Why did inflation rise and fall in 2021-24? Channels and evidence from expectations*

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Abstract

This article uses inflation expectations to investigate the mechanisms that linked supply and demand shocks to inflation outcomes during 2021-24. It describes several theoretical mechanisms through which shocks led to inflation, highlighting the role of expectations in this process. It uses multiple sources of expectations data for the US, EA, and UK to evaluate each of these channels. Finally, it surveys the literature that has used expectations data to make sense of the 2021-24 inflation surge. The article applies the results from this investigation to assess how well anchored inflation expectations were during the surge and at the end of it.

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1 Introduction

The increase in the US price level between the start of 2021 and the end of 2024 exceeded the Federal Reserve's inflation target by a full 10 percentage points. Why did this happen?

The conventional account. By August of 2024, a conventional account had emerged, expertly laid out by the Fed chairman in his annual Jackson Hole speech (Powell, 2024). It went as follows for the United States: at the start of 2021, consumers rushed to spend the pent-up savings from the pandemic, while government spending stimulated the economy. At the same time, workers only slowly returned to their jobs following lockdowns and firms struggled to find inputs since their supply relations had been disrupted. This meant that aggregate demand exceeded aggregate supply, so inflation rose.

Towards the end of 2021 and the start of 2022, two further shocks hit that added further momentum to the rise in prices. First, an increase in energy prices following Russia's invasion of Ukraine. Second, since different countries re-opened their borders at different times, there were bottlenecks in global supply chains leading to shortages of goods. Inflation accelerated as we entered 2022.

By the middle of 2022, a third and final shock came in the opposite direction, as the Fed started hiking rates. This contractionary monetary policy, working with a lag, together with the unwinding of the previous two shocks, made inflation come down quickly between mid-2022 and mid-2023. As monetary policy was quick to start cutting rates from mid-2023 onwards to prevent a recession, inflation only slowly and steadily fell reaching close to its target by the end of 2024.[1]

Accounts for EA and UK inflation are similar, albeit with a higher weight on the energy shocks in the second stage, and a lower weight on post-pandemic private and public consumption spending in the first stage (Lane, 2024, Tenreyro, 2023). Knowing what they know today, many policymakers state they would have tightened monetary policy earlier.[2] But such large shocks all pushing in the same direction were hard to anticipate or even to measure and to understand in real time.[3]

[1] Econometric support for this narrative is in Dao et al. (2024), Bernanke and Blanchard (2025), and Lipinska, Garcia and Schwartzman (2025).

[2] For instance, Lane (2024): "If policymakers had had perfect foresight about the shocks that were about to hit the economy, interest rates would have been raised earlier and more sharply."

[3] Lane (2024): "Two once-in-a-generation shocks of extreme virulence have hit the economy in a space of less than three years: first the pandemic, and its various aftershocks; and then the war in Ukraine, and its effect on energy and other commodity prices."

From shocks to mechanisms. This conventional account consists of *identifying shocks* behind the economic event. It comes naturally within an economic model, which will decompose the movements in an endogenous variable, like inflation, into the contribution of exogenous shocks, like the pandemic, fiscal expansion, or monetary surprises. It allows us to ask what the world would have looked like without these shocks.

But, from the perspective of policy, it is arguably more important to ask a different question: how would these same shocks have led to different outcomes if policy rules and institutions had been different? Policymakers can do little to prevent shocks. What they can do is consider different responses to these shocks and pick the best.

In turn, scientists want to use the 2021-24 data to figure out how economies work. That requires identifying the mechanisms through which any shock transmits into an observed outcome, rather than just this particular and likely not-to-be-seen-again combination of shocks. The answer to "why did this happen?" requires thinking through the mechanisms through which the shocks have their effects.

More pragmatically, both academics and policymakers should bring to public debates suggestions on how to prevent a similar inflation disaster from happening again. The conventional shock account offers none since, after all, we cannot prevent future shocks. Instead, if one figures out the mechanisms, one can suggest a combination of reforms and policy responses that are useful.

An illustration: the policy mechanism. A good example of the importance of looking at mechanisms, as opposed to shocks, comes from Giannone and Primiceri (2024)'s analysis of the 2021-24 inflation episode.

Take the conventional AD-AS framework from undergraduate textbooks. The AS is a positive relation between real activity and the price level that shifts in when there is an adverse supply shock. The supply shocks of 2021-22 would have led to either an increase in the price level for the same level of output, or lower output for the same price level, or some combination of the two. How much of each depends on the slope of the downward-sloping AD relation, which will determine the intersection point with the inwards-shifted AS.

A key determinant of the slope of this AD relation is how private agents perceive the conduct of monetary policy. In the two decades before the inflation surge, policy had credibly kept inflation almost always between 1% and 3% by quickly and decisively offsetting any shock, going as far as introducing new tools when inflation was persistently below the 2% target. Insofar as the agents setting wages and prices believed this would always be the case, they would have kept their wages and prices unchanged in response to shocks, changing quantities instead. The AD had become flat by 2020.

If this was still the case in 2021-22, then the sequence of adverse supply shocks would have led to a large recession and a modest rise in the price level. This is not what we saw. Instead, for the supply-shock account to be correct, the AD in 2021-22 must have been quite steep (or, almost indistinguishably, it must have shifted). Either monetary and fiscal policy changed relative to the previous decades, or people's expectations of them changed, or both. In the AD-AS world, supply shocks may have caused the inflation surge, but demand policies and expectations are what allowed them to happen.

A similar point applies with respect to fiscal shocks: Hazell and Hobler (2025) find that the US fiscal deficit *shock* of 2021 caused some of the rise in inflation through the *mechanism* of no reaction of policy rates to it, as shown by the *evidence* from expected inflation in market swap prices.

Therefore, the conventional account of listing the supply shocks as the causes of the inflation surge hides the more interesting and important question: why did policy behave differently, or/and why did people's expectations change so brusquely following these shocks?

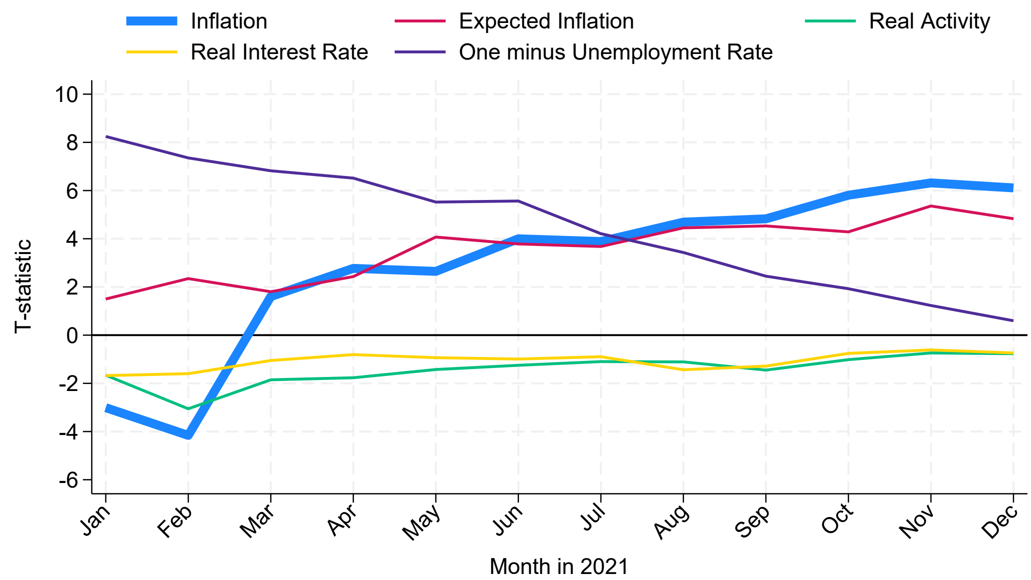
This paper will look at the evolution of the *data on inflation expectations* during this time to uncover some of the mechanisms from shocks to inflation. There are three reasons why these data are particularly informative.

The importance of expectations data: forecasting. The first is perhaps the shallowest, but also the most pressing: expectations data stood out in 2021. Across the four groups of indicators most used to forecast inflation—real activity, the labor market, financial markets, and expected inflation—it was expectations indicators that earlier and more decisively signaled that an inflation disaster was under way. Figure 1 shows this information value of expectations in a simple way, by plotting the difference between the value of an indicator in inflation in each of the twelve months of 2021 and its value in January of 2020, expressed in standardized units.[4]

By at least April of 2021, inflation was unusually higher. It became ever more so in the eight months that followed. And yet, the real activity and financial variables raised no alarm bells. The labor market variable was unusual at the start, but on the wrong side,

[4]If the changes in these variables were normally independently distributed over time, then each value in the figure would be a t-statistics to judge whether the observed evolution of the variable was unusual relative to the decade before.

Figure 1: Expectations were the leading indicator of the inflation surge



Note: The four indicators are: industrial production for real activity, one minus the unemployment rate for the labor market, the 10-year Treasury rate for financial markets, and the mean answer in the 1-year ahead Michigan survey for expected inflation. For indicator x at each date t this figure shows the variable $(x_t - x_{01\text{-}20})/\sigma(\Delta^t x)$ where $\Delta^t x$ is the difference between the monthly value of the variable and its value as-many-months earlier as the distance between t and January of 2020, and $\sigma(.)$ is the sample standard deviation of these changes between January of 2010 and December of 2019. For industrial production, the only variable of the five that has a clear trend, I also subtract the sample average of $\Delta^t x$ in the numerator.

since a loose labor market usually indicates low inflation. Moreover, this variable went back to normal as the year went by.

Expected inflation was the one indicator pointing to the disaster right from the start. Its performance is even better than what the figure shows. Actual inflation is only available with a one-month delay, and is successively revised one and two months later, while expected inflation is released at the end of each month. The coincidence between the two variables in the figure reflects expected inflation being a leading indicator of actual inflation by 1-3 months during this unusual year.[5]

The importance of expectations data: theory and policy. The second reason to look at expectations data is grounded in economic theory.

Modern macroeconomics emphasizes intertemporal tradeoffs and decisions, so there

[5]Section 3 more thoroughly discusses the forecasting power of expected inflation.

are few relevant economic mechanisms that do not involve expectations of the future. For instance, if people expect high inflation in the near future, they do not want to hold nominal assets that will quickly lose their value. Whether they do so by exchanging them for real assets or by spending them on goods, the result is an increase in inflation. There are few (if any) accounts of how demand or supply shocks raise inflation that does not involve describing what happened to expectations.

Moreover, inflation, at its heart, is the change in the real value of the liabilities of the central bank. An integral part of monetary policy is about shaping how private agents expect this real value to change (Castillo-Martinez and Reis, 2026). In the extreme case of hyperinflation, both theory and history have shown that people expecting ever-increasing inflation becomes the main driver of inflation, and that only credible reforms to fiscal and monetary policies that bring those expectations under control can bring down inflation. In more normal times, keeping inflation expectations anchored is part of what keeps the impact of shocks on inflation temporary (Powell, 2024). One evaluation of the performance of monetary policy during 2021-24 is to measure to what extent it kept expectations anchored.

