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Abstract

We study the impact of fluctuations in global oil prices on domestic inflation using an unbalanced panel of 72 advanced and developing economies over the period from 1970 to 2015. We find that a 10 percent increase in global oil inflation increases, on average, domestic inflation by about 0.4 percentage on impact, with the effect vanishing after two years and being similar between advanced and developing economies. We also find that the effect is asymmetric, with positive oil price shocks having a larger effect than negative ones. The impact of oil price shocks, however, has declined over time due in large part to a better conduct of monetary policy. We further examine the transmission channels of oil price shocks on domestic inflation during the recent decades, by making use of a monthly dataset from 2000 to 2015. The results suggest that the share of transport in the CPI basket and energy subsidies are the most robust factors in explaining cross-country variations in the effects of oil price shocks during the this period.

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* The opinions expressed herein are those of the authors and do not necessarily reflect those of the IMF, its member countries or its policy. The usual disclaimer applies and any remaining errors are the authors' sole responsibility.

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1. INTRODUCTION

How large is the effect of oil price shocks on domestic inflation? Which structural factors or policy frameworks govern the size of inflationary effect of oil price shocks? These questions have drawn a lot of new attention since the recent experience of oil price swings. Despite its relevance for both academics and policymakers, only limited effort has been made to answer these questions in a systematic way. Moreover, mainly due to the data availability, most of prior research focused on advanced economies, leaving out potential heterogeneity between advanced and emerging/developing economies.[6] We fill in the gap in the literature by providing a systematic analysis of the effect of global oil price shocks on domestic inflation covering both advanced and developing economies for sufficiently long time. Moreover, we examine the potential structural factors or policy frameworks that explain the cross-country and over-time differences in their effect.

Figure 1 shows fluctuations in real global oil prices from January 1970 to June 2017. The 1970s can be characterized by two oil crises that resulted in high inflation around the world.[7] Later then, there was a downward trend in oil prices in the 1980s that coincided with the beginning of the Great Moderation. A temporary spike in oil prices in the 1990s is due to the Persian Gulf crises. In the 2000s, however, oil prices steadily rose with a sharp spike in 2008, followed by an even larger decline in 2009 and a rebound thereafter. Elevated volatility in these developments has raised concerns that oil prices could again spill over into higher overall inflation. In the fourth quarter of 2014, however, global oil prices fell sharply again, and remained low since then, raising deflationary pressures on headline inflation in most economies. Given the unprecedented volatility in global oil prices since 2000, we pay special attention to this period with the availability of higher frequency data of disaggregated consumer price index (CPI).

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[6] In the remainder of the paper, we refer to 'emerging market and developing economies' simply as 'developing economies'.

[7] Because real oil prices were fairly constant up to the early 1970s, we begin our analysis from 1970. We obtain real oil prices by adjusting West Texas Intermediate Crude Oil Prices by the U.S. CPI.

Against this context, this paper carries out an empirical exploration of the following questions:

- What role have global oil price movements played in shaping domestic inflation since the 1970s?
- Has the impact of the global oil price shocks changed over time? If so, which factors have accounted for this change?
- Did the impact of the oil price shocks differ across advanced and emerging and developing economies and which factors explain cross-countries differences?

Our main results can be summarized as follows:

- A 10 percent increase in global oil inflation increases, on average, domestic inflation by about 0.4 percentage at impact. The effect is short-lasting—vanishing two years after the shock—, similar between advanced and developing economies and tends to be larger for positive oil price shocks than for negative ones.
- The impact of oil price shocks on domestic inflation has declined over time due in large part to a better conduct of monetary policy.
- Over the last 15 years, the effect of oil price shocks on headline inflation has been similar, on average, between advanced and developing economies. At the same time, there is a large heterogeneity in the magnitude of pass-through within each country groups, with the share of transport in the CPI basket and energy subsidies being the most robust factors explaining this heterogeneity.

The rest of the paper is organized as follows. Section 2 reviews the related literature. Section 3 provides a brief description of the two datasets use in the analysis. Section 4 provides evidence from annual data on the average impact of global oil prices on inflation and how the impact has changed over time.[8] Section 5 studies cross-countries differences in the effect oil price shocks using monthly data. Section 6 concludes.

2. Related literature

This section does not aim to provide a thorough literature review on studies that assess the impact of oil price shocks on inflation; rather it summarizes previous work that focuses on assessing the impact of oil price shocks on inflation using international data. Although a large body of literature has analyzed structural factors explaining the magnitude of effects of oil price shocks on inflation, the results are mixed.

By estimating augmented Phillips curves on quarterly data from the United States, United Kingdom, France, Germany, and Japan on the period 1980Q1 to 2001Q4, LeBlanc and Chinn () find that a 10 percent increase in oil price leads to direct inflationary increases of about 0.1-0.8 percentage points in these countries and there is no significant difference in the pass-through between U.S. and the E.U. By extending this framework to 19 advanced economies, Chen (2009) finds that a 10 percent increase in oil prices increases the overall price level by approximately 0.05 percent after one-quarter. He concludes that the effect has declined over time, and attributes this decline to improvements in the conduct of monetary policy and higher trade openness.

De Gregorio et al. (2007) also provide evidence of a decreased pass-through from oil prices to domestic inflation from estimating augmented Phillips curves using data from both advanced and developing economies. They find that the decline in the pass-through is more pronounced in advanced economies and attribute this decline to a reduction in oil intensity and the degree of exchange rate pass-through. Habermeier et al. (2009) estimate the panel data of 50 countries for the period 2007-08 and find that the role of monetary policy is important in determining the size of pass-through of food and oil price shocks. They find that a country with greater central bank independence and inflation targeting regime tends to have lower pass-through. On the other hand, Álvarez et al. (2011) find that the direct effects of oil price increases on inflation have increased over time in the Euro area due to the higher expenditure share of

[8] For an earlier empirical exploration of this kind, see Loungani and Swagel (2001).

households on refined oil products, whereas their indirect and second-round effects have decreased.

Using Vector Autoregressions, Zoli (2009) and Caceres et al. (2012) study the impact of commodity price shocks on inflation in Emerging Europe and Central Africa, respectively. Whereas relative prices to EU-15 countries are an important factor in explaining the response of inflation to commodity price shocks in Emerging Europe (see also IMF, 2015), price controls play an important role in Central Africa. These findings imply that the responses of domestic inflation to global oil price shocks in developing economies can be influenced by region-specific factors.

Recently, Gelos and Ustyugova (2017) estimate country-by-country augmented Phillips curves using data from both advanced and developing economies for the period between 2000 and 2010. Different from other studies, their analysis suggests that high fuel intensities and pre-existing inflation levels are the only significant factors explaining cross-country differences in the effects of food and oil price shocks. The conduct of monetary policy, including the existence of inflation targeting regimes, does not seem to be a major determinant of the degree of pass-through.

Another strand of the related literature studies time-varying effects of oil price shocks on the economy, including inflation dynamics. This literature has emphasized that the underlying sources of oil price changes are critical determinants of their macroeconomic effects. For example, Kilian (2009), Peersman and Van Robays (2012), and Baumeister and Peersman (2013) show that the effect of oil price increases has different effects on real GDP and inflation whether they are driven by negative supply shocks or positive demand shocks. According to their decomposition, the oil price shocks of the 1970s are mainly attributed to exogenous shortfalls in oil production (negative supply shocks), while the prolonged build-up in oil prices that started in 1999 is mainly driven by shifts in the demand for crude oil (positive demand shocks). Similarly to the approaches used to study the cause of the Great Moderation (e.g., Gali, and Gambetti, 2009), we can test whether changes in the relative size of structural shocks over time simply drove the declined response of overall inflation to oil price.

3. DATA

To assess how oil price shocks have historically affected domestic CPI inflation over time and across advanced and developing economies, ideally one would have data that covers both groups of countries for a long period at a high frequency. Unfortunately, this is not the case. Data for developing economies are not readily available, do not extend back in time, and there are issues of quality. We try to make a virtue of necessity by assembling two datasets that, taken together, do give us the ability to look at these issues.

The first dataset has annual data going back to the 1970s. It has a long coverage for most advanced economies, but a shorter coverage for many developing economies. The second dataset has monthly data since the 2000s and covers a large group of advanced and developing economies; data quality for the latter group remains an issue but is perhaps less acute than data for earlier decades. We use the first dataset to see how the impact of global oil prices on inflation has changed over time and whether it differs between advanced economies and developing economies. The second dataset is helpful in understanding the channels of transmission during the most recent period of high oil price volatility.

The annual dataset covers 72 countries. Table 1 provides summary statistics on domestic CPI inflation, global oil inflation, and the measures of the oil share in the CPI basket used in the empirical analysis. Tables A.1 and A.2 in the Appendix presents the sources of data used in the analysis and detailed summary statistics for every country in the sample. As purely an illustration of the basic properties of the data, Figure 2 shows a scatter plot of average CPI inflation and average global oil inflation at the country level, which suggests a modest positive correlation (0.21) between the two. Table A.3 in the appendix lists the summary statistics of the second dataset. This dataset consists of monthly data on the CPI and nominal exchange rates for 34 advanced economies and 37 developing economies over the period 2000–13.

4. Global oil prices and inflation: results from annual data

4.1 Channels and estimation method

This section outlines the channels through which global oil prices can affect inflation, which motivates the following estimation strategy.

Let P_t denote the headline CPI, which can be expressed as:

$$P_t = P_t^N w_t^{\delta}, \quad (1)$$

where $w_t = P_t^O / P_t^N$ is the ratio of oil to non-oil price index; δ the share of oil in the CPI basket; O and *N* stand for oil and non-oil, respectively. Taking logs and first differences of Equation (1), headline inflation can then be written as:

$$\pi_t = \pi_t^N + \delta \Delta log w_t. \quad (2)$$

Equation (2) illustrates how global oil prices can affect headline inflation. The first, direct, effect is through changes in the log of the ratio of oil to non-oil price index ($\Delta log w$). This direct effect is a positive function of the share of oil in the CPI basket (δ). The second, indirect effect is via changes in non-oil (core) inflation (π^N).

To estimate the impact of global oil prices on domestic inflation, we follow the method proposed by Jorda (2005) which consists of estimating impulse response functions directly from local projections. This approach has been advocated by, among others, Stock and Watson (2007) and Auerbach and Gorodnichenko (2013) as a flexible alternative that does not impose the dynamic restrictions embedded in vector autoregressive (autoregressive distributed lag) specifications.

Specifically, for each period *k*, the following reduced-form equation is estimated on annual data:

$$\pi_{i,t+k} = \alpha_i^k + \vartheta_t^k + \sum_{j=1}^{l} \gamma_j^k \pi_{i,t-j} + \beta_k \delta_{i,t-1} \pi_t^{oil} + \sum_{j=1}^{k} \theta_j \delta_{i,t+j-1} \pi_{t+j}^{oil} + \varepsilon_{i,t}^k \quad (3)$$

with *k*= 0,..3, and where π represents domestic CPI inflation; π_t^{oil} is defined as the global oil inflation in year *t;* δ_{it-1} is the share of oil in the domestic consumption basket—proxied by the share of transport in the CPI basket—of country *i* in previous year *t-1*; α_i^k are country-fixed effects; ϑ_t^k denotes time-fixed effect; β_k measures the impact of global oil prices on domestic inflation for each future period *k*; and γ_j^kcaptures the persistence of domestic CPI inflation. The inclusion of δ_{it-1} is motivated by the discussion on the channels through which global oil prices affect inflation and allow us to identify the average effect of global oil prices on inflation while controlling for cross-country heterogeneity and time-fixed effects.[9] We use a lagged term because changes in global oil prices can directly affect the oil share in a country's consumption basket.

In our baseline specification, the number of lags (*l*) has been chosen to be equal to two, but the results are robust to the choice of lag length. The specification also includes the forward leads of the of global oil inflation between time 0 (the date of the oil price shock) and the end of the forecast horizon (*k*) to correct the bias in the impulse response inherent in local projection methods (Teulings and Zubanov, 2014). Since country-fixed effects are included in the regression, the dynamic effects on inflation should be interpreted as compared to a baseline country-specific trend.

Impulse response functions (IRFs) of the average effect of global oil price shocks on headline inflation are obtained by plotting the estimated β_k rescaled by the average share of oil in the domestic consumption basket in the sample (i.e. by multiplying the estimated coefficients β_k by $\bar{\delta}$—the average oil share). Confidence bands for the estimated IRFs are computed using the standard deviations associated with the estimated coefficients. While the presence of a lagged dependent variable and country fixed effects may in principle bias the estimation of the parameters of interests in small samples (Nickell, 1981), the length of the time dimension mitigates this concern.[10]

4.2 Baseline results

[9] Data on the share of transport in the CPI basket is not necessarily observed in the earlier period. In this case, we impute the missing values with the nearest observation. The results hardly change when we impute the missing values with the country-average value.

[10] The finite sample bias is in the order of 1/T, where the average T in the baseline sample is 40.

Table 2 presents the results obtained by estimating the impact of global oil price shocks on domestic inflation over the period 1970-2015. The results show a positive and statistically significant effect on domestic inflation from fluctuations in global oil prices. These results are illustrated, along with the associated 90 percent confidence bands (dashed lines), in Figure 3 for *k=0, 1, 2, 3*. It is evident that global oil price shocks have substantial effects on domestic inflation. The estimates suggest that a 10 percent increase in global oil price typically increases domestic inflation by 0.4 percentage point in the short term (i.e. in the year of the oil price shock), and becomes statistically insignificant two years after the shock. Since many episodes of oil price shocks involve increases of 50 percent or more, this is an economically significant effect.

4.3 Robustness checks

Our main sample is an unbalanced panel of 72 countries. We start proceeding to assess the robustness of the main result, by checking whether a changing sample composition over time drives the results. For this purpose, we re-estimate equation (3) for a balanced panel of 57 countries with CPI data available for the whole period. Figure 4 shows that the results based on this sample are very similar to those presented in the baseline based on the unbalanced sample.

We use the share of transport in the CPI basket as a benchmark measure of the oil share in the baseline estimation. For robustness checks, we use the share of fuel in total merchandise imports as an alternative measure of oil share because of the wider coverage of this variable. The next section will explore other factors that can play a role in the transmission of oil price shocks to domestic inflation.

Figure 5 shows transport shares in the CPI basket and fuel import shares in total imports for 32 advanced economies and 40 developing economies. The median shares are quite similar between advanced (12.6 percent for a transport share in the CPI basket and 14.1 percent for a fuel import share) and developing economies (13.6 and 11.6 percent, respectively). Figures 6 shows the results from using fuel import shares. The impulse-response from Figure 6 is similar to those obtained from the baseline estimation, suggesting that the main results are robust to this alternative proxy for the oil share in the CPI basket.

The results presented in Equation (3) may be biased due to possible endogeneity. The first source of endogeneity is related to the inclusion of country-fixed effects in the presence of a lagged dependent variable (Nickell, 1981). To address this problem, we have re-estimated Equation (3) without country-fixed effects.

A second, and perhaps more relevant, the source of endogeneity is reverse causality or the fact that unobserved factors not included in the estimation framework may jointly affect global oil prices and domestic inflation. To address these issues, we use three alternative approaches. The first consists of estimating Equation (3) with a two-step generalized-method-of-moments system estimator, which uses up to four lags of domestic and global oil inflation as instruments for global oil inflation. The second approach tries to address endogeneity concerns by re-estimating Equation (3) using the difference between domestic price and global oil inflation ($\pi_{i,t} - \pi_t^{oil}$) as the dependent variable to purge for common factors affecting both global oil inflation and domestic inflation. The third approach uses a panel-VAR approach to control for possible lagged feedback effects from domestic inflation to global oil inflation.[11] Figure 7 shows that the estimates obtained using these four alternative specifications are similar to those obtained in the baseline, confirming the validity of the baseline results.

