"We now understand better how little we understand about inflation."
— Jerome Powell
Chaiman of the U.S. Federal Reserve

I. Introduction

The world economy is amid the worst inflation pressure since the 1970s due to a plethora of unprecedented developments. Global inflation has soared to 7.5 percent as of August 2022, from 3.4 percent in 2020 and an average of 2.1 percent during the period 2010-2020. The extent and pace of this surge are not just a recurring problem in developing countries, but it is also becoming an entrenched phenomenon across the world, including in advanced economies with a long history of low and stable inflation. Unsurprisingly, there is now a blame game for the rise in inflation—ranging from the strong rebound in aggregate demand caused by the extraordinary policy response to the COVID-19 pandemic to global supply constraints and shock waves through international commodity markets triggered by Russia's invasion of Ukraine.

Consumer price inflation is on the rise across the world, but there are considerable differences in the level of inflation and how the inflation process has changed across countries over time. We thereby aim to analyze and disentangle the confluence of domestic and external factors in explaining the evolution of inflation dynamics in Europe, where post-pandemic inflation reached the highest level in four decades. To this end, we use high-frequency data and employ alternative econometric methodologies, including a generalized (or approximate) dynamic factor model (GDFM), a standard panel model with cross-sectional correlation consideration, and local projection (LP) methods to analyze inflation dynamics in a balanced panel of 30 European countries over the period December 2002 to May 2022. This approach allows us to shed a particular light on post-pandemic developments and assess whether there are any structural changes in the contribution of global and country-specific factors.

Global factors continue to play an essential role in shaping inflation dynamics throughout Europe, but domestic factors, including monetary and fiscal policy responses to the crisis, have become more prominent after the pandemic. Inflation is a complex phenomenon, with multitudes of domestic and external factors having direct and indirect influences on pricing behavior. Our empirical findings confirm the role of both global and domestic developments in shaping inflation dynamics. First, we find that the observed explanatory power of global factors is significant and has remained roughly constant throughout the sample period. The share of the variance explained by global factors is about 40 percent for headline inflation and 20 percent for core inflation. Second, country-specific factors have gained greater prominence in explaining the variance of inflation dynamics during the pandemic. The share of variance explained by domestic factors increased by 10 percentage points after the COVID-19 pandemic. We also find

heterogeneous effects of global and domestic factors in advanced and emerging market economies. While common inflation dynamics remained dominant in explaining inflation variance in advanced economies prior to the pandemic, the role of both global and domestic factors increased substantially in these countries after the pandemic. In the case of emerging market economies, however, the role of global factors has continued to grow even after the pandemic, but domestic factors have gained even more significance in determining inflation dynamics across all countries during the post-pandemic period.

We deepen the empirical analysis by estimating alternative models of inflation dynamics in a panel setting and obtain corroborative evidence. These results show that inflation persistence is a highly significant factor across all specifications and for different measures of inflation. While the domestic output gap has a statistically significant effect on both headline and core inflation, the global output gap appears to have a greater influence on core inflation. We also find that other global factors (international energy and non-energy commodity prices and global supply chain pressures) and the exchange rate, reflecting both global and domestic developments and policy choices, exhibit significant effects on headline and core measures of consumer price inflation in Europe. These results, robust to a battery of sensitivity checks, also indicate notable differences between advanced and emerging market economies, with global factors having a more significant effect in developing countries. In the post-pandemic period, however, domestic factors have become far more critical in driving inflation dynamics across all countries.

The analysis of inflation dynamics presented in this paper has important implications for the optimal conduct of monetary policy in Europe—and beyond. A plethora of developments, mainly outside the control of policymakers, has undoubtedly contributed to the surge in inflation worldwide. However, putting the onus on global factors alone would be misleading. While much of the recent increase in inflation is a direct result of pandemic-related disruptions and Russia's invasion of Ukraine that has pushed international commodity prices higher, our analysis shows that the relative importance of global factors has not necessarily increased after the pandemic. Instead, we find that domestic developments have become influential in determining inflation dynamics with greater persistence across the board. In other words, the evolution of aggregate demand at home—and abroad—matters more than ever for the appropriate monetary policy stance to bring inflation under control. To this end, central banks should continue to recalibrate monetary conditions—by raising interest rates and removing quantitative easing—to anchor inflation expectations, which have become even more important in the post-pandemic period.

The remainder of this study is organized as follows. Section II provides a brief overview of the relevant literature. Section III introduces the data used in the analysis and presents the stylized facts. Section IV describes our econometric framework. Section V presents the empirical results

and a variety of sensitivity checks aimed to confirm the baseline results and provide a more granular analysis. Section VI draws conclusions with policy implications.

II. An Overview of the Literature

Voluminous literature exists on the fundamental determinants of inflation across countries and over time. The equilibrium rate of inflation is a function of factors determining a degree of inflation aversion, including policy preferences (Rogoff, 1985), macroeconomic developments including the level of income, trade openness and fiscal deficits (Végh, 1989; Romer, 1993; Campillo and Miron, 1997; Lane 1997; Galí and Gertler, 1999; Catao and Terrones, 2005; Clark and McCracken, 2006; Badinger, 2009), flexibility of labor-market institutions (Cukierman and Lippi, 1999), type of exchange rate regimes (Levy-Yeyati and Sturzenegger, 2001; Husain, Mody, and Rogoff, 2005), and political and institutional factors (Cukierman, 1992; Aisen and Veiga, 2007). While Moore, Lewis-Bynoe, and Morgan (2012) identify domestic demand pressures, commodity price shocks, and political factors as the key determinants of inflationary episodes, other studies, building on Kydland and Prescott (1977) and Barro and Gordon (1993), find a robust relationship between institutional factors such as central bank independence and inflation (Cukierman, Webb, and Neyapti, 1992; Alesina and Summers, 1993; Campillo and Miron, 1997; Lougani and Sheets, 1997; Cottarelli, Griffiths, and Moghadam, 1998; Posen, 1998; Arnone, Laurens, and Segalotto, 2006; Brumm, 2006; Walsh, 2008).

Another strand of the literature connects the macroeconomic policy trilemma to inflation, reasoning that when a country maintains a pegged exchange rate regime, it loses its monetary independence and thus effective control of inflation dynamics. While Hausmann and others (1999) and Frankel, Schmukler, and Serven (2004) argue that exchange rate flexibility does not necessarily provide monetary autonomy, Shambaugh (2004) finds evidence suggesting that "countries with fixed exchange rates follow the interest rate of the base country more closely than countries with flexible exchange rates." In other studies, Gruben and McLeod (2002), Gupta (2008), and Badinger (2009) examine the relationship between capital account openness and inflation and find that unrestricted capital mobility lowers inflation by disciplining central banks. More recently, Cevik and Zhu (2020) show that a country's ability to conduct its own monetary policy for domestic purposes independent of external monetary influences leads to lower inflation.

The standard way of modeling inflation is built on the Phillips curve, often used to examine the effectiveness of the monetary transmission mechanism. The Phillips curve forms an empirical relationship between the level of unemployment and wage growth—or the slack in economic activity and inflation. The most widely used model of the Phillips curve, however, is the so-called

hybrid New Keynesian Phillips curve, which is derived from a model characterized by monopolistic competition and short-run price rigidity, and it is hybrid in the sense that it contains past inflation (Galí and Gertler, 1999; Gali, Gertler and Lopez-Salido; 2005). In addition to the standard model, many studies have included other determinants of inflation. For example, using a sample of emerging market economies, Kamber and Wong (2020) argue that foreign shocks, i.e., commodity price shocks, have a more substantial impact on the transitory component of inflation than trend inflation. In addition, Kamber and others (2020) find that world oil prices and the foreign output gap have a more significant impact on emerging economies than on advanced economies over the period 1996-2018. Deniz and others (2016), on the other hand, show that inflation inertia has a considerable effect on inflation in inflation-targeting countries more than non-inflation-targeting countries, with various macroeconomic factors such as budget balance, currency appreciation, real wages, money supply growth, and the output gap having contradictory effects on inflation.

With rising financial openness, global value chain participation, and trade openness, inflation has developed more synchronized worldwide. The greater prominence of global factors has led to efforts to augment the standard Phillips curve with relevant global variables to improve the explanatory power. As in Auer, Borio, and Filardo (2017), the "global-centric" view of the inflation process indicates that globalization is responsible for the diminishing link between domestic slack and inflation and the intensifying link between global variables and inflation. Therefore, the globalization of inflation hypothesis suggests that deeper integration into global markets would exert downward pressure on inflation as a result of global competition and greater global value chain (GVC) participation that raises a degree of substitution and relocate production sites to countries with lower production costs (Bems and others, 2018). While numerous studies have investigated the role of global variables on inflation, empirical findings remain mixed. On the one hand, Ihrig and others (2010), Förster and Tillmann (2014), Mikolajun and Lodge (2016), and Bems and others (2018) find little support for globalization having a significant effect on inflation in advanced and emerging market economies. On the other hand, Borio and Filardo (2007) and Ciccarelli and Mojon (2010) argue that with greater globalization, international factors such as commodity prices and the global state of the economy have gained more prominence in explaining domestic inflation dynamics. Forbes (2019) confirms that global factors play a greater considerable role in shaping inflation, as the traditional relationship between domestic slack and inflation has weakened over time.[2]

The literature on post-pandemic inflation is developing fast and preliminary evidence is inconclusive with mixed results. Using historical data, Bonam and Smadu (2021) find that major

[2] Kohlscheen and Moessner (2022) conclude that globalization is a key force in flattening the Phillips curve.

pandemics in the past have induced a considerable decline in trend inflation over an extended period. However, the disinflationary effects of a pandemic vary with policy responses, which are unprecedented in the case of COVID-19 with expansionary fiscal and monetary measures aimed to prevent tightening credit conditions, bankruptcies, and mass layoffs. The fast rebound of economic activities due to vaccines, lifting lockdowns, and telework could have exerted upward pressure on consumer price inflation, while supply chain disruptions contribute to rising inflation when firms are able to pass the increasing costs to consumers. Ha and others (2021) provide early evidence for the collapse in global demand lowering inflation during the initial stage of the COVID-19 pandemic, followed by the strong recovery in economic activity pushing consumer prices higher.

III. Data Overview and Stylized Facts

We construct a balanced panel dataset of monthly observations covering 30 European countries over the period 2002-2022.[3] The dependent variable is headline and core measures of consumer price inflation, which are computed as the year-on-year change on a monthly basis as follows:

$$\pi_{c,t} = \left(\frac{CPI_{c,t}}{CPI_{c,t-12}} - 1\right) * 100,$$

where $\pi_{c,t}$ denotes headline or core inflation in country *c* at time *t* based on CPI series, which are drawn from the Eurostat and national statistics institutions in the case of non-EU countries in the sample. Both headline and core inflation are based on the harmonized indices, thus comparable across countries in our sample. Following the literature, we select domestic and global variables as described below to analyze inflation dynamics before and after the pandemic. These series are obtained from various sources including Eurostat, IMF, OECD, and the World Bank.[4] Although other variables, such as the exchange rate regime and monetary policy independence, could be important in determining inflation dynamics, the availability of monthly data limits the choice of variables. In addition, these variables are considered long-term structural factors, which would be less likely to be affected by post-pandemic developments. To obtain a more granular analysis, we include an additional variable, such as inflation forecasts, but data availability limits the number of countries and time period for the analysis.

Domestic variables: In explaining inflation, the standard Phillips curve accounts only for domestic variables including lagged inflation, inflation forecasts, and the domestic output gap.

[3] The list of countries is presented in Appendix Table A1.

[4] The list of data sources is presented in Appendix Table A2.

- *Lagged inflation.* Inflation tends to exhibit significant persistence over time, which is mainly due to price stickiness, among others. Assuming that inflation is positively correlated with its own lags, we use lagged inflation as a measure of persistence.

- *Domestic output gap.* A measure of the slack in real economic activity is obtained by using the Hamilton (2018) filter to isolate the cyclical fluctuations and trend. Given the unavailability of the monthly GDP series, we use the seasonally adjusted Industrial Production Index (IPI) as a proxy to calculate the domestic output gap. Our results remain unchanged when we use alternative filters, such as the Hodrick-Prescott (HP) filter

Global variables: The globalization of inflation hypothesis suggests that as countries integrate into a higher level of global markets, a downward pressure on prices is expected due to the competition that takes a more global aspect. As in Borio and Filardo (2007), Auer and others (2017) and Forbes (2019), inflation becomes more "global-centric" if global variables gradually develop into dominant factors shaping the inflation dynamics. Take, for instance, the GVC participation. Firms constantly look for ways to reduce costs, and one way to achieve it is to relocate production sites to countries with lower costs, which in turn makes domestic inflation dynamics more sensitive to global factors.

