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# The 2020-2022 Inflation Surge Across Europe: A Phillips-Curve-Based Dissection

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**Prepared by Chikako Baba, Romain Duval, Ting Lan and Petia Topalova***

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**ABSTRACT:** In 2021-22, inflation in Europe soared to multidecade highs, consistently exceeding policymakers' forecasts and surprising with its wide cross-country dispersion. This paper analyzes the key drivers of the inflation surge in Europe and its variation across countries. The analysis highlights significant differences in Phillips curve parameters across Europe's economies. Inflation is more sensitive to domestic slack and external price pressures in emerging European economies compared to their advanced counterparts, which contributed to a greater passthrough of global commodity price shocks into domestic prices, and, consequently, to larger increases in inflation rates. Across Europe, inflation also appears to have become increasingly backward looking and more sensitive to commodity price shocks since the onset of the COVID-19 pandemic. This finding helps explain why conventional (Phillips curve) inflation models consistently underpredicted the 2021-2022 inflation surge, although it remains too early to conclude there has been a structural break in the inflation process.

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# Contents

# I. Introduction

The marked and persistent rise in inflation in 2021-22 defied forecasts and took center stage in policy discussions in Europe and beyond. As inflation soared to multidecade highs and price pressures broadened beyond select commodities and durable goods affected by supply shocks related to the COVID-19 pandemic and Russia's war in Ukraine, central banks had to confront several challenges: diagnosing the drivers of the surge in inflation, forecasting its likely path and risks around it, and calibrating monetary policies accordingly.

Two aspects of the inflation surge in Europe have been particularly puzzling, namely its cross-country dispersion and recurring under-estimation by economic forecasters. First, inflation exceeded 5 percent in almost all European economies by late summer 2022, but its rise was far larger in emerging market economies than it was in advanced ones. For example, by the summer of 2022, headline inflation reached 20–25 percent in the Baltic countries, three to four times the rate in the lowest-inflation countries in the euro area (Figure 1, panels 1 and 2). Likewise, average core inflation in emerging European economies exceeded 20 percent by the second quarter of 2022—a 12 percentage points gap vis-a-vis advanced European countries, compared to a 2-3 percentage points gap prior to the pandemic (Figure 1, panel 3). This heterogeneity is surprising given the largely common nature of the energy, food and global supply chain price shocks that sparked the surge (Figure 1, panel 4). Second, inflation outturns have consistently and repeatedly exceeded analysts' and policymakers' forecasts. For example, IMF's April 2022 World Economic Outlook (WEO) forecast errors for core inflation in the second quarter of 2022 were positive for all but one advanced and emerging market economies in Europe.

Many hypotheses for the unusual behavior of inflation have been put forward (see e.g. Gopinath, 2022, and Chahad et al., 2022, for an overview). The aggressive and globally coordinated monetary and fiscal policy response to the pandemic promoted a fast recovery in global economic activity, which helped fuel inflation as the global supply of many goods was constrained by COVID-19 lockdowns and supply chain bottlenecks.[1] At the same time, as lockdowns limited households' ability to consume many services, the pandemic shifted the relative demand towards goods, contributing to soaring commodity prices. The war in Ukraine added further fuel to this trend. The pandemic could have also eroded potential output, by reducing labor supply due to long-term health effects and shifts in workers' preferences towards lower working hours and less contact-intensive and more teleworkable jobs, adding to Europe's demographic headwinds.[2] High vacancy-to-unemployment ratios by the end of 2022—that partly reflect large numbers of unfilled job vacancies—suggest that European labor markets may indeed have been tighter than unemployment dynamics alone would suggest, contributing to a larger-than-expected rise in inflation.[3] In turn, the magnitude and persistence of the inflation surge itself might have led to self-reinforcing structural changes in the inflation process itself, such as greater persistence and responsiveness to inflation expectations, external price shocks and slack (Gopinath 2022, BIS 2022). Policymakers' understanding of the 2021-22 inflation dynamics is still evolving, with no consensus yet on the smoking gun behind the "excessive" inflation in Europe and its variation across countries.

[1] See, for example, Celasun et al (2022) for the effect of supply bottlenecks on inflation and Baba and Lee (2022) for the effect of commodity prices on inflation.

[2] For example, some studies suggest that long-lasting adverse health impacts of long-COVID-19 could have affected labor supply. See Bach (2022), Waters and Wernham (2022), Faberman, Mueller, and Sahin (2022), and Crump et al. (2022).

[3] See Duval et al (2022) for analysis focused on the United Kingdom and the United States. Ball, Leigh, and Mishra (2022) present evidence on the role of unemployment-to-vacancy ratios in explaining post-pandemic inflation in the United States.

In this paper, we aim to shed light on Europe's post-COVID-19 inflation puzzle by exploring empirically the factors that contributed to the cross-country dispersion in inflation and its persistent overshooting through the lens of the standard Phillips curve. We find significant differences in the parameters of the Phillips curves across countries in Europe. Inflation is more sensitive to changes in domestic slack and external price pressures in emerging European economies compared to advanced ones. This contributed to a greater passthrough of global commodity price shocks into domestic prices and hence to a larger inflation surge. We also find evidence that inflation in Europe has become increasingly backward looking and more sensitive to food price shocks since the onset of the COVID-19 pandemic. This finding is consistent with the higher persistence of inflation and greater passthrough of global food prices we uncover more broadly during past high-inflation episodes. While it is too early to assess whether these post-COVID-19 empirical regularities signal a structural change in the Phillips curve, they help explain the consistent underprediction of inflation by models based on the historical relationship between inflation and its drivers.

Our analysis does not aim to examine all possible hypotheses for the unusual behavior of Europe's inflation (see e.g. IMF 2022a for a more comprehensive discussion). Instead, it focuses on two factors that have received relatively less attention in ongoing policy debates but, yet, have major policy implications. For example, the differences in Phillips curves across countries point to a risk of persistent inflation divergence between euro area economies, with significantly higher inflation in newer member states such as the Baltic countries. They also suggest that, outside the euro area, a more forceful response might be needed to tame inflationary pressures in emerging market economies. Likewise, our finding of an increase in inflation's backward-lookingness in the post-pandemic period warrants careful monitoring. It might signal a change in the way firms set prices and workers bargain over wages, raising risks of feedback loops between wages and prices and a de-anchoring of inflation expectations that would steepen monetary policy trade-offs.

Our paper contributes to two strands of literature. First, we build on the sizable empirical literature that estimates Phillips curves to identify the drivers of inflation. In the last two decades, this literature has focused on the role of globalization and external factors,[4] and the changing sensitivity of inflation to slack, particularly in the context of the stubbornly low inflation in many advanced economies prior to the onset of the COVID-19 pandemic. To this literature, we contribute new Phillips curve estimates for Europe and uncover significant differences between advanced and emerging market countries. Second, our paper contributes to the recent literature that aims to explain the post-pandemic inflation surge in the United States and Europe (see, among others, Ball, Leigh and Mishra, 2022, Celasun et al. 2022, di Giovanni et al., 2022, Hilscher, Raviv and Reis, 2022, McGregor and Toscani 2022, Schmitt-Grohé and Uribe, 2022). This study is, to our knowledge, the first to document the increasing persistence of inflation across Europe since the pandemic in a Phillips curve framework.[5]

The rest of this paper is structured as follows. Section II presents the empirical methodology and data, and discusses the baseline results across advanced and emerging European economies. Section III focuses on the potential shifts in the inflation process since the onset of the COVID-19 pandemic, and, more broadly, during high-inflation periods. Section IV concludes.

[4] For the role of globalization and external factors, see Auer, Borio and Filardo (2017), Ball (2006), Bems et al. (2022), Borio and Filardo (2007), Borio (2017), Calza (2008), and Forbes (2020), among others. For the flattening of the Phillips curve, see, among others, Coibion and Gorodnichenko (2015), Abdih, Lin and Paret (2018), Ciccarelli and Osbat (2019). Koester et al (2019) discuss the persistently low inflation in the euro area.

[5] Using aggregate data for the euro area and EU27, Caporale et al (2022) document rising persistence of monthly headline inflation using fractional integration methods.

