

The Effects of Macroeconomic Shocks on Firms' Price and Wage Inflation Expectations

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The views here are those of the authors and not of T. Rowe Price

Introduction

- **Understanding firm-level inflation expectations key to economic theory**
 - Expectations are key to decisions in economic theory
 - Important question for inflation targeting central banks
 - Role of inflation expectations in the Neo-Keynesian Phillips Curve
- **How to measure macroeconomic shocks**
 - Theory relies on the idea that surprises (shocks) affect expectations and outcomes
 - Significant debate about how to measure macroeconomic shocks
 - Standard approach is to measure as forecast error from an estimated Vector autoregression
 - Can estimate effects of many shocks (productivity, aggregate demand & supply, monetary policy, etc)
 - New approach is to measure shocks from fin. market reactions around policy announcement
 - But this only works around certain events (monetary policy, OPEC meetings)
 - We use a new approach to measure macroeconomic shocks
 - We look at forecast errors made by consensus forecasters in the Bloomberg terminal
 - But these are reduced-form shocks → no economic interpretation
 - We propose a way to assign economic interpretation to these shocks based on the VAR literature

The dependent variable

- **The CBI runs four largely qualitative surveys:**
 1. The Industrial Trends Survey (ITS) of mostly manufacturing firms- launched 1958
 2. The Service Sector Survey- launched 1998
 3. The Distributive Trades Survey- launched 1983
 4. The Financial Services Survey-launched 1989
- **In 2007, the Bank of England asked the CBI to include a quantitative inflation question in these surveys**
 - *What has been the percentage change over the past 12 months in the general level of prices in the UK markets that your firm competes in and what is expected to occur over the next 12 months?* (industry level inflation expectations question)
 - Similar questions were asked about the firms' own prices and about wage costs
 - In 2014, a question on the inflation expectations at 12-24 months for industry level expectations was added

The dependent variable

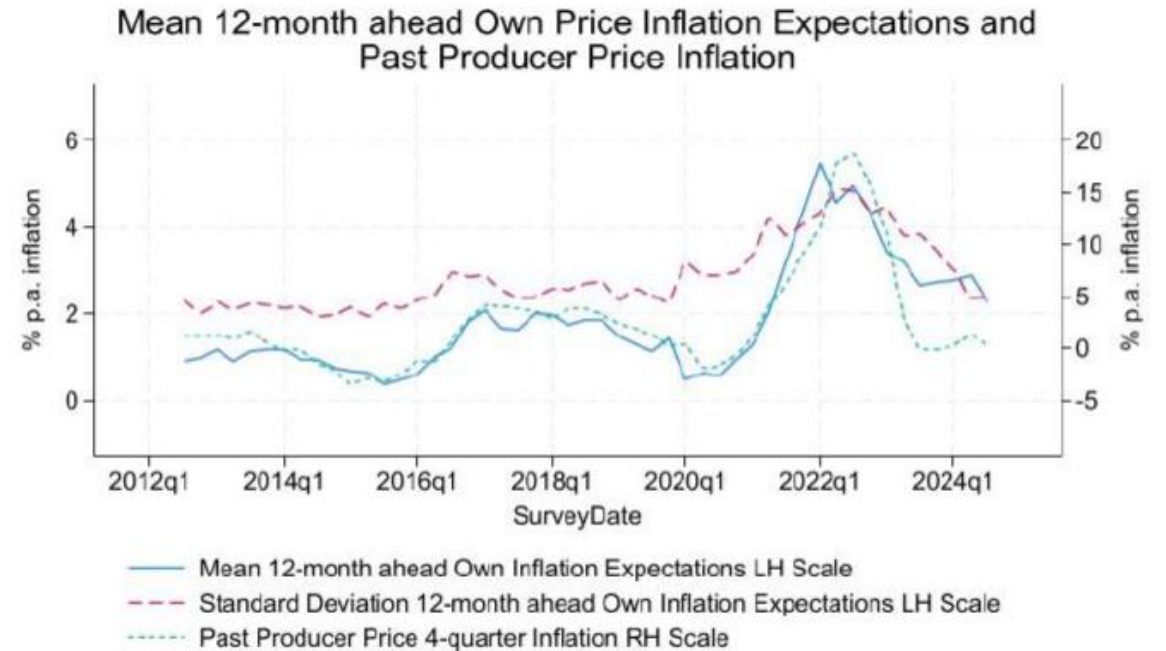
- **What are the key differences to the Decision Makers Panel survey?**
 - The DMP starts in 2016, the CBI questions in 2007
 - The only quantitative expectations questions in the CBI are for inflation, many others in the DMP
 - Price (wage) inflation expectations available since 2007, DMP only since 2016 (2022)
 - This is not a representative sample, but aggregated series highly correlated with macro outcomes
 - The long time series allows us to examine the impact of macroeconomic shocks on expectations
- **Previous research on the CBI ITS** focused the signals for Macro data (Mitchell, Smith and Weale, EJ 2002), the connection with official data (Lui, Mitchell and Weale, JRSS 2011), Effects of unconventional monetary policy (Boneva, Cloyne, Weale and Wieladek, IJCB 2016) and inflation expectations (Boneva, Cloyne, Weale and Wieladek, EJ 2020)
- **In this paper, we focus on the CBI ITS survey, the subject of previous research**
 - Questions on price inflation expectations can be answered by the following buckets: -8.1 to -10 0%, -6.1 to -8%, -4.1 to -6% -2.1 to -4%, -0.1 to -2%, 0%, 0.1 to 2%, 2.1 to 4% 4.1 to 6% 6.1 to 8% and 8.1 to 10%. Firms can also write in their answers.
 - These buckets are used for the wage responses: -1.1 to -2%, -0.1 to -1%, 0%, 0.1 to 1%, 1.1 to 2%, 2.1 to 3%, 3.1 to 4%, 4.1 to 5% 5.1 to 6% , 6.1 to 7%, 7.1 to 8%. Write-in answers are also allowed
 - We attributed to each response the mid-point of the relevant bucket- assuming that the buckets were contiguous

