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What Explains Global Inflation

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Abstract

This paper examines the drivers of fluctuations in global inflation, defined as a common factor across monthly headline consumer price index (CPI) inflation in G7 countries, over the past half-century. It estimates a Factor-Augmented Vector Autoregression model where a wide range of shocks, including global demand, supply, oil price, and interest rate shocks, are identified through narrative sign restrictions motivated by the predictions of a simple dynamic general equilibrium model. The authors report three main results. First, oil price shocks followed by global demand shocks explained the lion's share of variation in global inflation. Second, the contribution of global demand and oil price shocks increased over time, from 56 percent during 1970–1985 to 65 percent during 2001–2022, whereas the importance of global supply shocks declined. Since the pandemic, global demand and oil price shocks have accounted for most of the variation in global inflation. Finally, oil price shocks played a much smaller role in global core CPI inflation variation, for which global supply shocks were the main source of variation. These results are robust to various sensitivity exercises, including alternative definitions of global variables, different samples of countries, and additional narrative restrictions.

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I. Introduction

It has been two decades since Kenneth Rogoff presented the first systematic analysis of global inflation by describing a "near-universal fall in inflation" (Rogoff 2003). The main reasons he laid out for the global disinflation of the 1990s and early 2000s remain as relevant today as they were then. They included multiple structural factors in addition to a widespread shift towards inflation targeting and more credible central banks.[1] It is precisely to preserve this hard-earned credibility that many central banks around the world have been battling with resurgent inflation for the last two years.

After staying mostly dormant for the prior decade, global inflation has been on a rollercoaster over the past three years. It declined sharply at the early stages of the pandemic amid a collapse in demand and oil prices. In mid-2020, however, it started to pick up as demand bounced back, supply disruptions deepened, and oil prices rebounded. In 2022, global inflation reached its highest level since the mid-1990s. While it has been falling recently, it remains much higher than its level before the pandemic. These developments have pushed the sources of global inflation movements to the center of policy debates.

Against this background, we present the first systematic analysis of the drivers of global inflation—defined as a common factor across monthly headline consumer price index (CPI) inflation in G7 countries over the period 1970-2022. We study how global inflation is driven by a wide range of shocks, including shocks to global demand, global supply, oil prices, and global interest rates in a unified setup. We identify these shocks using sign and narrative restrictions in the context of a Factor-Augmented Vector Auto Regression (FAVAR) model. Our identification strategy is motivated by a simple dynamic general equilibrium model. We also examine the importance of these shocks in explaining global inflation during different sub-periods and global recessions. In addition, we study their roles in driving global core CPI and global PPI inflation.

We report three main results. First, oil price shocks were the main drivers of variation in global inflation, with a contribution of over 38 percent, followed by global demand shocks, with a contribution of about 28 percent during 1970-2022. The contributions of global supply and interest rate shocks to global inflation variation were considerably smaller. Impulse responses also suggest a more significant role for oil price and global demand shocks in driving inflation.

Second, the importance of global inflation drivers has evolved over time. Specifically, during 2001-22, oil price and global demand shocks accounted for 65 percent of inflation variation, up from 56 percent in the two earlier periods of 1970-85 and 1986-2000 we study. The contribution of global supply shocks, on the other hand, decreased to 13 percent in 2001-22 from 25 percent in the earlier two periods. The importance of global interest rate shocks in driving global inflation was stable—between 19 and 22 percent—over the three sub-periods.

[1] Rogoff (2003) also emphasized the forces of globalization that affected inflation through several channels: stronger trade linkages through global supply chains, increased product and labor competition, and greater flexibility of prices and wages.

Oil price and demand shocks tended to be the main drivers of movements in global inflation around every global recession since 1970. For example, global demand shocks played a major role in the sharp decline in global inflation during the early months of the 2020 global recession triggered by the COVID-19 pandemic. Oil price and demand shocks together led the subsequent rebound after mid-2020.

Third, the importance of shocks varied depending on the underlying measure of global inflation. For example, global oil price shocks accounted for only 7 percent of the variation in core CPI inflation, which excludes volatile energy and food prices. Global supply shocks explained 41 percent of core CPI inflation variation, and global demand and interest rate shocks split the rest of the core CPI inflation variation. For producer price index (PPI) inflation variation, the importance of oil price and global interest rate shocks was similar to that of headline CPI inflation variation. However, global supply shocks explained a larger share of PPI inflation variation than headline CPI inflation. These differences between the main sources of shocks in explaining various measures of global inflation were mostly stable over the three sub-periods.

A decade and a half after the publication of Rogoff's paper, global inflation was teetering on the verge of deflation and monetary policy rates were hitting the zero lower bound in many countries. While recognizing the risks associated with deflation, Rogoff (2019) also pointed out the dangers of reversing global disinflation resulting from such global factors as the deterioration in central bank independence and the accumulation of large amounts of debt. Since the COVID-19 pandemic, his work has been perceptive in explaining how economic crises can be associated with major turning points in inflation stability and how massive fiscal and monetary stimulus could raise inflation (Rogoff 2021a; Ilzetzki, Reinhart, and Rogoff 2020).[2] Thanks to Rogoff's seminal work on the topic, research on global inflation has grown significantly over the past two decades.[3]

The rest of this paper is organized as follows. The next section introduces our database and empirical methodology. Section III briefly explains the estimated factors and shocks. This is followed by a discussion of the drivers of global headline CPI, core CPI and PPI inflation in Sections IV and V, respectively. Section VI analyzes the role of shocks in driving inflation during global recessions. Section VII presents a set of robustness exercises. Section VIII concludes with a summary and future research directions.

[2] Rogoff also made extensive contributions to the literature on monetary policy and central banking. He emphasized the importance of central bank credibility and independence in stabilizing inflation in a series of papers. His research also explained how economic crises could be associated with major turning points in inflation and how massive fiscal and monetary stimulus could raise inflation (see Afrouzi, Halac, Rogoff, and Yarad 2023 and Rogoff 2007, 2021b, 2022a, 2022b, 2022c).

[3] Building on Rogoff's original work in 2003, many researchers have studied common movements in inflation across countries using various approaches. For example, Ciccarelli and Mojon (2010) documented that a global inflation factor explains more than one-third of national inflation variance. Forbes (2019) emphasized the role of global forces in driving national inflation. Auer, Levchenko, and Saure (2019) showed the importance of cross-border production linkages in transmitting inflation spillovers.

II. Database and Methodology

II.1. Database

The analysis is conducted at the monthly frequency for January 1970-October 2022 and is therefore constrained in its country sample and choice of variables. In particular, to ensure a balanced sample for all measures of inflation, we focus on G7 countries as our baseline country group. In our baseline model, inflation, π_t^i, is measured by headline CPI inflation; output growth, Y_t^i, is measured by the growth rate of industrial production (which, in contrast to real GDP growth, is available at a monthly frequency); and the interest rate, R_t^i, is measured by the first-differenced 3-month Treasury Bill yields (or shadow rates after the global financial crisis).[4] Oil price growth is measured as the growth rate of nominal oil prices (average of Dubai, WTI and Brent benchmark oil prices). All variables are month-on-month, seasonally adjusted, log-differenced, demeaned changes and are stationary.

For robustness, we also consider an alternative (unbalanced) sample of 30 countries, including advanced and emerging market economies, and alternative measures of inflation (producer price inflation and core CPI inflation), output growth, oil prices, and interest rates in Sections V and VII.

II.2. Dynamic Factor Model and FAVAR Model

Dynamic Factor Model. Global inflation, global output growth, and global interest rates are estimated by the following three dynamic factor models:

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

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

$$R_t^i = \beta_{global}^{R,i} f_t^{R,global} + e_t^{R,i}$$

where π_t^i, Y_t^i, and R_t^i represent inflation, output growth, and interest rate in country *i* in month *t*, respectively, while $f_t^{\pi,global}$, $f_t^{Y,global}$, and $f_t^{R,global}$ are the global common factors for inflation, output growth, and the changes in the interest rate in month *t*, respectively. The error terms (e_t^i) are assumed to be uncorrelated across countries at all leads and lags. The error terms and factors follow an autoregressive process. The model is estimated using Bayesian techniques as described in Kose, Otrok, and Whiteman (2008).

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

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

[4] The shadow interest rate is estimated as in Wu and Xia (2016) as the shortest maturity rate based on the shadow yield curve. It is essentially equal to the policy interest rate in "non-lower" bound or unconventional monetary policy environments.

where ε_t is a vector of orthogonal structural innovations, and Z_t consists of global inflation ($f_t^{\pi,global}$), global output growth ($f_t^{Y,global}$), global interest rate ($f_t^{R,global}$), and global oil price growth (Δop_t). The vector ε_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*), a shock to the global interest rate (*global interest rate shock*), and a shock to oil prices (*oil price shock*).[5]

Typical VAR models assume that the variance-covariance matrix of residuals is constant over time. However, this assumption could be problematic in our exercise since the time series exhibit large volatility induced by the COVID-19 pandemic or other global events (Lenza and Primiceri 2022). To address this issue, the model assumes stochastic volatility of structural shocks—the residuals are independently but not identically distributed across time. The variance-covariance matrix of residuals is allowed to be period-specific, hence rendering volatility stochastic and introducing heteroskedasticity (Carriero, Corsello, and Marcellino 2019).

II.3. Identification and Estimation

The identification of shocks is based on sign restrictions that are motivated by a simple dynamic general equilibrium model. We present the details of our model in Appendix A. Motivated by earlier similar frameworks, such as by Blanchard and Gali (2007), Hou, Mountain, and Wu (2016) and Yilmazkuday (2014, 2021), our model consists of individuals consuming oil and non-oil products, firms producing oil- and non-oil-products, and a cenral bank which conducts monetary policy to target inflation. The model includes four shocks broadly similar to those in our empirical setup. In Appendix A, we also present the model-based impulse responses of inflation to these four shocks. The sign restrictions used to indetify shocks in the FAVAR exercise below are consistent with these impulse responses. The sign restrictions we employ here are also consistent with earlier empirical studies.

II.3.1. Identification

Sign restrictions. The identification is first achieved by imposing sign restrictions following studies by Charnavoki and Dolado (2014) and Forbes, Hjortsoe, and Nenova (2018). Postulating that B_0^{-1} in our model has a recursive structure such that the reduced form errors can be decomposed according to $u_t = B_0^{-1}\varepsilon_t$, the sign restrictions on the responses of the variables to the structural shocks can be written as follows:

[5] The four global shocks we focus on as the key drivers of global inflation are also featured in some previous theoretical studies that analyze sources of inflation in the United States. For example, Smets and Wouters (2007) develop a theoretical model that decomposes the variations in output and inflation into demand shocks, price mark-up shocks (including commodity price shocks), supply shocks, and interest rate (monetary policy) shocks. Del Negro et al. (2013, 2022) built a theoretical model and consider a wider range of shocks in driving U.S. inflation.

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

where $*$ represents an unrestricted response without any economic motivation. These sign restrictions to identify the structural shocks are consistent with the predictions of our model and broadly follow some earlier empirical studies as we discuss later. However, our study differs in the formulation of the econometric model, types of variables, and structural shocks. The motivation behind the sign restrictions for each shock is as follows.

A positive *global supply shock* is assumed to be accompanied by higher global output and oil prices but lower global inflation. Global supply shocks typically include supply-driven non-oil disturbances in cross-border value chains, labor, or product markets. For example, a positive *global supply shock* can be due to an increase in productivity, greater competition across firms, or lower marginal costs of production in general (due to factors other than reductions in oil prices that are captured separately by oil price shocks). This is consistent with the predictions of our dynamic general equilibrium model in which a positive supply shock reduces the marginal cost of non-oil products, which is reflected in falling inflation and rising aggregate output. Since higher productivity drives up wages (and consumption for oil products), the price of oil rises as well.

A positive *global demand shock* is assumed to be associated with higher global output growth, inflation, interest rates, and oil price growth.[6] These shocks typically represent demand-driven non-monetary disturbances due to changes in factors such as fiscal policy or agents' saving and investment preferences. A positive global demand shock can be due to, for example, an expansionary fiscal policy and/or an increase in the marginal propensity to consume or invest. In our model, a positive demand shock increases consumption, and thus, output and inflation while putting pressure on oil prices. Monetary policy reacts to these developments by raising interest rates.

A positive *global interest rate shock* is defined as one that is accompanied by higher global interest rates but lower global inflation and output growth (Uhlig 2017, Fry and Pagan 2011). Global interest rate shocks can be driven by changes in monetary policy or investor risk sentiment.[7] In our model, a contractionary monetary policy that increases the interest rate depresses consumption demand which, in turn, lowers both inflation and output.

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[6] Our identifying assumptions with respect to supply and demand shocks are also consistent with those used by Charnavoki and Dolado (2014) that a negative non-commodity supply shock raises input cost, reduces output and commodity prices, and raises inflation and that a demand shock raises output, inflation, and commodity prices. For similar approaches to the identification of supply and demand shocks, see Gambetti, Pappa, and Canova (2008) and Melolinna (2015).

[7] The literature often assumes that fluctuations in short-term interest rates reflect factors related to monetary policy and to the risk (term) premium although both types of shocks can affect each other. Bekaert, Engstrom, and Ermolov (2021) trace out the effects of monetary policy on interest rates and contrast them with the effects of shocks to risk aversion and uncertainty that is not driven by monetary policy. Using data for the United States, euro area, and Japan, they find that global risk premium shocks

Finally, a positive *oil price shock* is associated with higher oil prices and global inflation but lower global output growth. These shocks typically stem from disturbances in oil markets, beyond changes in aggregate global demand and supply, which lead to changes in oil prices. These predictions are consistent with the behavior of impulse responses to oil price shocks in our model in which a positive oil price shock—which corresponds to a negative productivity shock in the oil sector—results in an increase in inflation but reduces output.

Narrative restrictions. The structural parameters estimated based on the sign restrictions are further constrained by the narrative restrictions following Antolin-Diaz and Rubio-Ramirez (2018). The narrative restrictions constrain the structural parameters by ensuring that, around key historical events, the structural shocks imposed here are consistent with the established historical narrative.[8]

The narrative sign restrictions are imposed by considering the subset of successful draws in Bayesian estimation that result in positive oil price shocks (or positive historical contributions to oil prices) in periods that coincided with sharp increases in oil prices: October 1973–March 1974, December 1978-January 1979, October 1980–March 1981, August-October 1990, and December 2002 (Table A1). Negative oil price shocks (or negative historical contributions to oil prices) are imposed for certain historical episodes that saw sharp declines in prices: February 1986, February 1998, January 2015, and March 2020 (Baffes et al. 2015, Wheeler et al. 2020, and Hamilton 2011). In addition, as a robustness check, we consider the possibility of historical contributions of oil price shocks to prices to be either positive or negative following Antolin-Diaz and Rubio-Ramirez (2018), or an additional narrative restriction that the oil price shock is positive in March 2022 when Russia's invasion of Ukraine resulted in severe disruptions in global oil markets.

