Inflation During the Pandemic: What Happened? What is Next?

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July 2021

Abstract: We analyze the evolution and drivers of inflation during the pandemic and the likely trajectory of inflation in the near-term using an event study of inflation around global recessions and a factor-augmented vector auto-regression (FAVAR) model. We report three main results. First, the decline in global inflation during the 2020 global recession was the most muted and shortest-lived of any of the five global recessions over the past 50 years and the increase in inflation since May 2020 has been the fastest. Second, the decline in global inflation from January-May 2020 was four-fifths driven by the collapse in global demand and another one-fifth driven by plunging oil prices, with some offsetting inflationary pressures from supply disruptions. The subsequent surge in inflation has been mostly driven by a sharp increase in global demand. Third, both model-based forecasts and current inflation expectations point to an increase in inflation for 2021 of just over 1 percentage point. For virtually all advanced economies and one-half of inflation-targeting emerging market and developing economies (EMDEs), an increase of this magnitude would leave inflation within target ranges. If the increase is temporary and inflation expectations remain well-anchored, it may not warrant a monetary policy response. If, however, inflation expectations risk becoming unanchored, EMDE central banks may be compelled to tighten monetary policy before the recovery is fully entrenched.

Keywords: Global Inflation; COVID-19; Global Recession; FAVAR; Oil Prices; Global Shocks
JEL Classification: E31, E32, Q43

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I think there's a one-third chance that inflation expectations meaningfully above the Fed's 2 percent target will become entrenched, a one-third chance that the Fed will bring about substantial financial instability or recession in order to contain inflation, and a one-third chance that this will work out as policymakers hope.
Lawrence Summers (2021)

[T]here are good reasons to worry. True, expectations have been extremely sticky for a long time, apparently not reacting to movements in actual inflation. But, with such overheating, expectations might well deanchor. If they do, the increase in inflation could be much stronger.
Olivier Blanchard (2021)

Our best view is that the effect on inflation will be neither particularly large nor persistent. And part of that .. .is that we've been living in a world of strong disinflationary pressures—around the world really—for a quarter of a century.
Jerome Powell (2021)

There are indeed reasons to be worried about inflationary overheating. In fact, even those of us who think it will be OK expect to see above-normal inflation this year. We just think it will be a blip.
Paul Krugman (2021)

Readings on inflation on a year-over-year basis have recently increased and are likely to rise somewhat further before moderating later this year. fi However, fi, these one-time increases in prices are likely to have only transitory effects on underlying inflation, ...
Richard Clarida (2021)

1. Introduction

The COVID-19 pandemic plunged the global economy into its deepest recession since the Second World War (Kose and Sugawara 2021; World Bank 2020a; 2021a). Amid a collapse in demand and plunging oil prices, global consumer price inflation declined by 0.9 percentage point between January and May 2020. This decline was about one-third more pronounced in advanced economies than in emerging market and developing economies (EMDEs).

Since May 2020, however, inflation has picked up. By April 2021, inflation had risen above pre-pandemic levels, in both advanced economies and EMDEs. The inflation pickup was broad-based and present in about four-fifths of countries. As a result, the 2020 global recession featured the most muted inflation decline and fastest subsequent inflation upturn of the five global recession episodes of the past 50 years. While this behavior partly reflects lower levels of inflation at the beginning of 2020, recent surveys of purchasing managers report growing pressures on input as well as output prices in 2021 (Figure 1). As consumer price inflation rose above 4 percent in the United States and is approaching 2 percent in parts of Europe in mid-2021, short-term market-based inflation expectations have increased; medium-term inflation expectations, however, remain stable at 2 percent.

Looking ahead, as the global economy gradually reopens, monetary and fiscal policies continue to be accommodative to support the recovery, and pent-up demand is being released in advanced economies. For major advanced economies, some have raised concerns that this confluence of factors may generate significant inflationary pressures (Summers 2021; Blanchard 2021; Landau 2021). Others, in contrast, see little reason for concern, at least for many advanced economies, because of the temporary nature of price pressures, well-anchored inflation expectations, and structural factors still depressing inflation (Ball et al. 2021; Gopinath 2021; Krugman 2021; Powell 2021; Clarida 2021).

For now, expectations are for major advanced economies to keep policy highly accommodative for the next two years (Federal Reserve Board 2021). However, if growing inflationary pressures cause financial market participants to become concerned about persistently higher inflation in advanced economies, they may reassess prospects for continued accommodative monetary policies by major central banks. This could trigger a significant rise in risk premia and borrowing costs. EMDEs are particularly vulnerable to such financial market disruptions because of their record high debt and a lagging economic recovery from the pandemic (World Bank 2021a). In the event of financial market stress, sharp exchange rate depreciations and capital outflows may force them to abruptly tighten policies in a manner that could throttle their recoveries.

Even in the absence of dislocating financial market stress, EMDEs may face rising inflation as global price pressures feed into domestic inflation through input prices and exchange rate movements. A temporary increase in inflation may not warrant a monetary policy response. However, if rapidly rising price pressures risk de-anchoring inflation expectations, EMDE central banks may be forced to tighten monetary policy before the recovery is fully entrenched.

Against this background, this paper first briefly examines the evolution of global inflation over the past five decades and then addresses the following questions: First, what have

been the main drivers of recent developments in global inflation? Second, how does the evolution of inflation during the 2020 global recession compare with that in earlier global recessions? Third, what are prospects for global inflation? Finally, what are the policy implications of higher inflation for EMDEs?

The paper contributes to the literature in four dimensions. First, it expands on existing studies by putting recent inflation developments into a historical context, drawing on a new, large inflation database (Ha, Kose, and Ohnsorge 2021). It is the first study that compares the evolution of inflation during the 2020 global recession with those during previous global recessions. Second, it analyzes the driving forces of global inflation focusing on the 2020 global recession, including in comparison with earlier global recessions. To this end, it employs two approaches: an event study of global inflation around global recessions and a factor-augmented vector auto-regression (FAVAR) model of global variables. Third, based on the discussion of various factors that determine inflation dynamics, and model-based conditional forecasts, it examines the near-term prospects for inflation. Fourth, it discusses the policy implications of growing inflationary pressures for EMDEs.

The main findings of the paper are the following. First, the decline in inflation during the 2020 global recession was the most muted and shortest-lived of any of the five global recessions over the past 50 years. Similarly, the increase in inflation since May 2020, amid a rebound in oil prices and global demand has been faster than after previous recessions, including after the 2009 global recession.

Second, the decline in global inflation from January-May 2020 was four-fifths driven by the collapse in global demand and another one-fifth driven by plunging oil prices, with some offsetting inflationary pressures from supply disruptions. This contrasts with the 2009 global recession in which the 13-month decline in global inflation that was three-fifths driven by plunging oil prices and only one-third driven by the contraction in global demand. In their rebounds, however, inflation developments after the end of these two global recessions resembled each other: both were virtually entirely driven by sharp increases in global demand.

Third, model-based forecasts and current inflation expectations point to an increase in global inflation for 2021 as a whole of just over 1 percentage point. For virtually all advanced economies and one-half of inflation-targeting EMDEs, an increase of this magnitude would leave inflation within target ranges. However, for another one-half of inflation-targeting EMDEs, it would raise inflation above target ranges. If this increase is temporary and inflation expectations remain well-anchored, this may not warrant a monetary policy response. If, however, inflation expectations risk becoming unanchored, EMDE central banks may be compelled to tighten monetary policy more than would be appropriate for their economies' recoveries.

For now, long-term expectations point to continued low and stable inflation. However, several structural forces that have depressed inflation over the past five decades are beginning to fade amid trade tensions, population aging, and protracted weakness in investment and productivity growth. As they recede, increases in short-term inflation may become more persistent and, thus, threaten the anchoring of long-term inflation

expectations.

The rest of this paper is organized as follows. The next section examines the evolution of global inflation over the past five decades and employs an event study to compare the evolution of inflation during the 2020 global recession with those during previous global recessions. Section 3 presents the empirical methodology used to estimate the drivers of inflation and derive conditional forecasts. Based on this methodology, Section 4 reports the drivers of global inflation in past global recessions as well as in the most recent global recession of 2020. Section 5 discusses short- and long-term inflation prospects. Section 6 concludes.

2. Evolution of global inflation

2.1. Global inflation before the pandemic

Inflation has been declining around the world over the past half century. Global inflation fell from 16.9 percent in 1974 to 2.3 percent in 2019, up from its lowest point on record of 1.8 percent in 2015 after a long slide in oil prices (Figure 2).[1] In EMDEs, inflation declined from a peak of 17.5 percent in 1974 to 2.9 percent in 2019. In low-income countries (LICs), inflation fell from 25.2 percent in 1994 to 3.5 percent in 2019. The trend decline started earlier (in the mid-1980s) in advanced economies than in EMDEs and LICs (in the mid-1990s).

In EMDEs, this disinflation process cut across all regions, including those with a history of persistently high inflation, such as Latin America and the Caribbean and Sub-Saharan Africa. The downward trend was evident in all inflation measures, including headline consumer price index (CPI), core CPI, producer price index (PPI), and GDP deflator growth. By the early 2000s, the disinflation was largely completed, although it resumed after the global financial crisis at a milder pace.

The widely shared disinflation in advanced economies has been attributed partly to changes in monetary policy regimes, including the increased focus on price stability, which took hold during the early 1980s (Cecchetti et al. 2007; Levin and Piger 2004). Other factors may have included sounder fiscal policies, deregulation, globalization, growing global labor forches, and, in the 1990s, bouts of rapid productivity growth in some parts of the world (Goodhart and Pradhan 2020; Ha et al. 2019a; Rogoff 2003).

In EMDEs, the introduction of inflation targeting, improvements in fiscal balances (prior to the 2007-09 financial crisis), greater exchange rate flexibility and macroeconomic stabilization programs helped lower inflation (Aizenman, Chinn, and Ito 2008; Mishkin and Schmidt-Hebbel 2007). Notwithstanding a pickup in the past 15 years, inflation expectations in EMDEs have become better-anchored and less responsive to inflation surprises (Kose et al. 2019).

[1] Comparisons in this section are based on annual data of 155 countries. For the purposes of this paper, inflation refers to year-on-year percent changes in headline consumer price index (CPI) inflation, but multiple other inflation measures are also examined.

2.2. Global inflation during the pandemic

Between January and May 2020, amid a collapse in demand and plunging oil prices, global inflation ticked down by 0.9 percentage point, and EMDE and advanced-economy inflation by 1.2 and 1.6 percentage point, respectively (Figure 3).[2] A surge in global and EMDE food inflation during January-April 2020 was more than offset by a collapse in oil prices (Dunn, Hood, and Driessen 2020; Shapiro 2020).

Starting in May 2020, however, inflation began to pick up, although it has remained low by historical standards. By April 2021, inflation had risen 0.3-0.6 percentage point above pre-pandemic levels, in both advanced economies and EMDEs. The initial surge in global food prices, the plunge in global oil prices, and the decline in global core inflation have also been unwound since May 2020. The magnitudes of the inflation pickup, however, varied widely, especially in EMDEs where the interquartile range of inflation widened by 1 percentage point between May 2020 and March 2021 before narrowing again in April 2021 as the inflation pickup broadened.

The decline in inflation during January-May 2020 was followed by a rebound that was broad-based across countries, EMDE regions, and inflation measures. In almost three-quarters of countries, inflation declined between January-May 2020 but rose thereafter.[3] Although EMDE core inflation remained broadly stable, global core inflation declined by 0.6 percentage point during January-June 2020 before rising to within 0.2 percentage point of its pre-pandemic (January 2020) level by April 2021.

2.3. Evolution of inflation during global recessions

As noted above, global inflation has steadily trended down since 1970. However, there were several notable departures from this downward trend associated with global recessions. During global recessions, global output often collapsed and oil prices plunged, thus lowering inflation (Baffes et al. 2015; Kose and Terrones 2015; Wheeler et al. 2020). Along the subsequent recovery path, some global recessions were followed by lasting supply weakness that compounded the inflationary pressures associated with the demand rebound. Against this background, this sub-section examines the evolution of inflation during global recessions.

For the purposes of this sub-section, global inflation is defined as the cross-country median of quarterly inflation rates of 25 advanced economies and 51 EMDEs with data available for 1970-2020. To remove one-off factors, the four-quarter moving average of quarter-on-quarter annualized inflation is used as a proxy for trend inflation.[4] The analysis is

[2] For the purposes of Sections 2-5, low income countries (LICs) are excluded from the EMDE and global aggregate because LIC data tends to lag and because inflation in the 15 LICs with available data did not share the general inflation pattern of other EMDEs: inflation rose throughout 2020 on higher food prices and depreciation.

