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Effects of Inflation Expectations on Inflation

Abstract

We study the effects of professionals' survey-based inflation expectations on inflation for a large number of 36 OECD economies, using dynamic cross-country panel estimation of New-Keynesian Phillips curves. We find that inflation expectations have a significantly positive effect on inflation. We also find that the effect of inflation expectations on inflation is larger when inflation is higher. This suggests that second-round effects via the effects of higher inflation expectations on inflation are more relevant in a high-inflation environment.

JEL-Codes: E520, E580.

Keywords: inflation, inflation expectations, Phillips curve.

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1. Introduction

In this paper we study the effects of professionals' survey-based inflation expectations on inflation for a large number of 36 OECD economies, using dynamic cross-country panel estimation of New-Keynesian Phillips curves. We also study how the effect of inflation expectations on inflation depends on the inflation environment.

In standard theoretical economic models used for monetary policy analysis, inflation expectations matter for inflation (Clarida et al., 1999; Smets, 2003; Woodford, 2003; Levin and Moessner, 2005). The role of inflation expectations has also played a central role in the recent debate on monetary policy frameworks, such as average inflation targeting, which attribute a key role to expected inflation. This has been the case for the monetary policy strategy reviews of both the Federal Reserve and the ECB (Powell and Wessel, 2020; Eurosystem work stream on inflation expectations, 2021). Partly based on the role of inflation expectations, the Federal Reserve adopted an average inflation targeting framework in 2020, and the ECB adopted a symmetric inflation target of 2% in 2021 (a change from an inflation aim of below but close to 2% previously).

Coibion et al. (2018) argue for a more systematic inclusion of real-time survey-based expectations in macroeconomic analyses. Coibion et al. (2018) find that it is important to include survey-based inflation expectations in the estimation of the New-Keynesian Phillips curve, and we do so in this paper. They note that while New-Keynesian Phillips curves are derived under the assumption of full information rational expectations, and subjective inflation expectations deviate from this, Adam and Padula (2011) show that survey-based expectations can be used if private agents follow the law of iterated expectations, which is only a weaker assumption. This constraint is satisfied for example when agents are rational but not sufficiently informed, and there is some evidence consistent with this condition being met (Coibion and Gorodnichenko, 2012, 2015a).

There is no consensus in the empirical literature on whether inflation expectations matter for inflation. This is the case since the effect of inflation expectations is difficult to distinguish from the effects of past inflation outturns and of trend inflation. On the one hand, some evidence for individual countries such as the United States suggests that there is no significant effect of inflation expectations on inflation (Rudd, 2021, and references therein). On the other hand, other evidence suggests that measures of inflation expectations matter for inflation, including in cross-country estimates of Phillips curves (Galí and Gertler, 1999; Brissimis and Magginas, 2008; Coibion et al. (2018); Coibion and Gorodnichenko, 2015b; Forbes, 2019; Kohlscheen and Moessner, 2021).

Resurgent consumer demand, supply chain bottlenecks and rising energy costs in the wake of the pandemic have been pushing up inflation globally. An important question is whether the increase in inflation will lead to second-round effects on inflation, which could lead to more persistent increases in inflation. This could happen

if inflation expectations increase, and if these higher inflation expectations lead to higher inflation.

We use a hybrid New-Keynesian Phillips curve framework with cross-country dynamic panel estimation based on Jasova et al. (2019, 2020), which includes a forward-looking inflation expectations term, in order to be consistent with the New-Keynesian Phillips curve framework which has commonly been used in macroeconomic and monetary policy analysis for capturing inflation dynamics.[2] This approach allows us to exploit cross-country variation to avoid the difficulties of identification present for country specific estimates, which were discussed by Reichlin (2018) and Forbes (2019) for the output gap. Here, we use this approach exploiting cross-country variation to also avoid some of the difficulties of identification of the effects of inflation expectations present with country-specific estimates discussed in Rudd (2021).