The importance of expectations data: research advances. The third reason to look at expectations is that their scientific study has gone through an empirical revolution in the last 20 years (Reis, 2024, Gorodnichenko, 2025).

Researchers have started jointly exploiting the information in the cross-sectional and time-series variability in the survey data, as well as the high frequency and microstructure of financial prices in the market data. The available data has multiplied, as new surveys were conducted and granular regulatory data on financial holdings were made available. Causal inference has made strides, by using randomized control strategies, cross-regional variability in monetary unions, impulse responses to identified shocks, and high-frequency event studies. This trove of research guides us in what to look for in the data to figure out the mechanisms of inflation dynamics during this period.

What this paper will do. Each section in this paper uses a different type of expectations data for the US, EA, and UK to clarify the mechanisms and the role of policy in the inflation surge of 2021-24. While there is a growing literature on what was behind the inflation surge, the paper only discusses the papers that looked at inflation expectations. I will also not cover the many papers trying to measure supply shocks and how they spread, since the focus is on the mechanisms from shocks to outcomes, and how they work through expectations.

In each of the sections, I start by sketching the theory behind the mechanisms. I then present some original empirical work, which is inspired by the literature that looked directly at particular features of inflation expectations during this period. After presenting the main findings using some simple statistics, I survey the papers that have established the facts more thoroughly. I find that the expectations data indeed speak quite decisively about which mechanisms transmitted the shocks to inflation. I conclude each section by asking whether inflation expectations were anchored during 2021-24, and whether they are anchored now. Unsurprisingly, that answer is invariably: "it depends", but what it depends on is useful.

Section 2 starts with inflation expectations for long horizons provided by financial markets. These are particularly useful to test Fisherian (or monetarist) mechanisms that emphasize the credibility of the central bank's inflation target. Surveys of professionals working in financial institutions complement them. Section 3 turns to survey data from households and firms at 1-year horizons, with which to test Phillips curve channels that rely on the pricing behavior of workers and firms. Section 4 then uses the expectations from institutional forecasts to look for the extent to which the inflation surge was fiscally-driven. Finally, section 5 uses the expectations of policymakers to reveal their preferences and justify their actions. Section 6 concludes by collecting the facts and stating te answers to the question of whether inflation expectations were and are anchored.[6]

2 Market expectations

Banks have the privilege of holding deposits at the central bank. Those deposits define the unit of account in a digital economy. Since inflation is then the loss in the real value of those deposits, when banks expect higher inflation they are expecting a lower return on those deposits. Banks form these expectations within financial markets, partly by looking at market prices and partly by listening to financial professionals that forecast the future. This section starts our investigation by looking at these data and linking it to crucial mechanisms through which shocks transmit to outcomes.

[6] A related literature asked whether inflation expectations were anchored after large changes in monetary policy (Kumar et al., 2015, Bonomo et al., 2024) and during the 1970s inflation disaster (Reis, 2021).

2.1 Theory: monetarist/Fisherian mechanisms

When banks choose to hold deposits at the central bank, they compare the nominal return that they get on this digital money to the alternatives real investments from lending or investing in the economy. These alternative earn the real interest rate r_t plus the expectation of inflation during the 1-period duration of this investment π_{t+1}. This expectation, $\mathbb{E}_t^m(.)$, is formed in markets, and it is "risk-neutral", in the sense that it incorporates both the actual value of inflation as well as the risk associated with the uncertainty around the expectation.

At the same time, the behavior of the central bank in setting or steering nominal interest rates is approximately equal to their estimate of that real rate $\hat{r}_t$ plus their inflation target π^*. If $\hat{r}_t = r_t$ at all times, then inflation will always be on target. Away from this situation, if inflation is above target, then the central bank tightens policy by raising nominal rates by an amount $\phi > 1$.

Combining the banks' and the central bank's behavior—or, as they are sometimes called, the Fisher and Taylor equations—gives the equations pinning down inflation:

$$r_t + \mathbb{E}_t^m(\pi_{t+1}) = \hat{r}_t + \pi^* + \phi(\pi_t - \pi^*)\,. \tag{1}$$

The economic mechanism behind this equation is that, when banks expect higher inflation (left-hand side), their withdrawal of deposits for the central banks, lowers the real value of these deposits. Since that value is, by definition, what inflation is, this raises actual inflation (right-hand side). In turn, a shock to the real economy that raises the real interest rate on the left-hand side raises inflation on the right-hand side but, depending on whether expected inflation rises by more or less, this increase in inflation may be lower or higher. Likewise, the impact of policy shocks to $\hat{r}_t$ on inflation depend on how expected inflation responds,

Writing the difference equation in its equivalent integral form:

$$\pi_t = \pi^* + \sum_{j=0}^{T} \phi^{-(j+1)} \bar{\mathbb{E}}_{t,t+j-1}^m \left(r_{t+j} - \hat{r}_{t+j}\right) + \phi^{-T} \bar{\mathbb{E}}_{t,T-1}^m (\pi_{t+T} - \pi^*)\,, \tag{2}$$

where $\bar{\mathbb{E}}_{t,t+j-1}^m = \mathbb{E}_t^m[\mathbb{E}_{t+1}^m[...\,\mathbb{E}_{t+j-1}^m(.)]]$, reveals that inflation depends on the three additive determinants on the right-hand side. The first is the inflation target. The second is misjudgments about the state of the economy that justify why central banks are constantly trying to figure out the neutral, or starred, interest rate.

The third term has expected inflation. It captures the credibility of monetary policy. If the markets expect inflation to be persistently above the announced target in the future, then they will be unwilling to hold nominal assets, which pushes up inflation to be above target in the present. This simple theory, which is present in virtually all DSGE models with nominal interest rates, makes crystal clear that market expectations are the relevant ones for this Fisherian-monetarist theoretical channel. More precisely, it is the expectations: (i) of the marginal market participant, (ii) in risk-neutral space so including distributions of risk and (iii) at a long horizon.

Beyond their direct relevance, market inflation expectations have two further virtues. First, market participants can distinguish between a 3-year, a 5-year and a 10-year horizon. Second, these professionals put serious effort into considering the probabilities of remote events. There is no convincing sign that households or firms answering surveys are able or willing to do either of these.

2.2 The raw data: swaps and indexed bonds

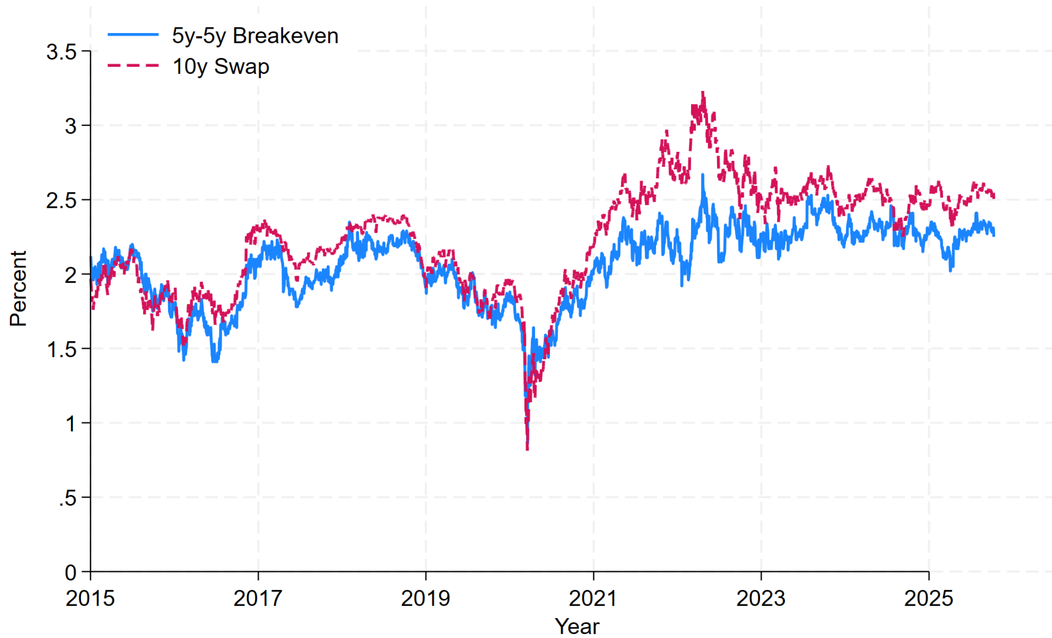
There are two main market prices from which to extract a measure of expected inflation at long horizons. The first are the yields on government bonds that have returns indexed to realized inflation. These bonds are TIPS in the US and linkers in the UK, both of which have large and liquid markets, with prices that go back for a few decades. Subtracting the yields of these inflation-indexed bond from the yields on nominal government bonds of the same maturity gives a measure of risk-neutral expected inflation at the desired horizon. This is sometimes called the breakeven rate.

The second market price is on an inflation swap contract sold by a dealer to one of their clients. The swap pays the realized inflation rate to its holder during the duration of the contract, who in turn pays a fixed amount at a pre-agreed rate. This pre-agreed rate is then a direct measure of expected inflation. Because no cash flows are exchanged when the contract is originated, and payments are made daily to maintain the contract with zero net present value, this is an attractive alternative to holding bonds.

Figure 2 shows US expected inflation using both indexed bonds and swap prices. It further shows those expectations at two long-run horizons. The first is 10 years (10y). The second is 5-year-5-year (5y5y) expected inflation, that is starting 5 years from now, on average over the succeeding years. This is equal to the 10-year measure minus the 5-year measure. It further focuses on the long run, by taking out the earlier years.

Staring at the data leads to two tentative conclusions. First, since both indicators rose

Figure 2: Market expected US inflation from swaps (10-year) and indexed bonds (5y5y)



Notes: The sample goes from the 1st of January 2015 to the 10th of October 2025 at a daily frequency. Data from Bloomberg (USSWIT10) and FRED (T5YIFR).

in 2021 and stayed above what they were in 2015-19 after that, then the Fisherian mechanism suggests that a loss of credibility contributed to a persistent rise in inflation. At the same time, note that this would have contributed to less than 1 percentage point of the increase.

Second, the 10y expected inflation was always above the 5y5y during the inflation surge, consistent with equation (2) and $\phi > 1$. The large gap that emerged between the 10y and the 5y5y, and the way it partially closed once inflation started falling, suggests that the inflation surge was perceived as being temporary.

2.3 The filtered data: dealing with liquidity

Both measures in figure 2 move by more at higher frequencies than what seems credible as a measure of expected inflation. Even outside of this episode, the 5y5y measure regularly moves by 10bp from month to month. It is unlikely that in most months there are enough changes in the credibility of the 2% inflation target of the central bank. Rather, perhaps the price of inflation swaps often moves because of changes in the ability of investors to buy the swaps and take on risk or in the size of the balance sheet of the dealers and their ability to sell them. A catch-all term for these movements in market expected inflation that do not match changes in expected inflation of market participants is liquidity frictions.

Figure 3 shows a measure of 10y UK expected inflation cleaned from these liquidity frictions.[7] The figure highlights five major events during the sample: two monetary in blue and three others in grey.