Own wage and price inflation expectations

- Own price inflation outcomes and expectations have decoupled since 2023



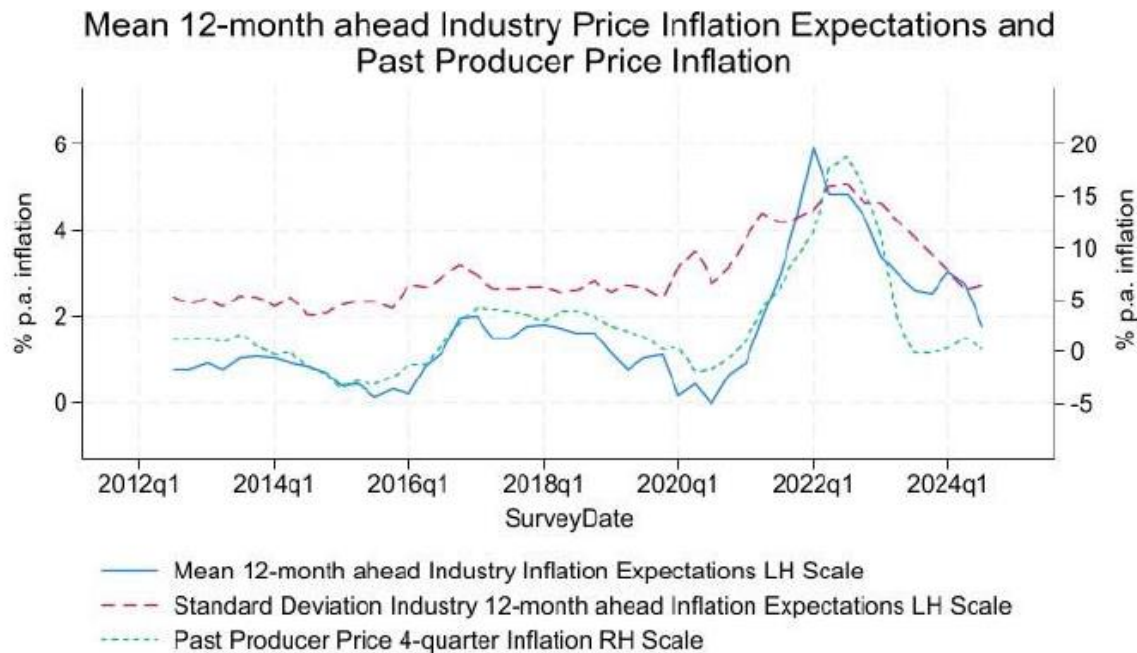
Note: This figure shows the mean of year-on-year wage inflation expectations 12 months ahead (blue line). We also show the standard deviation across firms (red dotted line). The actual year-on-year average weekly earnings inflation in manufacturing is the green dotted line. The corresponding scale is on the right-hand side.