We use survey-based inflation expectations of professionals, since they are available on a harmonised basis for the large number of countries in our sample, and since they are not distorted by risk and liquidity premia, in contrast to financial market-based measures.[3]

We find that professionals' survey-based inflation expectations have a significant effect on inflation. We also find evidence that these inflation expectations matter significantly more for inflation when inflation is higher. This suggests that second-round effects on inflation via rising inflation expectations are more relevant when inflation is already high.

The remainder of the paper is organised as follows. Section 2 introduces the data, section 3 presents the method and results, and section 4 concludes.

2. Data

Data on seasonally-adjusted headline consumer price indices (CPI) come from Datastream and national sources. We use data on professionals' survey-based CPI inflation expectations. These are taken from Consensus Economics surveys for next-year CPI inflation expectations.

Data on output gaps (as a percentage of potential GDP) were obtained from the OECD, and linearly interpolated from annual data**.** Nominal effective exchange rate indices (broad indices, quarterly averages) are taken from the BIS, where an increase indicates an appreciation of the domestic currency. Brent oil prices (quarterly averages, US dollar per barrel) are from Datastream.

[2] See Clarida et al., 1999; Smets, 2003; Woodford, 2003; and Levin and Moessner, 2005.

[3] For a discussion of the pros and cons of survey- versus market-based measures of inflation expectations see Galati et al (2011).

We consider the following 36 OECD economies: Austria, Australia, Belgium, Bulgaria, Canada, Chile, the Czech Republic, Denmark, Estonia, euro area, Finland, France, Germany, Great Britain, Greece, Hungary, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Mexico, the Netherlands, Norway, New Zealand, Poland, Portugal, Romania, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland and the United States. The sample period is from 2000Q1 to 2021Q1 at quarterly frequency.

3. Method and results

To study the effects of inflation expectations on inflation, we estimate the following New-Keynesian Phillips curve based on Jasova *et al* (2019, 2020), using a panel of 36 OECD economies:

$$\pi_{it} = \theta\, \pi^{e}_{it} + \rho\, \pi_{it-1} + \phi\, outputgap_{it} + \mu\, \Delta NEER_{it} + \lambda\, \pi^{oil}_{t} + \alpha_i + \varepsilon_{it.} \quad (1)$$

where π_{it} denotes quarter-on-quarter (q/q) seasonally adjusted CPI inflation at annualised rates (saar) in percent, calculated from log differences in quarterly seasonally adjusted consumer price indices (CPI) in country i at time t; $outputgap_{it}$ denotes the output gap; π^{e}_{it} denotes next-year CPI inflation expectations from Consensus Economics surveys, year-on-year (y/y) in percent; $\Delta NEER_{it}$ is the q/q change in the nominal effective exchange rate in percent, calculated from the log change in the nominal effective exchange rate, with an increase indicating an appreciation of the currency; π^{oil}_{t} denotes q/q oil price inflation (annualised) calculated from log-differences in quarterly oil prices. Finally, α_i are country fixed effects to control for observed and unobserved country heterogeneity. We use robust standard errors clustered at the country level. Equation (1) is our baseline specification.

We use the system generalised method of moments (GMM) following Arellano and Bover (1995) and Blundell and Bond (1998) for panel data with endogenous explanatory variables. It is appropriate to use this method here since the coefficient on the lagged dependent variable, lagged inflation, is significant in all our specifications.