The first of these is the pandemic lockdown in March of 2020. This came with a sharp and persistent fall in expected inflation. By early 2021 though, markets expected long-run inflation to be back on track. As inflation accelerated, they revised their views upwards, and long-run expected inflation rose steadily and significantly. By November of 2021, inflation expectations were 40-50bps above what they were in 2019.

The next event is the Bank of England raising interest rates by 15bp in December of 2021. This had an immediate impact on the credibility of the inflation target, with expectations falling by 15-25bps.

Russia's invasion of Ukraine—the third event—coincided with expected inflation shooting up again, exceeding its 2019 values by more than 75bps by February of 2022.

As the Bank of England raised rates throughout 2022, expected inflation came down, going below 3.5% just as the Bank strongly asserted its commitment to the inflation target with a 50bp hike in August, followed by another 50 in September and 75bp in December. This is our fourth event.

The final event occurred between 5 September and 24 October of 2022. This was the premiership of Liz Truss, where threats to the independence of the Bank of England, announcements of large public deficits, and a short-lived financial crisis came with great volatility of expected inflation. By the start of 2023, UK expected inflation was back at the levels of 2019.

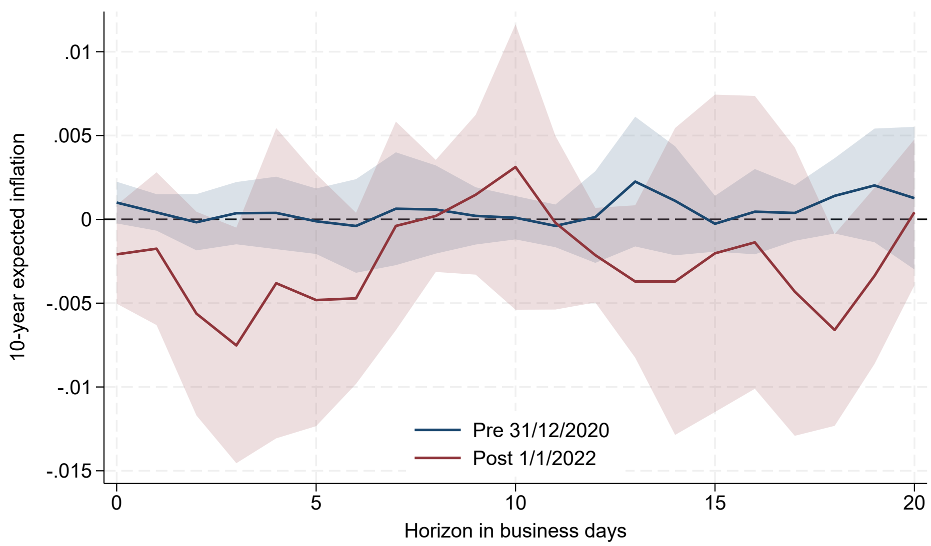
According to this series and description of events, long-run expected inflation moved around with shocks during this time. In turn, so did actual inflation. This is suggestive evidence that the theoretical mechanism described in this section was present. Monetary policy was unable to fully anchor long-run expectations, and market forces amplified the impact of shocks on inflation.

[7] To make sense of the values in the vertical axis, note that inflation swaps in the UK are written against the retail price index, as opposed to the consumer price index that is the reference to the 2% inflation target. In the two decades between 1999 and 2018, the average difference between the two was 0.8pp. Furthermore, recall that this expected inflation measure includes an inflation risk premium. Therefore, while the values around 3.5% in 2019 in the figure are above the inflation target, they are not so by much.

Figure 3: Market expected UK inflation 10-years ahead against events and shocks

(a) Value cleaned from liquidity frictions

(b) Responsiveness to 1-year expected inflation news around CPI release dates



Note: The top figure shows the Bahaj et al. (2025) series for 10-year expected inflation from UK swaps cleaned of liquidity frictions. The two monetary policy events, in blue, are the start of hiking in policy rates, and the move to 50bps hikes. The three other events, in grey, are the pandemic lockdown, Russia's invasion of Ukraine, and the period from Liz Truss's mini-budget to the end of her premiership. The bottom figure shows local projections of the series in the top figure on the change in the principal component of 1, 2 and 3-year inflation swap prices in a narrow window around monthly RPI data releases built by Ding (2025).

The bottom figure inspects the reverse direction of causality. It shows the impulse response of the series for expected inflation in the top figure following an inflation shock. The inflation shock is a movement in short-horizon inflation swap prices in narrow windows around the monthly release of inflation data. The figure shows estimates of this response in the period before inflation took off, and in the period after it reached its height. According to the estimates, following a shock that moves inflation in the present, and so expected inflation in the coming months, the long-run expected inflation does not move in either a quantitative or statistically significant way. This suggests that the movements in long-run expected inflation were not simply driven by an overreaction to changes in inflation.

2.4 Beyond averages: option contracts and tail risk

At a 5y5y horizon, it is plausible that the median expected forecast of financial market participants is the inflation target of the central bank. Perhaps what moves the average expectation reflected in figure 2 are either the probability that this inflation target is abandoned or the probability of another inflation (or deflation) disaster. One would like to have data on the tails of the perceived stationary distribution of inflation outcomes.

These data exist in the form of options over the inflation swap contracts. These options pay their holders only if inflation is above or below a certain value, and proportionally more the further inflation is from the threshold. The prices of these options can be converted into the implied probabilities for inflation at different thresholds. Table 1 uses these prices to assess the extent of the inflation disaster and its scars for the future.

The top panel in the table starts by showing inflation in the US and the EA in the 5-year period between December of 2019 and December of 2024. This appends the pandemic year of low inflation to the four years of the inflation surge. Still, average annual inflation was 4.2% in the US, and 3.8% in the EA, well above the 2% inflation target. Using option prices on 5-year inflation, the table then shows the probability that inflation would have been this high or higher according to the price of options traded in December of 2019. It presents both the market risk-neutral probability, as well as an adjusted probability that tries to take out the contribution of risk to the market price. These probabilities were exceedingly small: between 0.3 and 0.9%. The markets did not see the inflation disaster coming.

The bottom panel instead looks at the 5y5y horizon and shows the probability that we will have a similar inflation disaster in the future, understood as inflation being on

Table 1: Tail probabilities for US and EA inflation from option prices

	United States	Euro Area
How extraordinary was the 2020-2024 inflation?		
Actual realized inflation (in %)	4.19	3.80
Q-Probability in Dec 2019 (in %)	0.46	0.93
P-Probability in Dec 2019 (in %)	0.31	0.61
Probability of 5y5y inflation above 4% *(in* %*)*		
December 2019	0.95	1.40
December 2020	2.14	1.14
December 2021	5.14	0.83
December 2022	3.29	4.71
December 2023	4.83	5.85
December 2024	3.72	2.50

Note: The first panel shows realized inflation between December 19 and December 24, together with the December 2019 probability that inflation would have been this value or higher. Q-probabilities are the risk-neutral probabilities directly revealed by market prices, while P-probabilities are adjusted to take out the effect of risk over what inflation will be. The second panel shows the annual evolution of the 5y5y probability that inflation will on average be higher than 4%. Data from https://r2rsquaredlse.github.io/web-inflationdisasters/.

average 4% or higher during 5 years. In 2019, these probabilities were 1.0 and 1.4% for the US and the EA, respectively. By the end of 2024, they had climbed up to 3.7 and 2.5%, respectively. Participants in financial markets are willing to spend money today to buy insurance against a similar inflation surge occurring again in 2030-35.

To conclude, the inflation disaster was a complete surprise that has left behind scars.

2.5 Beyond averages: disagreement among market participants

A market price reveals the beliefs of the marginal trader, who is just indifferent between buying or selling the security at that price. Who this person is can change over time in a world where people disagree and their willingness to participate in these markets changes. If the distribution of the expectations across market participants is tightly concentrated around the inflation target, then the market expected inflation will not change by much as a result. Examining the spread of this distribution provides a fuller picture of whether inflation expectations are anchored and whether they amplified and propagated the shocks to inflation.

These are surveys of professional forecasters, which are usually dominated by employees of financial institutions. While they are rarely the ones making the final investment decisions, they are an input shaping the beliefs of those who do. Using the Philadelphia Fed's and the ECB's respective surveys, table 2 shows the estimates of the following regression:

$$\mathbb{E}_{i,t}(\bar{\pi}_T) - \mathbb{E}_{i,t-h}(\bar{\pi}_{T-h}) = \beta(\pi_t - \mathbb{E}_{i,t-h}(\pi_t)) + \phi_i + \eta_t + \chi_h + error_{i,t,h}\,. \quad (3)$$

Forecasters are indexed by i, quarters by t, and the horizon of updating of the forecast by h. On the left-hand side is the change in the long-run expectations of inflation between this survey wave and the one h quarters ago. On the right-hand side is the forecast error in short-horizon inflation that this forecaster made between back then and now. If long-run expectations were fully anchored, then $\beta = 0$: unexpected inflation over a few quarters should lead to no change in the forecast of inflation in the long-run. If instead $\beta > 0$, unexpectedly high inflation leads forecasters to revise upwards their long-run forecasts.

The US SPF asks every quarter t for respondents to provide their expected inflation 10-years ahead, so $T = 36$, as well as 1, 2, 3, and 4 quarters ahead, so $h = 1, 2, 3, 4$. Table 2 shows the results of estimating this regression, where the first column has the baseline specification, while columns 2-4 remove each of the fixed effects to isolate the impact that the variation across horizons, time, and forecaster in pinning down the estimates. In the sample before the inflation surge, between 1992 and 2019, the estimates are between 0.012 and 0.019. These are statistically significantly different from zero, but quantitatively small.

The bottom panel in the table has the same estimates using the post 2022 data. They are 2.8–4.7 times larger. Arguably, they are still small: a 1 percentage point forecast error in inflation leads to a revision of long-run expected inflation by 6bp at most. But, the scars from the disaster are visible.

Table 3 repeats the exercise for the EA. Now, $T = 16$ or 20, depending on whether the survey was taken in Q1–Q2 or Q3–Q4. The horizons are limited by asking only for inflation at the end of the year and two years ahead. Subject to being more imprecisely estimated, the estimates are not so different for the EA from what they were for the US in

Table 2: The sensitivity of US long-run inflation expectations to inflation surprises

	(1)	(2)	(3)	(4)
Sample	1992Q2-2019Q4	1992Q2-2019Q4	1992Q2-2019Q4	1992Q2-2019Q4
Forecast error	0.0126***	0.0125***	0.0118***	0.0189***
	(0.0016)	(0.0016)	(0.0016)	(0.0019)
Observations	11,528	11,528	11,539	11,539
R-squared	0.104	0.102	0.081	0.014
Sample	2022Q1-2025Q3	2022Q1-2025Q3	2022Q1-2025Q3	2022Q1-2025Q3
Forecast error	0.0593***	0.0549***	0.0367***	0.0528***
	(0.0056)	(0.0055)	(0.0047)	(0.0044)
Observations	1,314	1,314	1,316	1,316
R-squared	0.376	0.370	0.323	0.143
Quarter FE	✓	✓	✓	-
Forecaster FE	✓	✓	-	-
Horizon FE	✓	-	-	-

Note: Letting $\pi_{t,t+j}$ be annual inflation between quarter t and $t+h$, and $\mathbb{E}_{i,t}$ be the forecast made by person i in quarter t, then each column reports the estimates of a panel regression where on the left-hand side is the change in the long-run forecast between h quarters ago and this quarter by responder i: $\mathbb{E}_{i,t}(\pi_{t+36,t+40}) - \mathbb{E}_{i,t-h}(\pi_{t+36-h,t+40-h})$ and on the right-hand side is her/his forecast error for inflation this quarter given her forecast h quarters ago: $\pi_t - \mathbb{E}_{i,t-h}(\pi_t)$. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

the pre-disaster era. After 2022, they rise by even more than they did in the US. The scars on unanchoring are more visible.