II.3.2. Estimation

The FAVAR model is estimated by using monthly data with four lags (based on the AIC and SIC information criteria). In the Bayesian estimation, the routine first searches for 2,000 successful draws from at least 4,000 iterations with 2,000 burn-ins; the results reported are based on the median of these 2,000 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.[9] In the estimation of the FAVAR model, structural shocks are assumed to have unit variance. Impulse response functions are based on a positive one-standard-deviation increase in the identified structural shocks. More specifically, a positive one-standard-deviation shock to global demand represents a 0.6 percentage point increase in global industrial production growth; a positive one-

have been a major driver of asset price movements, and monetary policy has affected asset prices through changes in interest rates.

[8] Baumeister and Hamilton (2021) argue that sign restrictions themselves are based on information outside the model estimation. Our narrative restrictions bring some of this outside information more explicitly into the estimation.

[9] We used hyperparameters such that the prior mean on the first, own lag of a given variable is set equal to 0.8 and the overall tightness parameter and lag decay are 0.1 and 0.2, respectively. The prior for the first lag of a residual variance is set equal to one. Changes in these hyperparameters did not materially affect the estimation results.

standard deviation global supply shock a 0.1 percentage point decrease in global inflation; a positive one-standard deviation oil price shock a 10 percentage point increase in oil price growth; and a positive one-standard deviation global interest rate shock a 0.1 percentage point increase in global short-term interest rates.

III. Behaviors of Global Factors and Shocks

Before getting into the details of the importance of the global shocks in explaining the global inflation, we briefly analyze the consistency of the estimated global factors and shocks with well-known historical episodes.

III.1 Global factors

The estimation of the dynamic factor models described in Section II.2 results in the global factors presented in Figure 1. The behaviors of the global factors are consistent with well-known fluctuations in respective variables. For example, the global inflation factor went through large and persistent swings until the 1990s. It then stabilized in the 1990s and early 2000s before becoming more volatile again around the 2007-09 global financial crisis and the recovery in 2010. After a period of stability, it has again displayed significant volatility since the beginning of the COVID-19 pandemic in early 2020. The global inflation factor often declined around the turning points of the global business cycle. For example, the inflation factor fell sharply just before or during global recessions, especially those associated with the 2007-09 global financial crisis and the COVID-19 pandemic, but also around the 1975 and 1982 global recessions (a global recession is defined as a contraction in annual global real per capita GDP following Kose and Terrones 2015).

The global output factor plunged during global recessions and rebounded in subsequent recoveries. It was extremely volatile during the initial months of the pandemic when it declined more than 10 standard deviations in March-April 2020, and then rebounded by nearly 10 standard deviations in May-June 2020.

The global interest rate factor declined in episodes of U.S. Federal Reserve policy loosening, which often coincided with global recessions. During the 1970s and, especially, the 1980s the interest rate factor rose sharply reflecting steep U.S. policy tightening to end the Great Inflation of the 1970s (Ha, Kose, and Ohnsorge 2022). After the COVID-19 pandemic, the global interest rate factor rose again as central banks around the world began to tighten policy to contain soaring inflation. In contrast, during the period of low and stable inflation (the Great Moderation) from the mid-1990s to the 2010s, the global interest rate factor did not track U.S. tightening cycles particularly closely in part because policy rate increases during this period tended to be smaller and more gradual than during the 1970s, 1980s, and then again the 2020s.

Steep increases in oil prices occurred during periods of geopolitical tensions (the oil crises of the 1970s and early 1980s; the Gulf war of the early 1990s). Steep declines in oil prices coincided with shifts in OPEC policy in the mid-1980s and the mid-2010s, in response to the emergence of new sources of supply, as well as in the early 1990s when an earlier spike in geopolitical risk unwound.

Global factors were responsible for sizable shares of the variance of national inflation, output, and interest rates (Table A2). For example, the global inflation factor accounted for nearly 30 percent of national inflation variance on average across countries, ranging between 10 percent (for Japan) to 53 percent (for France).[10] Similarly, the global output factor accounted for almost 40 percent of national output variance, on average, with contributions ranging from 11 to 55 percent across G7 countries. Finally, the global interest rate factor accounted for 23 percent of the variance of national interest rates, on average, similar to that of the global inflation factor.

III.2 Global Shocks

The estimation of the FAVAR model also results in the identification of global demand, global supply, global interest rate, and oil price shocks (Figure 2). Large changes in the estimated shocks are broadly consistent with the key turning points of the global business cycle, oil markets, and policy changes. For example, negative oil price shocks coincided with major shifts in oil demand or supply on multiple occasions. Large positive oil price shocks were associated with the oil crises of the mid-1970s and early 1980s as well as the Gulf war of the early 1990s and rebounds from several global recessions. Large negative oil price shocks were associated with global recessions but also OPEC's decision to end production restraint in the mid-1980s and mid-2010s, the normalization of oil prices after the Gulf War in the early 1990s and the Asian financial crisis in 1997-98.[11]

Large negative global demand shocks coincided with all five global recessions (1975, 1982, 1991, 2009, and 2020), while large positive global demand shocks often preceded global recessions. Large negative supply shocks coincided with the economic disruptions associated with oil price shocks in the 1970s and 1980s, credit crunches in the early 1990s and around the global financial crisis, and the pandemic in 2020.

Large positive interest rate shocks occurred in the 1970s and early 1980s, when major central banks tightened monetary policy to end the Great Inflation, but also just before some global recessions (1982, 2009, 2020). Some of the largest negative interest rate shocks materialized early in some global recessions (1982, 1991, 2020).

IV. Drivers of global headline CPI inflation variation

Having presented the behavior of the structural shocks in the previous section, this section presents the main results of the estimation. Impulse response functions capture the

[10] This result is consistent with studies such as by Ciccarelli and Mojon (2010) who find that alternative measures of global inflation explain between 20 and 37 percent of national inflation variance, and by Forbes (2019) who reports that the global inflation factor explains about 40 percent of national CPI inflation variance of advanced countries.

[11] As explained in Antolin-Diaz and Rubio-Ramirez (2018), a higher probability of violating narrative restrictions may indicate that the restrictions are more informative for achieving more accurate identification (Table A1). Accordingly, positive oil price shocks have been more informative for achieving identification during the earlier episodes such as the Iran-Iraq war than in later episodes such as the start of the Iraq war or the Libyan civil war. Meanwhile, negative oil price shocks have been more informative for achieving identification after the COVID-19 pandemic.

sensitivity of the endogenous variables to the structural shocks. Variance decompositions capture both this sensitivity and the variability of the structural shocks.

IV.1. Drivers of global inflation over the full sample

Variance decompositions. The FAVAR model allows us to quantify the contributions of global demand, supply, interest rate, and oil price shocks to global headline CPI inflation variation (Figure 3 and Table 1). Over the full sample period of 1970-2022, oil price shocks were the main drivers of variation in global inflation at the two-year forecast horizon with a contribution of about 38 percent, followed by global demand shocks with a contribution of nearly 28 percent. The contributions of global supply shocks (18 percent) and global interest rate shocks (16 percent) were accounted for the remainder, in approximately equal proportions. The considerably smaller contribution of supply and interest rate shocks in part reflected the smaller impulse responses of inflation to these shocks (see below). These results imply that both supply-side disturbances (consisting of oil price and global supply shocks) and demand-side disturbances (consisting of global demand and interest rate shocks) have accounted for equally sizable (around 50 percent for each) shares of global headline inflation variation over the past five decades.[12]

Our study is the first one that examines the sources of variation in global inflation within a unified model. Our findings are broadly consistent with earlier work that focuses on different aspects of inflation variation. For example, Charnavoki and Dolado (2014) study the drivers of business-cycle fluctuations in Canada but they also report that commodity price and global demand shocks explain a large share of global inflation variance over the period of 1975-2010. However, our study is different from theirs since our main focus is on the drivers of *global* inflation, and we examine the drivers of global inflation in much more detail—for instance, by considering the role of interest rate and oil price shocks as well as testing alternative measures of global inflation. We also consider a wider range of shocks and a much longer sample period of 1970-2022 that includes the oil-price plunge in the mid-2010s and the post-pandemic period. Our findings with respect to the importance of interest rate shocks are also broadly consistent with results from studies focusing on the role of these shocks in driving inflation in the United States and the Euro Area (Peersman 2005 and Hristov, Hülsewig, and Wollmershäuser 2012).

For completeness, we also examine the importance of global shocks in driving global output, interest rate and oil prices (Figure 3). Our findings are again broadly consistent with previous studies focusing on individual countries. For example, global output variation was mostly driven by global demand shocks and global supply shocks. Oil price movements were primarily driven by developments in the oil market. Finally, volatility of global interest rates was mostly driven by global demand shocks and interest rate shocks.[13]

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[12] In our dynamic general equilibrium model, oil price shocks are associated with productivity shocks in the oil sector. Figure 2 also suggests that some of the largest oil price shocks occurred when there were changes in OPEC supply strategy in the 1970s, 1980s, and 2010s.

[13] For the role of demand shocks in driving output, see Smets and Wouters (2007), Hristov, Hülsewig, and Wollmershäuser (2012), and Charnavoki and Dolado (2014). On the importance of developments in oil

Impulse responses. Like the variance decompositions, impulse responses of global inflation to global shocks suggest a particularly large role for oil price shocks and global demand shocks. Specifically, a positive one-standard-deviation oil price shock (corresponding to an increase in oil price growth by around 10 percentage points) was accompanied by, cumulatively, about 0.5 percentage points (i.e., 6 percentage points annually) higher global inflation after two to three years (Figure 4 and Table 2).[14] A positive one-standard-deviation global demand shock (corresponding to a 0.6 percentage point increase in global output growth) was associated with an increase in global inflation by 0.4 percentage points (nearly 5 percentage points annually) after two to three years. The impacts of global supply and interest rate shocks were more modest over the full sample period: a positive one-standard-deviation global supply shock or global interest rate shock reduced global inflation by 0.3 and 0.2 percentage point, respectively, within two to three years. All the impulse response functions are statistically significant throughout the estimation horizon of our study.

IV.2. Evolution of global inflation drivers over time

After exploring the importance of global shocks over the full time period, we now examine how the roles of these shocks have evolved over time by estimating our model for three roughly equally-sized sub-periods. The first period, 1970-1985, overlaps with the Great Inflation of 1965-1984, the second period of 1986-2000 overlaps with a period of widespread disinflation, and the third period of 2001-22 coincides with a period of low but typically stable inflation that was brought to an end in the past two years.

The results suggest a material shift in the main sources of inflation variation over the three subperiods (Table 1 and Figure 5). In the first two sub-periods, the majority of global inflation variance was accounted for by global demand and supply shocks that were associated with three global recessions (1975, 1982, 1991) and the economic disruptions caused by the two oil crises and a period of major economic and financial liberalization. In the last subperiod—a period of macroeconomic stabilization with mostly low and stable inflation—oil price shocks and, in almost equal degrees, global interest rate and global demand shocks became the main drivers of inflation variation. Oil price, interest rate, and global demand shocks have accounted for more than four-fifths (88 percent) of global inflation variation since 2001.

markets in driving oil prices, see Peersman (2005), Baumeister and Peersman (2013), and Baffes et al. (2015). For the importance of demand and interest rate shocks in driving interest rates, see Smets and Wouters (2007) and Hristov, Hülsewig, and Wollmershäuser (2012).

[14] This sensitivity of global inflation to oil price shocks is broadly consistent with the earlier findings in the literature. For example, based on a VAR model for the United States, Rogoff (2006) finds that, following a 10 percent increase in oil prices, the growth rate of the quarterly GDP deflator rises by 0.8-1.2 percentage points within a few years. Using local projection models for 72 countries, Choi et al. (2018) report that domestic inflation, on average, increases by about 0.4 percentage point on impact following a 10 percent increase in oil prices.

The share of global supply shocks has halved to 12 percent from 25 percent in the first period.[15] The decline in the variance share of the global supply shocks also appears to reflect a halving of the sensitivity of global inflation to these shocks between the first and the second subperiod and remained around this level in the third subperiod (as shown in Figure 5).

The sensitivity of inflation to global demand shocks also receded between the first and third periods as inflation expectations became better anchored and monetary policy more credibly geared towards stabilizing inflation. The sensitivity of inflation to demand shocks declined by about two thirds between the first and second subperiod and fell further in the third. However, the sheer magnitude of the demand shocks in the third subperiod—the two largest global recessions (2009, 2020) since the Second World War—meant that global demand shocks continued to contribute more than 20 percent to global inflation variation in the last period.

Conversely, the large increase in the variance share of oil price shocks since 2001 mostly seems to reflect a near-tripling in the sensitivity of global inflation to these shocks between the second and third subperiods. Short-term fluctuations in global inflation around major swings in oil prices—including the 2007-09 global financial crisis, the oil price plunge during 2014-16, and the 2020 COVID-19 pandemic and the Russian invasion of Ukraine—may have driven up this sensitivity.

Finally, the modest uptick in the variance share of interest rate shocks during the third sub-period (relative to the previous sub-period) appears to reflect mostly the greater volatility—which is almost comparable to that in the first sub-period—introduced by large swings in interest rates shocks around the 2009 and 2020 global recessions. The sensitivity and persistence of global inflation to interest rate shocks receded after the first subperiod as inflation expectations became better anchored and monetary policy became more successful at macroeconomic stabilization.

To get a better understanding of the evolving role of these shocks in driving global inflation we examine the evolution of variance decompositions of global inflation over shorter periods focusing on 5-year windows (Table 3). These results also show the declining share of global supply shocks in the variance decomposition and the rising share of oil price shocks. The shares of global demand and interest rate shocks appear to have increased, to a peak in the late 1990s and early 2000s, and then declined over the course of these five decades.[16]

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[15] There are only a few studies that consider the evolution of the importance of shocks in explaining inflation over time. The findings of these studies are mostly consistent with our results here. For example, Baumeister and Peersman (2013) report that the contribution of oil-specific shocks to inflation variance has doubled since 2000 from the period of 1970-1990s in the Unites States. This partly reflects two factors. First, it reflects the stability of oil prices over long periods during the 1970s and the first half of the 1980s while oil prices were set by OPEC. Second, it is also driven by the large variability in inflation for reasons other than oil price shocks. Using a time-varying VAR models for a large panel of 33 countries, Mateju (2019) finds that the role of interest rate shocks has become larger since 2000s.