Note: This figure shows the mean of year-on-year own price inflation expectations 12 months ahead (blue line). We also show the standard deviation across firms (red dotted line). Actual year-on-year producer price inflation is the green dotted line. The scale for actual year-on-year Producer Price inflation is on the right-hand side.

Industry price inflation expectations

- Industry price inflation outcomes and expectations have also decoupled since 2023

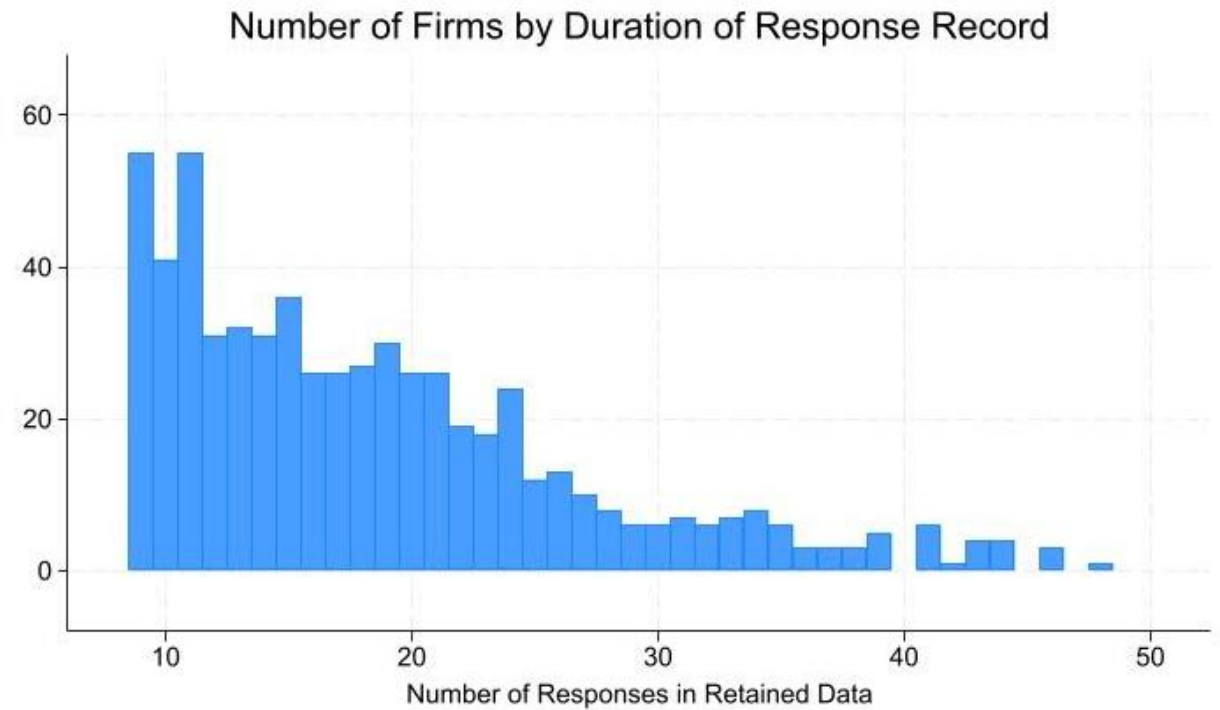
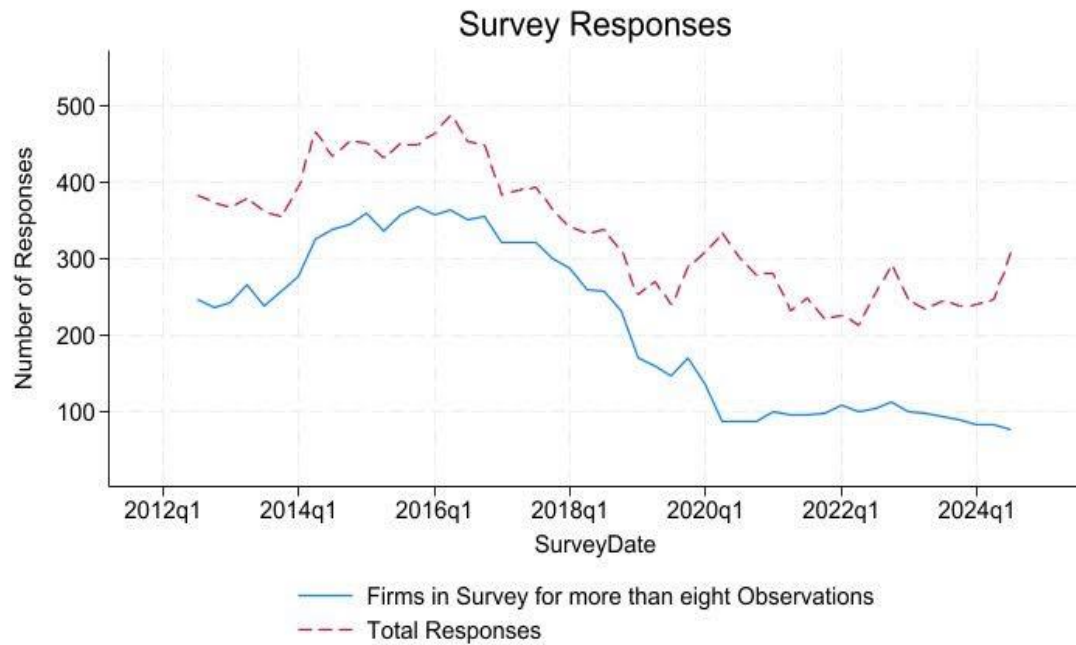