4.4 Global oil price shocks and core inflation.

As discussed in the stylized analytical framework presented above, global oil price shocks can affect headline inflation by influencing non-oil (core) inflation. To assess the importance of this transmission channel, we re-estimate equation (3) by replacing headline inflation with core inflation. Given limited data availability for core inflation, we restrict the sample to 45 countries for which both headline inflation and core inflation data are available. The results presented in Figure 8 shows that the effect of global oil price shocks on core inflation is considerably smaller and less persistent than on headline inflation, with the effect on core

[11] The panel-VAR approach assumes a Cholesky identification scheme in which global oil inflation is ordered first, followed by domestic inflation—this assumption implies that global oil inflation may have a contemporaneous effect on domestic inflation, while domestic inflation has an effect on global oil inflation only with a lag. The lag length is chosen equal to two.

inflation contributing by about one-third to the overall effect of oil price shocks on domestic headline inflation.

4.5 The effects of global oil price shocks on inflation over time

The estimates presented above for the full sample period may mask a change in the response of domestic inflation to global oil prices over time. To test whether the impact of global oil price shocks has changed over time, we re-estimate Equation (3) for two different sample periods: 1970-1992 and 1993-2015. The results presented in Figure 9 suggest that impact of oil prices on inflation has declined over time. The effect of oil price shocks is more than three times larger in the first sample (1970-1992) than in the second sample (1993-2015). The magnitude of decline in the effects is in line with the findings from previous studies (e.g., De Gregorio et al., 2007).

Figure 10 shows the changes in the impact of oil inflation on CPI inflation for the United States (Panel A) and the United Kingdom (Panel B). For both countries, the impact is more muted in the latter period, consistent with evidence from panel estimation and previous studies (see Blanchard and Gali, 2007; Kilian, 2008, and references cited therein). As Blanchard and Gali (2007) and Blinder and Rudd (2012) note, this diminished effect may be due to (i) the absence of significant oil shocks in the 1990s; (ii) the declining share of oil in the consumption basket; (iii) other changes in the structure of economies such as greater wage flexibility, which prevents a wage-price spiral; and (iv) perhaps most importantly, an increase in the credibility of monetary policy so that an unexpected increase in inflation—due to events such as oil price shocks—does not lead to a change in inflation expectations. We assess each of these factors in turn.

First, changes in the size of oil price shocks over time may be able to account for their reduced impact on inflation. While the observation from Blanchard and Gali (2007) that the oil shocks in the last two decades have not been smaller than in the 1970s seems to reject this hypothesis, we still check whether underlying shocks affecting global oil prices have changed over time. For this purpose, we study how the size of three structural shocks driving oil price fluctuations identified by Kilian (2009) has changed over time. Kilian (2009) decomposes oil price shocks into three structural (supply, demand, and oil-specific demand) shocks by employing structural VARs with three variables (global crude oil production, the index of global economic activity, and the real price of oil) and shows that each of structural shocks has distinct impacts on U.S. output and inflation. However, Table 3 shows that the sizes of three structural shocks are similar between the two subperiods, implying that changes in the size of oil shocks are unlikely to be responsible for the reduced response of inflation to oil price shocks.[12]

Another possibility is that the propagation mechanisms have changed significantly. The broader definition of oil share in the consumption basket we use in our analysis—transport share in the CPI basket—has been constant over time, suggesting that it cannot directly account for the substantial decline in the pass-through. To futher assess the relevance of the factors (i)-(iv), we extend our baseline estimation described in equation (3) by adding the structural variables X_{it} mentioned above and their interaction term with oil price shocks $\delta_{it-1}X_{it}\pi_t^{oil}$:[13]

$$\pi_{i,t+k} = \alpha_i^k + \vartheta_t^k + \sum_{j=1}^{l}\gamma_j^k\,\pi_{i,t-j-1} + \beta_k\delta_{i,t-1}\pi_t^{oil} + \sum_{j=1}^{k}\theta_j^1\delta_{i,t+j-1}\pi_{t+j}^{oil} + \rho_k\delta_{i,t-1}X_{i,t}\pi_t^{oil} + \sum_{j=1}^{k}\theta_j^2\delta_{i,t+j-1}X_{i,t}\pi_{t+j}^{oil} + \eta_kX_{i,t} + \sum_{j=1}^{k}\theta_j^3X_{i,t+j} + \varepsilon_{i,t}^k \quad (4)$$

where $X_{i,t}$ is a vector of variables including: (i) the inflation targeting regime, (ii) energy intensity, (iii) labor market flexibility, and (iv) the central bank governance index. The coefficients ρ_k measures the relevance of these factors in shaping the response of infaltion to oil price shocks.

The inflation targeting regime is a dummy variable taking a value of one if a country has adopted the inflation targeting in a given year and zero otherwise. We use the total primary energy consumption (British Thermal units) per dollar of real GDP taken from the U.S. Energy Information Administration (EIA) as a measure of energy intensity, which is available from 1980 to 2011. The labor market flexibility index is taken from the Fraser Institute's Economic Freedom of the World (EFW) database and is computed as the average of six subcategories

[12] We also test whether a decline in the size of shocks can account for the decreased effect by including a square term of oil price changes in our baseline equation (3). However, we find a negative but statistically insignificant coefficient on the square term.

[13] As in the baseline specification, we add the forward leads of the structural variables and their interaction terms between time 0 and *k* to correct the bias in the impulse response in local projection methods.

indicators covering various aspects of labor market regulations, taking a value from 0 (low flexiblity) to 10 (high flexibility). The index is available from 1970 to 2012.[14] As a measure of central bank governance, we use the central bank governor turnover index compiled by Crowe and Meade (2007) that is available for the period between 1980 and 1989, and between 1995 and 2004.

Table 4 presents the results from estimating equation (4). To save space and given that the impact of oil prices vanishes two years after the shock, we only report the estimates of ρ_k at the horizon $k=0$. All the interaction terms have a predicted sign, but only the inflation targeting regime and the central bank governor turnover index are statistically significant. Overall, these results suggest that the improved conduct of monetary policy over time can account for the reduced impact of oil price shocks. With these new estimates and changes in the average value of structural variables between the two periods, we can quantify the contribution of each of the two significant factors in explaining the reduced impact of oil price shocks.[15] Out of the 0.05 percentage point decrease in the immediate impact on CPI inflation ($k=0$) from 0.07 (1970-1992) to 0.02 (1993-2015), inflation targeting regimes and central bank governance account for 0.015 and 0.018 percentage points decrease, respectively. Overall, about 60 percent of the observed decline in the effect of oil prics shocks can be attributed to these two variables.

4.6 Asymmetry in oil price shocks

We study a potential asymmetry in the response of inflation to global oil price shocks. As already noted by Mork (1989) and Hamilton (2003) for the U.S. case, the responses of the macroeconomy to positive and negative oil price shocks are not necessarily equal. We check whether such asymmetry also holds in a large international panel data. We closely follow the specification by Mork (1989) by defining positive and negative global oil price shocks as follows:

[14] The six subcategories are (i) hiring regulations and minimum wage, (ii) firing regulations, (iii) centralized collective bargaining, (iv) hours regulations, (v) mandated cost of worker dismissal, and (vi) conscription. The index is only available every five years until 2000, and missing values are imputed using the preceding value available.

[15] The contributions are calculated as a difference between the estimated marginal effects at the average value of each sample.

$$\pi_t^{oil,pos} = \pi_t^{oil} \text{ if } \pi_t^{oil} > 0, = 0 \text{ otherwise,} \quad (5)$$

$$\pi_t^{oil,neg} = \pi_t^{oil} \text{ if } \pi_t^{oil} < 0, = 0 \text{ otherwise.}$$

To assess the effect of positive and negative oil price shocks by replacing in equation (3) π_t^{oil} with $\pi_t^{oil,pos}$ and $\pi_t^{oil,neg}$. In line with previous results for the U.S., we find that the response to positive oil price shocks is twice larger for positive shocks than that to negative oil price shocks (Figure 11). Nevertheless, this finding alone cannot explain changes in the effect of oil price shocks over time, as the response to both type of shocks equally decreased (Figure 12).

4.7 Advanced vs. developing economies

Finally, we also check whether the effect of oil price shocks on domestic inflation differs between advanced and developing economies. To check whether this is the case, we separately estimate Equation (3) for each group of countries. As some emerging countries lack data from the 1970-80s, we use a common sample starting from 1990 to ensure that the results are not driven by the difference in the time-series dimension between two groups. Figure 13 shows that while the effect of oil price shocks is more precisely estimated for advanced than for developing economies, the point estimates are not statistically different between these two groups. This result is consistent with the fact that there are no large differences in the transport share in the CPI basket between advanced (14.2%) and developing economies (12.1%).

5. EVIDENCE FROM MONTHLY DATA FOR THE 2000S

We have provided evidence on the impact of global oil price shocks on overall inflation since the 1970s and how that impact has changed over time. The flare up in global oil prices in the 2000s—combined with the greater availability of higher frequency data for much more developing economies—offers another opportunity to study possible channels of transmission from global oil prices to domestic inflation during the most recent period of high oil price volatility. We use monthly data from 2000M1 to 2015M12 of 34 advanced economies and 37 developing economies that have available data for more than ten consecutive years.

5.1 Pass-through of global oil inflation into domestic headline inflation

This section quantifies pass-through from world oil prices to domestic prices based on a country-by-country regression of monthly domestic headline inflation on monthly global oil inflation. The estimated equation is as follows for each country *i*:

$$\pi_{t+k} = \alpha_k + \sum_{j=1}^{l} \gamma_j^k \, \pi_{t-j} + \beta_k \pi_t^{oil} + \sum_{j=1}^{k} \theta_j \pi_{t+j}^{oil} + \varepsilon_t^k, \qquad (6)$$

where π_t denotes domestic headline inflation in month *t*, and as before π_t^{oil} denotes world oil inflation, measured in local currency units.[16] Equation (6) does not include the share of oil in the domestic CPI basket (δ_{it-1}) since it is estimated country-by-country and any weighting variable will be reflected in the parameter estimates. In contrast, the inclusion of the parameter δ_{it-1} in the panel framework presented in equation (3) is necessary to identify the average effect of global oil prices on inflation while controlling for cross-country heterogeneity and time-fixed effects.

To gauge the effect of world oil price shocks on domestic inflation, we look at the instantaneous coefficients β_0 for every country, as the peak effect typically occurs at $t=0$. Table 5 ranks the size of instantaneous effects (β_0) of every country in the sample. Figure 14 summarizes the estimation results, which suggest that pass-through tends to be less precisely estimated and more heterogeneous among developing economies than advanced economies. On average, however, the effect in developing economies is similar to the one in advanced economies in the recent period. These results are consistent with Gelos and Ustyugova (2017) who find a similar degree of pass-through between advanced and developing economies for the recent period.

5.2 What explains the heterogeneity in the response across countries?

Several factors can explain the heterogeneity in the response of headline inflation to global oil price shocks across countries. In the previous section, we have used the transport share in the CPI basket to identify the heterogeneous response of global oil shocks to domestic inflation across countries. However, other country-specific factors can also play a major role in

[16] We also estimate Equation (6) with world oil inflation measured in U.S. dollars. See Table A.4 in the Appendix for the results.

the transmission of fluctuations in oil prices to domestic inflation. This section formally tests the importance of these factors by estimating the following specification:

$$\beta_i^0 = a + dX_i + \varepsilon_i, \tag{7}$$

where β_i^0 is the estimated coefficient of the effect of global oil price shocks on domestic inflation presented in Table 5 and X_i is a set of potential explanatory factors listed below. Table A.1 in the appendix describes how each variable is constructed in detail. We estimate equation (7) using Weighted Least Squares (WLS)—with weights given by the inverse of the standard error of the estimated coefficients—to reflect the different degree of the precision in the estimates.

Potential explanatory factors

- *Transport share in the CPI basket:* A country with a higher share of transport in the CPI basket is likely to have a higher inflationary impact from global oil price shocks not only by a direct mechanical effect but also due to indirect second-round effects.

- *Fuel share of merchandise import or the ratio of net energy imports to total energy use*: Changes in world oil price can have opposite effects on the level of prices and the nominal exchange rate between net oil importers and net oil exporters. The impact of oil price increases on domestic inflation is expected to be smaller for a country with a lower level of oil imports or higher level of oil exports.

- *Past inflation—proxied by the average inflation in the 1990s*: A country with a high level of inflation is likely to have a higher inflationary impact from global oil price shocks. For example, firms in a high inflationary environment tend to perceive global oil price shocks more persistent than firms in a low inflationary environment (Taylor, 2000).

- *Inflation targeting regime*: When a central bank strives to hold inflation at some numerically specified level, it helps anchor inflation expectations, thereby reducing the impact of global oil price shocks on domestic inflation. IMF (2011) and Furceri et al. (2016) find that a country with inflation targeting tends to have a lower impact of inflation surprises on inflation expectations.

- *Anchoring of inflation expectation*: For a similar reason, inflation of a country with well-anchored inflation expectations (a smaller response of inflation expectations to inflation surprises) is likely to be less affected by changes in global oil prices. We measure the degree of anchoring of inflation expectations by the inverse of initial response of inflation expectations to inflation surprises using private sector inflation survey data between 1990 and 2014 (see Appendix).

- *Central bank autonomy*: A greater central bank independence is associated with higher credibility of monetary policy, thereby reducing the impact of global oil price shocks on domestic inflation. We take the average of the central bank independence index from Dince and Eichengreen (2014) for the period between 1998 and 2010. This index takes a value from 0 to 1, with a higher value indicates a greater degree of independence.

- *Energy subsidies as a share of GDP*: A country with a high level of energy subsidy is likely to have a lower inflationary impact from global oil price shocks These subsidies, in fact, distort the price signals from oil price shocks and prevent the correct pass-through of oil price increases to headline inflation, which may further reduce the transmission of monetary policies (Caceres et al., 2012). Data on energy subsidies are taken from Coady et al. (2015). We take the the average post-tax petroleum subsidies as a share of GDP as our benchmark measure of energy subsidies.[17]

Table A.5. in the appendix provides descriptive statistics for the above country-specific factors. Figure 15 shows the scatter plots of the size of the estimated coefficient β_i^0 and each of above factors weighted by the precision of the estimates. The figure suggests that the transport share in the CPI basket, the fuel import share, the net energy imports, and energy subsidy are strongly correlated with the size of the estimated coefficient. In contrast, the association between monetary policy factors and the estimated coefficient is weak and generally not statistically significant.

[17] Using post-tax gasoline subsidies hardly changes our main results.

The, expected, strong explanatory power of the transport share in the CPI basket (R^2=0.11) justifies the econometric specification in the previous section. Moreover, as there is no systematic difference in the transport share between advanced and developing economies, this finding is consistent with the result from the panel and country-by-country estimation that the impact of global oil price shocks on domestic inflation in developing economies is similar, on average, to that in advanced economies.

Bivariate scatter plots take us only so far. Table 6 shows the results of simple cross-country bivariate and multivariate regressions, based on equation (7). Due to the limited coverage of data on country-specific factors, we first run bivariate regressions of the estimated coefficients on each of country-specific factors with the unbalanced sample; then we turn to multivariate regression for a balanced sample of 47 countries.[18]

The main conclusion from the scatter plots continues to hold in the regression. We find that the transport share in the CPI basket is the most robust determinant of the response of inflation across countries. In contrast, variables regarding the conduct of monetary policy does not seem to be a major factor in explaining the magnitude of the pass-through across countries over the recent period. As one can confirm from Figure 17, most countries in the sample have converged to the better conduct of monetary policy over the last 20 years. A reduced cross-country heterogeneity, due to such convergence, might be a reason why we no longer find the conduct of monetary policy as an important factor in cross-country differences in the size of the pass-through. While these results are broadly consistent with those presented in the literature (see, for example, Gelos and Ustyugova 2017), we find that energy subsidies are indeed an important determinant of the degree of pass-through.

6. Conclusions

This paper investigates the role of global oil price movements in shaping domestic inflation since the 1970s and whether global oil price shocks have varied over time. Moreover, it

[18] Given the high correlations among three proxies for oil shares, we only include transport weight in the CPI basket in the multivariate regression. To keep a reasonable number of countries in the multivariate regression, we drop the degree of inflation anchoring variable. Table A.6 in the appendix shows the results from bivariate regressions with the balanced sample of 24 countries, which deliver a similar conclusion.