For robustness, we also estimate the following specification, where we replace oil price changes by time fixed effects, β_t, in order to control for all observed and unobserved variation in common global factors,

$$\pi_{it} = \theta\, \pi^{e}_{it} + \rho\, \pi_{it-1} + \phi\, outputgap_{it} + \mu\, \Delta NEER_{it} + \alpha_i + \beta_t + \varepsilon_{it.} \quad (2)$$

Our Phillips curve estimates for equations (1) and (2) are shown in Table 1. We can see that in both specifications the coefficient on the output gap is significantly positive, implying that in our cross-country dynamic panel setting the New-Keynesian

Phillips curve is "alive and well" (see also Coibion and Gorodnichenko, 2015b). We can also see that the coefficient on lagged inflation is significantly positive, so that our dynamic panel specification is appropriate. We find that inflation expectations have a significantly positive effect on inflation at the 1% significance level, with a coefficient which is similar for both specifications, at 1.17 and 1.15, respectively. Oil prices have a significantly positive effect on inflation at the 1% level. Moreover, exchange rate depreciations lead to significantly higher inflation, as would be expected, also at the 1% significance level in both specifications.

We next study whether the effects of inflation expectations on inflation depend on the inflation environment. We do so by adding an interaction term of inflation expectations with inflation lagged two periods, according to[4]

$$\pi_{\mathrm{it}} = \theta\, \pi_{it}^{e} + \rho\, \pi_{\mathrm{it}-1} + \phi\, outputgap_{_{it}} + \mu\, \Delta NEER_{it} + \gamma\, \pi_{it}^{e}\, \pi_{\mathrm{it}-2} + \lambda\, \pi_{\mathrm{t}}^{\mathrm{oil}} + \alpha_i + \varepsilon_{it.} \qquad (3)$$

The results for equation (3) are shown in Table 2. For robustness we also show the corresponding results in Table 3 when replacing oil price changes by time fixed effects in equation (3). For both specifications the effect of inflation expectations remains significantly positive at the 1% level. We find that the coefficient on the interaction term of inflation expectations with inflation lagged two periods is significantly positive at the 1% significance level, with a magnitude which is similar for both specifications, at 0.018 and 0.019, respectively. These results imply that inflation expectations have a stronger effect on inflation when inflation is higher. The coefficients on the remaining variables continue to be significant and have the expected signs.

We therefore find evidence that inflation expectations have a significantly larger effect on inflation when inflation is high. This suggests that second-round effects via the effects of higher inflation expectations on inflation are more of a problem in a high-inflation environment.

Quantile regressions

In order to study whether the effects of inflation expectations on inflation depend on the level of inflation, we next also estimate quantile regressions for the specification of equation (1), at the 10th, 25th (lower quartile), 50th (median), 75th (upper quartile) and 90th percentiles. This allows us to determine whether the effects of inflation expectations on inflation differ when inflation is in the upper tail of the inflation distribution, compared with at the median level or in the lower tail of the distribution.

[4] Inflation is lagged by two periods in order to reduce endogeneity issues. This follows the approach of Jasova et al. (2019) in determining whether the pass-through of exchange rate changes to inflation depends on the inflation environment.

Quantile regressions weigh observations in the neighbourhood of the quantile of interest more heavily, and weigh other observations less heavily, corresponding to a reduction in sample size. We adopt the quantiles-via-moments estimation method of Machado and Santos Silva (2019), using their xtqreg command in Stata, as in Kiley (2021).

The results of the quantile regressions for equation (1) are shown in Table 3. We can see that for the median regression (50th percentile), the coefficient of inflation expectations is similar to that for the mean fixed effects panel regression shown in Table 1, at 1.15 compared with 1.17, and it is also significant at the 1% level. Figure 1 shows the results for the coefficients of inflation expectations for q/q inflation by percentile together with 90% confidence intervals. We can see that the coefficient of inflation expectations on q/q inflation is higher at larger percentiles, but not significantly so at the 10% level. For each of the percentiles, the coefficients on the other variables all remain significant and with the expected signs.

