, ϕ_π^B needs to be substantially larger at 1.84.

The dotted blue line (labelled Behavioural II) in Figure 4 represents this scenario. The tighter policy stance results in a slightly larger fall in output, larger by about 5%.

From a normative perspective, though, the benefits obtained from the smaller increase in inflation dwarf the costs in terms of extra output variability. More specifically, consider the standard welfare-relevant loss function (Galí, 2015):

$$L = \pi_t^2 + \omega x_t^2, \tag{15}$$

with $\omega = \frac{\kappa}{\epsilon}$,[15] $\kappa = 0.17$ (given the calibration above) being the slope of the NK Philips Curve, and $\epsilon = 10$ (standard value in the literature) the elasticity of demand. The tiny coefficient on the output gap, $\omega = 0.017$, together with the fact that the the output-gap loss is much smaller, in absolute value, than the gain in terms of inflation, make it abundantly clear that a central bank should respond aggressively to rises in inflation induced by food price shocks. The excess persistence in inflation expectations induced by shocks to food prices calls for a resolute response, in spite of their well-known high volatility and relatively low persistence.

[15]This can be derived formally following Galí (2015) an assuming that the production function is linear in hours.

4 Concluding Remarks

In this paper, we provide evidence that food price changes have a disproportionately strong and persistent impact on UK consumer inflation expectations. Using both individual-level survey data and a Proxy SVAR with aggregate macroeconomic data, we uncover some key insights. First, over 60% of households consider food prices a major determinant of their perception of current inflation. Individuals who attach a large weight to food prices display a stronger link between their inflation expectations and their perceptions of current inflation, implying that their expectations are more backward-looking. Second, in line with the household-level results, our SVAR analysis indicates that food price shocks affect inflation expectations more strongly than average "representative" inflation shocks. The response to food price shocks is not only stronger but also significantly more persistent, suggesting that such shocks leave a lasting impression on households. Third, through the lens of a three-equation New Keynesian model with behavioural expectations, we demonstrate that these stylized facts call for a more aggressive monetary policy response to food price shocks. A stronger reaction by the central bank would cause a larger fall in output but lead to significant welfare gains from inflation stabilisation. As a result, our analysis suggests that central banks should pay close attention to food prices and not just focus on core inflation. Since food prices have a significant and long-lasting impact on household inflation expectations, monetary policy should quickly and credibly react to the inflationary pressures due to food price shocks to manage overall inflation effectively. To conclude, our paper highlights that central banks should consider the unique influence of food prices on inflation expectations in their policy frameworks. Disregarding food prices might lead them to underestimate the persistence of inflation expectations and, consequently, of inflation itself.

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A Data

A.1 Description of Survey Questions

For each group of questions we list below, we report if we do not have those questions for a particular wave. We use the following sets of questions:

1. `q1, q1a, q1a2` ask how prices have changed over the last 12 months. We combine the answers to these questions into one indicator measuring respondents' perceptions or nowcasts.

2. `q2, q2a, q2a2` ask how prices will evolve over the next 12 months. We combine the answers in one indicator measuring respondents' one-year ahead expectations or forecasts.

3. `q2b, q2b1, q2b2` ask how prices will evolve over the next 24 months, which we combine as a measure of two-year ahead inflation expectations or forecast (missing in 2008).

4. `q2c, q2c1, q2c2` are combined into five-year ahead (or long run) inflation expectations (missing in 2008).

5. `q1b_1, q1b_2, q1b_3, q1b_4, q1b_5, q1b_6, q1b_7, q1b_8`. For each of these 8 questions, we drop observations for which the answer is "Don't know" or "Refused" and create 32 dummies based on whether food, clothing, transport, household energy, housing, media reports, media reports of VAT changes, and other factors were reported as being very important, fairly important, not very important and not at all important, in forming inflation perceptions. Missing in 2009 and 2012. The `other` question is also missing in 2008, which is why we exclude it from our analysis.

6. `q2d_1, q2d_2, q2d_3, q2d_4, q2d_5, q2d_6, q2d_7, q2d_8`. For each of these 8 questions, we drop observations for which the answer is "Don't know" or "Refused" and create 32 dummies based on whether shopping in the last 6 months, shopping in the last 12 months, interest rates, the overall economic outlook, the inflation target, media reports, media reports of VAT changes, or other factors were reported to be very important, fairly important, not very important, or not at all important, in forming inflation expectations. Missing in 2009 and 2012.

7. `educ, sex, class, age, tenure, sreg, work, yyyyqq` provide information about the respondents' educational level, gender, social class, age, housing status, region, as well as the date of the survey.[16]

A.2 Heterogeneity in the Importance of Individual Experiences on Inflation Perceptions

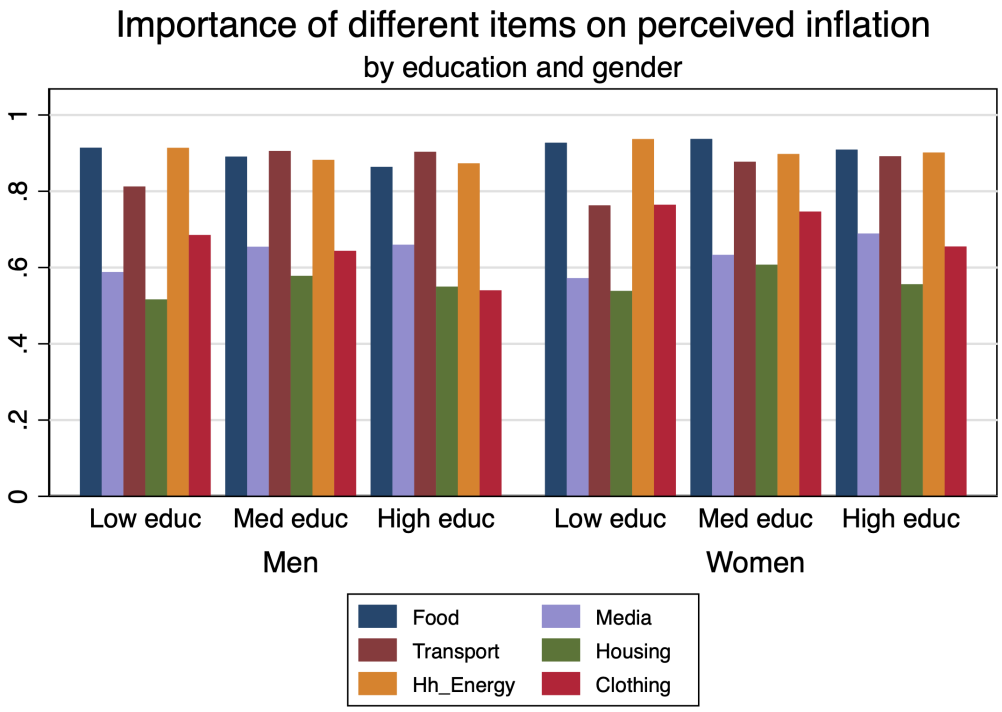

Figure A.1: Importance of inflation experiences (binary variables taking value 1 if very or fairly important and 0 otherwise) on inflation perception by education and gender. Sample size is $N = 5528$.

[16]We also have information about the respondent's income. However, approximately half of the observations are missing, as individuals refused to answer this question. Furthermore, in the years of interest for our analysis, the possible income brackets considered are relatively wide, with little breakdown on the upper-end of the distribution, i.e. the highest possible income bracket is "above 25000" GBP. The share of missing observations is negligible for other individual controls.

