Unconventional fiscal policy in times of high inflation

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Abstract

The surge in energy prices in 2022 has been a defining factor behind the increase in euro area inflation. We assess the impact of "unconventional fiscal policy," defined as the set of fiscal measures, possibly expansionary, motivated by a desire to mute the effects of the increase in energy prices and to lower inflation. Overall, we find that these unconventional measures reduced euro area inflation by 1 to 2 percentage points in 2022 and may avoid an undershoot later on. When nonlinearities in the Phillips curve are taken into account, the net effect is to reduce inflation by about 0.5 percentage points in 2021-24, and keep it nearer to its target. About one-third to one-half of the reduction in 2022 reflects the direct effects of the measures on headline inflation, with much of the remainder reflecting the lower pass-through to core inflation. The fiscal measures were deficit-financed but had limited effects on raising inflation by stimulating demand and instead modestly helped to stabilize longer-term inflation expectations. Looking ahead, the prospective decline in inflation in the euro area is partly due to fortunate circumstances, with energy prices falling from their 2022 peaks and their pass-through effects fading, and with less economic overheating than in economies such as the United States. Implementing similar measures in the face of a more persistent increase in energy prices, or in a more overheated economy, would have caused a more persistent rise in core inflation.

1 Introduction

Starting in 2021, inflation rates around the world surged to unexpectedly high levels, unseen since the great inflation of the 1970s, and became an acute problem for policymakers. World average annual inflation increased from 3.2 percent in 2020 to 8.7 percent in 2022. For advanced economies, inflation increased from 0.7 percent to 7.3 percent over the same period, whereas for emerging market and developing economies, the increase was more modest but still significant, from 5.2 percent to 9.8 percent.

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For the euro area, which had been struggling with inflation rates averaging only 1 percent between 2015 and 2019, well below the European Central Bank's (ECB) 2 percent inflation target, the surge was even more remarkable, from 0.3 percent in 2020 to 8.4 percent in 2022.

What followed was one of the most aggressive and synchronous monetary policy-tightening episodes on record. The US Federal Reserve started its hiking cycle in March 2022, with 12-month headline inflation already exceeding 8.5 percent. In the following 14 months, the Federal Reserve increased its policy rate by 500 basis points. The ECB's hiking cycle started in July 2022, with 12-month headline inflation exceeding 8 percent. By June 2023, it had tightened policy rates by a cumulative 400 basis points.

To this date, inflation pressures, especially for underlying (core) inflation, have abated only modestly, potentially because it typically takes time for monetary policy to first curb activity and later reduce inflation. In the most recent (April 2023) IMF World Economic Outlook forecast, global headline inflation is projected to decrease to 6.6 percent on a year-on-year basis in the second quarter of 2023, with inflation excluding food and energy declining to 5.9 percent. In the United States and the euro area, the corresponding inflation figures are 4.6 percent and 5.1 percent, and 6.3 percent and 6.5 percent, respectively—still well above target.

In such an environment, is there a role for fiscal policy in further reducing inflation? The textbook answer is an unambiguous "yes!" Tighter fiscal policy can help compress demand, especially if monetary policy is constrained—as is the case in a monetary union where monetary policy is set to address average price pressures—and can help reinforce the credibility of the overall disinflation strategy (see Erceg and Lindé 2013 for a classic treatment and Chen and others 2022 for a more recent analysis). A tighter fiscal policy alongside monetary tightening can alleviate pressures on external and fiscal accounts compared with a strategy based entirely on monetary policy.

Yet, many European countries chose a different fiscal policy path, one that aimed to directly act on one of the central sources of inflation by countering directly the rise in energy prices. Using a combination of transfers, energy subsidies, and tax cuts, the aim was to contain the increase in the price of energy (including electricity and gas) for households and businesses (see Altomare and Giavazzi 2023 for a summary of the strategy).

Economists' reactions to these "unconventional fiscal policy" (UFP) measures were generally skeptical.[2] By reducing energy prices, many argued, the measures would reduce incentives to conserve energy and keep energy demand too high.[3] The fiscal measures were also often poorly targeted, and the significant budgetary cost,

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2 In a June 2022 Chicago Booth poll of European economists, most respondents disagreed with the statement "Fiscal measures putting a cap on consumer energy prices would be a more appropriate immediate response to increased inflation in the euro area than raising interest rates." Olivier Blanchard—one of the economists who agreed with the statement—argued that "This is a case where a larger fiscal deficit can make the job of monetary policy easier" (Chicago Booth 2022).

3 Arregui and others (2022) estimate that price suppressing measures lowered natural gas savings in the euro area by some 2 percent of pre-war gas consumption (a mid-point estimate within a wide range).

estimated at 3.3 percent of GDP for the euro area, would delay much-needed debt reduction.[4] Additionally, if the energy shock were to be permanent, such policies would become fiscally unsustainable and only delay an inevitable increase in inflation. And if the shock were transitory, the measures would merely smooth inflation over time, reducing it now, but increasing it later. Finally, the fiscal impulse would stoke aggregate demand and underlying inflation, hampering central banks' anti-inflation efforts.

The purpose of this paper is to assess the effects of such fiscal measures. Did they reduce inflation, and if so, why and by how much? What are the relevant lessons for policymakers?

As a first pass, we use the IMF's Flexible System of Global Models (FSGM) to evaluate the impact of UFP of the type implemented in the euro area. The simulations assume that the supply-side factors that caused a spike in international energy prices observed in 2022 unwind in 2023 and 2024, as current futures markets suggest. The simulation results suggest that the deficit-financed unconventional measures contribute to stabilizing inflation and output during 2022–24. Specifically, our baseline calibration suggests that the measures reduce inflation by about 0.9 percentage point in 2022 and 0.5 percentage point in 2023 and raise inflation by 1.5 percentage point in 2024, with a very modest cumulative positive effect. Overall, the energy measures smooth the path of inflation: reducing the overshoot in 2022-23 and preventing an undershoot in 2024.

We also consider a simulation where the impact of the UFP measures on the deficit is offset by cuts to government consumption. The inflation outcomes are largely unchanged, with a further reduction in inflation of 0.1 percentage point and 0.3 percentage point in 2022 and 2023, respectively. The overall cumulative effect on the price level remains modest but is now negative. At the same time, the government spending cuts reduce the level of output significantly in that scenario.

This first part of our paper establishes two important results. First, UFP can smooth inflation in response to a temporary energy price shock while leaving cumulative inflation largely unchanged. Second, in this class of models, the inflation-reducing impact of a fiscal tightening is modest. The difference between the two scenarios described here consists of a fiscal consolidation of 3.3 percent of GDP that results in a cumulative inflation (price level) reduction of 0.6 percent (implying about a 0.2 percentage point of inflation reduction per 1 percentage point of GDP in fiscal consolidation). This result is in line with estimates in other studies. For example, a study by Coenen and others (2012), using a range of structural models used at policymaking institutions, shows that a temporary fiscal stimulus of 1 percent of GDP in the euro area raises inflation by 0.1 to 0.3 percentage point (consistent with our results in the reverse case), depending on the type of fiscal measure and the degree of monetary accommodation.[5] Hence, although the textbook intuition is correct that fiscal tightening can support monetary policy in reducing inflation by compressing

[4] See Arregui and others (2022) and European Commission (2023) for details on the budgetary costs.

[5] For larger effects of fiscal policy on inflation, see, for example, the April 2023 IMF Fiscal Monitor (Chapter 2).

aggregate demand, the magnitudes of the effects through that specific channel appear to be small. This does not mean, however, that fiscal tightening is not needed, or that a fiscal expansion would be harmless at the current juncture. From a broader perspective, fiscal tightening can help reinforce the credibility of the disinflation strategy by sending a strong combined signal with monetary authorities. Fiscal tightening can also support countries' efforts to rebuild budgetary space for maneuver and to ensure public debt sustainability—an issue we do not address in this paper—which is currently an important public policy issue in numerous economies.

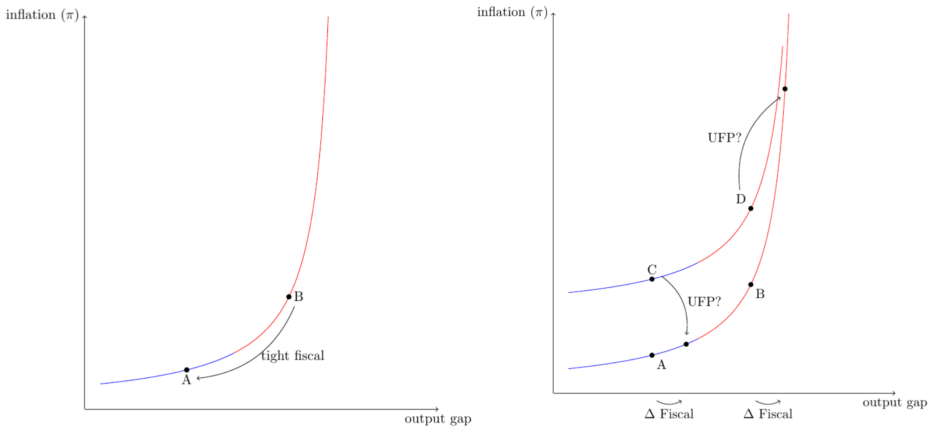
Although useful, the previous model lacks some ingredients that seem important to understand inflation dynamics during the COVID-19 pandemic and its aftermath, as well as the impact of conventional and unconventional fiscal policies. A consensus is gradually emerging that "there may be important non-linearities in the Phillips curve slope: price and wage pressures from falling unemployment become more acute when the economy is running hot than when it's below full employment" (Gopinath 2023). These nonlinearities are typically missing from standard large-scale New Keynesian models used at policy institutions. Further, such models typically assume that policy is credible so that medium-term inflation expectations remain anchored. But large and persistent increases in headline or core inflation may ultimately hurt the credibility of monetary frameworks and lead to the de-anchoring of expectations. By smoothing short-term inflation fluctuations, UFP may help to avoid a sharper pass-through of supply shocks and limit de-anchoring. At the same time, the inflationary response to the fiscal stimulus component of UFP may be much larger, if the economy is already running hot, that is, on the steeper part of the supply curve.

To illustrate these ideas, consider Chart 1, left panel. It represents the Phillips curve, with the output gap on the horizontal axis and inflation on the vertical axis. Importantly, this Phillips curve is non-linear so that the relationship between inflation and output steepens as the output gap increases. When the economy is not too hot, at point A on the blue part of the curve, a fiscal or monetary consolidation—which moves us along the Phillips curve—will help reduce inflation, but not by much. By contrast, when the economy runs "hot" at point B on the red part of the curve, aggregate demand policies will be more effective at reducing inflation. An energy price shock increases total inflation for any given level of the output gap, an upwards shift in the Phillips curve, as illustrated in the right panel of Chart 1. Point A becomes point C and point B shifts to point D. Let's now consider what a UFP may do in that setting. Somewhat trivially, because it neutralizes part of the increase in energy price, it shifts the Phillips curve back towards its original position. In the extreme case where the policy fully neutralizes the energy shock, it brings the Phillips curve back all the way to its initial position.[6] However, because these policies are expansionary, we do not come back to original point. The aggregate demand component of UFP shifts the economy to the right, as indicated by the arrows in the figure. If the economy is not too hot to start with (point C), the overall effect is to reduce inflation as the aggregate demand effects remain modest. If, on the other

[6] This is one place where the diagram simplifies things a lot. For instance, if energy markets are segmented and supply is inelastic, energy subsidies could increase the wholesale price of energy, leaving the retail price unchanged. We return to the question of the incidence of UFP later on.

hand, the economy is running "hot" (point D), the aggregate demand effect can dominate and increase inflation. In short, we expect that the inflation response will depend both on the size of the inflationary shock, but also on whether the economy is initially overheated.

Chart 1
A stylized representation of the inflationary consequences of unconventional fiscal policy



Sources: Authors' calculations.

To shed further light on these issues, we present an empirical assessment of the drivers of inflation in the euro area, in comparison to the United States. Following Ball, Leigh, and Mishra (2022), a central feature of the analysis is the decomposition of headline inflation into two components: core inflation and deviations of headline inflation from core. The latter are driven by relative price changes in particular industries. The former responds to longer-term expected inflation, slack or tightness in labor markets, and the pass-through of industry price shocks to core inflation, thus capturing with a reduced-form approach the Phillips curve nonlinearities described previously.

Based on this estimated framework, we conclude that, for the euro area, much of the increase in core inflation reflects the pass-through of headline-inflation shocks. In their absence, core inflation would have remained much more stable. By contrast, in the United States, most of the increase in core inflation would have occurred even in the absence of headline-inflation shocks. Overall, much of the rise in euro area inflation reflects the rise in headline-inflation shocks and their pass-through to core inflation. This is unlike the United States where the rise in core inflation also reflects significant overheating of the economy.

Next, we use our estimated framework to explore the effects of UFP measures in the euro area – this forms the basis for the main results of our paper. We construct counterfactual headline inflation paths that would have occurred in the absence of UFP measures, assuming all else remained equal.

We conclude that, without the energy price measures that governments have implemented, euro area headline inflation would have been higher in 2022 by about

2 percentage points. About one-third to one-half of this difference reflects the direct impact of UFP measures on headline inflation. Much of the remainder reflects a lower pass-through into core inflation, which has displayed a highly nonlinear dynamic. Moreover, despite their fiscal cost, the measures' effects on raising core inflation by stimulating aggregate demand have been modest thus far, in part because the euro area has not been excessively overheated (much less so than the United States, for example). Finally, during 2023 and 2024, as energy prices are expected to continue to decline, the unwinding of the UFP measures stabilizes inflation on the way down, by avoiding an undershoot of the target. Hence, the net effect of the UFP measures has been to reduce inflation by about 0.5 percentage point in 2021-24, and to keep it nearer to the target. Last, longer-term inflation expectations have remained broadly stable overall, in part reflecting the inflation-suppressing effects of the energy measures. Our estimates suggest that longer-term inflation expectations, as measured by the ECB's Survey of Professional Forecasters, would have reached 2.5 percent by the end of 2022, 0.3 percentage point higher than the observed 2.2 percent, in the absence of UFP.

1.1 What are the main policy implications?

Overall, the UFP measures have achieved some inflation reduction in the euro area and by more than standard models might have predicted.

Does this mean that measures of this kind should be part of the standard "toolkit?" We are much more reserved here. Two factors helped. First, quite a bit of luck was involved. The energy shock turned out to be more transitory than expected. Second, European economies were not strongly overheated to start with. Absent either of these conditions, the impact of UFP measures could have been much less favorable.

Consider first the persistence of the energy shock. Relative to initial market assumption under the height of uncertainty in the second quarter of 2022, subsequent outturns and futures prices adjusted down substantially, and the withdrawal of energy price measures in 2023 is thus unlikely to cause a burst of inflation.[7] Had energy prices remained at their peak levels, their effects on inflation would have persisted. Alternatively, avoiding the persistent inflationary effects would have required more costly—and probably unsustainable—fiscal interventions. In a counterfactual scenario where the shock to energy prices is more persistent, with energy prices staying at their peak 2022 levels and the fiscal measures being gradually unwound in 2023, headline inflation, pass-through to core, and inflation expectations are substantially higher. In this case, the energy measures provide less than half as much inflation stabilization than in the more favorable scenario with declining energy prices.

[7] In May 2022, the global price of Brent crude oil was about 123 US dollars per barrel and the price of Dutch Title Transfer Facility (TTF) gas was at 30 US dollars per Million Metric British Thermal Unit (MMBTU). At that time, forward markets priced the Brent at $98 and TTF gas at $25, both for May 2023 delivery. As of May 2023, spot prices were $73 dollars for Brent and $8.4 for TTF.

The upshot is that price measures on a sharp *temporary* energy price shock can help reduce inflation while maintaining expectations anchoring. But the approach is risky—the temporariness of energy price shocks in real time is difficult to ascertain.

Moreover, implementing similar price measures in a more overheated economy, as in the United States, would, our analysis suggests, have been counterproductive, thus causing a persistent rise in core inflation. The intuition is that the demand effects of fiscal policy are exacerbated when the economy is already overheated and is located on a steep part of the Phillips curve. In a counterfactual exercise, we implement euro area–style measures for the United States and find that headline inflation would have been lower by 1.2 percentage points on average in 2022 but would then have drifted upward in late 2022 and exceeded the actual level by about 1.6 percentage points by April 2023. Using deficit-financed, price-suppressing measures to artificially hold down core inflation in the face of a significantly overheated economy only adds to the inflation fire.

Given that the degree of economic overheating and the duration of energy price shocks are difficult to ascertain ex-ante, policy makers should deploy such measures with caution, given the risk of exacerbating price pressures if either economic slack is mismeasured or price shocks persist longer than expected, or both. At the very least, it is preferable for these measures to be fiscally neutral.

Finally, while it is beyond the scope of this paper to fully account for the impact of price suppressing measures in one country on neighbouring countries, we can offer a few general remarks. First, the effectiveness of UFP measures depends on how segmented and inelastic energy supply is. In a case of total market segmentation and inelastic supply, measures that lower the price of energy for households and firms in one country will drive up the wholesale price of energy for all countries in the same market. This would exacerbate headline-inflation shocks abroad, even as it alleviates them at home. If all countries in the same segmented market simultaneously attempt to suppress the spike in energy prices, the impact on headline inflation may then be minimal. This highlights the importance of coordination for euro area countries. Further work is needed to assess the overall elasticity of supply—which is different for oil, gas or electricity—and the ability of countries to substitute across energy sources. Second, designing UFP measures with the aim to preserve price signals at the margin, for instance via non-linear or block subsidies, would allow for demand compression, avoid the risk of shortages, and minimize the fiscal exposure.

1.2 A brief literature review

Our paper is related to the following strands of the literature. First, many recent papers analyze the underlying causes of the recent surge in inflation. Ball, Leigh and Mishra (2022) propose an empirical analysis similar to ours for the United States and conclude that much of the increase in median inflation in the United States can be tied back to the tightness of the labor market. Nonlinearities in the price Phillips curve play an important role in their setup, as they do in ours. Bernanke and

Blanchard (2023) compare the role of product market and labor market shocks and conclude that most of the surge in US inflation was the result of sharp increases in commodity and sectoral prices, not increases in wages given prices. Di Giovanni and others (2022) use an input-output, model-based calibration to compare euro-area and US inflation. They conclude that foreign shocks and global supply chain bottlenecks account for a large share of euro area inflation, compared to the United States. Further, di Giovanni and others (2023) find that aggregate demand shocks account for the bulk of US inflation. These results are largely consistent with our own analysis.