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Note: This figure shows the mean of year-on-year industry price inflation expectations 12 to 24 months ahead (blue line). We also show the standard deviation across firms (red dotted line). The actual year-on-year producer price inflation in manufacturing is the green dotted line. The corresponding scale is on the right-hand side.

The response pattern of firms



Explanatory variables (monetary and oil shocks)

- **We use macroeconomic shocks (surprises) as explanatory variables**
 - Difference from previous work – shocks should affect expectations
- **1) Shocks derived from high-frequency asset price changes**
 - Asset price reaction within half an hour of announcement captures the surprise (shock) in response to announcement - type of announcement supports interpretation. Monetary policy announcement → monetary policy shock
 - Monetary shocks taken from BoE database by Braun, Miranda-Agrippino and Saha (JME, 2025), who use the approach of Gürkaynak, Sack and Swanson (2005) to infer target (interest rate), path (forward guidance) and QE shocks from yield curve data
 - This approach looks at asset price reaction around monetary policy announcement. Applies a factor model to decompose shock into target (interest rate), path (forward guidance) and QE.
 - This is the standard way of measuring monetary policy shocks in the macroeconomic literature
 - Oil news and supply shocks from Känzig (AER, 2021)
 - Uses OPEC meeting announcements
 - Classifies

Explanatory variables (information shocks)

- **What is a central bank information shock?**

- Jarocinski and Karadi (2020) argue that in addition to monetary policy, central banks also reveal private information about the future state of the economy
- Can think of this shock as the CB's expectation of future growth/inflation
- Shock is identified from financial market reaction during MP announcement
 - Big debate on whether this is an 'information' or 'Fed response to news' effect

- **Our approach to measuring information shocks**

- The BoE collects consensus forecasts
- We measure them directly as the deviation between BoE forecasts for GDP/Inflation and the consensus forecast ahead of the BoE forecast.

Explanatory variables (real economy shocks)

- **1) Real economy shocks derived from observed forecast errors**
 - Usually shocks are estimated from VAR models forecast errors
 - The key assumption is that the VAR includes all of the necessary variables (information) that economic agents need to forecast economic variables
 - If this assumption is violated shocks will be mismeasured
 - We measure forecast errors of outturns relative to Bloomberg forecasts
 - Don't have to estimate shocks: Can measure them directly
 - No need for assumptions about full information, we can measure the forecast directly
 - But we only get professional economists forecast: Doesn't have to be the same thing as agents at the macroeconomic level
 - These forecasts are reduced form by construction

Mapping from reduced-form to structural shocks

- We select relevant price and quantity variables and use a two-step approach
- In step 1, we compute the reduced form shock e_t

$$\text{Reduced_form_error} = e_t^* = \overbrace{\hat{Y}_t}^{\text{Actual data}} - \overbrace{\text{Consensus Forecast of } Y_t}^{\text{Predicted } Y_t}$$