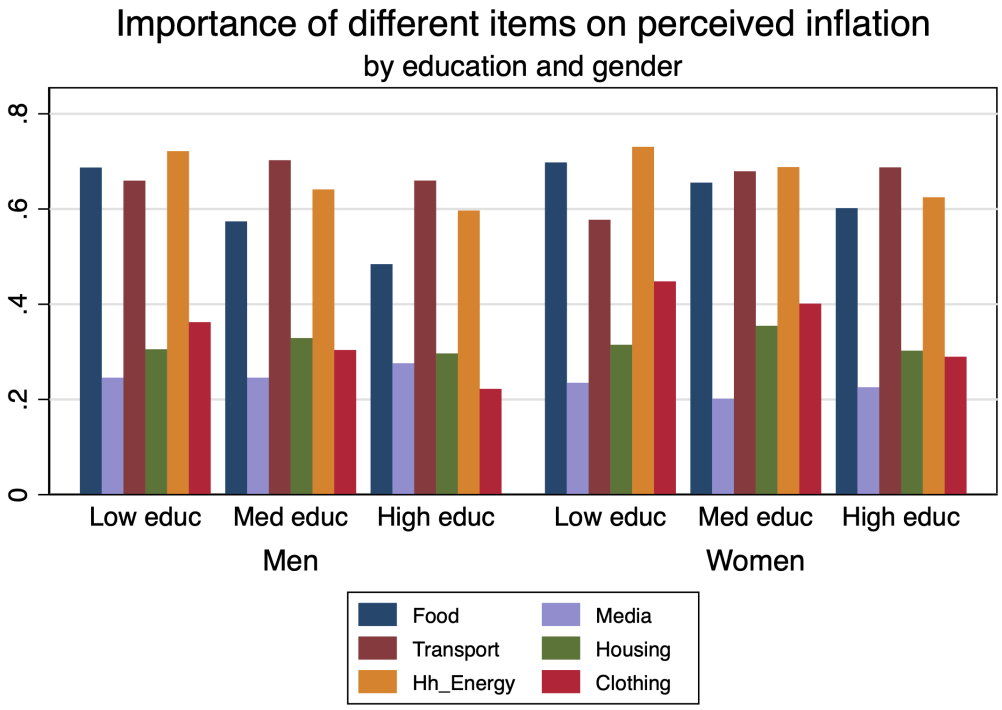

Figure A.2: Importance of inflation experiences (binary variables taking value 1 if very important and 0 otherwise) on inflation perception by education and gender. Sample size is $N = 5528$.

B Regression Results

Table B.1: 2-Year Inflation Expectations, Perceptions, and Experiences

	2y exp I	2y exp II	2y exp III	2y exp IV	2y exp V
constant	2.06***	2.26***	2.22***	1.30***	2.32***
	(0.30)	(0.30)	(0.31)	(0.14)	(0.37)
realised inflation	-0.22***	-0.22***	-0.20***		-0.19**
	(0.08)	(0.08)	(0.08)		(0.08)
200801				0.00	
				(0.00)	
201001				-0.03	
				(0.07)	
201101				0.60***	
				(0.08)	
201301				0.73***	
				(0.07)	
perception	0.38***	0.32***	0.30***	0.27***	0.31***
	(0.02)	(0.03)	(0.04)	(0.04)	(0.07)
perception x food		0.09***	0.04	0.04	0.17**
		(0.04)	(0.04)	(0.04)	(0.08)
perception x clothing			0.14***	0.14***	0.12***
			(0.04)	(0.04)	(0.04)
perception x hh energy			0.11**	0.11***	0.11***
			(0.04)	(0.04)	(0.04)
perception x transport			-0.09*	-0.09**	-0.08*
			(0.04)	(0.04)	(0.04)
perception x housing			-0.02	-0.03	-0.03
			(0.04)	(0.04)	(0.04)
perception x media			-0.04	-0.03	-0.04
			(0.04)	(0.04)	(0.04)
perception x Knows BoE					-0.01
					(0.07)
Knows BoE					-0.08
					(0.25)
food x Knows BoE					0.65*
					(0.34)
perception x food x Knows BoE					-0.17**
					(0.09)
N	4044	4044	4044	4044	4044
R^2	0.22	0.22	0.23	0.24	0.24

Table B.2: 5-Year Inflation Expectations, Perceptions, and Experiences

	5y exp I	5y exp II	5y exp III	5y exp IV	5y exp V
constant	3.11***	3.16***	3.16***	1.75***	3.35***
	(0.40)	(0.41)	(0.42)	(0.18)	(0.48)
realised inflation	-0.27***	-0.27***	-0.25**		-0.24**
	(0.10)	(0.10)	(0.10)		(0.10)
200801				0.00**	
				(0.00)	
201001				0.54***	
				(0.09)	
201101				0.45***	
				(0.10)	
201301				0.76***	
				(0.10)	
perception	0.28***	0.26***	0.25***	0.25***	0.27***
	(0.02)	(0.03)	(0.04)	(0.04)	(0.08)
perception x food		0.03	-0.03	-0.03	0.09
		(0.04)	(0.05)	(0.05)	(0.09)
perception x clothing			0.11**	0.11**	0.09*
			(0.05)	(0.05)	(0.05)
perception x hh energy			0.07	0.07	0.08
			(0.05)	(0.05)	(0.05)
perception x transport			-0.10*	-0.10*	-0.09*
			(0.05)	(0.05)	(0.05)
perception x housing			0.04	0.04	0.03
			(0.05)	(0.05)	(0.05)
perception x media			0.05	0.05	0.05
			(0.05)	(0.05)	(0.05)
perception x Knows BoE					-0.03
					(0.08)
Knows BoE					-0.20
					(0.31)
food x Knows BoE					0.70
					(0.43)
perception x food x Knows BoE					-0.15
					(0.10)
N	3617	3617	3617	3617	3617
R^2	0.11	0.11	0.12	0.12	0.13

C VAR Evidence

C.1 Baseline

Our baseline specification is a 4-lag quarterly VAR that includes measures of UK CPI annual inflation, international food prices (year-on-year percentage change) as measured by the IMF broad price index (see e.g. Peersman, 2022), Brent Oil Prices (year-on-year percentage change), the OECD Composite Leading Indicator (CLI, expressed in logs), the USD-GBP exchange rate (logs), real UK GDP (logs), 1-year ahead interest rates, a measures of one-year ahead inflation expectations, and UK whole economy unit-labour costs (from the Office for National Statistics, expressed in logs). Our sample spans 1986:Q4 to 2019:Q4. The VARs are estimated with Bayesian techniques using the Canova and Ferroni (2021) toolkit. We adopt Minnesota priors with hyperparameters optimized as in Giannone et al. (2015).

The measure of household inflation expectations poses a challenge. The Bank of England Inflation Attitudes Survey (BIAS) comes with a rich set of individual-level data that we exploit in our cross-sectional analysis. However, this would limit our sample to start in 2003. To expand the sample back to 1986, we combine it with data from another quarterly survey of UK households: the Barclays BASIX. We splice the two series by projecting the BIAS series onto the BASIX series and four lags of the CPI index in the post-2003 sample. Figure C.1 reports a scatter plot of the fitted values from our statistical model against the BIAS survey expectations, for the period in which they are available, showing the goodness of fit. For completeness, we report below our main VAR results when we use the plain BASIX inflation expectations series.

In Figure C.2 we report responses to a shock identified agnostically as the one that explains most of the one-step ahead forecast-error variance for CPI inflation. We do not attach any particular structural interpretation to this shock but rather interpret it as "the average" shock to inflation. The responses are economically sensible. International variables do not respond to a shock to UK CPI. Both consumer inflation expectations and unit-labour cost rise, as reported in the main body. So does the short-term nominal rate, while real GDP falls.