A second strand of literature explores the role of (conventional) fiscal policy in bringing down inflation. The general message from that literature is that conventional fiscal policy is much more powerful when monetary policy is constrained, either because of the effective lower bound or when countries share a common currency (see Christiano, Eichenbaum, and Rebelo 2011 or Erceg and Linde 2013).

A corollary of these model-based results is that fiscal policy should be less effective at reducing inflation once the economy enters a high-inflation regime. First, the effective lower bound stops binding once central banks start raising policy rates, as they are bound to do in the face of high and persistent inflation. Second, even in a monetary union, if inflation pressures are experienced by all members, the (common) monetary policy will also be unconstrained. Indeed, recent papers confirm this finding: Chen and others (2022) find that monetary policy is more potent than fiscal policy at reducing inflation for advanced economies.[8] Beyer and others (forthcoming) consider fiscal and monetary interactions in the euro area. Consistent with this argument—and with our own model-based findings—their analysis delivers a relatively modest impact of fiscal consolidation on inflation. Specifically, according to their results, a 1 percent of GDP fiscal consolidation in both 2023 and 2024 reduces core inflation by a modest 0.15–0.25 percentage point in the first two years relative to the baseline.

Third, recent theoretical literature explores the source of nonlinearities in the Phillips curve, that is, why we could have both a weak inflation response to the output gap when there is economic slack and a very sharp response once the economy is running hot. Benigno and Eggertsson (2023) present a search-and-matching new Keynesian model where the aggregate supply curve becomes much steeper once the labor market is tight. In their model, the aggregate Phillips curve steepens because wage inflation surges as firms compete for increasingly scarce workers.[9] But such nonlinearities can also emerge naturally from input-output models with sectoral supply shocks, as analyzed for instance by Baqaee and Farhi (2022). In these models, sectoral bottlenecks or frictions lead to surges in the prices of some intermediate goods. In the presence of nominal rigidities, these sectoral price increases are not offset by decreases in other sectors, resulting in price inflation,

8 For emerging market economies, that paper argues that fiscal consolidation could also lower risk premia, thus triggering an appreciation of the domestic currency that would support a faster disinflation. In general, fiscal and monetary policies have opposite effects on the real exchange rate and on the fiscal position.

9 See also Harding, Lindé, and Trabandt (2023) for a model with a nonlinear Phillips curve that steepens when inflationary pressures rise.

even if wage inflation remains muted. Importantly, these approaches suggest that the impact of (conventional) fiscal consolidation is also state dependent: on the steep part of the aggregate supply curve, fiscal policy may have an outsized effect on inflation, even if the impact on output remains small (that is, there is a small fiscal multiplier as conventionally measured by the equilibrium impact of fiscal policy on output, as opposed to the size of the shift in aggregate demand). This is precisely the finding in Gourinchas and others (2021). That paper shows that the large transfer policies implemented during the COVID-19 pandemic had a small impact on output (a fiscal multiplier of only 0.06) but a large impact on prices. Reversing the argument, this line of models suggests that fiscal consolidation may have an important role to play when the economy is overheating and could help lower headline and core inflation at minimal cost in terms of lost output.

Finally, there is a renewed policy debate on the possible benefits of price controls under high inflation. According to its proponents (including, for example, Weber and Wasner 2023), the current inflationary episode is driven by increased corporate pricing power and should therefore be tackled via price controls that would contain “corporate greed.” Yet the microeconomic evidence so far on increased market power is scant: increased corporate margins could simply reflect a surge in demand pressing against an inelastic supply. In other words, if prices need to rise to clear markets, this can cause corporate margins to increase, at least initially, and not the other way around.[10] We should be clear, however, that our paper does not directly speak to this debate, nor does it need to. From our perspective, what matters is that UFP measures reduce energy prices for consumers under certain conditions, and this can alter inflation dynamics. Such measures can involve either price caps (which reduce corporate profits) or subsidies (which may increase them insofar as subsidies stimulate demand).

The rest of the paper is structured as follows. Section 2 begins with a brief review of inflation and of monetary and fiscal policy developments in the euro area and the United States, with a special emphasis on the UFP measures. Section 3 then reviews the standard arguments for using fiscal policy alongside monetary policy in a high-inflation environment. It also uses model simulations to compare the effects of unconventional and conventional fiscal policy.

Sections 4 and 5 present the core of our analysis. Section 4 provides an empirical assessment of the drivers of inflation in the euro area and the United States, thus allowing for significant nonlinearities. Section 5 then uses the empirical model to consider the effect of UFP measures. Section 6 concludes.

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[10] The classic arguments against price controls as a tool to fight inflation are well understood. By preventing relative price adjustments, they lead to misallocation. Further, if they do not address the underlying supply-demand imbalance, they will be evaded or will require costly administration. The empirical evidence for the effectiveness of price controls in peace time is also limited. The Nixon administration price controls of the 1970s are widely viewed as a failure (Rockoff 1981). Even in the context of a war economy, they can be highly distortive (Keynes 1940).

2 Setting the stage: euro area and US inflation dynamics, monetary policy, and fiscal policy

This section presents some broad stylized facts on the surge in inflation in the euro area and the United States. It distinguishes between core inflation dynamics and headline-inflation shocks. It also discusses the response of monetary policy and its interaction with fiscal policy. We provide an overview of the composition of fiscal energy support measures in the euro area, in particular the extent of UFP measures in the form of price caps, tax cuts, transfers, and similar measures aimed at suppressing the energy price increase for consumers.

2.1 Headline and core inflation

Two main differences distinguish the dynamics of inflation surge on each side of the Atlantic. First, inflation started to rise earlier in the United States. Second, it was driven by energy price inflation less than in the euro area. Headline consumer price index inflation started to rise in the United States already in early 2021 and quickly more than doubled: from 1.4 percent in January at a 12-month rate to over 5 percent by June and nearly 9 percent at its peak in June 2022 (Chart 2). In the euro area, headline Harmonized Index of Consumer Prices (HICP) inflation did not surpass 5 percent at a 12-month rate until December 2021, before peaking at more than 10.5 percent in October 2022.

We decompose headline inflation into core inflation and deviations of headline from core. Our primary measure of core inflation for both the euro area and the United States is weighted median inflation, which strips out the effects of unusually large price changes in certain industries. This variable isolates the core component of inflation more effectively than a more traditional core measure that excludes food and energy prices when, as during the COVID-19 era, volatile shocks come from sectors other than food and energy.

With core inflation measured by weighted median inflation, we define “headline-inflation shocks” as deviations of headline from core. Core inflation and headline shocks sum to headline inflation.

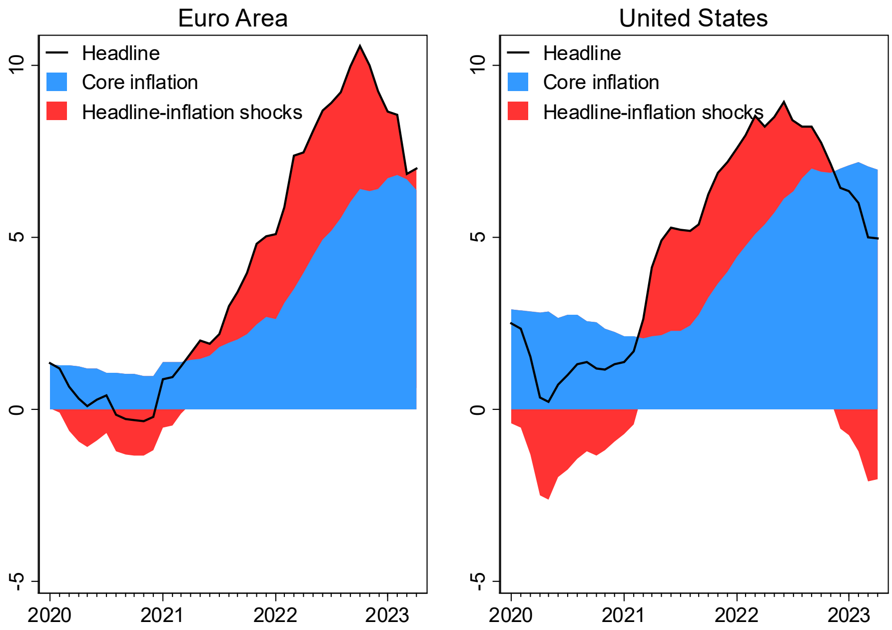
The composition of euro area headline inflation contrasts with that of the United States. In both cases, the initial rise in inflation, starting early 2021 in the United States and in late 2021 in the euro area, was driven by headline shocks. However, since 2022, headline shocks comprise a larger share of inflation in the euro area than in the United States, where, since December 2022, headline is more than entirely explained by core.

Energy price inflation has driven the run-up in headline-inflation shocks in the euro area in the second half of 2021 and in 2022 (Chart 3). The 12-month average of headline-inflation shocks peaked at 4.2 percentage points in October 2022. A simple regression of monthly headline-inflation shocks on monthly energy price inflation (minus median inflation) explains the entire run-up and the bulk of the subsequent decline in headline-inflation shocks.[11] In the United States, energy price inflation also plays a sizeable role in explaining headline-inflation shocks during the COVID-19 era (as documented by Ball, Leigh, and Mishra 2022) but has been running at a lower level. The contribution of energy inflation to headline-inflation shocks was negative in early 2023.

Chart 2

Euro area and US inflation: headline, core, and headline-inflation shocks

(12-month rate; percent)



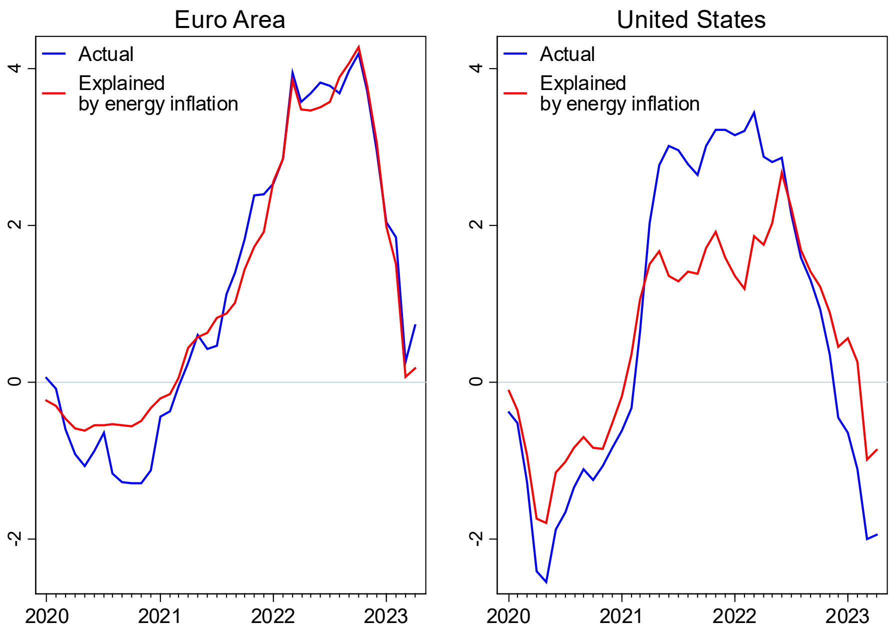
Sources: Bureau of Labor Statistics, Eurostat, Federal Reserve Bank of Cleveland, and authors' calculations.
Notes: "Headline-inflation shocks" denotes headline inflation in deviation from core (weighted median) inflation.

[11] The bivariate relation between headline-inflation shocks and energy relative price inflation has a tight fit with an R-squared of 72 percent. The fit is unchanged when controlling for two additional variables also considered by Ball, Leigh, and Mishra (2022): relative food price inflation and a measure of backlogs of goods and services orders from IHS Markit Economics, which we believe reflects the widely-reported problems with supply chains. The estimated coefficients for these additional controls are statistically insignificant, while that on energy relative price inflation remains unchanged and highly statistically significant.

Chart 3

Explaining headline-inflation shocks: the role of energy inflation

(12-month average; percentage points)



Sources: Bureau of Labor Statistics, Eurostat, Federal Reserve Bank of Cleveland, and authors' calculations.
Notes: "Headline-inflation shocks" denotes headline inflation minus core (weighted median) inflation. For the euro area, "energy inflation" denotes HICP Electricity, Gas and Other Fuels inflation minus core inflation. For the United States, "energy inflation" denotes CPI Energy inflation minus core inflation. "Explained by energy" denotes fitted values from regression of monthly annualized headline-inflation shocks on monthly annualized energy inflation minus median inflation using monthly data for 2020-23. Figure reports 12-month average of actual and fitted values of headline-inflation shocks.

This transatlantic difference in the role of energy prices in overall inflation is primarily due to the difference in the exposure to the energy shock resulting from the war in Ukraine. Furthermore, although the terms of trade shock for the United States, calculated as the change in costs for net energy imports, was close to zero, it was estimated to range between 2 and 6 percent of GDP for euro area countries heavily reliant on Russian gas imports (Albrizio and others 2022; di Bella and others 2022).

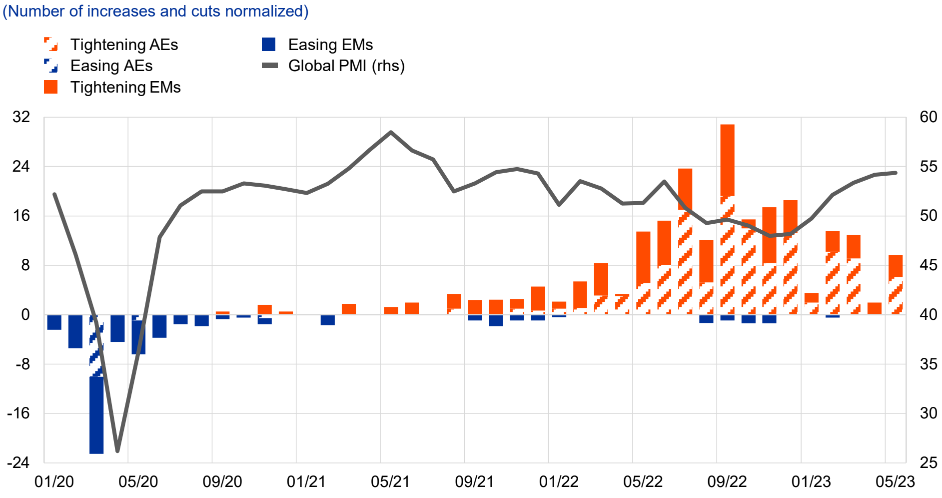
Overall, these results reaffirm the importance of energy price shocks in the euro area, as also documented elsewhere (see ECB 2023, for example).

2.2 Monetary policy

Central banks across the world have been engaged in a large and synchronized policy-tightening cycle (Chart 4). In September 2022 alone, more than 19 policy rate hikes were implemented by advanced economies, and more than 11 were implemented by emerging market central banks. The magnitude and synchronicity of monetary tightening across advanced and emerging market economies is unprecedented. Yet, although economic activity has slowed, it has also shown some resilience, indicating stronger than expected aggregate demand. Until recently, market expectations were for further tightening in the United States and the euro area.

Chart 4

Synchronous monetary tightening and growth slowdown



Sources: Bloomberg Finance L.P., and IMF staff calculations.
Note: Policy rate changes are normalized by size of country-specific average hike or cut. “AEs” denotes advanced economies. “EMs” denotes emerging market economies. PMI denotes Purchasing Managers' Index.

Some commentators argued at the onset of the inflation surge that a monetary tightening is not the right policy response to rising energy prices. However, persistently high headline inflation, even if driven by shocks to energy and food prices, can over time de-anchor inflation expectation and feed back into actual inflation through price and wage setting. Monetary policy has an important role to play in keeping expectations of medium to long-term inflation firmly anchored, irrespective of the initial source of price increases.

As price pressures broadened and inflation became increasingly driven by underlying core inflation, especially in the United States, monetary policy became even more critical in cooling down aggregate demand and bringing down inflation. Moreover, as inflation broadened, inflation expectations, even longer-term ones, started to drift upward in both the United States and euro area (Chart 11) and increased the urgency for central banks to act to prevent expectations from becoming more unmoored.

After its initial rate hike by 25 basis points in March 2022, the Federal Reserve raised rates by 50 basis points in May and by 75 basis points in each of the subsequent five increases from June to November 2022. It slowed the pace of increase to 50 basis points in December 2022 and to 25 basis points from February to May, before pausing in June 2023, as headline inflation showed signs of declining. The ECB increased its policy rate by 50 basis points (from negative to zero) in July 2022, moving to 75 basis point hikes in September and October, before slowing to 50 basis point increases between December and March 2023 and to 25 basis points in its latest hike in May and June. Overall, the Federal Reserve has raised the federal funds rate from close to zero to more than 5 percent over the course of the past 15 months, and the ECB has raised its deposit facility rate from a negative level to 3.5 percent. In both cases, these are policy rate levels unseen over the past decade and a half.

2.3 Unconventional fiscal policy measures

Although the ECB tightened monetary policy, European countries also responded strongly with fiscal measures designed to help households and businesses weather the energy crisis. These measures were designed to provide support but often with the secondary objective to directly reduce the impact of headline-inflation shocks and the subsequent pass-through into core inflation (Altomare and Giavazzi 2023). As mentioned, we call such fiscally expansionary measures designed in part to lower inflation “unconventional fiscal policy” measures.

These fiscal measures have been costly. The estimated size of the overall energy fiscal support aggregating over all measures to provide relief to households and businesses is about 1.3 percent of euro area GDP in 2022. The projected spending for 2023 is 2.0 percent of GDP. The total set of measures can be broken down into several elements. First, they include fiscal support targeted at households and small and medium-sized enterprises (SMEs) at 2.7 percent of GDP. Second, support measures to firms include tax credits for energy-intensive companies in Germany and Italy or subsidies to energy-intensive sectors in Spain. Fiscal costs budgeted for energy support to firms amounted to 0.6 percent of GDP in the euro area.[12]

Chart 5 breaks down fiscal spending in support of households and SMEs in each country into price-suppressing versus non–price-suppressing measures and targeted versus untargeted measures. Price-suppressing measures are those that suppress energy prices and include caps on energy retail prices or cuts to excise duties or value-added tax rates on energy products. We also classify block tariffs, which offer a discounted tariff for a limited consumption volume, as price suppressing because they lower the marginal price below a certain consumption threshold. Most countries have also adopted measures that are not price suppressing but largely untargeted, such as energy vouchers, lump-sum income tax credits, or cash transfers.