[3] The pattern of inflation decline followed by a rebound to near pre-pandemic levels was seen in all EMDE regions except in East Asia and Pacific (EAP), although the decline was somewhat delayed in Middle East and North Africa (MNA) and Sub-Saharan Africa (SSA), in part because of rising food price inflation.

[4] The rolling average smooths out seasonal and short-term factors. Other studies often employed different measures of trend inflation that span somewhat longer horizons; Ball (1994) employed a nine-quarter centered rolling average to eliminate the irregular factors in inflation. If applied here, this would rule out a

restricted to CPI inflation for lack of a sufficiently large country sample for other inflation measures in the 1970s-1990s. Turning points of global business cycles before the outbreak of the COVID-19 pandemic are identified using global per capita GDP as in World Bank (2020b). Since 1970, there have been five global recessions with their troughs in 1975Q1, 1982Q4, 1991Q1, and 2009Q1, and 2020Q2. These recessions were associated with a wide range of adverse developments, including financial crises in advanced economies and EMDEs (Kose, Sugawara, and Terrones 2020).

Global recessions set off a decline in global inflation that typically lasted several quarters beyond the trough of the recession and well into the recoveries (Figure 4). Global inflation declined by a cumulative 6.2 percentage points, on average, between the trough of the global recession and the subsequent trough of global inflation. The global recession in 2009 was accompanied by a somewhat shallower (5.1 percentage points, peak to trough) and shorter-lived inflation decline than previous recessions, in part reflecting lower inflation at the start of the recession. Four quarters after the trough of the 2009 global recession, global inflation began to pick up. This pickup was delayed by another 1-2 years after the 1991 and 1975 global recessions and by five more years in the 1982 global recession. After all global recessions other than 1991, global inflation subsequently stabilized at a lower rate than before the global recession, returning to a path of long-term trend disinflation.

The disinflation around global recessions was broad-based across country groups (for both headline CPI and GDP deflator inflation) and inflation measures (Figure 5). That said, in the 1970s through 1990s, the inflation decline was steeper in advanced economies than EMDEs, partly due to the delayed disinflation in EMDEs with high inflation in the early 1990s. From 2000, the decline in inflation around global recessions was much more pronounced in EMDEs than in advanced economies.

A more granular comparison, using monthly data for 31 advanced economies and 50 EMDEs for 2001-2021, is possible for the global recessions of 2009 and 2020. This narrower time window also allows the inclusion of data for other measures of inflation, such as core CPI and PPI inflation. Just like for the exercise based on quarterly data, the global inflation decline during the global recession of 2020 based on monthly data was more muted and shorter-lived than during the global recession of 2009 (Figure 6).

In particular, inflation declined by 0.9 percentage point globally and 1.2 percentage points in EMDEs from January 2020 before reaching its trough in May 2020—five months after the beginning of the global pandemic. In contrast, inflation declined by 6.3 percentage points globally and 7.6 percentage points in EMDEs from September 2008 to its trough in October 2009—13 months after the bankruptcy of Lehman Brothers that set off the global financial crisis. Whereas inflation started rising in the majority of countries five months after the onset of the pandemic, in May 2020, it only began increasing in the majority of countries a year after the onset of the global financial crisis, in October 2009.

comparison with 2020 for lack of data. Therefore, the four-quarter trailing moving average of inflation is employed instead. The results are largely consistent using four-quarter centered rolling averages.

The global recession of 2009 itself featured a shallower and shorter-lived inflation decline than previous global recessions.

The shallower decline and faster rebound in inflation during the pandemic-induced global recession of 2020 than during previous recessions may reflect the swifter global recovery from the 2020 recession, despite the most recent global recession being the most severe since the Second World War (World Bank 2021a).

3. Empirical Methodology

We employ a factor-augmented vector autoregression (FAVAR) model to analyze the drivers of inflation. The empirical framework is based on a few recent studies that use similar models to explore the sources of global inflation (Charnavoki and Dolado 2014; Ha et al. 2019b), or more generally, the Philips-curve framework (Forbes 2019). However, it deviates from these approaches in three dimensions to accommodate the circumstances of the 2020 pandemic. First, the model employs higher frequency (monthly) data rather than quarterly or annual data, to minimize concerns over endogeneity among variables. The use of monthly data is particularly important when the pace of recessions and recoveries differs. That said, monthly data are available only for a smaller set of countries for services activity. Therefore, the exercise with monthly data relies on industrial production, which rebounded faster than services from the global recession of 2020. For the historical comparison with global recessions before 2001, when comprehensive monthly data are unavailable, the model employs quarterly GDP data. The main findings for the comparison between the global recession of 2020 and earlier episodes are consistent, regardless of the choice of monthly or quarterly data.

Second, on top of the standard sign restrictions, an additional set of narrative restrictions is imposed for the periods of large oil price fluctuations. The sign restrictions are not sufficient to identify the structural shocks, in particular in the presence of multiple large shocks.

Third, the model allows for time-varying volatility in the global variables to reflect large fluctuations in these variables around global recessions and oil price shocks. The main findings in this paper are robust to different specifications (see Section 4.4).

3.1. Model specification

The model consists of three global variables: global inflation, global output growth, and oil price growth. Global output growth and global inflation are proxied by global industrial production growth and global inflation factors that are estimated separately using the following dynamic factor models:

$$\pi_t^i = \beta_{global}^{\pi,i} f_t^{\pi,global} + e_t^{\pi,i}$$

$$Y_t^i = \beta_{global}^{Y,i} f_t^{Y,global} + e_t^{Y,\mathrm{i}}$$

where π_t^i and Y_t^i are inflation and output growth in country i in month t, respectively,

while $f_t^{\pi,global}$ and $f_t^{Y,global}$ are the global factors for inflation and output growth in month t, respectively.

In its structural form, the FAVAR model is represented by:

$$B_0 Z_t = \alpha + \sum_{i=1}^{L} B_i Z_{t-i} + \varepsilon_t$$

where $\boldsymbol{\varepsilon}_t$ is a vector of orthogonal structural innovations, and Z_t consists of global inflation, global output growth, and oil price growth. The vector $\boldsymbol{\varepsilon}_t$ consists of a shock to the global supply of goods and services ("*global supply shock*"), a shock to the global demand for goods and services ("*global demand shock*"), and a shock to oil prices ("*oil price shock*").

Typical VAR models assume that the variance-covariance matrix of residuals is constant over time. However, this assumption could be problematic in this analysis, given the exceptionally large macroeconomic volatility induced by the COVID-19 pandemic (Lenza and Primiceri 2020; Primiceri and Tambalotti 2020). To resolve the issue, the model assumes stochastic volatility of structural shocks—the residuals are independently but not identically distributed across time. Their variance-covariance is allowed to be period-specific, hence rendering volatility stochastic and introducing heteroskedasticity (Carriero et al. 2019).

The model is estimated by using monthly data with four lags. In the Bayesian estimation, the estimation first searches for 10,000 successful draws from at least 15,000 iterations with 5,000 burn-ins; the results reported are based on the median of these 10,000 successful draws, along with 16-84 percent confidence intervals. The estimation process is standard Gibbs sampling except that the volatility of residuals is endogenously determined.

To reflect a sudden change in the volatility of variables around global recessions and oil price shocks, stochastic volatility is assumed to have random inertia. This extends the standard stochastic volatility model by turning volatility into an endogenous variable integrated into the Bayesian estimation process.[5] In the model, the inertia of stochastic volatility is endogenously estimated, allowing for variable-specific inertia (Cogley and Sargent 2005).

3.2. Identification of shocks

Sign restrictions. The paper follows the methodology in Charnavoki and Dolado (2014) and Ha et al. (2019b) in using sign restrictions to identify the global shocks.[6] Postulating that B_0^{-1} in our econometric model has a recursive structure such that the reduced form

[5] The standard stochastic volatility components model can have two limitations. First, the value of the autoregressive coefficient has to be predetermined. For instance, volatility in GDP growth may increase during a crisis, but it will likely return to its lower, long-run value once the crisis is over. Second, the inertia in volatility is assumed to be common to all variables included in the model.

[6] See also Melolinna (2015) and Gambetti, Pappa, and Canova (2005) for this identification approach.

errors can be decomposed according to $u_t = B_0^{-1}\varepsilon_t$, the three sign restrictions can be written as follows:

$$\begin{bmatrix} u_t^{Y,global} \\ u_t^{OilPrice} \\ u_t^{\pi,global} \end{bmatrix} = \begin{bmatrix} + & - & + \\ + & + & + \\ + & + & - \end{bmatrix} \begin{bmatrix} \varepsilon_t^{GlobalDemand} \\ \varepsilon_t^{OilPrice} \\ \varepsilon_t^{GlobalSupply} \end{bmatrix}$$

These imply the following. First, a positive *global demand shock* is assumed to increase global output growth, global inflation, and oil price growth. Second, a positive *global non-oil supply shock* (hereafter "*global supply shock*") is assumed to raise global output and oil price growth but reduce global inflation. Third, a positive *oil price shock* is defined as raising oil prices and global inflation but depressing global output growth.

Narrative restrictions. Since oil price shocks are often the main drivers of variation in global inflation, the identification of oil price shocks deserves further robustness checks. In particular, similar to Antolín-Díaz and Rubio-Ramírez (2018) and Kilian and Murphy (2012), these identified oil price shocks (or historical decompositions of the shocks) can further be constrained to ensure that they agree with the established narrative account of historical episodes. The narrative sign restrictions are imposed by considering the subset of successful draws in Bayesian estimation that result in negative oil price shocks (or negative historical contributions to oil prices) during key historical episodes since 2000 identified in Baffes et al. (2015) and Wheeler et al. (2020). Specifically, the following restrictions are imposed. First, structural oil price shocks are negative in January 2015 and March 2020. Second, historical contributions of oil price shocks to oil prices are negative in January 2015 and March 2020. Third, historical contributions of oil price shocks to oil prices are more sizeable (in absolute values) than other global shocks in January 2015.

3.3. Database

For the monthly estimation, the sample includes data for up to 30 advanced economies and 55 EMDEs for 2001-2021. Global output growth is the global common factor of month-on-month, seasonally adjusted industrial production growth. Global inflation is defined as the global common factor of month-on-month headline CPI inflation. The estimation is repeated using core consumer price inflation and producer price inflation, similarly defined. Oil price growth is the month-on-month growth rate of nominal oil prices (average of Dubai, West Texas Intermediate, and Brent).

For the quarterly estimation, the sample includes data for up to 35 advanced economies and 52 EMDEs for 1970-2020. Inflation is defined as the common factor of quarter-on-quarter detrended CPI inflation; oil price growth is defined as quarter-on-quarter nominal oil price changes; output growth is defined as the common factor of quarter-on-quarter real GDP growth.

3.4. Conditional forecasts of inflation

Global inflation in 2021 is forecast conditional on the FAVAR estimates over 2001-20 and

the baseline forecast scenario for global GDP growth and oil prices in 2021 as in World Bank (2021b). In particular, the conditional forecasts assume global GDP growth of 5.6 percent and an average oil price in 2021 of $62 per barrel. In the conditional forecast exercise, quarterly data are employed to allow the use of GDP growth (instead of industrial production). Median draws and 16-84 percentile are reported.

4. Drivers of Inflation

4.1. Potential drivers of inflation during the pandemic

Plunges in aggregate demand, oil price declines, and supply disruptions contributed to global inflation developments in 2020. For EMDEs, global shocks were in part channeled into domestic inflation rates through exchange rate movements, compounding the effect of domestic supply shocks as lockdowns disrupted services activity and food supply chains.

Plunge in aggregate demand. Lockdowns and weaker consumer confidence triggered a collapse in demand (Dunn, Hood, and Driessen 2020). Reflecting the sharp declines in aggregate demand, global trade also plunged. Uncertainty about the spread of the pandemic, future economic conditions, and policy responses deterred private consumption and investment (Caggiano, Castelnuovo, and Kima 2020; Leduc and Liu 2020a). Wages declined in response to higher unemployment: In the median country (among 44 countries), wages declined 5.4 percent (annualized) during the first half of 2020 and rebounded to pre-crisis levels in many countries in the second half. Global economic activity reached its trough in mid-2020 and subsequently recovered, supported by unprecedented policy measures. With the recovery in demand, accompanied by a shift from in-person to online purchases, retail sales bounced back, global trade rebounded, and demand for energy strengthened from mid-2020.