In order to study the effects of inflation expectations on inflation over a longer horizon, we also estimate these quantile regressions when using local projections based on Jordà (2005),

$$\pi_{it;h} = \theta\, \pi^{e}_{it} + \rho\, \pi_{it-1} + \phi\, outputgap_{it} + \mu\, \Delta NEER_{it} + \lambda\, \pi^{oil}_{t} + \alpha_i + \varepsilon_{it.} \qquad (4)$$

where $\pi_{it;h}$ denotes the seasonally adjusted annualised CPI inflation rate at time *t* over *h* quarters in country *i* at time *t*, calculated from the log-difference between the CPI index at time *t-1+h* and the CPI index at time *t-1*. Here, *h=1* corresponds to the q/q seasonally adjusted annualised inflation rate π_{it} used above, and *h=4* corresponds to year-on-year (y/y) inflation.

The results of the quantile regressions at the yearly horizon (*h=4*) for equation (4) are shown in Table 4. Also shown in column I of Table 4 for comparison are the results of the mean fixed effects panel regression for equation (4). We can see that for the median regression, the coefficient on inflation expectations is again similar to that for the mean fixed effects panel regression, at 0.75 compared with 0.76, and it is also significant at the 1% level.

Figure 2 shows the results for the coefficients of inflation expectations for y/y inflation by percentile together with 90% confidence intervals. We can see that the coefficients of inflation expectations are larger at higher percentiles of the inflation distribution. We find that at the yearly horizon, the coefficient of inflation expectations is significantly larger at the 10% level for the upper tail of the inflation distribution (the 90th percentile) than for the lower tail of the inflation distribution (the 10th percentile). Again, for each of the percentiles, the coefficients on the other variables all remain significant and with the expected signs. These results therefore also suggest that second-round effects via the effects of higher inflation expectations on inflation are more of a problem in a high-inflation environment.

4. Conclusions

We studied the effects of professionals' survey-based inflation expectations on inflation for 36 OECD economies, using dynamic cross-country panel estimation of New-Keynesian Phillips curves. We also studied how the effects of inflation expectations on inflation depend on the inflation environment.

We find that inflation expectations have a significant effect on inflation. We also find evidence that inflation expectations matter significantly more for inflation when inflation is higher. This suggests that second-round effects via the effects of higher inflation expectations on inflation are more relevant in a high-inflation environment.

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Tables

CPI inflation vs inflation expectations				**Table 1**
Dep. var: π_{it}				
	I		II	
π^{e}_{it}	1.1712***		1.1458***	
π_{it-1}	0.2409***		0.1872***	
$outputgap_{it}$	0.0497***		0.0394**	
$\Delta NEER_{it}$	-0.1145***		-0.1071***	
π^{oil}_{t}	0.0133***		-	
constant	-0.9188***		-1.0712***	
observations	2711		2711	
number of countries	36		36	
time fixed effects	no		yes	
R2 within	0.502		0.578	
R2 between	0.949		0.945	

Note: Fixed effects panel estimation; sample period: 2000Q1-2021Q1. ***/**/* denote statistical significance at 1/5/10% confidence level. Robust standard errors clustered at the country level.

CPI inflation vs inflation expectations: with interaction term				**Table 2**
Dep. var: π_{it}				
	I		II	
π^{e}_{it}	1.0275***		0.9992***	
π_{it-1}	0.2307***		0.1748***	
$outputgap_{it}$	0.0501***		0.0425***	
$\Delta NEER_{it}$	-0.1144***		-0.1077***	
$\pi^{e}_{it} * \pi_{it-2}$	0.0182***		0.0190***	
π^{oil}_{t}	0.0134***		-	
constant	-0.7030***		-0.8376***	
observations	2711		2711	
number of countries	36		36	
time fixed effects	no		yes	
R2 within	0.505		0.580	
R2 between	0.952		0.947	

Note: Fixed effects panel estimation; sample period: 2000Q1-2021Q1. ***/**/* denote statistical significance at 1/5/10% confidence level. Robust standard errors clustered at the country level.