2.6 The literature on market expectations during the inflation surge

Bahaj et al. (2025) found that market expected inflation tended to overreact to the shocks that drove UK expected inflation as on the top panel of figure 3. Using US data, Cieslak, McMahon and Pang (2024) found that market term premia became more sensitive to inflation shocks in the 2020-23 period, while Kroner (2025) found that all asset prices become more sensitive to inflation news in 2021-23. Consistent with the results in the bottom panel of figure 3, Bundick, Smith and der Meer (2025) found that, during this period,

Table 3: The sensitivity of EA long-run inflation expectations to inflation surprises

	(1)	(2)	(3)	(4)
Sample	1999Q4-2019Q4	1999Q4-2019Q4	1999Q4-2019Q4	1999Q4-2019Q4
Forecast error	-0.0192	-0.0192	0.00626	0.0168
	(0.0232)	(0.0232)	(0.0226)	(0.0104)
Observations	1,213	1,213	1,218	1,218
R-squared	0.182	0.182	0.041	0.005
Sample	2022Q1-2025Q3	2022Q1-2025Q3	2022Q1-2025Q3	2022Q1-2025Q3
Forecast error	0.0912**	0.0912**	0.1080***	0.0457***
	(0.0366)	(0.0366)	(0.0313)	(0.0072)
Observations	227	227	238	238
R-squared	0.397	0.397	0.183	0.141
Quarter FE	✓	✓	✓	-
Forecaster FE	✓	✓	-	-
Horizon FE	✓	-	-	-

Note: Same as table 2, but where the long-run is 5 years ahead.

US expected inflation did not become more responsive to inflation shocks.

Blanco, Ottonello and Ranošová (2025) studied surveys of professional forecasters in many episodes of inflation surges across decades and countries and found these disasters always come as large surprises, just as it was for 2021-24 in the top of table 1. Hilscher, Raviv and Reis (2025) examined the market for inflation options, and developed methods to convert the prices into probabilities. They found that even as recently as the end of 2025, the market expected probability that inflation would be above 4% on average in 2031-35 was four times higher than before 2021, as in the bottom panel of table 1.

The theory showed that inflation expectations matter more for inflation outcomes the smaller is the parameter ϕ, which measures the responsiveness of policy rates to inflation deviations from target. Bocola et al. (2024) measure the association between unexpected changes in nominal interest rates and unexpected changes in inflation, by using the changes in the prices of futures markets on nominal and inflation-indexed government bonds. They find that this relation became significantly weaker in 2020-22 relative to what it was in 2017-19. This is a sign that ϕ fell, which would strengthen the impact of the changes in long-run inflation expectations on inflation outcomes today.

Bauer, Pflueger and Sunderam (2024) use expectations from a US survey of professional forecasters across different variables and different horizons to estimate ϕ. They find estimates very close to zero during 2021, which then sharply rose after March 2022, when the Fed started raising rates. The estimates stabilized at a higher level in 2023. A similar pattern holds in EA data. On the positive side, these findings suggest that raising policy rates may be more powerful in curbing inflation because it also shifts expectations that policy will be tighter, attenuating future shocks. On the negative side, it suggests that the perception that monetary policy would not respond to inflation may have played a role in unanchoring expectations.

In their broad discussion of the U.S. inflation surge, Hajdini et al. (2025) discuss inflation expectations. Their reading of the evidence, including some shown in this section, led them to conclude that long-run market expectations stayed anchored throughout. Instead, I conclude that long-run expectations may unanchored slightly during the inflation disaster, and are nowadays less anchored than before. They also looked at short-term inflation expectations of firms and households, as I will do next, with conclusions similar to the ones below.

2.7 Were long-run market expectations well anchored?

It depends. Looking back, across estimates, expectations were well anchored before 2020. In 2021, long-run market expectations drifted a little in response to the shocks and amplified their impact on inflation outcomes. This was not a result of the short-run movements in inflation or in short-run expected inflation. Quantitatively, the unanchoring was less than one percentage point, and long-run market expectations by 2025 are close to their levels before the inflation surge.

Looking ahead, there are scars from the disaster in expectations, in both the higher willingness to pay for insurance against another disaster, and in the higher sensitivity of expectations to shocks. The anchor is back in place, but not as solidly grounded as it was before.

3 Household and firm expectations

Workers negotiate wages with their employers, while firms set prices taking into account their customers' willingness to pay. If they expect higher inflation, they will raise wages and prices, which in turn causes inflation. Through this mechanism, a shock that raises inflation will persist through second-round effects on wages and prices. This section looks at data on expected inflation from the households who supply labor and manage firms to investigate this Keynesian nominal-rigidities mechanism driving inflation.

3.1 Theory: the Keynesian / nominal rigidities mechanism

The organizing principle of most theories of nominal rigidities is a Phillips curve relation. It shows how fluctuations in nominal prices will be systematically related to fluctuations in quantities. If workers and/or firms make plans for wages and/or prices in nominal units, and are willing to supply more or less labor and/or goods when inflation is higher—because it lowers the relative prices of what they supply—then monetary policy, by affecting inflation, is not neutral with respect to real quantities.

Regardless of how these nominal rigidities are modeled—whether it is incomplete contracts, risk sharing, limited attention, slow diffusion of information, fixed menu prices, or another of the many alternatives the literature has provided—once linearized and simplified, most of these models lead to the relation:

$$\pi = \mathbb{E}^h(\pi) - \kappa(u - u^*) + s\,. \tag{4}$$

The variable u stands for unemployment while u^* is its level when the nominal rigidities are not binding. The coefficient κ is the slope of the Phillips curve. The variable s is typically referred to as a supply shock, since it stands for shocks to marginal costs or markups that introduce a wedge between the prices and wages set and those that would hold without rigidities.

The expectations operator $\mathbb{E}^h(\pi)$ refers to an aggregator of the expectations of the firms choosing the consumer prices, as well as of the firms selling intermediate inputs, and of the workers providing labor. Financial markets are one of these inputs, since funding is needed for production, but they are far from being especially relevant. Rather, more central are the expectations of the households who work for firms and who run them. While larger firms get a larger weight because they sell more output, smaller firms have more intense nominal rigidities (they pay less attention or adjust prices less often). It is the combination of size and extent of pricing frictions that determines the weights in the aggregator behind this expectation.[8]

Different models of nominal rigidities will have different timings for when these expectations are formed and on the precise horizon of inflation: in some models this is the expectation today of inflation in the next period, in others it is the expectation in the previous period of inflation today, but there are variants for all tastes. Common between them is that this aggregator of expectations is dominated by the short horizons.[9]

To conclude, it is household short-horizon expectations, say one year ahead, that are relevant for this channel.[10]

3.2 The raw data: household expectations

In some models, like the elegant model of Calvo (1983), the aggregator of beliefs of different workers and firms in $\mathbb{E}^h(\pi)$ is the simple arithmetic average expectation. In others, like the original model of Taylor (1980), it was a particular weighted average. In each model of nominal rigidities, the aggregator will be different. Unless an empirical researcher is willing to commit to one particular model, then it is wiser to try to capture the distribution of beliefs, for instance through some of its key moments.

Figure 4 shows the average and standard deviation of the survey answers on 1-year expected inflation from the Michigan survey. The moments are calculated over the residualized answers that take out the influence of age, gender, education, and income, so that the distribution of answers is purged from changes in the composition of the sample across these observables that are well known to affect expectations.

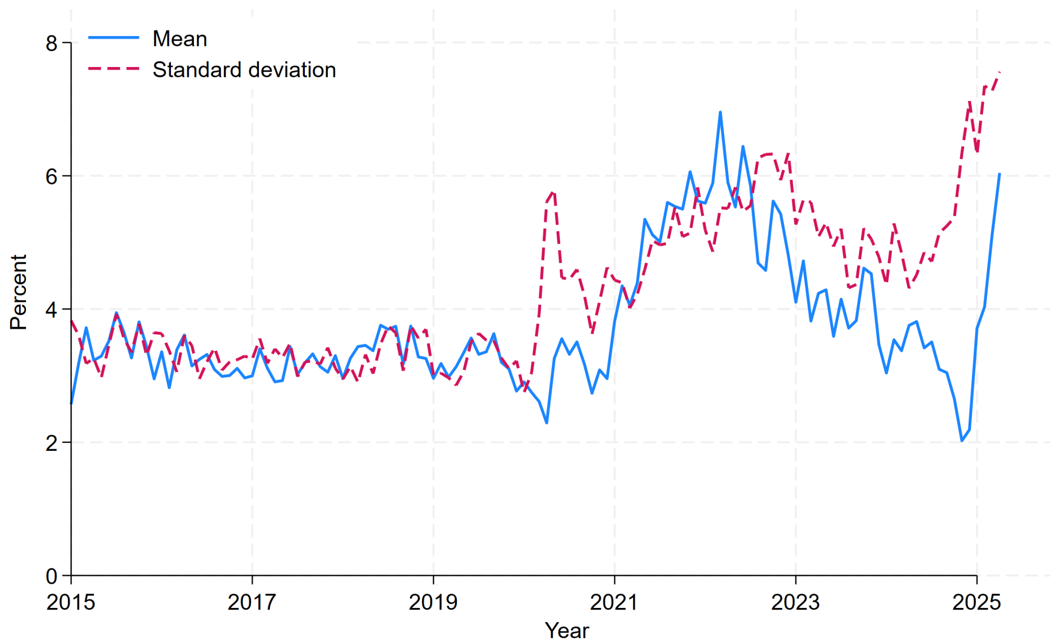
Noticeably, it was not just average expected inflation that rose in 2021. The disagreement between households also rose. Moreover, disagreement has stayed high since then,

[8] It is an unfortunate mistake to equate the $\mathbb{E}^h(.)$ with final goods' firms expectations or with only larger firms, as opposed to, say, the large mass of uninformed workers. This makes the mistake of looking at the Phillips curve as a pricing condition for firms, when in fact it is an equilibrium relation that results from aggregating the expectations of every agent in the economy involved in production (Reis, 2023*b*).

[9] See Werning (2022).

[10] A very long literature has asked whether these public expectations are rational and how alternative behavioral models make different predictions for inflation dynamics; for a recent survey, see Binder and Ryngaert (2024). The data from 2021-24 further rejects rationality and allows for sharper testing of different theories of expectations. Given the goals of this article—to explain what happened to inflation using data on expectations, as opposed to explaining expectations— the analysis below does not discuss this literature.