- *Global output gap.* Empirical evidence on the link between inflation and the slack in global economic activity is mixed.[5] Significant positive effects of global demand pressures are usually associated with higher headline inflation, whereas contrary outcomes are found in core inflation. We use the Hamilton filter to calculate the global output gap measure by resorting to the world IPI constructed by Baumeister and Hamilton (2019), which is closely associated with the general level of economic activity. Our results remain unchanged when we use alternative filters, such as the HP filter.

- *Global energy and non-energy prices.* Global energy prices measure energy-related prices, including coal, natural gas, oil, and propane, while global non-energy prices include industrial inputs, food and beverages, and fertilizers. Commodity price fluctuations could have a direct impact on headline inflation and influence core inflation indirectly through input prices and inflation expectation that captures second-round impact.

[5] While Borio and Filardo (2007), Jasova, Moessner, Takats (2018), and Forbes (2019) find support for the significant role of the world output gap on inflation, Calza (2008), Ihrig and others (2010) and Mikolajun and Lodge (2016) find no supporting evidence for the role of the global output gap in domestic inflation dynamics. One possible explanation for such a different impact of global economic slack could be the different relationship between the global output gap and headline and core inflation (Turner and others 2019).

- *Global Supply Chain Pressure (GSCP).* Built by Benigno and others (2022), the GSCP index measures supply chain disruptions according to the Baltic Dry Index (BDI), the Harpex index, air freight costs, and some components of the Purchase Manager Index (PMI) such as delivery time, backlogs, and purchased stocks. An increase in the standard deviation of the GSCP index implies more supply chain disruptions.

- *Nominal effective exchange rate (NEER).*[6] The NEER is a measure of the value of a currency against a weighted average of several foreign currencies. An increase in NEER indicates an appreciation of the local currency against the weighted basket of currencies of its trading partners. While the literature tends to categorize the exchange rate as a global factor, it is not, strictly speaking, a "common" factor like other global variables included in the analysis as domestic developments and policy choices have a significant bearing on the exchange rate.

Summary statistics for all variables used in the analysis, presented in Table 1, show considerable heterogeneity across countries and over time. For example, as measured by the headline CPI, average inflation in Europe is 2.2 percent from 2002 to 2022, with a minimum of -4.3 percent and a maximum of 20.1 percent. Similarly, core inflation excluding food and energy is 1.9 percent on average, with a minimum of -4.2 percent and a maximum of 16.4 percent during the sample period. The domestic and global output gaps are, on average, 0, respectively. However, the domestic output gap has a larger variance than the global output gap, denoting that the deviations of the domestic output gap could be significantly spread out. The three different exchange rate measures used in this analysis show similar values across different summary

Table 1. Summary Statistics

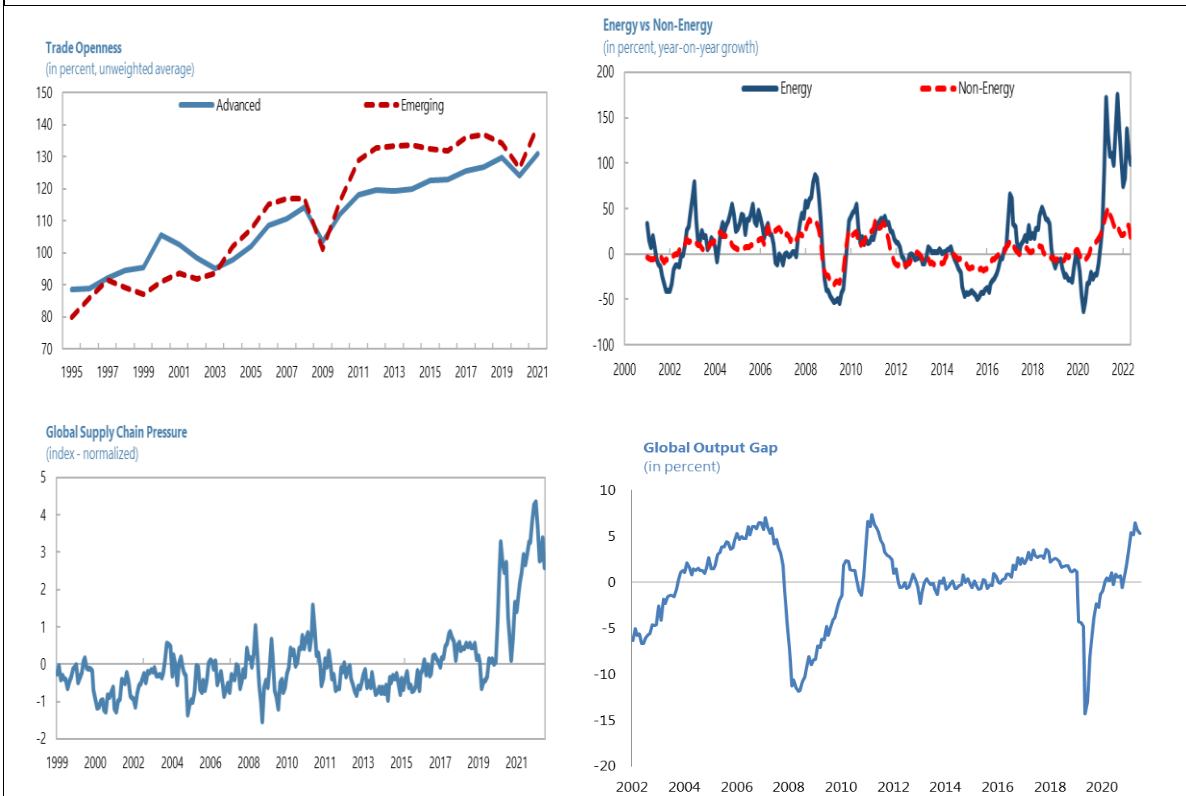
	Mean	Std. Dev.	Variance	Minimum	Maximum
Δ Headline Inflation (%)	2.219	2.397	5.744	-4.347	20.146
Δ Core Inflation (%)	1.916	1.935	3.745	-4.171	16.448
Domestic Output Gap (%)	0.000	4.479	20.058	-60.944	59.880
Global Output Gap (%)	0.000	4.193	17.577	-14.306	7.368
Δ NEER (%)	0.505	3.924	15.400	-23.982	23.049
Δ REER – ULC (%)	0.261	4.638	21.511	-22.911	29.101
Δ REER – CPI (%)	0.309	4.125	17.014	-21.670	24.525
Δ Energy Prices (%)	14.406	41.199	1697.386	-63.294	175.750
Δ Non-Energy Prices (%)	6.701	16.459	270.884	-34.351	51.508
Δ Commodity Prices (%)	8.804	24.451	597.853	-42.122	71.643
GSCP (Normalized)	0.149	1.044	1.089	-1.523	4.351

[6] For robustness checks, we use the real effective exchange rate (REER) index and obtain similar results.

statistics, but the average NEER is slightly higher due to the absence of inflation adjustment. In addition, the variance of the REER based on unit labor costs (ULC) is larger, indicating significant differences in ULC among European countries. With regards to energy- and non-energy prices, we observe more frequent fluctuations in energy prices compared to non-energy prices, indicating a potentially significant role played by energy prices in explaining inflation developments in Europe. Although global supply-chain pressures appear to have a relatively stable profile, the pandemic and the war in Ukraine have caused more volatile supply-chain disruptions.

Inflation becomes more "global" with international factors gradually developing into dominant factors in shaping inflation dynamics. As presented in Figure 1, global factors appear to move in tandem and have become more prominent determinants of domestic inflation dynamics over time. However, the onset of the global financial crisis (GFC) in 2008 led to abrupt and sharp changes in global resource utilization, commodity prices, and trade openness, all of which contributed to deflationary pressures worldwide, albeit with varying degrees across countries and in terms of headline and core inflation rates. While headline inflation exhibited a volatile pattern

Figure 1. Global Factors



Source: Haver Analytics, IMF, World Bank, OECD, Baumeister and Hamilton (2019), Benigno and others (2022) and IMF staff calculations.

highly correlated with global factors, core inflation, excluding energy and food prices, appeared less correlated with them. Lastly, the COVID-19 pandemic has induced a sharp decline in inflation due to plunging energy prices and demand, but it quickly rebounded with the strong pace of recovery and global supply-chain disruptions.

IV. Econometric Methodology and Results

The empirical analysis presented in this study is based on a threefold econometric strategy to ensure robustness and granular assessment. First, we implement a generalized DFM (GDFM) approach to disentangle the effect of common (global) and domestic (country-specific) factors on inflation and investigate the degree of synchronization of inflation dynamics across European countries. Second, we deepen the analysis by estimating an augmented Phillips curve model of inflation with global variables in a panel setting. Third, we use the LP method to estimate the dynamic response of consumer price inflation to global and domestic shocks.

A. Generalized Dynamic Factor Model

The objective of the GDFM analysis is to decompose the variation of inflation in each country into the following components:

- *Variation explained by observable global components*: These include global factors that are observable to us (such as energy and non-energy prices) and likely to affect inflation across all countries in the sample.

- *Variation explained by observable domestic factors:* These include other observable country-specific factors that are likely to have a differential effect on inflation.

- *Variation explained by common inflation dynamics:* This is obtained by applying the GDFM to the portion of inflation that is not explained either by observable global or domestic factors. This element of the variance decomposition captures the common co-movements of inflation across the countries by extracting $k \geq 1$ unobservable common shocks which are weighted by some country-specific factor-loadings, as explained in Forni and others (2000; 2005).[7] That is, all countries face the same common shocks, but the way inflation reacts to these common shocks is country specific. Notice that these common shocks do not necessarily have an economic interpretation, and that is why we refer to them as *common inflation dynamics*. The number of common shocks, k, is chosen using a data-driven information criterion, as explained below.

[7] The DFM approach has widely been used in the literature to assess global financial and business cycles (Cerutti and others, 2019; Menden and Proano, 2017; Miranda-Agrippino and Rey, 2020; Mumtaz and Musso, 2021) and inflation developments (Ciccarelli and Mojon, 2005; Mumtaz and Surico, 2008; Mumtaz and others, 2009; Neely and Rapach, 2011; Ha, Kose, and Ohnsorge, 2019; Chon 2020; Szafranek, 2021).

Early applications of DFMs by Sargent and Sims (1977) and Stock and Watson (1989; 1991; 1993) suggest that a few latent factors can account for much of the dynamic behavior of economic aggregates.[8] The advantages of the GDFM approach thereby include: (1) a parsimonious representation of the data regarding unobservable common elements, which characterizes the degree of inflation co-movement and synchronization without making strong assumptions a priori (Mumtaz and others, 2011); (2) a reduced-form solution to a standard Dynamic Stochastic General Equilibrium (DSGE) model (Sargent, 1989; Ha, Kose, and Ohnsorge, 2019); and (3) extraction of factors using nonparametric principal components, which prevents misspecification and deals with time-varying parameters and nonlinearities (Miranda and others, 2021).

We use the same baseline GDFM specification for each country in the sample in the following form:

$$\pi_{c,t} = X^{g}_{c,t}\beta_c + X^{d}_{c,t}\gamma_c + \chi_{c,t} + \varepsilon_{c,t} \quad (1)$$

where $X^{g}_{c,t}$ and $X^{d}_{c,t}$ are the observed global and domestic components respectively; $\chi_{c,t} = \sum_{j=1}^{k} b_{c,j}(L)u_{j,t}$ is the unobserved *common dynamic component*, L standing for the lag operator, and k the number of factors. The $b_{c,j}(L)$'s are the factor loadings, which are country-specific and whose dynamic structure is otherwise unspecified; and $\{u_{1,t}, \ldots, u_{k,t}\}$ are the *common shocks*. Finally, $\varepsilon_{c,t}$ is the idiosyncratic component, i.e., a zero-mean stationary process, independent of $(X^{g}_{c,t}, X^{d}_{c,t}, \chi_{c,t})$ at all leads and lags. The vector of coefficients, (β_c, γ_c), represents the country-specific loadings for the observed global and domestic components. The observable global component includes global output gap, energy and non-energy commodity prices, a measure of global supply chain pressure, and the NEER. The observable domestic component includes the domestic output gap. The unobservable common component, $\chi_{c,t}$, is allowed to have a causal dynamic structure as explained above (Forni and others, 2000). To obtain a consistent estimation of (β_c, γ_c), we further assume that $Cov(X^{g}_{c,t}, \chi_{c,t}) = Cov(X^{d}_{c,t}, \chi_{c,t}) = 0$. All observables in this equation are taken to have a mean equal to zero and standard deviation equal to one. The vector of regressors, $(X^{g}_{c,t}, X^{d}_{c,t})$, is a normalized version of the observable global and domestic factors. The constant term is thus omitted from the model. The covariance between $X^{g}_{c,t}\widehat{\beta_c}$ and $X^{d}_{c,t}\widehat{\gamma_c}$ is assigned to each one of these components proportionally to the total variance. For instance, if $Var(X^{g}_{c,t}\beta_c) = 5$, and $Var(X^{d}_{c,t}\gamma_c) = 1$, 5/6 of the covariance is assigned to the global components, and the remaining 1/6 is assigned to the domestic component (see Gibbons and others, 2013). As explained above, the variance of $\pi_{c,t}$ is thus decomposed as follows: (i) variance explained by

[8] There are several surveys of dynamic factor models, including Bai and Ng (2008), Bai and Wang (2016), Barigozzi (2018), Breitung and Eickmeier (2006), Darné, Barhoumi, and Ferrara (2013), Lütkepohl (2014), Stock and Watson (2006), and Stock and Watson (2011; 2016).