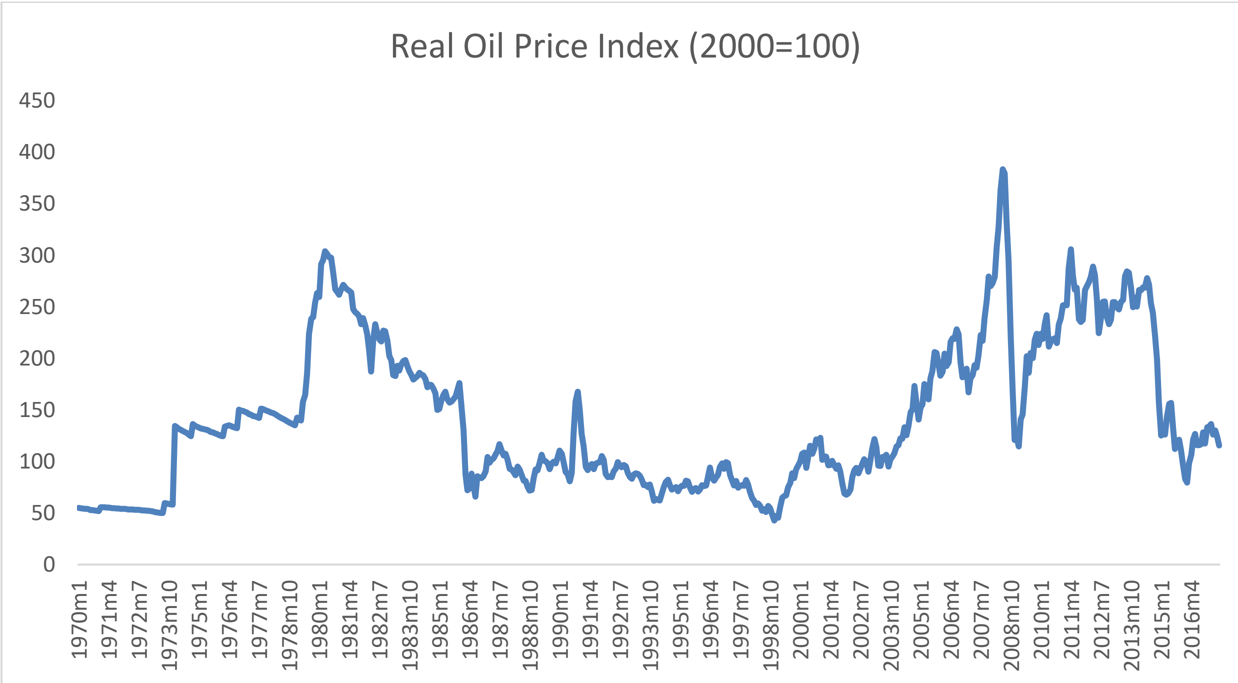
analyzes whether the effects of oil price shocks differ across advanced and emerging and developing economies, and which channels may influence such differences.

Our main finding is that a 10 percent increase in global oil inflation, on average, increases domestic inflation at the peak impact by about 0.4 percentage point, with the effect becoming statistically insignificant two years after the shock. The has declined over time, mostly due to the improvement in the conduct of monetary policy.

The great volatility in global oil prices since the 2000s provides further a somewhat controlled experiment to discriminate among different transmission channels. Using a second dataset consisting of monthly CPI information for 34 advanced and 37 developing economies we find that the more recent global oil price shocks (a one percent increase) has similar instantaneous effects of around 0.01 percentage points on both emerging and advanced economies. This could reflect the similar share of oil in these economies' consumption baskets (similar transportation share in the CPI basket). We indeed find that the transport share in the CPI basket is the most robust determinant of the response of inflation across countries. In contrast, variables regarding the conduct of monetary policy does not seem to be a major factor in explaining the cross-country differences in the magnitude of the pass-through. In addition, using a novel dataset on energy subsidies, we find that energy subsidies—by distorting the price signal from oil price shocks—tend to reduce the pass-through from global oil price shocks to domestic inflation.

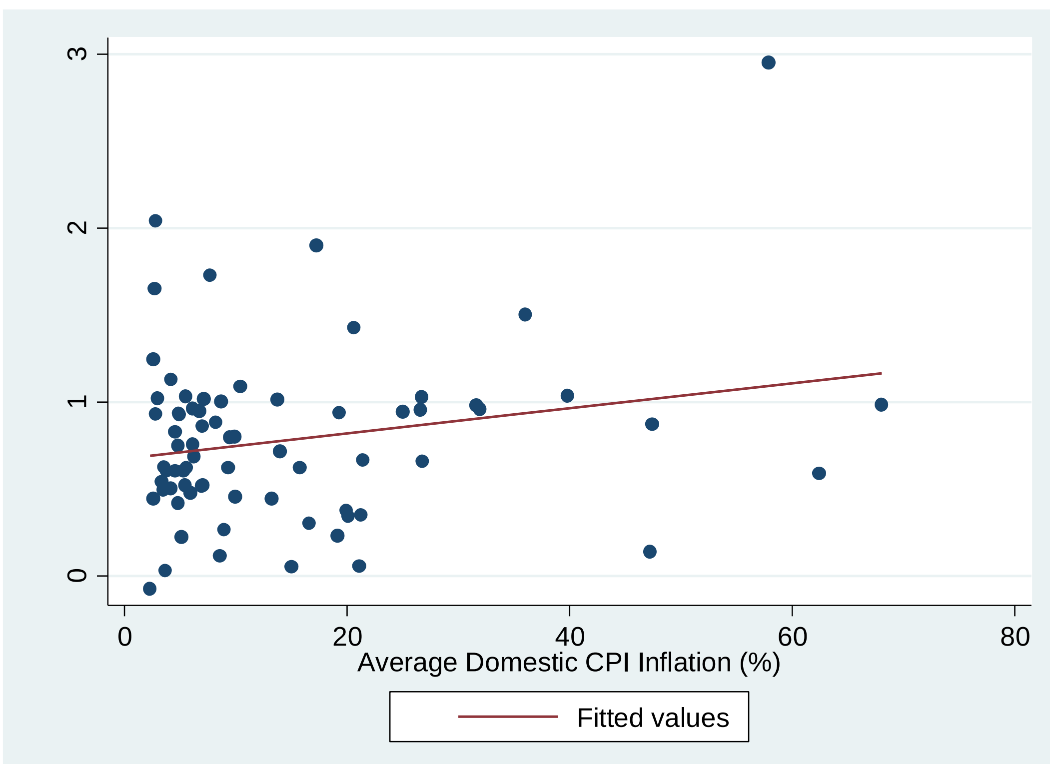
The current analysis offers various possibilities for future research. For example, additional analyses could be performed to test how energy price changes affect inflation expectations in advanced and developing economies. Supply and demand effects for the pass-through could also be further investigated, also to shed lights on the appropriate monetary policy framework to keep inflation expectations well anchored.

Figure 1: Real global oil prices, 1970M1–2015M12 (Index, 2000M1=100)



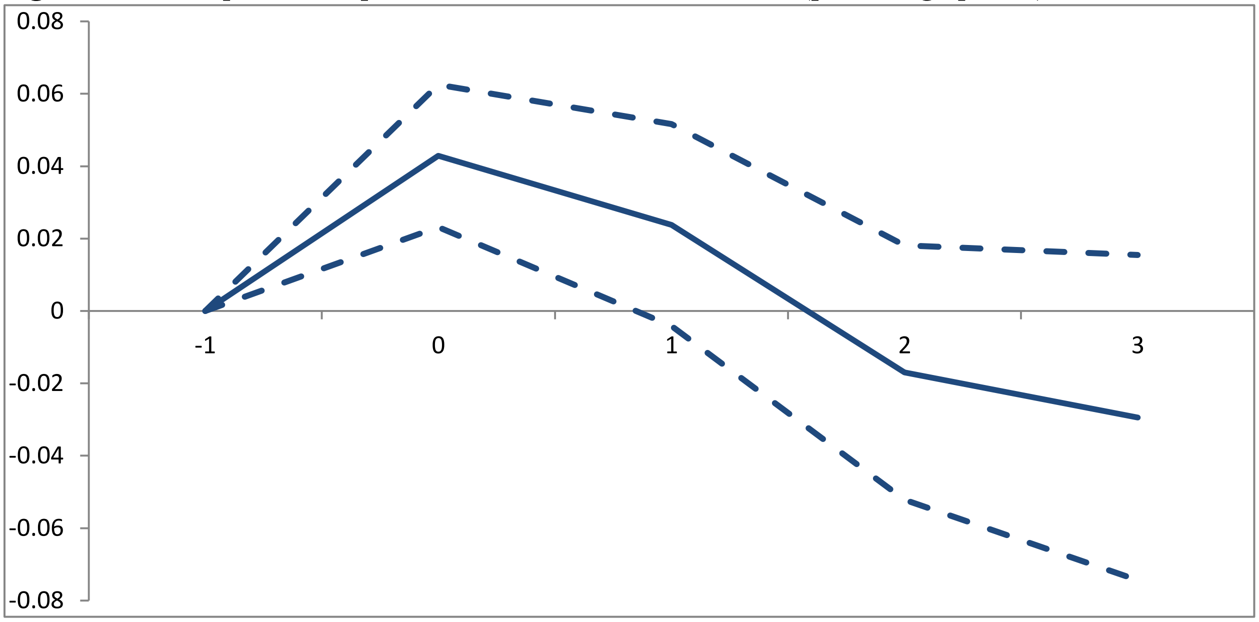
Source: IMF Primary Commodity Prices

Figure 2: Correlation of domestic CPI inflation with global oil inflation (1970-2015)



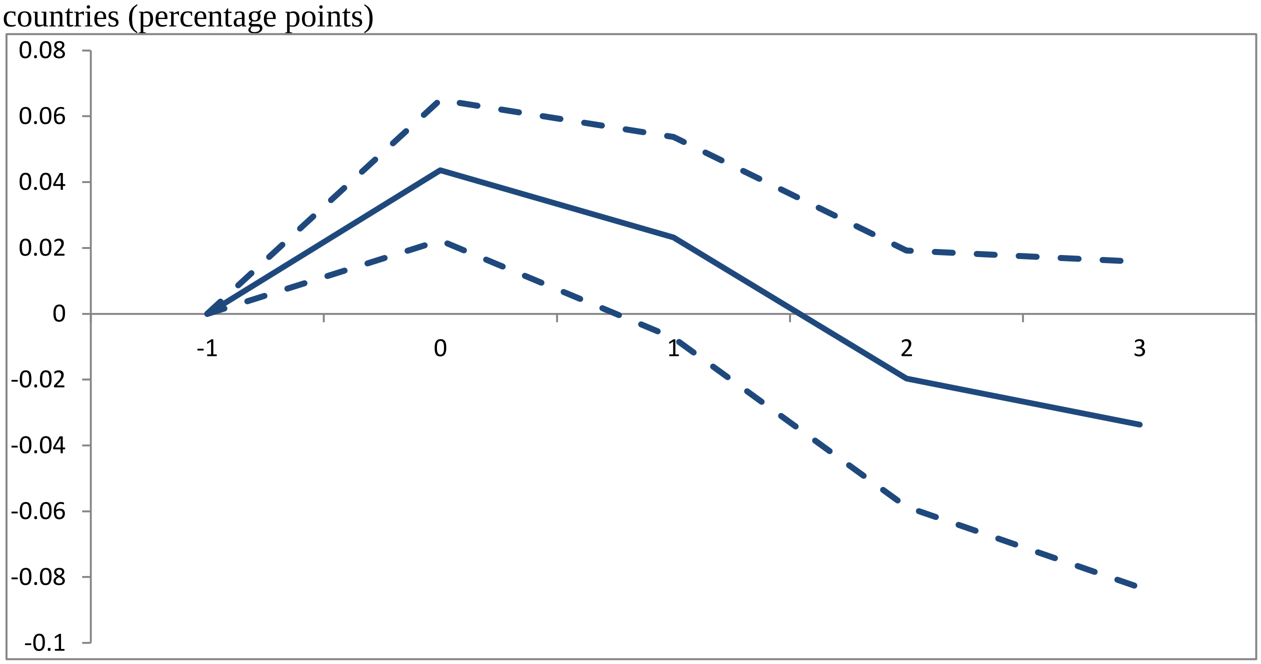
Source: authors' calculations using Haver Analytics.

Figure 3. The impact of oil price shocks on headline inflation (percentage points)



Note: the figure presents the impact of 1 percentage point change in world oil inflation on domestic headline inflation. The solid line is the impulse response function (IRF) and the dashed lines indicate 90 percent confidence bands. t=0 denotes the year of the shock.

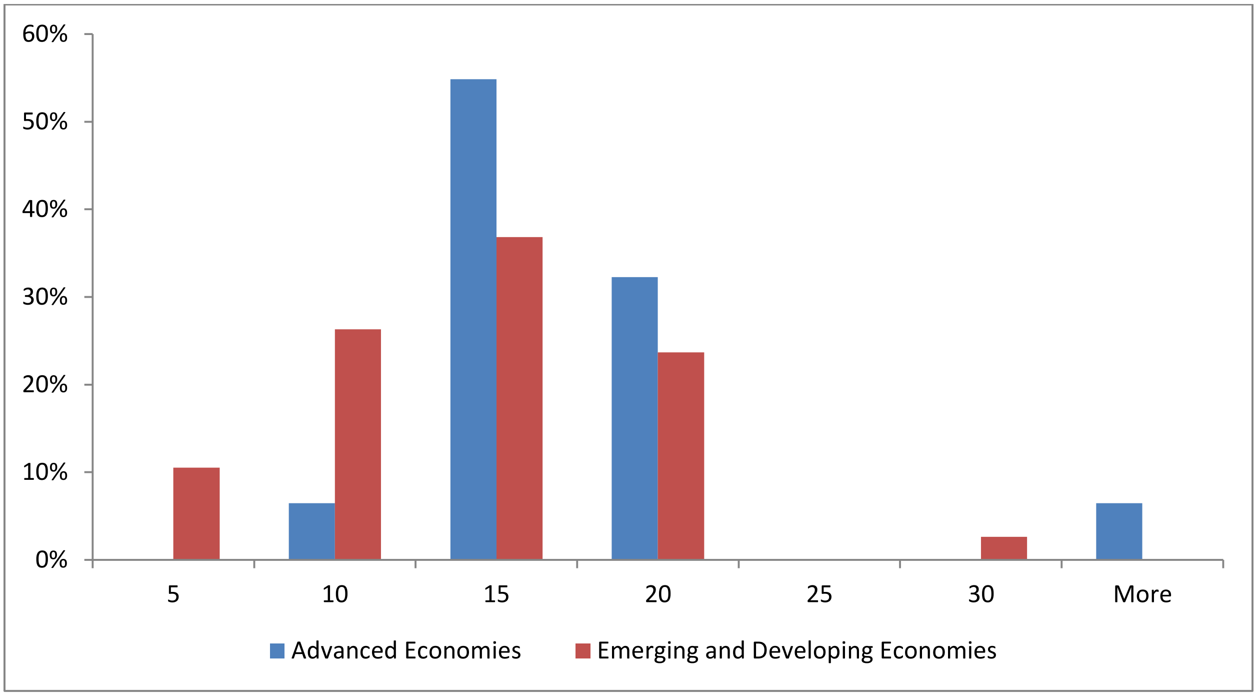
Figure 4. The impact of oil price shocks on headline inflation in the balanced panel of 57 countries (percentage points)



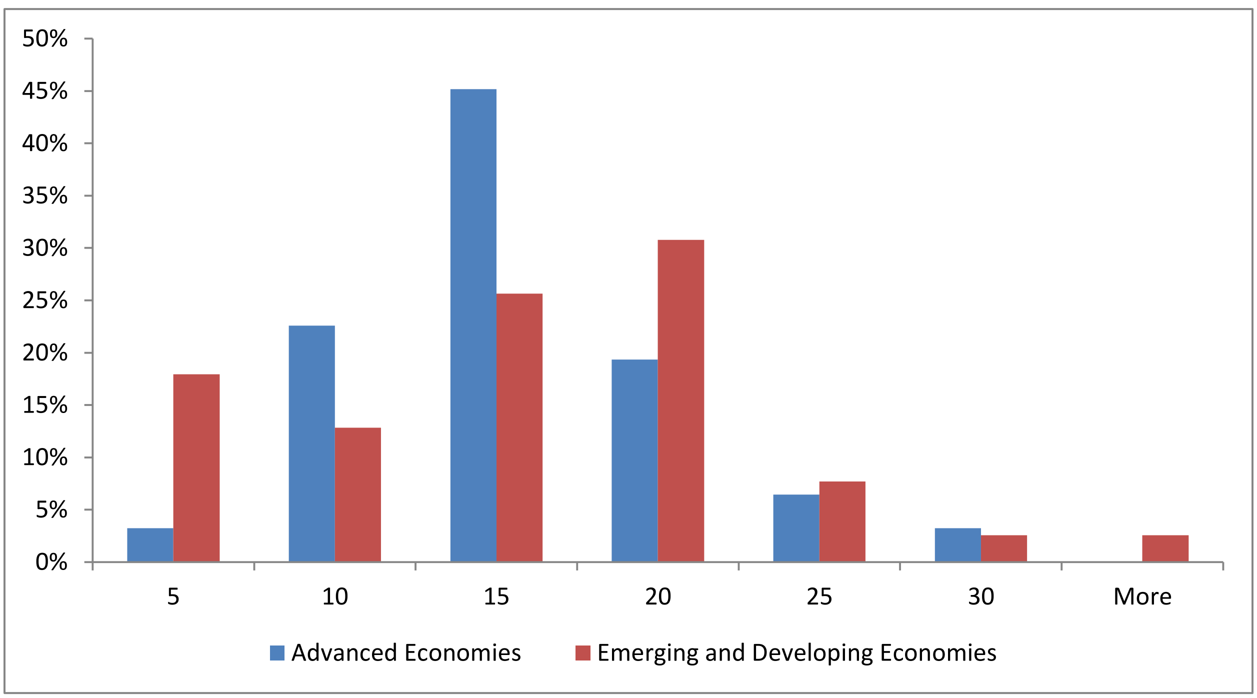
Note: the figure presents the impact of 1 percentage point change in world oil inflation on domestic headline inflation. The solid line is the impulse response function (IRF) and the dashed lines indicate 90 percent confidence bands. t=0 denotes the year of the shock.