[16] As an additional robustness check, we studied the variance decompositions over sub-samples with equal length: 1970-87, 1988-2005, and 2006-2023. The results are consistent with the baseline findings we document here.

V. Drivers of global core and PPI inflation variation

Our baseline findings in the previous section focus on global headline CPI inflation. We now consider the drivers of global core and producer price index (PPI) inflation to get a better understanding of the linkages between shocks and different measures of inflation. For example, the pronounced contribution of oil price shocks to the variance of global headline CPI inflation may partly reflect the sizeable share of energy and food components in consumer baskets (Altansukh et al. 2017).[17] Core inflation, which excludes energy and food prices, is expected to be less influenced by oil price shocks. Meanwhile, the rapid expansion of cross-border value chains and the associated international input-output linkages may strengthen the role of global supply shocks in explaining global PPI inflation variation (Auer, Levchenko, and Saure 2019).

We conduct the same FAVAR exercise for global core CPI inflation and global producer price inflation. As we did for headline CPI inflation, we first estimate global inflation factors for global core CPI and PPI inflation. The contribution of the global factor to country-specific inflation variation is, on average across countries, smaller for core CPI inflation (13 percent of core inflation variation over the full sample period) than for headline CPI inflation (28 percent). This result is consistent with studies such as by Altansukh et al. (2017) who document that energy and food price inflation have largely driven short-run (month-to-month) comovement in cross-country headline inflation rates and there is less comovement among core inflation rates than among headline inflation rates. Our findings also suggest that the contribution of the global factor to country-specific PPI inflation variation (40 percent of PPI inflation variation over the full sample period) is larger than that for headline CPI inflation (28 percent), possibly because the PPI inflation is influenced more by cross-border input-output linkages, consistent with studies such as by Auer, Levchenko, and Saure (2019).[18]

In terms of the importance of global shocks in explaining the variance of different measures of inflation, our findings are intuitively appealing (Table 4). As would be expected from a measure that excludes energy prices, global oil price shocks accounted for considerably less of core inflation variance (7 percent) than of either headline CPI or PPI inflation variance (38 percent) over the full sample period. Instead, global supply shocks were the single most important source of core CPI inflation variation (41 percent) and interest rate

[17] In the United States, energy and food together explain 17 percent of consumption basket. In France and Germany, these two have somewhat higher shares than that of the United States.

[18] Using a multi-country, industry-level data set that combines PPI and exchange rates with global input-output linkages, Auer, Levchenko, and Saure (2019) report that global linkages could explain half of the PPI variance in a sample of 30 countries and that half of this variance is driven by the cross-border propagation of cost shocks through international input–output linkages. They argue that the sizeable international comovement of PPI is driven by idiosyncratic developments in individual sectors, such as the energy or transportation equipment industries, which spill over across borders and sectors via input-output linkages.

shocks accounted for one-half more of core CPI inflation variation (26 percent) than of headline CPI or PPI inflation (16-17 percent).[19]

In contrast, the composition of PPI inflation variance, in particular the sizeable role of oil price shocks, was similar to that of headline CPI inflation. This may partly be driven by the almost equal share of energy in consumption and production: the share of energy in final-demand PPI is nearly 5.9 percent and the share of energy products in the CPI basket is 6 percent (according to the U.S. Bureau of Labor Statistics, as of end-2022). The importance of energy in producer prices becomes even greater when considering input-output linkages: the shares of fuels and related products in the intermediate-demand PPI and commodity PPI are 38 percent and 22 percent, respectively.[20]

An exception were the somewhat larger shares of global supply shocks, possibly reflecting propagation through global supply chains, as well as somewhat smaller share of global demand shocks, possibly reflecting the ability to adjust to global demand shocks through diversified supply chains. Although the contribution of supply shocks to PPI inflation variance (23 percent) was somewhat higher than that to headline CPI inflation, it was still only about half of that to core CPI inflation (41 percent).[21] This suggests much stronger propagation of global supply shocks through global value chains for the non-energy and non-food goods and services that form the core CPI than for more volatile components that are included in the PPI.

These differences between the main sources of shocks to headline and core CPI and PPI inflation also displayed some variations over time. We repeat the estimations for our three sub-sample periods, 1970-85, 1986-2000, and 2001-22 (Table A3). The prominence of global supply shocks and lesser role of global demand and oil price shocks that differentiated core CPI from headline CPI inflation variation over the full period were phenomena that only emerged in the second subperiod (for oil price shocks) and third subperiod (for global supply and demand shocks). In the first subperiod, the sources of headline and core CPI inflation variation were more similar than in the second and third subperiods. For PPI inflation variation, the larger role of global supply shocks and smaller role of global demand shocks than for headline CPI inflation were features of the third subperiod that did not hold in the first or second subperiod.

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[19] This result is in line with Forbes (2019) and Del Negro et al. (2013). For instance, based on a cross-country estimate of an augmented Philipps curve, Forbes (2019) reports that oil prices had a significant impact on headline CPI inflation, while their impact on core CPI inflation was statistically and economically insignificant. In a DSGE model calibrated for the United States, Del Negro et al. (2013) report that supply (including wage and productivity) shocks and demand (including risk spreads and investment) shocks were the main drivers of core inflation variation.

[20] The similar role of oil price shocks in driving PPI and CPI inflation variation is broadly consistent with the findings in Ha, Kose, and Ohnsorge (2023). They report roughly equal contributions by global factors, which are associated with major oil price swings, to domestic CPI and PPI inflation. They argue that this similarity may partly reflect the roughly equal shares of tradable goods and services in PPI (54 percent) and headline CPI (53 percent), in contrast to core CPI (15 percent).

[21] This is in line with findings from a structural VAR model for the United States and Germany by Aucremanne and Wouters (1999) who show that supply shocks explain a sizeable (40 percent) portion of core inflation variation in both countries while other types of shocks (demand, oil price, monetary, and exchange rate shocks) account for smaller shares.

Overall, oil price movements were the one of the main sources of variation in inflation aggregates that include volatile components such as energy and food. In contrast, the main driver of variation in inflation aggregates that exclude such components were global supply shocks and demand shocks for certain sub-periods. Global demand shocks accounted for a sizable share of variation of all inflation aggregates. This finding is also consistent with results in the earlier literature.[22]

VI. Explaining movements in global inflation during major historical episodes

In the previous sections, we assessed the roles of different types of shocks in driving inflation *variation* and *responses* by employing forecast error variance decompositions and impulse response functions, respectively. In this section, we examine the contributions of these shocks to changes in the *level* of inflation by using historical decompositions (Figure 6). Since we briefly discussed the evolution of global shocks over time in Section III, we here focus our analysis on the roles of these shocks in explaining inflation during the five global recessions since 1970: 1975, 1982, 1991, 2009, and 2020.[23] Consistent with the results based on variance decompositions and impulse responses, the historical decompositions of inflation suggest that both oil price and demand shocks often played important roles in explaining changes in inflation.

1975. Global inflation prior to the 1975 global recession was predominantly driven by oil price shocks as they accounted for nearly 80 percent of the increase in inflation between August 1973 and January 1974.[24] Global demand shocks explained the rest of the increase in inflation (about 20 percent). Oil prices quadrupled following the Arab oil embargo and suppressed aggregate demand through their impact on transport and manufacturing sectors. The decline in inflation after the recession was explained mostly by the fading away of pre-recession oil price shocks (over 60 percent) and demand shocks (nearly 40 percent) between February 1974 and July 1976.

1982. The surge in global inflation in the late 1970s that preceded the 1982 recession was driven by oil price shocks (about 60 percent) following the sharp increase in oil prices due to the Iranian revolution in 1979. Although these oil price shocks faded away within a year, demand shocks pushed inflation higher, accounting for nearly 40 percent of the increase between February 1978 and the end-1980. These demand shocks began to fade as monetary policy tightened to rein inflation. The protracted disinflation after 1981 was supported by a combination of an unwinding of earlier oil price shocks (about 50 percent) and demand shocks (nearly 45 percent) between 1981 and early 1986. Consistent with

[22] By estimating FAVAR models for three economies (Euro Area, the United States, and the United Kingdom), Melolinna (2015) finds that demand and monetary policy shocks have larger and more persistent effects on inflation in the service subcomponent than the goods subcomponent of headline CPI while cost shocks—including oil-supply shocks—also have a strong impact on energy components.
[23] We present the time series of historical decompositions in Figure A1. The evolution of inflation during the turning points of global business cycles was studied in previous work but the drivers of inflation have not been quantified in a systematic way as we do here (Kose and Terrones 2015).
[24] Positive oil price shocks were associated with disruptions in global oil supply in a number of episodes (Hamilton 2011): 1973-74 (Arab oil embargo), 1979-80 (the Iran-Iraq War), 1990 (the First Persian Gulf War), and 2002-03 (unrest in Venezuela).

historical narratives, a tightening monetary policy stance and a deterioration in market risk sentiment coincided with the 1982 global recession.

1991. Prior to the 1991 global recession, the increase in global inflation in the late 1980s and the beginning of the 1990s was mainly driven by oil price shocks (nearly 65 percent) associated with the 1990-91 Gulf War, in particular between April and September 1990. The fall in inflation following the recession was explained by oil price shocks (over 40 percent) and demand shocks (nearly 60 percent).[25] This period of disinflation also coincided with financial crises in several advanced economies.

2009. After a prolonged period of low and stable inflation, oil price shocks once again triggered a temporary increase in inflation in 2007-08 as global inflation (month-over-month) rose by 0.5 percentage point (about 6 percentage points annually) from the end-2006 to June 2008. These shocks accounted for nearly three-fourth of the surge in inflation rise in 2007-08. The subsequent disinflation at the height of the global recession of 2009 was driven by an unwinding of these oil price shocks as oil prices plunged, global demand shocks as the global economy tipped into one of its most severe global recessions since the second world war, and interest rate shocks as risk premia surged amid banking crises in the United States and Europe.[26]

2020. In the early stages of the pandemic, nearly 60 percent of the decline in global inflation was explained by global demand shocks as global consumption and investment demand collapsed between March and May amid lockdowns and uncertainty about policies and growth prospects. Global supply shocks were associated with inflationary pressures during this period because of disruptions in firm operations and global value chains. Contrary to the previous global recessions, the sharp decline in inflation at the beginning of the pandemic was followed by a swift rebound: over the May 2020-October 2022 period, global demand shocks accounted for the lion's share (nearly 45 percent) of the jump in inflation as economic agents quickly adjusted their behavior.[27] Oil price shocks and global interest rate shocks—associated with the lagged effects of accommodative monetary policies in 2020 and a stabilization of risk premia—explained the rest of the increase in inflation, particular in 2021 and early 2022.[28] Since the beginning of the

[25] The predominant role of oil price shocks in explaining the increase in global inflation before the 1991 global recession (as well as before the recessions in 1975 and 1982) and the significant role of demand shocks in the disinflation after the recessions are consistent with the findings by Smets and Wouters (2007) in a DSGE model calibrated for the United States.

[26] A surge in global interest rate shocks, rapidly followed by a plunge, around the 2009 and 2020 global recessions can be partly attributed to sharp swings in risk sentiment (as also reflected in volatile risk premiums) during these episodes that were accompanied by substantial monetary policy accommodation.

[27] di Giovanni et al. (2023) also find that, after the initial pandemic-related supply shocks in factor markets, inflation was pushed up by expansionary fiscal and monetary policies that stimulated aggregate demand.

[28] The overall pattern of the historical contributions of global shocks to the CPI inflation around the 2020 recession is similar to that of the PPI inflation, although the role of global supply shocks is more sizeable in the case of PPI inflation (Figure A2). In the case of core inflation, the contributions of historical oil price shocks are quite limited, as one would expect, but that of the global supply and monetary shocks is larger. These findings are consistent with the overall variance decompositions of different inflation measures documented in the previous section.

Russian invasion of Ukraine, oil price shocks and global supply shocks further raised inflation.[29]

VII. Robustness Exercises

This section presents several additional exercises to assess the robustness of our headline results. These include using a larger country group, different weighting schemes of global variables, an alternative identification of shocks, and different measures of commodity prices, global output, and global interest rates. We explain each of these robustness exercises next and present a summary of results in Table 5.[30]

VII.1. Different country groups and weighting schemes

We first check whether our results differ for a much larger set of countries. Specifically, instead of our baseline sample of G7 countries, we estimate our FAVAR model with a dataset of 30 countries (although unbalanced across variables and time).[31] Together, these countries have accounted for about two-thirds of global real GDP since 2000, on average. The contributions of global shocks to inflation variation in the larger dataset are largely consistent with our headline findings: oil price shocks explain the largest share of inflation variance (37 percent) followed by global demand shocks (27 percent) (Figure A3). The headline results are not sensitive to the exclusion of individual countries from the sample.

In addition to different country groups, we consider two alternative weighting schemes of global variables. Specifically, we construct a weighted average and a simple average of G7 countries' respective variables as alternative measures of global variables. For the weighted average, we use nominal U.S. dollar GDP weights. The results again broadly consistent with our headline findings, although the use of unweighted averages increases somewhat the contribution of global supply shocks to the inflation variance.

VII.2. Alternative narrative and sign restrictions

Since oil price shocks explain the largest share of global inflation variance in our baseline estimation, we undertake additional robustness checks for the identification of these shocks. We have discussed in Section III the consistency of the key historical developments in oil markets and the behavior of oil price shocks we identified. Since our sample also includes 2022, we imposed an additional narrative restriction that the structural oil price

[29] The predominant role of demand shocks and some offsetting role of supply shocks in driving inflation movements during the early stage of the pandemic were also reported by Bekaert, Engstrom, and Ermolov (2021) for the United States and O'Brien, Dumoncel, and Gonçalves (2021) for the euro area. The role of broad-based shocks—both demand- and supply-driven—in the sharp rise in inflation in 2021-22 was documented by Ball et al. (2022) and Del Negro et al. (2022) for the United States and Eickmeier and Hoffman (2022) for the United States and Euro Area.

[30] We also conducted robustness exercises to assess the validity of our findings in the context of core CPI and PPI inflation (Table A4). Our headline results do not differ much across aggregation methods, or alternative sign and narrative restrictions.

[31] This group includes 15 advanced economies and 15 emerging market and developing economies: Austria, Belgium, Germany, Greece, Italy, Japan, Netherland, Portugal, Singapore, South Korea, Spain, Sweden, Switzerland, Taiwan, United States, Chile, Colombia, Ecuador, Egypt, Arab Republic of, El Salvador, Guatemala, Honduras, Indonesia, Mauritius, Mexico, The Philippines, South Africa, Thailand, Tunisia, and Türkiye.

shock was positive in March 2022 due to the war in Ukraine and resulting disruptions in the global oil market. We test these additional narrative sign restrictions by considering the subset of successful draws in our Bayesian estimation. These alternative narrative restrictions do not have a material impact on the variance decompositions of global inflation.