Figure C.3 reports responses to an international food-price shock, identified as in Peersman (2022)

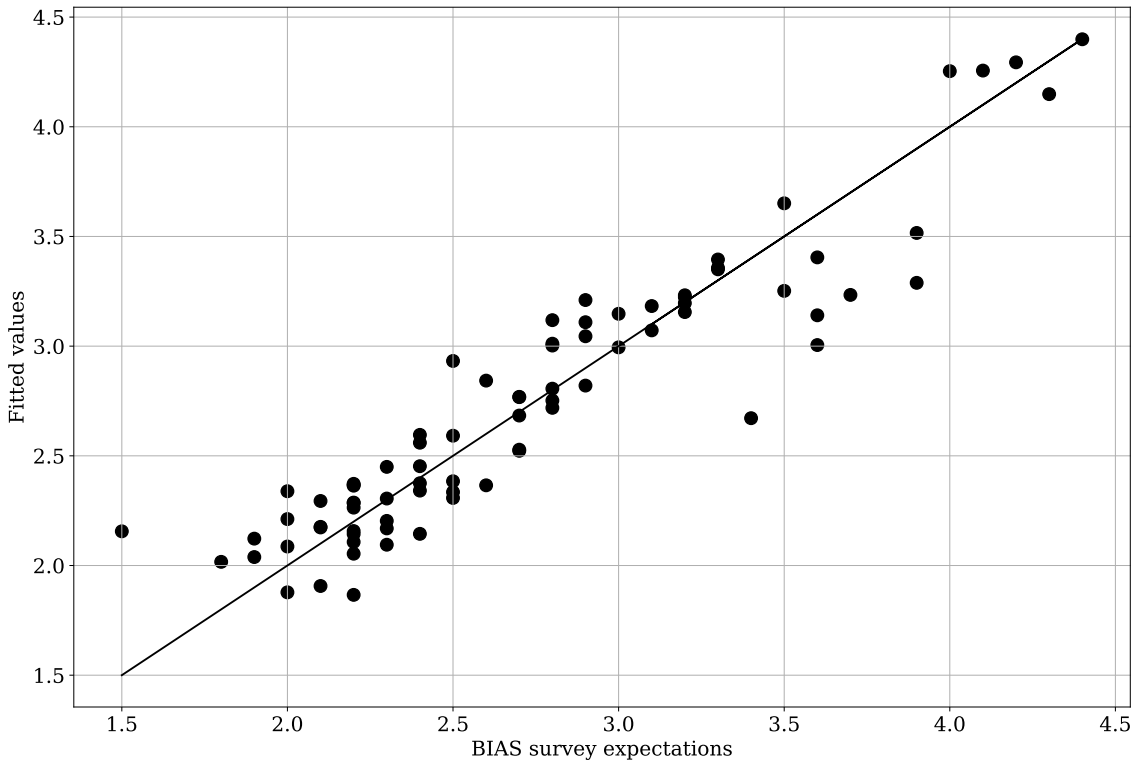

Figure C.1: BIAS survey one-year ahead inflation expectations on the x-axis and fitted values from the model we use to splice the BIAS and BASIX series together. The solid black line is the 45-degree line which would correspond to a perfect model fit.

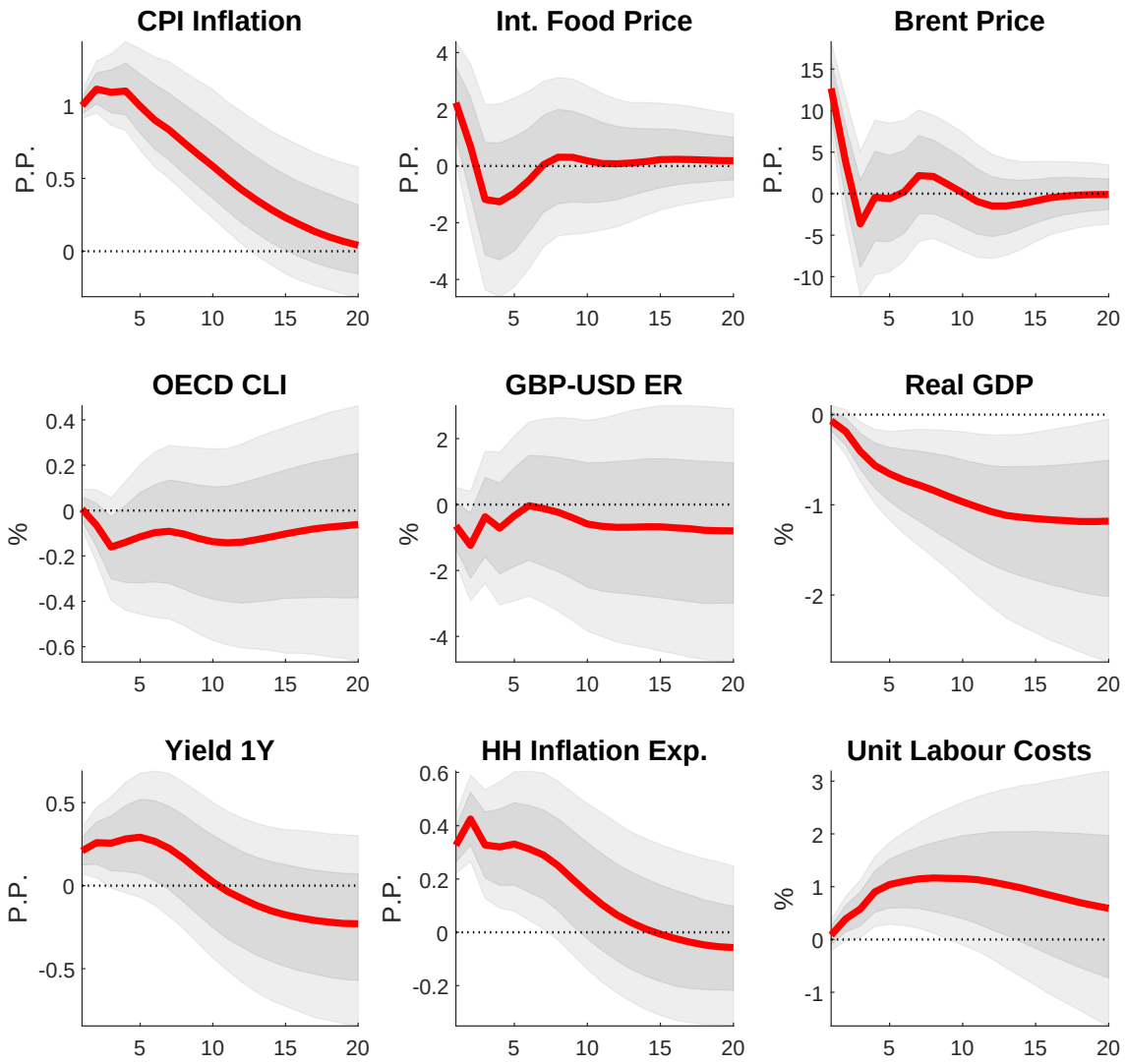

Figure C.2: Full set of responses to a "representative" inflation shock in the baseline VAR. The figure displays IRFs of CPI inflation (Y-o-Y), Food Commodity Prices (Y-o-Y pct. change), the Brent Oil Price (Y-o-Y pct. change), the OECD CLI index, the USD-GBP exchange rate, real UK GBP, the 1-year ahead interest rate, consumer inflation expectations (BIAS) and unit-labour cost to the shock explaining the largest share of the one-step ahead forecast-error variance for CPI inflation.

by using the series for harvests as an external instrument (available through 2016:Q4). Clearly world food prices increase and so do oil prices. The responses for the UK are in line with those reported in Peersman (2022) for the Euro Area. The food price shock cause the Sterling Pound to depreciate and output to fall. Inflation expectations increase persistently, while unit-labour cost does not respond significantly.