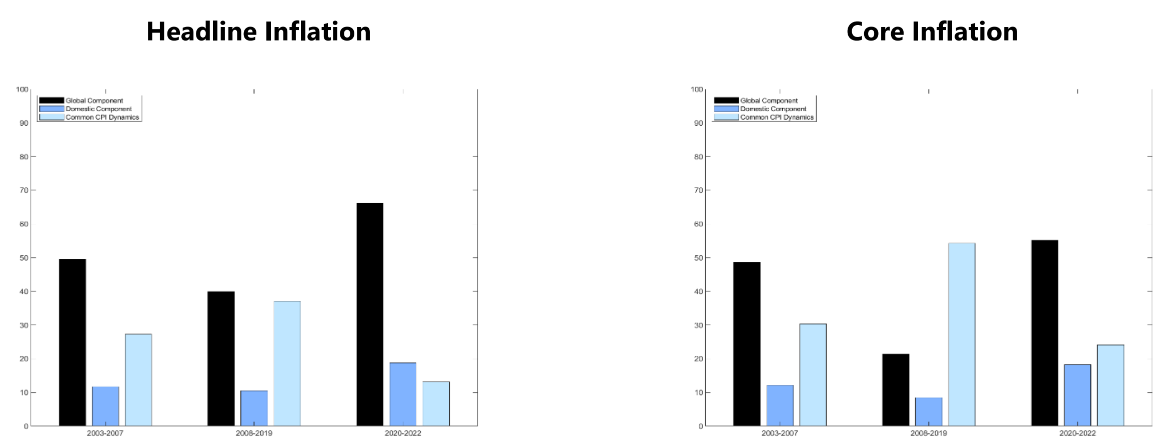
the observable global component; $Var(X^g_{c,t}\beta_c)$ (ii) variance explained by the observable domestic component, $Var(X^d_{c,t}\gamma_c)$; (iii) variance explained by the common inflation dynamics, $Var(\chi_{c,t})$; and (iv) idiosyncratic variation, $Var(\varepsilon_{c,t})$.

We first obtain an estimator of (β_c, γ_c), $(\widehat{\beta_c}, \widehat{\gamma_c})$, via ordinary least square (OLS) regression of inflation on observable (global and domestic) factors. Upon the assumptions listed above, this estimator is consistent and asymptotically normal as $T \to \infty$. We then compute the percentage of the variance explained by the observable global components as $Var(X^g_{c,t}\widehat{\beta_c}) \cdot 100$ and the percentage of the variance explained by the observed domestic components as $Var(X^d_{c,t}\widehat{\gamma_c}) \cdot 100$, where the covariance is distributed across the two components as explained above. Next, we construct:

$$\pi_{c,t} - X^g_{c,t}\widehat{\beta_c} - X^d_{c,t}\widehat{\gamma_c} = \chi_{c,t} + \varepsilon_{c,t} \quad (2)$$

which represents the residuals from the OLS regression of each country's inflation rate onto the observed global and domestic components. To simplify notations, we have omitted from equation (2) the estimation error which occurs from replacing (β_c, γ_c) with $(\widehat{\beta_c}, \widehat{\gamma_c})$.[9] These residuals correspond to our dependent variable, $\pi_{c,t}$, from which the effect of the observable global and domestic components has been partialled out. Next, we apply to these residuals the

Figure 2. Average Share of Variance Explained



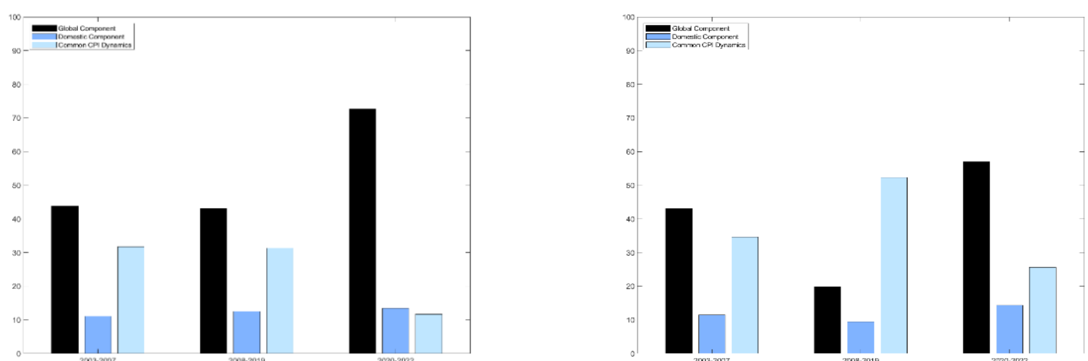
[9] Upon the stated assumptions, the OLS estimators of (β_c, γ_c) are consistent for $T \to \infty$, while the consistent estimation of $\chi_{c,t}$ requires both $n, T \to \infty$ (see Forni and others, 2000). The first step estimation error is thus negligible when estimating the GDFM in the second step.

GDFM as in Forni and others (2000). The estimation of the unobservable common factor, based on the matrix of inflation rates from the 30 European countries, gives us the variance explained by the common inflation dynamics. Therefore, a crucial step in the estimation of the GDFM is determining the number of common factors in the model. There are various statistical approaches in determining the number of factors in the DFM. In this paper, we determine the number of factors according to the information criterion proposed by Hallin and Liska (2007) and obtain $k^* = 3$, for headline CPI, and $k^* = 4$, for core CPI, as the optimal number of factors. This is also confirmed by a graphical analysis of the dynamic eigenvalues averaged over the spectral frequencies (Appendix Figure A1).[10]

The average variance explained by each one of the components over three separate periods is presented in Figure 3. The sample is split in this manner to separately consider the effects of the common components on inflation before and after the global financial crisis, and before and after the pandemic. The share of variance explained by the different components changes substantially over the period 2003-2022. In particular, the observable global component explains a larger share of the variance in the post-pandemic period, especially for headline inflation. Similarly, the share of variance explained by the country-specific component increases by about 10 percent for both headline and core inflation during the period 2020-2022. The sharp increase

Figure 3. Average Share of Variance Explained: Advanced Europe

Headline Inflation **Core Inflation**



---

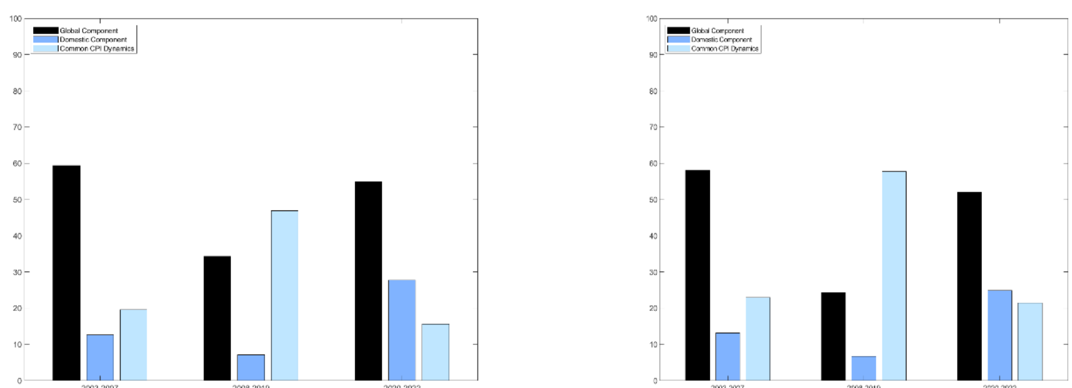
[10] The first six eigenvalues appear to diverge, while the others are relatively stable. A further analysis also reveals that the relative increase in the variance explained when increasing the common components from 6 to 7, is less than 3 percent. As 5 percent is often the pre-assigned minimum to include an additional component, we conclude that the choice of six unobservable global factors is likely to be robust.

in the percentage of variance explained by both the observable global and domestic factors goes along with a decrease in the variance explained by the common inflation dynamics. There are several potential explanations for this result. First, consumer price inflation in Europe was relatively stable during the pre-pandemic period, resulting in a high level of synchronization across countries as shown by the large percentage of variance explained by the common dynamics before 2020. The COVID-19 pandemic, however, may have caused a permanent upward break in inflation dynamics, which may not be necessarily homogenous across countries and may have reduced the level of synchronization in inflation. Second, because of containment restrictions and supply disruptions during the pandemic, many economies remained below potential, and consequently experienced an abrupt built-up of price pressures with the relaxation of lockdown measures.

Another interesting result that emerges from the GDFM is about the heterogeneity across countries. We divide our sample into advanced economies and emerging markets. The former group includes the Euro area (except for Latvia, Lithuania, Slovakia, and Slovenia), Norway, Sweden, Switzerland, and the UK, while the latter group includes most Eastern European countries. As it appears in Figure 3, the results for advanced economies are qualitatively different from the overall results. The relative importance of country-specific factors increases, although not substantially, since the beginning of the COVID-19 pandemic (the variance explained by the domestic component increases by less than 1 percent for headline inflation and by less than 5 percent for core inflation). By contrast, global factors play a fundamental role, and the variance explained by co-movement in inflation in the advanced economies decreases substantially.

Figure 4. Average Share of Variance Explained: Emerging Europe

Headline Inflation | **Core Inflation**



In the case of emerging market economies, presented in Figure 4, the importance of domestic factors has increased since the pandemic, and their total share of variance has increased from about 7 to about 25 percent for both headline and core inflation. On the contrary, the variance explained by the global components represents a smaller share of the variance in inflation and so do the common inflation dynamics. This seems to be consistent with the evidence that the output gap is larger on average for emerging economies since the pandemic, and that may have spurred higher inflation, compared to other advanced European economies.

B. Panel Data Analysis

We deepen the analysis by estimating an augmented Phillips curve model of inflation dynamics in a panel setting. To obtain a more granular analysis, we extend the standard Phillips curve by introducing a series of global variables as discussed above and develop a dynamic model of inflation:

$$\pi_{c,t} = \beta_1 + \beta_2\pi_{c,t-1} + \beta_3 Y_{c,t}^D + \beta_4 Y_t^W + \beta_5 neer_{c,t-1} + \beta_6 energy_t + \beta_7 nonenergy + \eta_c + \varepsilon_{c,t} \quad (3)$$

where subscripts c and t denote country c and at time t, respectively. $\pi_{c,t}$ indicates the year-on-year inflation rate on a monthly basis as measured by the headline and core CPI; $\pi_{c,t-1}$ is the first lag of inflation; Y_t^D and Y_t^W denote the domestic output gap and the global output gap, respectively; $neer_{c,t-1}$ is the nominal effective exchange rate, which is lagged to account for the delay in exchange rate pass-through to consumer prices; and $energy_t$ and $nonenergy_t$ are international energy and non-energy commodity prices, respectively.[11] The η_c coefficient denotes the time-invariant country-specific effects, and $\varepsilon_{c,t}$ is the error term. We therefore use a fixed-effect estimator with the Driscoll-Kraay standard errors, which helps address cross-sectional dependence and serial correlation over time.