- Remove the effects the three monetary and two oil price shocks from e_t^* by means of regression to give unexplained reduced-form shocks, e_t .
- In step 2, we identify supply and demand components in these shocks
 - First, we compute the covariance matrix of $e_t \sim N(0, \Sigma)$
 - We use the decomposition, $\Sigma = B'B$, to search across all permissible values of B using QR approach of Ramirez, Waggoner and Zha (2011) keeping those which give theory-consistent signs to the shocks- e.g a **demand shock leads to higher output and a higher price while a supply shock gives higher output and a lower price**. We use the mean of the permissible values.
 - Standardise shocks to have unit standard deviation.

Reduced-form and structural shocks

Reduced form shocks	Mapping	Recovered structural shocks
UK CPI inflation shock		UK aggregate demand shock
UK GDP growth shock		UK aggregate supply shock
UK wage inflation shock		UK labour demand shock
UK employment growth shock		UK labour supply shock
Citi global inflation surprise shock		Global demand shock
Citi global surprise shock		Global supply shock
BoE GDP growth forecast shock		BoE information demand shock
BoE CPI inflation forecast shock		BoE information supply shock

The regression model

$$y_{i,t} = \alpha_i + \gamma y_{i,t-1} + \beta X_t + \varepsilon_{i,t}$$

$y_{i,t}$ Expectation of firm i in period t

α_i Firm fixed effect

X_t Vector of macroeconomic shocks

$\varepsilon_{i,t}$ Residual

- Include those respondents with more than 8 observations- not necessarily consecutive. Gives 577 firms.
- 13 possible shock variables and 49 time series observations of the macro data, so some form of data selection is required.
- Estimate with OLS first initially.
- Then estimate with Bayesian Model Averaging and use only those variables with more than a 90% chance of relevance.

BMA approach whole sample results

- With FE panel OLS, most coefficients are statistically significant, when all variables are included in the regression model
- But only some are robust to BMA
- Monetary policy shocks have a negative and statistically significant impact on all three year ahead expectations measures
- Bank of England and labour supply shocks have a negative coefficient for all three one-year ahead measures
 - Note: **We define the supply shock such that a positive innovation raises output and lowers inflation**
 - A **negative coefficient** therefore means that a **supply shock that raises inflation has a positive effect on expectations**, as would be expected

Table 3 – BMA results

	Own price inf. expec.	Wage inf. expec.	Industry inf. expec.	12-24 month industry inf. expec.
Lagged dependent var	0.265*** {1.000}	0.347*** {1.000}	0.277*** {1.000}	0.164*** {1.000}
Macro demand shock	0.043 {0.390}	0.000 {0.004}	0.116* {0.832}	0.319*** {0.994}
Macro supply shock	0.096 {0.748}	0.000 {0.004}	0.188*** {0.991}	0.121 {0.594}
BoE demand shock	0.047 {0.335}	0.000 {0.004}	0.180*** {0.933}	0.010 {0.057}
BoE supply shock	-0.609*** {1.000}	-0.358*** {1.000}	-0.545*** {1.000}	-0.203* {0.826}
Labour demand shock	0.000 {0.001}	0.147*** {1.000}	0.000 {0.012}	0.000 {0.003}
Labour supply shock	-0.225*** {1.000}	-0.115*** {1.000}	-0.188*** {0.999}	-0.031 {0.221}
Global demand shock	0.278*** {1.000}	0.000 {0.006}	0.281*** {1.000}	0.029 {0.186}
Global supply shock	-0.010 {0.079}	-0.016 {0.240}	-0.149* {0.822}	-0.356*** {1.000}
Oil supply shock	0.010 {0.108}	-0.082*** {0.990}	0.011 {0.145}	0.000 {0.004}
Oil news shock	0.136** {0.899}	0.098*** {0.982}	0.205*** {0.988}	0.000 {0.002}
MPC target shock	-0.238*** {1.000}	-0.201*** {1.000}	-0.284*** {1.000}	-0.005 {0.031}
MPC path shock	-0.294*** {1.000}	-0.214*** {1.000}	-0.256*** {0.999}	-0.002 {0.016}
MPC QE shock	-0.259*** {1.000}	-0.153*** {1.000}	-0.314*** {1.000}	0.000 {0.004}