Oil price collapse. Between late-January and mid-April 2020, amid the pandemic-induced global recession, oil prices plunged by more than 60 percent as lockdowns disrupted the transport and travel that accounts for two-thirds of global energy consumption (Kabundi and Ohnsorge 2020; Wheeler et al. 2020). For oil-importing countries and manufacturing, this lowered the cost of a critical input into economic activity. For oil-exporting countries, it reduced export and fiscal revenues and, in some, compelled authorities to curtail government spending. Oil prices recovered from May onwards and are now near their pre-pandemic level.

Supply disruptions. Especially early in the pandemic, lockdowns disrupted economic activity. Services sector activity was sharply curtailed as restrictions were imposed on transactions that required in-person interaction. In some countries, restrictions on international travel complicated migration of agricultural workers and lockdowns of markets disrupted the sale of produce (World Bank 2020a, 2020c, 2021b).

Currency movements. Larger depreciations during the pandemic, especially during the financial market stress and capital outflows of March and April 2020, were a key source of inflationary pressures in EMDEs. During the first half of 2020, currencies depreciated against the U.S. dollar by 10 percent or more in one-third of EMDEs before recouping some of their losses in the second half of 2020. One-fifth of EMDEs ended 2020 with

weaker exchange rates than at the start of the year. These depreciations fed into inflation: In EMDEs, a 10 percent depreciation has been estimated to raise consumer prices by about 1 percent over the following year (Ha, Stocker, and Yilmazkuday 2020). The strength of the exchange rate pass-through to inflation is particularly high in EMDEs when it is caused by global or domestic demand shocks or domestic supply shocks. Indeed, in EMDEs with 10 percent or higher currency depreciation, median inflation was 6.8 percent in 2020, about 3 percentage point higher than in other EMDEs.

Food price volatility. In some countries, supply disruptions, such as market and trade restrictions or curfews, appear to have affected domestic food supply chains, increasing wholesale and retail markups, and contributed to rising food price inflation (Husain et al. 2020; Swinnen and McDermott 2020).[7] Food price increases have been higher in countries with larger currency depreciations that raised prices of imported foods. Food supply instability during the pandemic has coincided with episodes of internal conflict in some EMDEs (Ide 2021). Food price increases have been particularly pronounced (2-3 percentage points above the median EMDE) in EMDEs with a history of higher food price inflation over the past decade (in particular in South Asia, and Sub-Saharan Africa) and in low-income countries.

4.2. Relative importance of drivers of inflation

The FAVAR estimation described above allows us to disentangle the quantitative importance of these forces. The exercise is repeated for advanced economies and EMDEs separately, and for headline CPI inflation, core CPI inflation, and PPI inflation. The PPI tends to have a larger tradables content than the headline CPI, whereas the core CPI tends to have smaller a tradables content than the headline CPI (Ha, Kose, and Ohnsorge 2019). The estimation results suggest a sequence of changing disinflationary forces in January-May 2020 that were subsequently unwound.

January-May 2020. Between January and May, four-fifths of the decline in global inflation reflected the collapse in global demand as consumption and investment collapsed amid lockdowns and uncertainty about policies and growth prospects. Another one-fifth reflected the plunge in oil prices.[8] Both globally and for EMDEs, disinflationary effects from collapsing demand and oil prices were partly offset by the inflationary effect of supply disruptions such as disruptions to firm operations and global shipping caused by pandemic restrictions to domestic economic activity and international travel (Figure 7). Within this five-month period, however, the forces affecting inflation shifted. In February and March 2020, the decline in global inflation was in almost equal measure due to the plunge in oil prices and a collapse in global demand, but the disinflationary impact of the collapse in

[7] Using an event study approach, Ebrahimy, Igan, and Peria (2020) find that past epidemics, wars, and other disasters coincided with inflation increases, mainly driven by changes in food prices, although the increase was short-lived.

[8] Oil price shocks and supply shocks played a greater role in inflation volatility than in inflation movements. Nevertheless, global demand shocks remained the main source of inflation volatility in 2020-21.

global demand intensified in April.[9]

May 2020-February 2021. The collapse in demand and oil prices as well as supply disruptions began to unwind as consumers, firms, and investors began to adjust their behavior and operations. From May, as international trade and global manufacturing activity rebounded, supply factors began to lower inflation (Figure 7). A sharp rebound in demand, however, raised inflation as consumption shifted from in-person to online transactions. For the period from May 2020 to February 2021, demand pressures accounted for virtually all of the increase in global inflation and these were partially offset by improved supply conditions. For EMDEs, the recovery in oil prices from mid-2020 contributed one-third as much as the recovery in demand to the uptick in inflation.

4.3. Drivers of inflation during global recessions

4.3.1. CPI inflation

We now employ the same FAVAR model to briefly analyze the drivers of inflation during global recessions. With the exception of the 1991 global recession, disinflation in previous global recessions was driven by a broader range of factors than disinflation in the 2020 global recession (Figure 8; Ha, Kose, and Ohnsorge 2019).

1975. The disinflation in the global recession of 1975 was predominantly driven by oil price shocks but also, in almost equal measures, by global supply and demand shocks. This was in part an unwinding of the surge in inflation after the oil crisis in 1973-74 when oil prices quadrupled and an oil embargo disrupted transport and manufacturing.

1982. The disinflation in the 1982 global recession was driven by global demand shocks (one-half), global supply shocks (one-quarter) and global oil price shocks (one-quarter). This disinflation was in part the intended response to the monetary policy tightening in major advanced economies, after the oil price crisis of 1979 (following the Iranian revolution) led to a surge in inflation.

1991. The disinflation in the 1991 global recession was predominantly global demand driven as financial crises or credit crunches in several advanced economies culminated in a global recession.

2009. The disinflation at the height of the global recession of 2009 (2008Q4 and 2009Q1) was driven by both demand and oil price shocks in broadly equal measure. Despite coordinated global fiscal and monetary policy support, the global financial crisis caused a deep global recession that was accompanied by a two-thirds plunge in oil prices in the five months from July 2008.

2020. The decline in global inflation from January-May 2020 was four-fifths driven by the collapse in global demand and another one-fifth driven by plunging oil prices, with some offsetting inflationary pressures from supply disruptions. The greater role of global demand in the inflation decline in 2020 than in previous global recessions may reflect the

[9] The predominant role of demand shocks and some offsetting role of supply shocks during the pandemic were also found in some recent studies; see, for instance, Bekaert, Engstrom, and Ermolov (2020) for the United States, and Baleer et al. (2020) and O'Brien, Dumoncel, and Gonçalves (2021) for the euro area.

sheer severity of the recession of 2020 (World Bank 2021c). In their rebounds, however, global and EMDE inflation developments after the two global recessions of 2009 and 2020 resembled each other: both were virtually entirely driven by increases in global demand.

4.3.2. Core CPI and PPI inflation

With the exception of the global recession of 1991, the predominance of demand shocks in driving down core CPI and PPI inflation during the 2020 pandemic contrasts with the sources of disinflation in previous recessions.

In 1975, oil price shocks and demand shocks were the main source of PPI disinflation and oil price shocks and supply shocks the main source of core CPI disinflation. Disinflation at that time mainly reflected an unwinding of earlier shocks—the oil price spike of 1974 and the inflationary impact of wage and consumer price controls being lifted, accompanied by the collapse of the Bretton Woods fixed exchange rate system in 1971. The large role of oil price shocks in core CPI inflation dynamics—notwithstanding the exclusion of energy from the core inflation aggregate—in the 1970s may also have reflected poorly anchored inflation expectations once the nominal anchor of the Bretton Woods fixed exchange rate regimes was lost (Ha et al. 2019a).

In 1982, supply and demand shocks were the main source of core CPI disinflation and demand shocks the main source of PPI disinflation. Again, disinflation in part reflected a drawn-out unwinding of earlier shocks. By the late 1970s, inflation expectations had become unanchored in some advanced economies and inflation-wage spirals became entrenched in major advanced economies while output growth stagnated at a low level (Bryan 2021). The doubling of oil prices in 1979 added fuel to inflation pressures. The monetary tightening across advanced economies in the early 1980s helped stabilize inflation expectations while also causing recessions.

In 2009, negative oil price shocks and global demand shocks contributed, in almost equal measure, to declines in global PPI inflation while core CPI inflation remained broadly stable as negative demand shocks were offset by negative supply shocks. Well-anchored inflation expectations from the early 2000s helped stabilize inflation despite adverse demand shocks.

In 2020, demand shocks accounted for around four-fifths of the decline in core CPI inflation and PPI inflation in the first four to five months of 2020, partially offset by inflation pressures from supply disruptions. From May 2020 onwards, the rebound in global demand and oil price contributed four-fifths and one-fifths, respectively, to an increase in PPI inflation whereas the increase in core inflation mainly reflected demand pressures.

4.4. Robustness exercises

Since the FAVAR estimation rests on assumptions about the relationships among endogenous variables, several robustness checks to these assumptions are performed. First, the estimation using monthly data is cross-checked with the estimation based on quarterly data. This allows the substitution of real GDP growth for industrial production growth. Second, alternative measures of global inflation and global output are employed. These include global inflation and output factors estimated with an identical group of countries

and median output growth and inflation rates among countries. Third, alternative measures of oil prices, including real oil prices and nominal energy prices are substituted for nominal oil prices. Fourth, a standard VAR model is estimated as an alternative to the stochastic volatility model.

The main findings about the drivers of inflation are robust to these alternative specifications. That said, the results are somewhat sensitive to the types of inflation measures, partly reflecting the different tradables contents in the baskets. In particular, both during 2020-21 and throughout the sample period, core inflation featured larger contributions from supply shocks whereas PPI inflation featured larger contributions from oil price shocks (Figure 9; Table 1).

5. Prospects for inflation

5.1. Near-term inflation prospects

The global recession of 2020 was unusually severe but short. This was also reflected in inflation developments. The accompanying inflation decline was unusually muted and short-lived. Looking ahead, some factors point to an increase in inflation over the near term but stable low inflation over the long term. However, shocks may interact with large-scale policy support to deliver higher inflation and inflation volatility over a 2-3-year horizon (Baldwin and di Mauro 2020; Blanchard 2020). Uncertainty about future inflation is also reflected in wide disagreement among survey respondents on future inflation prospects, which could be a sign of growing risk of inflation expectations becoming unanchored (Ebrahimy, Igan, and Peria 2020; Williamson 2021). A FAVAR model is used to project global, advanced-economy and EMDE inflation in coming months that would be consistent with the growth and oil price forecasts of this paper.

Global inflation. Global output growth is expected to be 5.6 percent in 2021 and oil prices are expected to average $62 per barrel over the year as a whole (World Bank 2021b). This suggests an increase in global inflation by 1.4 percentage points in 2021 (from 2.5 percent in 2020 to 3.9 percent in 2021; Table 2; Figure 10). The model-predicted global inflation of 3.9 percent in 2021 is comparable to average inflation during 2011-13 after the global financial crisis.

If a similar exercise has been conducted in January 2009, with the benefit of hindsight for output growth and oil price movements, it would have yielded a projected decline in global inflation of 3.3 percentage points for 2009—just below the actual decline of 4.5 percentage points. A similar exercise conducted in 2011 would have predicted an upturn in global inflation of 0.8 percentage point in 2011, which was just below actual inflation declined (1.3 percent), followed by an inflation decline of 0.5 percentage point in 2012, which was also just below actual declines (0.9 percentage point).

Inflation in advanced economies. For advanced economies, growth and oil price forecasts are consistent with inflation rising to 1.8 percent in 2021 (from 0.5 percent in 2020)—still below the target rate of 2 percent in many advanced economies but a touch above the 1.4 percent average over the 2010s. For virtually all advanced economies, the model-predicted moderate inflation rise would bring inflation closer to inflation targets. A similar exercise

conducted in January 2009 would have forecast a decline in advanced-economy inflation of 2.4 percentage point for 2009, again below the 3.4 percentage-point decline in inflation between 2008 and 2009 that actually materialized.

Inflation in EMDEs. For EMDEs, growth and oil price forecasts would be consistent with inflation rising to 4.6 percent from 3.1 percent, well above the average over the 2010s of 3.8 percent. It would be just a touch above the mid-range (3.8 percent), but still below the 5.1 percent upper bound of the average inflation-targeting EMDE's target range. For the one-half of inflation-targeting EMDEs with inflation well below target, the model-predicted moderate inflation rise also would bring inflation closer to target. For another one-half of inflation-targeting EMDEs, however, a rise in inflation of this magnitude would put inflation above the target range. This may not warrant a policy response provided the inflation pickup is temporary. Should it, however, risk de-anchoring inflation expectations, it could become a monetary policy challenge that may hold back the recovery. In some EMDEs, inflation may rise even further if they are subject to above-average depreciation pressures or food price increases.