# II. Empirical Phillips Curves for Europe

## 1. Specification and Data

The starting point of our analysis is the Phillips curve, the workhorse inflation model in the literature, which describes the trade-off between inflation and economic activity, and still lies at the heart of most central banks' thinking. Drawing on past studies (Auer, Borio, and Filardo, 2017; Bems et al., 2022; IMF, 2021), we start with a baseline specification that augments a standard New Keynesian Phillips curve with variables that proxy for inflation developments abroad and global commodity price increases:

$$\pi_{i,t} = \beta_1 \pi_{i,t-1} + \beta_2 \pi_{i,t}^e + \beta_3 y_{i,t} + \beta_4 Energy_{i,t} + \sum_{j=0}^{4} \beta_j^F \; Food_{i,t-j} + \beta_5 extP_{i,t-1} + FE_i + \varepsilon_{i,t},$$

where $\pi_{i,t}$ is the quarter-over-quarter annualized core (headline) inflation in country *i* in quarter t; $\pi_{i,t}^e$ denotes three-year-ahead inflation expectations;[6] $y_{i,t}$ is the domestic economic slack measured by the unemployment (alternatively, output) gap, measured as the deviation from the Hodrick-Prescott (HP)-filtered unemployment rate (alternatively, log output), with a smoothing parameter of 1600; $Energy_{i,t}$ and $Food_{i,t-j}$ are quarterly growth in energy and food prices expressed in domestic currency and weighted by the shares of these items in domestic CPI baskets; $extP_{i,t-1}$ refers to lagged external price pressures; $FE_i$ are country fixed effects; and $\varepsilon_{i,t}$ is the error term. In our set-up, the role of external factors is captured by the external price pressure index as well as the global prices for energy and food.

The external price pressure variable captures the changes in producer prices of trading partners as well as the role of exchange rate fluctuations. Following IMF (2021), it is defined for country *i* as the sum of: i) the percent change in the import-weighted domestic producer price index (PPI) of countries *j* from which country *i* imports; and, ii) the relative changes in bilateral exchange rates against the US dollar $e$ in country *i* and *j*, weighted by country *j*'s share in country *i*'s total imports, $\omega_{ij,t}$, minus the percent change in country's *i* GDP deflator $P_{i,t}$:

$$extP_{i,t} = \sum_{j=1}^{J} \omega_{ij,t} \Delta PPI_{j,t} + \sum_{j=1}^{J} \omega_{ij,t} \left(\Delta e_{i,t} - \Delta e_{j,t}\right) - \Delta ln\left(P_{i,t}\right).$$

Likewise, the global prices for energy $Energy_t^*$ (and analogously for food) are converted to local currency using bilateral exchange rates against the US dollar $e$ in country *i*, and weighted by the share of energy (or food) in country *i*'s domestic consumption basket, $\omega_{i,t}^E$:

$$Energy_{i,t} = \omega_{i,t}^E e_{i,t} Energy_t^*.$$

The baseline specification includes contemporaneous energy and food price increases as well as four (quarterly) lags to capture the gradual passthrough of food and energy prices to domestic inflation.[7] To introduce forward-looking and backward-looking components of inflation in a theory-consistent fashion, the

[6] To capture inflation expectations, we prefer longer-term measures, since shorter-term expectations tend to react strongly to current inflation. The key findings of this paper are robust to using instead 1-year ahead inflation expectations.

[7] The choice of the number of lags reflects the empirical regularities uncovered in the data. Our empirical estimates suggest that the passthrough of food prices to domestic CPI is slower than the passthrough of energy prices. The coefficient on lagged food price is statistically significant only up to the fourth lag.

benchmark specification imposes the constraint that the sum of coefficients on past and expected inflation rates ($\beta_1 + \beta_2$) be equal to one, following Galí and Gertler (1999).[8]

The empirical dataset combines publicly available macroeconomic data from the IMF's World Economic Outlook database and Eurostat with proprietary data on inflation expectations from Consensus Economics, a leading organization that has collected international surveys of professional forecasters since 1989. The analysis is conducted at the quarterly frequency over the period 2000Q1-22Q2 for 24 advanced European economies (AE), including Austria, Belgium, Cyprus, Czech Republic, Germany, Denmark, Estonia, Finland, France, Greece, Ireland, Israel, Italy, Lithuania, Latvia, Netherlands, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and United Kingdom; and 7 emerging European economies (EE), namely Bulgaria, Croatia, Hungary, Poland, Romania, Russia and Türkiye.[9] This selection is based on data availability, in particular regarding medium-term inflation expectations. Annex I summarizes the data sources for the key variables of interest.

## 2. Estimation Results and Robustness

We estimate the Phillips curve in a panel framework for the full sample of European economies, as well as separately for the group of AE and EE in order to detect potential differences in the relationship between inflation and its determinants across the two sets of countries. Table 1 shows the findings from the benchmark estimation for core, while annex Table 1 shows the results for headline inflation.[10] These regressions confirm the strong association of inflation with economic slack and past and expected future price developments (Table 1). On average, a 1 percentage point increase in unemployment above its HP trend is associated with a decline in core inflation of 0.4 percentage points in Europe. A 1 percentage point rise in inflation expectations is significantly associated with a 0.6 percentage point increase in core inflation in Europe. Foreign price developments measured by the external price pressure variable and commodity prices are also found to drive domestic inflation, reflecting their impacts on production costs (Conflitti and Luciani, 2019, and Kilian and Zhou, 2021). The estimated coefficients are roughly in line with the literature on empirical Phillips curves augmented with global factors (see, among others, Coibion, Gorodnichenko, and Ulate, 2019; IMF, 2018).

The analysis reveals noteworthy differences between EE and AE. Columns (2) and (3) report estimation results for the AE and EE panels, respectively, while Column (4) shows full sample results from a specification in which the coefficients of the key regressors are allowed to differ across AE and EE by adding an interaction with a dummy variable for EE—which enables one to read readily the statistical significance of the differences in coefficients. First, we find that the slope of the Phillips curve – the coefficient on the domestic slack variable – is steeper in EE than in AE. Second, the coefficient on inflation expectations is lower in EE (0.4 compared to 0.7 in AE), indicating that price setting is less forward-looking in EE, consistent with weaker anchoring of

[8] Relaxing this restriction and estimating $\beta_1$ and $\beta_2$ freely would yield similar findings on the role of slack, external pressures and commodity prices for inflation, but in some cases may result in $\beta_1$ values above 1, similar to findings in other studies. See Table 2.

[9] Countries are classified as advanced following the definition of the IMF World Economic Outlook database. Countries not classified as advanced are considered emerging market economies.

[10] The results for headline inflation are qualitatively similar. For expositional brevity, we focus mostly on core inflation in the remainder of this paper. For countries in the euro area, we use the ECB definition of core inflation, namely headline excluding energy, food, alcohol and tobacco. For non-euro area countries, we use national definitions of core inflation.

inflation expectations historically. Third, inflation also responds more strongly to foreign price developments (especially global food prices) in EE.

We test the robustness of these findings to several alternative specifications. Table 2 reports: for AE, (1) the benchmark results, (2) OLS estimates of the benchmark regression without any constraint on the coefficients on expected and lagged inflation rates, (3) median regression results to address the possible influence of extreme observations, and (4) estimates of the benchmark regression using output gaps rather than unemployment gaps to measure economic slack; for EE, results from those same four specifications are reported in columns (5)-(8). Across specifications, the findings confirm the steeper slope of the Phillips curve, the bigger role of lagged inflation, and the bigger role of foreign price developments in EE than in AE. The coefficients on economic slack are not statistically significant for EE when measured by the output gap.

The differences in the estimated Phillips curves across the two groups of countries explain in part the larger inflation surge in EE compared to AE in 2021-22. Relative to AE, EE countries faced a larger impact of diminishing economic slack after the reopening of the economy following the COVID-19 pandemic, and a bigger contribution of the rise in food prices—whose weight in consumption baskets (controlled for in the construction of the food inflation variable) and passthrough to inflation are larger in EE. Moreover, as inflation started to pick up, the more backward-looking nature of the inflation process meant that high inflation would be expected to persist longer in EE.