We further augment the empirical model to explore the role of global supply chain disruptions**.** We therefore introduce a measure of global supply chain disruptions into the model:

$$\pi_{c,t} = \beta_1 + \beta_2\pi_{c,t-1} + \beta_3 Y_{c,t}^D + \beta_4 Y_t^W + \beta_5 neer_{c,t-1} + \beta_6 energy_t + \beta_7 nonenergy + \beta_8 GSCP_t + \eta_c + \varepsilon_{c,t} \quad (4)$$

where $GSCP_t$ denotes global supply chain pressure, which is normalized and interpreted such that a zero implies that the index is at its average value, with negative values reflecting how many

[11] Time-fixed effects are not included because the global output gap and energy prices, the two most significant global factors, should capture global elements changing each year common to all countries, consistent with Bems and others (2018), Forbes (2019), and Jasova, Moessner, and Takats (2020).

standard deviations the index is below this average value. As a result, we expect a higher value of global chain supply disruptions to exert an upward pressure on headline and core measures of consumer price inflation.

The panel data analysis, presented in Table 2, confirms the importance of inflation persistence and the domestic output gap. With all variables in the model correctly signed, we find that inflation persistence is a critical factor across all specifications and for different measures of inflation. The coefficients on the domestic output gap—0.004 for headline and core inflation—are positive and statistically significant at the 1 percent level. These imply that a one percentage point increase in the domestic output gap is associated with an increase of 0.004 percentage points in both headline and core measures of consumer price inflation, which are broadly consistent with previous findings in the literature.

The global output gap has a statistically significant positive effect on core inflation, but not on headline inflation. A one percentage point increase in the global output gap is associated with an increase of 0.005-0.008 percentage points in core inflation by direct and indirect channels of transmission. The global output gap affects domestic inflation directly through the pricing decision of producers and indirectly through its influence on other determinants of inflation,

Table 2. Baseline Estimates: Full Sample

	Headline Inflation		Core Inflation	
	Baseline	+GSCP	Baseline	+GSCP
Inflation_{t-1}	0.950***	0.950***	0.974***	0.975***
	(0.015)	(0.015)	(0.012)	(0.011)
Domestic output gap	0.004***	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Global output gap	0.005	0.007	0.006**	0.008***
	(0.005)	(0.005)	(0.003)	(0.003)
ΔNEER_{t-1}	-0.021***	-0.020***	-0.014***	-0.012***
	(0.003)	(0.003)	(0.002)	(0.002)
ΔEnergy prices	0.005***	0.004***	0.001**	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)
ΔNon-energy prices	0.002	0.002	0.001	0.001
	(0.002)	(0.002)	(0.001)	(0.001)
GSCP		0.0376		0.0498***
		(0.0288)		(0.0178)
Country FE	Yes	Yes	Yes	Yes
F-test: Global	28.91***	26.28***	28.81***	22.23***
Observations	7,020	7,020	7,020	7,020
Countries	30	30	30	30

Note: Driscoll-Kraay standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The F-test: Global tests the joint significance of our global variables. A constant is included in all specifications, but not shown in the table.

such as the exchange rate and global commodity prices. However, as discussed in the data section, previous studies usually find mixed results on the relationship between the global output gap and domestic inflation, which varies according to period, country, and measurement used in the analysis.

International energy prices exhibit a high degree of positive correlation with inflation. A one percent point year-on-year growth in energy prices is associated with a 0.004 and 0.001 percent point increase in headline and core inflation, respectively. The non-energy prices are not statistically significant, suggesting that the energy prices play a more significant role in shaping domestic inflation than non-energy commodity prices. We find support for a strong relationship between energy prices and inflation. Nevertheless, the impact of energy prices varies according to different measures of inflation. International energy prices have a direct effect on headline inflation, which includes energy components. Although there is no such direct effect on core inflation excluding energy and food prices, we still find evidence for an indirect effect on core inflation, capturing the second-round effect of energy price changes throughout the economy. On the other hand, non-energy commodity prices do not appear to have a statistically significant effect on headline and core inflation in Europe, where food does not account for a large share of the average consumption basket.

The global supply chain variable, measuring supply chain disruptions across the world, has an inflationary effect. The GSCP variable measures comprehensive global supply chain disruption in which an increase in one standard deviation is associated with a 0.05 percent point increase in core inflation. The F-test of the joint significance of the global variables continues to show a strong joint statistical significance on headline and core inflation, underscoring their vital role in shaping domestic inflation.[12] We notice that the values of the F-test in headline inflation are considerably higher than in core inflation. One possible explanation is that commodity prices directly affect headline inflation. However, when considering the individual statistical significance of global variables, core inflation receives a quantitatively and relatively similar impact from the state of the global economy compared to headline inflation except for commodities. This increasing role of global factors in determining core inflation might signify the persistent impact of global economic conditions on domestic inflation.

The exchange rate, capturing both global and domestic developments and policy choices, has a significant effect on inflation. We find support for the statistically significant role of the exchange

[12] To show that the F-test of joint significance of our global variables is not driven mainly by energy and non-energy prices, we run the equation (4) without the commodity variables. The values of the F-test are 8.78*** and 13.96*** for headline and core inflation, respectively. This suggests that the commodity variables are not the main drivers of the F-test of joint significance of our global variables.

rate in explaining inflation. For example, a one percent point year-on-year growth in the exchange rate explains about 0.01-0.02 percent point decrease in inflation. This variable is lagged to allow for the delay in pass-through into prices. The negative impact of exchange rate appreciation on inflation exerts downward pressure on inflation as a result of cheaper foreign products and services imported to the country.

The impact of global variables varies according to the level of income, showing notable differences between advanced and emerging countries. We divide the entire panel dataset into advanced and emerging market economies in Europe and obtain results, presented in Table 3, that are broadly in line with our baseline findings. One important difference is that the global output gap is statistically significant for core inflation in both advanced and emerging markets, but its effects are quantitatively more considerable in emerging markets than in advanced markets. This could be because of the greater weight of emerging economies in trade and thus the global output gap. Other global variables also appear to have quantitatively more prominent effects on emerging markets than advanced economies. These results, along with higher values of the F-test of the

Table 3. Estimates by Country Groups

	Advanced		Emerging	
	Headline Inflation	Core Inflation	Headline Inflation	Core Inflation
$Inflation_{t-1}$	0.903***	0.938***	0.963***	0.981***
	(0.017)	(0.012)	(0.014)	(0.011)
Domestic output gap	0.003***	0.003***	0.005**	0.006***
	(0.001)	(0.001)	(0.002)	(0.002)
Global output gap	0.005	0.005**	0.016*	0.013**
	(0.004)	(0.002)	(0.008)	(0.006)
$\Delta NEER_{t-1}$	-0.016***	-0.009***	-0.027***	-0.017***
	(0.003)	(0.002)	(0.003)	(0.003)
ΔEnergy prices	0.005***	0.001***	0.004***	0.001
	(0.001)	(0.000)	(0.001)	(0.001)
ΔNon-energy prices	0.001	-0.000	0.003	0.003*
	(0.001)	(0.001)	(0.003)	(0.002)
GSCP	0.021	0.031*	0.065	0.076***
	(0.026)	(0.016)	(0.040)	(0.026)
Country FE	Yes	Yes	Yes	Yes
F-test: Global	22.15***	8.48***	26.45***	19.15***
Observations	4,446	4,446	2,574	2,574
Countries	19	19	11	11

Note: Driscoll-Kraay standard errors are reported in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The F-test: Global tests the joint significance of our global variables. A constant is included in all specifications, but not shown in the table.

emerging economies than the advanced economies, align with our stylized facts that countries with higher integration into global markets are likely to receive larger effects from the underlying global economic activities.

We also focus on the impact of global factors during different periods, such as the post-global financial crisis and post-pandemic periods (Table 4). So far, we have run our econometric specifications for the entire period. However, the contribution of global variables could vary in different periods. Accordingly, we compare the post-GFC and post-pandemic periods to analyze whether their contributions have changed over time. Note that we have two post-pandemic period regression results to observe the contemporaneous and delayed effects of the GSCP variable separately. We find considerable differences between post-GFC and post-pandemic periods in terms of the statistical significance of global variables. These results show that global factors have contributed to shaping domestic inflation, though domestic variables still play a

Table 4. Estimates by Sub-Periods

	Headline Inflation			Core Inflation		
	Post-GFC	Post-Pandemic GSCP	Post-Pandemic $GSCP_{t-3}$	Post-GFC	Post-Pandemic GSCP	Post-Pandemic $GSCP_{t-3}$
$Inflation_{t-1}$	0.898***	1.006***	0.999***	0.926***	0.998***	1.006***
	(0.010)	(0.031)	(0.029)	(0.010)	(0.051)	(0.046)
Domestic output gap	0.003	0.008***	0.009***	0.003**	0.007*	0.005
	(0.002)	(0.003)	(0.003)	(0.001)	(0.004)	(0.004)
Global output gap	0.003	0.032*	0.021	0.007***	0.034**	0.019
	(0.005)	(0.019)	(0.019)	(0.002)	(0.014)	(0.011)
$\Delta NEER_{t-1}$	-0.026***	-0.028*	-0.026	-0.013***	-0.026*	-0.030**
	(0.003)	(0.015)	(0.016)	(0.002)	(0.0135)	(0.014)
ΔEnergy prices	0.005***			0.000		
	(0.001)			(0.000)		
ΔNon-energy prices	0.004**			0.002***		
	(0.002)			(0.001)		
ΔCommodity prices		0.005	0.005**		-0.002	0.001
		(0.004)	(0.002)		(0.002)	(0.002)
GSCP	-0.033	0.023		0.016	0.096**	
	(0.039)	(0.057)		(0.022)	(0.041)	
$GSCP_{t-3}$			0.089*			0.062**
			(0.047)			(0.028)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
F-test: Global	44.26***	13.46***	18.36***	28.79***	7.56***	8.65***
Observations	3,810	870	870	3,810	870	870
Countries	30	30	30	30	30	30

Note: Driscoll-Kraay standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The F-test: Global tests the joint significance of our global variables. Due to multicollinearity issues between energy- and non-energy prices in the post-pandemic period, we use a single index of commodity prices. A constant is included in all specifications, but not shown in the table.

significant role since the post-GFC. In contrast, they have developed into relatively minor factors since the post-pandemic period. Some global variables are statistically insignificant, while inflation persistence plays a substantial role in the post-pandemic period. In addition, the F-test of joint significance has dropped substantially from 44.26 and 28.79 in headline and core inflation, respectively, to 13.46 and 7.56 in the post-pandemic period.

Post-pandemic inflation developments appear to be primarily driven by domestic factors, surge in commodity prices and supply chain disruption. The persistence of inflation has become even more quantitatively significant in the post-pandemic period. Europe has been characterized by an increasing persistence in inflation and declining trend inflation before the COVID-19 pandemic due to primarily cyclical domestic and global factors (Ciccarelli and Osbat, 2017). While global factors were the primary driver of inflation dynamics in Europe before the pandemic, domestic factors also made significant contribution. As in Abdih and others (2018), the transition process tends to be longer, especially in the case of positive inflation shocks, due to persistence in pricing behavior. Moreover, we find that the more stringent government measures for containment during the COVID-19 pandemic, the higher the inflationary pressures on prices (Appendix Table A6). A critical question in this context is whether global factors are negligible in the post-pandemic period. The F-test of joint significance in the post-pandemic period is still statistically significant, though its value drops considerably. Therefore, we can conclude that the importance of global factors in shaping inflation dynamics has weakened after the pandemic, as inflation persistence and the domestic output gap have relatively larger effects.