Figure 4: One-year ahead household expected inflation in the US



Notes: The figure shows the first and second moments of the distribution of household expected inflation, taken from the Michigan survey, and residualized to take into account fixed household characteristics. Data from https://r2rsquaredlse.github.io/web-disagreement/ (Fofana, Patzelt and Reis, 2024).

even as the mean went down.[11]

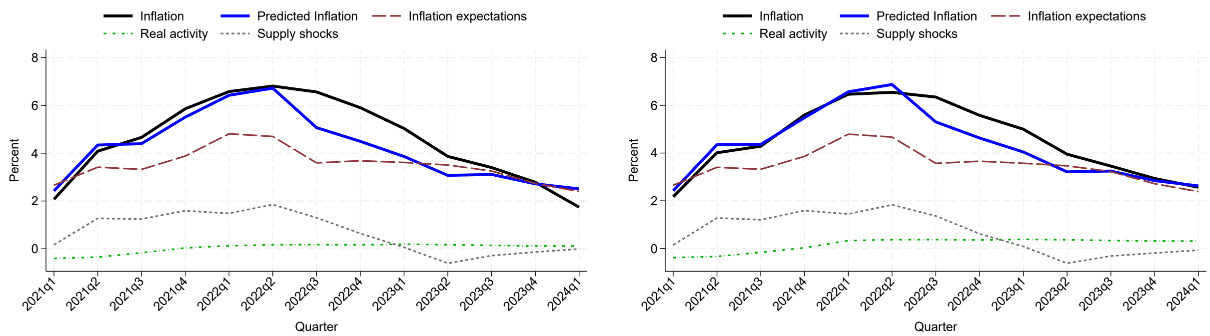
3.3 Using expected inflation to forecast inflation

The Phillips curve has had a bad reputation as an empirical relation since at least the 1970s. During that decade, inflation and unemployment both rose for many years, seemingly breaking down the predicted negative relation between them first noted by Phillips (1958) for the UK and by Samuelson and Solow (1960) for the US. Researchers have since noted that once one takes into account the expectations and supply shocks term then one could discern again the downward sloping relation (Blanchard, 2016). In this section, I focus on this empirical side of Phillips curve applied to the 2021-24 period.

[11] Disagreement is not uncertainty: the correlation between the standard deviation series and the value of the VIX—a measure of uncertainty from options on the S&P 500 index of stock prices—is a mere 0.34 in the data since 1990.

Figure 5: Forecasting inflation in 2021–24 using a model estimated before the pandemic

(a) Current revised data **(b)** Real time vintage data



Notes: Actual and predicted inflation from regression equation 5, where π^e is the mean of residualised expected inflation answers to the Michigan survey, d^e is the standard deviations of these answers, $\hat{u}$ is unemployment rate minus the natural rate, and s is the PCE energy inflation index. The prediction is decomposed into the predicted value from just considering each of the three predictor variables, so the three components add up to the predicted series. Estimation period is 1984Q1-2020Q1 while forecasting evaluation period is 2021Q1-2025Q2. The left plot uses current data, while the right plot uses real-time data vintages.

Consider the augmented US Phillips curve:

$$\underbrace{\pi_t}_{\text{Inflation}} = \beta_0 + \underbrace{\beta_1 \pi_t^e + \beta_2 d_t^e}_{\text{Expectations}} + \underbrace{\beta_3 (u_t - u_t^n)}_{\text{Labor Market}} + \underbrace{\beta_4 s_t}_{\text{Supply Shocks}} + \varepsilon_t \,. \tag{5}$$

On the left-hand side is inflation. On the right-hand side are measures of the three drivers according to theory. For inflation expectations, I use the mean and standard deviation of the distribution shown in figure 4. To measure slack in the labor market, I use the difference between the unemployment rate and the non-cyclical rate of unemployment calculated by the Congressional Budget Office. To measure supply shocks, I use the energy price index of the PCE. Estimating this equation using US data between the first quarters of 1984 and 2020 gives a reasonably good fit.

Figure 5 shows predicted inflation using the point estimates of equation (5) from the earlier sample and the realized values of the right-hand side variables from 2021 onwards. The left plot has the realized values in their final data release version, while the right plot uses the vintage of the data that was available in real time. Remarkably, the prediction lines up well with the actual realized inflation. There is no break down of the Phillips curve. The inflation surge of 2021-24 was entirely predictable using the pre-2020 Phillips

Table 4: Forecasting performance of Phillips curves for inflation

Forecasting model	RMSE (in %)	
	(revised)	(real-time)
No expectations variables	2.566	2.095
Baseline model	1.894	0.894
Including tightness and a kink	1.865	0.876
Including global supply pressures and food prices	2.31	1.786
All variables	2.696	1.926

Note: The first specification includes only the difference between the unemployment rate and the natural rate. The baseline specification includes the unemployment gap and the mean and standard deviation of expectations, as well as the PCE energy price index, as in figure 5. The next specification includes the log of the vacancy-unemployment ratio allowing for a kink in the slope when this exceeds one to the baseline, while the following one includes the PCE food price index, and the global supply chain price index of Benigno et al. (2022). Finally, the last specification includes all of the labor market and supply shocks variables together. The first column uses current (revised) data, while the second column uses the data available in real time.

curve.

Table 4 unpacks what is behind this result. It estimates different versions of equation 5 in the 1984Q1-2020Q1 period, and calculates the root mean squared error of their predictions in the 2021Q1-2025Q2 period. The first row has the result from using the unemployment gap variable as the sole predictor. The next row has the baseline specification, whose fit was displayed graphically in figure 5. As in the 1970s, the improvement is noticeable from including expectations and measures of supply shocks, and this is even more so using the real-time data.

The other rows in the table dissect this exercise further. Researchers have long argued that measuring slack requires moving beyond unemployment gaps. The next row in the table uses the ratio of vacancies and unemployment and allows the slope to be different when that ratio is above versus below one. The improvement in forecasting performance is minimal.

There are also better measures of supply shocks than just the price of energy. The next row includes a measure of the cost of transporting goods across the world using multiple indicators, while the following one uses the price of commodities, especially food, which were especially important following the Russian invasion of Ukraine. Surprisingly, including these two measures of supply shocks significantly worsens the predictive power of the Phillips curve.

The final row includes both the extended measures of labor market slack, and the measures of supply shocks all at once. The over-fitting of such a specification leads to a significant decline in performance. In fact, rather than these elaborations on how to measure slack and supply shocks, one would be better off going back to only using the unemployment gap.

These results show the importance of taking into account expectations when estimating Phillips curves. In a prediction exercise, the advantages of including kinks in the slope of Phillips curve, considering vacancies, including both energy and food prices, and devising new measure of supply chain problems, all disappear once one includes expectations of inflation.[12]

3.4 The stability of the Phillips curve

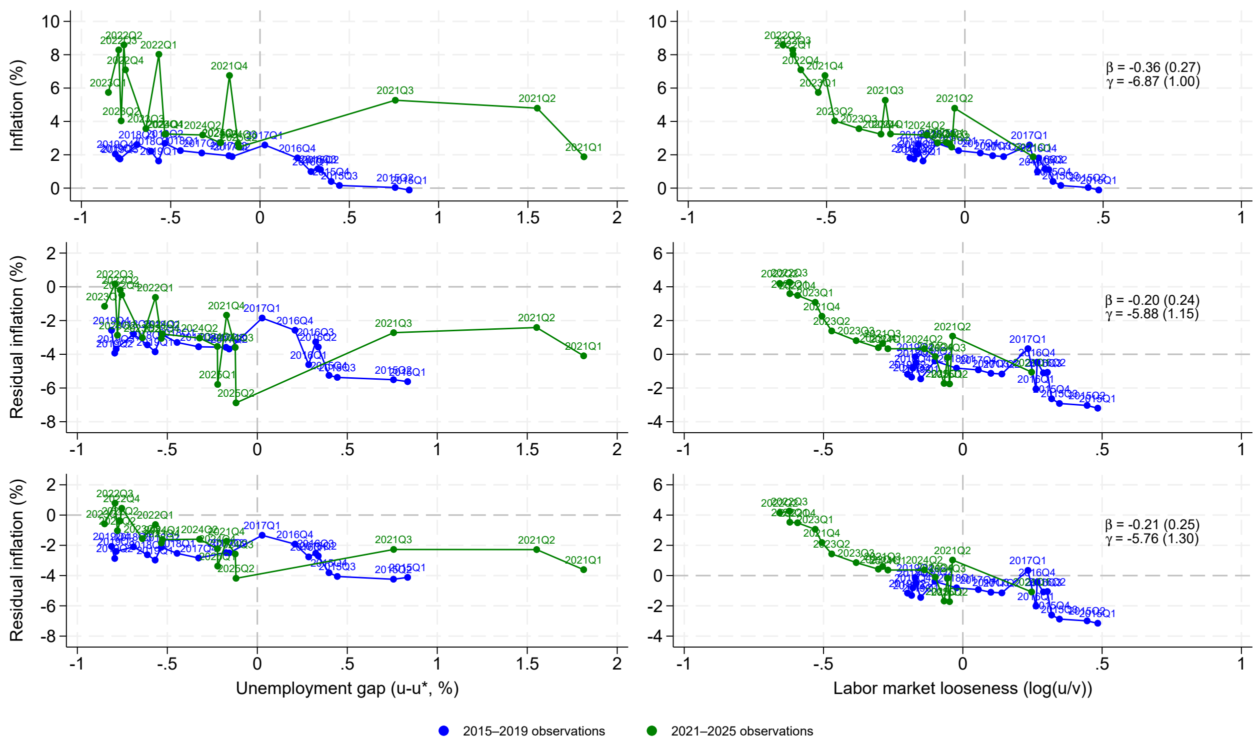
Figure 6 conducts a related exercise with a different goal. Instead of asking whether expectations variables helped in predicting the inflation surge, it asks whether the inflation-unemployment relation stayed stable throughout this period. While the previous section considered the role of expectations in the Phillips curve out of sample, here I study their role in sample.

The top-left panel shows the plot of inflation against the unemployment gap, distinguishing between the 5 years before the pandemic, and 5 years after, while omitting 2020. Before the pandemic, this Phillips curve plot was stable and quite flat. Afterwards, and especially from 2021Q4 onwards it becomes erratic, with no discernible slope. The right-hand side top plot replaces the unemployment gap with the log of the unemployment-vacancies ratio allowing for a kink when this is positive. Confirming earlier results, the Phillips curve is flat (0.36) when unemployment is above vacancies, but much steeper (7.23) when vacancies are higher and labor markets are tight.

The top panel, however, does not control for inflation expectations. The middle panel includes the mean and standard deviation of the 1-year ahead residualised answers in the Michigan survey as controls. On the left plot, the observations in the inflation disaster period are now less erratic. On the right plot, the fit is also noticeably better. The kink in the Phillips curve is still present, even though it is not as large.

[12]One would miss this result by using as the variable for expectations the mean forecast of long-run inflation from the SPF survey. This is the incorrect measure both in its horizon and on who is being asked.