Figure 5. Oil shares in individual countries

Panel A. Share of transport in the CPI basket

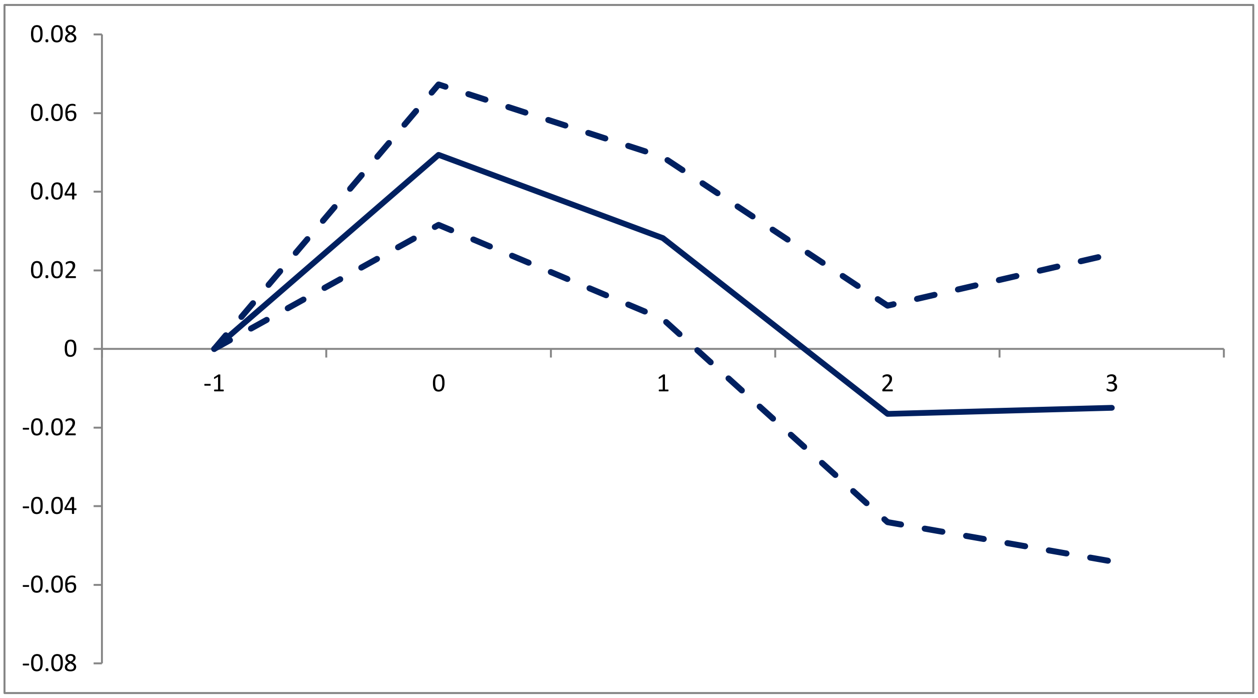


Panel A. Share of fuel imports in total merchandise imports



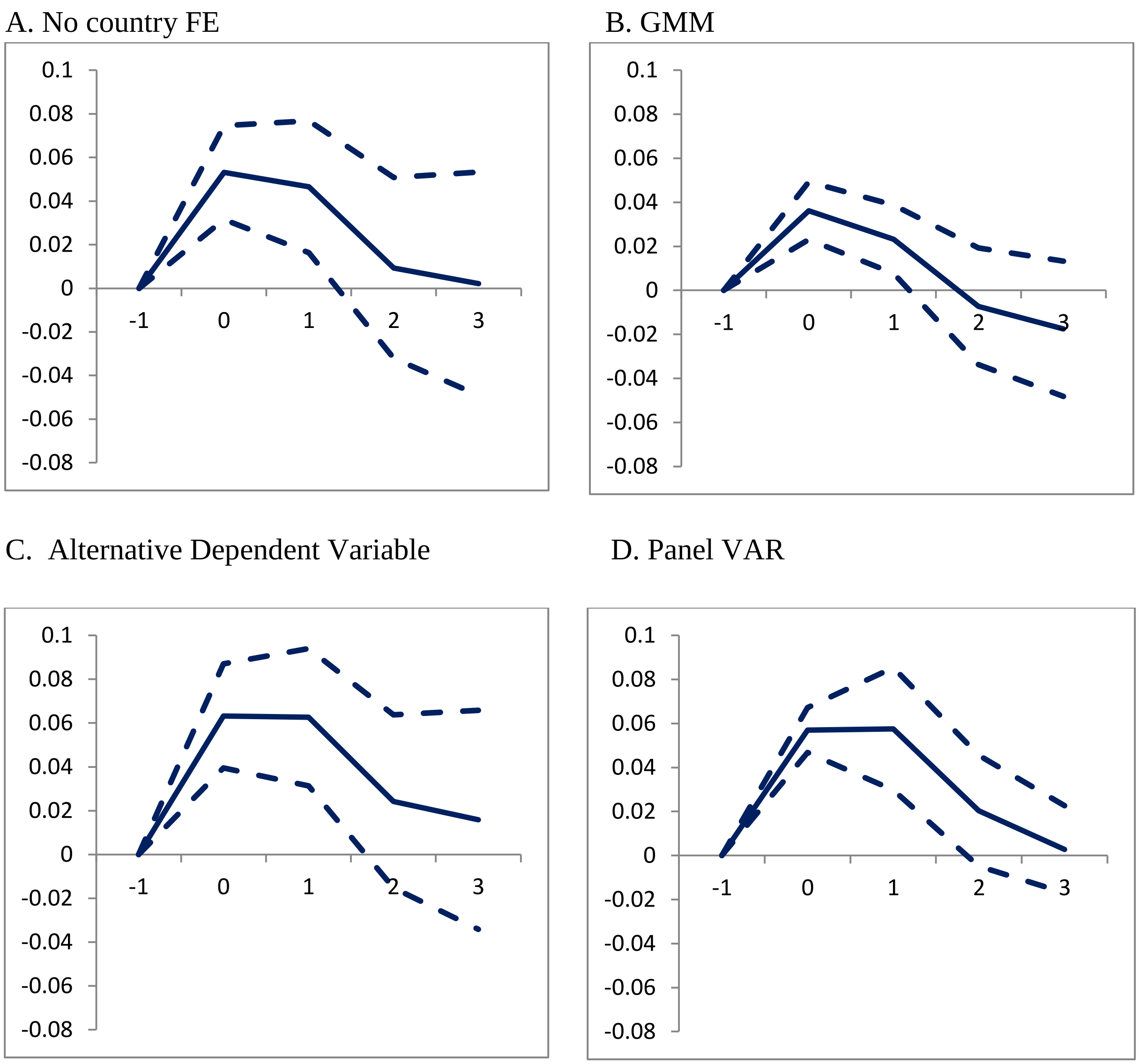
Source: World Bank and Haver Analytics.
Note: The above charts provide a distribution of the oil share in a country's consumption basket.

Figure 6. The impact of oil price shocks on headline inflation: using a fuel import share in merchandise imports (percentage points)



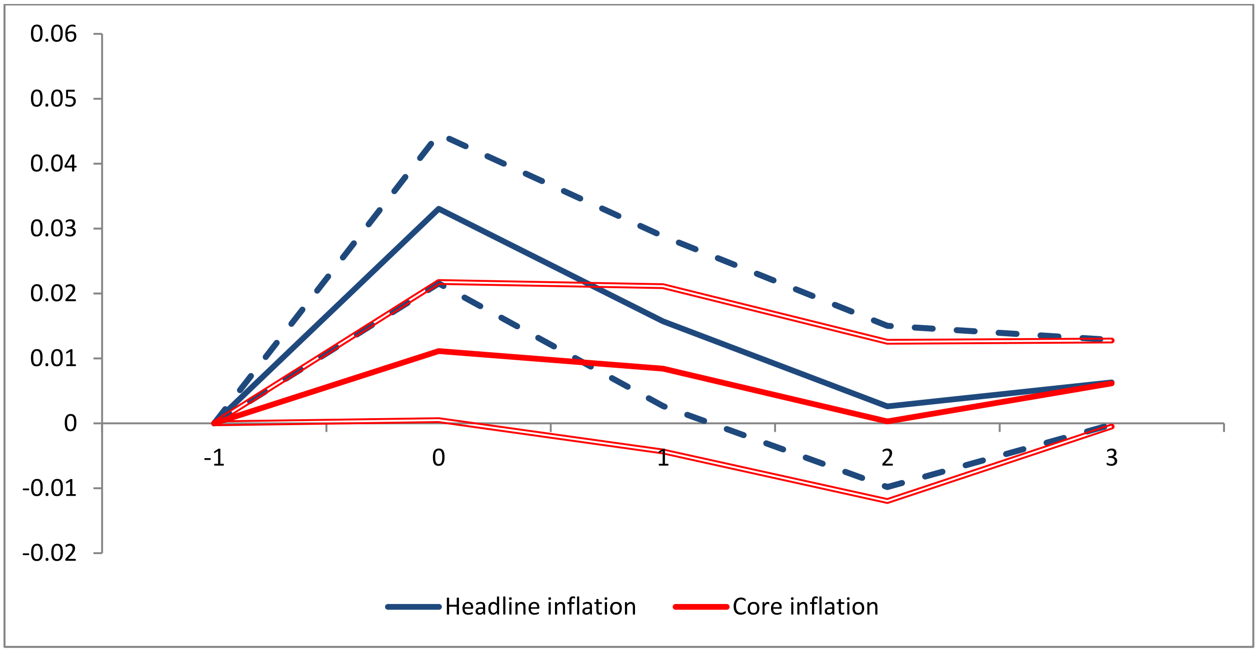
Note: the figure presents the impact of 1 percentage point change in world oil inflation on domestic headline inflation. The solid line is the impulse response function (IRF) and the dashed lines indicate 90 percent confidence bands. t=0 denotes the year of the shock.

Figure 7. The impact of oil price shocks on domestic (CPI) inflation: robustness checks (percentage points)



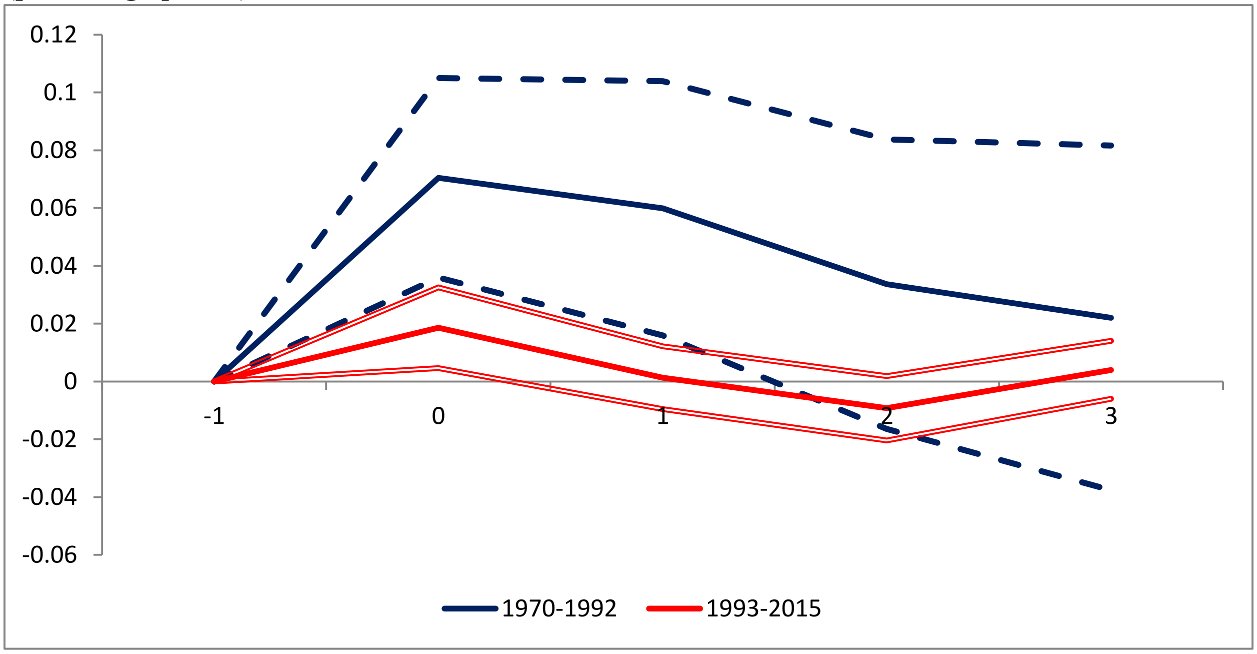
Note: the figure presents the impact of 1 percentage point change in world oil inflation on domestic headline inflation. The solid line is the impulse response function (IRF) and the dashed lines indicate 90 percent confidence bands. t=0 denotes the year of the shock.

Figure 8. The impact of oil price shocks on domestic headline inflation vs. domestic core inflation in the common sample of 45 countries



Note: the figure presents the impact of 1 percentage point change in world oil inflation on domestic headline inflation. The solid line is the impulse response function (IRF) and the dashed lines indicate 90 percent confidence bands. t=0 denotes the year of the shock.