Finally, Figures C.4, C.5, C.6 report IRFs, as well as the rescaled IRFs (similarly as in Figure 2) from an alternative VAR, in which we use the BASIX inflation expectations rather than the BASIX-BIAS combination. Differences are hardly distinguishable and do not change the main conclusions.

C.2 VAR with market expectations

To compare the response of consumer expectations to those of financial market operators, we consider specifications including a measure of financial market expectations. We use a measure of inflation expectations derived from inflation-linked swap rates (for more details, see also Braun et al., 2024). That series is only available starting in 2004:Q4. We thus add market-based expectations to the set of variables presented above and estimate a Bayesian VAR(2). This allows us to compare the responses of market and consumer expectations to different shocks and also serves as a check that our results hold even on this shorter sample. Figures C.7 and C.8 report the responses to the max-share inflation shock and the food-price shock. Some variables are less precisely estimated but, overall they paint a similar picture as above.

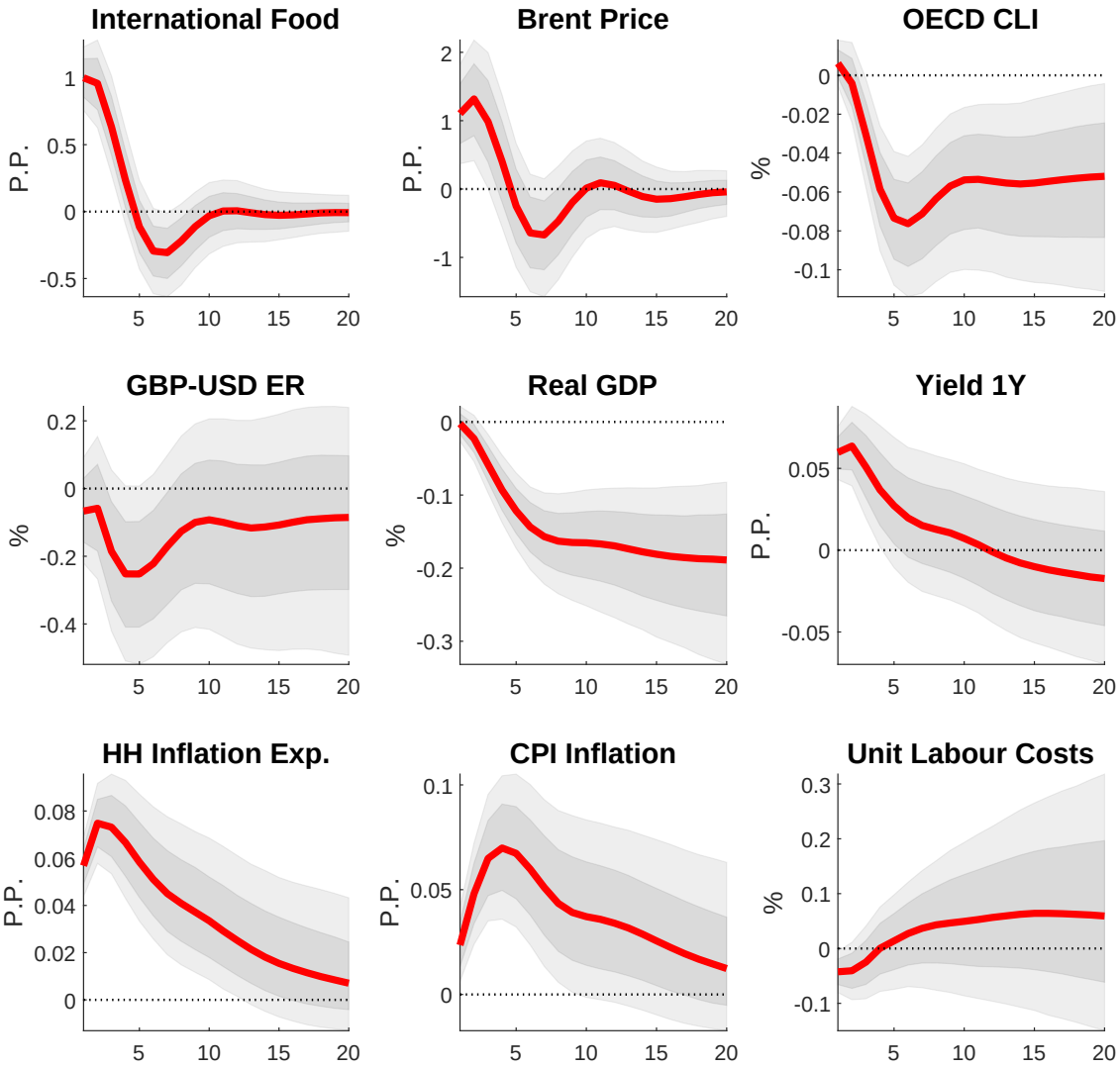

Figure C.3: Full set of responses to a food price shock in the baseline VAR. The figure displays IRFs of CPI inflation (Y-o-Y), Food Commodity Prices (Y-o-Y pct. change), the Brent Oil Price (Y-o-Y pct. change), the OECD CLI index, the USD-GBP exchange rate, real UK GBP, the 1-year ahead interest rate, consumer inflation expectations (BIAS) and unit-labour cost to the shock explaining the largest share of the one-step ahead forecast-error variance for CPI inflation.