## 3. Contribution to Inflation Dynamics

To what extent can the augmented Phillips curve help explain the 2021-22 inflation surge in Europe? To address this question, we first estimate the Phillips curve for each country with sufficiently long time-series coverage (at least 30 quarters) separately. This flexible approach, which allows for country-specific estimates of the relationship between inflation and its drivers, maximizes the potential explanatory power of the baseline specification. We then use the country-specific coefficients to compute the Phillips curve predicted inflation as well as the contribution from each regressor to inflation in each quarter, as in Yellen (2015). Given the presence of a lagged inflation term in our Phillips curves, we perform dynamic simulations to fully attribute fluctuations in past inflation to movements in the independent variables. Specifically, the contribution of independent variables $x$ to inflation dynamics in country i at time t, $C_{i,t}^{x}$, is calculated by:

$$C_{i,t}^{x} = \hat{\beta}_t^{x} x_{i,t} + \hat{\beta}_1 C_{i,t-1}^{x}$$

where $\hat{\beta}_t^{x}$ is the corresponding coefficient on variable $x$ obtained from country-by-country Phillips curve regressions, and $\hat{\beta}_1$ is the coefficient on lagged inflation.

Figure 2 and annex Figure 1 show the cross-country average contribution of each factor to core and headline inflation, respectively, expressed as deviations from the inflation target.[11] Several takeaways emerge from this analysis.

First, foreign price developments have been a major driver of rising inflation during 2021-22 in both AE and EE. while domestic factors, including inflation expectations, have played modest roles. This finding reflects the

[11] For the handful of economies without explicit inflation targets, the analysis assumes a three percent target. The findings are robust to alternative assumptions, such as using moving averages of 10-year-ahead inflation expectations.

dramatic rise in commodity prices over this period, particularly in 2022, amid still well-anchored inflation expectations. The role of diminishing economic slack, as captured by unemployment (or output) gaps, is estimated to be negligible given the estimated flatness of Phillips curves, particularly in AE.

Second, the Phillips curve simulations predict substantially higher inflation on average for EE compared to AE, in line with the actual outturns during 2021-22. For the average AE, the predicted deviation of core inflation from target in 2022Q2 was 2¾ percentage points, less than half of the 6 percentage points predicted deviation in the average EE —even after factoring in the higher average inflation target in EE compared to AE. This finding is consistent with the difference in the sensitivity of inflation to its drivers between the two groups of countries (Table 1), which implies larger contributions of commodity prices (especially food, but also fuel) and external price pressures (including exchange rate depreciation and its passthrough) to rising inflation in EE.

Third, for both AE and EE, the standard model of inflation can account for at most two-thirds of the surge in inflation. The estimated residuals— the difference between actual and model-predicted inflation—during 2022 are positive and very sizable.[12] Several factors have been put forward to account for this large unexplained component of the inflation surge. One is mismeasured (over-estimated) economic slack. Conventional unemployment or output gaps may be poor proxies for slack during times of extraordinary supply shocks (e.g. Gopinath, 2022) and structural labor market changes, such as shifts in workers' preferences and other pandemic-driven declines in labor supply (see e.g. Duval et al., 2022; McGregor and Toscani, 2022). Indeed, high vacancy-to-unemployment ratios—that partly reflect large numbers of unfilled job vacancies—at the end of 2022 suggest that European labor markets may have been tighter than unemployment alone suggests. Beyond labor shortages, unprecedented supply bottlenecks that are also captured poorly in the conventional Phillips curve model may also have contributed to recent price pressures (Celasun et al. 2022). Other possible unaccounted factors include discretionary policies, such as temporary tax changes (for instance, Germany's value-added tax cut that reduced inflation in the second half of 2020) and price-suppressing responses (for instance, gas and electricity price caps) to higher energy prices (Ari et al. 2022); however, these factors have tended to *contain* rather than amplify the inflation rise, and therefore cannot account for its positive unobserved component. All countries in Europe were affected by these factors in some way, as reflected in the consistently positive Phillips curve residuals in the last few quarters, but the extent varied across countries, accounting for some of the cross-country heterogeneity in unexplained inflation. For example, suggestive analysis not reported here points to some cross-country correlation between survey-based measures of rising input shortages and Phillips curve simulation residuals during 2022, indicating that mismeasured slack may have been one explanatory factor.[13]

Beyond the inability to properly capture the extent of slack and discretionary policies in the Phillips curve framework, the structural relationships that underpin the inflation process may have changed as Europe was hit by two tail-risk events: the pandemic and Russia's war in Ukraine. These shocks may have altered the way firms set prices and/or workers bargain over wages, which could lead to structural breaks in Phillips curve

[12] The estimated residuals for 2022 would be even larger if using Phillips curves estimated only on the pre-COVID-19 (rather than the full) sample period.

[13] More broadly, regressing the historical residuals on variables outside of the Phillips curve model also uncovers correlations with alternative measures of labor market tightness (e.g. the share of firms reporting labor shortages) or supply bottlenecks (e.g. the share of firms reporting shortages of intermediate inputs). Illustrative calculations suggest that the widespread reported input and labor shortages might have raised core inflation by up to 1.5 percentage point on average in Europe. IMF 2022a also documents that specific tax and regulatory measures (such as price caps or freezes) adopted to mitigate rising commodity prices helped limit the rise in inflation in some European countries.

relationships estimated on historical data. We provide some preliminary evidence of such breaks in the next section.

# III. Shifts in the Phillips Curves

To explore possible structural shifts, we start by estimating Phillips curves on a rolling basis, using panel data for 28 countries over 16 quarters.[14] The point estimates along with the 90$^{th}$ percentile confidence intervals of the key inflation drivers are presented in Figure 3, with the first, second and third columns showing results for the full set of European countries, AE and EE, respectively.

The rolling estimation points to several possible shifts in the Phillips curve coefficients in the post-pandemic period. First, the coefficient on lagged core (headline) inflation shows signs of increasing in the last 3 rolling sample periods, starting from the 2018Q1-2021Q4 window, suggesting that inflation may have become more backward-looking. Likewise, the passthrough of global food prices to domestic inflation appears to have increased sharply, while the rise in the passthrough of energy prices to core inflation is more moderate and started earlier during the pandemic. These patterns are particularly pronounced within the EE sample.

As an alternative to, and more formal evidence than the rolling regressions, we re-estimate the Phillips curve using the full dataset but allow its coefficients to differ in the post-pandemic period by including interactions between key explanatory variables and a dummy variable equal to 1 for all quarters after 2019Q4. The findings, summarized in Table 3, confirm statistically significant changes in the persistence of inflation and its sensitivity to external price pressures in the post-pandemic period.

Finally, we explore whether the shifts in Phillips curve coefficients observed during the recent high-inflation episode fit a more general historical pattern. Specifically, we examine whether a significant increase in inflation's persistence and its sensitivity to external price pressures can generally be observed during historical periods of high inflation. In a high-inflation regime, the inflation process may become fundamentally different from that in low-inflation regimes (see e.g. BIS, 2022, IMF 2022b). In particular, as inflation rises, its level may gain a more prominent role in price- and wage-setting decisions; firms may become more willing to raise their prices to reflect increases in input costs, while workers may become more inclined to demand higher wages to compensate for loss of purchasing power.[15] Such behavioral changes can make the inflation process more backward-looking and raise inflation persistence.

As presented in Table 4, we find that the coefficient on past inflation is significantly higher—and the coefficient on inflation expectations correspondingly lower—during periods of high inflation, where high inflation periods are defined here as those when inflation exceeds the 60th percentile observed in each country over the sample period.[16] Likewise, inflation becomes significantly more sensitive to food price shocks during these periods. As in Table 3, the findings are more pronounced for the EE sample. These results are consistent with the findings of several recent studies. Characterizing inflation dynamics following episodes of large inflation surges in the last three decades, Blanco et al. (2022) find that inflation following surges tends to be persistent, with the

[14] For this exercise, we keep the sample of countries consistent over time to avoid conflating changes in the estimated coefficients with changes in sample composition. This explains the lower number of countries relative to the analysis presented in Section II.