Results split over time (before 2020Q1 & after)

- BoE supply shock always significant
- Monetary policy shocks only significant in normal times (2012q3-2020q1)
- Labour supply shocks only significant in high inflation (2020q2-2024q3) times
- Global supply shock estimate doubles

Table 4 – Subsample results

VARIABLES	2012q3 to 2020q1				2020q2 to 2024q3			
	Own price expectations	Wage expectations	Ind price expectations	Foll yr price expectations	Own price expectations	Wage expectations	Ind price expectations	Foll yr price expectations
Lagged dependent variable	0.266*** (0.024)	0.363*** (0.020)	0.255*** (0.022)	0.109*** (0.023)	0.194*** (0.040)	0.201*** (0.040)	0.235*** (0.035)	0.132*** (0.033)
BoE supply shock	-0.726*** (0.103)	-0.193** (0.090)	-0.856*** (0.122)		-0.757*** (0.115)	-0.514*** (0.048)	-0.829*** (0.128)	
Labour demand shock		0.157*** (0.019)				-0.010 (0.061)		
Labour supply shock	-0.040 (0.036)	-0.056** (0.022)	0.040 (0.041)		-0.457*** (0.148)	-0.327*** (0.069)	-0.576*** (0.204)	
Oil supply shock		-0.047* (0.028)				-0.024 (0.040)		
Oil news shock		0.061** (0.029)	0.127*** (0.042)			-0.007 (0.063)	0.170 (0.177)	
MPC target shock	-0.373*** (0.091)	-0.227*** (0.061)	-0.847*** (0.108)		-0.069 (0.087)	-0.106** (0.047)	-0.055 (0.092)	
MPC path shock	-0.191*** (0.070)	-0.183*** (0.042)	-0.129* (0.070)		-0.126 (0.120)	-0.027 (0.058)	-0.061 (0.203)	
MPC QE shock	-0.266*** (0.061)	-0.100** (0.039)	-0.430*** (0.069)		-0.012 (0.151)	-0.156** (0.071)	-0.044 (0.163)	
Global demand Shock	0.176*** (0.042)		0.212*** (0.050)		0.261** (0.125)		0.379** (0.145)	
Macro supply Shock			0.298*** (0.043)				0.019 (0.118)	
BoE demand Shock			0.454*** (0.114)				-0.062 (0.126)	
Macro demand Shock				0.253*** (0.049)				-0.000 (0.087)
Global supply Shock				-0.194*** (0.060)				-0.465*** (0.057)
Observations	6,576	6,575	6,637	5,030	1,349	1,327	1,365	1,297
R-squared	0.087	0.151	0.097	0.021	0.190	0.338	0.220	0.142
Number of Participant	507	508	508	501	137	137	137	135

Results split over time by firm type

- We split firms by whether they are exporters or not.
- In normal times (2012q3-2020q1), only exporters pay attention to BoE information and global supply shocks
- In high inflation times (2020q2-2024q3), all firms pay attention to BoE information and global supply shocks
- In the paper we show a number of other splits- e.g. by firm size.