Inflation expectations. Consistent with the model-based inflation forecasts, survey-based consumer price inflation expectations suggest that global inflation is expected to rise by about 1 percentage point in 2021, from its low rate in 2020 (Table 2; Figure 11). The expected inflation rise is broad-based, in both advanced economies and EMDEs. It is also anticipated for PPI inflation, although not for wage inflation: Consensus forecasts point to an increase in global PPI inflation (defined as median across 9 countries) to about 4 percent in 2021 (from -1 percent in 2020).[10] Forecasts of headline CPI inflation by major central banks also suggest a moderate increase in inflation in 2021 (by 1.5 percentage points in G7 economies and 1.2 percentage points in seven large EMDEs). Finally, although the data are limited to a few advanced economies, market-based inflation expectations point to a similar conclusion: break-even implied inflation (measured as the spreads between nominal and real 5-year bond yields) has risen since April 2020 and recovered to pre-pandemic level by January 2021. The rise in market-based inflation expectations was particularly pronounced for the United States, where implied inflation had risen to above 2.7 percent by May 2021.

5.2. Long-term inflation prospects

The pandemic-induced global recession was preceded by a decade of very low global inflation (2 percent) as well as low advanced-economy and EMDE inflation. This stands in contrast to previous global recessions when pre-recession global inflation ranged from 6 percent (2008) to 16 percent (1975). This may account for the more muted inflation response in the 2020 global recession than in earlier ones.

This points to longer-term structural factors in depressing global inflation. Provided they continue to exert their influence, these factors may also dampen any post-pandemic uptick in inflation. Well-anchored inflation expectations, greater price transparency, and growing automation may continue to dampen inflation. In contrast, turning demographic trends, stabilizing global value chains, potential demand pressures, and weaker fiscal positions

[10] In contrast, global wage inflation (defined as median across 23 economies) is expected to remain broadly stable in 2020-22.

may increase inflation pressures.

Well-anchored inflation expectations. In contrast to an uptick in short-term inflation expectations, long-term inflation expectations have been broadly stable trough the pandemic and continue to forecast global, advanced-economy, and EMDE inflation at 2.3, 1.8, and 3.7 percent, respectively, half a decade from now (Figure 11). Such robust anchoring of inflation expectations in part reflected the introduction of more resilient macroeconomic policy frameworks such as inflation targeting, fiscal rules, and greater exchange rate flexibility in EMDEs (Ha, Kose, and Ohnsorge 2019). The median EMDE inflation target has remained steady at around 4 percent since the mid-2010s but the number of EMDEs meeting their targets has risen (Ha et al. 2019a). If, however, inflation expectations start de-anchoring from central banks' targets, inflation can rise in unexpected ways in the medium-term (Armantier et al. 2020).

Greater price transparency. During the pandemic, consumers have switched to online shopping from in-store shopping. To the extent that e-retail helps increase price transparency and competition, this may extend the downward pressure on prices (Charbonneau et al. 2017). If this price adjustment stretches over several years, it may appear to be disinflation. Conversely, growing market power of online retailers may increase profit margins and may mute any disinflation effects from greater transparency (Charbonneau et al. 2017).

Automation. The pandemic may induce a move by firms to increase automation to lift productivity and reduce their need to fill vacancies as job markets tighten in the recovery (Ding and Molina 2020; Leduc and Liu 2020b). This may continue and deepen a long-term trend in advanced economies, where increased automation and labor market flexibility may have held down wage growth over the past decade (Haldane 2018, 2021).

Global value chains. Global value chains have contributed to lower inflation through greater competition (Andrews, Gal, and Witheridge 2018; de Soyres and Franco 2019). Over the past decade, maturing global value chains appear to have contributed to slowing trade growth (World Bank 2020d). If global value chains were to outright reshore rather than relocate to other countries, this could reverse some of the disinflationary pressures over the past several decades.

Demographics. Over the past five decades, deflationary pressures demographic trends have begun to wane; this could result in inflationary pressures in the next few years. Over the past three decades, the entry of China and Eastern Europe into the world's trading system combined with rapid population growth to limit input cost increases and lower inflation (Goodhart and Pradhan 2020). The disinflationary benefits reaped from this process may, however, now be at an inflection point as the share of the working-age population stabilizes even in EMDEs (World Bank 2018).

Unprecedented policy support. During the pandemic, many central banks in advanced economies resumed or expanded large-scale asset purchases, and central banks in about two dozen EMDEs launched asset purchase programs (Rebucci, Hartley, and Jiménez 2020; World Bank 2021c). The literature generally suggests that monetary easing, both conventional and unconventional, typically boosts aggregate demand and inflation with a

lag of 1-3 years, with somewhat clearer evidence for advanced economies than for EMDEs (Ha, Kose, and Ohnsorge 2019; World Bank 2021c).[11] In addition, many countries have put in place unprecedented fiscal support programs (Miles and Scott 2020). If these unprecedented policy measures are not unwound before demand runs well ahead of potential output, inflation could pick up. This inflation pickup could be temporary once excess demand pressures recede, provided that inflation expectations remain well-anchored.

Weak fiscal positions. Government fiscal positions have deteriorated markedly since the start of the pandemic and are unlikely to return to pre-pandemic levels in the next two years. The average EMDE will continue to run a fiscal deficit in excess of 3 percent of GDP in 2022 and 2023; EMDE government debt has risen to a record high of 66 percent of GDP in 2020. Several EMDEs have implemented asset purchases that may further tighten links between fiscal and monetary policy. Where such purchases continue to grow and fiscal positions are weak, central banks may be subject to political pressure to ease government financing conditions, deepening perceptions of monetary financing of fiscal deficits and further skewing secondary markets (Mandelman 20201; World Bank 2021c). These developments could further increase price pressures and de-anchor long-run inflation expectations.

Slowing potential growth. The global economy headed into the COVID-19 pandemic on the heels of a decade of slowing productivity growth and weak investment. By 2018, labor productivity growth in advanced economies and EMDEs had slowed to 0.8 and 3.5 percent, respectively, from 1.0 and 4.1 percent during the first decade of the 2000s (Dieppe 2020). In 2019, investment growth was below its 2000-09 average in two-thirds of the world's economies and in three-quarters of EMDEs (World Bank 2019). As these fundamental drivers of long-term growth weakened, growth in global potential output—the output that can be sustained at full employment and capacity utilization—had fallen to 2.2 percent in 2019, well below its annual average of 3.3 percent in the first decade of the 2000s. This decline in potential growth was broad-based, affecting three-quarters of countries, including two-thirds of EMDEs, and was expected to continue into the next decade (World Bank 2018; Kilic Celik, Kose, and Ohnsorge 2020). The additional damage from the pandemic may further steepen the slowdown in the growth of global potential output (World Bank 2021c).

6. Conclusion

Inflation has rebounded quickly from an unusually muted decline during the global recession of 2020, despite this recession being the deepest since the Second World War. This has reflected the rapid rebound in aggregate demand, supported by unprecedented macroeconomic policy measures.

[11] While the design of unconventional monetary policy after the global financial crisis and global recession of 2009 meant that most of the injections remained within the banking system in the form of excess reserves and did not filter through to the broader money aggregates that matter for inflation, in the COVID-induced recession, measures have instead taken the form of injecting support that raised the broader measures of money (Goodhart and Pradhan 2020).

Model-based forecasts and inflation expectations point to a short-term increase in inflation of just over 1 percentage point in 2020. For virtually all advanced economies and about one-half of inflation-targeting EMDEs, an increase of this magnitude would leave inflation within target ranges but, for another one-half of inflation-targeting EMDEs, it would raise inflation above target ranges. Over the longer-term, however, well-anchored long-term inflation expectations point to continued low and stable inflation. As long as expectations remain well-anchored and any inflation increase—even above target ranges—is temporary, there may not be a need for a monetary policy response.

The short-term increase in inflation might extend over the longer term if policymakers are unable to keep inflation expectations anchored. Structural forces—such as demographics, growing globalization, and improvements in policy frameworks—supported disinflation over the past decade. However, if the recovery from the pandemic coincides with a sharp turning point in some of these forces, the expected inflation pickup in 2021 may extend and, in EMDEs, could risk de-anchoring inflation expectations. Concerns over poorly anchored inflation expectations and the possibility of permanently higher inflation may compel EMDE central banks to tighten monetary policy earlier, or more strongly, than warranted by their economies' cyclical positions.

Similar policy responses may also become necessary in some EMDEs if concerns about advanced-economy inflation prospects cause investors to reassess inflation risks and result in a sudden increase in global borrowing costs. In EMDEs with flexible exchange rates and limited financial vulnerabilities to exchange rate movements, currency depreciation may help buffer some of the impact of tightening financial conditions on activity (Gourinchas 2018). In other EMDEs, however, financial stability concerns may force central banks to tighten monetary policy more than warranted by the strength of their economies' recovery. In part due to concerns about financial stability, a number of EMDE central banks that had implemented expansionary monetary policy in 2020 have begun to tighten policy in 2021.

Anchoring inflation expectations will be critical in preserving central banks' room to maneuver even during periods of financial stress. To achieve this, several policy options are available. In inflation-targeting EMDEs with large economic slack and below-target inflation, monetary easing and fiscal support can help the recovery gain traction and raise inflation towards the target. In EMDEs where the economic recovery from the pandemic is further advanced, a more nuanced design of monetary policy will be necessary. While it may be premature to withdraw monetary and fiscal support in some EMDEs, it would be prudent to prepare now for the possibility of future inflation risks materializing, especially those related to exchange market disruptions. Central banks can embark on an opportunistic buildup of foreign exchange reserves, heighten foreign currency risk monitoring, and strengthen macroprudential policies in anticipation of possible capital outflows once advanced economies begin to withdraw accommodative policies.

Better-anchored inflation expectations will help stabilize inflation over the next few years. To avoid an undesirable inflation scenario, central banks will need to clearly communicate their inflation target (Baldwin and di Mauro 2020). Enhancing central bank transparency can help anchor inflation expectations (Gelos, Rawat, and Ye 2020; Kose et al. 2019). In

EMDEs that employ unconventional policies, including asset purchase programs, forward guidance, transparent objectives and operational details can help maintain investor confidence (World Bank 2021c).

Sharp changes in the composition of consumer spending, such as those that took place during the pandemic, may distort inflation estimates.[12] Many prices have become unobservable, either because the shops are closed or because field collection is not possible during the lockdown. Supply disruptions may create perceptions of scarcity, even if not accompanied by actual price increases. [13] A new challenge is the collection of prices for an increasing number of services that are offered digitally or remotely. Central banks may need to consider the possibility that actual inflation is considerably higher or lower than official estimates and avoid policy overshoots that might result. Statistical agencies could develop a supplementary index whose weights reflect new spending patterns emerging as a result of the pandemic to give policy makers a more accurate picture of the prices that consumers are currently paying.

[12] Using data from credit and debit transactions in the United States to update the official basket weights and estimate the impact on the CPI, Cavallo (2020) finds that the "COVID inflation," which reflected changes in consumption baskets after the pandemic, could have been higher than the official CPI for both headline and core indices in 2020. In addition, by applying the methodology to 17 other countries, the study also finds that, official CPI inflation after the pandemic could have been underestimated by 0.4 percentage point on average in 13 economies, while, in five countries, the official inflation could have been overestimated by 0.3 percentage point.

[13] On supply disruptions see Baker et al. 2020 and Coibion, Gorodnichenko, and Weber 2020; on monetary policy challenges, see Lane 2020; Tenreyro 2020; and on the underestimation of inflation, see Reinsdorf 2020.

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Table 1. Variance decompositions: Alternative models

Alternative models	Proxy Variables	Structural Shocks		
		Oil Price	Global Supply	Global Demand
Baseline		**42.7**	**17.5**	**39.8**
Alternative Inflation Measures	Producer price index	50.3	5.9	43.8
	Core CPI	20.8	36.7	42.5
Alternative Commodity Prices	Real oil price	47.1	9.4	43.5
	Nominal energy price	37.9	17.2	34.2
Alternative Global Factor Measures	Simple median	37.8	11.6	49.6
	Global factors from 39 balanced countries	49.8	9.0	41.2
Alternative VAR specification	VAR with fixed residual variances	31.1	15.4	53.4
Alternative data frequency	Quarterly data with GDP	33.9	5.2	61.6

Notes: This table reports variance decompositions of global inflation over 2001-21 based on various types of robustness exercises as explained in Section 3.4. Variance decompositions are based on median from 2000 successful Bayesian draws. "Baseline" indicates the variance decompositions of global inflation based on the global FAVAR model that consists of oil price growth, and the global factors extracted from the dataset up to 85 countries, as explained in Section 3. "Real oil prices" indicate that nominal oil prices are deflated by US CPI.