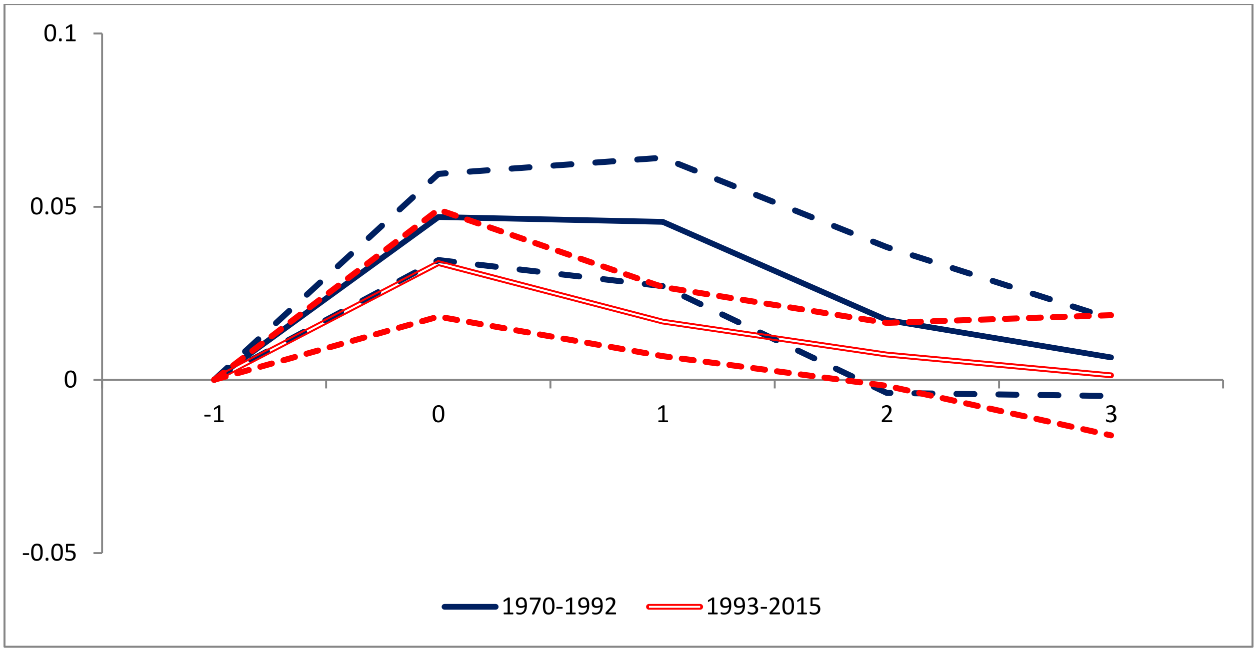
Figure 9. The impact of oil price shocks on domestic (CPI) inflation: 1970-1992 vs.1993-2015 (percentage points)



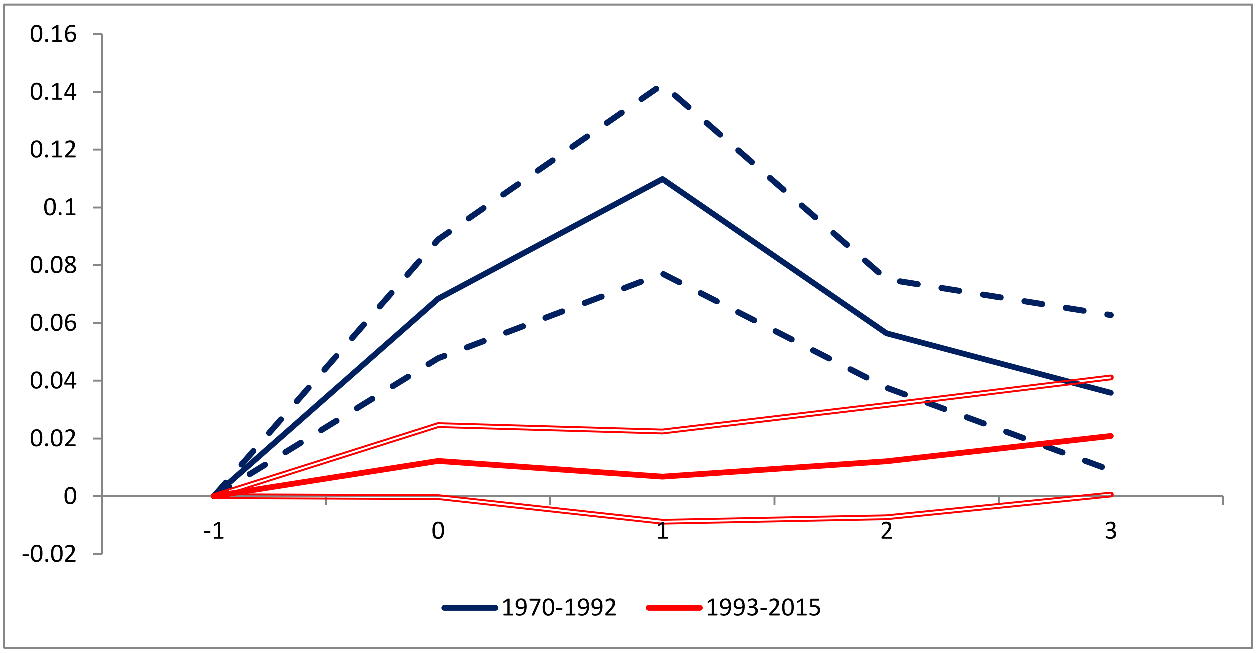
Note: the figure presents the impact of 1 percentage point change in world oil inflation on domestic headline inflation. The solid line is the impulse response function (IRF) and the dashed lines indicate 90 percent confidence bands. t=0 denotes the year of the shock.

Figure 10. The impact of oil price shocks on domestic (CPI) inflation: 1970-92 vs.1993-2015 for the US and the UK (percentage points)

Panel A. The United States



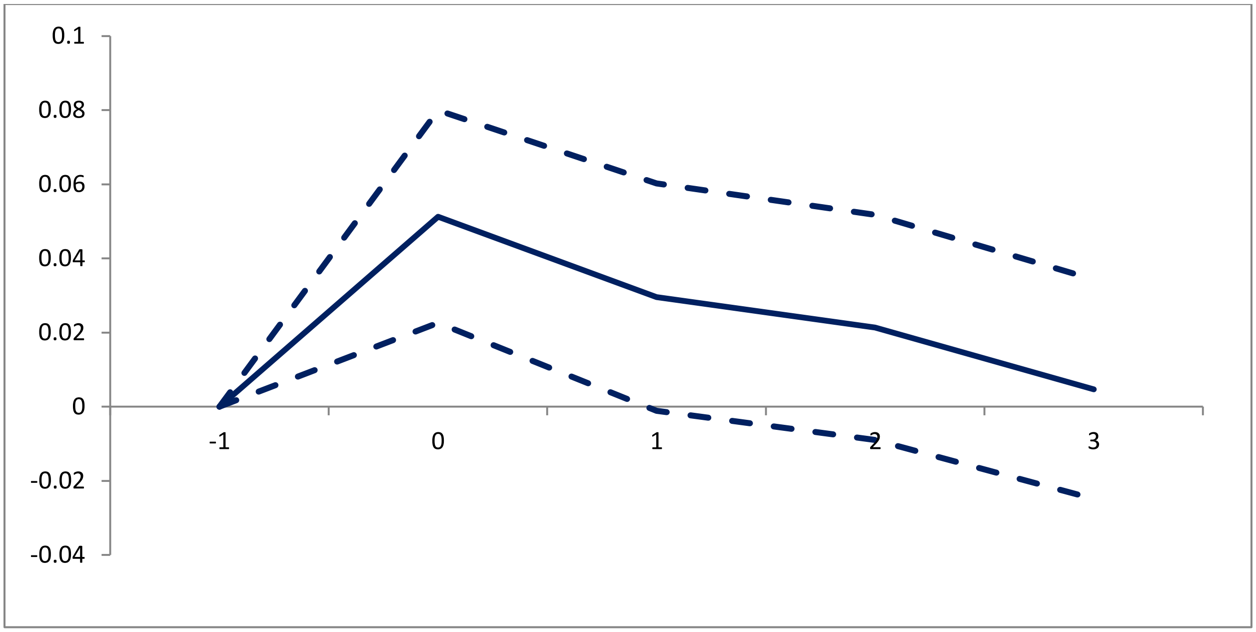
Panel B. The United Kingdom



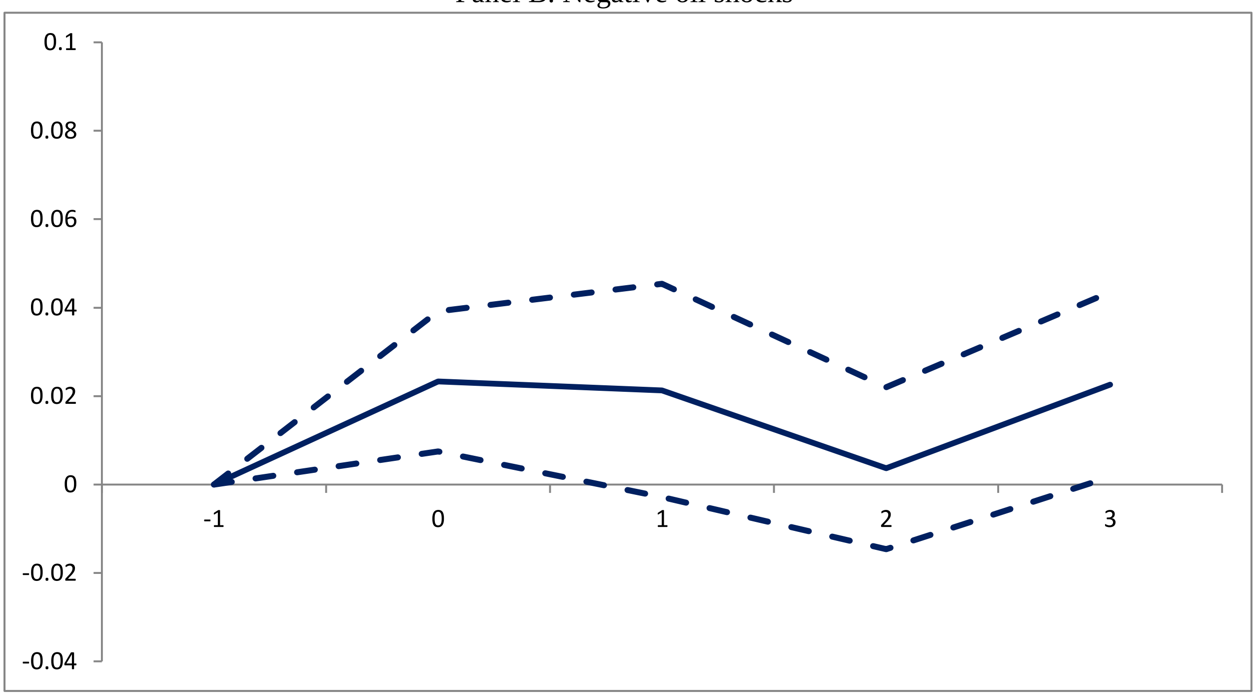
Note: the figure presents the impact of 1 percentage point change in world oil inflation on domestic headline inflation. The solid line is the impulse response function (IRF) and the dashed lines indicate 90 percent confidence bands. t=0 denotes the year of the shock.

Figure 11. The impact of positive and negative oil price shocks on domestic (CPI) inflation: 1970-2015 (percentage points)

Panel A. Positive oil shocks



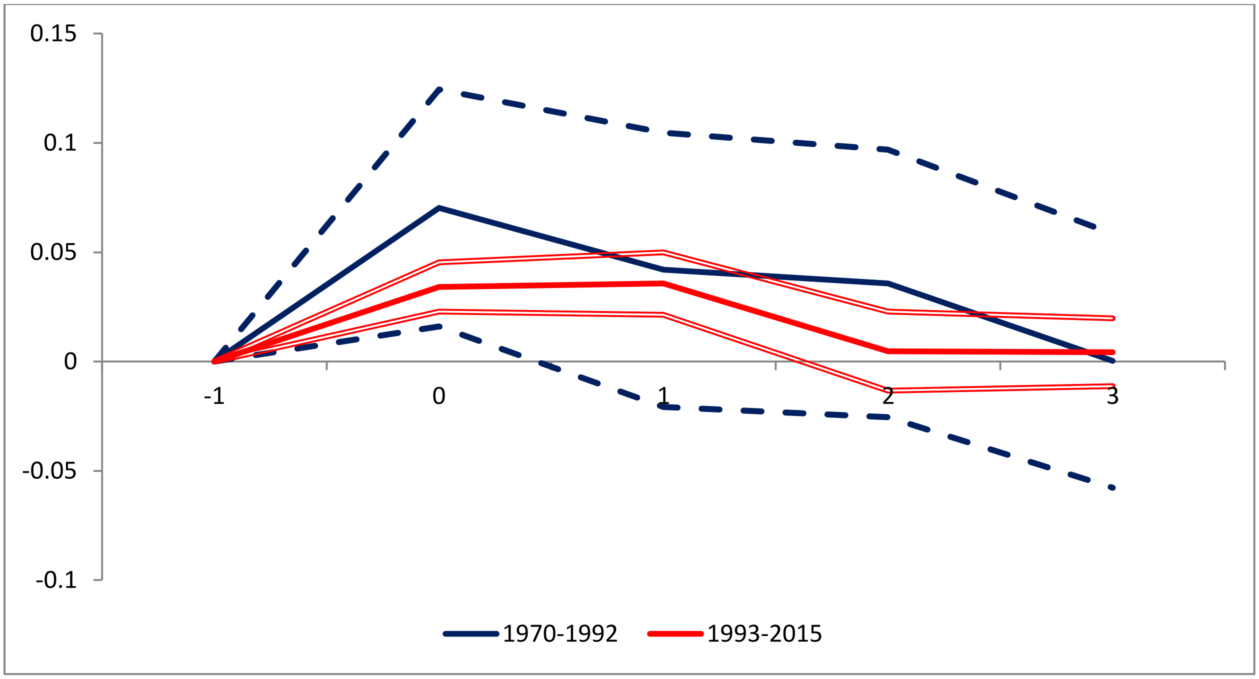
Panel B. Negative oil shocks



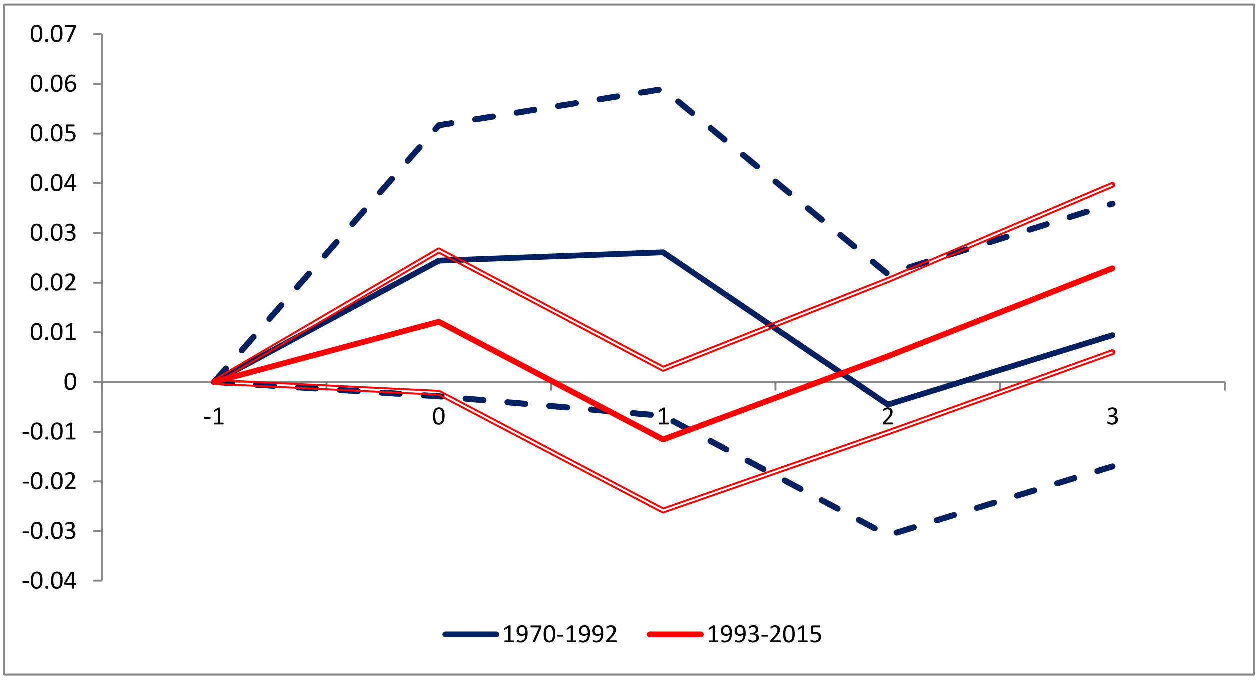
Note: the figure presents the impact of 1 percentage point change in world oil inflation on domestic headline inflation (in an absolute term). The solid line is the impulse response function (IRF) and the dashed lines indicate 90 percent confidence bands. t=0 denotes the year of the shock.