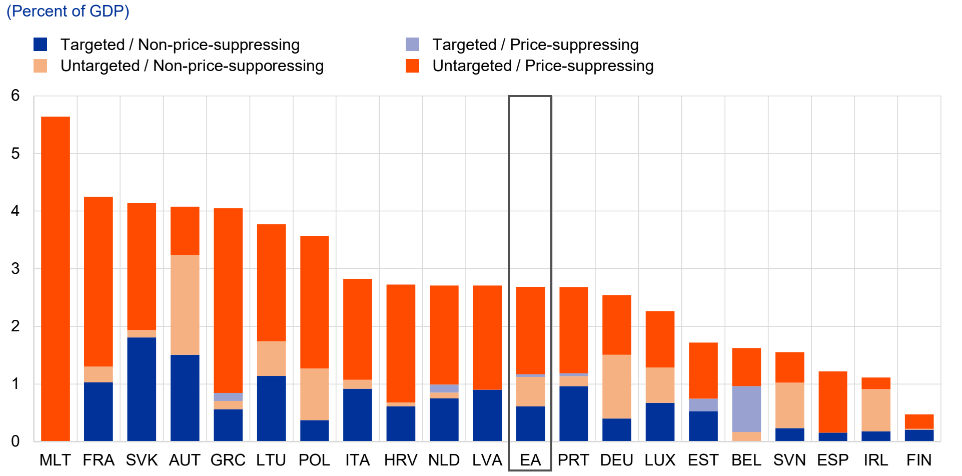
France, Greece, and the Netherlands enacted extensive price controls or reduced value-added tax or other energy-specific tax rates, whereas others relied more on transfers (including Germany and Ireland). By and large, measures were untargeted as authorities prioritized speed and reach. Overall, price-suppressing and untargeted measures account for about 45 percent of fiscal outlays for households and SMEs in European Union (EU) countries (Arregui and others 2022). Targeted measures (whether price suppressing or not) accounted for only about 24 percent of total fiscal measures in the euro area. Examples of targeted measures include expansions of existing social assistance programs and progressive or taxable transfers.

[12] For some countries, the total size is net of windfall profit taxes collected from firms (for example, energy producers in France). Note that some economies also introduced energy support measures in 2021.

Given the high aggregate fiscal costs of the energy support measures and their wide variation across the euro area, a natural question arises as to whether their distribution across countries is reflective of the underlying needs. How does the size of the fiscal measures correlate with country exposures to the energy shock and to inflation outcomes?

Chart 5

Fiscal costs of household and SME energy measures in 2022 and 2023



Sources: Arregui and others (2022).
Note: Measures include those budgeted for support to households and small and medium-sized enterprises (SMEs) but not those for support to large firms. Figure indicates economies based on International Organization for Standardization (ISO) codes. EA indicates euro area.

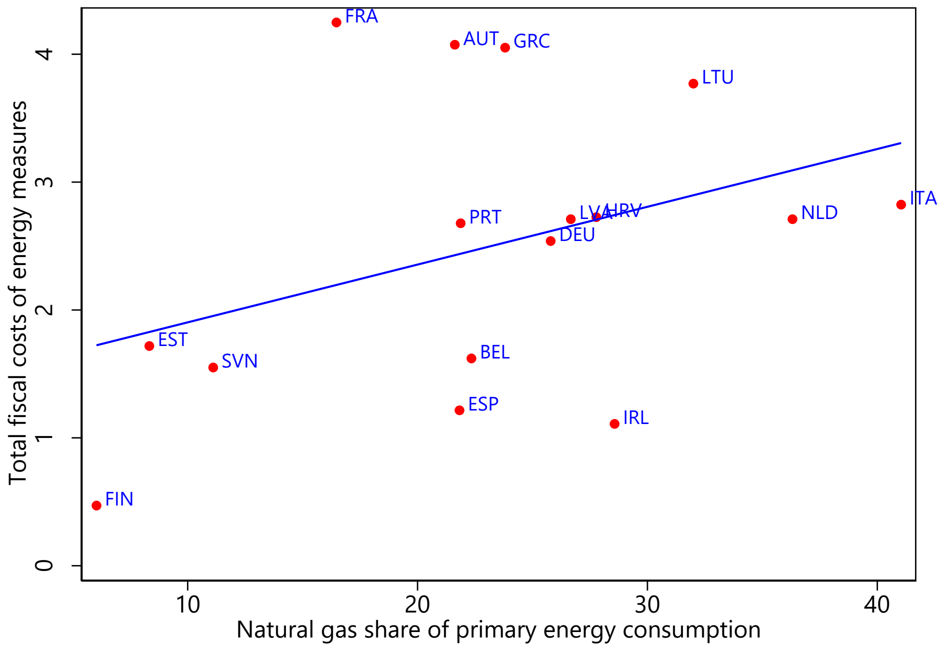
Chart 6 reports the correlation between the share of natural gas in primary energy consumption—a measure of initial exposure to the 2022 energy price shock—and the size of these unconventional fiscal packages, that is, the size of total energy support measures as well as the price-suppressing components. Both total and untargeted price-suppressing measures increase weakly with initial exposure.[13]

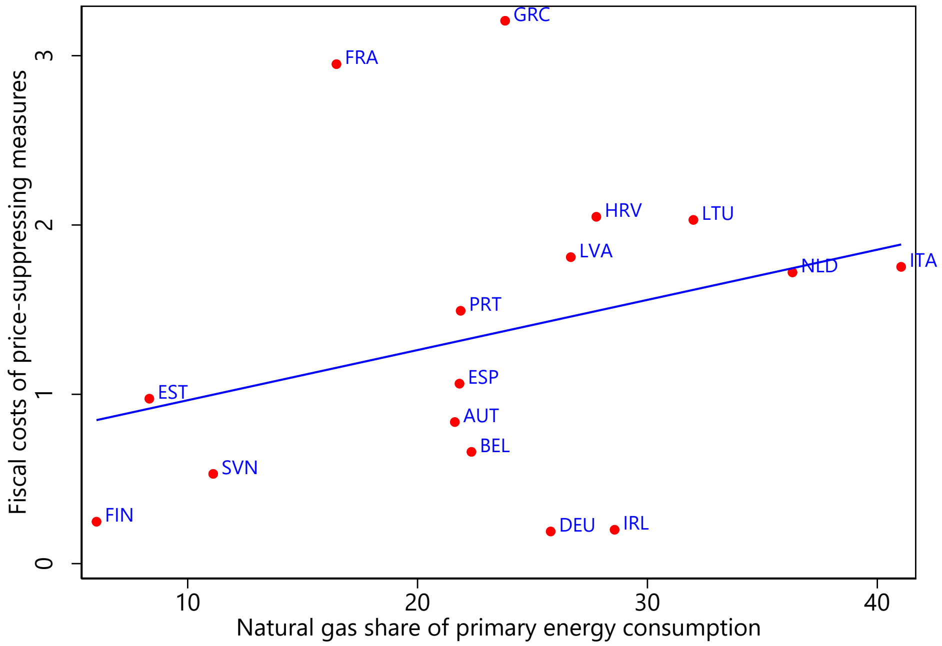
[13] Both France and Greece appear as outliers, although in the case of France, reliance on imported electricity and gas was much higher in 2022 because of maintenance problems for a large share of its nuclear power plants.

Chart 6

Energy shock exposure vs. fiscal cost of household energy support measures

(Percent; percent of GDP)





Sources: Arregui and others (2022), BP Statistical Review 2022, and authors' calculations.
Note: Share of primary energy consumption refers to 2021 and fiscal costs (in percent of GDP) are those budgeted for 2022-2023. Price-suppressing measures are untargeted. Figure indicates economies based on International Organization for Standardization (ISO) codes.

The raw correlation between the fiscal costs of these measures and the variation in inflation is weak across countries, although stronger among larger euro area countries. This is perhaps unsurprising as countries that face more exposure to the energy price shock are likely to experience more inflation but also implement more measures to mitigate its impact.

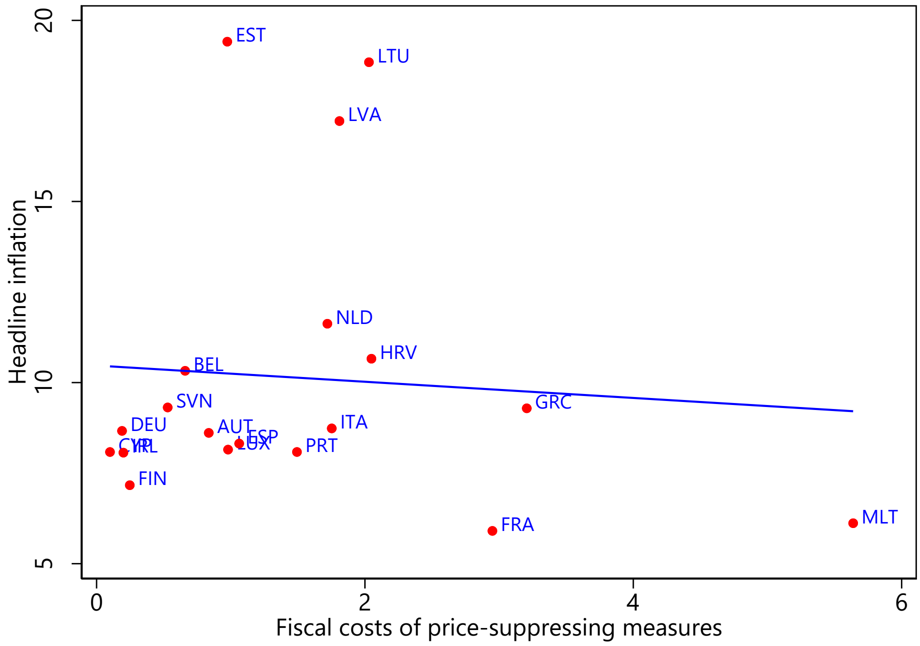
Also, countries that spent more on fiscal price measures do not see more firmly anchored inflation expectation (Chart 7). This finding holds across measures of inflation expectation (Consensus Economics surveys and household surveys available for fewer countries) as well as for three- and five-year ahead inflation expectations.

Chart 7

Headline inflation and inflation expectations vs. fiscal cost of energy measures

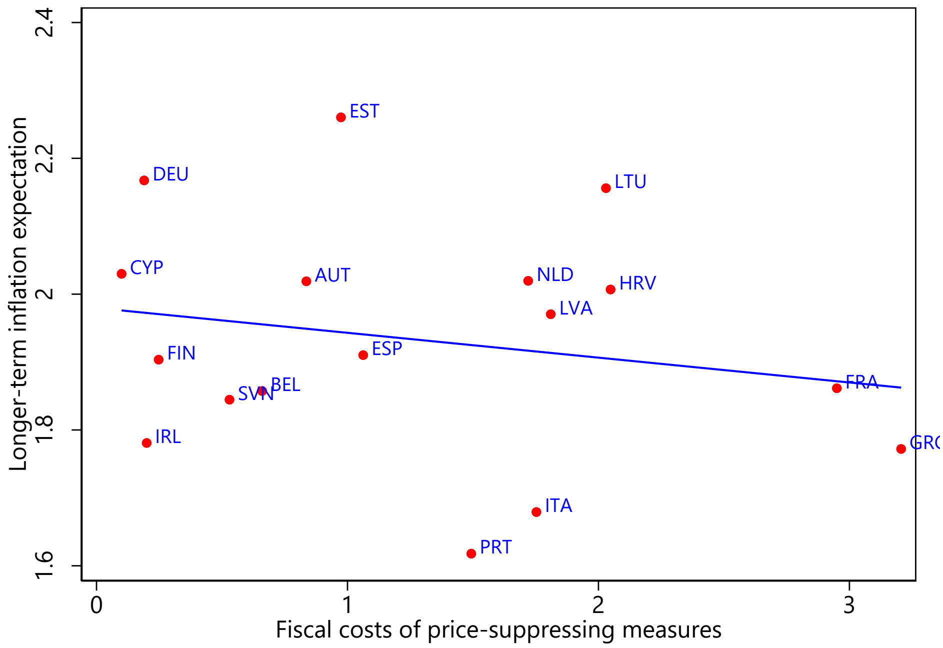
a) Headline inflation in 2022 vs. fiscal cost of energy measures

(Percent of GDP; percent)



b) Longer-term inflation expectations in 2022 vs. fiscal cost of energy measures

(Percent of GDP; percent)



Sources: Arregui and others (2022), Consensus Economics, Haver Analytics, and authors' calculations.
Note: Headline inflation is the average of 12-month HICP inflation over 2022. Longer-term expectations indicate monthly Consensus Economics five-year ahead forecasts, averaged over 2022. Fiscal costs (in percent of GDP) are those budgeted for 2022-2023 and include price-suppressing untargeted measures. Figure indicates economies based on International Organization for Standardization (ISO) codes.

However, these associations are plagued by endogeneity and cannot indicate the efficacy of the measures on influencing headline inflation or inflation expectations. To reach an assessment, we will use both a semi-structural model and an empirical analysis as follows.

3 Fiscal policy in times of high inflation: a model-based approach

We begin with a semi-structural multi-region model assessment of the effectiveness of the UFP measures using IMF's FSGM for the euro area as a whole.[14] FSGM incorporates countries' commodities production, consumption, and trade and includes hand-to-mouth as well as Ricardian households. It also contains a range of fiscal policy tools that allow us to capture the effects of the range of fiscal measures implemented in the euro area.

The simulations are first calibrated to capture the significant rise in energy prices. We create an energy index, which is an average of oil and natural gas prices weighted by their share in end-use energy consumption.[15] The shares vary according to each country's or region's energy use mix. Futures energy prices use the energy price assumptions underlying the projections in the April 2023 IMF World Economic Outlook. The model was expanded to include indirect effects of energy prices on core inflation via supply chain effects, which we calibrate from estimates in the literature.[16]

3.1 Unconventional versus conventional fiscal policies

We then feed into the model the discretionary fiscal measures announced in response to the energy shock (see Section 2.3 for the overview of measures across countries and types). FSGM's richness of fiscal instruments allows for a differentiated assessment of the impact of the fiscal measures on inflation and activity. For instance, transfers targeted toward liquidity-constrained households have a larger effect on activity and inflation than do untargeted transfers or tax cuts. Measures that reduce energy prices directly, including price caps and changes in energy taxes, are implemented using energy subsidies and taxes in the model. By directly and temporarily affecting local consumers' energy prices, these fiscal measures have the largest impact on headline and core consumer inflation. Moreover, these measures temporarily boost activity by increasing real disposable income, with the effect amplified by the presence of liquidity-constrained households.

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[14] For details on FSGM, see Andrle and others (2015).

[15] Pass-through of energy shocks to inflation is fast in the model because it is calibrated to oil price shocks. The pass-through of natural gas prices to consumer prices, however, is typically more lagged. We capture this effect by taking a four-quarter average of natural gas prices and contemporary oil prices in the energy index.

[16] See ECB (2010) where a 10 percent temporary energy price shock increases inflation by 0.35 percentage point and raises core inflation by 0.15 percentage point.

The top panel of Chart 8 shows the effect of the UFP measures. The blue line reports the counterfactual path in the absence of measures for inflation (panel a) and output (panel b). The red line reports the paths when UFP measures are implemented. The results are reported for the euro area as well as for France, Germany, and Italy separately. Fiscal policy is estimated to stabilize inflation by lowering it during the energy price shock in 2022, and by raising it in 2024 when the energy price shock unwinds. Without the UFP measures, inflation overshoots the no-shock baseline by more in 2022 and undershoots it by more in 2024.[17] The effects, like the energy price shock, are temporary. The measures also stabilize output: supporting it in 2022 (especially in France) and moderating it in 2024.

Chart 9 reports the difference between the two lines of Chart 8; that is, it reports the net effect of the UFP measures on inflation and output. According to the model, fiscal policy lowers inflation in the euro area by 0.9 percentage point in 2022 and by 0.5 percentage point in 2023, relative to a counterfactual with the same energy shock but without the UFP measures. This result is consistent with a recent ECB study, which reached a similar result using a detailed bottom-up aggregation of country-specific estimates (ECB 2023). The non–price-suppressing measures are incorporated in our estimates. They do not directly affect energy prices but do boost demand (including for energy), and hence inflation, thus counteracting the effects of measures that directly reduce energy prices. In the model, the price of energy is endogenous to aggregate activity. As the fiscal measures support aggregate demand, they keep energy prices higher, muting some of the effect of the UFP measures. Overall, about one-third of the negative impact on headline inflation is from reduced core inflation, as supply chain effects that lower firms' costs outweigh the demand boost to core inflation from other fiscal measures.