Table 2. Inflation Prospects

A. Model-based inflation forecasts

(percent)

Inflation	Year	Forecast		
		16%	Baseline	84%
Global	2020	-	2.5	-
	2021	1.5	3.9	6.5
Advanced economies	2020	-	0.5	-
	2021	0.1	1.8	3.6
EMDEs	2020	-	3.1	-
	2021	1.5	4.6	8.3

Note: Conditional forecast of global, EMDE, and advanced-economy inflation based on quarterly FAVAR model of global CPI inflation, global GDP growth, and oil price growth over 2001-2020. Inflation refers to annual average inflation for the corresponding year. "2020" indicates actual inflation. "16%" and "84%" indicate 16-84 percentile confidence intervals. CPI = consumer price index; EMDEs = emerging market and developing economies.

B. Survey-based inflation expectations

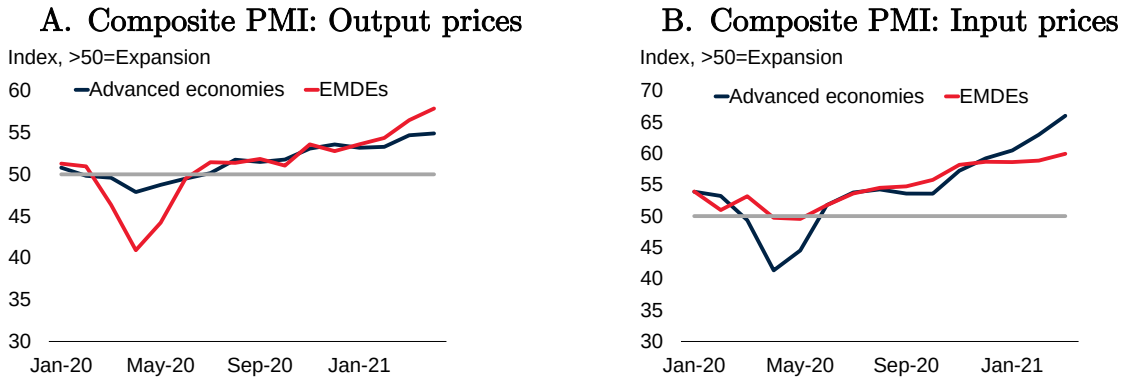
(percent)

Inflation	Year	Responses		
		Minimum	Median	Maximum
Global	2020	-	1.8	-
	2021	2.1	2.9	3.6
	2022	1.8	2.6	3.4
Advanced economies	2020	-	0.5	-
	2021	1.0	1.5	2.1
	2022	0.8	1.5	2.2
EMDEs	2020	-	3.5	-
	2021	3.6	4.5	5.5
	2022	3.2	3.9	4.9

Source: Consensus Economics

Note: Average headline CPI inflation expectations for 2021-22 based on surveys of May 2021 in 57 countries (31 advanced economies and 26 EMDEs). 2020 indicates actual inflation rates. CPI = consumer price index; EMDEs = emerging market and developing economies.

Figure 1. Prices from PMI surveys

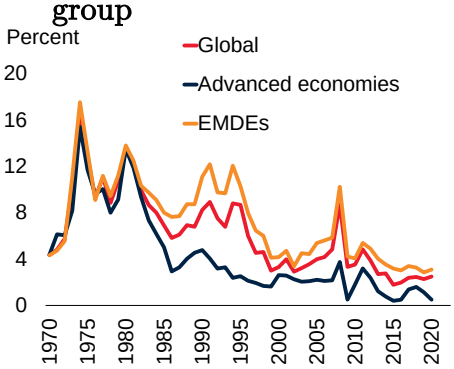


Sources: Haver Analytics; World Bank.

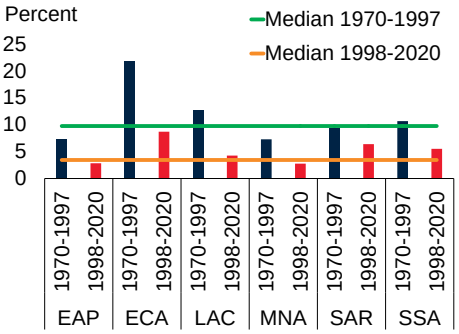
Note: Subcomponent of composite purchasing managers index (PMI) for emerging markets ("EMDEs") and developed markets ("Advanced economies") for output prices and input prices. An index above 50 indicates price increases.

Figure 2. Global inflation

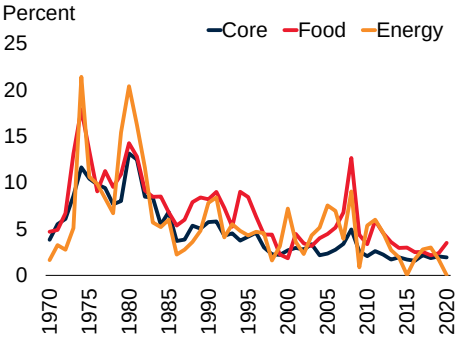
A. Headline CPI inflation, by country group



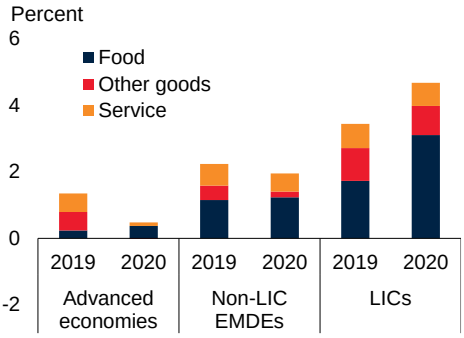
B. EMDE inflation, by region



C. Core, food, and energy CPI inflation

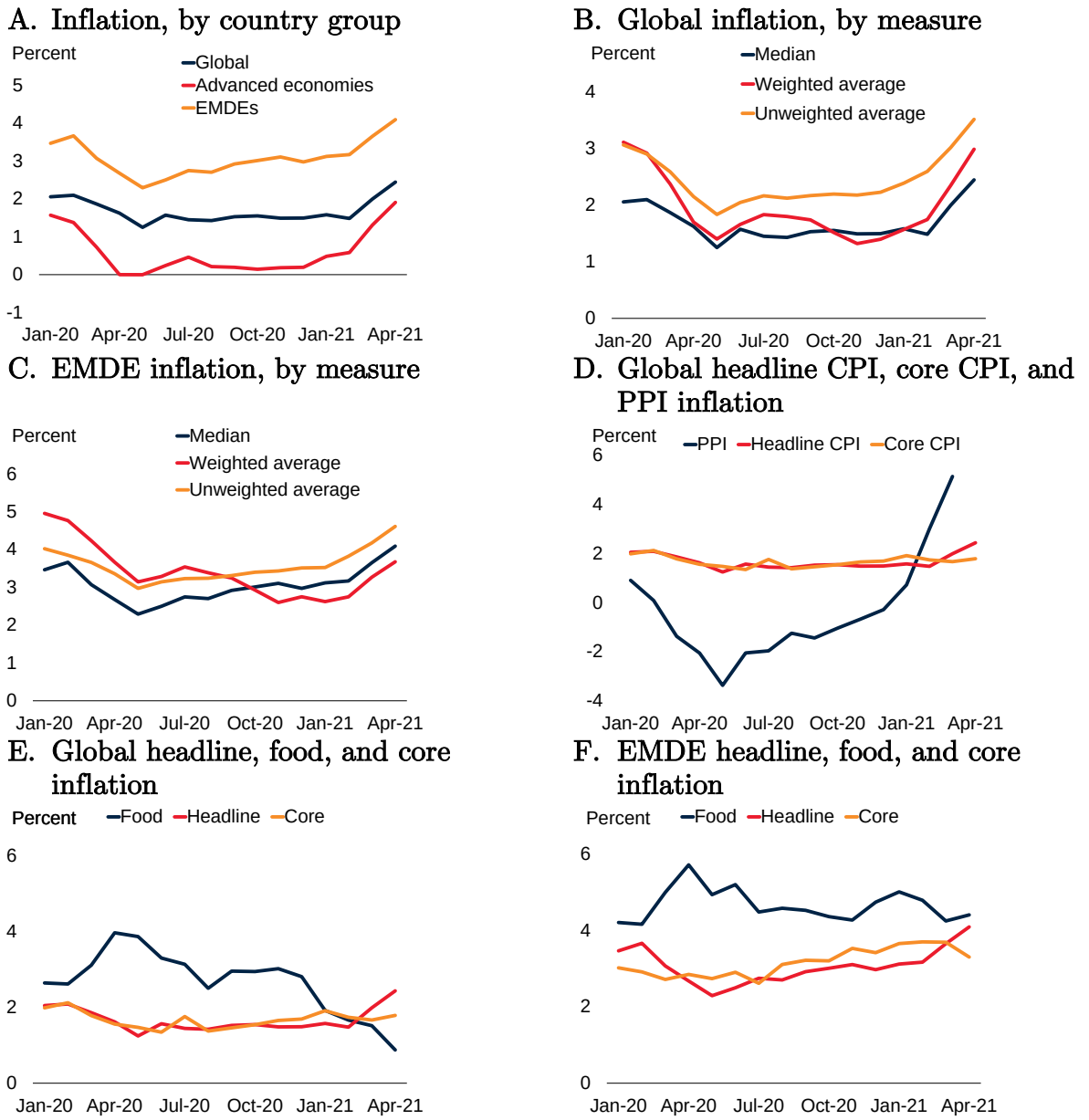


D. Sectoral contribution to headline CPI inflation: 2019-20



Sources: Havers Analytics; International Monetary Fund; World Bank.
Note: CPI = consumer price index; EMDEs = emerging market and developing economies.; LICs= low income countries. Cross-country medians unless otherwise specified.
A.-C. Based on a sample of 155 countries (30 advanced economies and 125 EMDEs). The values show headline CPI inflation or its sub-components.
B. EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MNA = Middle East and North Africa; SAR = South Asia; SSA = Sub-Saharan Africa.
D. Median headline CPI inflation (annual averages) in 12 sectors across 147 countries. Sectors are categorized following International Financial Statistics. Food indicates food and nonalcoholic beverages and alcoholic beverages, tobacco, and narcotics sectors. Other goods include clothing and footwear, housing, water, electricity, gas and other fuels, furnishings, household equipment and routine household maintenance sectors. Service sector includes health, transportation, communication, recreation, education, restaurants, and miscellaneous sectors.

Figure 3. Inflation during the pandemic



Sources: Haver Analytics; World Bank.

Note: CPI = consumer price index; PPI = producer price index. Year-on-year inflation for 81 countries, of which 31 are advanced economies and 50 are EMDEs.

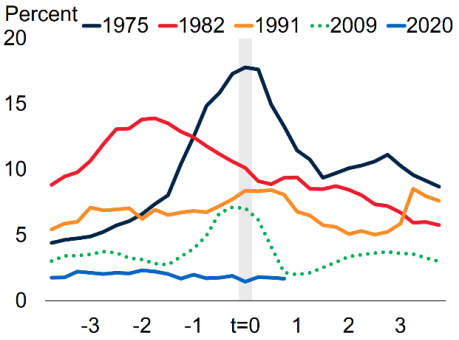
A. Group medians.

B.C. Weighted average uses 2020 real GDP weights (at 2010 prices and exchange rates).

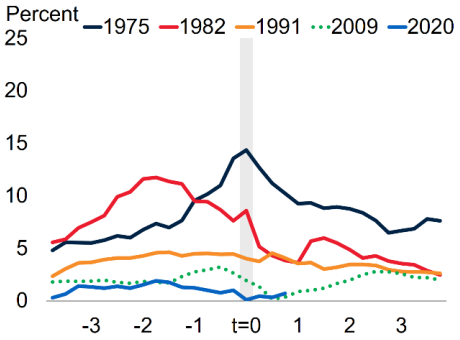
D.-.F. Year-on-year consumer price inflation for 81 countries, of which 31 are advanced economies and 50 are EMDEs. PPI inflation for 97 countries. Monthly data. Group medians.