We next consider the possibility of more persistent shock transmission than assumed in the baseline estimations. Since monthly variables exhibit high volatility, we assume that sign restrictions are imposed over two months instead of the initial month only.[32] We keep all the other identification restrictions as in the baseline estimation. The results are again very similar to the baseline findings where oil price shocks explain the largest share of global inflation variance. If anything, the contribution of global oil price shocks to inflation variance rises somewhat and that of global interest rate shocks is diminished somewhat.

VII.3. Alternative measures of global indicators

We also experiment with alternative commodity prices, global output, and global interest rates. Instead of nominal oil prices, we employ real oil prices and nominal energy prices. These alternative oil prices do not materially change our headline findings; if anything, they strengthen the contribution of global oil price shocks to global inflation.[33] We then replace the global common factor of interest rates with weighted and simple averages of interest rates of G7 countries. These changes do not significantly affect our headline findings. Finally, we replace the global common factor of industrial production with two monthly indicators of global activity: the global economic conditions index (by Baumeister, Korobilis, and Lee 2020) and the world industrial production index (by Baumeister and Hamilton 2019). Once again, the results of variance decompositions of global inflation (and other global variables) are broadly in line with the baseline results.

VII.4. Decomposition of oil price shocks

Our baseline findings point to the sizeable role of oil price shocks in global inflation variation. In a robustness exercise, we disentangle the sources of oil price shocks into oil supply and demand shocks. The large literature on oil prices often decomposes the main drivers of oil prices into oil production and oil-specific demand shocks (for example, Baumeister and Hamilton 2019 and Baumeister and Peersman 2013). In keeping with this literature, we estimate an amended model that adds a global oil production shock. The model thus includes five global variables: oil production, oil price growth, inflation, output

[32] Following earlier studies (such as Uhlig 2017 and Fry and Pagan 2011), we applied sign restrictions on short-term responses. Although some shocks—particularly those related to monetary policy—may trigger macroeconomic responses with longer time lags, as demonstrated in Section 3, our current sign restrictions consistently lead to the same directions of impulse response functions (and consistent with our model) across forecasting horizons. Uhlig (2017) argued that restrictions imposed on longer horizons could unnecessarily eliminate certain movements in responses.

[33] Charnavoki and Dolado (2014) and Wong (2015) also examine the role of real oil prices in driving inflation fluctuations. Although not shown here, we also study variance decompositions of global inflation when global food prices are included in the model instead of global oil prices. In this case, while global food price shocks explain around 15 percent of global inflation variation (i.e., about half the share of global oil price shocks), global non-food supply shocks, which include the effects of global oil price shocks, play a major role in explaining global inflation variation.

growth, and interest rates. For the identification, we simply assume that oil production is exogeneous to the other global shocks within a month while we maintain all the other restrictions same as those in the baseline. This implies that oil price fluctuations that are not explained by oil production shocks are due to oil-specific demand shocks.[34]

The results of this exercise suggest that our key results on the importance of oil price shocks in inflation variation is robust to the decomposition of oil price shocks (Table 5). Among the two oil-specific shocks, it appears that oil production shocks are more important than oil-specific demand shocks in driving inflation fluctuations, broadly consistent with the findings of Baumeister and Peersman (2013).

VIII. Conclusion

Understanding the sources of inflation movements is key for the design and conduct of monetary policy. As Rogoff (2003) first observed two decades ago, globalization has made it more challenging to identify the drivers of inflation over time since it has introduced a wide range of external factors that influence national inflation. Since the beginning of the COVID-19 pandemic, the simultaneous occurrence of a series of large global shocks—including global demand fluctuations, supply disruptions, commodity price swings, and interest rate movements—clearly showed the need for a deeper analysis of the forces explaining global inflation developments. Our study provides the first systematic empirical analysis of the cyclical drivers of global inflation in a unified setup.

Our results suggest that oil price shocks have been the main drivers of variation in global (headline CPI) inflation over the past five decades, with a contribution of about 38 percent, followed by global demand shocks with a share of about 28 percent, with lesser and near-equal contributions of global supply shocks and global interest rate shocks. The relative importance of these shocks has changed over time: the contributions of oil price and global demand shocks have increased, whereas the importance of supply shocks has declined. The role of shocks differed across measures of global inflation: while global PPI inflation was mainly driven by oil price shocks, global core CPI inflation was mostly explained by global supply shocks.

Global inflation provides fertile ground for future research. For example, it would be useful to consider the transmission channels through which global factors drive global and national inflation, including cross-border spillovers. In addition, while the analysis here has focused on cyclical drivers of global inflation, an assessment of structural drivers would also be useful in light of recent discussions about shifts in major structural factors explaining inflation.

[34] We also tested a model that includes both oil production and oil-specific demand shocks following Baumeister and Hamilton (2019). The results of this exercise are similar to our headline findings.

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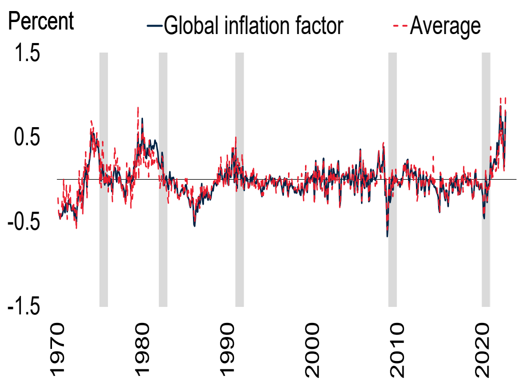
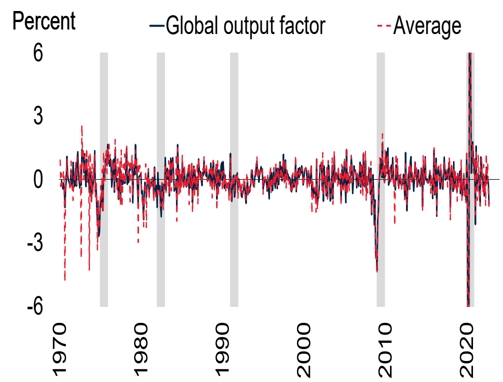
Figure 1. Global factors and oil prices

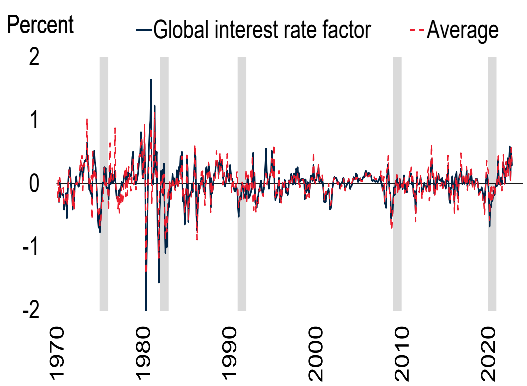
A. Global inflation factor



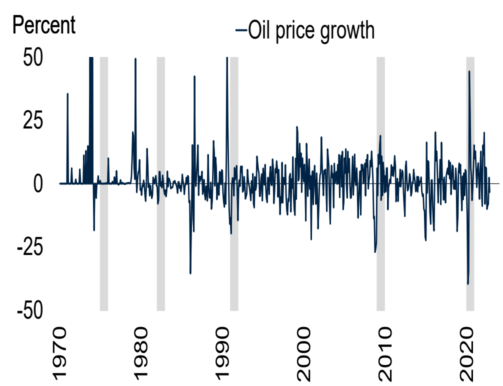
B. Global output growth factor



C. Global interest rate factor



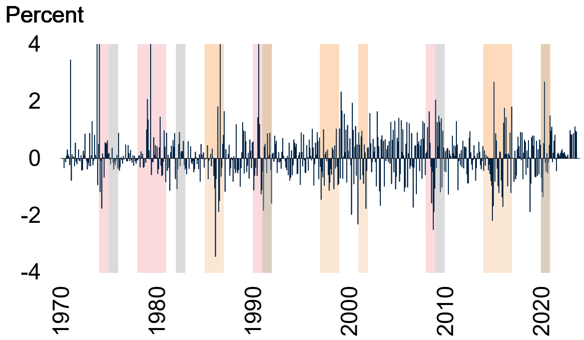
D. Global oil price growth



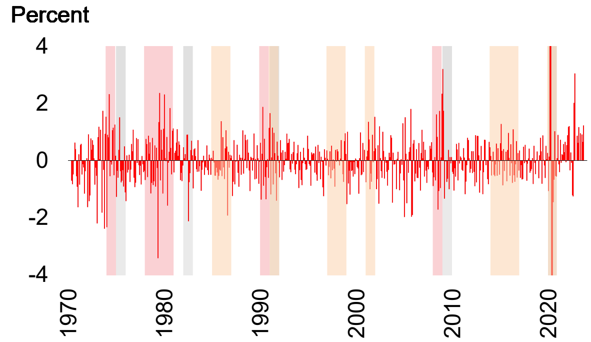
Note: All the global variables are demeaned. Shaded areas indicate global recessions (1975, 1982, 1991, 2009, and 2020). Global factors for G7 inflation, output growth, and interest rates are extracted from detrended national inflation, output growth, and interest rates (1[st] differenced), respectively, using a dynamic factor model. Inflation, output growth, oil price growth rate are based on month over month (seasonally adjusted) series.

Figure 2. Global demand, supply, oil price, and interest rate shocks

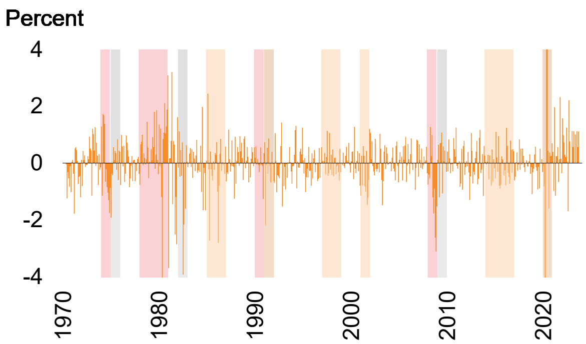
A. Global oil price shocks



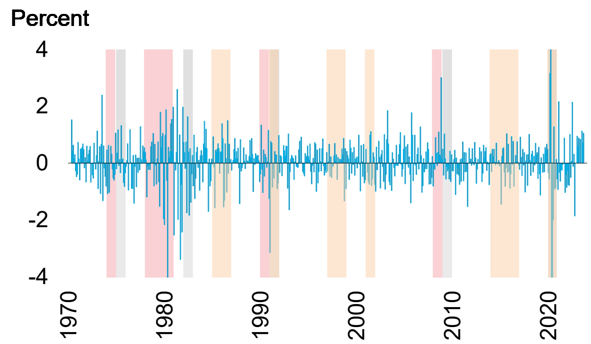
B. Global supply shocks



C. Global demand shocks



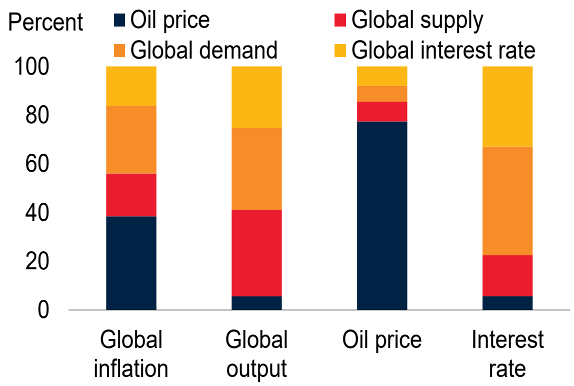
D. Global interest rate shocks



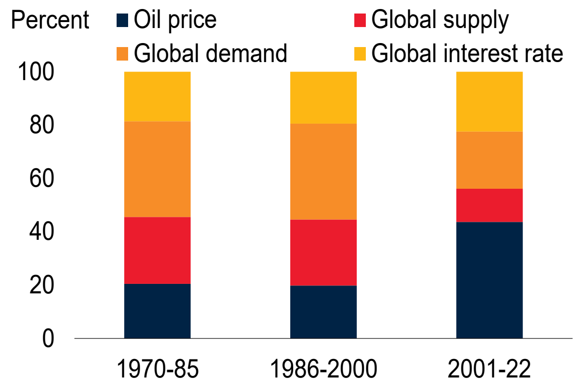
Note: The structural shocks are estimated with the global FAVAR model. Grey-shaded areas indicate global recessions (1975, 1982, 1991, 2009, and 2020) and red-shaded areas indicate periods of oil price spikes (1974, 1978-80, 1990, 2008). Orange-shaded areas indicate periods of oil price plunges (1985-86, 1990-91, 1997-98, 2001, 2007-09, 2014-16, and 2020).

Figure 3. Contributions of global shocks to global inflation variation

A. Variance decompositions of global variables: 1970-2022



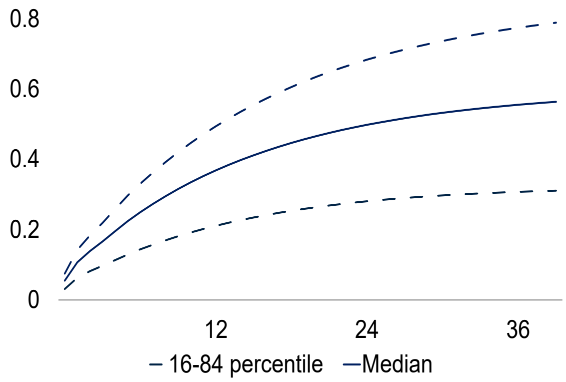
B. Variance decompositions of global inflation: over time



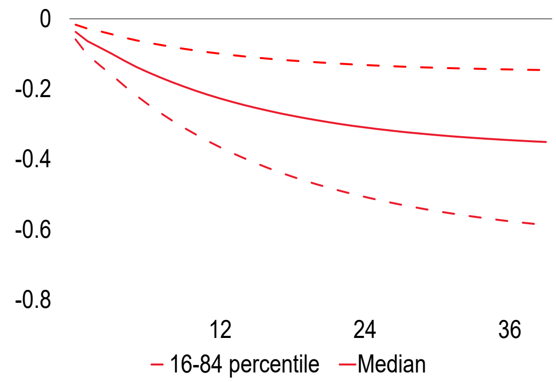
Note: The figures present variance decompositions of global variables (Panel A) and global inflation (Panel B) at the 2-year forecasting horizons. The results are medians of 2000 successful Bayesian drawings based on the global FAVAR model.