C. Local Projection Method

We implement the LP method of Jordà (2005) to estimate the response of inflation to global and domestic shocks. The LP approach is found to be better suited to estimate dynamic responses and robust to non-linear model misspecification (Auerbach and Gorodnichenko, 2013; Romer and Romer, 2019). We estimated the following baseline specification with the LP method:

$$\pi_{c,t+h} - \pi_{c,t-1} = \beta_{c,h} + \beta_{c,h} Y_{c,t}^{D} + \beta_h Y_t^{W} + \sum_{m}^{2} \delta_{c,t,m}\, neer_{c,t-m} + \beta_h energy_t$$
$$+\beta_h nonenergy_t + \beta_h GSCP_t + \textstyle\sum_{l=1}^{2} \gamma'_{c,t,l}\, X_{c,t-l} + \varepsilon_{c,t+h} \quad (5)$$

where h indicates the forecast horizons. $\pi_{c,t+h} - \pi_{c,t-1}$ is the dependent variable, which is the cumulative response of inflation from *t - 1* to *t + h*. The cumulative IRF values are constructed from the β estimated coefficients at each time horizon *h*. Thus, the coefficients reflect the step in the cumulative IRF at a forward time *h* and they can be interpreted as the accumulated response of inflation to an increase in one standard deviation in *GSCP,* for example. Given that the error terms could be serially correlated due to the successive leading of the dependent variable in the local projection method, we thus resort to the Driscoll-Kraay standard errors to address the serial

correlation across time and cross-sectional dependence.[13] $X_{c,t}$ is a vector containing domestic and global output gap, energy and non-energy prices, inflation, and global supply chain pressure. $X_{c,t}$ and $neer_{t-2}$ are used as controls to cleanse the β coefficients from the dynamic effects of inflation and the effects of past changes in domestic and global output gap, energy and non-energy prices, exchange rate and global supply chain pressure. Thus, this vector and $neer_{t-2}$ are not used to construct the IRF, and lag-augmented local projection remains robust to highly persistent data and the estimation of IRs at long horizon.[14]

We use the LP method to examine the shocks in the post-GFC and the post-pandemic periods on the future path of inflation (Figure 5,6,7, and 8). First, we examine the post-pandemic domestic and global output gap. The domestic factor has developed into a more critical determinant in the post-pandemic period. The domestic output gap is quantitatively more significant, and the inflation responds sharply to the domestic factor in the post-pandemic period. Consistent with our FE regression estimates, the domestic output gap has grown to be a driving factor shaping domestic inflation. Moreover, they are likely to be persistent over time in the post-pandemic period.

The global output gap is quantitatively more significant than the domestic output gap in the post-pandemic period at the beginning of the future path. Inflation also responds sharply to the global output gap. Nevertheless, the domestic output gap is more persistent, and its effects last longer than the global output gap. This would imply that the impact of the domestic output gap in the post-pandemic period could be more considerable at the later stage of the future path of inflation. Accordingly, the domestic output gap being one of the driving factors in the post-pandemic period hints at monitoring domestic economic activities, consistent with Oinonen and Paloviita (2014), who argue that the domestic output gap has played a more decisive role since 2012 in steepening the Phillips curve in the eurozone. In addition, it possibly captures all the policy effects in the wake of the COVID-19 pandemic, such as fiscal and monetary policies.

Second, global factors—the global output gap, commodity prices, exchange rate, and global supply chain pressures— in the post-GFC are likely to exert upward pressure on headline and core inflation, and their effects could be long-lasting. Moreover, the long-lasting effects of these global variables on core inflation draw the attention of monetary authorities to consider external factors when implementing monetary policy. In contrast, energy prices have relatively short-lived effects on inflation, and their effects quickly disappear at the end of two months in headline inflation in post-GFC headline inflation. Likewise, their effects have negligible effects on core

[13] Olea and Plagborg-Moller (2021) argue that the lag augmentation corrects standard errors for serial correlation.

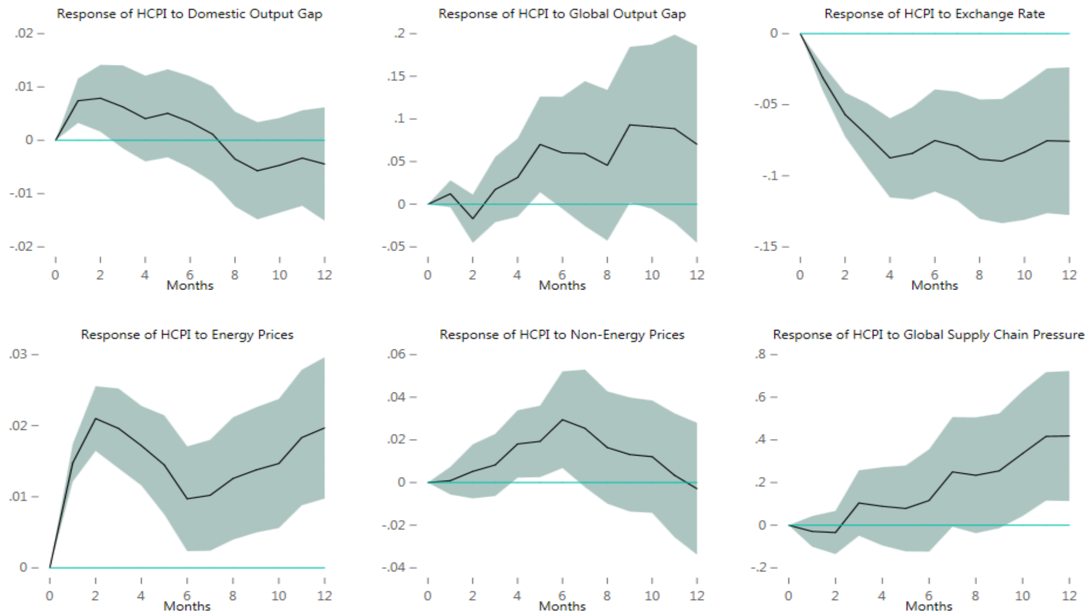
[14] Results are broadly similar when longer lags are employed in the LP method.

inflation and are short-lived. On the exchange rate, its effects are relatively muted in core inflation for 1-2 months, also statistically insignificant, denoting a slower pass-through into prices in the post-GFC.

Considering variables other than output gap measures is crucial when comparing domestic and global factors. For instance, the response of inflation to the exchange rate in the post-pandemic period is slightly more considerable but less persistent than in the post-GFC period. Furthermore, the novelty of this paper is the integration of the impact of global supply chain pressure on inflation. We show that the global supply chain pressure exerts upward pressure on inflation with a delay of one month in the post-pandemic period. Our results align with Benigno and others (2022), who show that recent inflationary pressures are closely associated with global supply chain pressures in the eurozone. This is because the global supply chain disruption would increase the costs of production, which could be passed on to consumers. Again, global supply chain pressure is quantitatively more considerable in the post-pandemic period than in the post-GFC period, but it is less persistent.

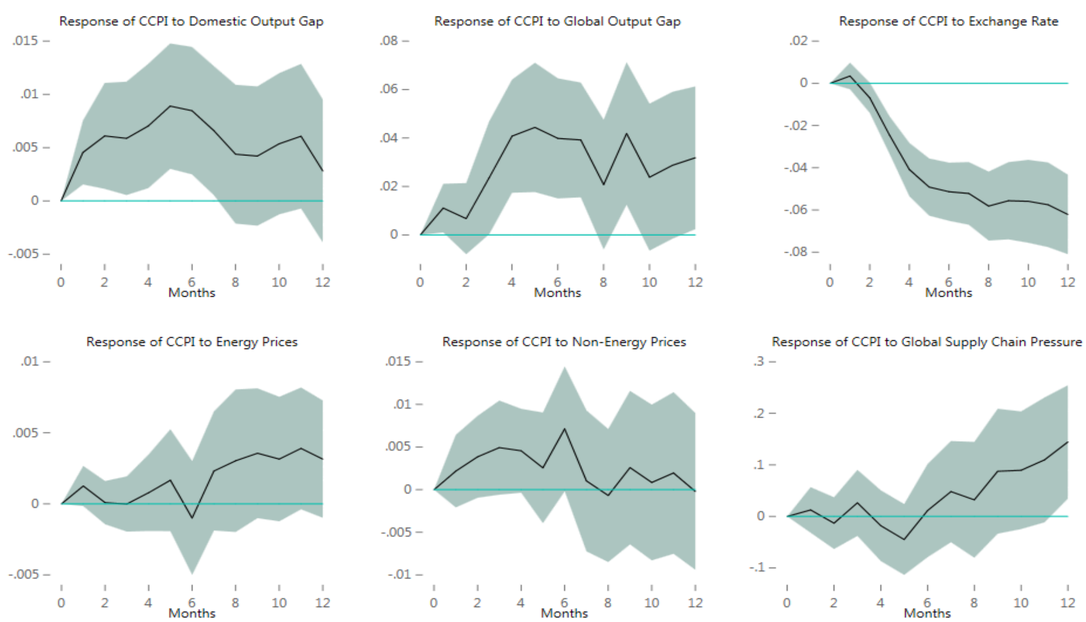
Overall, inflation has become more responsive to both domestic and global factors in the post-pandemic period. The more significant responsiveness of inflation to domestic and global factors indicates that a slight change in underlying domestic and global economic activities could influence the price levels quickly. When the shocks become persistent, they could affect the general trend in inflation. Given that central banks focus more on trend inflation than short-term volatility, both demand-pull and cost-push inflation from domestic and global factors during the post-pandemic period hint at the need for stronger monetary policy tightening to bring inflation under control. This is particularly critical in view of the increasing persistence in inflation dynamics we observe after the pandemic.

Figure 5. Augmented Phillips Curve Estimates, Post-GFC: Headline Inflation



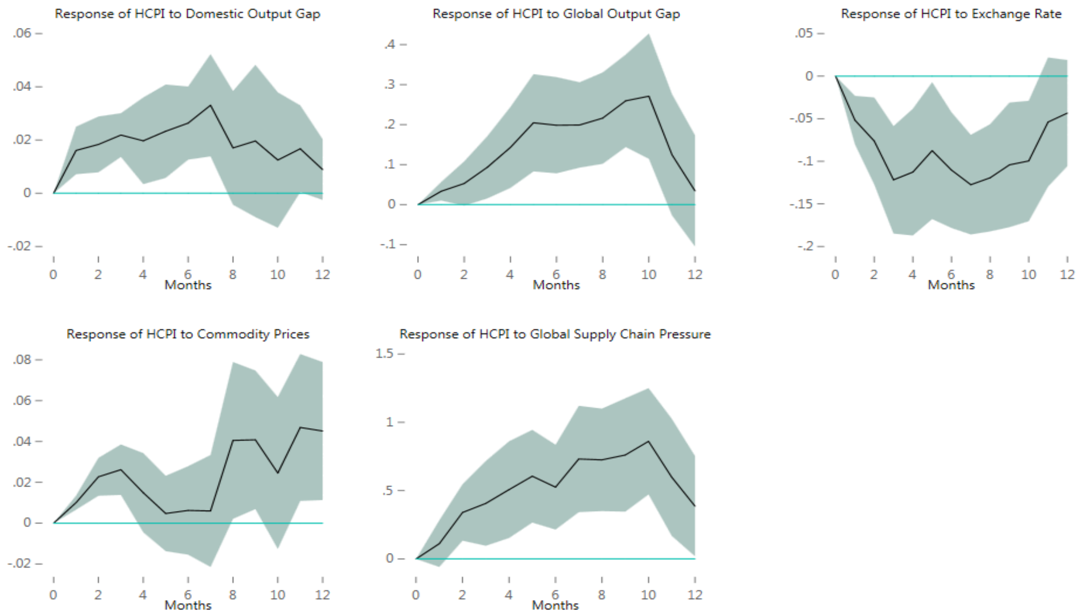
Note: Cumulative responses of headline inflation, with Driscoll-Kraay standard errors and 90 percent confidence interval during the period from June 2009 to December 2019.

Figure 6. Augmented Phillips Curve Estimates, Post-GFC: Core Inflation



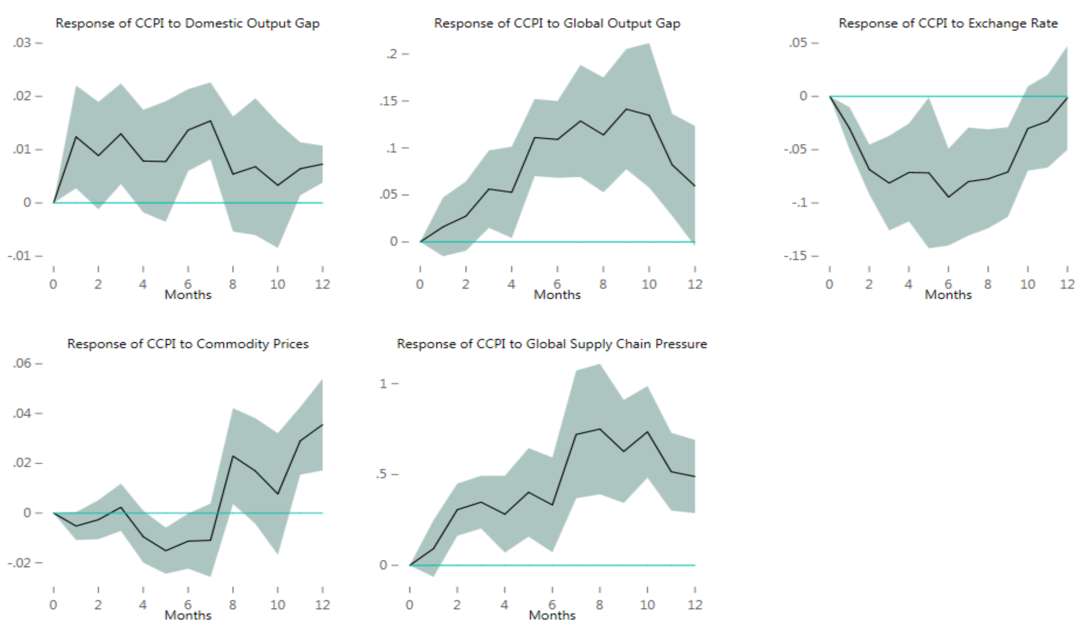
Note: Cumulative responses of core inflation, with Driscoll-Kraay standard errors and 90 percent confidence interval during the period from June 2009 to December 2019.