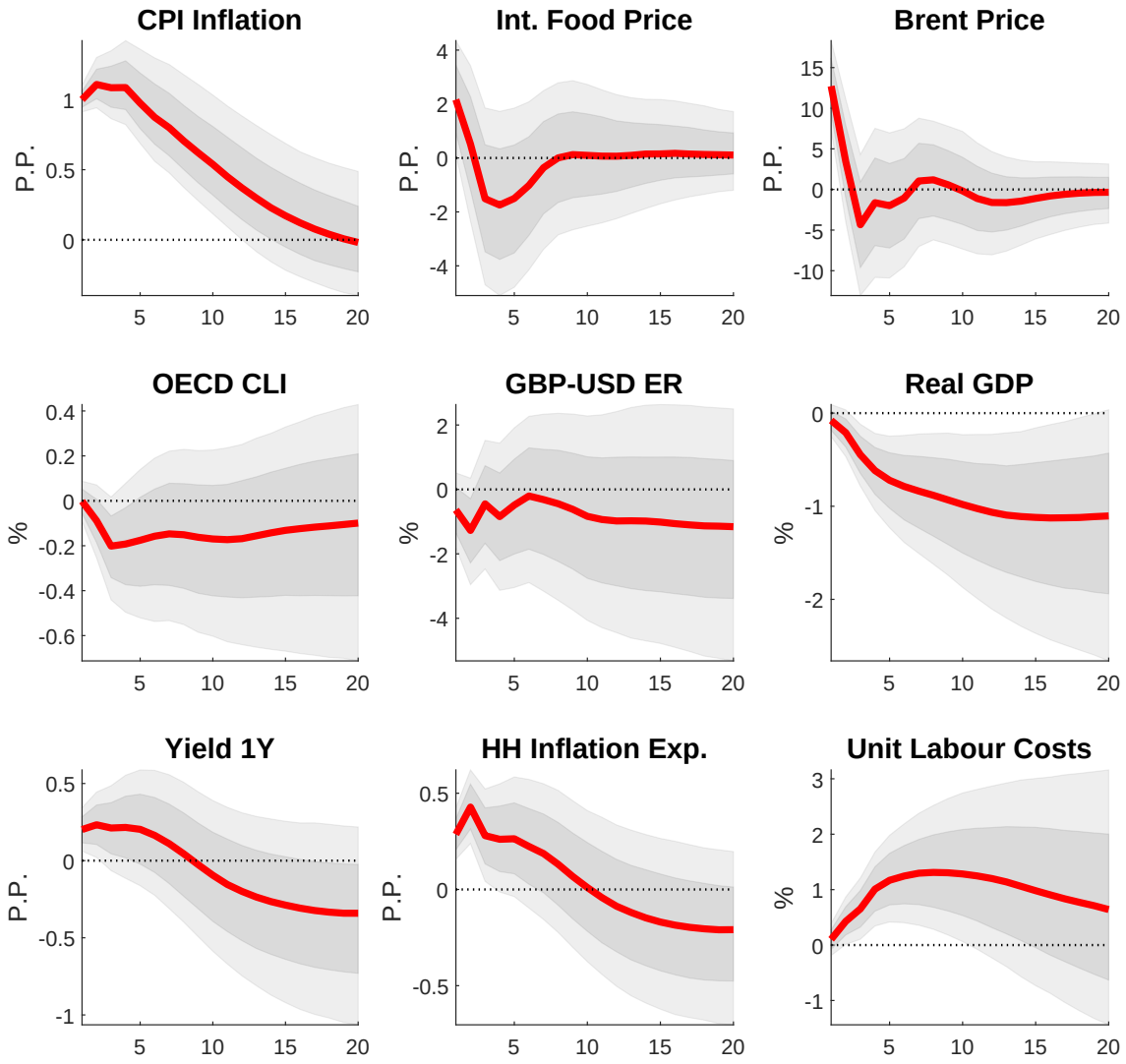

Figure C.4: A "representative" inflation shock in an alternative VAR specification: BASIX inflation expectations. The figure displays IRFs of CPI inflation (Y-o-Y), Food Commodity Prices (Y-o-Y pct. change), the Brent Oil Price (Y-o-Y pct. change), the OECD CLI index, the USD-GBP exchange rate, real UK GBP, the 1-year ahead interest rate, consumer inflation expectations (BASIX) and unit-labour cost to the shock explaining the largest share of the one-step ahead forecast-error variance for CPI inflation.

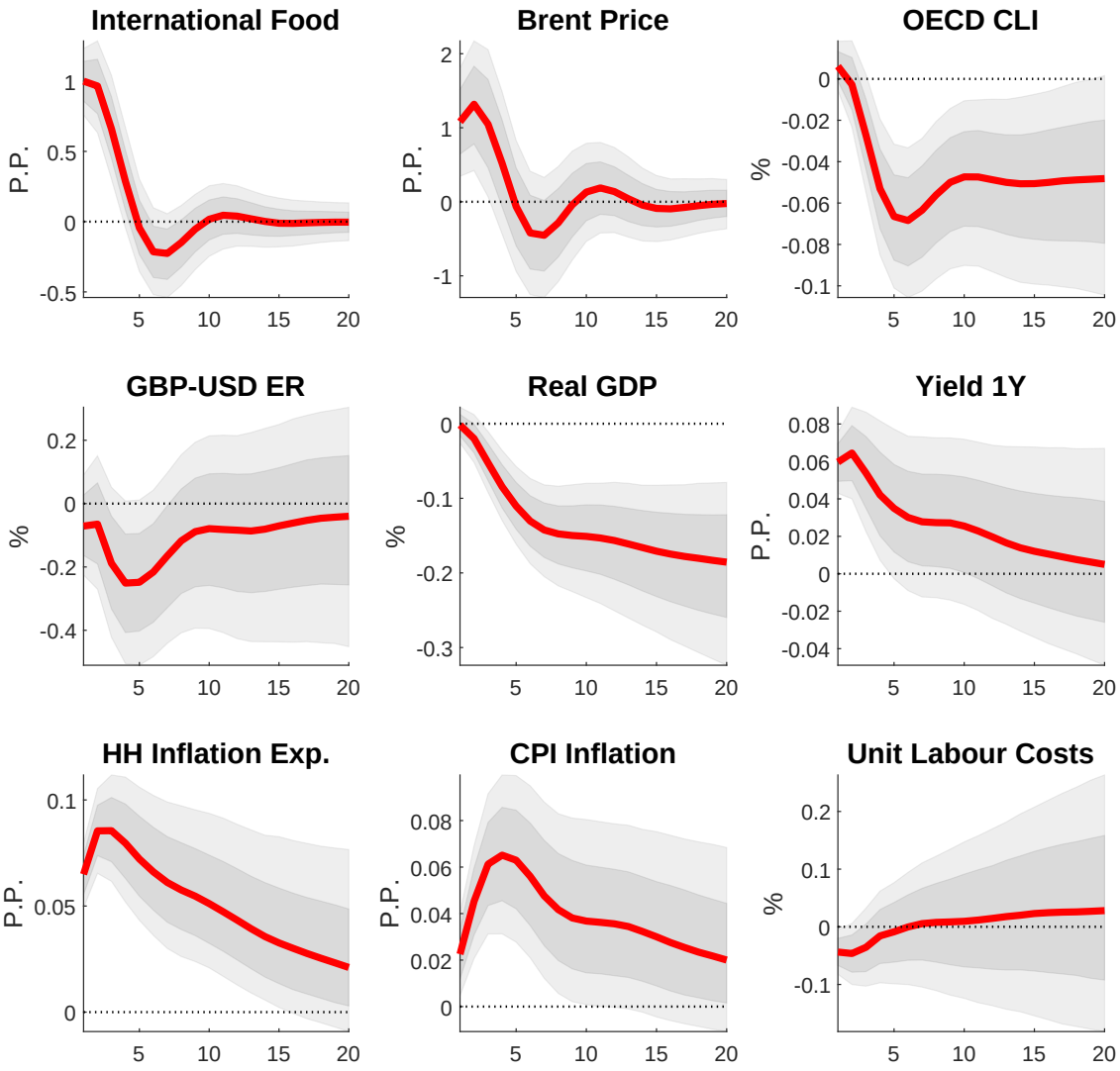

Figure C.5: A food price shock in an alternative VAR specification: BASIX inflation expectations. The figure displays IRFs of CPI inflation (Y-o-Y), Food Commodity Prices (Y-o-Y pct. change), the Brent Oil Price (Y-o-Y pct. change), the OECD CLI index, the USD-GBP exchange rate, real UK GBP, the 1-year ahead interest rate, consumer inflation expectations (BASIX) and unit-labour cost to the shock explaining the largest share of the one-step ahead forecast-error variance for CPI inflation.