Figure 4. Cumulative impulse responses of global inflation to global shocks

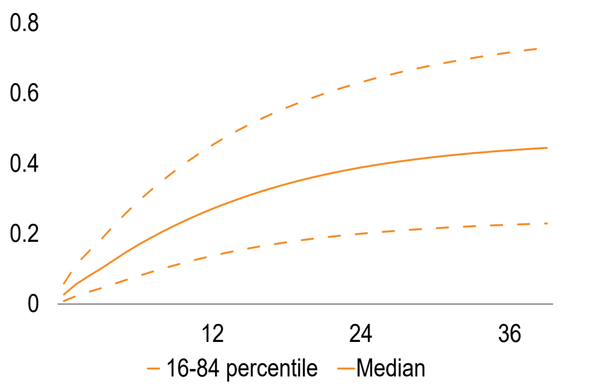
A. Global inflation following oil price shock



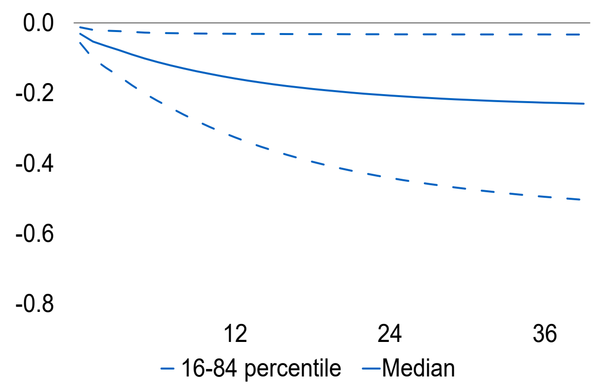
B. Global inflation following global supply shock



C. Global inflation following global demand shock



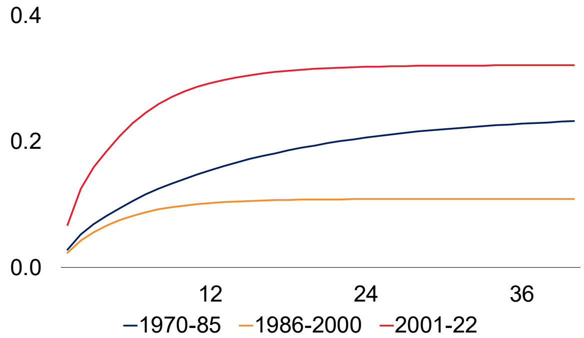
D. Global inflation following global interest-rate shock



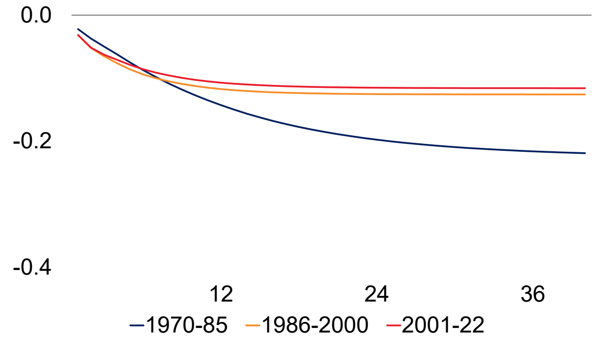
Note: The impulse responses (in percentage point) are based on the global FAVAR model to a 1 standard-deviation global shocks. Median and 16-84 percentiles among 2,000 successful Bayesian drawings are reported. Horizontal axis indicates month(s).

Figure 5. Cumulative impulse responses of global inflation over time

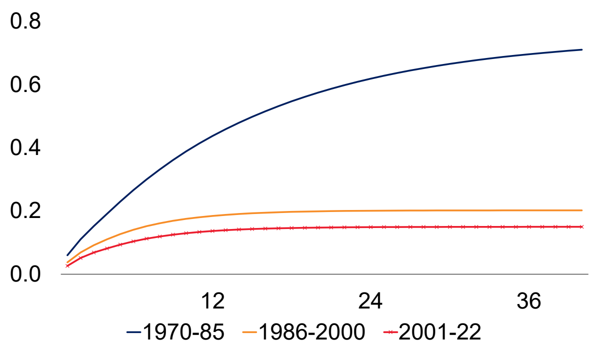
A. Global inflation following oil price shock



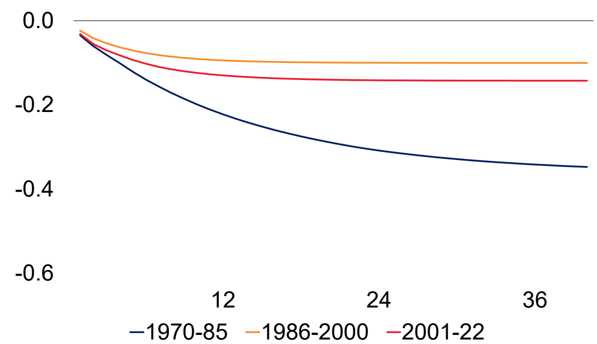
B. Global inflation following global supply shock



C. Global inflation following global demand shock



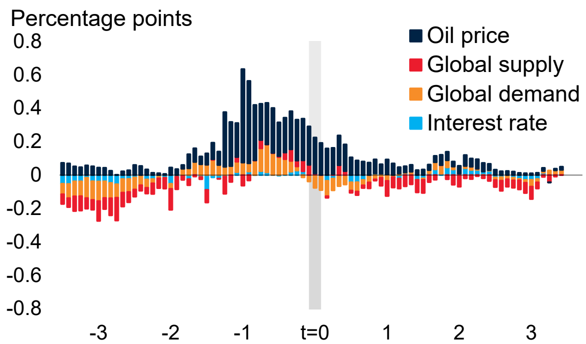
D. Global inflation following global interest-rate shock



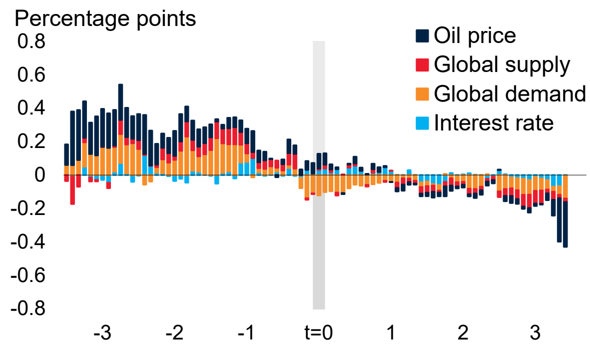
Note: The impulse responses (in percentage point) are based on three sub-sample global FAVAR estimations (1970-85, 1986-00, 2001-22). Three solid lines with different colors indicate median responses to a 1-standard-deviation global shocks for the corresponding three sub-sample periods. Horizontal axis indicates month(s).

Figure 6. Historical contributions of global shocks to global inflation around global recessions

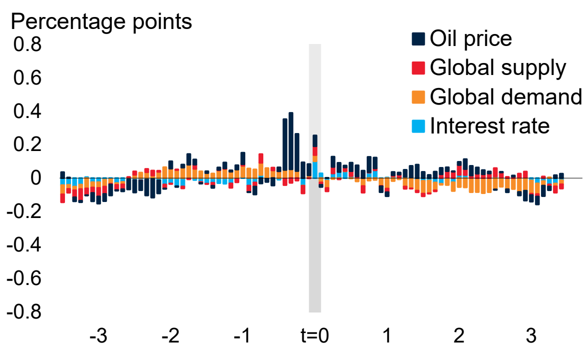
A. 1975 global recession



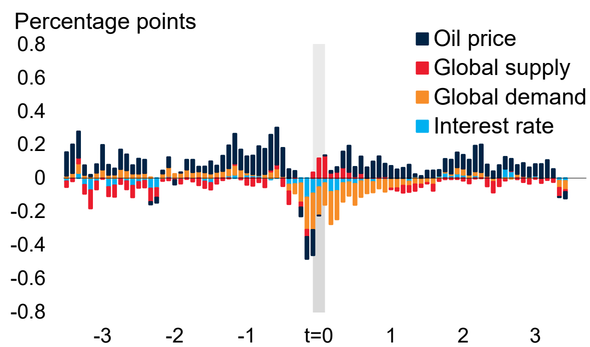
B. 1982 global recession



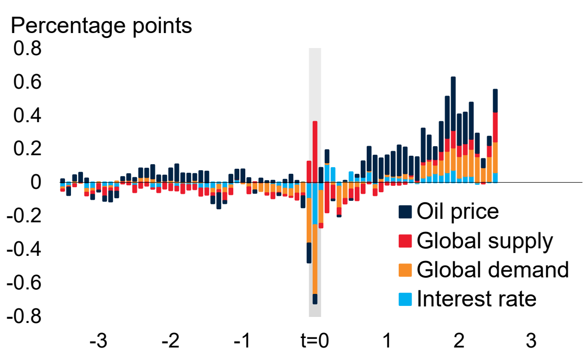
C. 1991 global recession



D. 2009 global recession



E. 2020 global recession



Note: The historical contributions of the structural shocks to global inflation are estimated using global FAVAR model. The troughs of the global recessions—1975 Q1, 1982 Q4, 1991 Q1, 2009 Q1, and 2020 Q2—were identified using global per capita GDP and the algorithm in Harding and Pagan (2002). Horizontal axes indicate years before and after the troughs of global recessions (shaded area, t=0).

Table 1. Contributions of global shocks to global CPI inflation factor

A. Contributions for the full period

Forecasting horizon	Structural Shocks			
	Oil Price	Global Supply	Global Demand	Global Interest rate
On impact	37.3	20.4	21.5	20.8
1 year	38.7	17.7	27.1	16.5
2 year	38.4	17.6	27.8	16.2

B. Contributions for sub-periods

Sub-periods	Oil Price Shock	Global Supply Shock	Global Demand Shock	Interest Rate Shock
1970-1985	20.5	25.1	35.9	18.6
1986-2000	19.8	24.8	35.9	19.5
2001-2022	43.7	12.5	21.4	22.4

Note: This table reports variance decompositions of global inflation factor (in percent), based on the global FAVAR model that consists of oil price growth, and the global factors of inflation, output growth, and interest rates extracted from the dataset of G7 countries.

Table 2. Impact of global shocks on global inflation

Forecasting horizons	Global Demand Shock			Global Supply Shock			Oil Price Shock			Interest Rate Shock		
	16%	**50%**	**84%**	**16%**	**50%**	**84%**	**16%**	**50%**	**84%**	**16%**	**50%**	**84%**
On impact	0.01	0.03	0.06	-0.06	-0.04	-0.02	0.03	0.05	0.08	-0.06	-0.03	-0.01
6 month	0.07	0.15	0.26	-0.22	-0.14	-0.06	0.13	0.22	0.30	-0.20	-0.10	-0.03
1 year	0.13	0.26	0.43	-0.35	-0.22	-0.09	0.20	0.35	0.47	-0.31	-0.15	-0.03
2 year	0.20	0.38	0.62	-0.50	-0.30	-0.13	0.28	0.49	0.67	-0.43	-0.20	-0.03
3 year	0.22	0.44	0.71	-0.57	-0.34	-0.14	0.31	0.55	0.77	-0.49	-0.23	-0.03

Note: This table reports cumulative impulse response functions (in percentage point) of global inflation factor to positive one-standard deviation global shocks, based on the global FAVAR model that consists of oil price growth, and the global factors of inflation, output growth, and interest rates extracted from the dataset of G7 countries.

Table 3. Contributions of global shocks to global CPI inflation factor: 5-year windows

Time periods	Structural Shocks			
	Oil Price	Global Supply	Global Demand	Global Interest rate
Full period	**38.4** [12.9 66.9]	**17.6** [2.4 33.3]	**27.8** [4.5 59.5]	**16.2** [1.2 34.4]
1970-74	29.1	24.7	28.4	17.8
1975-79	24.7	28.4	25.5	21.4
1980-84	18.1	20.3	37.6	24.0
1985-89	30.3	16.1	33.9	19.7
1990-94	18.5	13.8	40.6	27.0
1995-99	27.0	19.5	27.3	26.1
2000-04	20.8	10.1	41.8	27.4
2005-09	31.7	8.8	34.6	24.9
2010-14	37.7	7.3	35.8	18.3
2015-19	37.8	10.0	35.2	18.1
2019-22	44.4	13.4	26.5	15.6

Note: The results are based on the global FAVAR model based on 5-year rolling windows. The estimates of variance decompositions (in percent) are based on 2-year forecasting horizon when the results mostly converge to the long-term level.

Table 4. Contributions of global shocks to alternative measures of global inflation

Sensitivity	Proxy variables	Structural Shocks			
		Oil Price	Global Supply	Global Demand	Global Interest rate
Baseline (Headline CPI)		**38.4** [12.9 66.9]	**17.6** [2.4 33.3]	**27.8** [4.5 59.5]	**16.2** [1.2 34.4]
Alternative Inflation Measures	Core CPI	6.9 [0.5 14.5]	41.1 [8.3 77.3]	25.7 [1.9 55.6]	26.4 [2.5 54.3]
	Producer price index	38.0 [12.4 68.9]	22.5 [3.0 42.2]	22.9 [3.4 48.5]	16.5 [1.5 35.7]

Note: This table reports variance decompositions of global inflation (in percent) based on median from 1000 successful Bayesian draws. The numbers in the brackets are 16-84 percentiles 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 of inflation, output growth, and interest rates from the dataset of G7 countries. "Alternative inflation measures" indicates that global inflation factor is replaced by either global core CPI inflation factor or global producer price index inflation factor.