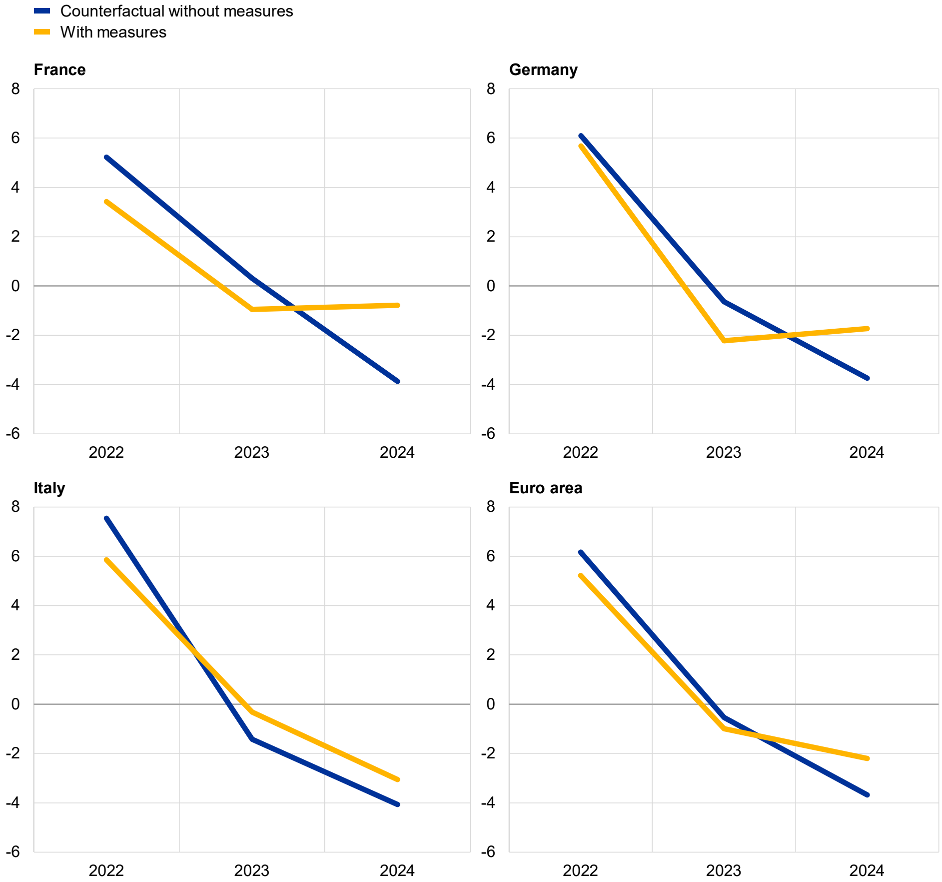
[17] The marginal effect of the UFP measures is marginally higher if we assume no change in monetary policy.

Chart 8

Effect of energy price shocks on headline inflation and real GDP with and without deficit-financed energy price measures

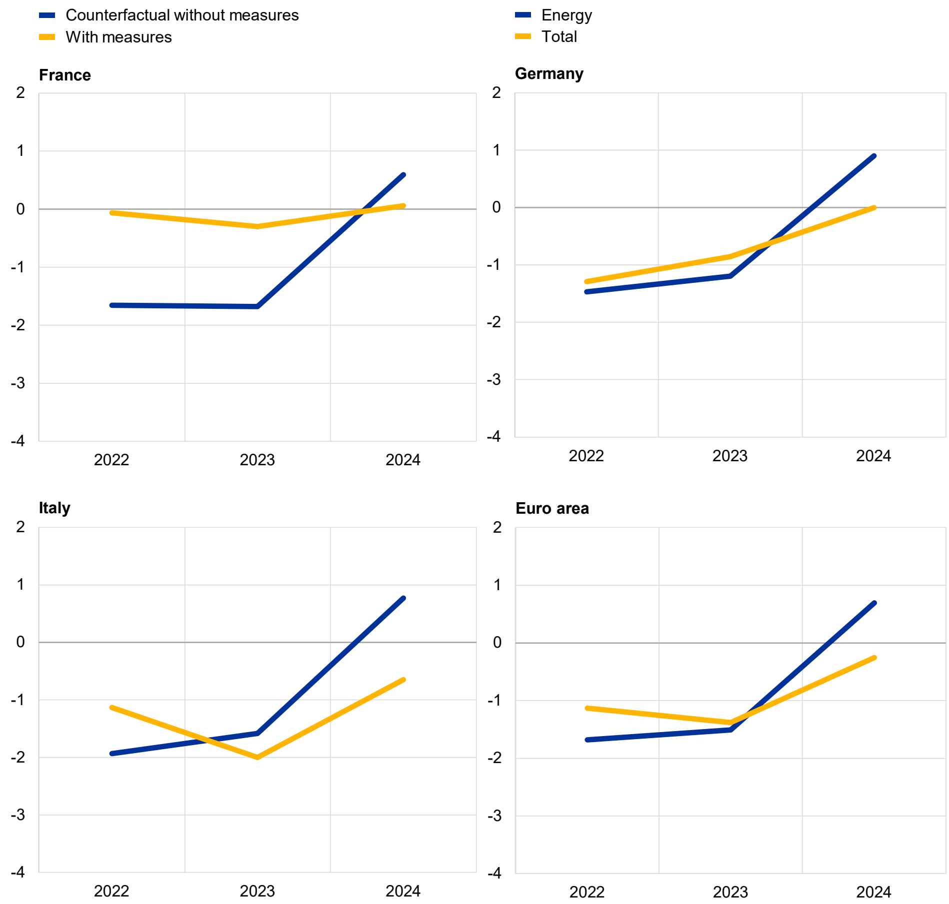
a) Headline inflation

(Deviation from no-shock baseline; percentage points)



b) Real GDP level

(Deviation from no-shock baseline; percentage points)



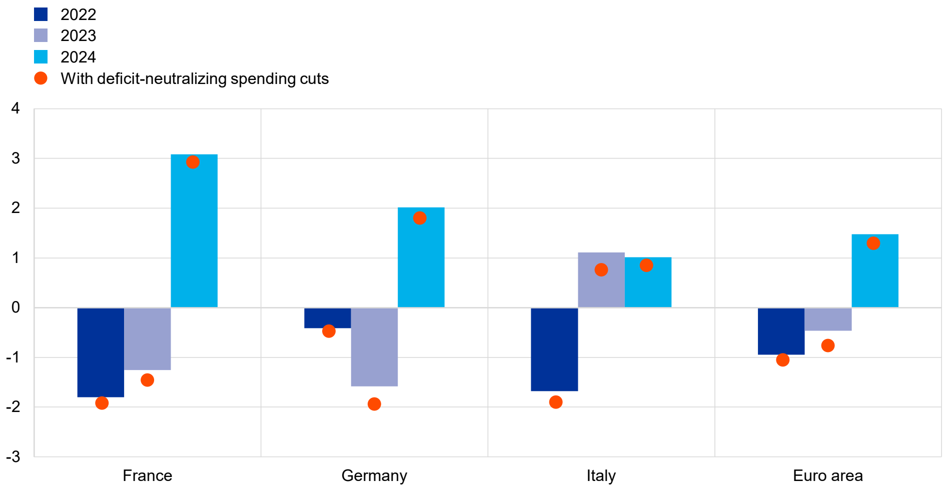
Notes: Figure reports simulations based on the IMF Flexible System of Global Models.

Chart 9

Marginal effect of deficit-financed energy price measures on headline inflation and real GDP level

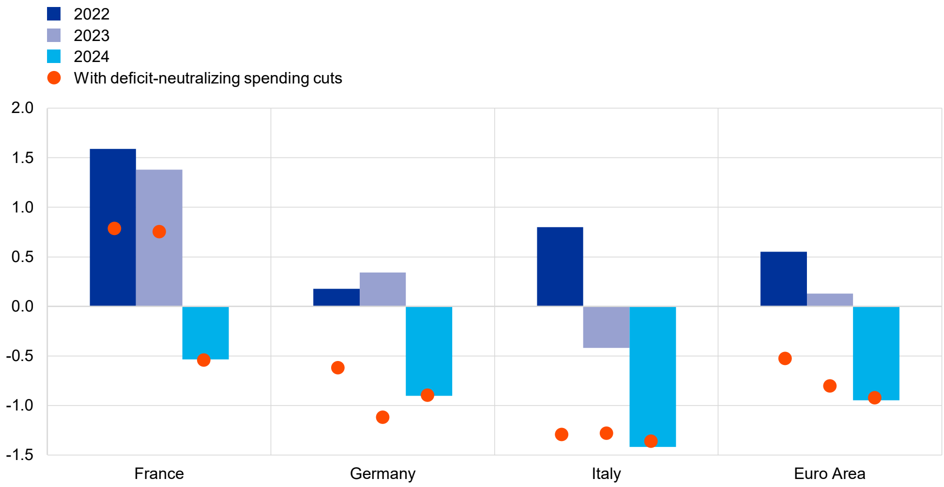
a) Headline inflation

(Deviation from counterfactual path without energy measures; percentage points)



b) Real GDP level

(Deviation from counterfactual path without energy measures; percentage points)



Notes: Figure reports simulations based on the IMF Flexible System of Global Models.

The negative impact on inflation is only temporary, however. As energy subsidies are withdrawn in 2024, the UFP measures raise inflation by 1.5 percentage points. The overall cumulated impact of UFP measures on the price level is slightly positive (at about 0.1 percentage point). Therefore, the direct effect of the energy price measures is to smooth the path of the overall price level response rather than to reduce it, while other fiscal measures that to support real incomes boost demand and the price level. Overall, the energy measures smooth the path of inflation: reducing the overshoot in 2022-23 and preventing an undershoot in 2024. They also stabilize output.[18]

[18] Absolute deviations from the no-shock baseline are 20 percent smaller for inflation and 30 percent smaller for output with the UFP measures.

We consider three extensions to these baseline projections to illustrate some of the mechanisms that underly the results. First, we assess how the inflation response differs if the fiscal measures are budget neutral. Most of the UFP measures have been financed through additional borrowing, which, as mentioned, partly offsets their inflation-reducing effects. Chart 9 (red dots) shows that financing the measures through reduced government spending (implemented by cutting government consumption) instead of borrowing complements rather than mitigates their effect on inflation, thus increasing the negative impact of fiscal policy on inflation from –0.9 percentage point to –1.0 percentage point in 2022 and from –0.5 percentage point to –0.8 percentage point in 2023. The level of output, however, is significantly lower under that scenario, by about 0.9 percent in 2023 compared with the no-shock baseline (panel b).

The comparison of the two scenarios (with and without deficit-neutralizing spending cuts) also provides a direct estimate of the impact of a conventional fiscal consolidation on output and inflation. According to our calibrated results, the deficit-neutralizing cuts to government consumption, which amount to 1.3 percent of GDP in 2022 and a further 2.0 percent of GDP in 2023, reduce the output level by 1.1 percent in 2022 and 0.9 percent in 2023. Their effect on inflation is –0.1 percentage point in 2022 and –0.3 percentage point in 2023.[19] Achieving a reduction in inflation in 2022 comparable with that achieved with UFP but through conventional fiscal policy tightening would have required a significantly larger fiscal tightening with correspondingly larger output losses.

The finding that a sizeable conventional fiscal policy tightening (3.3 percent of GDP within two years) has only a modest effect on inflation is in line with other estimates in the literature (Chen and others 2022, for example). Hence, although the textbook intuition is correct that fiscal tightening can support monetary policy in reducing inflation, the magnitudes of the effects (even for a sizeable fiscal adjustment) appear to be small. At the same time, fiscal tightening can support countries' efforts to rebuild budgetary space for maneuver and to ensure public debt sustainability—an issue that goes beyond the scope of the analysis in this paper.

Next, we consider how the elasticity of energy supply affects the impact of energy subsidies on inflation (Annex Chart A1). In FSGM, the supply of energy is relatively inelastic in the near term and limits the impact of energy subsidies on consumer prices. If we assume that the supply of energy is twice as elastic, the impact of fiscal energy subsidies on inflation is modestly greater: it increases (in absolute value) from –0.9 percentage point in 2022 to –1.0 percentage point. Finally, combining the estimated size of the fiscal expansion (1.3 percent of GDP) and estimates of supply, demand, and income elasticities from the literature, we can further gauge the offsetting impact of deficit-financed UFP on energy prices via higher demand for energy. With a boost to household income of 1.3 percent of GDP and assuming income and price elasticities for natural gas from the literature, we obtain an offsetting effect of about 1 percent on energy prices via the demand channel within a year, which would correspond to a rise in overall consumer prices of less than 0.1

19 Additional FSGM simulations based on deficit reduction via tax increases on average yield smaller effects on inflation.

percent.[20] These calculations further support the conclusion that, even after allowing for offsetting price effects from higher demand for energy, the UFP policies reduced consumer prices.

The main takeaways from this section are as follows. First, UFP measures can reallocate inflation over time, which helps smooth out a large and temporary energy price shock. The cumulated reduction in inflation (the effect on the price level) is around 1.4 percent for the euro area in 2022–23, followed by a more than offsetting increase in inflation in 2024. Second, the inflation-reducing impact of a conventional fiscal tightening is modest in the model.

However, as highlighted previously, a potential drawback of the analysis is that the model assumes a linear Phillips curve, as is standard in most large-scale New Keynesian models used at policy institutions. Such nonlinearities have proved important to understand recent inflation dynamics. Hence, the impact of the shocks on inflation—and the impact of the fiscal policy measures on inflation—could be too low in settings that abstract from these relevant features.

This tells us that a more direct assessment of the impact of these measures is needed, one that considers the nonlinearities in the Phillips curve.

4 Drivers of euro area and US inflation: the role of nonlinearities

4.1 Explaining core inflation in the euro area and in the United States

To understand the evolution of core inflation in the euro area and compare it with that of the United States, we use a Phillips curve framework that focuses on the role of three variables: expected inflation, labor market tightness, and headline-inflation shocks. We allow for nonlinearities in the effects of labor market tightness and of past headline-inflation shocks on core. In our baseline specification for the euro area, we measure inflation expectations based on five-year-ahead forecasts from the ECB's Survey of Professional Forecasters; labor market tightness based on the unemployment gap, or deviations of unemployment from the natural rate of unemployment, as a conventional measure of labor market tightness; and past headline-inflation shocks by the average deviation of headline from median inflation over the current and previous 11 months. We compare these estimates with those obtained for the United States based on the same specification with one notable difference: we measure US labor market tightness based on the ratio of job vacancies to unemployed (V/U) over the current and previous 11 months to address

[20] We consider natural gas for this simple back of the envelope calculation. The long-term income elasticity of demand is estimated around 1.5 (Burke and Yang, 2016). With a long-run price elasticity of supply and demand of 0.55 and -0.9 respectively (Fally and Sayre 2018), the resulting price change would be –1.5/(0.9+0.55) = –1.03 percent in response to a reduction of income of 1% of GDP, which corresponds to 0.06 ppt increase in headline inflation using the weight of electricity, gas and solid fuels in the HICP index (around 6 percent). The short-run incidence would be even lower as the income elasticity of demand is close to zero in the short-run (Burke and Yang, 2016).

the issue—which we discuss as follows—of a shift in the Beveridge curve. Overall, our empirical approach follows closely that in the Ball, Leigh and Mishra (2022) study of US inflation.

4.1.1 The role of labor market tightness

For the euro area, our measure of labor market tightness is the gap between the unemployment rate and its natural rate. To measure the natural rate, we use IMF staff estimates included in the April 2023 World Economic Outlook report. The euro area unemployment rate has averaged 6.7 percent since the start of 2022, well below its historical average (9.5 percent from 1999–2019) and below the IMF staff estimate of the natural rate of 7.0 percent (estimate for 2022), indicating a tight labor market. To allow for the possibility of nonlinearities in the unemployment-inflation relation, we consider both quadratic and cubic functions of the unemployment gap. To capture lags in the effects of labor market tightness on inflation, we follow past studies to compare the current level of the inflation gap to an average of labor market tightness over the current and previous 11 months.

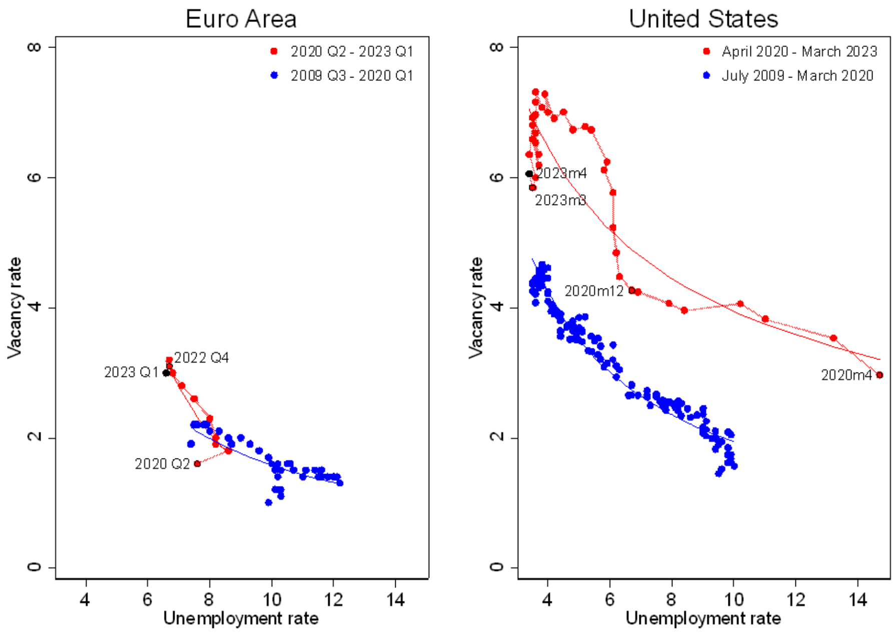
For the United States, however, we follow recent studies and measure labor market tightness based on the ratio of V/U. This approach is preferable to the unemployment gap for the COVID-19 period in light of the substantial shift in the US Beveridge curve relation between vacancies and unemployment illustrated in Chart 10. As Ball, Leigh and Mishra (2022) explain, this Beveridge curve shift implies a corresponding upward shift in the conventional unemployment-based Phillips curve, with higher inflation for any given level of unemployment. Using the conventional specification in this context would thus fail to adequately account for the rise in inflation due to this shock.[21] As Chart 10 indicates, no such shift has occurred in the Beveridge curve for the euro area. In this case, the conventional unemployment-based specification therefore remains appropriate.

21 Ball, Leigh, and Mishra (2022) find that the conventional unemployment-based Phillips curve relation results in large, positive, and unexplained residuals when fitted to the COVID-19 period for the United States.

Chart 10

Beveridge curves

(Percent of filled and unfiled vacancies; percent of labor force)



Sources: Eurostat, US Bureau of Labor Statistics, and authors' calculations.
Notes: Figure reports log-linear curves fitted to each period. For the United States, July 2009 – March 2020 covers the pre-COVID-19 expansion and the first month of the COVID-19 era, based on NBER business cycle dates. For euro area, periods displayed correspondingly.

4.1.2 The role of pass-through from headline-inflation shocks

Pass-through from past headline shocks, such as energy price increases, to core inflation can occur through many channels. It can occur through wage adjustment (Blanchard 2022) and through production chains where increases in the prices of products in some industries have implications for the cost of inputs in other industries.