Figure 7. Augmented Phillips Curve Estimates, Post-Pandemic: Headline Inflation



Note: Cumulative responses of headline inflation, with Driscoll-Kraay standard errors and 90 percent confidence interval during the period from January 2020 onward.

Figure 8. Augmented Phillips Curve Estimates, Post-Pandemic: Core Inflation



Note: Cumulative responses of core inflation, with Driscoll-Kraay standard errors and 90 percent confidence interval during the period from January 2020 onward.

IV. Robustness Checks

We use two alternative measures of the REER, inflation forecasts and longer lags of our variables of interest to confirm the robustness of our baseline results**.** First, we rely on the REER constructed based on CPI and Unit Labor Cost (ULC) to test whether these variables change our baseline results (Table 5). The choice of the exchange rate variable between the NEER and the REER may influence inflation dynamics differently due to the inclusion of Eurozone countries in our panel. These robustness checks, however, show that there is no qualitative difference when we use the REER compared to our baseline results including the NEER.

Second, we include inflation forecasts, which has become standard practice in the literature to control for forward-looking price behavior along with past inflation (Albuquerque and Baumann, 2017; Jorda and Nechio, 2018; Mcleay and Tenreyro, 2019). We use a one-year ahead inflation forecast in the model and obtain broadly similar results, which show that inflation expectations have become even more significant after the pandemic (Table 6). Notably, the inflation forecast is quantitatively more significant in the post-pandemic period, implying a growing role of domestic factors. Likewise, the persistence of inflation is still qualitatively and quantitatively substantial despite the inclusion of the inflation forecast.

Table 5. Augmented Phillips Curve Estimates: Alternative REER Measures

	Headline Inflation		Core Inflation	
	REER-CPI	REER-ULC	REER-CPI	REER-ULC
Inflation_{t-1}	0.963***	0.951***	0.985***	0.973***
	(0.015)	(0.018)	(0.011)	(0.013)
Domestic output gap	0.004***	0.003***	0.004***	0.0034***
	(0.001)	(0.001)	(0.001)	(0.001)
Global output gap	0.006	0.008	0.008***	0.009***
	(0.005)	(0.005)	(0.003)	(0.003)
$\Delta\text{reer\_CPI}_{t-1}$	-0.018***		-0.012***	
	(0.003)		(0.002)	
$\Delta\text{reer\_ULC}_{t-1}$		-0.007***		-0.004***
		(0.002)		(0.001)
ΔEnergy prices	0.004***	0.004***	0.001**	0.001**
	(0.001)	(0.001)	(0.000)	(0.000)
ΔNon-energy prices	0.002	0.001	0.001	0.001
	(0.002)	(0.002)	(0.001)	(0.001)
GSCP	0.036	0.038	0.049***	0.046***
	(0.028)	(0.028)	(0.017)	(0.017)
Country FE	Yes	Yes	Yes	Yes
Observations	7,020	5,850	7,020	5,850
Countries	30	25	30	25

Note: Driscoll-Kraay robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. A constant is included in all specifications, but not shown in the table.

Third, we employ longer lags for commodity prices, exchange rates, and global supply chain pressures in the post-pandemic period. So, for instance, exchange rate movements might take longer to feed through inflation in core inflation. Likewise, commodity prices would take longer to feed through core inflation, though it takes a relatively shorter period on headline inflation. Accordingly, we run an additional robustness test using third and fifth lags. The results show that domestic and global output gap are statistically significant on headline inflation, aligning with our baseline results (Table A7 in Appendix). However, the exchange rate, commodity prices, and global supply chain pressures appear statistically insignificant when using third lags. When using the fifth lag, commodity prices are significant on both headline and core inflation, indicating that commodity prices would continue to affect inflation in the longer term. The delayed effects of the global factor, therefore, display that the role of the global factor might have diminished in the post-pandemic period. This is consistent with the F-test joint significance, whose values are broadly comparable to the ones observed in the sub-period estimates.

Table 6. Augmented Phillips Curve Estimates: Inflation Forecasts

	Headline Inflation		Core Inflation	
	Post-GFC	Post-Pandemic	Post-GFC	Post-Pandemic
$Inflation_{t-1}$	0.882***	0.988***	0.908***	0.975***
	(0.011)	(0.031)	(0.010)	(0.065)
Forecast	0.0941***	0.179**	0.083***	0.153*
	(0.025)	(0.065)	(0.013)	(0.079)
Domestic output gap	0.0020	0.006**	0.003**	0.006*
	(0.002)	(0.003)	(0.001)	(0.003)
Global output gap	0.0018	0.031*	0.004**	0.031**
	(0.005)	(0.018)	(0.002)	(0.012)
$\Delta NEER_{t-1}$	-0.025***	-0.025*	-0.012***	-0.021
	(0.003)	(0.014)	(0.002)	(0.013)
ΔEnergy prices	0.004***		-0.000	
	(0.001)		(0.000)	
ΔNon-energy prices	0.004**		0.002**	
	(0.002)		(0.001)	
ΔCommodity prices		0.005		-0.002
		(0.004)		(0.002)
GSCP	-0.021	0.004	0.022	0.073*
	(0.037)	(0.057)	(0.020)	(0.037)
Country FE	Yes	Yes	Yes	Yes
Observations	3,556	812	3,556	812
Countries	28	28	28	28

Note: Driscoll-Kraay robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Due to multicollinearity issues between energy- and non-energy prices in the post-pandemic period, we use a single index of commodity prices. A constant is included in all specifications, but not shown in the table.

VI. CONCLUSION

The world economy is in the midst of the worst inflation shock since the 1970s due to a confluence of unprecedented developments. Global inflation has soared to 7.5 percent as of August 2022, from 3.4 percent in 2020 and an average of 2.1 percent during the period 2010-2020. The extent and pace of this surge in inflation is not just a problem in developing countries, but it is also becoming an entrenched phenomenon across the world including in advanced economies with a long history of low and stable inflation. Unsurprisingly, there is a blame game for the rise in inflation—ranging from the extraordinary policy response to the pandemic leading to a strong rebound in aggregate demand to global supply constraints caused by the COVID-19 pandemic and worsened by geopolitical tensions since Russia's invasion of Ukraine.

This paper contributes to the debate by disentangling the confluence of contributing factors to the post-pandemic rise in inflation. Consumer price inflation is on the rise across the world, but there are considerable differences in the level of inflation and how the inflation process has changed across countries over time. We thereby aim to identify policy and structural differences as well as international commodity shocks and supply bottlenecks in explaining the evolution of inflation dynamics in Europe, where post-pandemic inflation reached the highest level in four decades. To this end, we use high-frequency data and employ alternative econometric methodologies, including a dynamic factor model, a panel data analysis, and the local projection method, to analyze inflation dynamics in a balanced panel of 30 European countries over the period December 2002 to May 2022.

Global factors continue to play an essential role in shaping inflation dynamics throughout Europe, but domestic factors, including monetary and fiscal policy responses to the crisis, have become more prominent after the pandemic. Inflation is a complex phenomenon, with multitudes of domestic and external factors having direct and indirect influences on pricing behavior. Our empirical findings confirm the role of both global and domestic developments in shaping inflation dynamics. First, we find that the observed explanatory power of global factors is significant and has remained roughly constant throughout the sample period. The share of the variance explained by global factors is about 40 percent for headline inflation and 20 percent for core inflation. Second, country-specific factors have gained greater prominence in explaining the variance of inflation dynamics during the pandemic. The share of variance explained by domestic factors increased by 10 percentage points after the COVID-19 pandemic. We also find heterogeneous effects of global and domestic factors in advanced and emerging market economies. While common inflation dynamics remained dominant in explaining inflation variance in advanced economies prior to the pandemic, the role of both global and domestic factors increased substantially in these countries after the pandemic. In the case of emerging

market economies, however, the role of global factors has continued to grow even after the pandemic, but domestic factors have gained even more significance in determining inflation dynamics across all countries during the post-pandemic period.

We deepen the empirical analysis by estimating alternative models of inflation dynamics in a panel setting and obtain corroborative evidence. Our panel data analysis shows that inflation persistence is a highly significant factor across all specifications and for different measures of inflation. While the domestic output gap has a statistically significant effect on both headline and core inflation, the global output gap appears to have a greater influence on core inflation. We also find that other global factors (international energy and non-energy commodity prices and global supply chain pressures) and the exchange rate, reflecting both global and domestic developments and policy choices, exhibit significant effects on inflation in Europe. These results, robust to a battery of sensitivity checks, also indicate that there are notable differences between advanced and emerging market economies, with global factors having a more significant effect in developing countries. In the post-pandemic period, however, domestic factors have become far more important across all countries in driving inflation dynamics.

The analysis of consumer price inflation presented in this paper has important implications for the optimal conduct of monetary policy in Europe—and beyond. A plethora of developments, mostly outside the control of policymakers, has certainly contributed to the surge in inflation across the world, but it would be misleading to put the onus on global factors alone. While much of the recent increase in inflation is a direct result of pandemic-related disruptions and Russia's invasion of Ukraine that has pushed international commodity prices higher, our analysis show that the joint significance of global factors has diminished after the pandemic. Instead, we find that domestic developments have become far more influential in determining inflation dynamics with greater persistence. In other words, the evolution of aggregate demand at home—and abroad—matters more than ever for the appropriate monetary policy stance to bring inflation under control. To this end, central banks should continue to recalibrate monetary conditions—by raising interest rates and removing quantitative easing—to anchor inflation expectations, which have become even more important in the post-pandemic period.

References

Aisen, A., and F. Veiga (2006). "Does Political Instability Lead to Higher Inflation? A Panel Data Analysis," *Journal of Money Credit and Banking*, Vol. 38, pp. 1379–1390.

Alesina, A., and L. Summers (1993). "Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence," *Journal of Money, Credit, and Banking*, Vol. 25, pp. 151–162.

Auer, R., C. Borio, and A. Filardo (2017). "The Globalization of Inflation: The Growing Importance of Global Value Chains," CEPR Discussion Paper No. DP11905 (London: Centre for Economic Policy Research).

Badinger, H. (2009). "Globalization, the Output–Inflation Tradeoff and Inflation," *European Economic Review*, Vol. 53, pp. 888–907.

Bai, J., and S. Ng (2008). "Large Dimensional Factor Analysis," *Foundations and Trends in Econometrics*, Vol. 3, pp. 89–163.

Bai, J. and Wang, P. (2016). "Econometric Analysis of Large Factor Models." *Annual Review of Economics*, Vol. 8, pp. 53-80, Available at SSRN: https://ssrn.com/abstract=2870853 or http://dx.doi.org/10.1146/annurev-economics-080315-015356

Barro, R., and D. Gordon (1993). "Rules, Discretion and reputation in a Model of Monetary Policy," *Journal of Monetary Economics*, Vol. 12, pp. 101–121.

Baumeister, C., and J. Hamilton (2019). "Structural Interpretation of Vector Autoregressions with Incomplete Identification: Revisiting the Role of Oil Supply and Demand Shocks," *American Economic Review*, Vol. 109, pp. 1873–1910.

Bems, R., F. Caselli, F. Grigoli, B. Gruss, and W. Lian (2018). "Is Inflation Domestic or Global? Evidence from Emerging Markets," IMF Working Paper No. 18/241 (Washington, DC: International Monetary Fund).

Benigno, G., J. Di Giovanni, J. Groen, and A. Noble (2022). "The GSCPI: A New Barometer of Global Supply Chain Pressures," FRB of New York Staff Report No. 1017 (New York, NY: Federal Reserve Bank of New York).

Bonam, D., and A. Smădu (2021). "The Long-Run Effects of Pandemics on Inflation: Will This Time Be Different?" *Economics Letters*, Vol. 208, 110065.

Borio, C., and A. Filardo (2007). "Globalization and Inflation: New Cross-Country Evidence on the Global Determinants of Domestic Inflation," BIS Working Paper No. 227 (Basel: Bank for International Settlements).