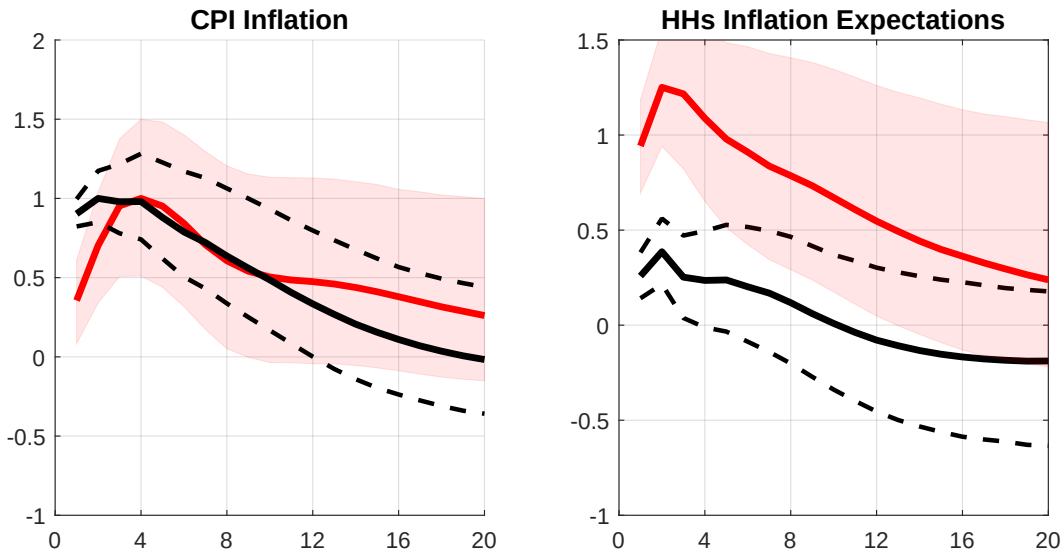

Figure C.6: Responses of UK CPI inflation and BASIX household inflation expectations to a "representative" inflation shock (black lines with 90 percent credible sets delimited by dashed lines) and to a food-price shock (red lines with 90 percent credible set shaded). Responses are rescaled such that the CPI inflation increase peaks at 1.

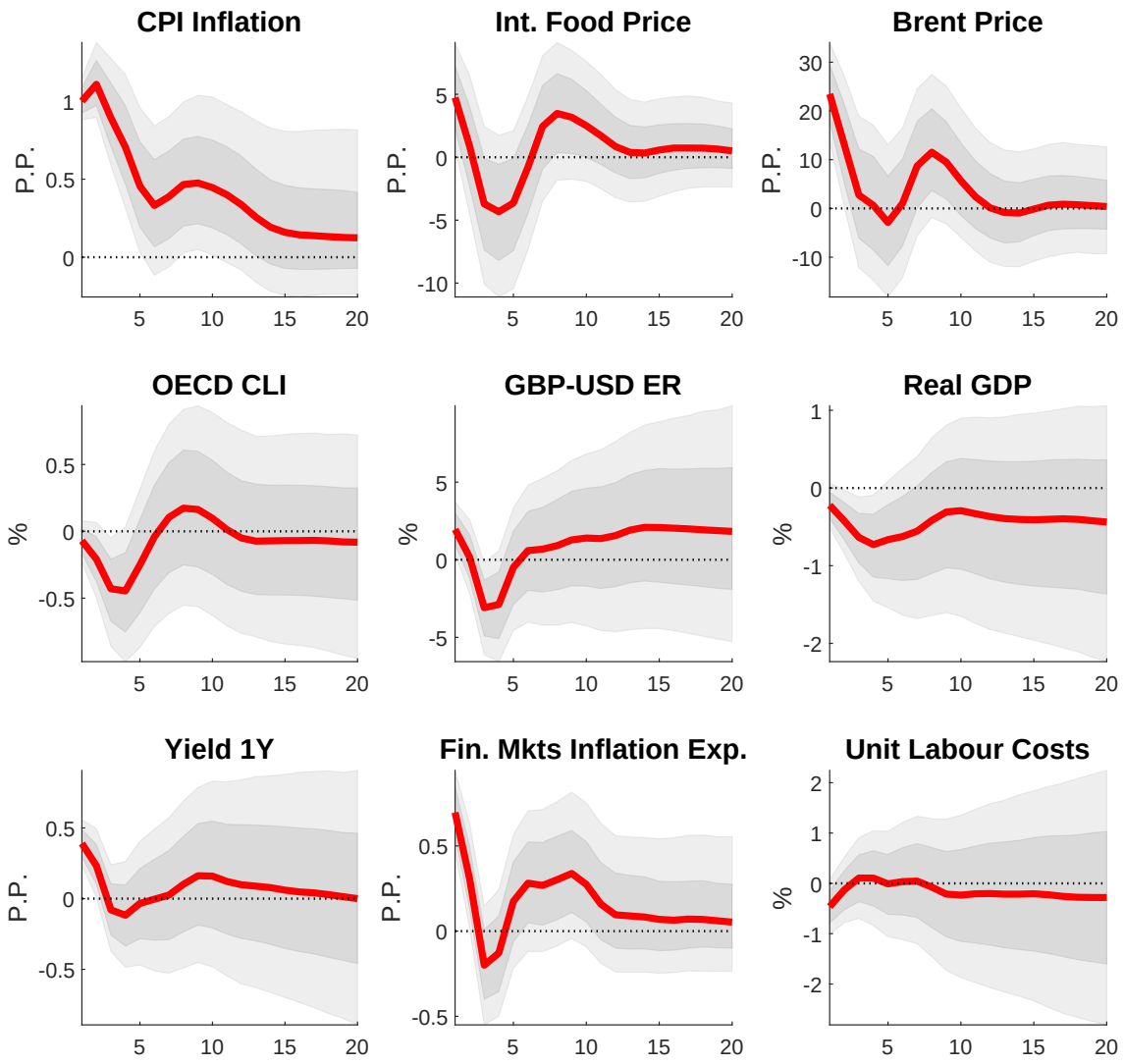

Figure C.7: Full set of responses to a food price shock in the VAR with financial markets (swaps-based) inflation expectations. The figure displays IRFs of CPI inflation (Y-o-Y), Food Commodity Prices (Y-o-Y pct. change), the Brent Oil Price (Y-o-Y pct. change), the OECD CLI index, the USD-GBP exchange rate, real UK GBP, the 1-year ahead interest rate, financial markets inflation expectations and unit-labour cost to the shock explaining the largest share of the one-step ahead forecast-error variance for CPI inflation.