CPI inflation (q/q) vs inflation expectations: quantile regressions					**Table 3**
Dep. var: π_{it}					
			quantile regressions		
	10th percentile	25th percentile	median	75th percentile	90th percentile
π^{e}_{it}	1.0252***	1.0851***	1.1471***	1.2102***	1.2836***
π_{it-1}	0.2247***	0.2330***	0.2417***	0.2505***	0.2607***
$outputgap_{it}$	0.0527**	0.0522***	0.0516***	0.0511***	0.0504*
$\Delta NEER_{it}$	-0.1439***	-0.1309***	-0.1175***	-0.1039***	-0.0880***
π^{oil}_{t}	0.0138***	0.0135***	0.0133***	0.0130***	0.0127***
constant	0.0138***	0.0135***	0.0133***	0.0130***	0.0127***
observations	2734	2734	2734	2734	2734
number of countries	36	36	36	36	36

Note: Fixed effects panel estimation; sample period: 2000Q1-2021Q1. ***/**/* denote statistical significance at 1/5/10% confidence level.

CPI inflation (y/y) vs inflation expectations						**Table 4**
Dep. var: $\pi_{it;4}$						
	mean regression		quantile regressions			
	I	10th percentile	25th percentile	median	75th percentile	90th percentile
π^{e}_{it}	0.7571***	0.5005***	0.6142***	0.7468***	0.8807***	1.0091***
π_{it-1}	0.1062***	0.0713**	0.0876***	0.1067***	0.1259***	0.1443***
$outputgap_{it}$	0.0839***	0.0874***	0.0866***	0.0857***	0.0848***	0.0839***
$\Delta NEER_{it}$	-0.0681***	-0.0514***	-0.0604***	-0.0709***	-0.0816***	-0.0917***
π^{oil}_{t}	0.0073***	0.0081***	0.0078***	0.0074***	0.0070***	0.0066***
constant	0.161					
observations	2711	2626	2626	2626	2626	2626
number of countries	36	36	36	36	36	36
R2 within	0.4217					
R2 between	0.8948					

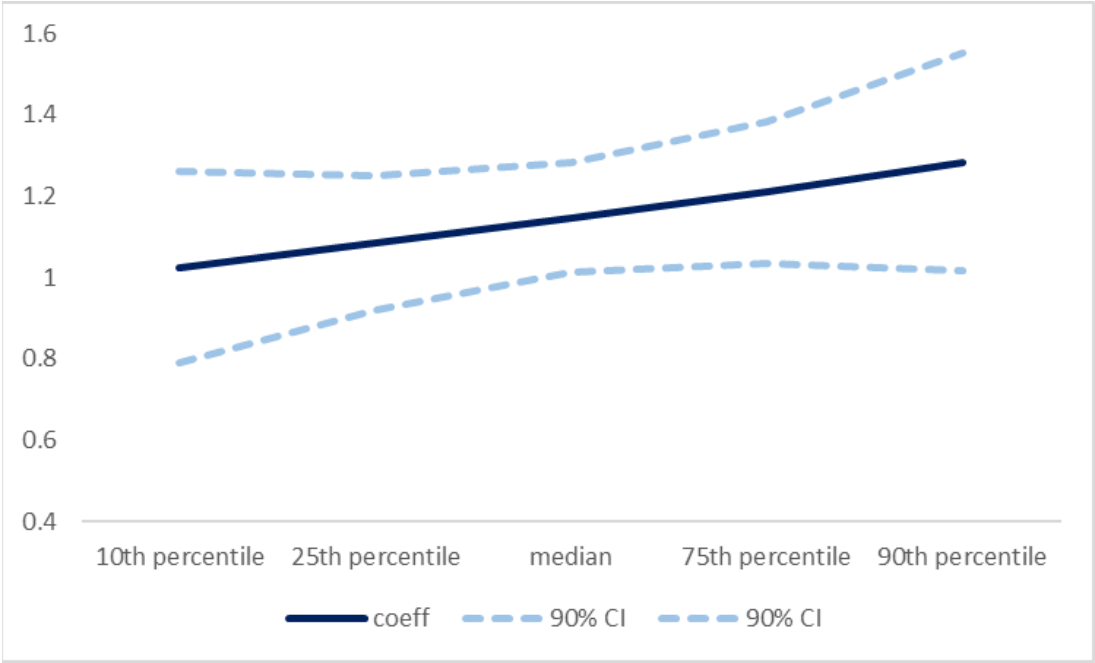
Note: Fixed effects panel estimation; sample period: 2000Q1-2021Q1. ***/**/* denote statistical significance at 1/5/10% confidence level.