Figure 12. The impact of positive and negative oil price shocks on domestic (CPI) inflation: 1970-1992 vs. 1993-2015 (percentage points)

Panel A. Positive oil shocks



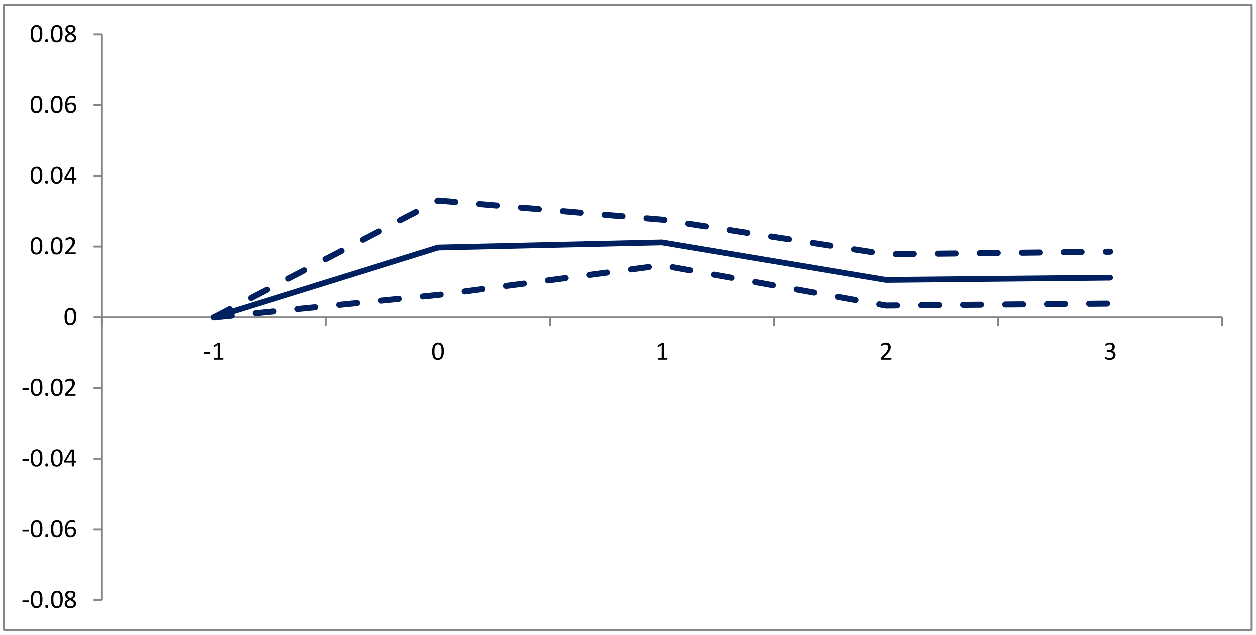
Panel B. Negative oil shocks



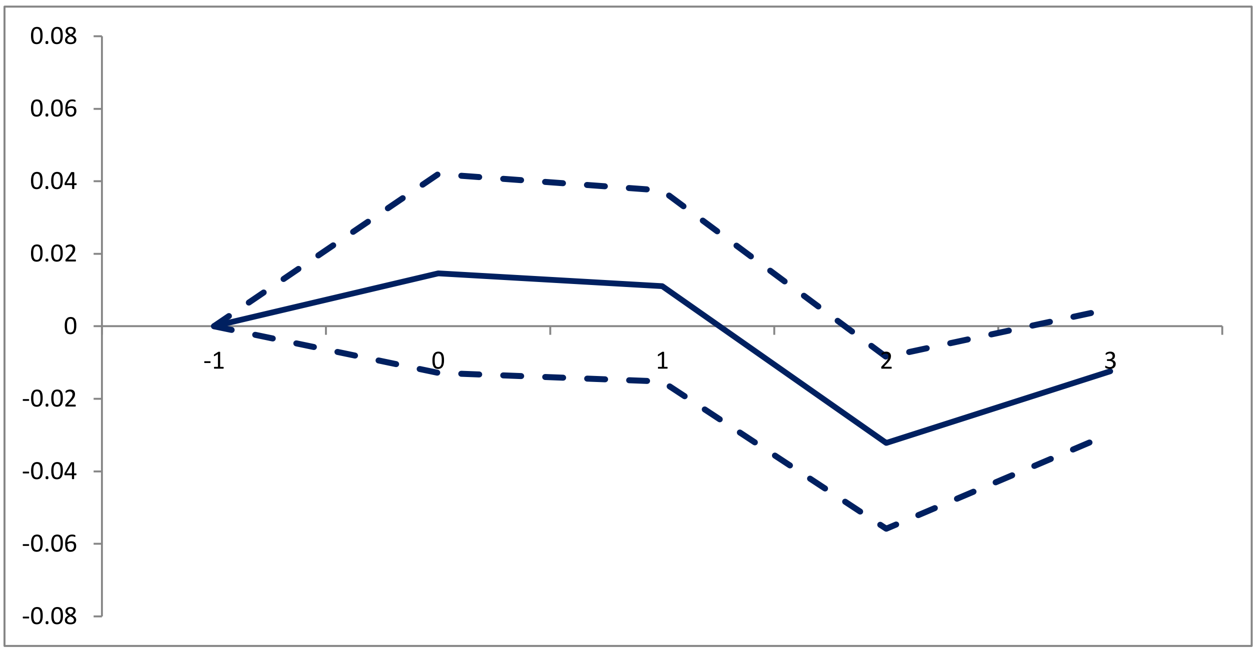
Note: the figure presents the impact of 1 percentage point change in world oil inflation on domestic headline inflation (in an absolute term). The solid line is the impulse response function (IRF) and the dashed lines indicate 90 percent confidence bands. t=0 denotes the year of the shock.

Figure 13. The impact of oil price shocks on domestic (CPI) inflation: advanced economies vs. developing economies (percentage points)

Panel A. Advanced Economies

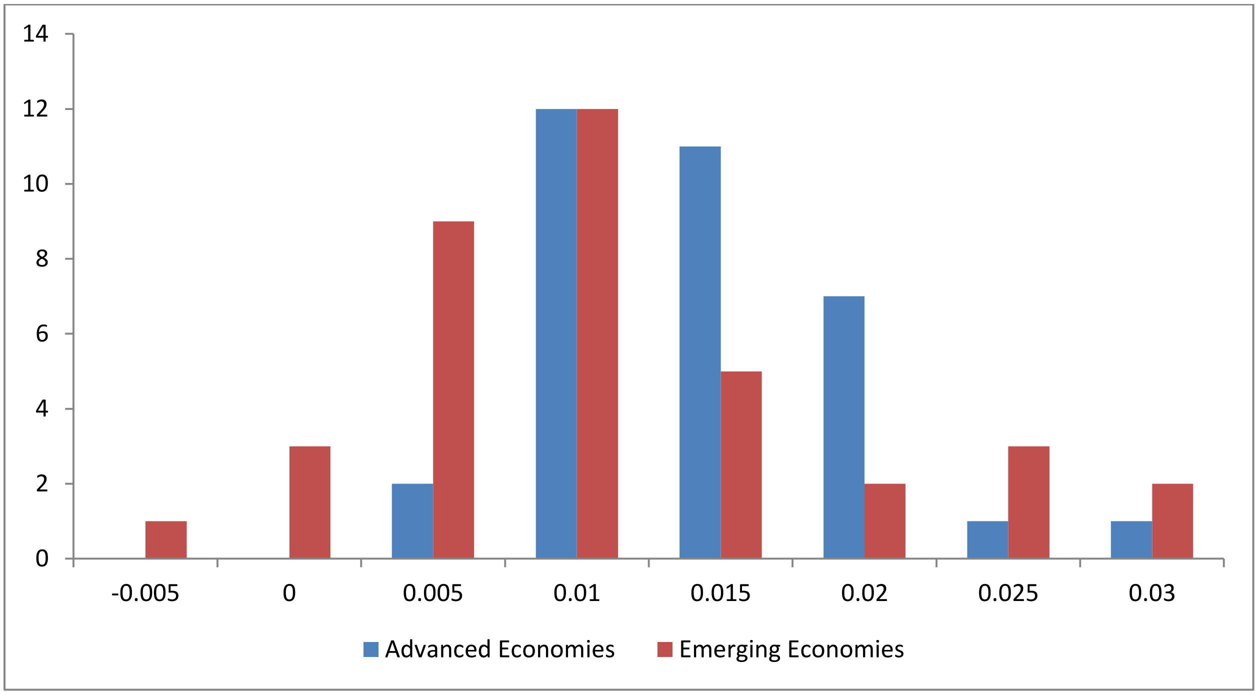


Panel B. Developing economies



Note: the figure presents the impact of 1 percentage point change in world oil inflation on domestic headline inflation. The solid line is the impulse response function (IRF) and the dashed lines indicate 90 percent confidence bands. t=0 denotes the year of the shock.

Figure 14. Instantaneous effects from global oil inflation to domestic headline inflation (2000M1 to 2015M12)



Note: the figure presents the distribution of the impact of 1 percentage point change in world oil inflation on domestic headline inflation across advanced and developing economies.

Figure 15. Correlation between the estimated coefficients and country-specific characteristics

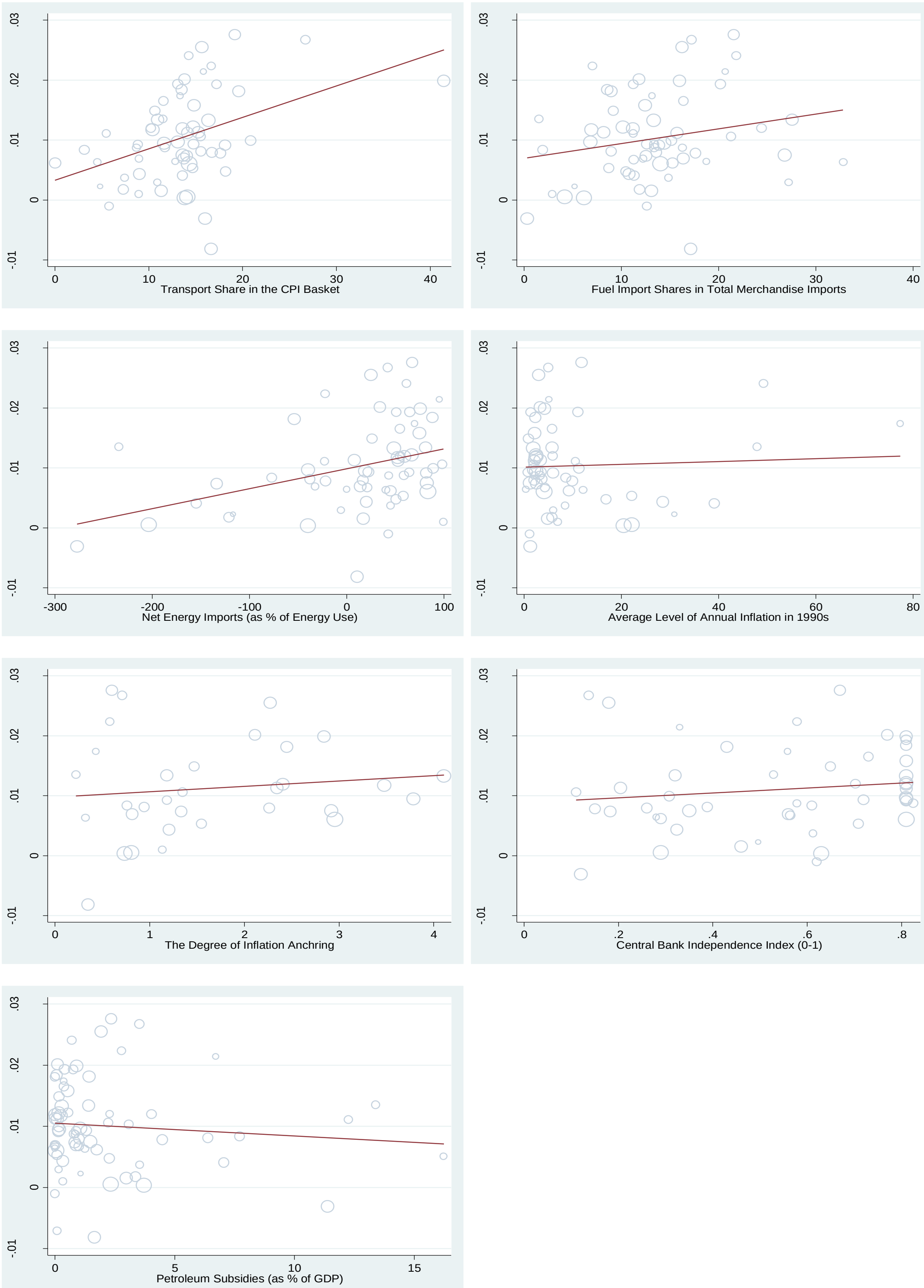
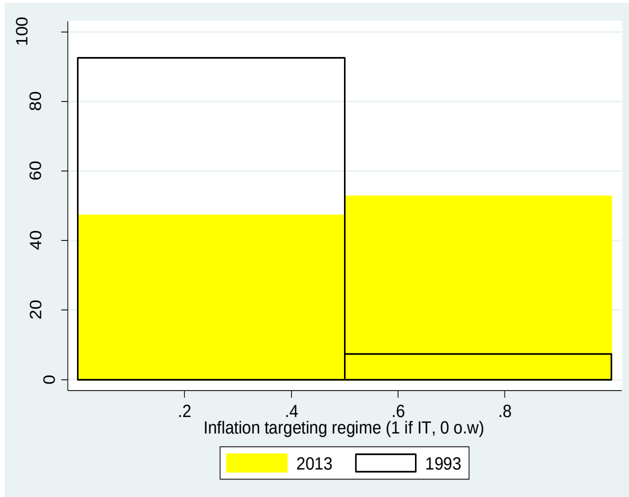
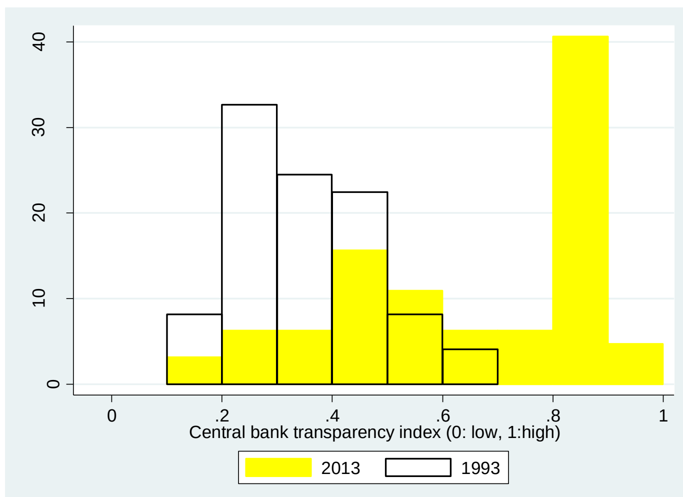


Figure 16. Changes in the conduct of monetary policy over time





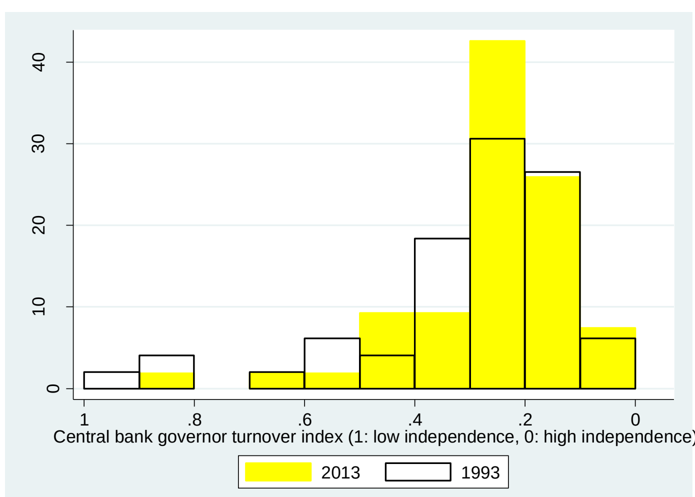


Table 1. Summary statistics for world sample

	CPI Inflation (%)	Global Oil Inflation (%)	Transport share in the Consumption Basket (%)	Fuel Import Share (%)
Full Sample	14.33	0.72	15.21	12.78
Obs	2,820	2,582	837	2,651
Advanced	6.26	0.73	17.17	13.02
Obs	1,247	1,239	515	1,270
Emerging	20.74	0.71	12.08	12.55
Obs	1,573	1,343	322	1,381
1970-1992	19.44	0.78	12.89	13.62
Obs	1,209	1,057	47	1,107
1993-2015	10.50	0.68	15.35	12.17
Obs	1,611	1,525	790	1,544

Table 2. Baseline estimates

	k=0	**k=1**	**k=2**	**k=3**
$\delta_{it-1}\pi_t^{oil}$	0.043	0.023	-0.016	-0.029
	(3.58)***	(1.40)	(-0.79)	(-1.07)
$\pi_{i,t-1}$	-0.051	-0.420	-0.701	-0.698
	(-0.42)	(-3.13)***	(-5.78)***	(-5.72)***
$\pi_{i,t-2}$	-0.225	-0.096	0.070	.015
	(-3.04) ***	(-0.98)	(0.63)	(0.16)
N	2240	2168	2096	2024
R^2	0.154	0.251	0.327	0.359

Note: T-statics based on clustered robust standard errors are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent level.