Figure 6: Phillips curves



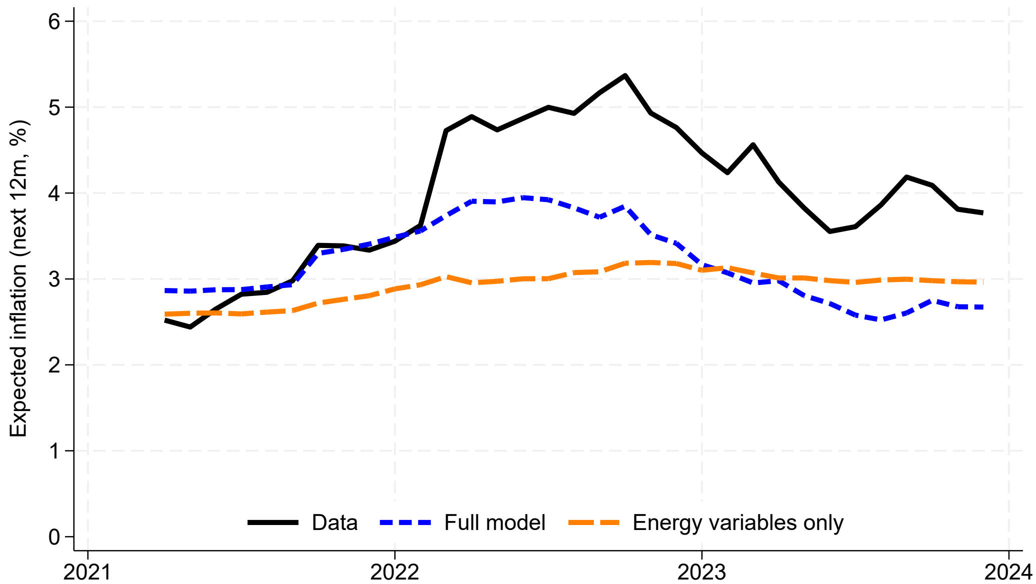
Notes: The top row plots quarterly observations of CPI inflation and measures of slack for the pre-pandemic period, and the inflation-surge period. The second row residualises inflation by the predicted component by expected inflation (mean and standard deviation), and the third row by the predicted component from expectations and supply shocks (gas prices and the global supply pressures index). The measure of slack in the left column is the difference between the unemployment rate and the CBO non-cyclical rate of unemployment. The measure of slack in the right column is the log of the unemployment-vacancy ratio. The coefficient estimates are from $(\beta + \gamma I(u/v)) \log(u/v)$, where $I(.)$ is an indicator function equal to one when $\log(u/v) < 0$.

The bottom panel adds the variables for supply shocks, and finds they make little difference. As with forecasting, controlling for expected inflation is important, but once one does so, controlling for supply shocks makes no difference.

3.5 Supply shocks as drivers of expectations

Having looked at the expected inflation and real activity terms in the Phillips curve, I now turn to the usefulness of expected inflation in learning about the mechanisms from supply shocks to actual inflation. In 2021-22 there was a large increase in energy prices, at first as a result of the pandemic, and afterwards due to Russia's invasion of Ukraine.

Figure 7: Energy prices do not drive inflation expectations



Notes: EA household expected inflation 12-months ahead. Mean of responses and predicted values taking into account only energy prices, and energy prices together with lagged inflation and monetary policy, using the model of Patzelt and Reis (2024): $\Delta^6 \pi^e_{i,c,g,t} = \beta \Delta^6 e_{c,t} + \gamma \Delta^6 e_{c,t} \times \Delta^6 a_{c,g,t} + \alpha^c_c + \alpha^g_g + \boldsymbol{\theta} y_{c,t} + \varepsilon_{i,c,g,t}$, where Δ^6 is the change in a variable relative to its value h months ago, $\pi^e_{i,c,g,t}$ is expected inflation by household i in country c, who is part of demographic group g in month t, $e_{c,t}$ are electricity prices, $a_{c,g,t}$ is the standard deviations of expectations within the groups, α^c_c and α^g_g are country and group fixed effects, and $y_{c,t}$ are two control variables: average inflation in the EA in the previous 6 months, and the change in the EB policy rate. This is estimated on data between April of 2020 and December of 2023. The "energy variables only" prediction does not include the $y_{c,t}$ variables.

Beyond its direct impact on inflation in the Phillips curve, this would have an indirect, but potentially relevant, further impact if the supply shocks raised expected inflation.

Figure 7 shows two predicted values for expected inflation in the EA from using survey data on individual inflation expectations. According to these estimates, the sharp increase in energy prices might have raised expected inflation by somewhere between half and one percentage points. This is between one tenth and one third of the increase in expected inflation during this time. According to these estimates, the transmission from supply shocks to inflation through expected inflation was quantitatively small. These results suggest that policies to control inflation by putting price controls on energy prices to dampen expectations may not be all that effective.

3.6 The literature on household expectations during the inflation surge

The sharp rise in expected inflation in figure 4 is explained by Chahrour, Shapiro and Wilson (2025) as the result of the media covering inflation more when it is on the way up. It shows that household expectations become more responsive to rises in inflation than to falls. The increase in disagreement in the same series can be accounted by selective memory cues: Gennaioli et al. (2024) argue that the sudden rise in inflation during the surge triggered memories of past inflation from older households leading them to quickly revise upwards their expectations.

The exercise in figure 5 extends an earlier insightful exercise by Hazell (2025). I included the second cross-household moment of the distributions given the results in Brandão-Marques et al. (2023) on the power of the distribution of inflation expectations in predicting inflation, beyond the first moment. Experiments with surveys of households and firms show that across many countries during the inflation surge, people become more informed about inflation (Weber et al., 2025). Perhaps this made the inflation expectations series better incorporate the information from supply shocks. Since the economic agents would do so in the way that is more relevant to them, then survey expected inflation becomes a better statistic for inflation than the supply shocks themselves.

Unpacking the results in table 4, with the remarkable predictive ability of inflation expectations, Meyer and Sheng (2025), Baumann et al. (2024), Asghar, Fudurich and Voll (2023), Ghassibe, Wanengkirtyo and Yotzov (2025) found that firms that expect higher inflation raised their prices. In turn, Jordà and Nechio (2023) found that during the pandemic, the passthrough from inflation expectations to higher wages increased by a factor of five.

Beaudry, Hou and Portier (2025*a*) found a stable Phillips curve with a dominant role for inflation expectations shown in figure 6. The figure finds a kink in the Phillips curve slope, first noted by Benigno and Eggertsson (2023). However, Beaudry, Hou and Portier (2025*b*) using cross-city evidence find no statistical signs of a non-linearity in the recent data, and Doser et al. (2023) also reject non-linearities in the Phillips curve looking farther back in time. The key point in both papers, and in the analysis in this section, is that controlling for short-term inflation expectations makes a very large difference.

Along the same lines, several papers have found that the rise in inflation expectations not just shifted the Phillips curve, but also steepened the relation with slack. This is because households are learning about the supply shock (Erceg, Linde and Trabandt, 2024), firms pay more attention and update their prices more often in response to more volatile inflation (Morales-Jimenez and Stevens, 2025, Pfäuti, 2023, Blanco et al., 2024, Bracha and Tang, 2024) or in response to dovish policy (Afrouzi and Yang, 2017). Acharya et al. (2023) provided a rich analysis of how supply shocks and inflation expectations interacted during the inflation disaster, beyond the Phillips curve.

On the link between energy shocks and expected inflation, a small literature has shown that households' 1-year inflation expectations are especially sensitive to changes in energy prices (D'Acunto and Weber, 2024). At the same time, when this effect is quantified, the impact of energy prices on expected inflation is lower than either their information value or their weight on the consumption basket (Patzelt and Reis, 2024). Figure 7 used the specification of Patzelt and Reis (2024) that exploited the cross-regional variability in electricity prices within the EA to identify their impact on individual inflation expectations. Using instead variability in U.S. gasoline prices, Hajdini et al. (2024) finds similar results, and using time-series variation instead Miyamoto, Nguyen and Sergeyev (2024) finds an even weaker response of expected inflation to energy prices.

Finally, Coibion and Gorodnichenko (2025) examined survey expectations data to ask whether inflation expectations were anchored during the inflation surge, with an emphasis on the US, and focusing on the role of supply shocks. They argue that, in absolute terms, inflation expectations have always been unanchored, whether before or after the inflation surge

3.7 Were short-run household expectations well anchored?

It depends. The distribution of these expectations moved significantly during this time, as one would expect given the large movements in actual inflation. In doing so, they amplified the impact of the shocks themselves. The Phillips curve was stable during the inflation surge, and it predicted well the movements in inflation, with expectations playing a key role in those predictions.

At the same time, while the energy shocks played a role in moving expectations, quantitatively they accounted for less than one quarter of their movement. Moreover, once taking into account the changes in expected inflation, it is hard to statistically see an additional direct impact from the measures of supply shocks themselves into inflation outcomes. Inspecting the expectations mechanism casts doubt on a shock account that put too much weight on supply shocks during the inflation disaster.

4 Institutional expectations

Governments in advanced economies issue most of their public debt in units of the national currency. When they are unwilling or unable to have the requisite fiscal surpluses to service their past debts, higher inflation is one way to keep the real value of the debt from rising. Expected inflation lowers the real value of outstanding debts, but raises the cost of servicing debt from then onwards. Unexpected inflation is more effective, and inflation disasters often come hand-in-hand with fiscal crises. This section presents the mechanism that goes from fiscal shocks to unexpected inflation, and discusses the expectations from the institutions that monitor the evolution of the public debt.

4.1 Theory: the fiscal mechanism

Let b_t be the debt-to-GDP ratio today: the ratio of debt outstanding today that was issued last period B_{t-1}, to real GDP Y_t times the price level P_t, so: $b_t = B_{t-1}/P_tY_t$. Then, if the ratio of the fiscal surplus to GDP is s_t and the real growth and inflation rates are, respectively, $g_t = Y_t/Y_{t-1} - 1$ and $\pi_t = P_t/P_{t-1} - 1$, the debt evolves according to the accounting identity:

$$b_{t+1} = \left[\frac{1+i_t}{(1+\pi_t)(1+g_t)}\right](b_t - s_t)\ . \tag{6}$$

Mechanically, higher inflation lowers the right-hand side, and thus leads to a lower debt. However, if investors expected the inflation, they would have required a higher nominal interest rate to compensate them. If that adjustment was one-to-one, then the right-hand side would be unchanged, and so would the debt-to-GDP ratio. Worse, if attempts at having high inflation to lower the debt lead those investors to require an extra premium to compensate for this inflation risk, then the higher expected inflation may actually worsen the government's fiscal position.

What happens to the interest rate ultimately depends on how those who lend to the government perceive the value of its debt. From today's perspective, say that those investors discount payoffs at a future date T by a discount factor $M_{t,T}$ that has the property that in the limit at infinity, the discounted debt-to-GDP ratio is zero. The key behavioral assumption is then that the government is not expected to run a Ponzi scheme on the bond holders. It is their expectations, denote them by $\mathbb{E}^b(.)$ that matter.