To capture such effects over time, we include in our specification for both the euro area and the United States the 12-month average of headline-inflation shocks. To allow for the notion that larger headline shocks are more salient to wage and price setters than small ones, and that positive headline shocks may have different effects than negative ones, we allow for nonlinearities. Ball and Mankiw (1994) theorize that shocks have asymmetric effects in the presence of menu costs and trend inflation. Literature also exists on the asymmetric effects of crude oil price fluctuations on retail fuel prices ("rockets and feathers").[22] We explore the possibility of nonlinearities by considering both quadratic and cubic functions. For the euro area, where headline

[22] See, for example, Borenstein, Cameron, and Gilbert (1997) and Owyang and Vermann (2014).

shocks have been especially large, the effect of such pass-through effects, and potentially nonlinearities, are highly relevant.

4.1.3 The role of inflation expectations

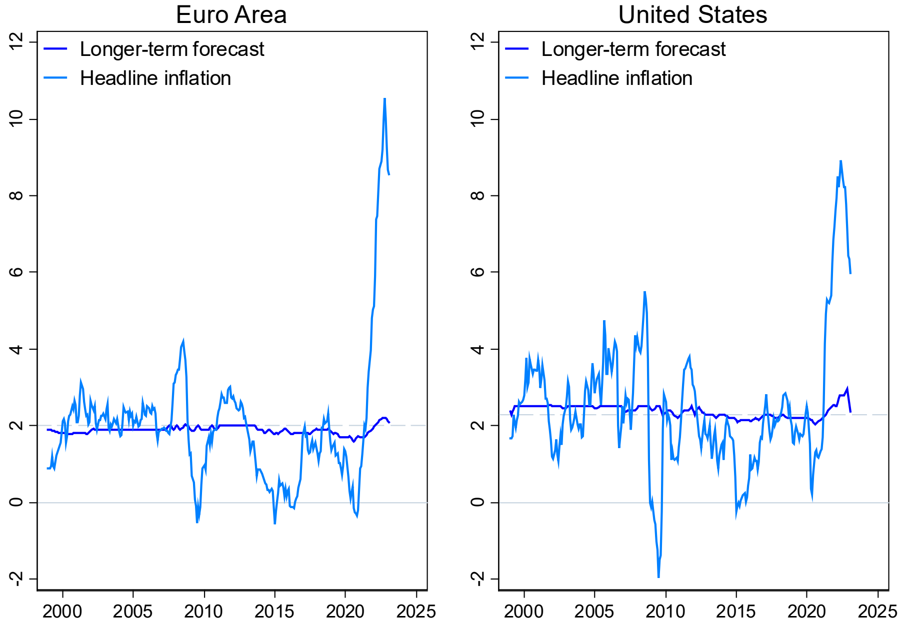
We account for the standard notion that inflation depends on expected inflation and follow studies such as Hazell and others (2022) by measuring expected inflation with longer-term survey expectations. For the euro area, we use the ECB Survey of Professional Forecasters (SPF) five-year-ahead HICP inflation forecast. For the United States, we use 10-year-ahead consumer price index inflation forecasts from the Survey of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia. As Chart 11 shows, both euro area and US longer-term inflation expectations have been broadly stable (anchored) during the COVID-19 period, despite substantial fluctuations in actual inflation. An issue we return to later is whether there has been any feedback from actual inflation to longer-term inflation expectations. As in Ball, Leigh and Mishra (2022), when estimating the Phillips curve specifications, we assume that core inflation responds one-for-one to movements in longer-term expected inflation.[23]

[23] This one-for-one relation is, as Ball, Leigh, and Mishra (2022) explain, consistent with the derivation by Hazell and others (2022) in a New Keynesian framework under the assumption that shocks to the unemployment gap and cost-push shocks are transitory.

Chart 11

Longer-term inflation expectations and headline inflation

(Percent)



Notes: "Longer-term forecast" denotes five-year forecast from ECB Survey of Professional Forecasters (SPF) for euro area, and ten-year forecast for CPI inflation from Survey of Professional Forecasters conducted by Federal Reserve Bank of Philadelphia for the United States. "Headline inflation" denotes 12-month headline HICP inflation for euro area and 12-month headline CPI inflation for United States. For euro area, horizontal dashes show 2.0 percent target inflation target. For United States, horizontal dashes show 2.3 percent target for CPI based on 2 percent PCE target reported on Federal Reserve Bank of Atlanta Underlying Inflation Dashboard.

4.1.4 Estimation results

Table 1 presents our Phillips curve estimates for the euro area. Our sample of monthly data for the euro area starts in January 1999 and ends in April 2023, and we report results both for the full sample and for the pre–COVID-19 sample ending in December 2019. Column 1 first reports estimation results based on a purely linear specification for the pre–COVID-19 period. For both the unemployment gap and the pass-through terms, the results are strongly statistically significant and almost exactly match those of Ball and Mazumder (2021) who estimate the same specification using euro area data for 1999–2018.

Table 1

Euro area Phillips curve estimates

Dependent variable: median CPI inflation gap

VARIABLES	(1) 1999-2019	(2) 1999-2023	(3) 1999-2019	(4) 1999-2023
U gap	-0.316***	-0.300***	-0.490***	-0.520***
	(0.031)	(0.062)	(0.101)	(0.159)
U gap-squared			0.088**	0.090
			(0.039)	(0.068)
H	0.391***	0.928***	0.427***	0.587***
	(0.078)	(0.177)	(0.065)	(0.097)
H-squared			-0.049	0.172***
			(0.056)	(0.029)
Observations	252	292	252	292
Rbar-squared	0.559	0.641	0.580	0.725

Notes: Dependent variable is inflation gap, defined as core inflation minus expected inflation, with core measured by monthly annualized weighted median HICP inflation and expected inflation by ECB Survey of Professional Forecasters (SPF) five-year-ahead forecast of headline inflation. "U gap" denotes difference between unemployment rate and IMF staff estimates of natural rate (12-month average). "H" denotes headline-inflation shock, defined as deviation of headline inflation from core (12-month average). Newey-West standard errors with 12 lags in parentheses. ***, **, and * denote statistical significance at the 1,5, and 10 percent level, respectively.

For the euro area, nonlinearities become especially relevant for the COVID-19 period, particularly regarding the pass-through from headline shocks into core, because of the unusually large size of shocks. The absolute size of headline-inflation shocks (12-month average) is 0.5 percentage point for the pre–COVID-19 sample (2009–19) and 1.7 percentage points since 2020—a more than threefold increase. As column 2 of Table 1 reports, when including the COVID-19 period, there is evidence of stronger pass-through, with the estimated coefficient more than doubling in size. As column 4 reports, when allowing for nonlinearities with the use of squared terms, the results imply that the larger shocks experienced during the COVID-19 period had especially powerful pass-through effects. For the unemployment gap, the results do not indicate a strong degree of nonlinearity over the range of outcomes observed in the sample.[24]

As Annex Table A1 reports, these results are robust to specification changes, changing little when outlier observations are excluded (using Cook's distance method) and when higher orders of nonlinearity (cubed terms) are included. Importantly, however, the results reveal the importance of measuring core inflation using weighted median inflation: when repeating the estimation using the traditional measure of core—inflation excluding food and energy prices (XFE)—the fit of the equation drops almost by half. The adjusted R-squared drops from 73 percent for the

[24] The positive coefficient estimate for the unemployment gap quadratic term is of the expected sign: in a more overheated economy with a larger negative unemployment gap (and, therefore, a larger squared unemployment gap) the associated rise in inflation is greater.

baseline specification using weighted median inflation to only 38 percent when using XFE inflation.[25]

Annex Table A2 reports additional estimation results with the degree of labor market tightness measured by the ratio of vacancies to unemployed (V/U). Data for V/U are available for a shorter sample staring in 2006 and at the quarterly frequency.[26] The results with V/U are less stable than with the unemployment gap. For the pre-COVID-19 sample, the V/U terms are statistically insignificant. For the full sample through the first quarter of 2023, they are statistically significant but lose significance and change sign when outlier observations are discarded. By contrast, the results based on the unemployment gap for this quarterly sample are robust and similar to the baseline results in Tables 1 and 2, including when discarding outliers.[27]

For the United States, there is strong evidence of nonlinearities in the pass-through of headline-inflation shocks, with positive shocks significantly raising core inflation and negative shocks having modest, statistically insignificant effects. There is also greater evidence of significant nonlinearities in the effects of labor market tightness on core inflation. Overall, the results, reported in Annex Table A3, are close to those of Ball, Leigh and Mishra (2022) based on data through September 2022.

To further clarify the differences in the euro area and US Phillips curve results, Chart 12 plots the slope functions for the unemployment rate and for headline-inflation shocks over the economies' respective samples. For the euro area, the relationship with unemployment shows less nonlinearity than for the United States. The slope when the unemployment rate is 8 percent is about –0.4, implying that a 1 percentage point rise in unemployment comes with a 0.4 percentage point fall in core inflation. The slope steepens to about –0.7 when the unemployment rate declines to 6 percent. For the United States, the chart reports a more nonlinear relationship, which we derive from the Phillips curve estimates reported in Annex Table A1 (column 2) and the Beveridge curves reported for the pandemic and prepandemic periods reported in Chart 10.[28] For example, for the prepandemic period, the slope of the US

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25 Studies that find that "outlier-exclusion" measure of core, such as medians and trimmed means, are more closely related to macroeconomic conditions, including the unemployment rate, than are "fixed-industry exclusion" measures, such as XFE inflation, include, for the euro area, Ball and Mazumder (2011) and, for the United States, Verbrugge (2021); Ball, Leigh, Mishra, and Spilimbergo (2022); and Ball, Leigh and Mishra (2022).

26 The estimation sample here starts in 2007 given our use of the four-quarter-average of labor market tightness in our specifications.

27 Estimation results based on the output gap (as measured in the IMF World Economic Outlook database) indicate a similarly strong fit as do the baseline results based on the unemployment gap reported in Table 1. The Phillips curve slope estimate for the output gap is positive, at about 0.2, for both the prepandemic sample—in line with the estimates for the euro area of Ball and Mazumder (2021)—and for the full sample ending in 2023, and indicate little evidence of nonlinearity. In addition, the estimation results for the headline-inflation shock terms in the output gap-based specification are statistically significant and similar to those obtained in the baseline specification based on the unemployment gap. Results for the additional empirical exercises reported in this section are also similar when using the output gap as the measure of economic slack.

28 As Ball, Leigh and Mishra (2022) explain, a log-linear Beveridge curve implies a relation between the ratio V/U and the unemployment rate: $V/U = v/u = au^{b-1}$. The estimated parameters in the Beveridge curves are a = 13.9 and b = –0.85 for the prepandemic (July 2009–March 2020) sample and a = 13.6 and b = –0.54 for the pandemic (April 2020–April 2023) sample. Substituting this expression for V/U into the Phillips curve yields a relation between the core inflation gap and the unemployment rate. For comparability with the US curve in Chart 12, the euro area curve is converted from a relation with the unemployment gap to a relation with the unemployment rate by adding the IMF staff estimate of the natural rate of unemployment for the euro area for the pandemic (2020–23) period.

relation is about –0.3 at 8 percent unemployment but steepens to –2 at 3.5 percent unemployment. The results also suggest that overheating has pushed the United States onto the steep part of the Phillips curve. The euro area might have a similarly steep part of the curve, but this remains uncertain as there has not yet been sufficient overheating to reveal it. A further implication is that policy tightening that cools demand can potentially achieve larger inflation reductions in a more overheated economy. By the same token, increasing demand in an already overheated economy comes with greater inflation risks.

In addition, the results for both economies display a strong degree of pass-through from headline-inflation shocks to core inflation, with an asymmetry—positive headline-inflation shocks have a strong increasing relation with core inflation, whereas negative headline shocks have an insignificant relation with core inflation. More research is needed on the sources of such asymmetries.[29]

To illustrate how the drivers of core inflation in the euro area differ from those of the United States, Chart 13 plots the fitted values from the respective Phillips curve models, along with actual core inflation. To ease interpretation, we convert the fitted values from the Phillips curves models, which we estimate based on monthly annualized inflation gaps, into 12-month inflation rates. To further ease interpretation, we add to the estimates the level of longer-term expected inflation expectations. For both economies, the resulting fitted values of 12-month core inflation are close to their actual values.

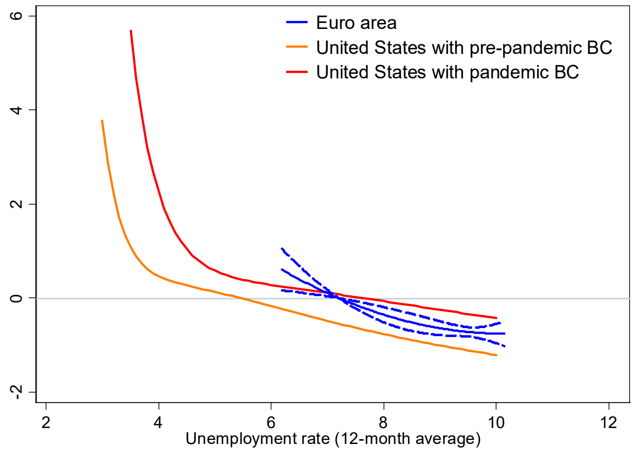
29 In the model of Ball and Mankiw (1994), shocks have asymmetric effects when there are menu costs and trend inflation.

Chart 12

Estimated inflation gap as a function of unemployment rate and headline-inflation shocks

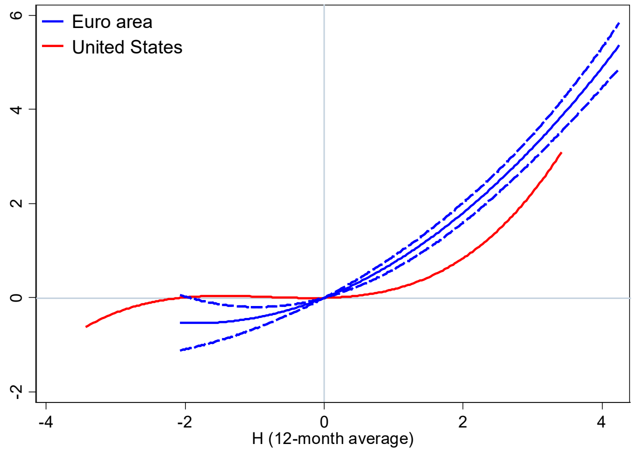
a) Estimated inflation gap vs. unemployment

(Percentage points; monthly data)



b) Estimated inflation gap vs. headline-inflation shock

(Percentage points; monthly data)



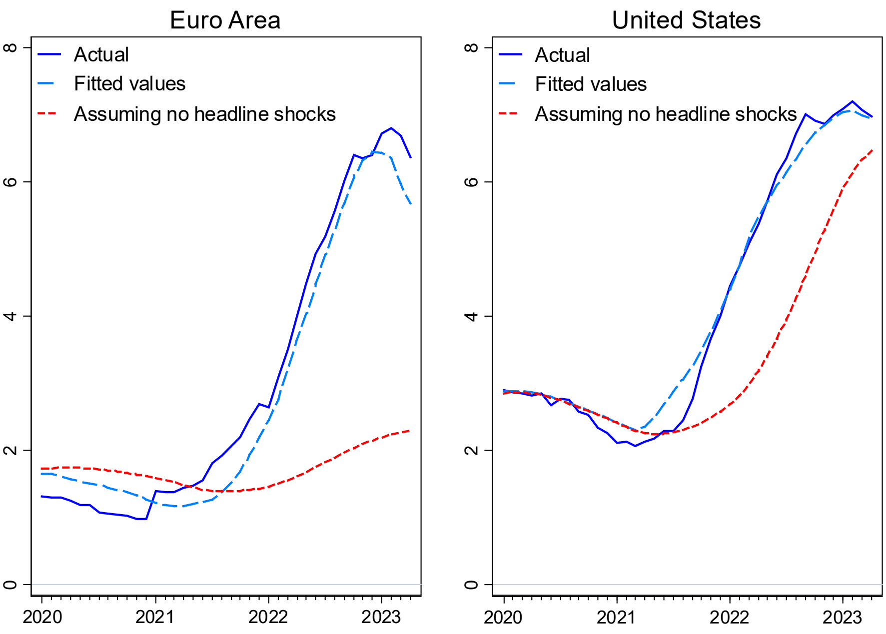
Note: Panel a reports, for euro area, estimated relation between inflation gap and unemployment rate (U) based on results reported in Table 1 (column 4). For United States, panel reports estimated relations derived from results reported in Annex Table 1 (column 2) and US Beveridge curve (BC) estimates for the pre-pandemic and pandemic samples, as explained in the text. Panel b reports estimated relation between inflation gap and headline-inflation shock (H) terms. Bands report 95 percent confidence intervals. Inflation gap denotes monthly annualized median HICP inflation minus longer-term inflation expectations. Figure reports estimated relations for values of U and H observed in the euro area and US samples, respectively.

The results suggest the drivers of inflation are strikingly different for the two economies. The rise in euro area core inflation since January 2021 primarily reflects pass-through from past headline-inflation shocks, not economic overheating. Of the 5.0 percentage point total rise in core inflation from January 2021 to April 2023, 3.8 percentage points (three-quarters of the rise) are due to pass-through; 0.2 percentage point is due to labor market tightness; 0.5 percentage point comes from higher inflation expectations, and there is a 0.5 percentage point residual. For the United States, the contributions at this point are nearly reversed. Of the 4.9 percentage point difference between core inflation in January 2021 and April 2023, 3.4 percentage points come from labor market tightness (70 percent of the rise), and only 0.5 percentage point comes from pass-through from past headline shocks, with a 0.6 percentage point contribution from higher expectations and a 0.4 percentage point residual. The results for the United States confirm that, during the initial rise in core inflation, pass-through from past headline-inflation shocks plays a dominant role, but that, during 2022, labor market tightness becomes the principal factor explaining core inflation.

Chart 13

Predictions for core inflation during 2020-23

(12-month rate; percent)



Notes: Core inflation denotes 12-month weighted median inflation. Left panel reports fitted values for the euro area specification reported in Table 1 (column 4). Right panel reports fitted values for the United States reported in Annex Table 1 (column 2) which updates the results of Ball, Leigh and Mishra (2022). Fitted values for inflation gap estimates converted into 12-month rates and summed with longer-term expectations for comparability with the level of core inflation.