[15] Schwartzman and Ravindranath Waddell (2022) present evidence from surveys of US firms suggesting that, in 2021-22, CEOs and other business leaders increasingly incorporated aggregate measures of current inflation into their decision-making and price/cost expectations.

[16] The findings are robust to alternative, higher thresholds for defining high inflation periods, such as 80 percent.

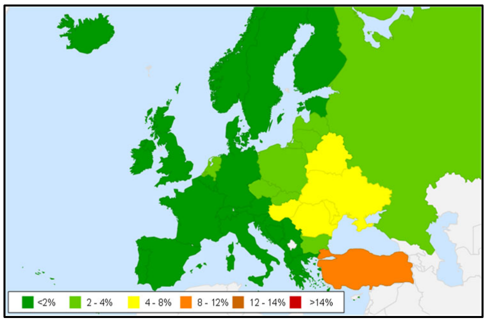
duration of disinflation exceeding that of the initial inflation increase. Baba and Lee (2022) analyze the response of wage growth to inflation triggered by commodity price increases in Europe and document a high passthrough from price shock to wages when prevailing inflation is high. Similarly, the passthrough of prices to wages in Europe has been found to be larger in a high-inflation environment (Boranova et al. 2021).

# IV. Conclusion

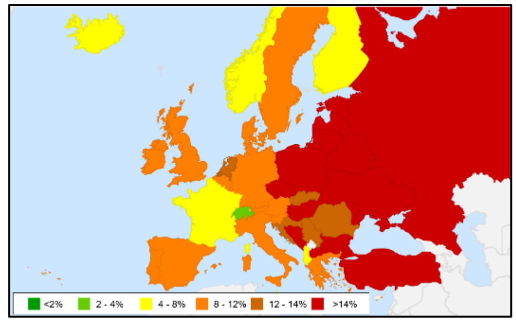
The return of inflation in 2021-22 to levels not seen in decades is yet to be fully understood. In Europe, it surprised policymakers and forecasters alike, not only by its persistence, but also by its wide dispersion in response to shocks that were largely common across countries. In this paper, we shed some light on the puzzling behavior of inflation through the lens of the Phillips curve. First, we find that an important factor that could explain the heterogeneity in inflation across AE and EE is differences in the sensitivity of inflation to its traditional drivers across these groups of economies. Relative to advanced economies, in emerging market economies in Europe, inflation is more sensitive to changes in domestic slack and external price pressures. This contributed to the greater passthrough of the global commodity price shock into domestic prices and hence to higher inflation rates in EE. Further, the inflation process is more backward-looking in EE, which increases the persistence of an inflation spike. Second, we find that a sizable share of the 2022 uptick in inflation cannot be explained by conventional inflation drivers. Our analysis suggests that across Europe, inflation became more backward looking and more sensitive to food price shocks after the onset of the COVID-19 pandemic. Thus, models based on the historical relationship between inflation and its conventional drivers consistently underpredicted inflation outturns during 2021-22. We show that this finding is consistent with the higher persistence of inflation and greater passthrough of global food prices observed during past periods of high inflation. It is too early to judge whether these findings signal long-lasting shifts in the structural relationships underpinning the inflation process in Europe. Nevertheless, the suggestive signs are worrisome. The increase in the extent to which inflation is influenced by its past values could make it harder and costlier to reduce inflation from the multidecade highs that it reached in 2022. And the greater passthrough of commodity prices to core inflation makes inflation more vulnerable to further adverse supply shocks such as new geopolitical or extreme weather events.

## Figure 1. Inflation Developments in Europe

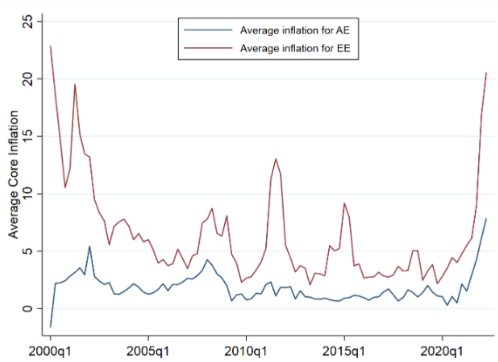
**1. Inflation, December 2019**
*(Percent change, year-over-year)*



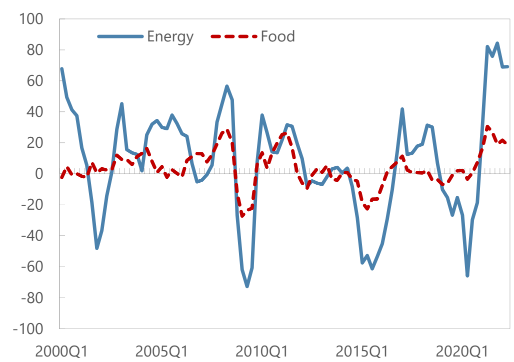

**2. Inflation, August 2022**
*(Percent change, year-over-year)*




**3. Core inflation in advanced and emerging Europe**
*(Percent change, quarter-over-quarter annualized)*

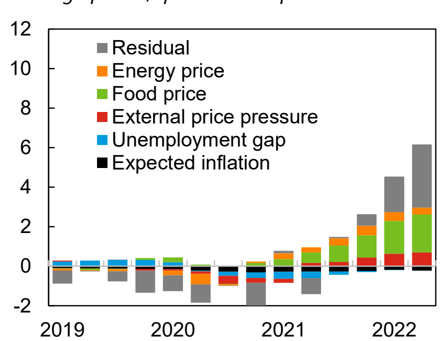



**4. Global energy and food price inflation**
*(Percent change, 4 quarter moving average of quarter-over-quarter annualized)*