Table 3. Summary statistics on structural shocks

	Mean		Standard deviation	
	1975-1992	1993-2007	1975-1992	1993-2007
Supply shock	0.028	-0.031	0.260	0.228
Demand shock	-0.048	0.046	0.210	0.283
Oil-specific demand shock	0.023	-0.023	0.246	0.336

Table 4. Estimates from the extended specification

Variable	(1)	(2)	(3)	(4)	(5)
β_0	0.049 (3.63) ***	0.020 (0.50)	0.060 (1.44)	-0.018 (-0.5)	0.031 (0.51)
ρ_0					
Inflation Targeting	-0.021 (-1.36)				-0.047 (-2.23) **
Energy Intensity		0.060 (1.08)			0.043 (0.68)
Labor Market Flexibility			-0.004 (-0.60)		-0.009 (-093)
Central Bank Governor Turnover				0.361 (1.90) *	0.363 (1.91) *
η_0					
Inflation Targeting	-2.184 (-2.21) **				-2.083 (-1.39)
Energy Intensity		0.878 (0.23)			0.001 (0.00)
Labor Market Flexibility			-0.055 (-0.09)		0.490 (0.54)
Central Bank Governor Turnover				29.721 (3.31) ***	30.941 (3.34) ***
N	2234	1746	2167	1548	1407
Adjusted R-squared	0.169	0.176	0.168	0.199	0.201

Note: T-statics based on clustered robust standard errors are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent level.

Table 5. Pass-through coefficients from world oil inflation to domestic headline inflation (2000M1 to 2015M12)

Advanced Economies				Developing economies			
Country	Coefficients	s.e.		Country	Coefficients	s.e.	
United States	0.025	0.003	***	Chile	0.028	0.004	***
Sweden	0.020	0.004	***	Thailand	0.027	0.005	***
Spain	0.020	0.003	***	Uruguay	0.024	0.006	***
Greece	0.019	0.004	***	Argentina	0.022	0.006	***
Slovenia	0.019	0.005	***	Jordan	0.021	0.011	*
Ireland	0.018	0.004	***	Mauritius	0.018	0.005	***
Canada	0.018	0.003	***	Croatia	0.017	0.005	***
Turkey	0.017	0.011		Venezuela	0.014	0.007	**
Belgium	0.016	0.003	***	Lithuania	0.012	0.005	***
Czech Republic	0.015	0.005	***	Egypt	0.011	0.007	
Korea	0.013	0.003	***	Macao	0.011	0.005	**
France	0.013	0.003	***	Botswana	0.010	0.006	*
Norway	0.012	0.005	***	Latvia	0.009	0.005	
Austria	0.012	0.003	***	Macedonia	0.009	0.007	
Taiwan	0.012	0.008		Russia	0.008	0.005	*
Germany	0.012	0.003	***	Malaysia	0.008	0.005	*
Switzerland	0.012	0.003	***	South Africa	0.008	0.004	*
United Kingdom	0.011	0.003	*	Peru	0.007	0.003	**
Finland	0.011	0.003	***	Vietnam	0.007	0.008	
Singapore	0.011	0.005	*	Uganda	0.006	0.011	
Israel	0.010	0.004	**	Ukraine	0.006	0.008	
Denmark	0.010	0.003	***	Philippines	0.006	0.004	*
Netherlands	0.009	0.003	***	Hungary	0.005	0.005	
Estonia	0.009	0.004	***	Iran	0.005	0.009	
Slovakia	0.009	0.005	*	Costa Rica	0.005	0.005	
Portugal	0.009	0.004	***	Poland	0.004	0.003	
New Zealand	0.008	0.004	*	Ecuador	0.004	0.005	
Japan	0.008	0.003	***	Bulgaria	0.004	0.008	
Australia	0.007	0.004	**	Ivory Coast	0.003	0.009	*
Cyprus	0.007	0.005		Nigeria	0.002	0.016	
Iceland	0.007	0.005		Kazakhstan	0.002	0.004	
Italy	0.006	0.002	***	Tunisia	0.002	0.003	
Hong Kong	0.001	0.008		Colombia	0.001	0.002	
Malta	0.001	0.007		Mexico	-0.001	0.002	
				Albania	-0.001	0.006	
				Saudi Arabia	-0.003	0.003	
				Brazil	-0.008	0.003	***

Note: T-statics based on clustered robust standard errors are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent level.

Table 6. Country-specific factors and the size of pass-through coefficients

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Transport Weight in CPI	0.045 (2.94)***								0.044 (2.64)***
Level of Inflation in the 90s		-0.007 (-0.84)							0.009 (-871)
IT Dummy			0.001 (0.38)						-0.001 (-0.38)
Central Bank Independence Index				0.005 (1.23)					0.001 (0.26)
Energy Subsidies					-0.071 (-1.91)*				-0.092 (-1.91)*
Fuel Import						0.033 (2.19)**			
Net Energy Import							0.002 (2.44)***		
Inflation Anchoring								0.001 (1.32)	
Constant	0.003 (1.54)	0.011 (9.54)	0.009 (6.57)	0.008 (3.35)	0.011 (10.11)	0.005 (2.60)	0.009 (10.91)	0.007 (2.66)	0.006 (1.61)
N	65	60	68	52	68	63	63	33	47
Adjusted R-squared	0.107	-0.004	-0.012	0.0103	0.0381	0.0578	0.074	0.023	0.174

Note: T-statics based on WLS are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent level.

Appendix

Table A.1. Sources and definitions of variables

Definition	Source	Note
Consumer Price Index	Haver Analytics	Including data for the core CPI
World Oil Price	IMF Primary Commodity Prices	West Texas Intermediate Crude Oil Prices
CPI Transport Basket Share	Country statistics sources and Haver Analytics	A broad concept of oil share
Fuel Import Share	World Bank	World Bank staff estimates from the Comtrade database maintained by the United Nations Statistics Division
Net Energy Imports	International Energy Agency and United Nations, Energy Statistics Yearbook	As a % of the total energy use
Nominal Exchange Rate	IMF/GDS Database	Local currency units/USD
Inflation Expectation	Consensus Economic Forecasts	
Global Energy Subsidies	Coady et al. (2015)	As a % of the GDP
Inflation Targeting Dummy	IMF's World Economic Outlook	1 if inflation targeting, 0 otherwise
Advanced/Emerging Dummy	IMF's World Economic Outlook	1 if advanced, 0 if emerging
Central Bank Governor Turnover Index	Crowe and Meade (2007)	A lower value indicates more independence
Energy Intensity	U.S. Energy Information Administration	As a % of the GDP, normalized the value in 1980 to one
Labor Market Flexibility	Fraser Institute's Economic Freedom of the World database	A higher value indicates more flexibility (0 to 10)

Table A.2. Summary statistics on the annual dataset, 1970 to 2015

	Headline Inflation	Global Oil Inflation	Core Inflation	Fuel Share in Merchandise Import	Transport Share in CPI Basket	Headline Inflation	Global Oil Inflation	Core Inflation	Fuel Share in Merchandise Import	Transport Share in CPI Basket	Obs
	Mean					Standard Deviation					
Advanced Economies											
Australia	5.44	0.52	5.40	8.97	13.87	3.74	2.22	4.12	4.06	1.29	44
Austria	3.31	0.54	1.92	9.36	14.71	2.12	2.60	0.86	3.86	0.60	44
Belgium	3.78	0.60	1.72	11.55	14.71	2.84	3.05	0.64	4.29	0.94	44
Canada	4.17	0.50	2.26	7.33	19.34	3.11	1.92	0.97	3.00	0.70	44
Czech Republic	3.57	0.62	1.35	8.75	10.50	2.84	2.09	1.23	1.79	0.59	19
Denmark	4.53	0.60	2.29	10.08	13.12	3.46	3.09	2.03	6.14	0.95	44
Estonia	8.22	0.88	3.03	11.46	14.77	9.57	2.85	1.70	4.72	1.03	21
Finland	4.94	0.93	1.89	16.36	14.15	4.20	4.48	1.03	6.30	0.73	44
France	4.55	0.83	1.56	14.53	16.53	3.82	4.06	0.82	6.32	0.44	44
Germany	2.80	0.93	1.60	13.25	14.05	1.82	4.08	1.33	6.18	0.91	44
Greece	9.89	0.80	2.57	16.28	13.13	7.14	4.61	1.98	8.39	0.13	44
Hong Kong	5.13	0.22	4.28	3.57	8.93	4.59	0.95	4.89	1.77	0.37	44
Iceland	15.76	0.62		10.84	90.37	15.22	2.93		3.62	334.15	44
Ireland	5.92	0.48	2.90	8.58	13.50	5.54	2.29	2.40	4.07	0.63	44
Israel	26.81	0.66	19.00	12.51	19.33	39.20	3.32	37.09	6.03	2.33	44
Italy	6.71	0.95	2.75	16.40	13.83	5.48	4.62	1.35	8.12	1.36	44
Japan	2.71	1.65	2.60	29.31	11.39	4.26	8.02	3.92	10.86	2.21	44
Korea	7.15	1.02	5.76	20.56	10.92	6.24	5.14	5.31	7.68	0.00	44
Latvia	10.39	1.09	3.90	14.65	10.44	16.49	3.12	4.53	4.86	2.70	22
Netherlands	2.28	-0.07	1.89	13.90	11.34	1.50	3.38	0.92	6.35	0.71	34
New Zealand	6.25	0.69	2.31	11.29	16.62	5.09	2.96	1.27	4.65	0.59	44
Norway	4.80	0.42	1.33	6.18	17.23	3.38	1.87	0.79	3.77	1.53	44
Portugal	7.04	0.52	3.08	13.60	18.13	6.18	3.85	3.80	6.24	1.76	44
Singapore	2.96	1.02	1.48	19.49	15.53	4.13	5.27	1.22	8.08	0.00	44
Slovakia	5.52	1.03	4.74	13.66	8.83	3.48	3.13	4.65	2.07	0.80	21
Slovenia	6.94	0.52	2.77	10.17	17.24	6.42	2.29	2.65	3.15	1.56	22
Spain	7.01	0.86	3.50	18.88	41.45	5.21	5.57	1.82	10.26	59.20	44
Sweden	4.83	0.75	1.84	12.70	13.83	3.98	3.59	1.93	5.39	0.59	44
Switzerland	2.56	0.44	0.55	6.89	10.39	2.46	2.02	0.66	2.80	0.70	44
United Kingdom	5.59	0.62	1.52	9.09	15.64	4.85	2.68	0.68	4.48	0.78	44
United States	4.20	1.13	4.10	16.00	17.15	2.75	4.37	2.52	7.56	0.48	44
Developing economies											
Asia											
India	7.70	1.73	7.18	27.71	7.57	4.66	7.05	2.33	10.41	0.00	44

Malaysia	3.51	0.49	1.66	8.75	15.57	2.80	2.29	1.11	4.26	0.49	44
Pakistan	8.66	1.00		21.36	7.20	4.57	5.41		7.97	0.00	44
Philippines	9.49	0.80	4.42	16.64		7.45	4.70	1.37	6.72		44
Thailand	4.87	0.93	2.07	15.74	26.70	4.48	4.37	2.02	6.98	0.36	44
Vietnam	26.61	0.96		11.70	8.96	41.43	3.19		2.52	0.09	44
Commonwealth of Independent States											
Kazakhstan	39.86	1.04		13.15	6.87	82.22	3.26		3.62	1.07	22
Russia	47.28	0.14	8.31	2.14	3.13	74.29	0.58	2.62	0.80	0.21	25
Ukraine	57.86	2.96		35.40	4.53	103.80	9.14		6.80	0.37	23
Emerging and Developing Europe											
Albania	13.96	0.72		10.50	5.78	26.30	2.65		5.33	0.60	25
Bosnia & Herzegovina	2.58	1.25		15.47	9.51	2.32	3.52		4.96	0.53	16
Bulgaria	19.14	0.23	6.05	18.42	7.41	44.92	5.28	6.24	10.64	0.59	44
Croatia	19.33	0.94		14.13	11.60	61.02	3.14		4.48	1.11	22
Hungary	8.99	0.26	6.79	10.68	14.67	7.23	3.13	4.97	6.42	1.01	44
Lithuania	2.79	2.04	0.54	23.76	10.01	2.85	5.34	6.60	6.59	2.01	15
Macedonia	13.74	1.02		14.44	8.68	35.35	3.56		4.72	0.62	22
Poland	21.28	0.35	4.23	12.50	9.00	35.09	2.39	4.45	4.71	0.38	44
Romania	21.46	0.66	6.72	17.96	0.86	34.08	3.76	4.93	10.35	0.06	44
Serbia	17.22	1.90		17.51	11.00	16.64	4.05		2.24	0.78	18
Turkey	31.94	0.96	23.64	19.28	13.36	20.83	5.66	22.02	10.69	2.30	44
Latin America and the Caribbean											
Argentina	62.43	0.59		8.05	16.66	82.54	2.39		4.37	0.19	44
Brazil	68.07	0.99	5.84	23.99	16.66	94.22	7.01	2.66	12.53	0.39	44
Chile	26.75	1.03	9.92	16.00	19.10	42.41	4.37	8.24	5.58	0.28	44
Colombia	14.98	0.05	5.28	4.83	14.06	8.12	1.56	1.82	3.90	0.83	44
Costa Rica	13.20	0.44		10.12	18.19	11.20	2.82		3.74	0.00	44
Ecuador	19.95	0.37		6.66	13.60	16.03	1.89		5.20	0.00	44
Mexico	20.11	0.34	20.95	4.29	13.82	20.80	1.49	23.85	2.24	0.58	44
Peru	47.45	0.87	8.77	10.28	13.76	87.75	2.64	13.35	5.78	1.99	44
Uruguay	31.64	0.98		21.27	14.26	22.23	5.86		9.26	0.00	44
Venezuela	21.09	0.05	26.50	1.50	11.50	15.01	0.44	5.75	0.91	0.79	44
Middle East, North Africa, Afghanistan, and Pakistan											
Algeria	8.54	0.11		1.99	15.85	6.84	0.44		1.63	0.00	44
Egypt	9.95	0.45		6.01	5.48	5.55	1.52		4.78	0.23	44
Jordan	6.17	0.76		15.40	15.84	5.03	3.95		6.81	0.00	44
Lebanon	20.62	1.43		16.00	12.30	32.45	4.16		8.27	0.00	44