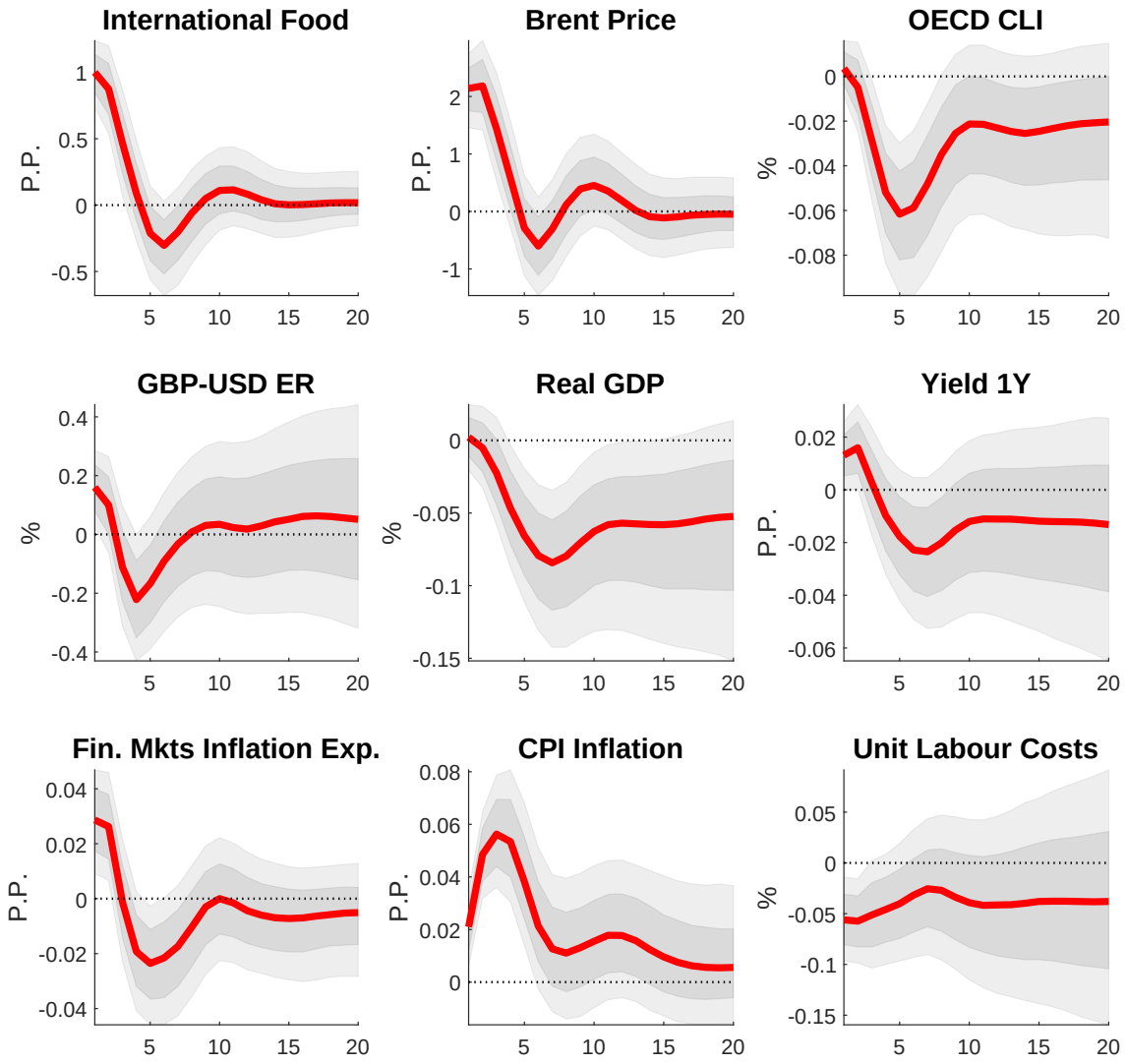

Figure C.8: Full set of responses to a food price shock in the VAR with financial markets (swaps-based) inflation expectations. The figure displays IRFs of CPI inflation (Y-o-Y), Food Commodity Prices (Y-o-Y pct. change), the Brent Oil Price (Y-o-Y pct. change), the OECD CLI index, the USD-GBP exchange rate, real UK GBP, the 1-year ahead interest rate, financial markets inflation expectations and unit-labour cost to the shock explaining the largest share of the one-step ahead forecast-error variance for CPI inflation.

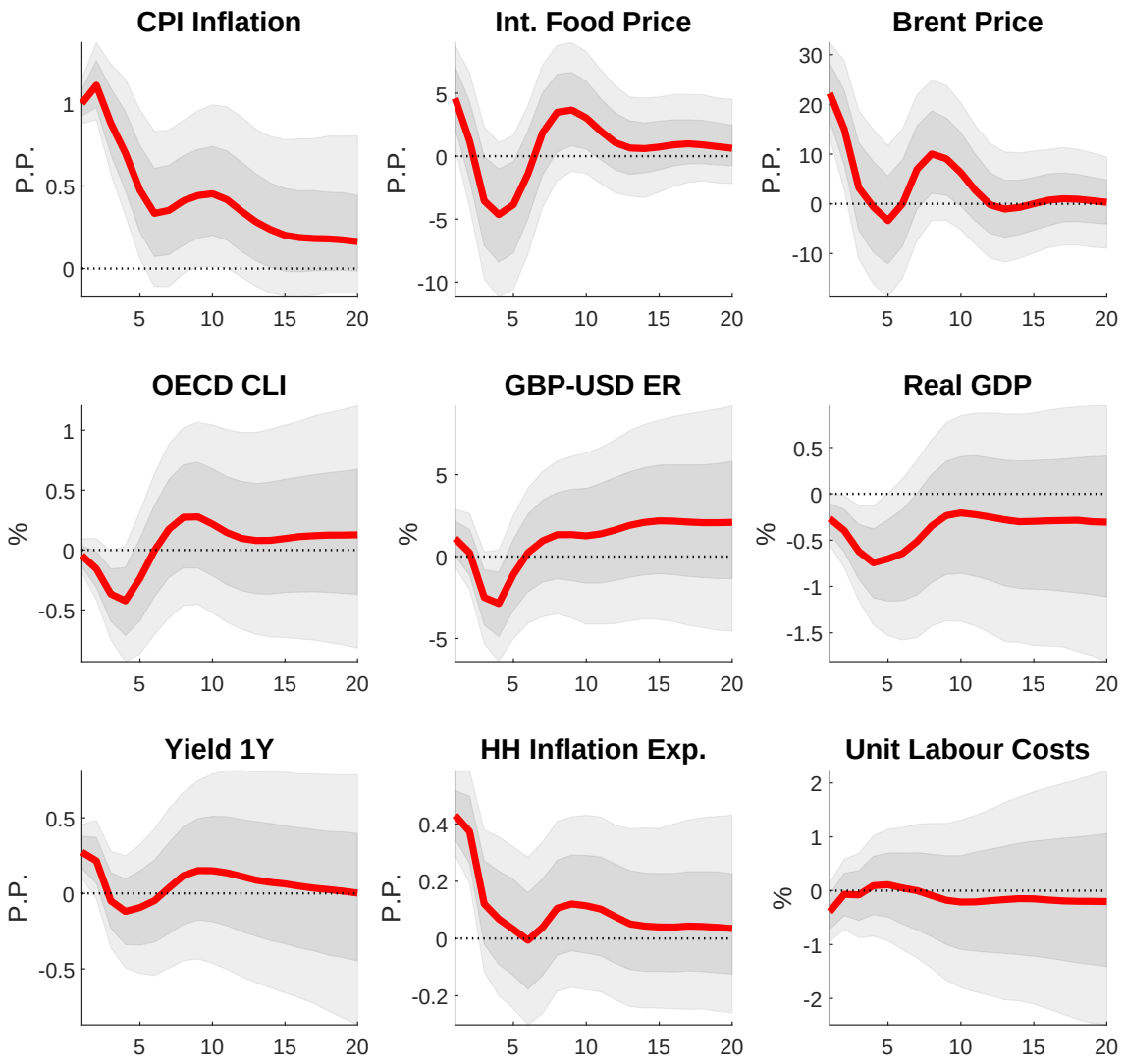

Figure C.9: A "representative" inflation shock in the baseline VAR estimated on a shorter sample (2004Q4-2019Q4). The figure displays IRFs of CPI inflation (Y-o-Y), Food Commodity Prices (Y-o-Y pct. change), the Brent Oil Price (Y-o-Y pct. change), the OECD CLI index, the USD-GBP exchange rate, real UK GBP, the 1-year ahead interest rate, consumer inflation expectations (BIAS) and unit-labour cost to the shock explaining the largest share of the one-step ahead forecast-error variance for CPI inflation.