Figure 4. Headline CPI inflation around global recessions

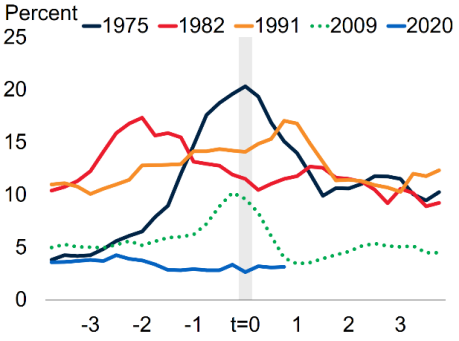
A. Global CPI inflation around global recessions



B. Advanced-economy CPI inflation around global recessions

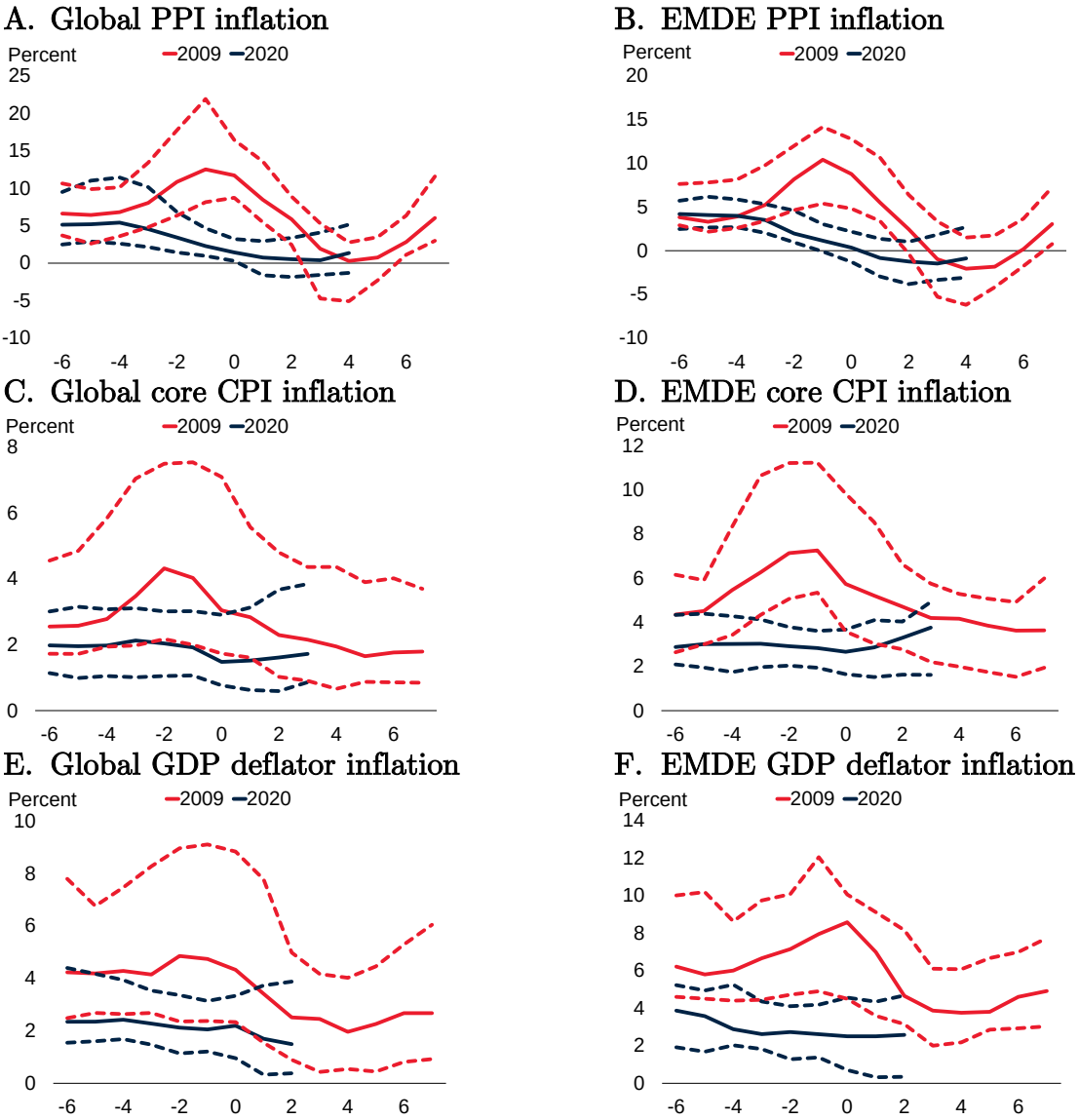


C. EMDE CPI inflation around global recessions



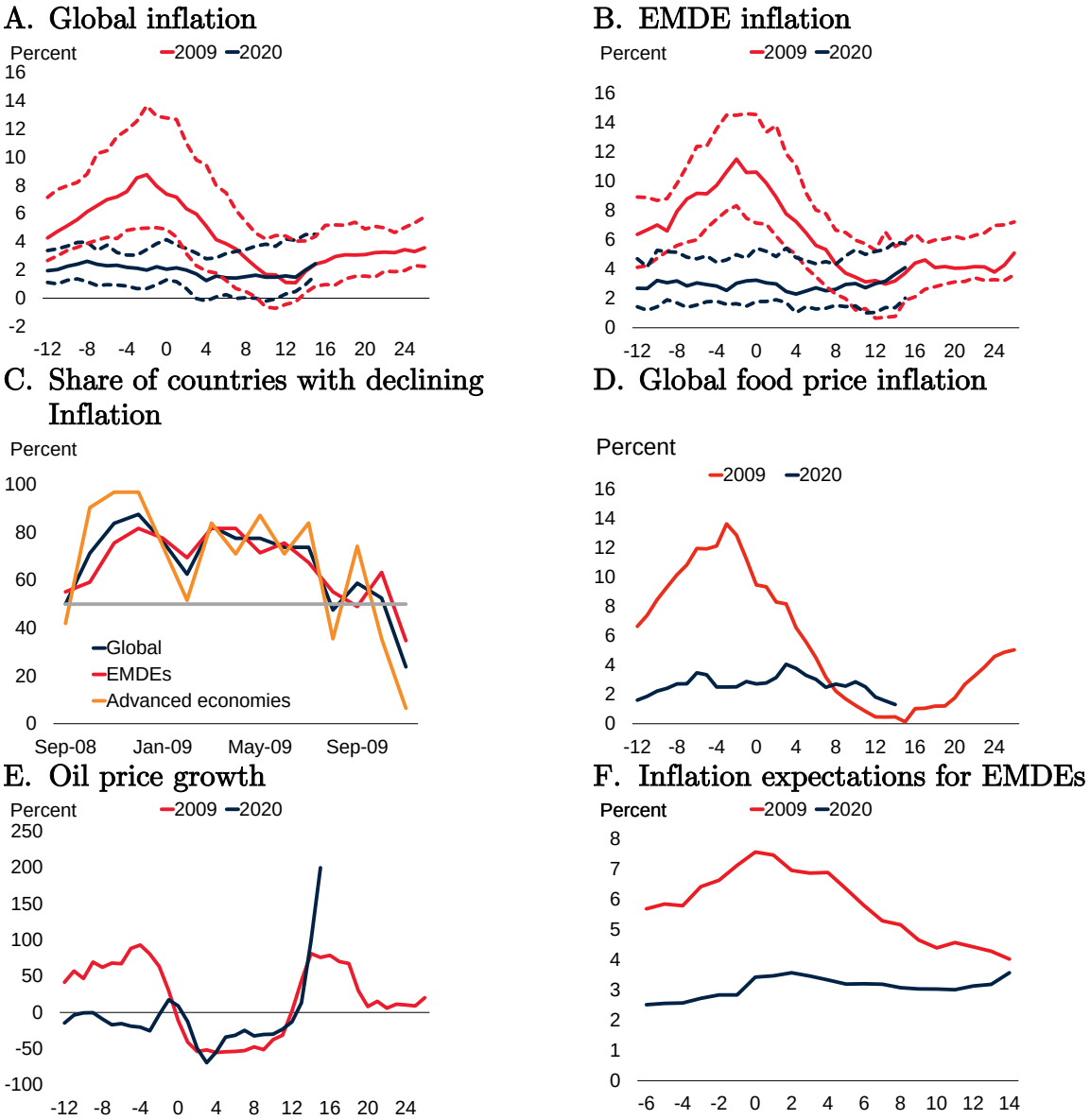
Sources: Kose, Sugawara, and Terrones (2020); World Bank (2020a, 2021a).
Note: Horizontal axes indicate years before and after the troughs of global recessions (shaded area, t = 0). Global inflation is defined as median trend inflation (4-quarter rolling average of quarterly annualized inflation) across 76 countries, consisting of 25 advanced economies and 51 EMDEs. Troughs of global recessions are identified using global per capita GDP and the algorithm in Harding and Pagan (2002) and are consistent with the results in Kose and Terrones (2015). Trough of global recession in 2020 is assumed to be at the second quarter of 2020. EMDEs = emerging market and developing economies.

Figure 5. Evolution of inflation during 2009 and 2020 global recessions



Sources: Kose, Sugawara, and Terrones (2020); World Bank (2020a, 2021a).
Note: Horizontal axes indicate quarters before and after the troughs of global recessions (t=0). Global inflation is defined as median trend inflation (four-quarter rolling average of quarterly inflation). Core inflation data are available for 51 countries, including 28 emerging market and developing economies (EMDEs), and producer price index (PPI) data are available for 85 countries, including 53 EMDEs, GDP deflator data are available for 81 countries, including 50 EMDEs. Troughs of global recessions are 2009Q1 and 2020Q2.

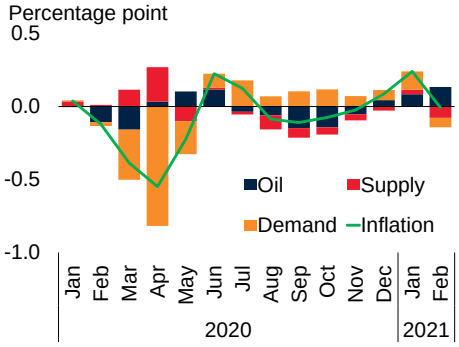
Figure 6. Inflation in 2008-10 and 2020-21



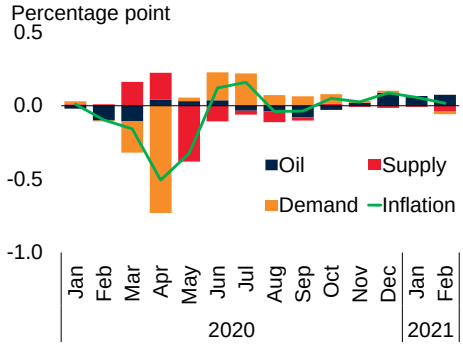
Sources: Consensus Economic; Haver Analytics; World Bank.
Note: Year-on-year monthly inflation for 81 countries, of which 31 are advanced economies and 50 are emerging market and developing economies (EMDEs). t=0 is September 2008 for 2009 and January 2020 for 2020.
A.B. Blue and red lines are medians, dotted lines are interquartile ranges.
C. Share of all countries, advanced economies and EMDEs in which year-on-year inflation slowed from one month to the next. Gray line shows 50 percent.
D. Median.
E. Year-on-year growth in the average of Brent, Dubai, and WTI oil prices.
F. Consensus inflation expectation for 2009 ("2009") and 2021 ("2020") for 48 EMDEs.

Figure 7. Drivers of inflation in 2020-21

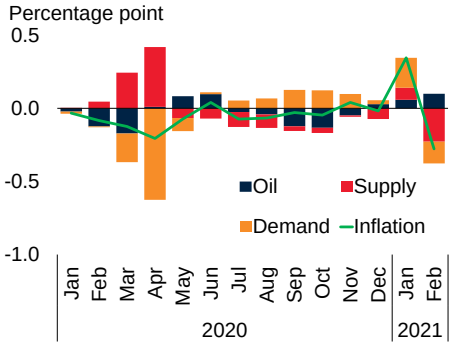
A. Contributions to monthly change in global headline CPI inflation in 2020-21



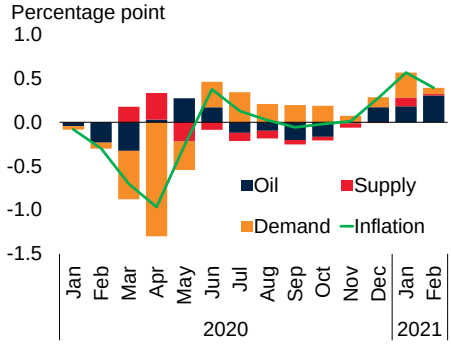
B. Contributions to monthly change in EMDE headline CPI inflation in 2020-21



C. Contributions to monthly change in global core CPI inflation in 2020-21



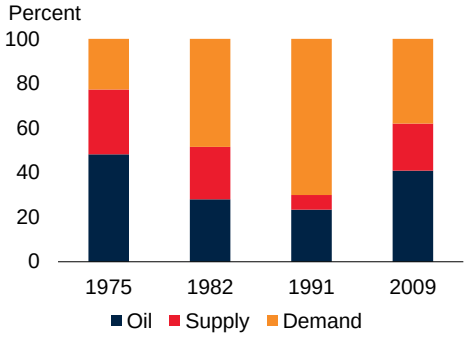
D. Contributions to monthly change in global PPI inflation in 2020-21



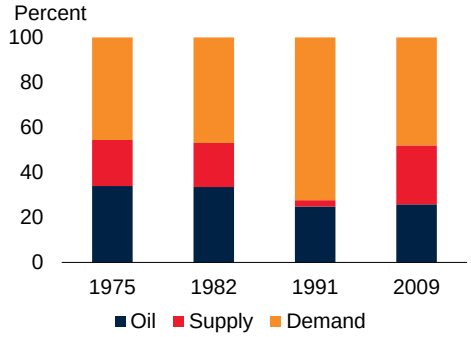
Note: Contributions to changes in year-on-year inflation from the previous month for up to 85 countries, based on factor-augmented vector autoregression (FAVAR) estimation over the period of 2001-2. Monthly data. Unexplained residual is omitted from the graph. "Oil," "Supply," and "Demand" indicate oil price shocks, global supply shocks, and global demand shocks, respectively.