Multiplying by the discount factor and taking expectations gives the integral version of the budget constraint:

$$b_t = \sum_{j=0}^{\infty} E_t^b \left[M_{t,t+j}\, s_{t+j}\right] + \sum_{j=0}^{\infty} E_t^b \left[M_{t,t+j} \left(\frac{1}{M_{t+j,t+j+1}} - \frac{1+i_{t+j}}{(1+\pi_{t+j})(1+g_{t+j})}\right) b_{t+j}\right]. \quad (7)$$

The real value of the debt is on the left-hand side. It equals, on the right-hand side, the present value of primary surpluses plus the revenue from issuing public debt and paying for it a lower interest rate than the rate at which investors discount the future.

Say that that there is an unexpected decline in surpluses, for instance because of the large expenses in the pandemic, or because of the fiscal stimulus programs in 2021. Then, on the left-hand side, this will be accompanied by an unexpected increase in inflation in that year. In turn, that inflation and the losses it imposes on the bondholders will raise questions over the liquidity and safety of government bonds. The same questions arise from the expected future deficits and the prospect of financial repression or partial default. These reduce the gap between the discount rate and the interest rate, reducing the second term on the right-hand side. Again, this will come with unexpectedly higher inflation on the left-hand side.

The account on the previous paragraph could be taken as a causal connection from the right-hand side to the left-hand side. This is the fiscal theory of the price level (Cochrane, 2023). But, since the equation above only requires a no-Ponzi scheme condition on government bonds, it holds in almost any other theory of inflation as well. Going from the left- to the right-hand sides of the equation instead, it says that unexpected inflation is one way to compensate for future deficits or for a loss of trust by investors in the government debt. That unexpected inflation can be the result of benign neglect by the central bank (Hall and Sargent, 2025) or may be part of the optimal way to finance the deficits from a war or a pandemic (Lucas and Stokey, 1983). Whichever theory one takes on which policy drives inflation, whether it is fiscal or monetary, this equation still holds and captures the fiscal mechanisms connecting shocks to inflation.

This mechanism makes clear that the expectations that matter are those of the ultimate holders of the government debt, the ones who will be willing to lend to the government and not let themselves be sucked into a Ponzi scheme. In part, these are the expectations of markets that we already studied in section 2. But in another part, they are the expectations of the institutions that, if and once markets withdraw, will step in and lend to the government. Fortunately, these institutions produce and make public their joint expectations for these variables.

4.2 The raw data: inflation expectations of the IMF staff

Institutions like the International Monetary Fund (IMF) or the European Stability Mechanism (ESM) spend considerable resources and accumulate expertise in forming forecasts of the fiscal situation and inflation. Their expectations are important not just in the (fortunately rare) occasions when these institutions are called to lend to governments. They also serve as the basis for many of the investors in public debt to form their views. Importantly, and unlike most surveys or markets, they form expectations for the different components of the government budget constraint in a way that is coherent and satisfies the accounting identities.

Figure 8 shows the annual expectations of the IMF staff on what inflation would be for the coming five years. These come from the IMF's flagship publication, the World Economic Outlook. Like markets and households, the IMF did not see the inflation surge coming. Like many, it forecasted the rise in inflation would be transitory, and yet it was later surprised by how quickly inflation fell. But, to a larger extent than markets or households, the IMF's expectations were solidly anchored, since they did not rise as much as inflation rose, and they were quicker to revert back on target.

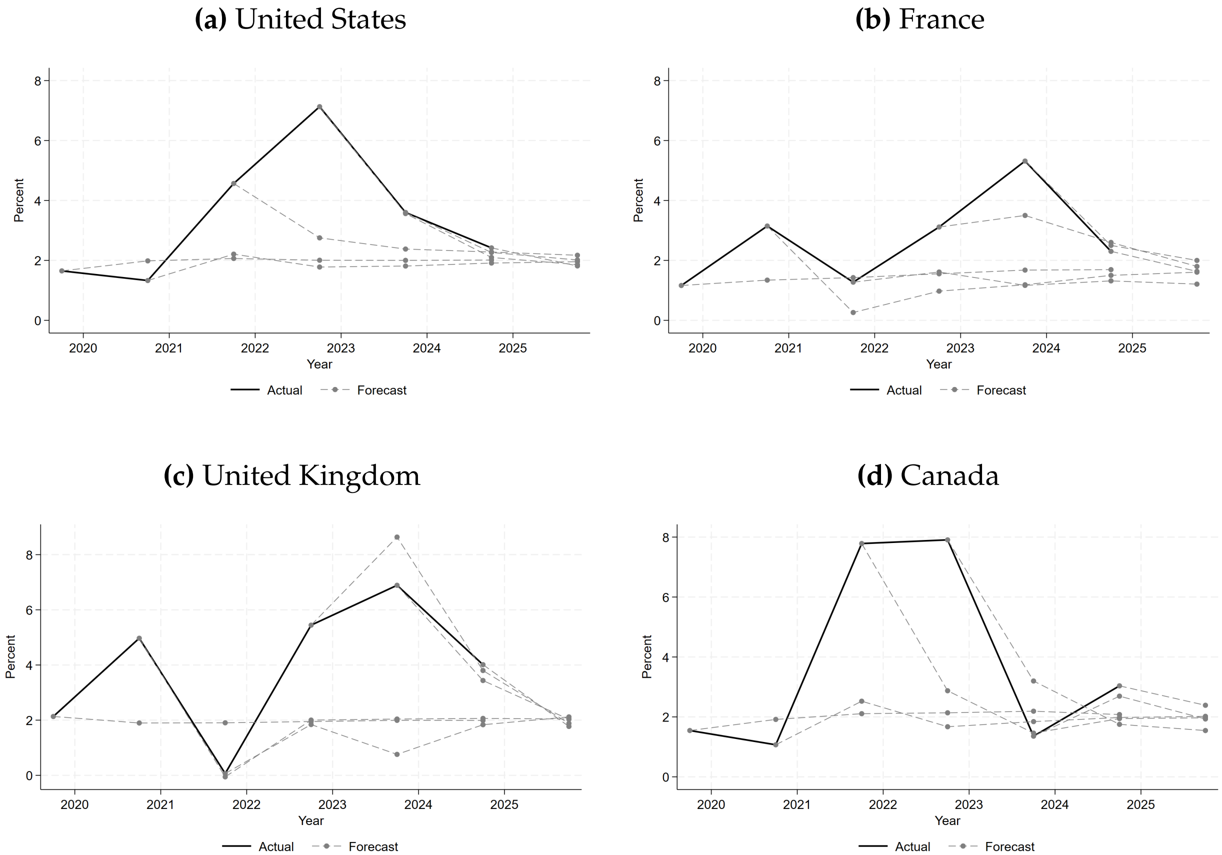
4.3 Connecting fiscal to inflation surprises

To inspect the fiscal mechanism, I compare the IMF's 2019 forecasts for the increase in the public debt over the next 5 years, with the actual increase that we saw.

The IMF also publishes forecasts for each term in the accounting identity linking current to future debt in equation (6). Using these forecasts, I constructed the expected increase in debt due to expected inflation, interest rates, economic growth, and fiscal deficits. Then, using the April 2025 actual values for what each of these variables were, I constructed the actual increase in public debt due to the actual evolution of each of these four variables. Subtracting one from the other gives the unexpected increase in public debt, broken down into four unexpected terms, for each country in the WEO sample.

Figure 9 plots two of these terms: the unexpected increase in public debt due to unexpected deficits, and the unexpected increase in the debt due to inflation in 2019-25 per country. The figure shows a clear positive relation, which is statistically significant. This says that for countries where deficits turned out to be higher than the IMF expected, inflation also turned out to be unexpectedly higher, using the common metric of their impact on the public debt. The fiscal mechanism is validated using the expectations data.

Figure 8: IMF inflation forecasts and actual inflation in four countries



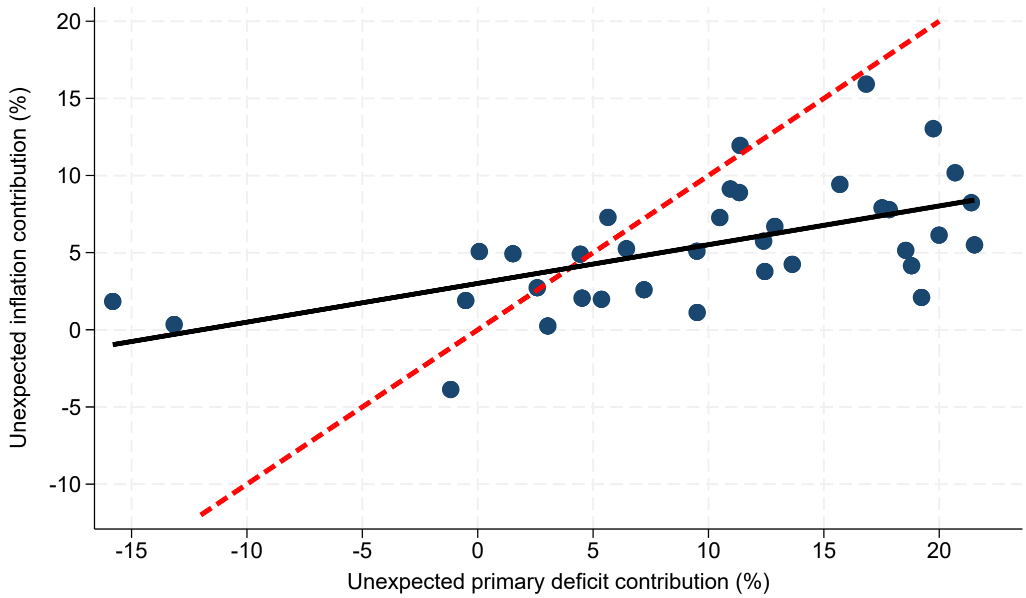
Note: This picture shows actual inflation, and the forecasts of inflation for 1 to 4 years ahead. Data comes from the April and October issues of the World Economic Outlook.

Moreover, these correlated forecast errors across the two variables would justify a revision of procedures by a rational forecaster. If fiscal developments lead the IMF to raise its expected deficits, then this past experience should lead it to raise its expected inflation as well. Even it does not, the bondholders that choose to hold the public debt of these countries, and who have their money at stake, would rationally do so. They would correspondingly raise the interest rate charged on the debt (or lower the price they are willing to pay for it). In this sense, insofar as one might expect that fiscal news will be negative, inflation expectations of bondholders may become less anchored.

4.4 The literature on inflation expectations and fiscal policy

Barro and Bianchi (2025) found a strong relation between realized inflation and realized extra spending during this time across OECD countries. Focusing on expected inflation,

Figure 9: Contributions of deficits and inflation to the unexpected increase in public debt



Note: Using the WEO 2019 forecasts in October 2019, and the WEO actual outcomes in April 2025, I construct the unexpected increase in public debt between 2019 and 2024 due to unexpectedly high primary deficits and the unexpected decrease in public debt due to unexpectedly high inflation, for each country in the OECD. Also plotted is a 45 degree line, and a linear regression, which has a coefficient of 0.25 and a standard error of 0.06. The two left outlier points are Norway and Denmark, which had large surpluses; excluding them from the regression, the slope rises to 0.31, with standard error 0.08.