Boivin, J. and S. Ng (2006). "Are More Data Always Better for Factor Analysis?" *Journal of Econometrics*, Vol. 132, pp. 169–94.

Breitung, J. and Eickmeier, S. (2006). "How Synchronized are New EU Member States with the Euro Area? Evidence from a Structural Factor Model." *Journal of Comparative Economics,* Vol. 34, Issue 3, pp. 538-563.

Brumm, H. (2006). "The Effect of Central Bank Independence on Inflation in Developing Countries," *Economics Letters*, Vol. 90, pp. 189–193.

Busetti F., M. Caivano, and D. Delle Monache (2021). "Domestic and Global Determinants of Inflation: Evidence from Quantile Regression," *Oxford Bulletin of Economics and Statistics*, Vol. 83, pp. 982–1001.

Calza, A. (2008). "Globalisation, Domestic Inflation and Global Output Gaps: Evidence from the Euro Area," ECB Working Paper No. 890 (Frankfurt: European Central Bank).

Campillo, M., and J. Miron (1997). "Why Does Inflation Differ Across Countries?" NBER Working Paper No. 5540 (Cambridge, MA: National Bureau of Economic Research).

Catao, L., and M. Terrones (2005). "Fiscal Deficits and Inflation," *Journal of Monetary Economics*, Vol. 52, pp. 529–554.

Cecchetti, S., and S. Krause (2002). "Central Bank Structure, Policy Efficiency, and Macroeconomic Performance: Exploring Empirical Relationships," *Federal Reserve Bank of St. Louis Review*, Vol. 84, pp. 47–60.

Cerutti, E., S. Claessens, and A. Rose, (2019). "How Important is the Global Financial Cycle? Evidence from Capital Flows." *IMF Economic Review,* Vol. 67, pp. 24–60.

Cevik, S., and T. Zhu (2020). "Trinity Strikes Back: Monetary Independence and Inflation in the Caribbean," *Journal of International Development*, Vol. 32, pp. 375–380.

Chon, S. (2020). "International Inflation Synchronization and Implications," *Journal of Economic Policy*, Vol. 42, pp. 57–84.

Ciccarelli, M., and B. Mojon (2010). "Global Inflation," *Review of Economics and Statistics*, Vol. 92, pp. 163–192.

Clark, T., and M. McCracken (2006). "The Predictive Content of the Output Gap for Inflation: Resolving In-Sample and Out-of-Sample Evidence," *Journal of Money, Credit, and Banking*, Vol. 38, pp. 1127–1148.

Cravino, J. (2019). Comment on "Inflation Dynamics: Dead, Dormant, or Determined Abroad?" by Kristin Forbes. *Brookings Papers on Economic Activity*, Vol. X, pp. X-x.

Cukierman, A. (1992). *Central Bank Strategy, Credibility, and Independence: Theory and Evidence* (Cambridge, MA: The MIT Press).

Cukierman, A., and F. Lippi (1999). "Central Bank Independence, Centralization of Wage Bargaining, Inflation and Unemployment: Theory and Some Evidence," *European Economic Review*, Vol. 43, pp. 1395–1434.

Cukierman, A., S. Webb, and B. Neyapti (1992). "Measuring the Independence of Central banks and Its Effect on Policy Outcomes," *World Bank Economic Review*, Vol. 6, pp. 353–398.

Deniz, P., M. Tekçe, and A. Yılmaz (2016). "Investigating the Determinants of Inflation: A Panel Data Analysis," *International Journal of Financial Research*, Vol. 7, pp. 233-246.

Forbes, K. (2019). "Has Globalization Changed the Inflation Process?" BIS Working Paper No. 791 (Basel: Bank for International Settlements).

Forni, M., M. Hallin, M. Lippi, and L. Reichlin (2000). "The Generalized Dynamic Factor Model: Identification and Estimation," *Review of Economics and Statistics, 82, 540–554*.

Forni, M., M. Hallin, M. Lippi, and L. Reichlin. (2005) "The Generalized Factor Model: One-sided Estimation and Forecasting," *Journal of the American Statistical Association*, Vol. 100, pp. 830–840.

Forni, M., M. Hallin, M. Lippi, and P. Zaaroni (2015). "Dynamic Factor Models with Infinite-Dimensional Factor Spaces: One-Sided Representations," *Journal of Econometrics*, Vol. 185, pp. 359–371.

Forni, M., M. Hallin, M. Lippi, and P. Zaaroni (2017). "Dynamic Factor Models with Infinite-Dimensional Factor Space: Asymptotic Analysis," *Journal of Econometrics*, Vol. 199, pp. 74–92.

Forni, M., and M. Lippi (2011). "The General Dynamic Factor Model: One-Sided Representation Results," *Journal of Econometrics*, Vol. 163, pp. 23–28.

Förster, M., and P. Tillmann (2014). "Reconsidering the International Co-movement of Inflation," *Open Economies Review*, Vol. 25, pp. 841–863.

Galí, J., and M. Gertler (1999). "Inflation Dynamics: A Structural Econometric Analysis," *Journal of Monetary Economics*, Vol. 44, pp. 195-222.

Galí, J., M. Gertler, and J. López-Salido (2005). "Robustness of the Estimates of the Hybrid New Keynesian Phillips Curve," *Journal of Monetary Economics*, Vol. 52, pp. 1107-1118.

Gibbons, S., Overman, H. G., and Pelkonen, P. (2013). "Area Disparities in Britain: Understanding the Contribution of People vs. Place Through Variance Decompositions," *Oxford Bulletin of Economics and Statistics*, Vol. 76, n 5, pp. 754-763.

Gruben, W., and D. McLeod (2002). "Capital Account Liberalization and Inflation," *Economic Letters*, Vol. 77, pp. 221–225.

Gupta, A. (2008). "Does Capital Account Openness Lower Inflation," *International Economic Journal*, Vol. 22, pp. 471–487.

Ha, J., A. Kose, and F. Ohnsorge (2019). *Inflation in Emerging and Developing Economies: Evolution, Drivers, and Policies* (Washington, DC: World Bank).

Ha, J., A. Kose, and F. Ohnsorge (2021). Inflation During the Pandemic: What happened? What is Next?" ERF Working Paper No. 2108 (Istanbul: Koç University-TÜSIAD Economic Research Forum).

Hallin, M., and R. Liska, (2007) "Determining the Number of Factors in the General Dynamic Factor Model," *Journal of the American Statistical Association,* Vol. 102, pp. 603–617.

Hamilton, J. (2018). "Why You Should Never Use the Hodrick-Prescott Filter," *Review of Economics and Statistics*, vol. 100, pp. 831–843.

Hausmann, R., M. Gavin, C. Pages, and E. Stein (1999). "Financial Turmoil and Choice of Exchange Rate Regime," IDB Working Paper No. 331 (Washington, DC: Inter-American Development Bank).

Husain, A., A. Mody, and K. Rogoff (2005). "Exchange Rate Regime Durability and Performance in Developing vs. Advanced Economies," *Journal of Monetary Economics*, Vol. 52, pp. 35–64.

Ihrig, J., Kamin, S., Lindner, D., and Marquez, J. (2010). "Some Simple Tests of the Globalization and Inflation Hypothesis." *International Finance,* Vol. 13, pp. 343–375.

Jasova, M., R. Moessner, and E. Takats (2020). "Domestic and Global Output Gaps as Inflation Drivers: What does the Phillips Curve Tell?" *Economic Modelling*, Vol. 87, pp. 238–253.

Kamber, G. and Wong, B. (2020). "Global Factors and Trend Inflation." *Journal of International Economics,* Vol. 122, 103265.

Kamber, G., Mohanty, M. and Morley, J. (2020). "What Drives Inflation in Advanced and Emerging Market Economies?" BIS Working Paper No. 111 (Basel: Bank for International Settlements).

Kohlscheen, E., and R. Moessner (2022). "Globalisation and the Slope of the Phillips Curve," *Economics Letters,* Vol. 216, 110587.

Kydland, F., and E. Prescott (1977). "Rules Rather Than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy*, Vol. 85, pp. 473–492.

Lane, P. (1997). "Inflation in Open Economies," *Journal of International Economics*, Vol. 42, pp. 327–347.

Levy Yeyati, E., and F. Sturzenegger (2001). "Exchange Rate Regimes and Economic Performance," *IMF Staff Papers*, Vol. 47, pp. 62-98.

Lougani, P., and N. Sheets (1997). "Central Bank Independence, Inflation and Growth in Transition Economies," *Journal of Money, Credit and Banking*, Vol. 29, pp. 381–399.

Lütkepohl, H. (2014). A Survey, Structural Vector Autoregressive Analysis in a Data Rich Environment. *DIW Berlin Discussion Papers* 1351, 48 S.

Menden, C., and C. Proaño (2017). "Dissecting the Financial Cycle with Dynamic Factor Models," *Quantitative Finance*, Vol. 17, pp. 1965-1994.

Mikolajun, I., and D. Lodge (2016). "Advanced Economy Inflation: The Role of Global Factors," ECB Working Paper No 1948 (Frankfurt: European Central Bank).

Miranda-Agrippino, S., and H. Rey (2020). "U.S. Monetary Policy and the Global Financial Cycle," *Review of Economic Studies,* Vol. 87, pp. 2754-2776.

Miranda, K., P. Poncela, and E. Ruiz. (2021). "Dynamic Factor Models: Does the Specification Matter?" *SERIEs,* Vol. 13, pp. 397-428.

Mumtaz, H., and A. Musso (2021). "The Evolving Impact of Global, Region-Specific, and Country-Specific Uncertainty," *Journal of Business & Economic Statistics,* Vol. 39, pp. 466-481.

Mumtaz, H., and P. Surico (2008). "Evolving International Inflation Dynamics: Evidence from a Time-varying Dynamic Factor Model," CEPR Discussion Papers No. 6767 (London: Center for Economic Policy Research).

Mumtaz, H., S. Simonelli, and P. Surico (2011). "International Co-movements, Business Cycle and Inflation: A historical Perspective," *Review of Economic Dynamics,* Vol. 14, pp. 176–198.

Moore, W., D. Lewis-Bynoe, and N. Morgan (2012). "Inflation Starts in Latin America and the Caribbean," *Applied Economics*, Vol. 44, pp. 825–834.

Mumtaz, H., and Surico, P. (2012). "Evolving International Inflation Dynamics: Evidence from a Time-Varying Dynamic Factor Model," *Journal of the European Economic Association*, Vol. 10, pp. 716-734.

Nagy, E., and V. Tengely (2018). "The External and Domestic Drivers of Inflation: The Case Study of Hungary," BIS Working Paper No. 100 (Basel: Bank for International Settlements).

Neely, C., and D. Rapach (2011). "International Co-movements in Inflation Rates and Country Characteristics," *Journal of International Money and Finance*, Vol. 30, pp. 1471–1490.

Montiel Olea, J., and M. Plagborg-Møller (2021). "Local Projection Inference Is Simpler and More Robust Than You Think," *Econometrica,* Vol. 89, pp. 1789–1823.

Pesaran, M. H. (2007). "A Simple Panel Unit Root Test in the Presence of Cross-section Dependence", *Journal of Applied Econometrics*, Vol. 22, No. 2, pp. 265–312.

Posen, A. (1998). "Central Bank Independence and Disinflation Credibility: A Missing Link?" *Oxford Economic Papers*, Vol. 50, pp. 335–359.

Sargent, T. (1989). "Two Models of Measurements and the Investment Accelerator," *Journal of Political Economy*, Vol. 97, pp. 251–87.

Sargent, T., and C. Sims (1977). "Business Cycle Modeling Without Pretending to Have Too Much a Priori Economic Theory," *New Methods in Business Cycle Research*, Vol. 1, pp. 145–168.

Stock, J., and M. Watson (1989). "New Indexes of Coincident and Leading Economic Indicators," *NBER Macroeconomics Annual*, Vol. 4, pp. 351–394.

Stock, J., & Warson, M. (1991). "A probability model of the coincident economic indicators". In K. Lahiri & G. Moore (Eds.), Leading Economic Indicators: New Approaches and Forecasting Records, pp. 63-90. *Cambridge: Cambridge University Press*.

Stock, J., and M. Watson (1993). *Business cycles, Indicators and Forecasting* (Chicago: University of Chicago Press).

Stock, J., & Warson, M. (2006). "Forecasting with Many Predictors". In G. Elliott, C.W.J. Granger & A. Timmermann (Eds.), *Handbook of Economic Forecasting.* Vol 1, pp. 515-554.