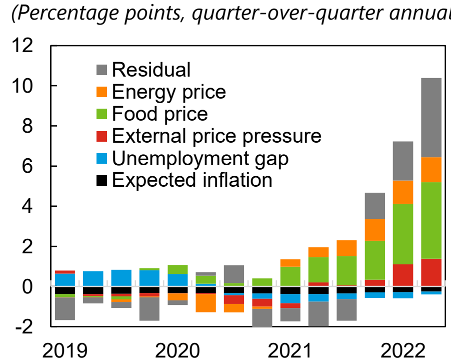



## Figure 2. Contribution to Inflation Dynamics

**Core inflation in Advanced Europe**
*(Percentage points, quater-over-quater annualized)*

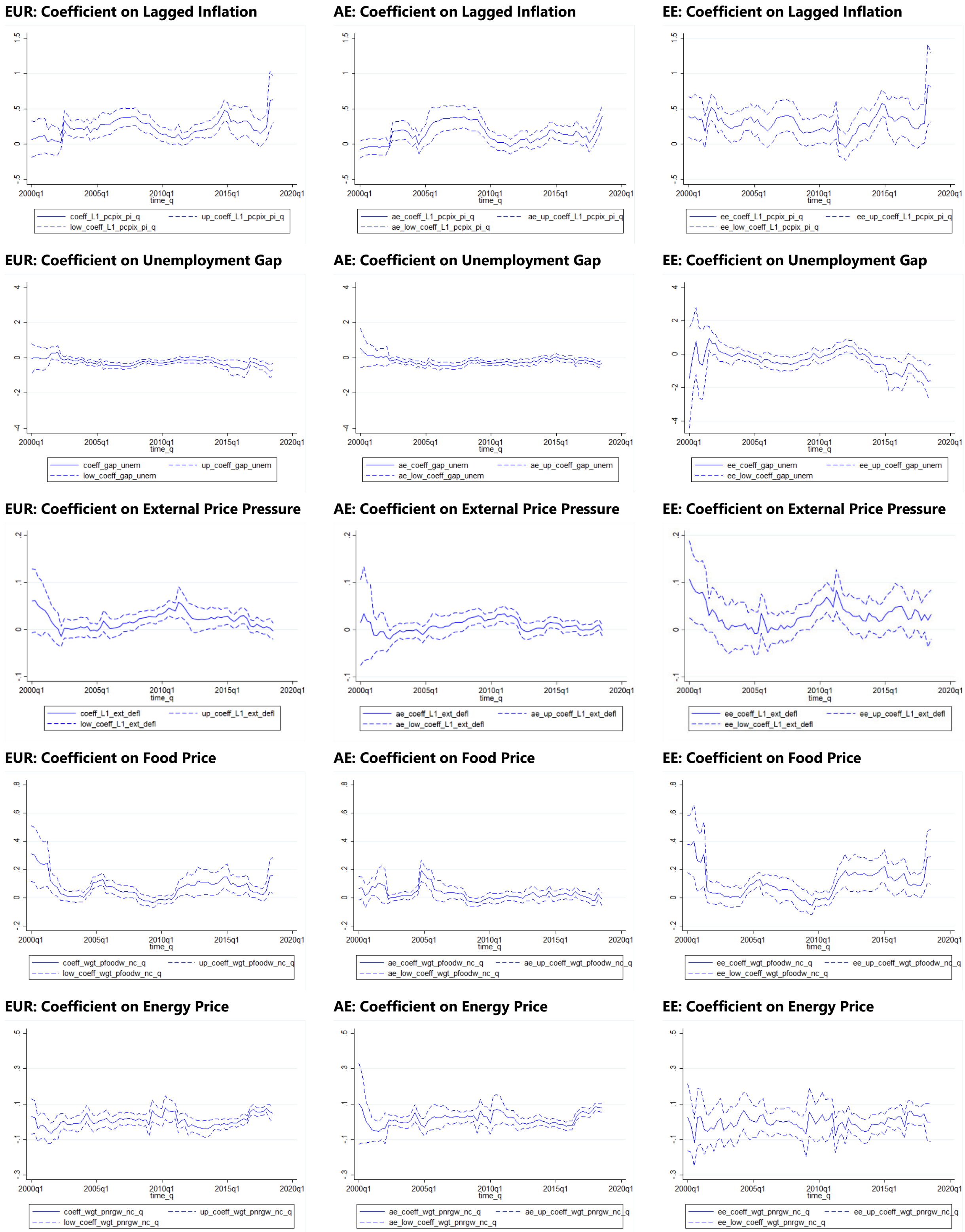



**Core inflation in Emerging Europe**
*(Percentage points, quarter-over-quarter annualized*




Sources: Haver Analytics; Consensus Economics; IMF, World Economic Outlook Database; and IMF staff calculations.
Note: The bars in the charts represent the simple average contribution of each factor across advanced and emerging economies in Europe. Contributions are calculated based on the dynamic simulations of country-by-country Phillips curve regressions.

**Figure 3. Coefficients from Rolling Regressions**




Notes: The solid line displays the coefficients on core inflation for full data (left), AE data (middle) and EE data (right). The dashed lines show its 10th and 90th percentile confidence interval. Each regression covers a rolling window of 16 quarters starting in the quarter indicated on x-axis.

## Table 1. Benchmark Phillips Curve Estimation
(Dependent variable: Core inflation, quarter-over-quarter annualized)

| | (1) All | (2) AE | (3) EE | (4) All |
|---|---|---|---|---|
| Unemployment gap | -0.374*** | -0.337*** | -0.676*** | -0.337*** |
| | (0.078) | (0.097) | (0.179) | (0.097) |
| Unemployment gap x EE dummy | | | | -0.339* |
| | | | | (0.203) |
| Lag of inflation | 0.431*** | 0.287* | 0.581*** | 0.287* |
| | (0.127) | (0.161) | (0.105) | (0.162) |
| Lag of inflation x EE dummy | | | | 0.295 |
| | | | | (0.192) |
| Inflation expectations | 0.569*** | 0.713*** | 0.419*** | 0.713*** |
| | (0.127) | (0.161) | (0.105) | (0.162) |
| Inflation expectations x EE dummy | | | | -0.295 |
| | | | | (0.192) |
| Lag of external price pressure | 0.020*** | 0.009* | 0.037** | 0.009* |
| | (0.006) | (0.005) | (0.015) | (0.005) |
| Lag of external price pressure x EE dummy | | | | 0.028* |
| | | | | (0.015) |
| Food prices | | | | |
| Lag 0 | 0.127*** | 0.065*** | 0.181*** | 0.065*** |
| | (0.034) | (0.015) | (0.054) | (0.015) |
| Lag 0 x EE dummy | | | | 0.115** |
| | | | | (0.056) |
| Lag 1 | 0.078*** | 0.054*** | 0.075*** | 0.054*** |
| | (0.020) | (0.020) | (0.027) | (0.020) |
| Lag 1 x EE dummy | | | | 0.020 |
| | | | | (0.033) |
| Lag 2 | 0.032 | 0.045*** | -0.001 | 0.045*** |
| | (0.022) | (0.015) | (0.030) | (0.015) |
| Lag 2 x EE dummy | | | | -0.045 |
| | | | | (0.033) |
| Lag 3 | 0.070*** | 0.077*** | 0.065** | 0.077*** |
| | (0.021) | (0.018) | (0.032) | (0.018) |
| Lag 3 x EE dummy | | | | -0.012 |
| | | | | (0.037) |
| Lag 4 | 0.042** | 0.040** | 0.053** | 0.040** |
| | (0.017) | (0.019) | (0.026) | (0.019) |
| Lag 4 x EE dummy | | | | 0.012 |
| | | | | (0.032) |
| Energy prices | 0.016 | 0.032*** | 0.021 | 0.032*** |
| | (0.011) | (0.008) | (0.022) | (0.008) |
| Energy prices x EE dummy | | | | -0.011 |
| | | | | (0.024) |
| Observations | 2,210 | 1,707 | 503 | 2,210 |
| Country FE | Yes | Yes | Yes | Yes |
| Time FE | No | No | No | No |

Unbalanced panel data for 24 advanced and 7 emerging economies in Europe, 2000Q1-2022Q2. The sum of coefficients on lagged and expected inflation rates are constrained to be one. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

**Table 2. Robustness Checks: Phillips Curve Estimation**

(Dependent variable: Core inflation, quarter-over-quarter annualized)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Advanced Europe | | | | Emerging Europe | | | |
| VARIABLES | Const Reg | OLS | Median Reg | Output Gap | Const Reg | OLS | Median Reg | Output Gap |
| Unemployment Gap | -0.337*** | -0.305*** | -0.194*** | | -0.676*** | -0.706** | -0.382*** | |
| | (0.097) | (0.064) | (0.027) | | (0.179) | (0.244) | (0.078) | |
| Output Gap | | | | 0.117*** | | | | 0.097 |
| | | | | (0.036) | | | | (0.076) |
| Lag of inflation | 0.287* | 0.264* | 0.451*** | 0.310* | 0.581*** | 0.543*** | 0.495*** | 0.601*** |
| | (0.161) | (0.129) | (0.023) | (0.165) | (0.105) | (0.045) | (0.046) | (0.108) |
| Inflation expectations | 0.713*** | 1.424** | 0.644*** | 0.690*** | 0.419*** | 0.656*** | 0.702*** | 0.399*** |
| | (0.161) | (0.528) | (0.089) | (0.165) | (0.105) | (0.089) | (0.128) | (0.108) |
| Lag of external price pressure | 0.009* | 0.011** | 0.007*** | 0.005 | 0.037** | 0.044* | 0.011 | 0.030** |
| | (0.005) | (0.005) | (0.002) | (0.005) | (0.015) | (0.023) | (0.009) | (0.014) |
| Food prices | | | | | | | | |
| Lag 0 | 0.065*** | 0.070*** | 0.034*** | 0.059*** | 0.181*** | 0.171* | 0.071*** | 0.178*** |
| | (0.015) | (0.019) | (0.005) | (0.015) | (0.054) | (0.071) | (0.015) | (0.056) |
| Lag 1 | 0.054*** | 0.055*** | 0.044*** | 0.061*** | 0.075*** | 0.056 | 0.048*** | 0.087*** |
| | (0.020) | (0.009) | (0.006) | (0.020) | (0.027) | (0.037) | (0.016) | (0.028) |
| Lag 2 | 0.045*** | 0.048*** | 0.032*** | 0.050*** | -0.001 | -0.008 | 0.022 | 0.006 |
| | (0.015) | (0.015) | (0.006) | (0.017) | (0.030) | (0.021) | (0.015) | (0.030) |
| Lag 3 | 0.077*** | 0.077*** | 0.042*** | 0.072*** | 0.065** | 0.056 | 0.042*** | 0.054* |
| | (0.018) | (0.025) | (0.005) | (0.018) | (0.032) | (0.029) | (0.014) | (0.031) |
| Lag 4 | 0.040** | 0.040*** | 0.026*** | 0.040** | 0.053** | 0.043*** | 0.021 | 0.045* |
| | (0.019) | (0.010) | (0.006) | (0.019) | (0.026) | (0.004) | (0.013) | (0.026) |
| Energy Price | 0.032*** | 0.034*** | 0.018*** | 0.018* | 0.021 | 0.029 | 0.031** | 0.012 |
| | (0.008) | (0.011) | (0.005) | (0.010) | (0.022) | (0.019) | (0.013) | (0.022) |
| Observations | 1,707 | 1,707 | 1,707 | 1,710 | 503 | 503 | 503 | 502 |