Saudi Arabia	3.69	0.03		0.41	16.00	7.08	0.10		0.31	0.00	44
Tunisia	5.26	0.60		10.82	11.33	2.48	2.97		4.10	0.00	44
Sub-Saharan Africa											
Ghana	24.98	0.94		14.44	6.32	18.89	3.86		9.13	0.26	44
Ivory Coast	6.14	0.96		19.42	10.92	6.38	5.53		8.89	1.44	44
Nigeria	16.60	0.30		3.00	4.81	12.36	0.88		4.26	1.13	44
South Africa	9.33	0.62	4.92	8.86	17.65	3.82	2.94	2.87	8.42	0.50	44
Uganda	36.06	1.51		15.90	12.80	32.52	3.44		7.16	0.00	44

Table A.3. Summary statistics on the monthly dataset, 2000M1 to 2015M12

	Headline Inflation	Oil Inflation in LCU	Headline Inflation	Oil Inflation in LCU	
	Mean		S.D.		Obs
Advanced Economies					
Australia	0.26	1.01	1.08	8.00	135
Austria	0.17	0.92	1.02	10.25	167
Belgium	0.18	0.93	0.52	7.96	168
Canada	0.17	0.91	0.30	7.95	152
Cyprus	0.19	0.94	0.28	7.92	166
Czech Republic	0.21	0.73	0.55	8.33	167
Denmark	0.17	0.94	0.46	8.50	168
Estonia	0.32	0.93	0.86	7.94	168
Finland	0.15	0.93	0.31	7.91	168
France	0.14	0.93	0.43	8.14	168
Germany	0.13	0.93	0.25	8.26	168
Greece	0.23	0.93	0.52	8.34	168
Hong Kong	0.11	1.12	0.49	7.89	167
Iceland	0.46	1.44	0.89	8.43	167
Ireland	0.19	0.92	0.51	7.80	167
Israel	0.17	1.00	0.38	7.93	167
Italy	0.18	0.93	1.84	9.02	168
Japan	-0.02	1.21	0.81	8.51	138
Korea	0.24	1.06	0.41	7.92	168
Latvia	0.36	1.03	0.38	8.84	168
Malta	0.20	0.94	0.34	7.92	167
Netherlands	0.17	0.93	0.29	7.92	168
New Zealand	0.23	1.11	0.32	7.92	135
Norway	0.16	0.93	1.16	7.92	168
Portugal	0.20	0.93	0.81	8.27	168
Singapore	0.18	0.92	0.53	7.98	167
Slovakia	0.34	0.93	0.57	8.32	168
Slovenia	0.31	0.93	1.10	11.66	168
Spain	0.23	0.93	0.48	7.95	168
Sweden	0.12	0.94	0.47	8.10	168
Switzerland	0.05	0.79	0.18	7.92	168
Taiwan	0.09	1.09	0.79	7.95	168
United Kingdom	0.19	1.10	1.04	8.28	168
United States	0.20	1.12	0.54	8.33	167
Developing economies					
Asia					
Malaysia	0.18	1.00	0.64	7.72	167

Philippines	0.42	1.51	0.42	7.73	136
Thailand	0.22	1.01	1.17	8.30	167
Vietnam	0.76	1.70	0.89	8.39	142
Commonwealth of Independent States					
Kazakhstan	0.65	1.19	0.32	8.07	167
Russia	0.90	1.19	0.54	8.25	167
Ukraine	0.78	1.35	0.41	8.27	167
Emerging and Developing Europe					
Albania	0.22	0.94	0.39	7.91	167
Bulgaria	0.43	0.92	0.75	8.00	167
Croatia	0.23	0.92	0.22	8.02	167
Hungary	0.43	1.04	1.59	8.25	168
Lithuania	0.23	0.82	0.39	7.79	167
Macedonia	0.21	0.95	0.75	7.84	167
Poland	0.25	0.91	0.39	8.16	168
Turkey	1.26	2.11	0.29	9.18	167
Latin America and the Caribbean					
Argentina	0.75	2.35	0.63	7.80	167
Brazil	0.54	1.26	0.51	8.74	167
Chile	0.26	1.12	0.40	8.10	168
Colombia	0.41	1.15	1.34	7.93	168
Costa Rica	0.71	1.44	0.55	8.01	167
Ecuador	0.85	1.38	0.47	7.92	167
Mexico	0.38	1.31	0.55	8.01	168
Peru	0.22	0.97	0.53	7.92	167
Uruguay	0.68	1.52	0.74	8.81	167
Venezuela	1.82	2.72	1.08	11.03	167
Middle East, North Africa, Afghanistan, and Pakistan					
Iran	1.35	2.00	0.49	7.59	167
Jordan	0.34	1.12	0.79	8.31	167
Mauritius	0.44	1.20	0.35	8.27	167
Saudi Arabia	0.22	1.12	0.30	8.01	167
Tunisia	0.31	1.27	1.07	7.80	167
Sub-Saharan Africa					
Botswana	0.66	1.50	0.52	7.82	167
Ivory Coast	0.24	0.92	0.47	8.25	167
Nigeria	0.99	1.39	0.71	7.92	167
South Africa	0.43	1.42	1.79	10.25	167

Uganda	0.61	1.43	0.36	7.92	167

Table A.4. Pass-through coefficients from world oil inflation (measured in USD) to domestic headline inflation (2000M1 to 2015M12)

Advanced Economies				Developing economies			
Country	Coefficients	s.e.		Country	Coefficients	s.e.	
United States	0.025	0.003	***	Mauritius	0.026	0.005	***
Israel	0.022	0.004	***	Philippines	0.021	0.004	***
Spain	0.019	0.003	***	Uruguay	0.020	0.006	***
Sweden	0.018	0.003	***	Albania	0.017	0.006	***
Greece	0.017	0.004	***	Ecuador	0.015	0.005	***
Canada	0.017	0.003	***	Thailand	0.012	0.005	***
Slovenia	0.016	0.005	***	Colombia	0.012	0.002	***
Ireland	0.016	0.004	***	Brazil	0.012	0.003	***
Belgium	0.014	0.003	***	Tunisia	0.012	0.003	***
France	0.013	0.003	***	Malaysia	0.011	0.005	***
Cyprus	0.012	0.007	*	Croatia	0.011	0.005	***
Austria	0.012	0.003	***	Costa Rica	0.011	0.005	***
Switzerland	0.012	0.003	***	Vietnam	0.011	0.008	
Norway	0.011	0.005	***	South Africa	0.011	0.004	***
Germany	0.011	0.003	***	Mexico	0.010	0.002	***
Korea	0.011	0.007	*	Peru	0.010	0.003	***
Finland	0.011	0.003	***	Hungary	0.009	0.005	*
United Kingdom	0.010	0.003	***	Botswana	0.008	0.006	
Australia	0.009	0.003	***	Macedonia	0.007	0.007	
Denmark	0.009	0.003	***	Uganda	0.007	0.011	
Netherlands	0.008	0.003	***	Nigeria	0.007	0.016	
Japan	0.008	0.003	***	Ivory Coast	0.006	0.009	
Portugal	0.008	0.004	***	Venezuela	0.006	0.007	
New Zealand	0.007	0.004	*	Macao	0.006	0.005	
Hong Kong	0.006	0.003	*	Argentina	0.005	0.006	
Italy	0.006	0.002	***	Russia	0.005	0.005	
Estonia	0.006	0.004		Lithuania	0.004	0.005	
Slovakia	0.004	0.008		Poland	0.004	0.003	
Czech Republic	0.002	0.004		Egypt	0.004	0.007	
Iceland	0.002	0.006		Latvia	0.004	0.005	
Taiwan	0.000	0.002		Saudi Arabia	0.004	0.003	
Turkey	-0.002	0.013		Bulgaria	0.001	0.008	
Singapore	-0.003	0.003		Chile	0.001	0.008	
Malta	-0.008	0.007		Jordan	0.000	0.011	
				Kazakhstan	-0.001	0.004	
				Ukraine	-0.003	0.008	
				Iran	-0.006	0.009	

Note: T-statics based on robust standard errors are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent level.

Table A.5. Summary statistics on country characteristics

	Transport Weight in CPI (%)	Fuel Share in Merchandise Import (%)	Net Energy Imports (%)	Level of Inflation in the 90s (% points)	IT Dummy	Inflation anchoring	Central Bank Independence Index (0-1)	Energy Subsidies (%)
Advanced Economies								
Australia	14.03	12.54	-133.68	2.51	1	1.33	0.18	0.83
Austria	14.72	10.15	66.95	2.42	1		0.81	0.15
Belgium	14.84	12.44	74.86	2.15	1		0.81	0.53
Canada	19.62	8.96	-53.79		1	2.45	0.43	1.42
Cyprus					1			0.00
Czech Republic	10.65	9.18	25.95	0.86	1	1.47	0.65	0.17
Denmark	13.12	6.83	-39.60	2.06	0		0.81	1.06
Estonia	14.77	12.64	22.40	3.41	0		0.72	1.31
Finland	14.15	15.73	53.08	2.14	1		0.81	0.10
France	16.37	13.34	48.52	1.89	1	4.11	0.81	0.29
Germany	13.60	11.19	59.54	2.56	1	2.41	0.81	0.02
Greece	13.13	20.22	65.07	11.12	1		0.81	0.40
Hong Kong	8.93	2.89	99.63	6.88	0	1.13		0.33
Iceland		11.25	21.17	4.29	1		0.56	0.98
Ireland	13.49	8.54	88.02	2.31	1		0.81	0.08
Israel	20.85	15.16	88.85	11.26	1		0.31	0.16
Italy	14.31	14.05	83.65	4.13	1	2.96	0.81	0.04
Japan	13.61	26.81	82.61	1.21	0	2.92	0.35	1.48
Korea	10.92	27.55	81.20	5.74	1	1.18	0.32	1.41
Latvia	11.71	13.39	58.94	3.26	0		0.82	0.80
Malta					1			0.10
Netherlands	11.64	14.41	19.15	2.45	1	3.79	0.81	0.17
New Zealand	16.73	13.60	16.52	2.12	1	2.26	0.26	1.01
Norway	17.45	4.97	-688.67	2.45	1	2.15	0.33	0.53
Portugal	18.13	13.85	81.87	5.93	1		0.81	0.15
Singapore	15.53	21.29	98.30	1.94	0	1.35	0.11	2.23
Slovakia	8.83	13.40	64.34	0.75	0	1.18		0.88
Slovenia	17.24	11.23	51.18	1.38	0			0.77
Spain	41.45	16.00	75.90	4.22	1	2.84	0.81	0.90
Sweden	13.83	11.81	34.18	3.28	1	2.11	0.77	0.11
Switzerland	10.39	6.93	52.74	2.34	0	3.48		0.23
Taiwan	13.85			2.88	0	1.40		2.29
United Kingdom	15.28	8.18	8.07	3.31	1	2.35	0.20	0.02
United States	15.67	16.27	24.88	3.00	0	2.27	0.18	1.93
Developing economies								
Asia								

Malaysia	15.57	8.94	-37.78	3.70	0	0.94	0.39	6.39
Philippines		15.27	44.98	9.24	1		0.29	1.74
Thailand	26.70	17.21	42.32	4.99	1	0.71	0.14	3.52
Vietnam	8.96	12.25	-32.36					0.00
Commonwealth of Independent States								
Kazakhstan	7.29	11.86	-121.01	5.77	0			3.36
Russia	3.13	1.93	-76.95	8.55	0	0.76	0.61	7.71
Ukraine	4.53	32.81	40.26	12.13	0	0.32		1.25
Emerging and Developing Europe								
Albania	5.77	12.60	42.79	1.12	0		0.62	0.00
Bulgaria	7.41	14.85	45.12	8.46	0		0.61	3.53
Croatia	11.58	16.42	54.86	5.79	0		0.73	0.38
Hungary	14.67	8.73	58.33	22.18	1	1.55	0.71	0.09
Lithuania	10.23	24.40	55.22	5.89	0		0.70	4.03
Macedonia	8.68	16.30	43.42	2.12	0		0.58	0.85
Poland	9.00	10.78	20.33	28.56	1	1.21	0.32	0.32
Turkey	13.34	13.16	69.88	77.40	1	0.43	0.56	0.36
Latin America and the Caribbean								
Argentina	16.66	7.04	-22.30		0	0.58	0.58	2.78
Brazil	16.64	17.16	11.01		1	0.35		1.66
Chile	19.17	21.57	67.50	11.79	1	0.60	0.67	2.35
Colombia	14.10	4.18	-203.65	22.18	1	0.81	0.29	2.32
Costa Rica	18.19	10.48	50.81	16.88	0			2.27
Ecuador	13.60	11.31	-154.59	39.09	0			7.05
Mexico	13.82	6.17	-39.86	20.51	1	0.73	0.63	3.72
Peru	13.74	16.37	13.99		1	0.82	0.56	0.88
Uruguay	14.26	21.81	61.53	49.25	0			0.70
Venezuela	11.50	1.52	-234.15	47.97	0	0.22	0.53	13.40
Middle East, North Africa, Afghanistan, and Pakistan								
Iran	11.69				0			16.23
Jordan	15.84	20.68	95.45	5.12	0		0.33	6.72
Mauritius	14.73			7.63	0		0.38	0.00
Saudi Arabia	16.00	0.31	-277.17	1.27	0		0.12	11.38
Tunisia	11.33	13.09	17.12	4.87	0		0.46	2.98
Sub-Saharan Africa								
Botswana	18.98				0		0.38	3.08
Ivory Coast	10.91	27.21	-5.89	6.00	0			0.16
Nigeria	4.81	5.21	-116.76	30.89	0		0.50	1.07

South Africa	17.66	17.63	-21.78	9.91	1		0.15	4.48
Uganda	12.80	18.75	0.00	0.34	0		0.28	0.00

Table A.6. Country-specific factors and the size of pass-through coefficients (balanced sample)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Transport Weight in CPI	0.049 (2.28)***							
Level of Inflation in the 90s		-0.019 (-1.40)						
IT Dummy			-0.002 (-0.49)					
Central Bank Independence Index				0.001 (0.10)				
Energy Subsidies					-0.043 (-0.48)			
Fuel Import						0.051 (2.31)***		
Net Energy Import							0.001 (1.20)	
Inflation Anchoring								0.001 (0.51)
Constant	0.003 (0.92)	0.012 (6.57)***	0.012 (3.41)***	0.011 (2.94)***	0.0117 (5.66)***	0.004 (1.34)	0.011 (7.15)***	0.009 (2.83)***
N	24	24	24	24	24	24	24	24
Adjusted R-squared	0.1554	0.0405	-0.0341	-0.0449	-0.0346	0.1588	0.0191	-0.0332

Note: T-statics based on WLS are reported in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent level.

Estimating Inflation Anchoring

The extent to which inflation expectations are anchored is estimated using the response of medium-term inflation expectations to an unexpected increase in inflation in the current period. we estimate the response of expectations of future inflation to an unexpected 1 standard deviation increase in inflation in the current year. The inflation expectation data are based on surveys of professional forecasters conducted in 20 advanced and 18 emerging and developing economies over the past two decades, and the statistical approach is based on that of Levin, Natalucci, and Piger (2004).

The change in future inflation expectations is the dependent variable on the left side of the equation, and the explanatory variable on the right side is the unexpected change in current-year inflation, defined as the revision of expectations for inflation in year *t* made between spring and fall of year *t*. The following equation estimated is estimated separately for each country:

$$\Delta E_{it}\pi_{i,t+N} = \alpha + \beta \Delta E_{it}\pi_{it} + \mu_i + \lambda_t + \nu_{i,t}, \qquad \text{(A1)}$$

where the subscript *i* denotes the *i*th country, the subscript *t* denotes the *t*th year, and $\Delta E_{it}\pi_{i,t+N}$ denotes the revision of expectations for inflation in year $t+N$, with N=1…5. The data on inflation expectations come from *Consensus Economics* and are based on surveys of professional forecasters published twice yearly in the spring (March/April) and fall (September/October) from 1990 to 2015 (see Table A.4 for the list of countries included in this part of the analysis).

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