4.1.5 Accounting for the rise in headline inflation

We conclude this section with an accounting exercise for the sources of the overall rise in headline inflation since January 2021 based our earlier assessment of the drivers of headline-inflation shocks and of core inflation. In this exercise, we augment the fitted values reported in Chart 13 with the headline-inflation shocks reported in Charts 2 and 3 to yield a full decomposition.

The results, reported In Chart 14, highlight the dominant role of energy price shocks in driving headline inflation in the euro area, both directly as well as through their pass-through effects on core inflation. At the peak of headline inflation in October 2022, headline inflation is 10.6 percent—9.7 percentage points higher than in January 2021. Of this difference, 4.8 percentage points reflect the estimated direct contribution of energy price inflation to headline-inflation shocks, and 4.2 percentage points reflect the associated pass-through effects into core inflation, for a total of 9.0 percentage points (93 percent of the total rise).[30] With energy price inflation subsiding in late 2022 and in early 2023, the bulk of the remaining rise in inflation compared with the January 2021 level reflects the pass-through effects of the past energy price shocks into core, as already mentioned.

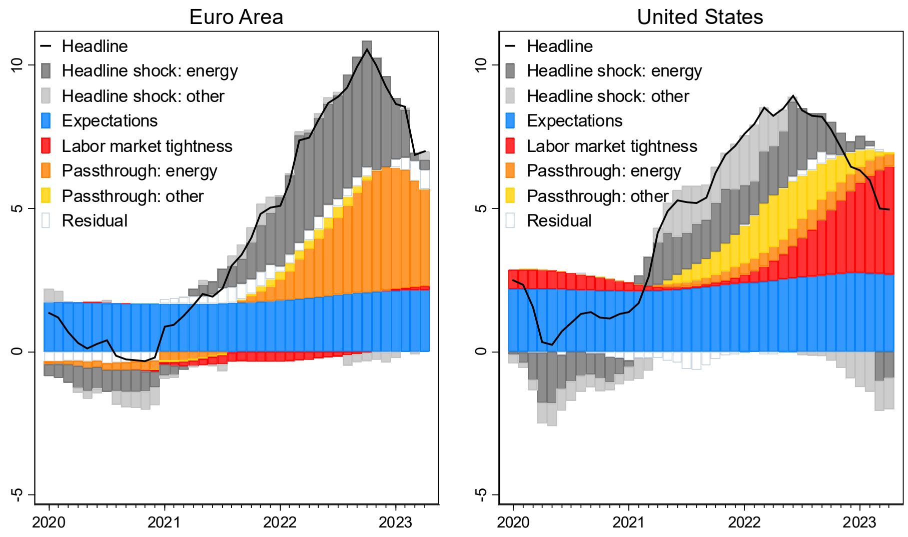
For the United States, the results are strikingly different. At the peak of headline inflation in June 2022, headline inflation is 7.5 percentage points higher than in January 2021. Of this difference, 2.8 percentage points reflect the estimated direct contribution of energy price inflation to headline-inflation shocks, and 0.6 percentage point reflects the associated pass-through effects. Headline-inflation shocks arising from other industries, and their associated pass-through effects, together account for 2.3 percentage points, and labor market tightness accounts for 0.8 percentage point of the rise through June 2022.[31] However, with headline-inflation shocks later subsiding and turning negative, their direct and pass-through contributions fade. By April 2023, the rise in inflation compared with the January 2021 level fully reflects labor market tightness.

30 To decompose the headline-inflation shocks into the part due to energy price fluctuations and the part due to other factors, we use the fitted values reported in Chart 3. To derive the pass-through effects, we take these fitted values of headline-inflation shocks and combine them with the pass-through coefficient estimates reported in Table 1 (column 4) for the euro area and in Annex Table 3 (column 2) for the United States. For the pass-through effects of other headline-inflation shocks, we take the residual from the fitted headline-inflation shocks reported in Chart 3 and, similarly, combine them with the pass-through coefficient estimates.

31 Ball, Leigh, and Mishra (2022) find that headline-inflation shocks other than energy that increased US inflation included shocks associated with backlogs of orders for goods and services, which, they argue, capture problems with supply chains, and changes in prices in auto-related industries.

Chart 14
Accounting for the rise in headline inflation

(12-month rate; percent)



Notes: Left panel reports fitted values for the euro area specification reported in Table 1 (column 4) as well as the headline-inflation shocks reported in Figure 2 (left panel). Right panel reports fitted values for the United States reported in Annex Table 1 (column 2) which updates the results of Ball, Leigh and Mishra (2022) as well as the headline-inflation shocks reported in Figure 2 (right panel). Fitted values for inflation gap estimates converted into 12-month rates and summed with longer-term expectations for comparability with the level of core inflation.

5 Effects of unconventional fiscal measures while allowing for nonlinearities

We now use our estimated Phillips curve framework to compare the actual path of headline inflation to a counterfactual scenario without the UFP measures. We proceed in three steps:

- First, we construct a monthly series of counterfactual headline-inflation shocks that would have occurred in the absence of the UFP measures. For this step, we use the gap between estimates of "market" energy retail prices taken from official sources with actual retail prices.
- Second, we derive a counterfactual path of the core inflation gap. Given the path of counterfactual headline-inflation shocks, we compute the impact on the core inflation gap based on the monthly euro area Phillips curve (Table 1, column 4), which accounts for nonlinear pass-through from headline-inflation shocks to core. In addition, we derive the impact on the core inflation gap from an assumed unemployment path in the absence of the measures. For this step, we use the budgetary cost of the energy measures as well as assumptions regarding fiscal multipliers and Okun's law.
- Third, we calculate the counterfactual effect of the measures on inflation expectations based on the counterfactual core inflation gap and a process we

estimate for the evolution of longer-term inflation expectations that allows for feedback effects from headline inflation into longer-term expectations.

- Finally, we use the resulting counterfactual path of monthly headline inflation to compute the path of 12-month inflation, which we compare with the actual path of 12-month inflation. We now explain the steps in greater detail, while acknowledging associated uncertainties, before reporting the results.

5.1 Counterfactual headline-inflation shocks

To construct a monthly series of counterfactual headline-inflation shocks in the absence of UFP measures, we compare the growth of underlying "market" retail prices of gas and electricity in the absence of measures with the actual growth of gas and electricity retail prices. We do not estimate the underlying market prices; rather we take the estimates from official sources. We then scale the additional price growth of gas and electricity by their respective shares in the HICP to obtain the additional headline-inflation shocks in the absence of the energy price measures.

For gas, we obtain a series of "market" retail prices from the French Energy Regulatory Commission (CRE). The CRE publishes indicative market retail prices in the absence of energy price measures, which it constructs based on the evolution of wholesale market contract prices in combination with the official formula for setting retail prices.[32] The CRE formula-based market retail prices move closely with the Title Transfer Facility international benchmark for gas price, although, because they are for retail prices, they move more smoothly.[33] Given this tight relation with the international benchmark, we make the simplifying assumption that the growth rate of the CRE market retail prices provides a measure of the counterfactual retail gas price growth in the euro area.[34] For electricity prices, there is greater cross-country variation in how market prices evolve, so we do not use a euro-wide market measure. Instead, we use estimates of counterfactual market retail prices for two major economies that introduced electricity retail tariff freezes: France and Spain. For France, we use the CRE monthly series of theoretical retail electricity prices, which the CRE also constructs based on the evolution of wholesale market contract prices. For Spain, the market electricity indicative prices come from IMF staff estimates prepared for the 2022 Spain Article IV Consultation staff report. In this case, given the tight correlation between retail and wholesale electricity prices until

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32 See Bourgeois and Lafrogne-Joussier (2022) and the references therein for a summary of the CRE reference price process and an assessment of the effects of the energy support measures introduced in France on inflation in 2021–22.

33 The bivariate relation between the (log) CRE gas price level and (log) TTF benchmark level lagged by two months has an R-squared of 92 percent for the 2020–23 period with a slope coefficient of 0.5; the bivariate relation between the monthly growth rate of the CRE gas price and monthly growth rate of the TTF benchmark gas price lagged by two months has an R-squared of 64 percent and a slope coefficient of 0.4.

34 The CRE market price potentially overestimates the counterfactual rise in energy in the absence of UFP measures to the extent that, absent the positive effect of the measures on household incomes, there would have been lower energy demand and hence lower energy prices, especially in the segmented gas market in Europe. However, as argued in section 3, considering estimates of energy demand and supply elasticities estimates in the literature together with the size of the deficit-financed UFP measures, such demand-induced effects on energy prices may have been modest, especially in comparison with the large overall swing in energy prices in 2022.

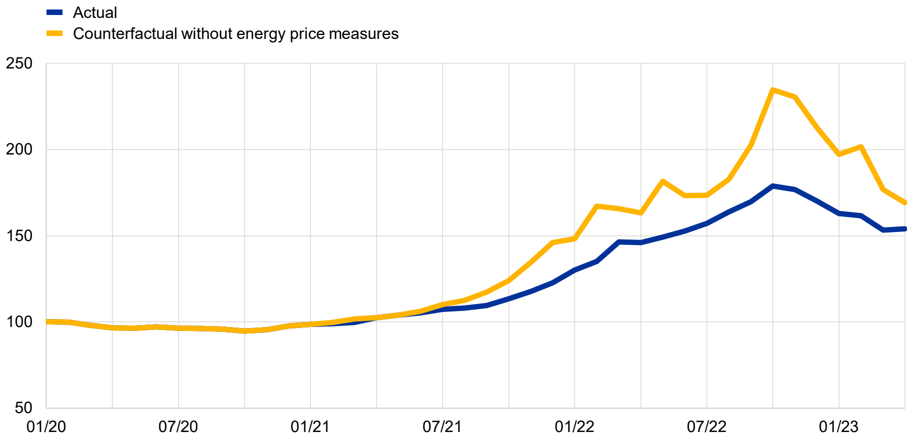
before the energy crisis, we compute counterfactual retail electricity price using the estimated historical correlation between retail and wholesale electricity prices in Spain before the energy price surge in 2022.

Chart 15 reports the overall result of these calculations for retail energy prices. In the absence of the energy price measures, the estimates suggest that the level of energy retail prices in the euro area on average in 2022 would have been about 19 percent higher than observed, increasing by about 65 percent over the average level in 2021, instead of by the actual 46 percent. The peak of energy prices in October 2022 would have been 31 percent higher. Market energy retail prices have fallen especially sharply since the peak, and futures markets suggest that further declines are plausible.

Chart 15

Euro area: actual and counterfactual energy price levels

(Index; January 2020 = 100)



Notes: "Actual" indicates HICP for Electricity, Gas and Other Fuels series. See text for description of counterfactual path without energy price measures.

Multiplying the gap between the growth in market and actual prices by the share of energy in the HICP yields a series of additional headline-inflation shocks that would have occurred in the absence of the energy measures. We add this series to the actual series of headline-inflation shocks to obtain the counterfactual path.

5.2 Counterfactual effects on the core inflation gap

Given the counterfactual path of headline-inflation shocks, we construct the 12-month average and compute the impact on the core inflation gap based on the monthly euro area Phillips curve (column 4 in Table 1). This calculation provides us with an estimate of the nonlinear pass-through from the headline-inflation shocks to the core inflation gap that would have occurred in the absence of the energy price measures.

To derive the counterfactual path of the core inflation gap due to the lower level of aggregate demand—and higher level of unemployment—in the absence of the energy support measures, we start with the estimated budgetary cost of the energy measures (1.3 percent of GDP in 2022 and 2.0 percent of GDP in 2023) from Arregui and others (2022).

We make a simplifying assumption that the measures come with an average peak fiscal multiplier effect on GDP of 1 after 12 months, which fades to zero after 24 months. A peak multiplier of 1 after 12 months (implying a 0.5 multiplier on average over the year) is arguably on the high end of plausible values for the energy price measures, most of which were untargeted. For use in our Phillips curve framework, we obtain a corresponding impact on unemployment based on an Okun's law coefficient of –0.5, also on the high end of plausible (absolute) values. These assumptions could lead our calculations to err on the side of overstating the effects of the measures on inflation through the aggregate demand channel. As we will see later, however, even with these assumptions, the inflation effects are modest. The assumptions imply that, without the deficit-financed measures, unemployment would have been 0.7 percentage point higher at the end of 2022 and 1.0 percentage point higher at the end of 2023. We obtain a monthly path for the unemployment rate by interpolating between these year-end values. We take the 12-month average of this counterfactual unemployment path, add it to the actual observed unemployment path, and compute the impact on the core inflation gap based on the Phillips curve.

5.3 Counterfactual inflation expectation effects

Longer-term inflation expectations have been broadly, if not entirely, stable near 2 percent during 2020–23, thus reflecting the credibility of the ECB's inflation target. Longer-term expectations in the ECB SPF survey have moved from 1.7 percent in the fourth quarter of 2019 to 2.1 percent in the first quarter of 2023. However, it is possible that higher inflation in the absence of energy price measures would have caused people's longer-term expectations to drift further upward, pushing actual inflation even higher.[35]

To allow for this possibility in the counterfactual simulations without energy price measures, we estimate a process for the evolution of longer-term inflation expectations that allows for feedback effects from headline inflation into longer-term expectations. We estimate a simple model of inflation expectations, using the specification that Ball, Leigh, and Mishra (2022) estimate for the United States. The approach features a simple equation in which expectations evolve in response to movements in actual headline inflation:

$$\pi_t^e = \gamma \pi_{t-1}^e + (1-\gamma)\pi_t \,, \tag{1}$$

where π_t^e is longer-term expected inflation and π_t is actual headline inflation. The parameter γ captures the degree of anchoring. For γ = 1, expected inflation is constant regardless of actual inflation behavior. For γ = 0, expected inflation adjusts one-for-one with current inflation.

35 Coleman and Nautz (2023) present evidence that the share of German households with longer-term inflation expectations above 2 percent has already risen significantly in 2021 and 2022.

We consider the evolution of expected inflation over some period starting at $t = \tau$. By repeatedly substituting the equation for π_t^e into itself, we obtain

$$\pi_t^e = (1-\gamma)\sum_{i=0}^{t-\tau-1}\gamma^i\pi_{t-i} + \gamma^{t-\tau}\pi_\tau^e\ , \quad t > \tau\ . \qquad (2)$$

We estimate γ with the ECB SPF's quarterly series for five-year-ahead expected inflation. We account for the fact that the current quarter's inflation rate is not known when a five-year-ahead forecast is made by replacing π_t with the SPF current-period (nowcast) expectation of π_t reported at the same time. We denote this expectation by ${}_t\pi_t$. We also add an error term to the equation to capture other influences on expectations:

$$\pi_t^e = (1-\gamma)\ {}_t\pi_t + (1-\gamma)\sum_{i=1}^{t-\tau-1}\gamma^i\pi_{t-i} + \gamma^{t-\tau}\pi_\tau^e + \epsilon_t\ , \quad t > \tau. \qquad (3)$$

We estimate γ, the single parameter in this equation, with nonlinear least squares.

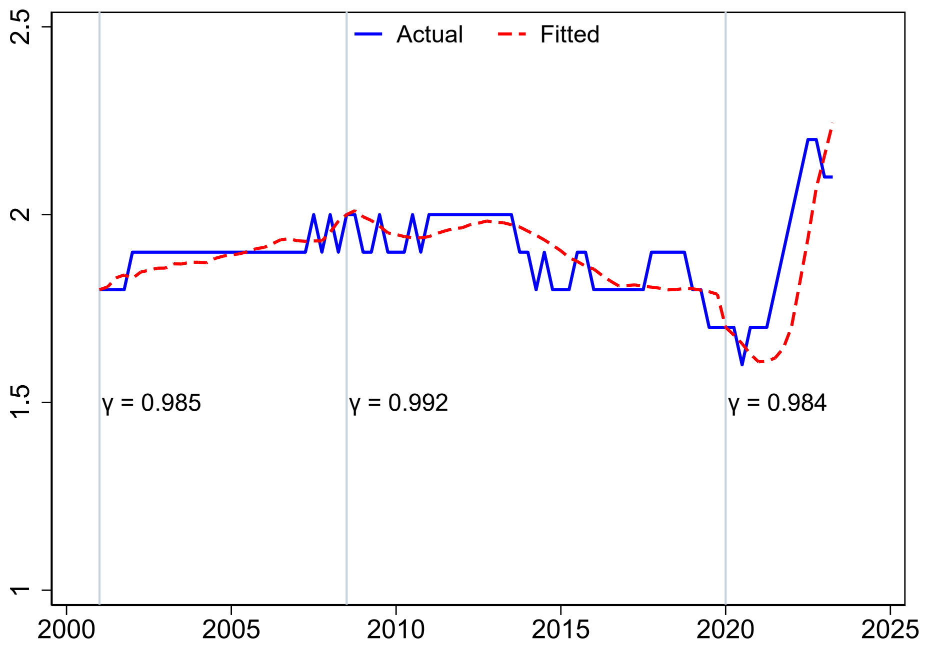
The results, reported in Chart 16, suggest that longer-term inflation expectations have responded, albeit modestly, to near-term expectations. For the period from the third quarter of 2008 to the fourth quarter of 2019, which included the global financial crisis and its aftermath, when inflation was on average below the ECB's 2 percent target, there was a modest degree of expectations drift, with the estimated γ at 0.992. For the period from the first quarter of 2020 to the first quarter of 2023, the estimated γ is 0.984, which suggests that anchoring has become slightly weaker than it was before the pandemic.[36] Interestingly, this estimate of γ is the same as Ball, Leigh, and Mishra (2022) obtain for the United States during the COVID-19 era.

[36] The estimated γ is 0.985 for the period from the first quarter of 2001 to the second quarter of 2008, which suggests that anchoring was also slightly weaker at start of the euro era than subsequently.

Chart 16

Actual and fitted longer-term inflation expectations

(Percent)



Sources: ECB Survey of Professional Forecasters. All vintages since 1999Q1.
Notes: Figure reports actual values of five-year-ahead inflation expectations from the ECB Survey of Professional Forecasters and fitted values for several periods from the partial-adjustment model described in the text. The parameter γ indicates the degree of anchoring of inflation expectations in each period.