Standard errors, reported in parentheses, are corrected for heteroscedasticity and autocorrelations. *** p<0.01, ** p<0.05, * p<0.1. All regressions include country fixed effects.

**Table 3. Phillips Curve: Pre vs Post Covid Period**
(Dependent variable: Core inflation, quarter-over-quarter annualized)

| | (1) All | (2) AE | (3) EE | (4) All | (5) AE | (6) EE |
|---|---|---|---|---|---|---|
| Unemployment gap | -0.374*** | -0.337*** | -0.676*** | -0.358*** | -0.362*** | -0.542*** |
| | (0.078) | (0.097) | (0.179) | (0.079) | (0.093) | (0.169) |
| Unemployment gap x Post-covid dummy | | | | 0.018 | 0.192 | -0.406 |
| | | | | (0.226) | (0.187) | (0.955) |
| Lag of inflation | 0.431*** | 0.287* | 0.581*** | 0.364*** | 0.205 | 0.510*** |
| | (0.127) | (0.161) | (0.105) | (0.116) | (0.141) | (0.073) |
| Lag of inflation x Post-covid dummy | | | | 0.551** | 0.339* | 0.908** |
| | | | | (0.256) | (0.176) | (0.394) |
| Inflation expectations | 0.569*** | 0.713*** | 0.419*** | 0.636*** | 0.795*** | 0.490*** |
| | (0.127) | (0.161) | (0.105) | (0.116) | (0.141) | (0.073) |
| Inflation expectations x Post-covid dummy | | | | -0.551** | -0.339* | -0.908** |
| | | | | (0.256) | (0.176) | (0.394) |
| Lag of external price pressure | 0.020*** | 0.009* | 0.037** | 0.016** | 0.003 | 0.027** |
| | (0.006) | (0.005) | (0.015) | (0.006) | (0.005) | (0.012) |
| Lag of external price pressure x Post-covid dummy | | | | -0.037*** | -0.019** | -0.006 |
| | | | | (0.014) | (0.010) | (0.036) |
| Food prices | | | | | | |
| Lag 0 | 0.127*** | 0.065*** | 0.181*** | 0.099** | 0.033*** | 0.141** |
| | (0.034) | (0.015) | (0.054) | (0.039) | (0.012) | (0.061) |
| Lag 0 x Post-covid dummy | | | | 0.056 | -0.051 | 0.119 |
| | | | | (0.098) | (0.039) | (0.133) |
| Lag 1 | 0.078*** | 0.054*** | 0.075*** | 0.061*** | 0.028 | 0.068*** |
| | (0.020) | (0.020) | (0.027) | (0.019) | (0.021) | (0.025) |
| Lag 1 x Post-covid dummy | | | | 0.082 | 0.159*** | -0.062 |
| | | | | (0.072) | (0.041) | (0.096) |
| Lag 2 | 0.032 | 0.045*** | -0.001 | 0.026 | 0.021* | 0.006 |
| | (0.022) | (0.015) | (0.030) | (0.020) | (0.012) | (0.022) |
| Lag 2 x Post-covid dummy | | | | -0.086 | -0.027 | -0.075 |
| | | | | (0.113) | (0.049) | (0.110) |
| Lag 3 | 0.070*** | 0.077*** | 0.065** | 0.042** | 0.051** | 0.035 |
| | (0.021) | (0.018) | (0.032) | (0.017) | (0.020) | (0.022) |
| Lag 3 x Post-covid dummy | | | | 0.188 | 0.065 | 0.145 |
| | | | | (0.166) | (0.052) | (0.156) |
| Lag 4 | 0.042** | 0.040** | 0.053** | 0.031** | 0.009 | 0.053*** |
| | (0.017) | (0.019) | (0.026) | (0.013) | (0.016) | (0.020) |
| Lag 4 x Post-covid dummy | | | | -0.068 | 0.195*** | -0.222 |
| | | | | (0.172) | (0.054) | (0.184) |
| Energy prices | 0.016 | 0.032*** | 0.021 | -0.011 | 0.005 | 0.002 |
| | (0.011) | (0.008) | (0.022) | (0.014) | (0.012) | (0.022) |
| Energy prices x Post-covid dummy | | | | 0.034 | 0.078*** | -0.050 |
| | | | | (0.041) | (0.022) | (0.067) |
| Post-covid dummy | | | | -0.153 | -0.070 | 0.153 |
| | | | | (0.347) | (0.263) | (0.923) |
| Observations | 2,210 | 1,707 | 503 | 2,210 | 1,707 | 503 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | No | No | No | No | No | No |

Unbalanced panel data for 24 advanced and 7 emerging economies in Europe, 2000Q1-2022Q2. The sum of coefficients on lagged and expected inflation rates are constrained to be one. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

## Table 4. Philipps Curve: High vs Low Inflation Period

(Dependent variable: Core inflation, quarter-over-quarter annualized)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | All | AE | EE | All | AE | EE |
| Unemployment gap | -0.374*** | -0.337*** | -0.676*** | -0.288*** | -0.278*** | -0.376*** |
| | (0.078) | (0.097) | (0.179) | (0.048) | (0.048) | (0.132) |
| Unemployment gap x high inflation dummy | | | | 0.274** | 0.433** | -0.235 |
| | | | | (0.132) | (0.173) | (0.370) |
| Lag of inflation | 0.431*** | 0.287* | 0.581*** | 0.124 | 0.062 | 0.309*** |
| | (0.127) | (0.161) | (0.105) | (0.076) | (0.058) | (0.081) |
| Lag of inflation x high inflation dummy | | | | 0.527*** | 0.663*** | 0.269* |
| | | | | (0.121) | (0.126) | (0.143) |
| Inflation expectations | 0.569*** | 0.713*** | 0.419*** | 0.876*** | 0.938*** | 0.691*** |
| | (0.127) | (0.161) | (0.105) | (0.076) | (0.058) | (0.081) |
| Inflation expectations x high inflation dummy | | | | -0.527*** | -0.663*** | -0.269* |
| | | | | (0.121) | (0.126) | (0.143) |
| Lag of external price pressure | 0.020*** | 0.009* | 0.037** | 0.009* | 0.012** | 0.010 |
| | (0.006) | (0.005) | (0.015) | (0.005) | (0.005) | (0.011) |
| Lag of external price pressure x high inflation dun | | | | 0.009 | -0.013* | 0.044* |
| | | | | (0.013) | (0.007) | (0.027) |
| Food prices | | | | | | |
| Lag 0 | 0.127*** | 0.065*** | 0.181*** | 0.003 | -0.002 | 0.012 |
| | (0.034) | (0.015) | (0.054) | (0.010) | (0.009) | (0.018) |
| Lag 0 x high inflation dummy | | | | 0.206*** | 0.089*** | 0.259*** |
| | | | | (0.055) | (0.018) | (0.078) |
| Lag 1 | 0.078*** | 0.054*** | 0.075*** | 0.045*** | 0.018 | 0.048* |
| | (0.020) | (0.020) | (0.027) | (0.017) | (0.019) | (0.025) |
| Lag 2 | 0.032 | 0.045*** | -0.001 | 0.000 | 0.005 | -0.012 |
| | (0.022) | (0.015) | (0.030) | (0.016) | (0.009) | (0.025) |
| Lag 3 | 0.070*** | 0.077*** | 0.065** | 0.041*** | 0.039*** | 0.052 |
| | (0.021) | (0.018) | (0.032) | (0.016) | (0.013) | (0.032) |
| Lag 4 | 0.042** | 0.040** | 0.053** | 0.017 | -0.000 | 0.042* |
| | (0.017) | (0.019) | (0.026) | (0.017) | (0.018) | (0.022) |
| Energy prices | 0.016 | 0.032*** | 0.021 | 0.020*** | 0.028*** | 0.014 |
| | (0.011) | (0.008) | (0.022) | (0.008) | (0.009) | (0.014) |
| Energy prices x high inflation dummy | | | | -0.038* | -0.009 | -0.007 |
| | | | | (0.023) | (0.015) | (0.039) |
| High inflation dummy | | | | 1.755*** | 1.947*** | 1.624*** |
| | | | | (0.170) | (0.134) | (0.555) |
| Observations | 2,210 | 1,707 | 503 | 2,210 | 2,210 | 2,210 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | No | No | No | No | No | No |