Table 5. Contributions of global shocks to global inflation factor variation: robustness exercises

Sensitivity	Proxy variables	Structural Shocks			
		Oil Price	Global Supply	Global Demand	Global Interest rate
Baseline		**38.4 [12.9 66.9]**	**17.6 [2.4 33.3]**	**27.8 [4.5 59.5]**	**16.2 [1.2 34.4]**
Country sample	30 economies (unbalanced)	36.9 [13.7 61.5]	20.6 [3.7 40.9]	27.3 [6.0 52.9]	15.2 [1.8 31.8]
Commodity Prices	Real oil price	44.4 [14.4 69.6]	17.4 [3.2 32.5]	23.1 [4.1 48.4]	15.1 [1.1 30.4]
	Nominal energy price	44.6 [18.1 78.4]	17.2 [2.2 31.2]	27.4 [4.4 57.9]	10.8 [0.9 20.8]
	Sum of oil production and oil-specific demand	45.0 [8.2 78.9]	8.9 [0.9 24.1]	30.2 [5.8 53.4]	16.0 [1.3 37.2]
Global Output	Global economic activities index	35.6 [6.5 60.5]	8.5 [6.5 60.5]	34.1 [4.9 60.6]	21.8 [2.7 47.2]
	Global economic conditions index	41.6 [14.2 67.7]	17.1 [2.3 34.6]	24.1 [4.2 49.0]	17.3 [1.3 39.7]
Global Interest Rates	Weighted average of G7 interest rates	35.6 [10.4 62.7]	18.7 [2.3 37.7]	31.4 [6.8 63.7]	14.3 [0.6 30.6]
	Simple average of G7 interest rates	39.4 [15.2 64.5]	20.5 [2.0 38.6]	29.5 [5.1 54.3]	10.6 [0.9 22.5]
Global Factor Measures	Weighted average	34.7 [10.7 57.7]	19.7 [3.1 38.0]	27.8 [5.6 50.8]	17.8 [1.9 37.9]
	Simple average	34.0 [12.0 63.0]	25.0 [6.7 45.1]	27.9 [6.1 51.3]	13.0 [2.0 28.6]
Identification Scheme	Sign restriction	45.0 [19.6 71.9]	19.0 [3.8 35.8]	25.1 [6.0 49.9]	10.9 [0.8 20.8]
	Alternative narrative approach	36.7 [12.4 63.7]	17.5 [2.1 34.7]	28.6 [4.5 62.1]	17.1 [1.3 34.3]
	Additional narrative restriction	38.4 [12.9 66.9]	17.6 [2.4 33.3]	27.8 [4.5 59.5]	16.2 [1.2 34.4]

Note: This table reports variance decompositions of global inflation (in percent) based on various types of robustness exercises as explained in the paper. Variance decompositions are based on median from 1000 successful Bayesian draws. The numbers in the brackets are 16-84 percentiles draws. Oil production oil-specific demand shocks are estimated by Baumeister and Hamilton (2019). Global economic activity index and Global economic conditions index are monthly indicators on global economic activity, estimated by Baumeister and Hamilton (2019), Baumeister, Korobilis, and Lee

(2020), respectively. “Baseline” indicates the variance decompositions of global inflation based on the global FAVAR model that consists of oil price growth, and the global factors of inflation, output growth, and interest rates extracted from the dataset of G7 countries. “Alternative narrative restriction” indicates that narrative restrictions are imposed on the historical contribution of oil price shocks on oil prices. “Additional narrative restriction” indicates that an additional narrative restriction is imposed such that the structural oil price shock is positive in March 2022 when the Russian invasion of Ukraine resulted in disruptions in global oil productions. “Alternative sign restriction” indicates that sign restrictions are imposed two months over impulse responses of interest rates following the global shocks. All the other restrictions are same as the baseline sign restriction.

What Explains Global Inflation

Jongrim Ha, M. Ayhan Kose, Franziska Ohnsorge and Hakan Yilmazkuday[1]

December 2023

Supplemental Appendix

Not for Publication

This appendix contains:

Appendix A. A Dynamic General Equilibrium Model

Appendix B. Additional Figures and Tables

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Appendix A. A Dynamic General Equilibrium Model

A.1 Economic Environment

We present a simple dynamic general equilibirum model to motivate the sign restrictions used to identify the shocks in our FAVAR model. Since our objective is to study global (not national) inflation, we consider a closed-economy setup to represent the global economy. The model consists of individuals consuming oil and non-oil products, oil producing firms, non-oil producing firms, and a central bank employing monetary policy. The model dynamics are driven by bond accumulation. The model features are motivated by earlier studies such as by Blanchard and Gali (2007), Hou, Mountain, and Wu (2016), and Yilmazkuday (2014; 2021), and more broadly for demand- and supply-driven sources of business cycles and inflation fluctuations, with Smets and Wouters (2007) and Del Negro et al. (2013; 2022).[2]

A1.1 Households

Following Gali and Monacelli (2005), the representative household has the following standard intertemporal lifetime utility function:

$$E_t\left[\sum_{k=0}^{\infty}\beta^k\left\{\frac{(C_{t+k})^{1-\upsilon}}{1-\upsilon}-\frac{(N_{t+k})^{1+\varrho}}{1+\varrho}\right\}\right] \tag{A1}$$

where $\frac{(C_t)^{1-\upsilon}}{1-\upsilon}$ is utility out of consuming a composite index of C_t, υ is the inverse intertemporal elasticity of substituion, and $\frac{(N_t)^{1+\varrho}}{1+\varrho}$ is disutility out of supplying N_t hours of labor, with ϱ being the inverse elasticity of work effort with respect to labor, and $0 < \beta < 1$ is the discount factor.

Following Hou, Mountain, and Wu (2016), the composite index of C_t is described by:

$$C_t=\left((\gamma)^{\frac{1}{\theta}}(C_t^O)^{\frac{\theta-1}{\theta}}+(1-\gamma)^{\frac{1}{\theta}}(C_t^N)^{\frac{\theta-1}{\theta}}\right)^{\frac{\theta}{\theta-1}} \tag{A2}$$

where g is the share of oil in consumption, q is the elasticity of substitution between oil and non-oil consumption and C_t^O and C_t^N represent consumption indices of oil and non-oil products, respectively, which are formulated by:

$$C_t^O=\left(\int_0^1\left(C_t^O(i)\right)^{\frac{\eta-1}{\eta}}di\right)^{\frac{\eta}{\eta-1}} \tag{A3}$$

and

[2] Some previous studies develop general equilibrium models for a more data-intensive estimation for the United States that cannot be replicated for global inflation (Smets and Wouters 2007; Del Negro et al. 2013, 2022) or for a smaller number of shocks than considered here (Clarida, Gali, and Gertler 1999; Woodford 2001).

$$C_t^N = \left(\int_0^1 \left(C_t^N(i)\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}} \quad \text{(A4)}$$

where $C_t^O(i)$ and $C_t^N(i)$ represent varieties of oil and non-oil products, respectively, and *h* is the elasticity of substitution across varieties.[3]

The optimization across C_t^O and C_t^N results in the following demand functions:

$$C_t^O = \gamma \left(\frac{P_t^O}{P_t}\right)^{-\theta} C_t \quad \text{(A5)}$$

and

$$C_t^N = (1-\gamma) \left(\frac{P_t^N}{P_t}\right)^{-\theta} C_t \quad \text{(A6)}$$

where P_t^O and P_t^N represents prices per unit of C_t^O and C_t^N, respectively, that satisfy the following expression for consumer price index (CPI):

$$P_t = \left(\gamma(P_t^O)^{1-\theta} + (1-\gamma)(P_t^N)^{1-\theta}\right)^{\frac{1}{1-\theta}} \quad \text{(A7)}$$

Similarly, the optimization across varieties of each good results in the following demand functions:

$$C_t^O(i) = \left(\frac{P_t^O(i)}{P_t^O}\right)^{-\eta} C_t^O \quad \text{(A8)}$$

and

$$C_t^N(i) = \left(\frac{P_t^N(i)}{P_t^N}\right)^{-\eta} C_t^N \quad \text{(A9)}$$

where $P_t^O(i)$ and $P_t^N(i)$ represents prices per unit of $C_t^O(i)$ and $C_t^N(i)$, respectively, that satisfy:

$$P_t^O = \left(\int_0^1 \left(P_t^O(i)\right)^{1-\eta} di\right)^{\frac{1}{1-\eta}} \quad \text{(A10)}$$

and

$$P_t^N = \left(\int_0^1 \left(P_t^N(i)\right)^{1-\eta} di\right)^{\frac{1}{1-\eta}} \quad \text{(A11)}$$

The household budget constraint is given by:

$$P_t C_t + E_t\left[F_{t,t+1} D_{t+1}\right] = W_t N_t + D_t + T_t \quad \text{(A12)}$$

[3] Our consumption framework is similar to models in earlier studies such as by Blanchard and Gali (2007), where consumption is based on domestically produced goods and imported oil.

where D_{t+1} is the nominal pay-off in period $t+1$ of the bond portfolio held at the end of period t (which includes shares in firms), $F_{t,t+1}$ is the stochastic discount factor for one-period ahead nominal pay-offs, W_t is the wage rate, and T_t is the lump sum transfer of profits of non-oil and oil producers.

The household maximizes its expected utility subject to its budget constraint (by choosing C_t, N_t, D_{t+1}, and F_{t+1} for all t), which results in the standard intertemporal Euler equation for total real consumption:

$$\beta E_t\left[\left(\frac{C_{t+1}}{C_t}\right)^{-\upsilon}\left(\frac{P_t}{P_{t+1}}\right)\right]=\frac{\exp(\tau_t)}{I_t} \tag{A13}$$

where $\frac{I_t}{\exp(\tau_t)}=\frac{1}{E_t[F_{t,t+1}]}$ is the gross return on bonds, with $\exp(\tau_t)$ representing the inverse risk premium (i.e., the difference between the return on bonds and the policy rate controlled by the monetary authority) as in Yilmazkuday (2021).[4] The optimization also implies the following first order condition:

$$(C_t)^{\upsilon}(N_t)^{\varrho}=\frac{W_t}{P_t} \tag{A14}$$

which corresponds to a positively sloped labor supply curve.

A1.2 Firms

Firms (represented by i's) produce varities of oil or non-oil products according to the following functions:

$$Y_t^O(i)=Z_t^O N_t^O(i) \tag{A15}$$

and

$$Y_t^N(i)=Z_t^N N_t^N(i) \tag{A16}$$

where $\boldsymbol{Y_t^O(i)}$ and $\boldsymbol{Y_t^N(i)}$ represent output, $\boldsymbol{Z_t^O}$ and $\boldsymbol{Z_t^N}$ represent productivity, and $\boldsymbol{N_t^O(i)}$ and $\boldsymbol{N_t^N(i)}$ represent labor employed in the production of oil and non-oil products, respectively. The cost minimization of firms results in the marginal cost of production, whereas the profit maximiation of firms in a staggered fashion as in Calvo (1983) results in the optimal prices set.

A1.3 Market Clearing

Market clearing conditions at the variety level are given by $Y_t^O(i)=C_t^O(i)$ and $Y_t^N(i)=C_t^N(i)$ for oil and non-oil products, respectively. Similar to Gali and Monacelli (2005), we define aggregate output Y_t as follows:

$$Y_t=\left((\gamma)^{\frac{1}{\theta}}(Y_t^O)^{\frac{\theta-1}{\theta}}+(1-\gamma)^{\frac{1}{\theta}}(Y_t^N)^{\frac{\theta-1}{\theta}}\right)^{\frac{\theta}{\theta-1}} \tag{A17}$$

[4] We simply consider consumption shocks as shocks to the risk premium or changes in households' assessment of uncertainty. Alternatively, they could be modelled as preference shocks, but these do not lead to any material change in impulse responses.

where aggregations across varieties are given by $Y_t^O = \left(\int_0^1 \left(Y_t^O(i)\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}}$ and $Y_t^N = \left(\int_0^1 \left(Y_t^N(i)\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}}$. At the aggregate, total output is equal to total consumption ($Y_t = C_t$).

The labor market clearing condition is given by $\int_0^1 N_t^O(i)di + \int_0^1 N_t^N(i)di = N_t$, where total labor demand coming from firms is satisfied by total labor supply by households. [5]

A1.4 Inflation

We assume that prices of varieties are set in a staggered fashion as in Calvo (1983). Accordingly, similar to Gali and Monacelli (2005), we can then obtain the following pricing strategies for oil and non-oil producing firms:

$$\pi_t^O = \beta E_t[\pi_{t+1}^O] + \lambda m_t^O \quad \text{(A18)}$$

and

$$\pi_t^N = \beta E_t[\pi_{t+1}^N] + \lambda m_t^N \quad \text{(A19)}$$

where lower-case letters represent log deviations from the steady-state, $\pi_t^O = p_t^O - p_{t-1}^O$ is the inflation of oil products, $\pi_t^N = p_t^N - p_{t-1}^N$ is the inflation of non-oil products, $E_t[\pi_{t+1}^O]$ and $E_t[\pi_{t+1}^N]$ are future expected inflation rates for oil and non-oil products, respectively, $m_t^O = w_t - p_t^O - z_t^O$ is the log real marginal cost of oil products, $m_t^N = w_t - p_t^N - z_t^N$ is the log real marginal cost of non-oil products, and $\lambda = \frac{(1-\alpha)(1-\alpha\beta)}{\alpha}$ with $(1-\alpha)$ representing the probability of changing prices for each variety.

We log-linearize Equation (7) resulting in $\pi_t = \gamma\pi_t^O + (1-\gamma)\pi_t^N$. This then implies the following expression for CPI inflation:

$$\pi_t = \beta E_t[\pi_{t+1}] + \lambda(\gamma m_t^O + (1-\gamma)m_t^N) \quad \text{(A20)}$$

which is a function of future expected inflation rate as well as changes in real marginal costs of oil and non-oil products.

---

[5] This condition can be rewritten as $\frac{Y_t^O X_t^O}{Z_t^O} + \frac{Y_t^N X_t^N}{Z_t^N} = N_t$, where $X_t^O = \int_0^1 \frac{Y_t^O(i)}{Y_t^O} di$ and $X_t^N = \int_0^1 \frac{Y_t^N(i)}{Y_t^N} di$. Considering $Y_t^O = \left(\int_0^1 \left(Y_t^O(i)\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}}$ and $Y_t^N = \left(\int_0^1 \left(Y_t^N(i)\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}}$, the log-linearized version of this condition is implied as $\frac{N^O}{N}(y_t^O - z_t^O) + \frac{N^N}{N}(y_t^N - z_t^N) = n_t$, where $\frac{N^O}{N}$ and $\frac{N^N}{N}$ are steady-state shares of labor used by oil versus non-oil producers. When $\frac{N^O}{N} = \gamma$, it is further implied due to $Y_t = \left((\gamma)^{\frac{1}{\theta}}(Y_t^O)^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}}(Y_t^N)^{\frac{\theta-1}{\theta}}\right)^{\frac{\theta}{\theta-1}}$ that $y_t = z_t + n_t$, where $z_t = \gamma z_t^O + (1-\gamma)z_t^N$.

A1.5 Monetary Policy

Following Gali and Monacelli (2005), the model is closed by the following CPI inflation-based monetary policy rule (in log-linearized form):

$$i_t = \chi_p \pi_t + \mu_t^i \tag{A21}$$

where i_t is the log deviation of the interest rate (I_t) from its steady-state value, and μ_t^i represents deviations from monetary policy rule.[6]

A1.6 Shocks

Similar to our FAVAR framework, the model includes four shocks. A supply shock ε_t^N shifts the non-oil production function of equation (A16), a demand shock ε_t^τ shifts consumption preferences of equation (A13), a monetary policy (interest rate) shock ε_t^i shifts the monetary policy rule in equation (A21), and an oil price shock ε_t^O shifts the oil production function of equation (A15).

A positive supply shock ε_t^N is represented by the following formulation:

$$z_t^N = \rho^N z_{t-1}^N + \varepsilon_t^N \tag{A22}$$

where z_t^N is the log deviation of non-oil productivity from its steady state value. Therefore, a positive supply shock is represented by a positive non-oil productivity shock in the economic model.