Table 6 – Subsample results for exporters vs non-exporters firms

VARIABLES	2012q3 to 2020q1				2020q2 to 2023q4			
	Own price expectations	Wage expectations	Ind price expectations	Foll yr price expectations	Own price expectations	Wage expectations	Ind price expectations	Foll yr price expectations
Lagged dependent	0.265*** (0.024)	0.360*** (0.020)	0.252*** (0.022)	0.107*** (0.023)	0.195*** (0.040)	0.200*** (0.040)	0.233*** (0.034)	0.130*** (0.033)
Variable								
BoE supply shock	-0.221 (0.183)	0.098 (0.173)	-0.562*** (0.261)		-0.868*** (0.181)	-0.531*** (0.069)	-0.835*** (0.202)	
not exporter								
BoE supply shock	-0.933*** (0.120)	-0.332*** (0.106)	-0.982*** (0.132)		-0.677*** (0.119)	-0.507*** (0.057)	-0.865*** (0.135)	
Exporter								
Labour demand shock		0.144*** (0.037)				-0.075 (0.087)		
not exporter								
Labour demand shock		0.163*** (0.022)				0.040 (0.074)		
Exporter								
Labour supply shock	-0.010 (0.070)	-0.029 (0.046)	0.055 (0.085)		-0.357* (0.206)	-0.349*** (0.086)	-0.432 (0.267)	
not exporter								
Labour supply shock	-0.046 (0.041)	-0.066*** (0.024)	0.040 (0.046)		-0.550*** (0.163)	-0.315*** (0.075)	-0.728*** (0.227)	
Exporter								
Oil supply shock		0.001 (0.053)				-0.039 (0.049)		
not exporter								
Oil supply shock		-0.075** (0.033)				-0.007 (0.057)		
Exporter								
Oil news shock		0.025 (0.059)	0.256*** (0.078)			-0.072 (0.100)	0.230 (0.267)	
not exporter								
Oil news shock		0.081** (0.034)	0.069 (0.051)			0.034 (0.079)	0.110 (0.225)	
Exporter								
MPC target shock	-0.024 (0.164)	-0.041 (0.135)	-0.677*** (0.228)		-0.031 (0.155)	-0.109 (0.077)	-0.135 (0.155)	
not exporter								
MPC target shock	-0.530*** (0.109)	-0.318*** (0.069)	-0.930*** (0.120)		-0.077 (0.090)	-0.104* (0.053)	0.011 (0.105)	
Exporter								
MPC path shock	-0.254** (0.115)	-0.066 (0.075)	-0.169 (0.143)		-0.274* (0.156)	0.043 (0.105)	-0.525** (0.241)	
not exporter								
MPC path shock	-0.157* (0.086)	-0.237*** (0.052)	-0.107 (0.079)		-0.014 (0.169)	-0.079 (0.065)	0.292 (0.289)	
Exporter								
QE MPC shock	-0.216* (0.117)	-0.038 (0.071)	-0.407*** (0.154)		0.261 (0.273)	-0.044 (0.112)	0.284 (0.290)	
not exporter								
QE MPC shock	-0.285*** (0.071)	-0.131*** (0.046)	-0.442*** (0.070)		-0.169 (0.142)	-0.227*** (0.084)	-0.255 (0.164)	
Exporter								
Global demand shock	0.241*** (0.082)		0.331*** (0.104)		0.085 (0.177)		0.266 (0.227)	
not exporter								
Global demand shock	0.151*** (0.049)		0.163*** (0.056)		0.384** (0.155)		0.451** (0.176)	
Exporter								
Macro supply shock			0.414*** (0.089)				0.027 (0.181)	
not exporter								
Macro supply shock			0.251*** (0.049)				0.038 (0.146)	
Exporter								
BoE demand shock			0.209 (0.219)				0.086 (0.186)	
not exporter								
BoE demand shock			0.569*** (0.133)				-0.162 (0.165)	
Exporter								
Macro demand shock				0.291*** (0.098)				0.139 (0.124)
not exporter								
Macro demand shock				0.235*** (0.057)				-0.111 (0.111)
Exporter								
Global supply shock				-0.106 (0.124)				-0.502*** (0.100)
not exporter								
Global supply shock				-0.232*** (0.064)				-0.436*** (0.064)
Exporter								

What could explain time variation in results?

- Disagreement among firms
 - Mankiw, Reis & Wolfers (2003); Andrade, Crump, Eusepi & Moench (2016); Coibon, Gorodnichenko & Repele (2020) show disagreement relevant in theory
 - Dong, Liu, Wang, Wei (2024) & Bussiere, Grishchenko, Gilbert (2025) show that disagreement among households lowers effect of monetary policy on expectations
- Changes in perception of Bank of England credibility
 - Interact all coefficients with long-term (5-year) household inflation expectations
- Greater awareness of inflation among firms
 - Concerns about inflation may make firms less rational and more adaptive
- Labour market tightness
 - When labour markets are tight, firms are more likely to pay attention to labour market shocks

Explaining the time variation in results

- Interact all shocks with google searches on inflation, monetary policy shocks with 5-year inf. expectation, labor market shocks with V/U ratio
- When google searches for inflation are high, money shocks are less effective
- Labour supply shocks are more significant when V/U ratio is high
- 5-year inflation expectations do not produce many significant results