Figures

Effects of inflation expectations on inflation (q/q) by percentile[1]

Responses of CPI inflation to 1 percentage point increase in inflation expectations, in per cent — Figure 1

CPI inflation (q/q)[2]

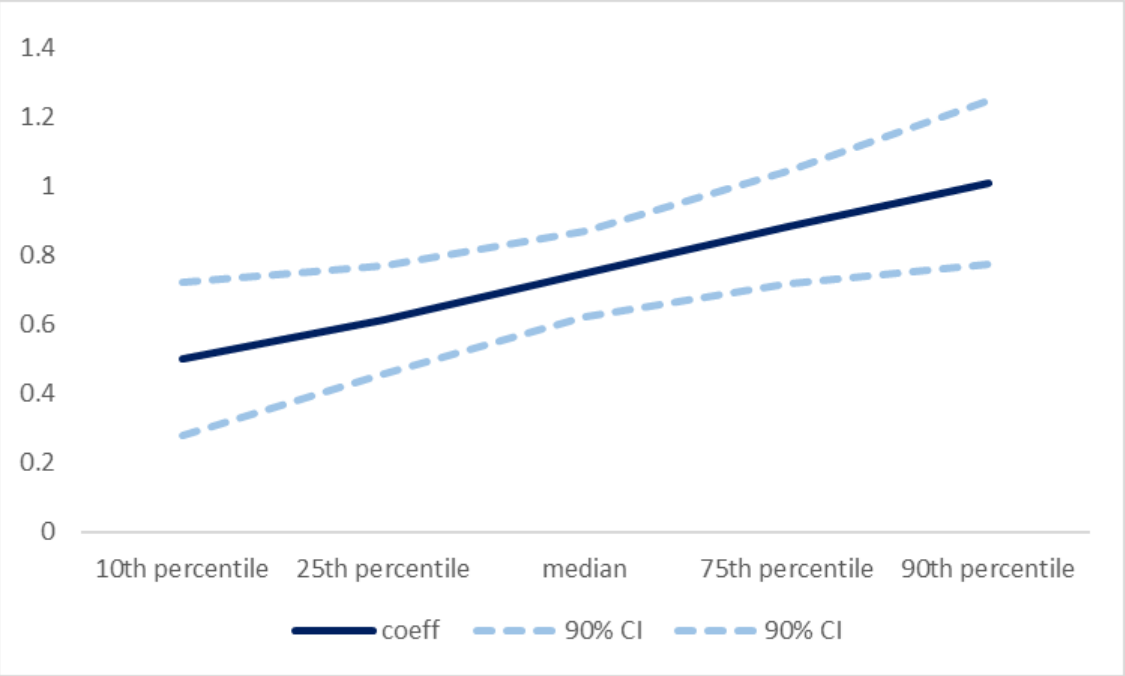


[1] Estimates using quantile regressions based on equation (1). [2] Effect on CPI inflation (q/q saar), with 90% confidence intervals.

Effects of inflation expectations on inflation (y/y) by percentile[1]

Responses of CPI inflation to 1 percentage point increase in inflation expectations, in per cent — Figure 2

CPI inflation (y/y)[2]



[1] Estimates using quantile regressions based on equation (4). [2] Effect on CPI inflation (y/y), with 90% confidence intervals.