A positive demand shock ε_t^τ is represented by the following expression:

$$\tau_t = \rho^\tau \tau_{t-1} + \varepsilon_t^\tau \tag{A23}$$

where τ_t is the log deviation of the inverse risk premium $\exp(\tau_t)$ from its steady state value. Therefore, a decline in the risk premium corresponds to a positive demand shock, similar to Yilmazkuday (2021).

A positive monetary policy (interest rate) shock ε_t^i is represented by the following expression:

$$\mu_t^i = \rho^i \mu_{t-1}^i + \varepsilon_t^i \tag{A24}$$

where μ_t^i represents error term in the log-linearized monetary policy rule of equation (A21).

A positive oil price shock $(-\varepsilon_t^O)$ is represented by the following expression:

$$z_t^O = \rho^O z_{t-1}^O - \varepsilon_t^O \tag{A25}$$

[6] We also considered an alternative monetary policy function that includes output, $i_t = \chi_p \pi_t + \chi_y y_t + \mu_t^i$, and the results were broadly similar to those we report here.

where z_t^O is the log deviation of oil productivity from its steady state value. This implies that a positive oil price shock is associated wit a negative productivity shock in the oil sectormodel.[7]

A2 Simulation of the Model

A2.1 Log-linearized Equations

The following log-linearized equations are used to solve the model.

$$y_t = c_t \tag{A26}$$

$$c_t = E_t[c_{t+1}] - \frac{1}{\upsilon}(i_t - E_t[\pi_{t+1}] - \tau_t) \tag{A27}$$

$$\upsilon c_t + \varrho n_t = w_t - p_t \tag{A28}$$

$$\pi_t^O = \beta E_t[\pi_{t+1}^O] + \left(\frac{(1-\alpha)(1-\alpha\beta)}{\alpha}\right) m_t^O \tag{A29}$$

$$\pi_t^N = \beta E_t[\pi_{t+1}^N] + \left(\frac{(1-\alpha)(1-\alpha\beta)}{\alpha}\right) m_t^N \tag{A30}$$

$$\pi_t = p_t - p_{t-1} \tag{A31}$$

$$\pi_t^O = p_t^O - p_{t-1}^O \tag{A32}$$

$$\pi_t^N = p_t^N - p_{t-1}^N \tag{A33}$$

$$\pi_t = \gamma \pi_t^O + (1-\gamma)\pi_t^N \tag{A34}$$

$$m_t^O = w_t - p_t^O - z_t^O \tag{A35}$$

$$m_t^N = w_t - p_t^N - z_t^N \tag{A36}$$

$$i_t = \chi_p \pi_t + v_t^i \tag{A37}$$

$$z_t^N = \rho^N z_{t-1}^N + \varepsilon_t^N \tag{A38}$$

$$\tau_t = \rho^\tau \tau_{t-1} + \varepsilon_t^\tau \tag{A39}$$

$$\mu_t^i = \rho^i \mu_{t-1}^i + \varepsilon_t^i \tag{A40}$$

$$z_t^O = \rho^O z_{t-1}^O - \varepsilon_t^O \tag{A41}$$

where ε_t^N, ε_t^τ, ε_t^i, and ε_t^O represent supply, demand, interest rate, and oil-price shocks.

[7] Other studies such as Smets and Wouters (2007) and Del Negro et al. (2022) treat oil price shocks as mark-up shocks, which similarly raise inflation and reduce labor demand and output.

A2.2 Calibration

The calibration of the model parameters follows the previous studies. Specifically, the following standard parameter values are used in the model simulation, as in Gali and Monacelli (2005) and Hou, Mountain, and Wu (2016):

$\beta = 0.99$	$\alpha = 0.75$	$\upsilon = 1$	$\varrho = 1$	$\gamma = 0.5$
$\chi_p = 2.5$	$\rho^i = 0.7$	$\rho^N = 0.9$	$\rho^\tau = 0.9$	$\rho^O = 0.9$

A2.3 Impulse Responses

The model is solved for the impulse responses of CPI inflation (π_t), output (y_t), interest rate (i_t), and oil price growth (π_t^O) to global supply, demand, interest rate, and oil price shocks.

A positive supply shock (ε_t^N). This shock reduces inflation while increasing output and oil prices on impact in the model (Figure A4). These findings motivate the sign restrictions employed to indentify supply shocks in our FAVAR setup. In the model, a positive supply shock—that is, an increase in productivity—reduces the marginal cost of non-oil products, which is reflected in falling inflation and rising aggregate output. Since higher productivity also drives up wages, the oil price (which includes wages as a factor of production) rises as well.[8] Although not part of the FAVAR restrictions, the model impulse responses suggest that monetary policy responds to the decline in inflation with a lowering of interest rates.

A positive demand shock (ε_t^τ). As is evident, this shock increases all variables (Figure A5). These impulse responses motivate the sign restrictions used to identify demand shocks in our FAVAR model. A positive demand shock increases consumption, and thus, output and inflation. Monetary policy reacts to this development by raising interest rates. Finally, higher consumption also puts pressure on oil prices.

A positive interest rate shock (ε_t^i). This shock reduces inflation and output but it increases the interest rate (Figure A6). A contractionary monetary policy that increases the interest rate depresses consumption demand which, in turn, lowers both inflation and output. These impulse responses motivate the sign restrictions used to idetify interest rate shocks in our empirical model. Although it is not assumed in our sign restrictions in the FAVAR model, demand for oil also declines, which is reflected in lower oil prices.

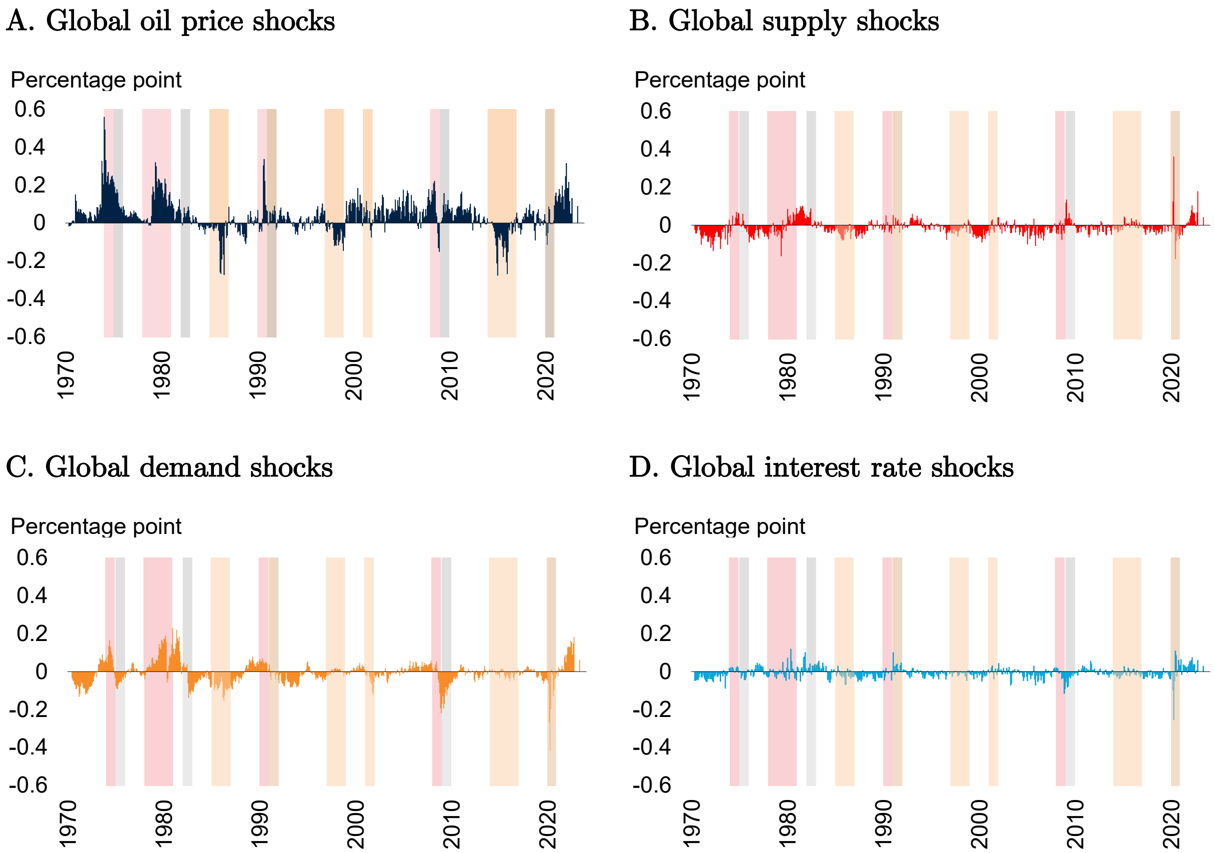
A positive oil price shock (ε_t^O). This shock increases oil prices and inflation, and reduces output (Figure A7). These model-based results are consistent with the sign restrictions to

[8] The impulse responses of oil prices to supply shocks are positive up to five periods and then turn negative in the long run. The results suggest that the propagation of supply (productivity) shocks into oil prices operates through multiple channels. The initially positive responses, for instance, may reflect the increases in oil prices due to higher productivity (and increased wage, consumption, and demand for oil products), while the negative responses can reflect cost-push channels due to lower general inflation and spillovers from the non-oil sector.

identify oil price shocks in our FAVAR model. A positive oil price shock—which corresponds to a negative productivity shock in the oil sector—increases CPI inflation arithmetically, because the oil price is a part of the aggregate consumer price, but reduces output. Although it is not a part of our sign restrictions in the FAVAR model, monetary policy reacts to the oil-induced increase in inflation with an interest rate increase .

Appendix B. Additional Figures and Tables

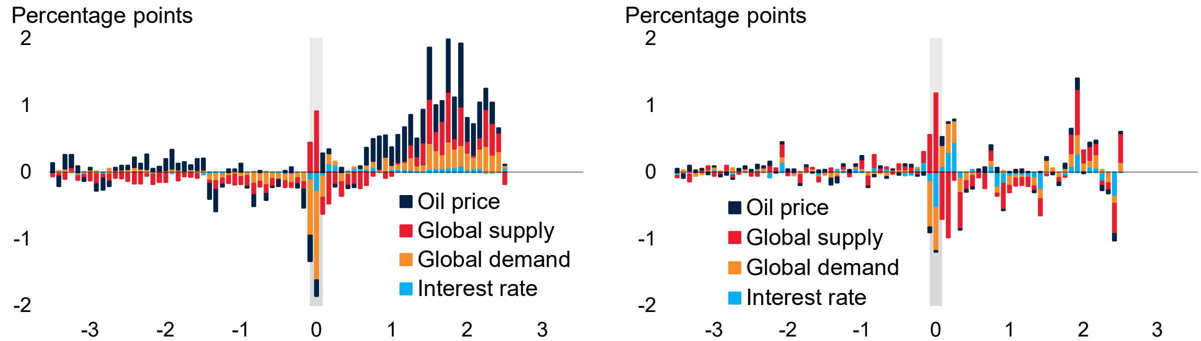
Figure A1. Historical decompositions of global inflation



Note: The structural shocks are estimated with the global FAVAR model. Grey-shaded areas indicate global recessions (1975, 1982, 1991, 2009, and 2020) and red-shaded areas indicate periods of oil price spikes (1974, 1978-80, 1990, 2008). Orange-shaded areas indicate periods of oil price plunges (1985-86, 1990-91, 1997-98, 2001, 2007-09, 2014-16, and 2020).

Figure A2. Historical contributions of global shocks around 2020 global recession

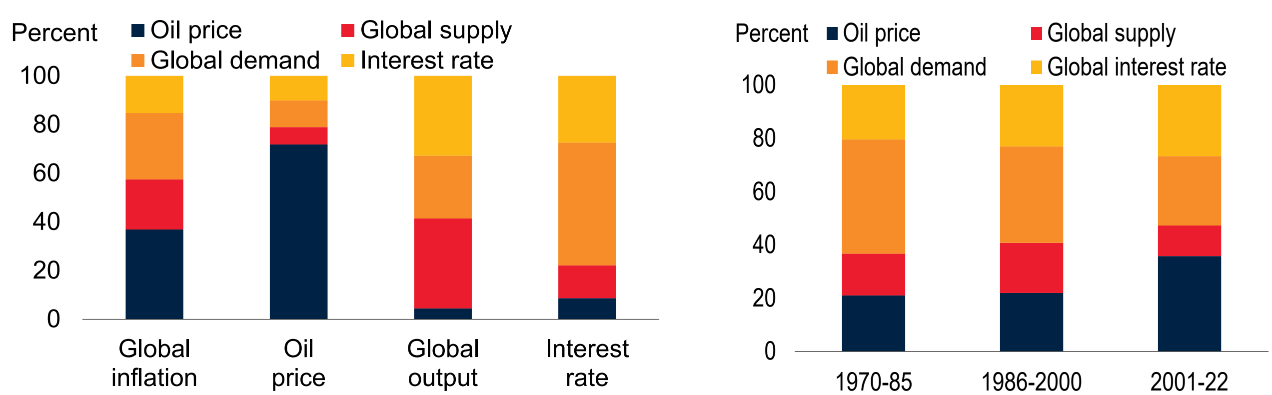
A. Global PPI inflation **B. Global core CPI inflation**



Note: Historical contributions of the structural shocks to global PPI (A) and core CPI (B) inflation, estimated using global FAVAR model. The trough of the global 2020 recession is 2020 Q2. Horizontal axes indicate years before and after the troughs of global recessions (shaded area, t=0).