Table 7 – Interactions with Google inflation searches

VARIABLES	Own price expectations	Own wage exp.	Ind price exp.	Foll yr price expectations
Lagged dependent variable	0.261*** (0.022)	0.316*** (0.019)	0.272*** (0.019)	0.144*** (0.021)
BoE supply shock	-0.581*** (0.115)	-0.267*** (0.062)	-0.930*** (0.205)	
BoE supply shock ×Google	0.001 (0.061)	0.007 (0.027)	0.037 (0.119)	
Labour demand shock		-0.080* (0.045)		
Labour demand shock ×Google		0.125*** (0.032)		
Labour supply shock	-0.016 (0.102)	-0.080 (0.067)	0.192 (0.125)	
Labour supply shock ×Google	-0.125* (0.075)	-0.039 (0.047)	-0.223** (0.095)	
Oil supply shock		-0.287*** (0.080)		
Oil supply shock ×Google		0.127** (0.054)		
Oil news shock		0.284*** (0.060)	0.198 (0.133)	
Oil news shock ×Google		-0.076** (0.038)	-0.032 (0.088)	
MPC target shock	-0.258** (0.124)	-0.313*** (0.070)	-1.010*** (0.174)	
MPC target shock ×Google	0.093** (0.043)	0.090*** (0.027)	0.291*** (0.060)	
MPC path shock	-0.492*** (0.136)	-0.321*** (0.078)	-0.507*** (0.168)	
MPC path shock × Google	0.149** (0.071)	0.096** (0.044)	0.177* (0.105)	
MPC QE shock	-0.597*** (0.139)	-0.306*** (0.064)	-0.915*** (0.179)	
MPC QE shock × Google	0.237*** (0.081)	0.113*** (0.037)	0.327*** (0.101)	
Google	0.291*** (0.108)	0.388*** (0.056)	0.249* (0.136)	0.574*** (0.079)
Global demand Shock	0.207 (0.126)		-0.091 (0.169)	
Global demand Shock × Google	0.067 (0.081)		0.246** (0.107)	
Macro supply Shock			0.180** (0.087)	
Macro supply Shock×Google			0.002 (0.057)	
BoE demand shock			0.725*** (0.173)	
BoE demand shock×Google			-0.211* (0.110)	
Macro demand shock				0.148 (0.091)
Macro demand shock×Google				-0.018 (0.054)
Global supply shock				-0.257*** (0.088)
Global supply shock×Google				0.016 (0.041)

Table 9: Interactions with vacancy to unemployment ratio

VARIABLES	Own price expectations	Own wage expectations	Ind price expectations	Foll yr price expectations
Lagged dependent variable	0.256*** (0.022)	0.312*** (0.018)	0.270*** (0.019)	0.147*** (0.020)
BoE supply shock	-0.422*** (0.061)	-0.125*** (0.031)	-0.480*** (0.064)	
Labour demand shock		-0.137** (0.053)		
Labour demand shock ×VU ratio		0.094*** (0.026)		
Labour supply shock	0.169* (0.095)	-0.028 (0.058)	0.312*** (0.113)	
Labour supply shock ×VU ratio	-0.156*** (0.048)	-0.026 (0.029)	-0.216*** (0.056)	
Oil supply shock		-0.073*** (0.016)		
Oil news shock		0.130*** (0.025)	0.157*** (0.043)	
MPC target shock	-0.052 (0.061)	-0.002 (0.036)	-0.186*** (0.064)	
MPC path shock	-0.202*** (0.061)	-0.178*** (0.031)	-0.226*** (0.064)	
MPC QE shock	-0.077 (0.049)	0.010 (0.023)	-0.214*** (0.052)	
VU ratio	0.407*** (0.059)	0.453*** (0.033)	0.409*** (0.070)	0.697*** (0.076)
Global demand Shock	0.206*** (0.041)		0.199*** (0.047)	
Macro supply Shock			0.167*** (0.038)	
BoE demand shock			0.257*** (0.066)	
Macro demand shock				0.125*** (0.038)
Global supply shock				-0.079* (0.047)
Observations	7,925	7,902	8,002	6,327
R-squared	0.166	0.258	0.180	0.090
Number of Participant	576	577	577	570

Conclusions

- We show that macroeconomic shocks affect wage and price inflation expectations with theoretically consistent signs
- But the effects vary over time: Monetary policy shocks affect expectations in normal times, while labour supply shocks affect expectations in high inflation times
- Google searches about inflation and labour market tightness can partially explain this time variation in effect