Stock, J., and M. Watson (2011). "Dynamic Factor Models". In M. P. Clements, and D. F. Hendry (Eds.), *The Oxford Handbook of Economic Forecasting*. Vol. 1, pp. 35-60.

Stock, J., and M. Watson (2016). "Dynamic Factor Models, Factor-Augmented Vector Autoregressions, and Structural Vector Autoregressions in Macroeconomics," *Handbook of Macroeconomics*, Vol. 2, pp. 415–525.

Szafranek, K. (2021). "Evidence on Time-Varying Inflation Synchronization," Economic Modelling, Vol. 94, pp. 1–13.

Romer, D. (1993). "Openness and Inflation: Theory and Evidence," *Quarterly Journal of Economics*, Vol. 108, pp. 869–903.

Rogoff, K. (1985). "The Optimal Degree of Commitment to an Intermediate Monetary Target," *Quarterly Journal of Economics*, Vol. 100, pp. 1169–1189.

Rogoff, K. (2003). "Globalization and Global Disinflation," *Federal Reserve Bank of Kansas City Economic Review*, Vol. 88, pp. 45–78.

Shambaugh, J. (2004). "The Effects of Fixed Exchange Rates on Monetary Policy," *Quarterly Journal of Economics*, Vol. 119, pp. 301–352.

Végh, C. (1989). "Government Spending and Inflationary Finance: A Public Finance Approach," IMF Staff Papers, Vol. 36, pp. 657–77.

Walsh, C. (2008). "Central Bank Independence," in S. Durlauf and L. Blume, eds., *The New Palgrave Dictionary of Economics* (New York: Palgrave Macmillan).

Appendix Table A1. List of Countries

Advanced Europe	Emerging Europe
Austria	Bulgaria
Belgium	Croatia
Cyprus	Czech Republic
Denmark	Estonia
Finland	Hungary
France	Latvia
Germany	Lithuania
Greece	Poland
Ireland	Romania
Italy	Slovak Republic
Luxembourg	Slovenia
Malta	
Netherlands	
Norway	
Portugal	
Spain	
Sweden	
Switzerland	
United Kingdom	

Appendix Table A2. Data Sources

Variable	Source
Headline Inflation	Eurostat and IMF
Core Inflation	Eurostat, OECD, and CEIC.
Domestic output gap	IMF staff calculations based on the industrial production taken from Eurostat, OECD, and IMF
Global output gap	IMF staff calculations based on the world industrial production taken from Baumeister and Hamilton (2019),
Nominal and real effective exchange rate	IMF
Energy prices	IMF
Non-energy prices	IMF and World Bank
Commodity price index	IMF
Global supply chain pressure	Benigno et al. (2022)
Inflation forecast	Consensus Economics

Appendix Table A3. Panel Unit Root Test

	Lag (1) C	Lag (1) C+T	Lag (2) C	Lag (2) C+T
$\boldsymbol{Headline\ \pi_{c,t}}$	-9.635***	-8.638***	-8.613***	-7.514***
$\boldsymbol{Core\ \pi_{c,t}}$	-7.448***	-7.587***	-7.079***	-6.508***
$\boldsymbol{Y^{D}_{c,t}}$	-25.861***	-25.952***	-24.489***	-24.001***
$\boldsymbol{\Delta NEER_{c,t}}$	-15.294***	-13.508***	-13.458***	-11.475***
$\boldsymbol{\Delta REER_{c,t}\ CPI}$	-12.541***	-10.649***	-11.510***	-9.559***
$\boldsymbol{\Delta REER_{c,t}\ ULC}$	-10.422***	-8.615***	-11.047***	-9.354***
$\boldsymbol{\pi^{e}_{c,t}}$	-7.157***	-6.079***	-6.556***	-5.299***

Note: Pesaran (2007) t-test for unit roots in heterogeneous panels with cross-section dependence. C and T denote constant and trend, respectively. Z[t-bar] is reported.

Appendix Table A4. Time Series Unit Root Test

	Drift	Trend
$\boldsymbol{Y^{W}_{t}}$	-2.606***	-2.615
$\boldsymbol{GSCP_{t}}$	-2.719***	-3.783**
$\boldsymbol{\Delta Energy\ pric}$	-3.715***	-3.745**
$\boldsymbol{\Delta Non - energy\ pri}$	-3.695***	-3.709**
$\boldsymbol{\Delta Commodity}$	-3.397***	-3.385*

Note: The ADF test is used. The t-statistic is reported. One lag is used based on the AIC.

Appendix Table A5. Structural Break Test at Unknown Break Dates

		Bai & Perron Critical Values		
Headline	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
SupW($\boldsymbol{\tau}$)	28.43***	3.12	2.71	2.52
	Estimated Break Points: June 2008 and June 2019			
Core				
SupW($\boldsymbol{\tau}$)	19.28***	3.12	2.71	2.52
	Estimated Break Points: June 2008 and May 2019			

Note: Null hypothesis of no break(s) against 2 breaks.

Appendix Table A6. Impact of the COVID-19-Related Government Response to Inflation

	Headline Inflation		Core Inflation	
	IV	DK	IV	DK
ln Government Response$_{t-1}$	0.113***	1.082**	0.026	0.018
	(0.022)	(0.041)	(0.016)	(0.029)
Country FE	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes
Countries	30	30	30	30
Obs.	822	822	822	822

Note: IV indicates the instrumental variable estimator to explicitly account for the lagged inflation, whereas DK denotes the Driscoll-Kraay standard errors. Robust standard errors included in parentheses for the IV estimator. *** p<0.01, ** p<0.05, * p<0.1. The COVID-19 government response stringency index is taken from https://data.humdata.org/dataset/oxford-covid-19-government-response-tracker?force_layout=descktop. The estimations begin from January 2020 and onward.

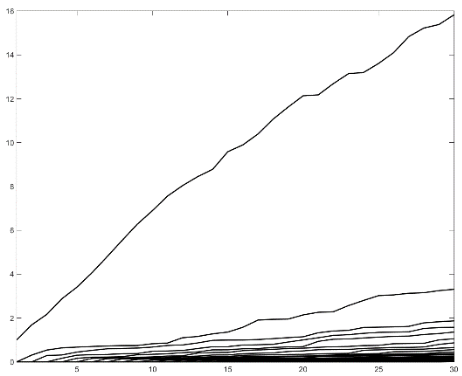
Appendix Table A7. Augmented Phillips Curve Estimates, Post-Pandemic: Longer Lags

	Headline Inflation		Core Inflation	
	Lag 3	Lag 5	Lag 3	Lag 5
Inflation_{t-1}	1.017***	0.991***	1.017***	0.960***
	(0.025)	(0.032)	(0.042)	(0.043)
Domestic output gap	0.009**	0.011*	0.0056	0.011*
	(0.003)	(0.006)	(0.004)	(0.005)
Global output gap	0.039***	0.036**	0.011	0.010
	(0.013)	(0.017)	(0.008)	(0.014)
ΔNEER_{t-3}	-0.005		-0.010	
	(0.010)		(0.009)	
$\Delta\text{Commodity prices}_{t-3}$	0.001		0.003	
	(0.002)		(0.002)	
GSCP_{t-3}	0.069		0.056	
	(0.045)		(0.038)	
ΔNEER_{t-5}		-0.014		-0.012
		(0.013)		(0.014)
$\Delta\text{Commodity prices}_{t-5}$		0.007***		0.005***
		(0.001)		(0.001)
GSCP_{t-5}		-0.059		0.060*
		(0.044)		(0.031)
Country FE	Yes	Yes	Yes	Yes
F-test: Global	7.75***	13.19***	5.25***	21.20***
Observations	780	720	780	720
Number of groups	30	30	30	30

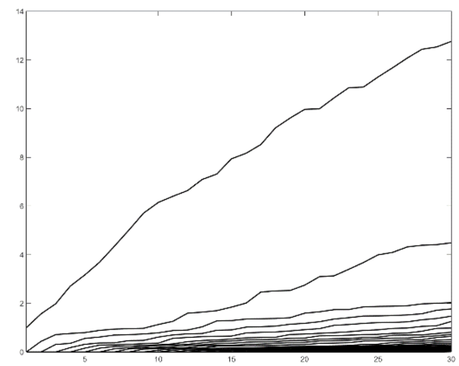
Note: Driscoll-Kraay standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The post-pandemic periods are estimated from January 2020 to May 2022. Constant is omitted for clarity. Due to multicollinearity issues between energy- and non–energy prices, we employ the commodity price index in the post-pandemic period.

Appendix Figure A1. Dynamic Eigenvalues (Averaged over Frequencies)

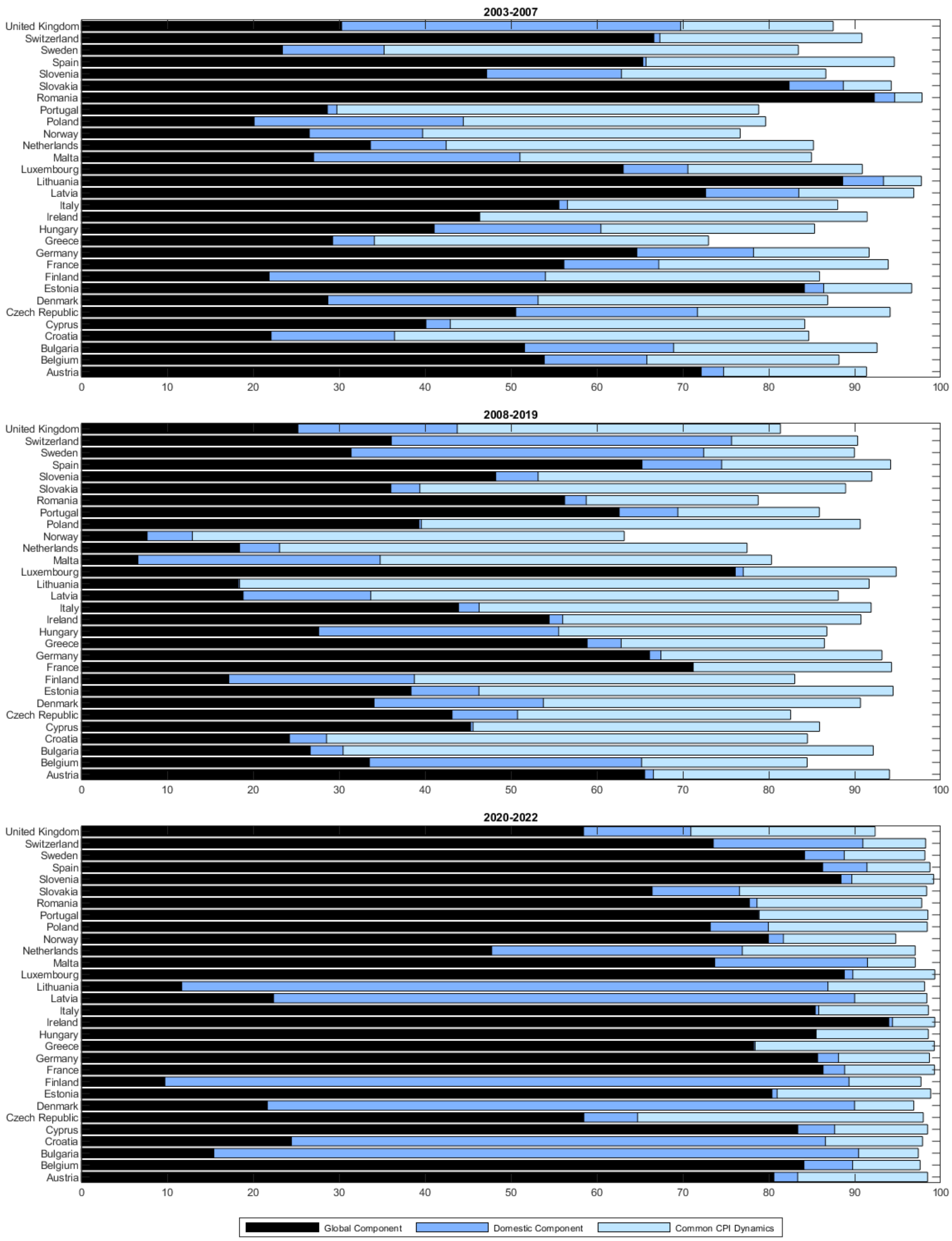
Headline Inflation



Core Inflation



Appendix Figure A2. Share of Headline Inflation Variance



Appendix Figure A3. Share of Core Inflation Variance