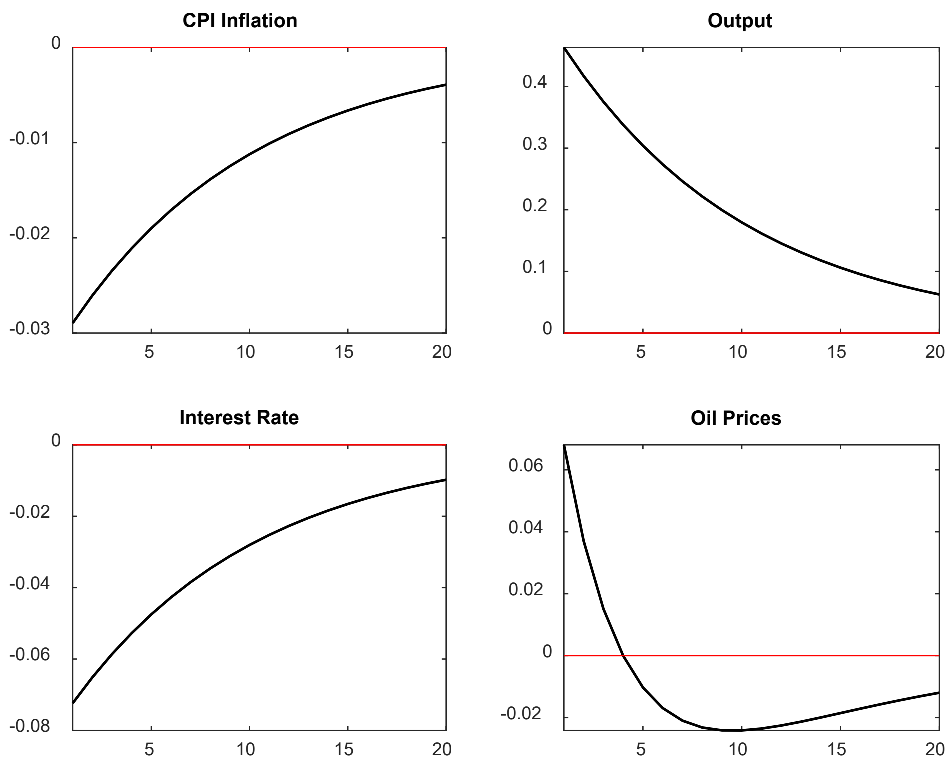
Figure A3. Contributions of global shocks to global inflation: Alternative country group (30 countries)

A. Variance decompositions of global inflation, output, oil price, and interest rates: 1970-2022 **B. Variance decompositions of global inflation over time**



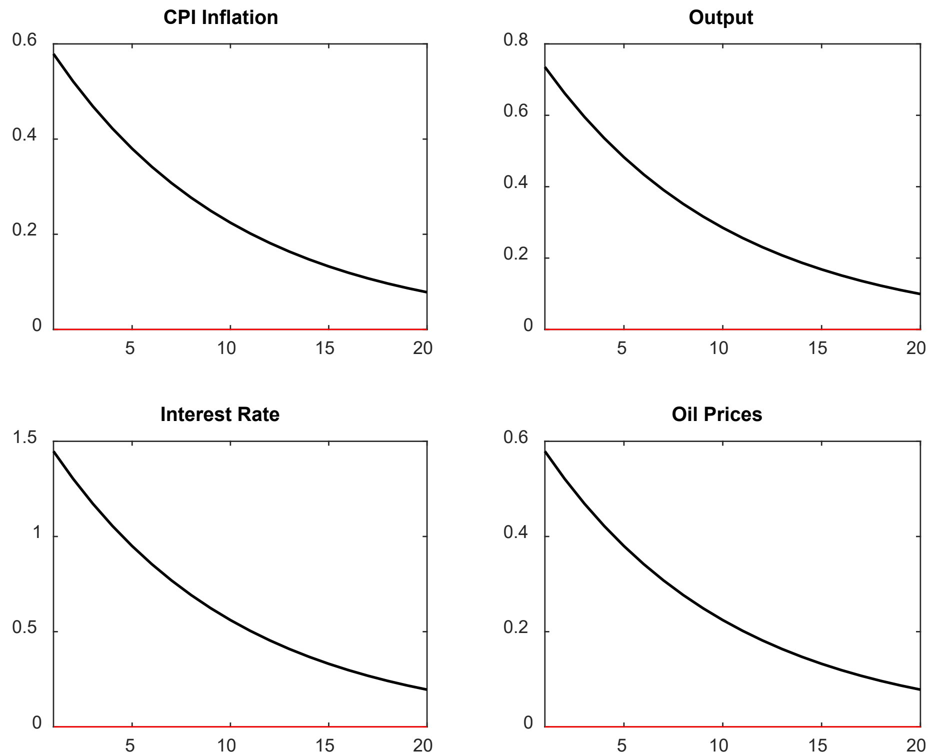
Notes: The results are based on the global FAVAR model using national inflation, output growth, and interest rates (1st differenced), respectively, in 30 countries and global oil price growth. The variables are based on month over month (seasonally adjusted). The FAVAR model specification and identification strategy are the same as the baseline estimation using G7 countries.

Figure A4. Impulse Responses to a Positive Supply Shock



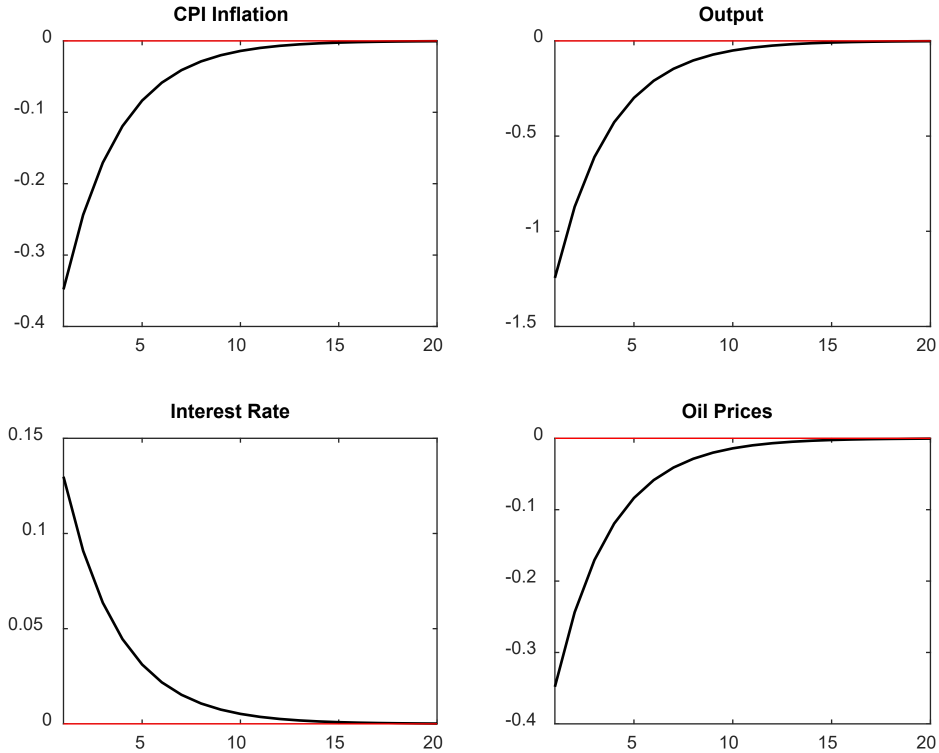
Notes: The impulse responses are based on the economic model introduced in the Appendix A. The impulse responses follow a one-standard deviation of a positive supply shock.

Figure A5. Impulse Responses to a Positive Demand Shock



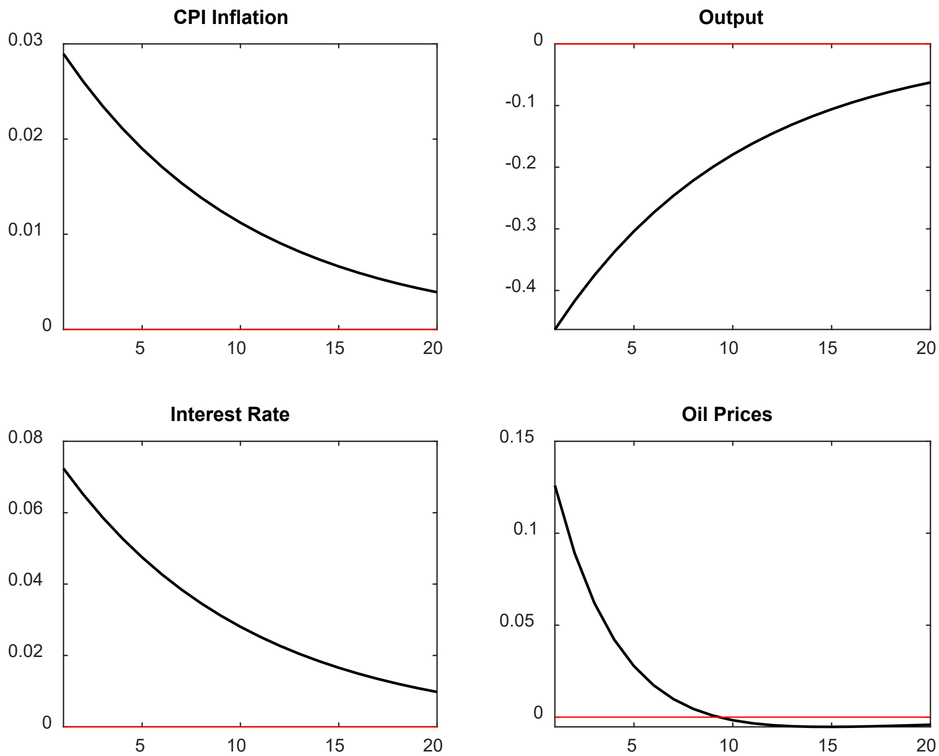
Notes: The impulse responses are based on the economic model introduced in the Appendix A. The impulse responses follow a one-standard deviation of a positive demand shock.

Figure A6. Impulse Responses to a Positive Interest Rate Shock



Notes: The impulse responses are based on the economic model introduced in the Appendix A. The impulse responses follow a one-standard deviation of a positive interest rate shock.

Figure A7. Impulse Responses to a Positive Oil Price Shock



Notes: The impulse responses are based on the economic model introduced in the Appendix A. The impulse responses follow a one-standard deviation of a positive oil price shock.

Table A1. Narrative sign restrictions

A. Episodes of positive oil price shocks

Date	Episode	Sign restriction violation rate
1973.10-1974.3	Yom Kippur war	1.5
1978.12-1979.1	Iranian revolution	0.1
1980.10-1981.3	Iran-Iraq war	32.7
1990.8-10	Iraq s invasion of Kuwait	0.1
2002.12	Venezuela oil strike	0.1

B. Episodes of negative oil price shocks

Date	Episode	Sign restriction violation rate
1986.2	OPEC production target increase	1.3
1998.2	Asian currency crisis and OPEC production expansion	8.6
2015.1	Surging U.S. shale oil production, receding geopolitical risks	0.3
2020.3	COVID-19 pandemic, price war between Saudi Arabia and Russia	79.8

Note: This table indicates the list of historical events of large oil price shocks based on Hamilton (2011), Baffes et al (2015), Wheeler et al (2020), Kabundi and Ohnsorge (2020), and Antolin-Diaz and Rubio-Ramirez (2018). The last column presents the probability of draws that violate the narrative restrictions when the standard sign restrictions are imposed in identifying the oil price shocks.

Table A2. Variance decompositions of global factors

	Global Inflation factor			Global output growth factor			Global interest rate factor		
	16%	**Median**	**84%**	**16%**	**Median**	**84%**	**16%**	**Median**	**84%**
Canada	26.0	30.1	34.4	33.5	36.4	39.1	53.8	63.3	73.9
France	46.0	52.8	58.1	51.3	54.6	58.0	11.0	14.9	20.7
Germany	14.7	17.5	20.2	42.6	45.5	48.5	11.2	15.2	21.2
Italy	18.4	21.6	24.7	20.7	23.2	25.5	2.5	4.2	7.1
Japan	8.0	10.1	12.5	8.8	10.5	12.5	1.6	2.9	5.0
United Kingdom	20.7	24.5	28.5	46.2	49.2	51.9	7.7	10.6	14.4
United States	35.4	40.9	46.5	46.7	49.7	53.4	41.4	48.4	54.7
Average	**24.2**	**28.2**	**32.1**	**35.7**	**38.4**	**41.3**	**18.5**	**22.8**	**28.1**

Note: Global output growth factor, global interest rate factor, and global inflation factor are extracted from de-trended national industrial production growth rates, short-term interest rates (1^{st} differenced), and inflation rates in G7 countries, respectively, using a dynamic factor model.

Table A3. Contributions of global shocks to alternative measures of global inflation: over time

	Oil Price Shock	Global Supply Shock	Global Demand Shock	Interest Rate Shock
Headline CPI inflation				
1970-1985	20.5	25.1	35.9	18.6
1986-2000	19.8	24.8	35.9	19.5
2001-2022	43.7	12.5	21.4	22.4
Producer Price Index Inflation				
1970-1985	26.5	18.8	30.3	24.2
1986-2000	22.6	14.1	42.2	21.0
2001-2022	41.7	14.9	24.6	18.8
Core CPI inflation				
1970-1985	23.9	24.7	32.3	19.7
1986-2000	5.2	32.5	38.0	24.3
2001-2022	29.2	30.6	13.9	26.4

Note: This table reports the evolution of variance decompositions of three global inflation measures based on median from 1000 successful Bayesian draws. The global FAVAR model that consists of oil price growth, and the global factors of inflation, output, and interest rates extracted from the dataset of G7 countries.

Table A4. Contributions of global shocks to alternative measures of global inflation: Robustness checks

Sensitivity	Proxy variables	Structural Shocks			
		Oil Price	Global Supply	Global Demand	Global Interest rate
Core CPI	**Baseline**	**6.9 [0.5 14.5]**	**41.1 [8.3 77.3]**	**25.7 [1.9 55.6]**	**26.4 [2.5 54.3]**
	Global Factor Measures (Simple average of G7)	11.9 [1.7 25.0]	41.9 [11.7 65.9]	25.5 [2.9 55.8]	20.7 [1.9 45.4]
	Global Factor Measures (US variable)	17.9 [0.8 32.9]	38.5 [8.0 71.3]	23.2 [4.6 43.1]	20.4 [1.0 44.6]
	Alternative narrative approach	13.7 [1.8 28.7]	40.9 [8.7 73.4]	18.1 [1.0 35.5]	27.3 [3.5 54.6]
Producer price index	**Baseline**	**38.0 [12.4 68.9]**	**22.5 [3.0 42.2]**	**22.9 [3.4 48.5]**	**16.5 [1.5 35.7]**
	Global Factor Measures (Simple average)	39.2 [10.9 73.7]	19.0 [2.1 40.2]	27.6 [3.7 61.0]	14.2 [0.9 28.5]
	Global Factor Measures (US variable)	30.1 [11.4 51.4]	21.6 [3.8 41.3]	26.0 [2.3 53.0]	22.3 [1.8 47.3]
	Alternative narrative approach	37.8 [12.5 68.5]	21.5 [2.7 41.6]	22.3 [2.8 47.9]	18.4 [1.6 37.1]

Note: This table reports variance decompositions of global core CPI and PPI inflation (in percent) based on various types of robustness exercises as explained in the paper. Variance decompositions are based on median from 1000 successful Bayesian draws. The numbers in the brackets are 16-84 percentiles 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 of inflation, output growth, and interest rates extracted from the dataset of G7 countries. "Alternative narrative restriction" indicates that narrative restrictions are imposed on the historical contribution of oil price shocks on oil prices.