Unbalanced panel data for 24 advanced and 7 emerging economies in Europe, 2000Q1-2022Q2. The dummy variable for high inflation regimes is 1 when core inflation exceeds a 60 percentile of historical values for a given country. The sum of coefficients on lagged and expected inflation rates are constrained to be one. Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

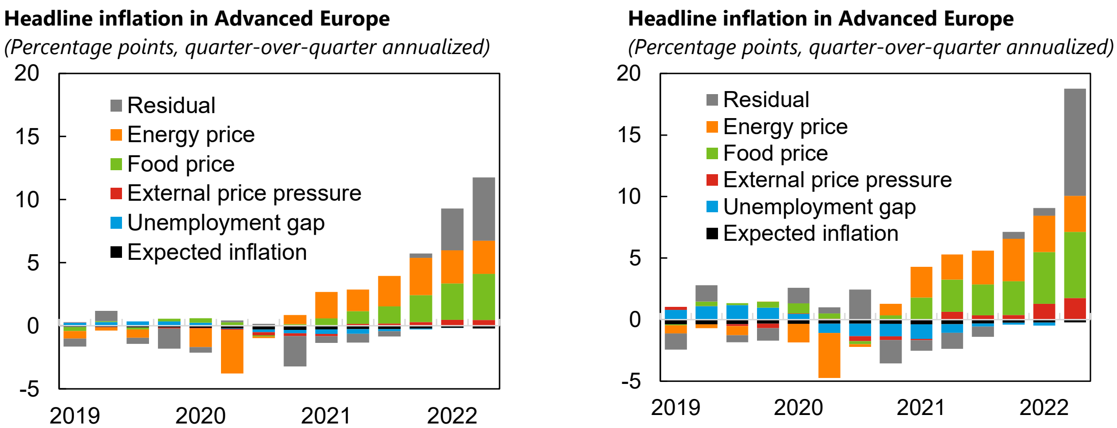
## Annex I. Data Sources

**Table A1. Data Sources**

| Variable | Source |
|---|---|
| Core/Headline consumer price index | Haver Analytics |
| Three-year-ahead inflation expectations | Consensus Economics |
| Commodity price (food and energy) | IMF, International Financial Statistics |
| Bilateral exchange rate against the US dollars | IMF, International Financial Statistics |
| External price pressure | IMF staff calculations |
| Producer price index | Haver Analytics |
| Bilateral exports and imports | IMF, Direction of Trade Statistics |
| Real GDP | IMF, World Economic Outlook Database |
| Unemployment rate | IMF, World Economic Outlook Database |
| Inflation target | Central Banks |

## Annex II. Results for Headline inflation

**Figure A1. Contribution to Inflation Dynamics: Headline inflation**




Sources: Haver Analytics; Consensus Economics; IMF, World Economic Outlook Database; and IMF staff calculations.
Note: The bars in the charts represent the simple average contribution of each factor across advanced and emerging economies in Europe. Contributions are calculated based on the dynamic simulations of country-by-country Phillips curve regressions.

**Table A2. Benchmark Phillips Curve Estimation: Headline inflation**
(Dependent variable: Headline inflation, quarter-over-quarter annualized)

| | (1) All | (2) AE | (3) EE | (4) All |
|---|---|---|---|---|
| Unemployment gap | -0.412*** | -0.272*** | -0.781*** | -0.272*** |
| | (0.072) | (0.058) | (0.230) | (0.058) |
| Unemployment gap x EE dummy | | | | -0.508** |
| | | | | (0.236) |
| Lag of inflation | 0.460*** | 0.492*** | 0.450*** | 0.492*** |
| | (0.065) | (0.040) | (0.130) | (0.041) |
| Lag of inflation x EE dummy | | | | -0.042 |
| | | | | (0.136) |
| Inflation expectations | 0.540*** | 0.508*** | 0.550*** | 0.508*** |
| | (0.065) | (0.040) | (0.130) | (0.041) |
| Inflation expectations x EE dummy | | | | 0.042 |
| | | | | (0.136) |
| Lag of external price pressure | 0.018* | 0.006 | 0.036 | 0.006 |
| | (0.010) | (0.007) | (0.024) | (0.007) |
| Lag of external price pressure x EE dummy | | | | 0.030 |
| | | | | (0.025) |
| Food prices | | | | |
| Lag 0 | 0.159*** | 0.082*** | 0.231*** | 0.082*** |
| | (0.039) | (0.015) | (0.067) | (0.015) |
| Lag 0 x EE dummy | | | | 0.149** |
| | | | | (0.069) |
| Lag 1 | 0.105*** | 0.065*** | 0.124*** | 0.065*** |
| | (0.020) | (0.017) | (0.030) | (0.017) |
| Lag 1 x EE dummy | | | | 0.058* |
| | | | | (0.035) |
| Lag 2 | 0.056*** | 0.080*** | 0.031 | 0.080*** |
| | (0.020) | (0.013) | (0.042) | (0.013) |
| Lag 2 x EE dummy | | | | -0.049 |
| | | | | (0.044) |
| Lag 3 | 0.067*** | 0.045*** | 0.100** | 0.045*** |
| | (0.021) | (0.012) | (0.041) | (0.012) |
| Lag 3 x EE dummy | | | | 0.055 |
| | | | | (0.042) |
| Lag 4 | 0.051** | 0.083*** | 0.026 | 0.083*** |
| | (0.022) | (0.013) | (0.040) | (0.013) |
| Lag 4 x EE dummy | | | | -0.056 |
| | | | | (0.041) |
| Energy prices | 0.152*** | 0.172*** | 0.140*** | 0.172*** |
| | (0.014) | (0.010) | (0.027) | (0.010) |
| Energy prices x EE dummy | | | | -0.032 |
| | | | | (0.029) |
| Observations | 2,210 | 1,707 | 503 | 2,210 |
| Country FE | Yes | Yes | Yes | Yes |
| Time FE | No | No | No | No |

Unbalanced panel data for 24 advanced and 7 emerging economies in Europe, 2000Q1-2022Q2. The sum of coefficients on lagged and expected inflation rates are constrained to be one. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