Ilzetzki (2023) presents five case studies of fiscal shock and the anchoring of inflation expectations.

Turning to the sensitivity of expected inflation to fiscal surprises, Brandao-Marques et al. (2024) found that unexpected increases in the level of public debt are correlated with increases in long-term inflation expectations in emerging economies. Gati (2023), Gennaioli et al. (2024) found that the large forecast errors during the inflation surge have made inflation expectations more sensitive to future forecast errors. Finally, the model and evidence in Carvalho et al. (2023) support a connection between fiscal policy shocks and the anchoring of inflation expectations.

4.5 Were institutional expectations well anchored?

It depends. On the one hand, the inflation forecasts of the IMF did not drift as far up as others, and were quicker to stabilize. On the other hand, this implied that the IMF overstated the increase in public debt since 2020, by not taking into account the use of the "inflation tax" to pay for some of the extra spending. If institutions, and ultimately bondholders, revise upwards their procedures to more closely tie inflation forecasts to the forecasts of fiscal deficits, this would unanchor inflation expectations.

5 Policymakers' expectations

Insofar as monetary policy has an effect on inflation only after many months, then the setting of policy tools must be done with an eye on the future. Therefore, a large part of the job of a central banker is to make forecasts about the future of the economy. Policymakers' expectations in turn determine how they choose policy, and since policy partly determines what inflation will be, then these expectations matter for inflation.

This is especially true after a shock. Different policymakers will have different beliefs on how that shock affects outcomes, and their response will modulate how this transmission happens. This section describes the aggregate demand channel of transmission of shocks, and looks at policymakers' expectations to learn whether they leaned against the inflation surge in the same way as they had done against other past shocks.

5.1 Theory: policy choices over aggregate demand

It is a common assumption in models of business cycles where aggregate demand policy matters that a policymaker whose expectations are $E^p(.)$ solves a problem:

$$\min \quad \mathbb{E}^p \left\{ (\pi - \bar{\pi})^2 + \lambda (u - \bar{u})^2 \right\} \quad \text{s.t. equation (4)}\,. \tag{8}$$

The loss function being minimized penalizes inflation away from a target $\bar{\pi}$, and unemployment away from another target $\bar{u}$, with the key parameter λ determining how costly the latter deviation is relative to the former. This representation captures the dual mandate of the Federal Reserve, and in that context the size of λ is sometimes referred to as the degree of dovishness.

The constraint in this maximization is the Phillips curve tradeoff discussed earlier.

As for the variable being chosen, take it to be the actual value of inflation (or its expectation). Policymakers may have access to many tools, and some may be better described as fiscal or as monetary. But insofar as policy can have some effect over aggregate demand then it targets a point on the Phillips curve.

This is a consequential approach to inflation: no matter the channel, the key mechanism is how policymakers set policy to achieve a particular feasible outcome. Taking as given the households' expected inflation—a major assumption that the literature on commitment has thoroughly studied—then the optimality condition from this problem is a famous targeting rule:

$$\mathbb{E}^p(\pi - \bar{\pi}) = \frac{\lambda}{\kappa} \mathbb{E}^p(u - \bar{u}) \,. \tag{9}$$

Take the special case where the target for unemployment is the natural rate ($\bar{u} = u^*$), households expect inflation to be on target $\bar{\pi} = \mathbb{E}^h(\pi)$, and there are no supply shocks ($s = 0$). Then this equation has zeros on both sides. Policy should try to keep inflation on target, and unemployment will be at its target natural rate as well.

If any of these three conditions does not hold, then this equation expresses how policy will trade off its two goals. Taking the case of a positive supply shock ($s > 0$), then policymakers will tolerate some inflation above target at the same time as unemployment is elevated from target as well. Keeping inflation directly on target would not be optimal because then unemployment would be higher. The rate at which the two goals are traded off against each other is the ratio of how much the policymaker dislikes unemployment and how much it can trade off inflation against unemployment. If, for instance, policymakers are very dovish (λ high) and the Phillips curve is very flat (κ low) then inflation can be significantly above target in order to keep unemployment close to its target.

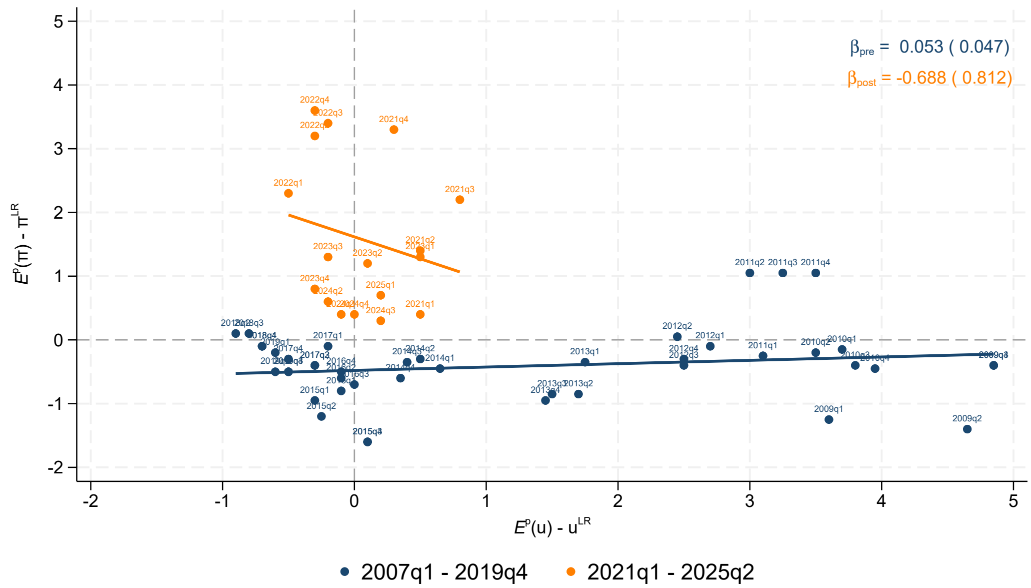
Expectations are central in this mechanism, and just as in the previous section, what matters is the joint expectation across variables. If policymakers expect a very large recession because of a large supply shocks, then they may tolerate an inflation surge.

5.2 The raw data: expectations of members of the FOMC

Since 1970, the individual forecasts of different members of the FOMC that sets interest rates in the US have been published semi-annually. Since 2007, these have been quarterly and published as part of the Summary of Economic Projections (SEP), and since 2009 they have also divulged their expected long-run values of inflation and unemployment.

Figure 10 plots the median across policymakers in each survey wave for the objects

Figure 10: Expectations of inflation and unemployment gaps from FOMC members



Note: Median expected inflation and unemployment from the SEP in each quarter, with the expected value subtracted from its expectations in the long run. Coefficients are simple fitted line by OLS to the two subsamples.

in equation (9). It separates the data into two separate samples: before the pandemic in blue, and from 2021 onwards in orange.

There are several reasons to not expect a perfect linear fit between these points. First, the horizon of the expectations in equation (9) is tricky to pin down. If the horizon is too long, then by definition of the survey both the left-hand side and the right-hand side are zero. If it is too short, like one quarter, then the policymaker would not be able to steer inflation with any precision for this optimality condition to hold. I use the expectations of inflation until the end of the year in the SEP. Second, the target for unemployment need not be the long-run expected value of unemployment. I have tried using the CBO's non-cyclical rate of unemployment with similar results. Third, policymakers may report their expectations strategically to influence the direction of votes or because of career concerns, or may care asymmetrically between inflation above or below target, and likewise for unemployment.

It is still suggestive to note that between 2007 and 2019, the fitted value of λ/κ is 0.053. During the inflation disaster period, instead, it became so flat that it even switched sign.

Given the stability of the slope of the Phillips curve that we found in section 3, this points to preferences of policymakers becoming quite dovish in 2021.

Beyond the fit, the scatter plot of points tells a clear story. When inflation shot up to two digits in 2021, unemployment was barely above any estimate of its long-run or neutral level. That this did not lead to any tightening of fiscal or monetary policy is hard to explain unless policymakers were quite dovish, or they believed that the Phillips curve was very flat.

5.3 The literature on policymaker's expectations

Giannone and Primiceri (2024) notes that the combination of inflation and output outcomes in 2021-22 were consistent with a central bank that puts little weight on inflation stabilization. Romer and Romer (2024) argued that the change in policymakers' preferences was visible in the framework review the Fed did in 2020, as does Reis (2023*a*), who more precisely traces the changes to both a tightly-held belief that r-star would be forever lower and to an over-reliance on the Fed's credibility and the anchoring of expectations. Bianchi, Faccini and Melosi (2023) argued that the root of the change was in choosing to accommodate the unfunded fiscal stimulus of 2021.

6 Conclusion

While laying out the mechanisms from shocks to inflation outcomes, and the way in which they are intermediated by inflation expectations, this article went through several disparate pieces of evidence. I collect them here now for ease of reference:

1. Market long-horizon inflation expectations moved following the shocks in 2021-24, so they were not fully anchored, but those movements can account for less than one percentage point of the movements in actual inflation.

2. The inflation disaster was unexpected, and has left scars in financial markets as the probability of a similar disaster in the far-future is judged to be 2-4 times higher than pre-pandemic.

3. The inflation disaster left scars in professional forecasters, whose long-horizons expectations are 4-10 times more sensitive to short-term shocks than they were before.

4. Households' short-horizon US expectations are persistently higher and more dispersed.
5. Expected inflation was the key leading indicator of the 2021 inflation surge, and forecasts based on a model estimated until 2019 with the inflation expectations data tracked quite well the up and down of inflation in 2021-24.
6. The Phillips curve was stable throughout, with all of the shifts in plots of unemployment against inflation accounted for by the changes in expected inflation.
7. Supply shocks account for at most one third of the rise in expected inflation, and once expected inflation is taken into account, measures of supply shocks do not shift the Phillips curve and they worsen forecasts of inflation.
8. Across countries, the unexpected worsening of fiscal surplus during the period during and after the pandemic is strongly correlated with the unexpected increases in inflation.
9. Given that people are paying more attention to inflation, looking ahead, fiscal shocks should have a larger impact on expected inflation.
10. During 2021-24, policymakers' expectations of inflation relative to unemployment reveal a higher tolerance for higher inflation than before the pandemic.

These findings gave support to each of the four mechanisms that I presented: (i) the monetary mechanism that long-run expected inflation can move but decisive policy actions can re-anchor it, (ii) the Phillips-curve mechanism, whereby a shift in the distribution of household and firm near-term expected inflation amplifies shocks, (iii) the fiscal mechanism that links shocks to public deficits to shocks to inflation, (iv) and the policy choices mechanism that links loose policy in 2021 to the preferences of policymakers revealed by their expectations.

As for the applied question on the anchoring of inflation expectations, the findings provide a nuanced answer. On the one hand, the evidence suggests that expectations became unanchored during the inflation surge, but on the other hand it is debatable whether that was quantitatively important for the evolution of inflation. On the one hand, inflation expectations are anchored now, in 2025, but on the other hand, there are reasons to suspect that they are less well anchored as they were before 2021.

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