Figure 8. Drivers of disinflation in past global recessions

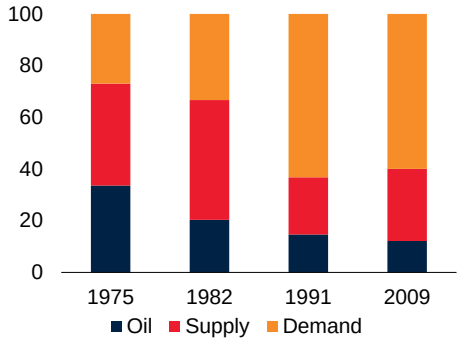
A. Contributions to disinflation around global recessions: Headline CPI inflation



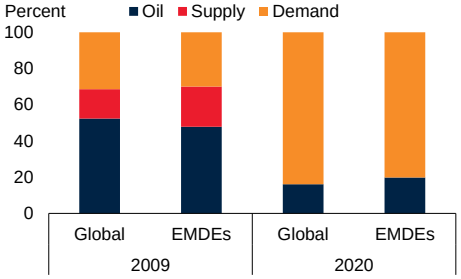
B. Contributions to disinflation around global recessions: PPI inflation



C. Contributions to disinflation around global recessions: Core CPI inflation

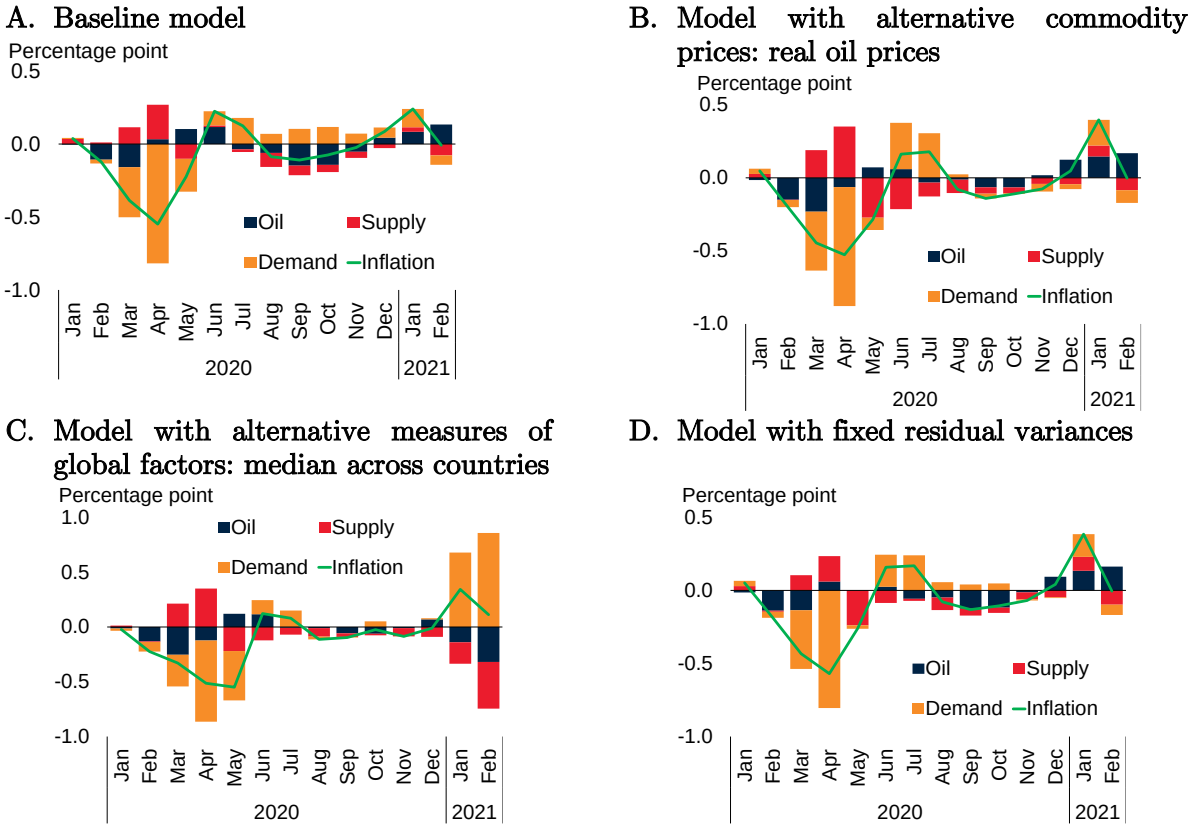


D. Contributions to disinflation around global recessions in 2009 and 2020: Headline CPI inflation



Sources: Ha, Kose, and Ohnsorge (2019); Kose, Sugawara, and Terrones (2020).
Note: The charts show relative contribution of oil price, global demand, and global supply shocks to global disinflation from the trough of the global recession to the subsequent trough in global inflation. Historical decompositions of global inflation measures are estimated by the global FAVAR model using quarterly data for the sample period 1970-2017. Troughs of global recessions are identified using global per capita GDP and the algorithm in Harding and Pagan (2002) and are consistent with the results in Kose and Terrones (2015). Negative contribution of the shocks are omitted from the charts. D. The results are based on monthly FAVAR model. In 2020, supply shocks were inflationary and partially offset the disinflationary impacts of demand and oil price shocks.

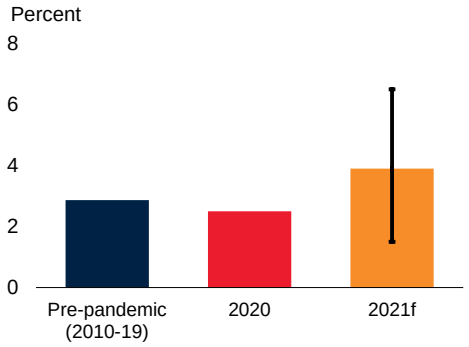
Figure 9. Decomposition of global inflation: Alternative models



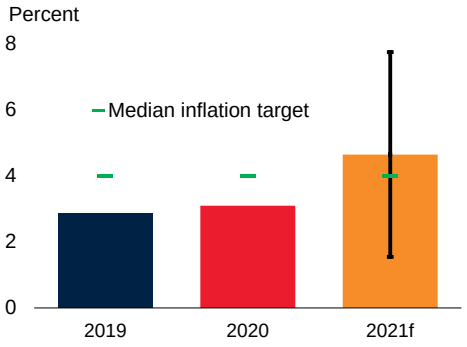
Note: Contributions to changes in year-on-year headline consumer price inflation from the previous month for 81 countries, of which 31 are advanced economies and 50 are emerging market and developing economies (EMDEs), based on alternative types of FAVAR models over the period of 2001-21. Unexplained residual is omitted from the graph. "Oil," "Supply," and "Demand" indicate oil price shocks, global supply shocks, and global demand shocks, respectively.

Figure 10. Prospects for inflation

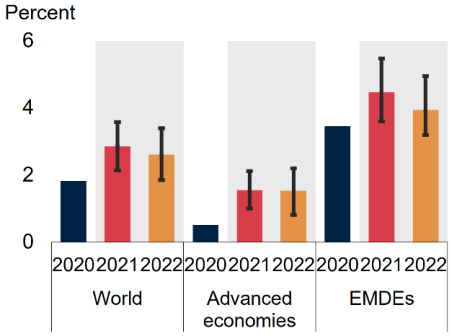
A. Model-based conditional forecast of global inflation



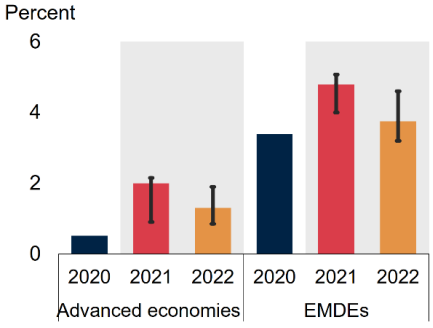
B. Model-based conditional forecast of EMDE inflation



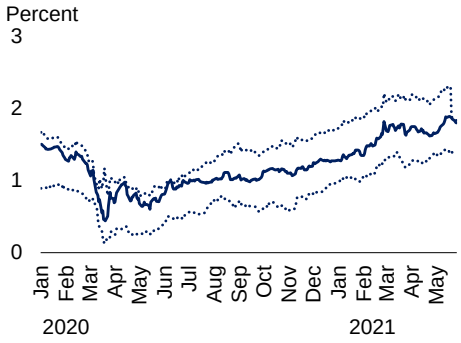
C. Survey-based inflation expectations: headline CPI inflation



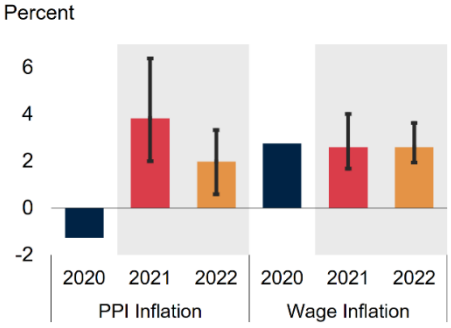
D. Inflation expectations by select central banks: headline CPI inflation



E. Market-based inflation expectations



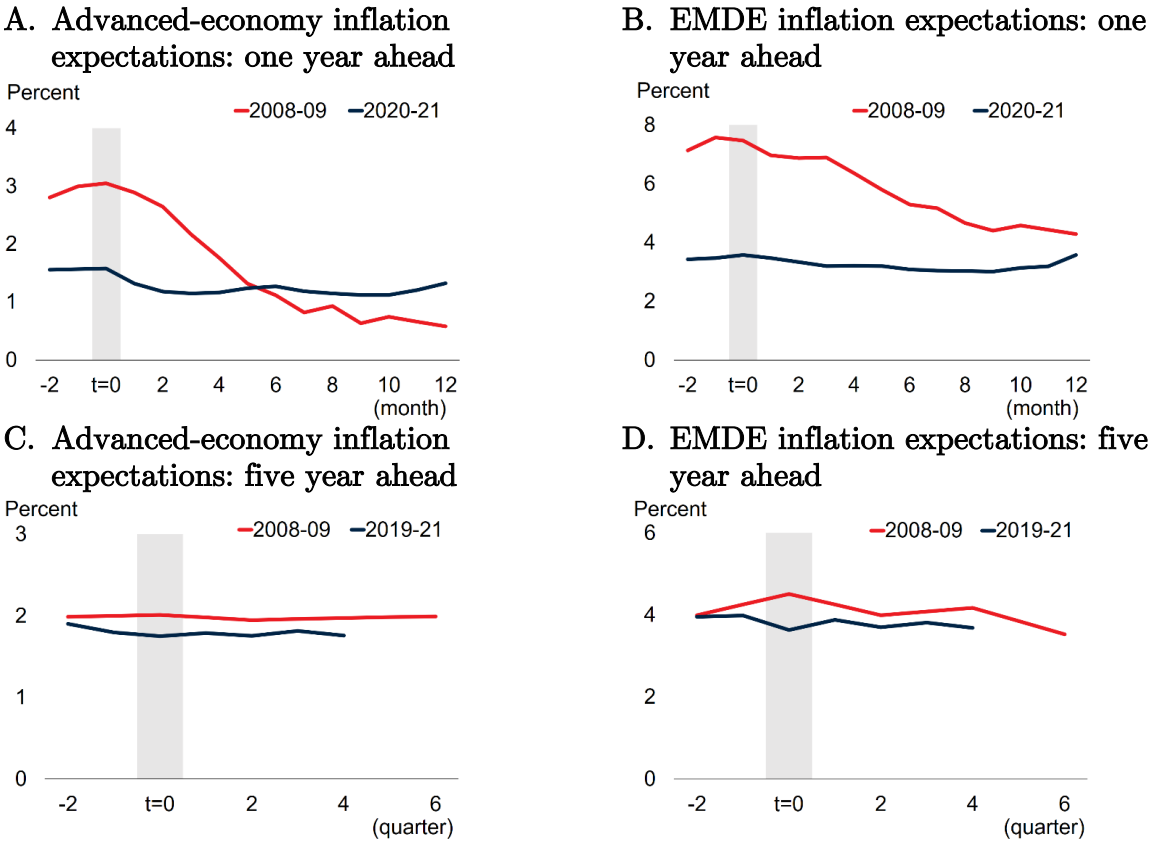
F. Survey-based inflation expectations: global PPI and wage inflation



Sources: Haver Analytics; Consensus Economics; World Bank.
Note: EMDEs = emerging market and developing economies; PPI = producer price index.
A. Conditional forecast of global inflation based on quarterly FAVAR model of global inflation, global GDP growth, and oil price growth. Vertical line indicates 16-84 confidence bands.
B. Based on median inflation in 125 EMDEs and inflation target in 30 inflation-targeting EMDEs. 2021 inflation is based on the conditional forecast of EMDE inflation. Vertical line indicates 16-84 confidence bands.