## Table A3. Phillips Curve for Headline Inflation: Pre vs Post Covid Period
(Dependent variable: Headline inflation, quarter-over-quarter annualized)

| | (1) All | (2) AE | (3) EE | (4) All | (5) AE | (6) EE |
|---|---|---|---|---|---|---|
| Unemployment gap | -0.412*** | -0.272*** | -0.781*** | -0.367*** | -0.287*** | -0.556** |
| | (0.072) | (0.058) | (0.230) | (0.074) | (0.061) | (0.219) |
| Unemployment gap x Post-covid dummy | | | | -0.075 | 0.287 | -1.458 |
| | | | | (0.300) | (0.230) | (0.981) |
| Lag of inflation | 0.460*** | 0.492*** | 0.450*** | 0.375*** | 0.396*** | 0.351*** |
| | (0.065) | (0.040) | (0.130) | (0.048) | (0.040) | (0.081) |
| Lag of inflation x Post-covid dummy | | | | 0.207 | -0.149 | 1.216*** |
| | | | | (0.168) | (0.104) | (0.441) |
| Inflation expectations | 0.540*** | 0.508*** | 0.550*** | 0.625*** | 0.604*** | 0.649*** |
| | (0.065) | (0.040) | (0.130) | (0.048) | (0.040) | (0.081) |
| Inflation expectations x Post-covid dummy | | | | -0.207 | 0.149 | -1.216*** |
| | | | | (0.168) | (0.104) | (0.441) |
| Lag of external price pressure | 0.018* | 0.006 | 0.036 | 0.007 | -0.004 | 0.019 |
| | (0.010) | (0.007) | (0.024) | (0.010) | (0.007) | (0.020) |
| Lag of external price pressure x Post-covid dummy | | | | -0.019 | -0.011 | -0.045 |
| | | | | (0.024) | (0.021) | (0.056) |
| Food prices | | | | | | |
| Lag 0 | 0.159*** | 0.082*** | 0.231*** | 0.111*** | 0.031** | 0.175** |
| | (0.039) | (0.015) | (0.067) | (0.043) | (0.014) | (0.070) |
| Lag 0 x Post-covid dummy | | | | 0.092 | 0.046 | 0.003 |
| | | | | (0.139) | (0.060) | (0.163) |
| Lag 1 | 0.105*** | 0.065*** | 0.124*** | 0.077*** | 0.033** | 0.106*** |
| | (0.020) | (0.017) | (0.030) | (0.017) | (0.013) | (0.029) |
| Lag 1 x Post-covid dummy | | | | 0.281** | 0.354*** | 0.136 |
| | | | | (0.114) | (0.074) | (0.129) |
| Lag 2 | 0.056*** | 0.080*** | 0.031 | 0.059*** | 0.060*** | 0.056* |
| | (0.020) | (0.013) | (0.042) | (0.017) | (0.013) | (0.030) |
| Lag 2 x Post-covid dummy | | | | -0.195 | 0.004 | -0.413** |
| | | | | (0.155) | (0.068) | (0.178) |
| Lag 3 | 0.067*** | 0.045*** | 0.100** | 0.039** | 0.024** | 0.067** |
| | (0.021) | (0.012) | (0.041) | (0.016) | (0.012) | (0.028) |
| Lag 3 x Post-covid dummy | | | | 0.317 | 0.213*** | 0.035 |
| | | | | (0.248) | (0.073) | (0.196) |
| Lag 4 | 0.051** | 0.083*** | 0.026 | 0.033* | 0.041*** | 0.026 |
| | (0.022) | (0.013) | (0.040) | (0.018) | (0.011) | (0.032) |
| Lag 4 x Post-covid dummy | | | | 0.032 | 0.375*** | -0.192 |
| | | | | (0.225) | (0.093) | (0.250) |
| Energy prices | 0.152*** | 0.172*** | 0.140*** | 0.142*** | 0.167*** | 0.126*** |
| | (0.014) | (0.010) | (0.027) | (0.016) | (0.012) | (0.031) |
| Energy prices x Post-covid dummy | | | | -0.029 | -0.010 | 0.008 |
| | | | | (0.058) | (0.029) | (0.082) |
| Post-covid dummy | | | | -0.955 | -1.231*** | 0.464 |
| | | | | (0.611) | (0.374) | (1.449) |
| Observations | 2,210 | 1,707 | 503 | 2,210 | 1,707 | 503 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | No | No | No | No | No | No |

Unbalanced panel data for 24 advanced and 7 emerging economies in Europe, 2000Q1-2022Q2. The sum of coefficients on lagged and expected inflation rates are constrained to be one. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

**Table A4. Philipps Curve for Headline Inflation: High vs Low Inflation Period**
(Dependent variable: Headline inflation, quarter-over-quarter annualized)

| | (1) All | (2) AE | (3) EE | (4) All | (5) AE | (6) EE |
|---|---|---|---|---|---|---|
| Unemployment gap | -0.412*** | -0.272*** | -0.781*** | -0.281*** | -0.221*** | -0.518*** |
| | (0.072) | (0.058) | (0.230) | (0.055) | (0.059) | (0.138) |
| Unemployment gap x high inflation dummy | | | | 0.030 | 0.109 | -0.123 |
| | | | | (0.136) | (0.110) | (0.491) |
| Lag of inflation | 0.460*** | 0.492*** | 0.450*** | 0.204*** | 0.169*** | 0.234*** |
| | (0.065) | (0.040) | (0.130) | (0.031) | (0.033) | (0.057) |
| Lag of inflation x high inflation dummy | | | | 0.339*** | 0.418*** | 0.254 |
| | | | | (0.107) | (0.064) | (0.178) |
| Inflation expectations | 0.540*** | 0.508*** | 0.550*** | 0.796*** | 0.831*** | 0.766*** |
| | (0.065) | (0.040) | (0.130) | (0.031) | (0.033) | (0.057) |
| Inflation expectations x high inflation dummy | | | | -0.339*** | -0.418*** | -0.254 |
| | | | | (0.107) | (0.064) | (0.178) |
| Lag of external price pressure | 0.018* | 0.006 | 0.036 | -0.004 | 0.009* | -0.013 |
| | (0.010) | (0.007) | (0.024) | (0.006) | (0.005) | (0.012) |
| Lag of external price pressure x high inflation dun | | | | 0.030 | -0.012 | 0.086* |
| | | | | (0.023) | (0.011) | (0.044) |
| Food prices | | | | | | |
| Lag 0 | 0.159*** | 0.082*** | 0.231*** | 0.012 | -0.005 | 0.036* |
| | (0.039) | (0.015) | (0.067) | (0.012) | (0.011) | (0.021) |
| Lag 0 x high inflation dummy | | | | 0.244*** | 0.146*** | 0.275** |
| | | | | (0.070) | (0.026) | (0.108) |
| Lag 1 | 0.105*** | 0.065*** | 0.124*** | 0.076*** | 0.036** | 0.087*** |
| | (0.020) | (0.017) | (0.030) | (0.016) | (0.015) | (0.028) |
| Lag 2 | 0.056*** | 0.080*** | 0.031 | 0.036* | 0.038*** | 0.025 |
| | (0.020) | (0.013) | (0.042) | (0.020) | (0.010) | (0.039) |
| Lag 3 | 0.067*** | 0.045*** | 0.100** | 0.054*** | 0.028*** | 0.086** |
| | (0.021) | (0.012) | (0.041) | (0.020) | (0.010) | (0.040) |
| Lag 4 | 0.051** | 0.083*** | 0.026 | 0.023 | 0.042*** | 0.014 |
| | (0.022) | (0.013) | (0.040) | (0.023) | (0.010) | (0.035) |
| Energy prices | 0.152*** | 0.172*** | 0.140*** | 0.126*** | 0.129*** | 0.124*** |
| | (0.014) | (0.010) | (0.027) | (0.010) | (0.010) | (0.022) |
| Energy prices x high inflation dummy | | | | -0.052* | -0.022 | -0.033 |
| | | | | (0.029) | (0.025) | (0.066) |
| High inflation dummy | | | | 1.704*** | 1.891*** | 1.718 |
| | | | | (0.259) | (0.100) | (1.111) |
| Observations | 2,210 | 1,707 | 503 | 2,210 | 2,210 | 2,210 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | No | No | No | No | No | No |

Unbalanced panel data for 24 advanced and 7 emerging economies in Europe, 2000Q1-2022Q2. The dummy variable for high inflation regimes is 1 when headline inflation exceeds a 60 percentile of historical values for a given country. The sum of coefficients on lagged and expected inflation rates are constrained to be one. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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