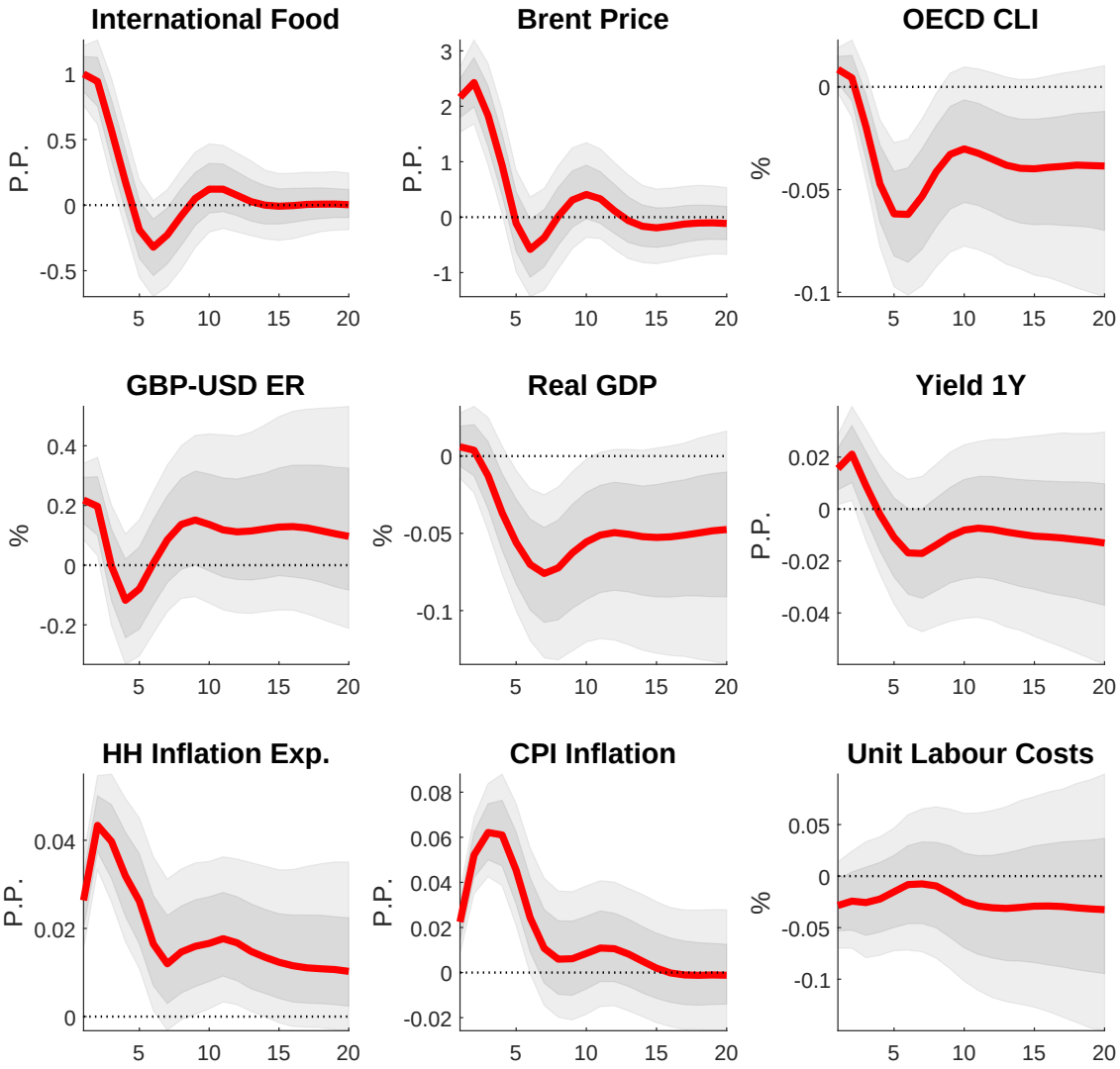

Figure C.10: A food price shock in the baseline VAR estimated on a shorter sample (2004Q4-2019Q4). The figure displays IRFs of CPI inflation (Y-o-Y), Food Commodity Prices (Y-o-Y pct. change), the Brent Oil Price (Y-o-Y pct. change), the OECD CLI index, the USD-GBP exchange rate, real UK GBP, the 1-year ahead interest rate, consumer inflation expectations (BIAS) and unit-labour cost to the shock explaining the largest share of the one-step ahead forecast-error variance for CPI inflation.

D MP Implications: Alternative Calibration

In this section of the appendix, we consider a different calibration of the autocorrelation coefficients ρ_e and ρ_e^{BR}. In the main text, we calibrated this parameters in line with the VAR evidence in Section 2.2 and Appendix C. Here, instead, we calibrate these parameters consistently with the micro-data evidence provided in Table 4 Section 2.1.3. In particular, we set $\rho_e = 0.43$ and $\rho_e^{BR} = 0.56$

The rest of the parameters are parametrised as in the main text: $\sigma = 1$, $\beta = 0.995$, $\theta = 0.75$, $\eta = 1$, $\phi_\pi^R = 1.5$. The size of the cost-push shock, is set such that, in the rational model, inflation rises by one percentage point.

Results are presented in Figure D. The orange lines represent the IRFs under rational expectations. The black lines (labelled "Behavioural I") are the IRFs under behavioural expectations when the central bank follows the same policy rule as under rational expectations. The blue lines (labelled "Behavioural II") are the IRFs under behavioural expectations when the central bank reacts more strongly to inflation, so to match the inflation IRF under rational expectations. In this last case, the Taylor rule coefficient becomes $\phi_\pi^{BR} = 2.07$. Comparing the orange and black lines highlights the stronger increase (by 23%) in inflation that occurs under behavioural expectations if the central bank follows the same policy rule as under rational expectations. Comparing the black line with the blue line highlights the larger fall in the output gap (by 40%) if the central bank reacts more strongly to inflation.

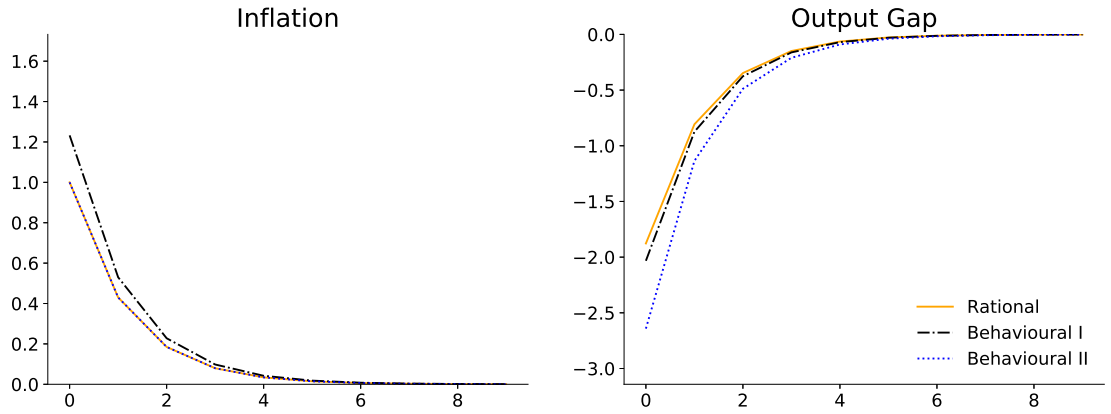

Figure D.1: Model responses to a cost-push shock: Alternative Calibration

To draw policy implications, consider the standard welfare loss function:

$$L = \pi_t^2 + \omega x_t^2, \tag{D.1}$$

with $\omega = \frac{\kappa}{\epsilon}$, $\kappa = 0.17$ (see Section 3) being the slope of the NK Philips Curve, and $\epsilon = 10$ the elasticity of demand. Since $\omega = 0.017$ is much smaller than the weight on inflation volatility, the "Behavioural I" case leads to significantly larger welfare losses than the "Behavioural II" case. Hence, in line with our baseline results, our theoretical exercise suggests that, under such behavioural inflation expectations, central banks should react more strongly to inflation.