Based on this estimated process, we then jointly derive the counterfactual path of inflation expectations and headline inflation given the counterfactual path of the core inflation gap.[37]

5.4 Counterfactual simulation results: effects of energy support measures on headline inflation

Overall, the calculations suggest that in the absence of the energy measures,12-month euro area headline inflation would have peaked at 13.7 percent in October 2022, 3.2 percentage points higher than the actual peak of 10.6 percent (Chart 17). On average, in 2022, headline inflation is higher by 2.2 percentage points. Of this difference, about 0.8 percentage point reflects the direct effect of the headline-inflation shocks, and 1.2 percentage points come from the pass-through effects into core inflation. This greater than one-for-one pass-through reflects the steepness of the pass-through slope in the estimated Phillips curve in the presence of large positive headline-inflation shocks. The offsetting effect from the weaker economic activity in the absence of the measures on core inflation is negative but modest (less

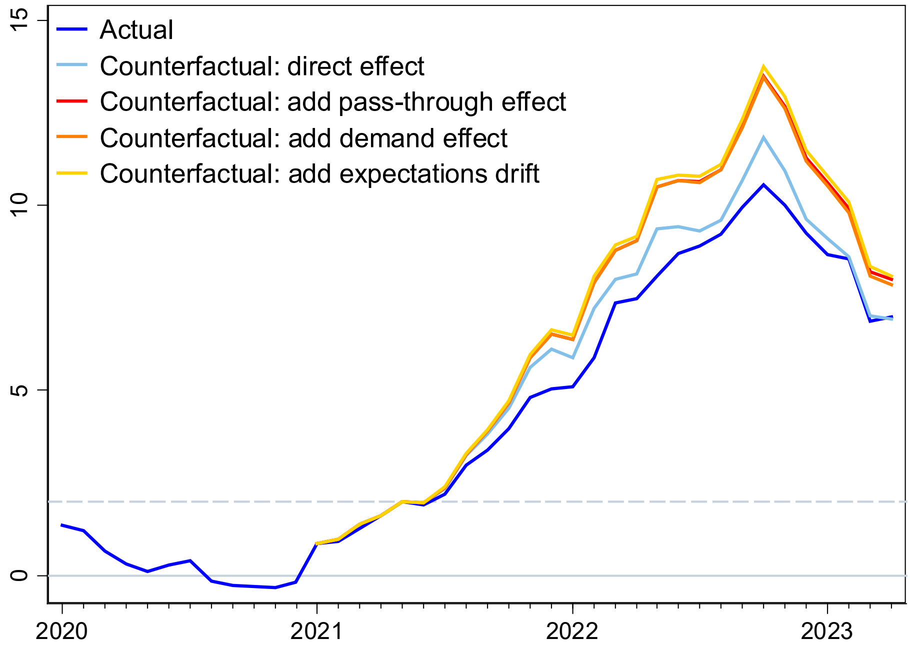
[37] To solve jointly for the path of inflation expectations and headline inflation, we follow the approach of Ball, Leigh and Mishra (2022): we use the equations $\pi_t = \pi_t^e + core\ gap_t$ and $\pi_t^e = \gamma\pi_{t-1}^e + (1-\gamma)\pi_t$. Given the $core\ gap_t$ and π_{t-1}^e, we solve the two equations for π_t and π_t^e.

than 0.1 percentage point). Longer-term inflation expectations rise by 0.2 percentage point in the absence of the energy measures.[38]

Chart 17

Headline inflation: actual and counterfactual without energy measures

(12-month rate; percent)



Notes: Horizontal dashes show 2 percent target for HICP inflation.

5.5 Scenarios for future inflation: luck versus skill

The preceding discussion concludes that the energy measures have so far reduced inflation. Where is inflation heading? We do not make unconditional forecasts but use our empirical Phillips curve framework to offer predictions conditional on available (IMF staff) forecasts of the unemployment gap and different assumptions regarding the future path of energy prices.

For the unemployment gap, we use the unemployment forecasts from the April 2023 World Economic Outlook. The forecasts for the unemployment rate are quarterly and peak at 6.9 percent in the first quarter of 2023. The natural rate of unemployment forecasts is annual and remains near 7.0 percent in 2023 and 2024. We construct a monthly unemployment gap path by assigning each quarterly unemployment forecast to the second month of each quarter and then by interpolating between months, starting with the actual unemployment rate of 6.5 percent in April 2023. For the natural rate, we assign the estimates to June of each year and interpolate

[38] In related work focusing on the effects of energy price measures in France, Bourgeois and Lafrogne-Joussier (2022) conclude that the “tariff shield” measures introduced in France in 2021 reduced headline consumer price inflation between the second quarters of 2021 and 2022 by about 3 percentage points.

between available observations (Annex Chart A2). Based on the interpolated monthly paths, we then compute the 12-month average of the unemployment gap needed for our Phillips curve model.

For energy prices, we first make the simplifying assumption that no further headline-inflation shocks stem from energy prices or other sectors starting from May 2023. We set headline-inflation shocks to zero for future months for this scenario—a natural benchmark given the historically unpredictable nature of headline-inflation shocks. The resulting 12-month headline shock (H), given zero monthly shocks starting in May 2023 and the earlier actual shocks, declines to zero in April 2024. It is important to keep in mind the uncertainty regarding future headline shocks. We might see adverse inflationary shocks resulting from an intensification of the war in Ukraine or disinflationary shocks if energy prices fall further.

We also explore what would have happened if market energy prices had remained constant at their October 2022 peak levels instead of declining. In that scenario, we assume policymakers decide to allow actual (regulated) energy prices to rise linearly to their market levels by December 2023 from the October 2022 levels—a total rise of 52 percent.

In all cases, as before, we solve jointly for the path of inflation expectations and headline inflation, while assuming that the degree of expectations anchoring remains at our estimate level (with a coefficient γ = 0.984).

5.5.1 Future inflation paths with stable energy prices

Chart 18 shows the simulated path of 12-month headline inflation under the assumptions of no further headline-inflation shocks and the IMF staff forecast of the unemployment gap. The inflation rate declines from the April 2023 level of 7.0 percent to 2.8 percent by December 2023 and to 2.1 percent by December 2024.[39]

To complement this prediction, we compute a corresponding path of inflation in the absence of UFP measures. This path is an extension of the counterfactual path reported in Chart 17. We extend that path based on the assumption that “market” energy prices converge with the level of actual regulated energy prices by December 2023 and remain at that level thereafter. This implies a gradually declining path for market energy prices. We compute the implied path of counterfactual (negative) energy inflation shocks, recompute the 12-month average of headline-inflation shocks, and use it to derive the impact on the core inflation gap using the Phillips curve. As before, we assume that the demand boost from the energy measures that reduce unemployment is absent, which also implies modestly lower inflation.

As Chart 18 shows, in this case without the energy measures, headline inflation falls from its counterfactual level of 8.1 percent in April 2023 to 1.6 percent by December

[39] Note that this inflation path does not necessarily correspond to the IMF staff forecast for euro area inflation, which may also reflect additional considerations that are beyond the scope of this paper.

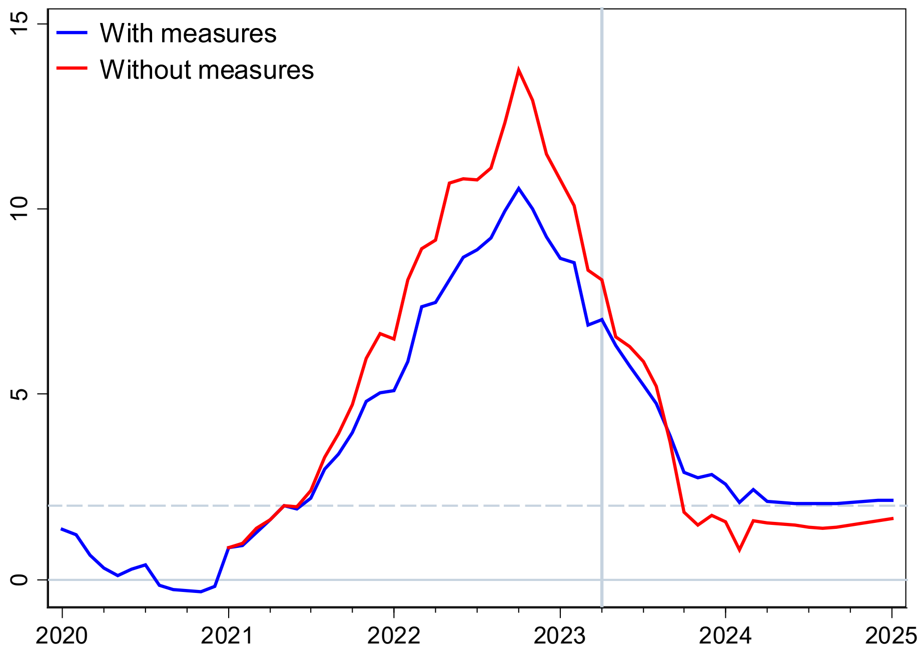
2024, modestly undershooting the target, primarily on the back of the lagged effects of the lower demand and declining core inflation.

Chart 18

Scenario: headline inflation with and without energy measures

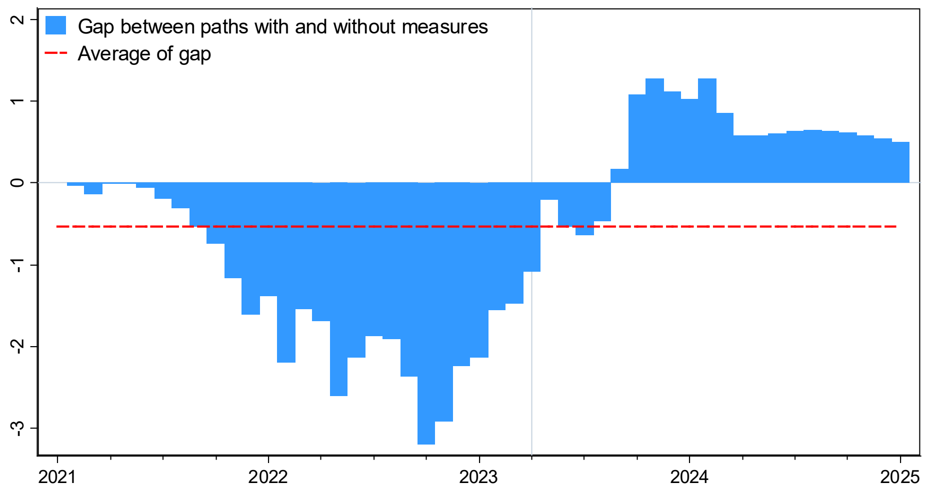
a) Headline inflation

(Percent; 12-month rate)



b) Marginal effect of energy measures

(Percentage points)



Notes: Horizontal dashes in panel a show 2 percent target for HICP inflation.

Overall, in this scenario, European economies "get lucky." The energy price measures prevent a sharper rise in inflation in 2022 because of a temporary energy price spike. They also prevent a (more modest) undershoot of the inflation target later. The additional inflation stability—the smaller absolute deviations from target—from the energy price measures is substantial. Absolute deviations of inflation from target during 2021–24 are 24 percent smaller with the energy price measures than without them. Average inflation in 2021–24 is 0.5 percentage point lower with the measures, which implies a cumulative (price level) reduction of about 2.0 percent.[40]

5.5.2 Future inflation paths with persistently high energy prices

Chart 19 shows the scenario where market energy prices do not decline from their October 2022 peak levels, and actual energy prices end up rising to market levels by December 2023. In this case, because of the additional headline inflation implied by the increase in actual energy prices up to market levels in 2023, the associated pass-through into core, and the consequent upward drift in longer-term expectations, the simulated 12-month headline inflation path declines much more gradually. With the energy measures, inflation now averages 8.1 percent in 2023 instead of 5.5 percent with the more favorable scenario with declining energy prices. It reaches 6.0 percent by December 2023 instead of 2.8 percent and 3.1 percent by December 2024 instead of 2.1 percent.

The chart also shows the corresponding counterfactual inflation path in the absence of energy measures. That path also declines more gradually, and this time there is no undershoot of the 2 percent inflation target. Overall, in this "unlucky" case, the price measures deliver less than half as much inflation stabilization during 2021–24 as in the more favorable scenario. Absolute deviations of inflation from target are now only 11 percent smaller with the energy price measures than without them, compared with 24 percent lower in the more favorable scenario. In 2024, inflation is on average 1.6 percentage points higher than without the measures, whereas in the more favorable scenario, it is only 0.7 percentage point higher than without the measures. Inflation is on average 0.4 percentage point lower than without the measures, which implies a cumulative (price level) reduction of about 1.6 percent.

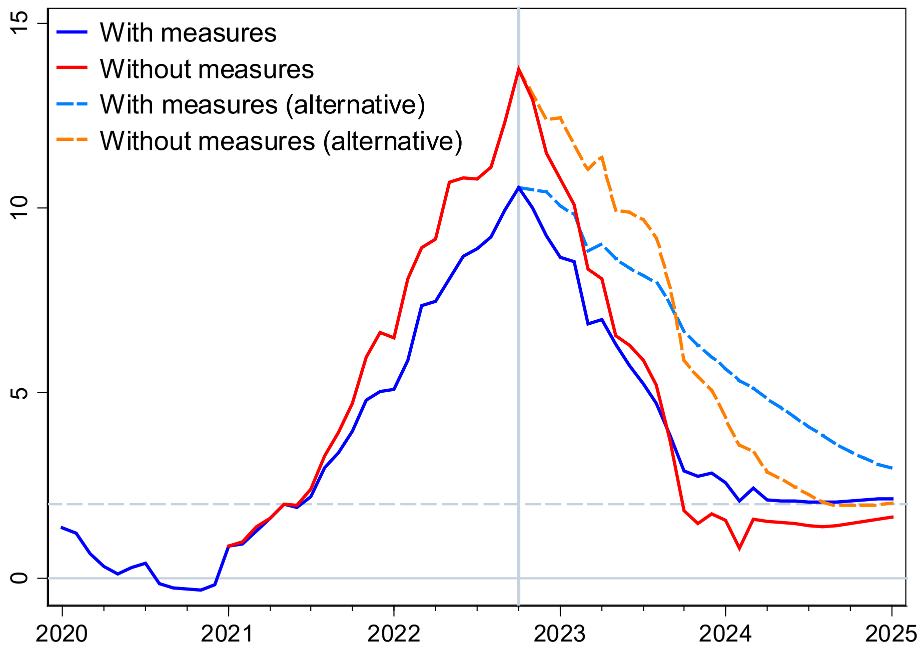
[40] This cumulative effect contrasts with the more modest cumulative effect of the measures in the earlier FSGM simulation results. The difference in part reflects the pass-through asymmetries in our estimated Phillips curve framework, which imply a sharper rise in inflation without measures during the positive headline-inflation shocks of 2022 and a more modest fall in inflation without measures during the negative headline-inflation shocks of 2023.

Chart 19

Alternative scenario with energy prices staying high: Headline inflation with and without energy measures

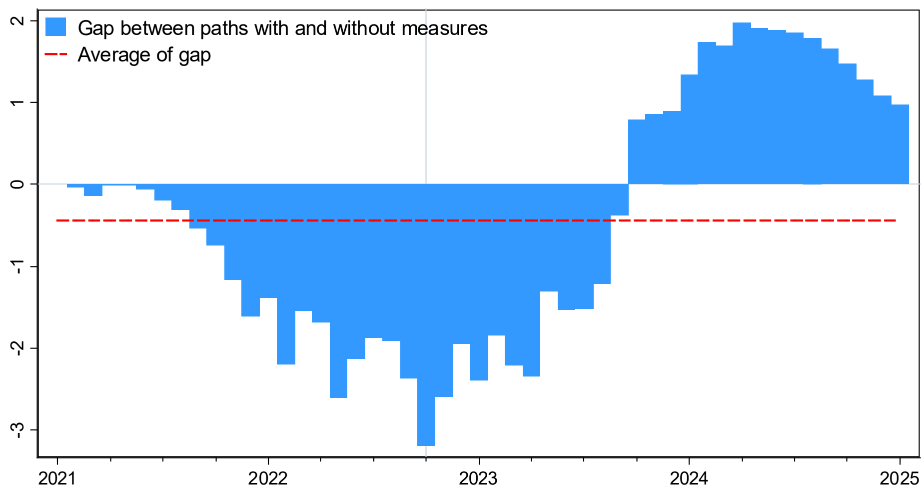
a) Headline inflation

(Percent; 12-month rate)



b) Marginal effect of energy measures in alternative scenario

(Percentage points)



Notes: Vertical line indicates October 2022 after which market energy prices assumed to be constant with actual retail prices rising linearly to their market price level by December 2023. Horizontal dashes in panel a show 2 percent target for HICP inflation.

5.5.3 Inflation paths in an overheated economy: playing with fire

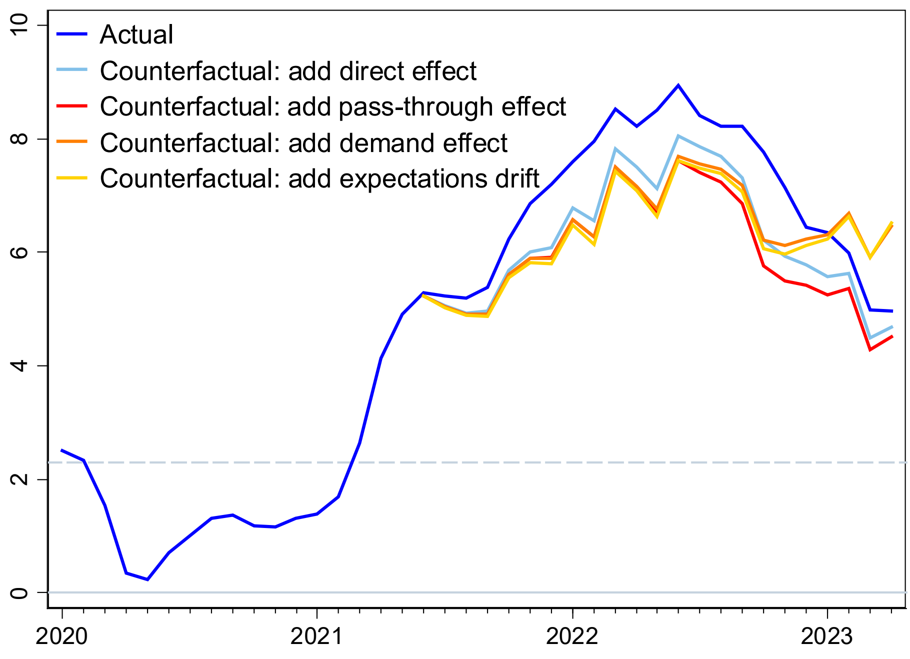
Finally, we consider how the effectiveness of UFP measures at stabilizing inflation depends on the initial cyclical position of the economy. To do so, we return to the case of the US economy. We take the size of euro area counterfactual headline-inflation shocks and unemployment effects due to the UFP measures during 2022–23 used in our initial analysis (as applied in Chart 17) and apply them to the United States over the same period. In this case, however, we apply them with the opposite sign to simulate the effect of efforts to reduce inflation below the actual level rather than simulating the higher inflation that would have occurred in their absence.