C. Average headline CPI inflation expectations for 2021-22 based on surveys of April 2021 in 57 countries (31 advanced economies and 26 EMDEs). 2020 indicates actual inflation rates. Vertical lines indicate maximum and minimal responses.
D. Median headline CPI inflation expectations for 2021-22 based on surveys of G7 economies and seven large EMDEs (Brazil, China, Mexico, India, Indonesia, Russian Federation, Turkey).
E. Median implied breakeven inflation, measured as the spreads between nominal and real 5-year treasury bond yields in 7 advanced economies (Australia, Canada, Germany, the Republic of Korea, New Zealand, United Kingdom, and United States). Dotted lines indicate inter-quartile range.
F. Median Producer Prices Index (PPI) and wage inflation expectations for 2021-22 based on surveys of 9 and 23 economies, respectively. 2020 indicates actual inflation rates. Vertical lines indicate maximum and minimal responses.

Figure 11. Inflation expectations in 2008-10 and 2020-21



Sources: Consensus Economics; World Bank.
Note: Median short-term (A, B) or long-term (C, D) inflation expectations among 33 advanced economies (A, C) and 51 EMDEs (B, D). Shaded areas (t=0) indicate the outbreak of COVID-19 pandemic (March 2020) and the Global Financial Crisis (September 2008).

Appendix

Additional Results from the FAVAR Model

In Sections 4 and 5, the empirical results based on FAVAR estimation are presented mainly focusing on the drivers of global inflation during the pandemic and inflation prospects. In this appendix, the empirical results over the full sample period (2000m1-2021m2) are presented.

A. Evolution of global inflation factors

Since 2001, the global inflation factor has been broadly stable and remained low. That said, its volatility increased sharply around global recessions and slowdowns and oil price fluctuations (Figure A1). The global inflation factor fell sharply (over three standard deviations below its long-term average) during the global financial crisis in 2008-09, and after the pandemic in 2020. Around the oil price slide of 2014-16, it declined by over two standard deviations from its long-term average. It took about two years from the trough of the global recession (and the associated global financial crisis) for the global inflation factor to recover to its long-term average. This recovery occurred much faster after the pandemic-induced global recession. Within a year of the trough of the COVID-induced global recession in April 2020, the global inflation factor is estimated to have recovered to its long-term average.

The global factor for PPI inflation tended to move together with the global factor for CPI inflation, but with considerably greater variability—as may be expected for goods prices that are heavily exposed to, if not determined in, global markets. During global recessions and episodes of large oil price swings, the global PPI factor exhibited sharper movements than the global headline CPI factor. With a larger share of services and non-tradable goods and services prices in the GDP deflator and core CPI, the global factors for these two inflation measures were considerably less volatile than those for headline CPI and PPI inflation.

B. Variance share of global inflation factors to domestic inflation

The contribution of global factors to the inflation in individual countries is presented in Table A1. The contribution of the global headline CPI inflation factor in total variation of domestic inflation is 11 percent in the median country across 81 countries, ranging from 3 percent to 28 percent in interquartile ranges. The contribution of the global inflation factor is considerably more sizeable in advanced economies (33 percent) than in EMDEs (4 percent). The estimated global factor's share in inflation variance was higher the greater the tradable goods and services content of the basket. For example, the global factor's share of inflation variation was larger for producer price inflation (31 percent in the median country) and smaller for core CPI inflation (5 percent).

C. Contribution of global shocks to global inflation variation

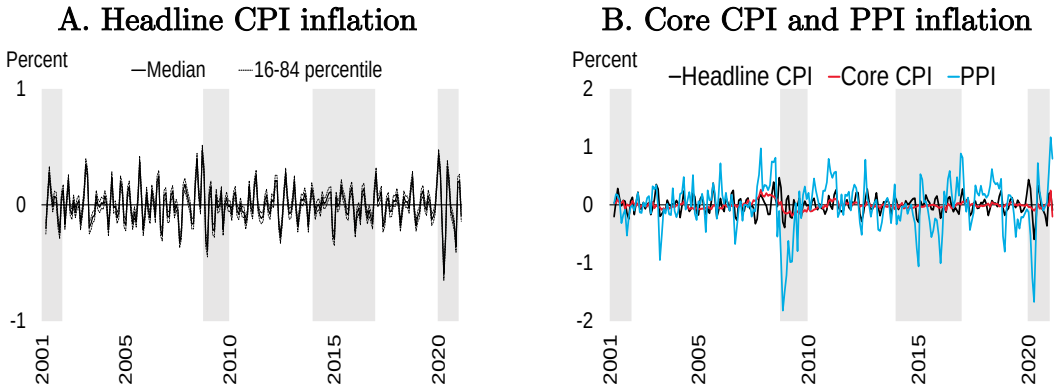
Global demand shocks and oil price shocks, in almost equal measure, have been the main drivers of global inflation variation since the 2000s (Table A2, Panel A). These two types

of shocks together have accounted for over 80 percent of the variation in global inflation since the 2000s, each contributing about 40 percent. In contrast to global inflation, the variance of global output growth has been driven mostly by global demand shocks in (accounting for 55 percent of output growth variance), with a more modest role for oil price shocks (accounting for less than 10 percent of growth variation). As expected, fluctuations in oil prices mostly reflect shocks specific to oil prices (accounting for 76 percent of oil price variation) over the sample period.

D. Role of global shocks in different measures of global inflation

The contribution of global demand shocks to global inflation variation was similar across all three measures (40-44 percent), but the relative contributions of oil prices and global supply shocks differed (Table A2, Panel B). The smaller energy content may account for the modest contribution of oil price shocks to global core CPI inflation variation (20 percent)—about one-half of contribution to headline CPI inflation variation. Less affected by energy and other tradables price shocks, core CPI inflation reflects an important role for global supply shocks: global productivity shocks or their cross-country spillovers, as captured by global supply shocks, appear to have been an important source of variation in core CPI inflation (37 percent), considerably more than for PPI inflation (6 percent) and headline CPI inflation (18 percent).

Figure A1. Global inflation factors: monthly data



Note: The global inflation factors are extracted from up to 81 national inflation rates using a dynamic factor model. Shaded areas indicate global recessions and slowdowns (2001, 2009, and 2020) and oil price plunges (2014-16).

Table A1. Variance contributions of global factors: 2001-21
(percent)

Country groups	Global inflation measures		
	Headline CPI	PPI	Core CPI
Global	11.0 [15.7; 2.6 – 28.4]	30.8 [31.5; 14.2 – 46.5]	5.1 [7.1; 2.4 – 9.7]
Advanced economies	33.3 [31.8; 19.0 – 41.3]	45.3 [42.4; 18.5 – 64.2]	5.6 [7.3; 4.0 – 9.7]
EMDEs	4.0 [6.8; 0.3 – 10.6]	15.8 [19.3; 5.5 – 32.1]	2.7 [6.7; 1.2 – 7.6]

Note: The contribution of global inflation factors is estimated over 2001m1-2021m2 with the dynamic factor model for each of the three different inflation measures: headline CPI inflation, PPI inflation, and core CPI inflation. The data set includes 81 countries (30 advanced economies and 51 EMDEs) for headline CPI, and 55 and 35 countries, respectively for PPI and core CPI inflation due to the data availability. The first argument in the first row indicates the unweighted median across countries. The first argument in the second row (in brackets) is the mean variance share across countries. The second and third arguments in the second row (in brackets) indicate the interquartile range (25th and 75th percentiles) of variance shares. CPI = consumer price index; EMDEs = emerging market and developing economies; PPI = producer price index.

Table A2. Variance decompositions of global variables: 2001-2021

A. Model with headline CPI inflation

(Percent)

	Oil price	Supply	Demand
Global inflation	42.7 [39.8]	17.5 [21.8]	39.8 [38.4]
Global output growth	8.3 [10.7]	36.4 [40.9]	55.2 [48.4]
Oil price growth	79.2 [69.7]	9.3 [13.6]	11.5 [16.7]

B. Model with alternative measures of global inflation

(Percent)

	Oil price	Supply	Demand
Headline CPI inflation	42.7 [39.8]	17.5 [21.8]	39.8 [38.4]
PPI inflation	50.3 [46.8]	5.9 [9.2]	43.8 [44.0]
Core CPI inflation	20.8 [25.0]	36.7 [36.1]	42.5 [38.8]

Note: This table presents the variance decompositions of global variables based on global FAVAR model that consist of oil price growth, and global inflation and global output growth factors extracted from monthly dataset up to 85 countries. Sample period is 2001m1-2021m2. Unweighted median draws and averages draws (in the bracket) from 10,000 successful draws are reported. The global factor for producer price index (PPI) and core CPI inflation are based on the data for 55 countries and 35 countries, respectively, due to the data availability. "Oil price," "Supply," and "Demand" indicate the contributions of oil price shocks, global supply shocks, and global demand shocks, respectively. CPI = consumer price index; PPI = producer price index.

Table A3. Historical decompositions of global inflation

A. Around global recession in 2020

(Percentage points)

Year	Month	Oil price	Supply	Demand	Sum
2020	Jan	0.00	0.04	0.01	0.04
	Feb	-0.11	0.01	-0.03	-0.12
	Mar	-0.16	0.12	-0.34	-0.39
	Apr	0.03	0.24	-0.82	-0.55
	May	0.10	-0.10	-0.23	-0.22
	Jun	0.12	0.01	0.10	0.23
	Jul	-0.04	-0.02	0.18	0.13
	Aug	-0.06	-0.10	0.07	-0.09
	Sep	-0.15	-0.07	0.10	-0.11
	Oct	-0.14	-0.05	0.12	-0.08
	Nov	-0.05	-0.04	0.07	-0.02
	Dec	0.04	-0.03	0.07	0.09
2021	Jan	0.08	0.03	0.13	0.24
	Feb	0.13	-0.08	-0.06	-0.01

B. Around global recession in 2009

(Percentage points)

Year	Month	Oil price	Supply	Demand	Sum
2008	Sep	-0.22	0.05	-0.02	-0.19
	Oct	-0.40	0.11	-0.10	-0.39
	Nov	-0.37	-0.02	-0.40	-0.78
	Dec	-0.47	0.01	-0.34	-0.81
2009	Jan	-0.64	0.04	-0.43	-1.03
	Feb	-0.57	0.15	0.06	-0.36
	Mar	-0.23	-0.22	-0.33	-0.78
	Apr	-0.19	-0.19	-0.24	-0.62
	May	0.01	-0.22	-0.08	-0.29
	Jun	0.16	-0.25	0.01	-0.07
	Jul	-0.18	-0.12	-0.07	-0.36
	Aug	0.10	-0.13	0.02	-0.02
	Sep	-0.18	-0.17	-0.01	-0.36
	Oct	0.06	-0.22	-0.12	-0.27
	Nov	0.14	-0.08	0.64	0.69
	Dec	0.32	0.20	0.23	0.76
2010	Jan	-0.02	-0.02	0.09	0.05
	Feb	-0.11	-0.03	-0.01	-0.15
	Mar	-0.03	-0.12	0.14	-0.01
	Apr	0.15	-0.26	0.08	-0.04
	May	-0.28	0.00	0.03	-0.26
	Jun	0.03	0.02	0.02	0.07

Note: This table presents the contributions to changes in year-on-year global headline CPI from the previous month based on global FAVAR estimation over 2001-21. Unexplained residual is omitted from the graph. "Oil price," "Supply," and "Demand" indicate the contributions of oil price shocks, global supply shocks, and global demand shocks, respectively.