Chart 20 shows the resulting simulated and actual paths of 12-month US headline inflation. There is initially lower inflation because of the direct and indirect channels stemming from the (negative) headline-inflation shocks. On average, in 2022, headline inflation is 1.2 percentage points below the actual level. However, within a few months, by the end of 2022, inflation is already drifting upward due to the demand-stimulating channel, which starts to dominate. By April 2023, inflation exceeds the actual level by about 1.6 percentage points.

Chart 20

US headline inflation: actual and counterfactual with unconventional fiscal measures

(Percent; 12-month rate)



Notes: Horizontal dashes show 2.3 percent target for CPI based on 2 percent PCE target reported on Federal Reserve Bank of Atlanta Underlying Inflation Dashboard.

These results illustrate the risks of implementing UFP measures in an overheated economy. With the US economy at exceptionally overheated levels in 2022—on the steep part of the nonlinear Phillips curve—further stoking demand would have quickly translated into significantly higher inflation. This would have hampered the inflation-reducing efforts of the Federal Reserve.

6 Conclusion

The world is going through a persistent surge in inflation not seen in decades. The reasons are complex and still being debated but involve a combination of supply bottlenecks, strong income support during the pandemic, and energy market disruptions in the aftermath of Russia's invasion of Ukraine. Faced with such persistent inflation pressures, central banks responded forcefully. In such a high inflation environment, standard considerations also suggest that fiscal policy tightening has a role to play to accompany monetary policy's efforts at curbing aggregate activity.

Yet, many European economies followed a different path, choosing to implement instead somewhat expansionary fiscal policies to curb the cost of living by countering directly the rise in energy prices. Economists generally viewed these "unconventional fiscal policies" with skepticism. Among the concerns was the view that their expansionary component would further fuel inflation pressures, thus achieving the opposite of the stated objective and complicating the task of monetary authorities.

This paper proposes a macroeconomic assessment of these UFP measures. How effective were they, and should they be part of the toolkit?

The answer to the first question is that UFP measures were surprisingly effective in helping smooth inflation. We reach this conclusion through two distinct exercises: a semi-structural model and an empirical model. The first approach relies on the IMF's semi-structural large scale New Keynesian model. It yielded two important results: UFP measures can help smooth inflation in the face of large transitory energy shocks; moreover, the model suggests that conventional fiscal policy would have been of little help in curbing inflation. In other words, the combination of low fiscal multipliers in a high inflation environment and a modest slope of the Phillips curve would have required very sharp tightening to achieve meaningful inflation reduction.

The empirical model relies on a Phillips curve framework that allows for significant nonlinearities in the transmission of economic slack and cost-push shocks to inflation. It accounts well for the surge in inflation in the euro area and the United States and delivers two main findings. First, the euro area and US economies face profoundly different inflation environments. Most of the inflation in the former currently reflects energy shocks and their pass-through effects, whereas economic overheating is the primary driver in the latter. Second, because of the strong nonlinearities, UFP measures helped reduce inflation by 2.2 percentage points on average in the euro area in 2022. It did so through three channels—directly, by reducing headline shocks; indirectly by reducing core inflation via the pass-through from headline shocks; and even more indirectly, by helping to keep longer-term inflation expectations well anchored. The stimulative effects of these packages on inflation remained instead muted. Overall, these policies clearly supported monetary policy's overall anti-inflation efforts. Looking ahead, and assuming no further headline-inflation shocks, the model suggests that euro area headline inflation will decline from 7.0 percent in April 2023 to 2.8 percent by December 2023 and to 2.1 percent by December 2024. By contrast, in the absence of these measures, inflation would have peaked at 13.7 percent in October 2022 before declining to 8.1 percent in April 2023 and to 1.7 percent in December 2023, undershooting the ECB's target.

The two modeling approaches are complementary and deliver consistent results. When output is close to its potential and headline shocks are modest, both models suggest modest gains from fiscal policy—conventional or unconventional. But when the shocks are large and trigger nonlinearities, the empirical model indicates that both unconventional (when the headline shocks are large) and conventional (when the economy is overheating) fiscal policies can be effective at reducing inflation. This last point is important for policymakers: (conventional) fiscal policy has an important supporting role to play when the economy is overheating.

The answer to the second question is more nuanced. As the previous paragraph makes clear, the effectiveness of UFP is "state dependent." If the energy shock had been persistent, or if the euro area had been overheating, the inflation outcome would not have been nearly so benign. From that perspective, the euro area may have been lucky. In fact, when we run the same set of policies for the US economy, which is characterized by much more severe overheating, we find that the stimulative effects of the measures would have dominated the inflation dynamics, pushing inflation further astray. Clearly, a first step would be to ensure the economy is not overheating and that energy prices are likely to recede quickly from their peak.

At the same time, assessing some of the factors behind the original concerns with UFP is beyond the scope of this paper. Future research could investigate in greater depth the effects of price-suppressing measures on energy demand and wholesale prices in the presence of low short-run demand and supply elasticities, as also examined by Albrizio and others (2022) and di Bella and others (2022). A more comprehensive welfare-based analysis would be needed to fully assess the consequences of UFP policies and their implications for other countries in Europe and beyond.[41] [42] Designing the optimal form of UFP in a monetary union with an integrated energy market is also beyond the scope of this paper.[43]

Further, the strategy cannot necessarily be generalized. Broadly speaking, relative prices need to move and adjust frequently for resources to be allocated efficiently. In the event of a short-lived and extreme surge in a narrow set of prices, such as the energy price surge of 2022, the policy helped reduce inflation. But generalized to more modest—and possibly more persistent—changes in more relative prices, it could generate widespread and cumulative microeconomic misallocation losses.

The UFP measures have also come at a fiscal cost. They could have been even more effective if accompanied with budget-compensating measures and deployed in

41 In the case of Europe, for instance, such measures would have added pressure on the global market for liquid natural gas that served as a substitute for Russian gas, thus increasing prices and reducing demand in other parts of the world. See Albrizio and others (2022) for an analysis of the impact of the Russian gas shutoff that explicitly incorporates the liquid natural gas global market.

42 As observers have noted, sustained energy demand in the face of reduced external supply has led to the reopening of several retired coal power plants in some European countries, with an adverse impact on greenhouse gas emissions.

43 We note that the shock is not fully symmetric. Energy markets remain fragmented, countries have different energy mixes, different price and wage indexation mechanisms, and different levels of fiscal space, which suggests that a fully symmetric policy may not be optimal.

a more targeted way. Our results indicate that deficit-neutralizing spending cuts would have further lowered inflation—if modestly. Such deficit-compensating measures could also have supported euro area countries' efforts to preserve and rebuild budgetary space for maneuver in the context of rising real interest rates, slowing growth, and new fiscal demands. Other research suggests that focusing the support on lower-income households is a more efficient use of public funds to limit the incidence of energy price shocks (Arregui and others 2022).

Finally, we want to reiterate a point made earlier. Our paper is not about price controls or the distribution of income under high inflation, per se. We show that measures that helped contain energy price inflation helped keep core inflation and inflation expectations lower in the euro area. Subsidies will work just as well as price controls from that perspective. This brings two questions, which future research should investigate. First, should subsidies target household energy prices or firms' energy inputs? The former may more directly enter consumer price indexes and help with the anchoring of inflation expectations. But the latter could neutralize cost increases "upstream" in the production network, with cascading effects on downstream (and core) prices. To assess whether one is more efficient than the other, more granular models are needed. This seems a promising avenue to explore. Second, and along the same lines, is it possible for non price-distorting measures to reduce inflation? For instance, can direct lump-sum transfer payments to households (or firms) affect price-wage dynamics, or inflation expectations, by alleviating the increase in costs? Because such measures would not be price distorting, they might preserve the price signal, prevent the risk of shortages arising, and reduce energy consumption.

For policymakers, the overall lesson regarding UFP measures is a mixed one. They have helped contain the 2022 inflation surge in the euro area. But the lesson is hard to generalize. Protecting the economy against sharp movements in energy prices through diversification of supply chains, improvements in resilience, and interconnectedness of the energy grid is likely to be necessary to effectively deal with future disruptions.

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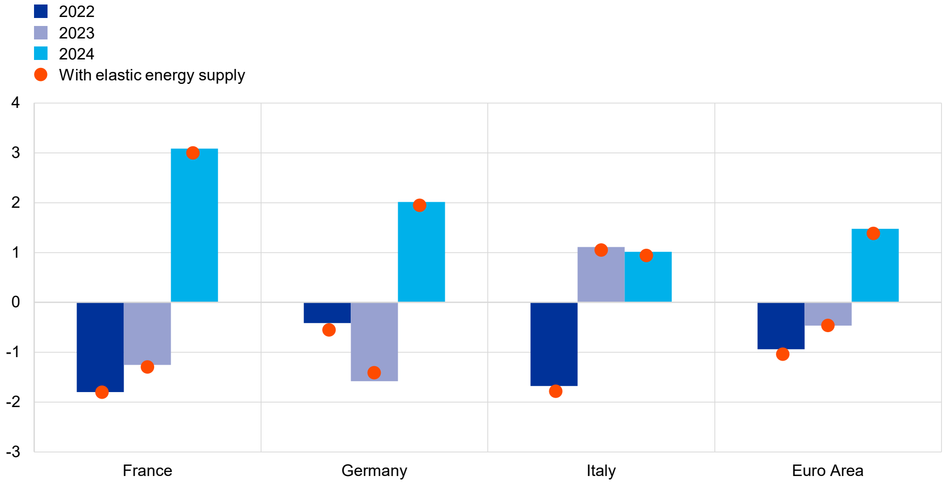
Annex

Chart A1

Marginal effect of deficit-financed energy fiscal measures on headline inflation: baseline vs. alternative with elastic energy supply

(Deviation from counterfactual path without energy measures; percentage points)

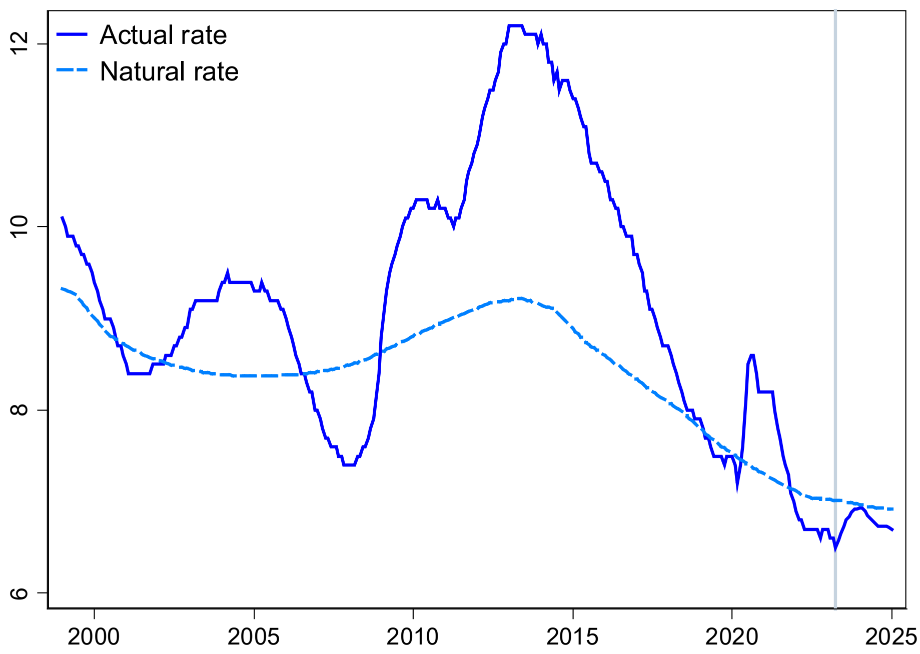


Notes: Figure reports simulations based on IMF Flexible System of Global Models.

Chart A2

Euro area unemployment: actual rate and estimated natural rate

(Percent of labor force)



Notes: Figure reports IMF staff estimates of natural rate of unemployment and forecast of actual rate of unemployment in April 2023 IMF World Economic Outlook. Vertical line indicates April 2023.

Table A1

Robustness and extensions: euro area Phillips curve estimates

Dependent variable: median HICP inflation gap

VARIABLES	(1) Baseline	(2) Constant	(3) Outliers	(4) Cubic	(5) Outliers	(6) XFE
U gap	-0.520***	-0.477***	-0.571***	-0.452***	-0.432***	-0.673**
	(0.159)	(0.173)	(0.117)	(0.133)	(0.097)	(0.300)
U gap-squared	0.090	0.089	0.110**	-0.155	-0.116	0.110
	(0.068)	(0.061)	(0.047)	(0.132)	(0.104)	(0.128)
U gap-cubed				0.086**	0.069**	
				(0.042)	(0.031)	
H	0.587***	0.596***	0.546***	0.651***	0.511***	0.279
	(0.097)	(0.086)	(0.059)	(0.152)	(0.085)	(0.197)
H-squared	0.172***	0.178***	0.147***	0.194**	0.140***	0.250***
	(0.029)	(0.031)	(0.023)	(0.093)	(0.052)	(0.052)
z_12ma3				-0.009	0.012	
				(0.034)	(0.017)	
Constant		-0.081				
		(0.112)				
Observations	292	292	272	292	273	292
Rbar-squared	0.725	0.727	0.654	0.731	0.639	0.379

Notes: Sample is 1999-2023 in all cases. Dependent variable is inflation gap, defined as core inflation minus expected inflation, with core measured by monthly annualized weighted median HICP inflation in all columns except 6, and monthly annualized HICP inflation excluding food and energy (XFE) in column 6. Expected inflation measured by ECB Survey of Professional Forecasters (SPF) five-year-ahead forecast of headline inflation. “U gap” denotes deviation of unemployment rate from IMF staff estimate of natural rate of unemployment (12-month average). H denotes headline-inflation shock (12-month average). Column 3 excludes outliers based on Cook’s distance (observations where Cook’s distance exceeds 4/*N*, where *N* is the sample size, are discarded). Sample is 1999-2023 as in baseline specification (Table 1, column 4, in main text). Newey-West standard errors with 12 lags in parentheses. ***, **, and * denote statistical significance at the 1,5, and 10 percent level, respectively.

Table A2

Extensions with quarterly data: euro area Phillips curve estimates

Dependent variable: median HICP inflation gap

VARIABLES	(1) 2007-2019	(2) 2007-2023	(3) Outliers	(4) 2007-2019	(5) 2007-2023	(6) Outliers
V/U				17.990	-14.144***	7.538
				(18.842)	(4.579)	(7.866)
V/U-squared				-43.199	42.175***	-15.543
				(48.370)	(8.873)	(19.421)
H	0.343***	0.545***	0.514***	0.462***	0.419***	0.445***
	(0.094)	(0.086)	(0.062)	(0.105)	(0.107)	(0.068)
H-squared	-0.074	0.141***	0.151***	0.246**	0.041	0.254***
	(0.065)	(0.022)	(0.023)	(0.096)	(0.035)	(0.057)
U gap	-0.561***	-0.653***	-0.599***			
	(0.106)	(0.217)	(0.132)			
U gap-squared	0.117***	0.148	0.126**			
	(0.038)	(0.089)	(0.050)			
Constant				-2.195	0.660	-1.322*
				(1.572)	(0.503)	(0.704)
Observations	**52**	**65**	**60**	**52**	**65**	**59**
Rbar-squared	**0.778**	**0.761**	**0.838**	**0.384**	**0.860**	**0.787**

Notes: Estimation is based on quarterly data starting in 2007 in all cases based on the availability of the quarterly data for the ratio of vacancies to unemployed (4-quarter average). Dependent variable is inflation gap, defined as core inflation minus expected inflation, with core measured by quarterly annualized weighted median HICP inflation in all columns. Expected inflation measured by ECB Survey of Professional Forecasters (SPF) five-year-ahead forecast of headline inflation. “U gap” denotes deviation of unemployment rate from IMF staff estimate of natural rate of unemployment (4-quarter average). H denotes headline-inflation shock (4-quarter average). Columns 3 and 6 exclude outliers for the 2007-2023 sample based on Cook’s distance (observations where Cook’s distance exceeds 4/N, where N is the sample size, are discarded). Newey-West standard errors with 4 lags in parentheses. ***, **, and * denote statistical significance at the 1,5, and 10 percent level, respectively.

Table A3

US Phillips curve estimates

Dependent variable: median CPI inflation gap

VARIABLES	(1) 1985-2019	(2) 1985-2023
V/U	9.626**	7.814***
	(4.272)	(2.138)
V/U-squared	-11.014*	-8.122***
	(6.384)	(2.342)
V/U-cubed	4.512	3.146***
	(2.926)	(0.746)
H	0.010	0.033
	(0.073)	(0.073)
H-squared	0.128***	0.106***
	(0.035)	(0.019)
H-cubed	0.053***	0.044***
	(0.017)	(0.012)
Constant	-2.770***	-2.437***
	(0.875)	(0.577)
Observations	420	460
Rbar-squared	0.273	0.615

Notes: Table reports updated estimates of specification estimated by Ball, Leigh and Mishra (2022). Dependent variable is inflation gap, defined as core inflation minus expected inflation, with core measured by weighted median CPI inflation and expected inflation by US Survey of Professional Forecasters (SPF) ten-year-ahead forecast of CPI inflation. V/U denotes ratio of vacancies to unemployed (12-month average). H denotes headline-inflation shock (12-month average). Newey-West standard errors with 12 lags in parentheses. ***, **, and * denote statistical significance at the 1,5, and 10 percent level, respectively.