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Commodity Price Shocks and Global Cycles: Monetary Policy Matters

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Keywords

commodity price shocks, transmission mechanisms, monetary policy

JEL Classification

E32, E52, F44, G15, Q02

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Commodity Price Shocks and Global Cycles: Monetary Policy Matters*

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Abstract

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1 Introduction

Fluctuations in commodity prices and interest rates have long been recognized as important for global economic and financial developments (Fernández et al., 2017; Miranda-Agrippino and Rey, 2020). Yet the precise nature of these relationships remains inadequately understood. This paper examines the impact of different types of commodity price shocks on global real and financial cycles, the role of monetary policy in shaping these effects, and the underlying transmission mechanisms.

We approach our analysis in three steps. First, we use a structural VAR model with global and US variables to evaluate the contribution of exogenous shocks to crude oil, food commodities, and industrial input prices to the volatility of world output, and whether such shocks induce co-movements in international financial variables that characterize the "Global Financial Cycle" (GFC) identified in Miranda-Agrippino and Rey (2020). To achieve identification, we use external instruments for global oil and food commodity price shocks; that is, the oil supply news shocks from Känzig (2021) and the global agricultural-weighted weather innovations from De Winne and Peersman (2021), respectively, while we employ sign restrictions for isolating shocks to industrial input prices.[1] We find that (i) food commodity price shocks exert the greatest impact on both the GFC and economic activity, (ii) oil price shocks also matter for fluctuations in economic activity, albeit to a lesser extent and not significantly affecting the GFC, and (iii) industrial input price shifts are almost entirely endogenous responses to other shocks, rather than an independent source of macroeconomic fluctuations.

Second, considering the hegemonic role of the United States in international markets, we conduct counterfactual estimations in the spirit of McKay and Wolf (2023) to isolate the contribution of systematic monetary policy responses by the US Federal Reserve to the transmission of oil versus food price shocks. Our findings indicate that systematic policy exacerbates the repercussions of food price shocks, whereas a counter-cyclical policy easing in response to positive oil price shocks curbs their impact on global output and the GFC. In the absence of systematic monetary policy interventions, the relevance of oil price shocks for the volatility in the GFC and world output would have been more than double and sixfold, respectively, compared to the impact of food price shocks. We observe that these divergent monetary policy responses to both shocks are not unique to the US; we provide evidence that other advanced economies exhibit similar contrasting responses.

Finally, to enhance our understanding of the "fundamental" mechanisms of oil and food price shocks, we examine the counterfactual pass-through to several key US macroeconomic variables included in the VAR, such as nominal wages, core CPI, and proxies for financial stress. In addition, we

[1] Food commodity prices are a weighted average of the four most important staples: corn, wheat, rice, and soybeans. Industrial inputs, which include agricultural raw materials and metals, is the third main category of the Primary Commodity System of the International Monetary Fund (besides food and energy).

apply a novel diff-in-diff approach on sectoral-level data, which involves (i) estimating the counterfactual effects of both shocks across sectors, (ii) controlling for the aggregate consequences of the shocks and (iii) comparing the differences between the shocks. The remaining "differences" between the sectors isolate the relative strength of the underlying mechanisms for both shocks, without distortions due to systematic monetary policy or sectoral sensitivity to macroeconomic shocks more generally.

The counterfactual results reveal that food price shocks raise nominal wages and core CPI, thereby intensifying inflationary pressures. We also note a stronger decline in nondurable (nonfood) consumption compared to oil shocks. Conversely, although consumer prices rise after oil price shocks, core inflation and nominal wages tend to decline absent a monetary policy easing. In addition, risk premiums and financial uncertainty would surge considerably. Notably, in contrast to food shocks, there is a considerably stronger fall of durable consumption and spending on goods and services that are complementary with energy consumption, such as purchases of motor vehicles, retail trade, leisure activities and construction. Therefore, oil price shocks behave more like adverse aggregate demand shocks that are amplified through financial frictions. We argue that these distinct transmission mechanisms explain the opposing monetary policy responses that we find in the data.

To our knowledge, this is the first paper that (i) identifies exogenous industrial input price shocks, (ii) estimates the causal effects of commodity market shocks on the GFC, (iii) examines the relevance of endogenous monetary policy for global real and financial developments, and (iv) explores the differences between commodities to uncover the transmission mechanisms. Section 2 discusses the contribution of our paper to the existing literature. Sections 3 to 6 outline the empirical strategy, present the baseline results, analyze the role of monetary policy, and examine the transmission mechanisms. Section 7 concludes. The paper also has an online supplementary appendix reporting robustness checks and additional analyses.

2 Contribution to the literature

This paper is related to various areas of the literature. First, we contribute to the literature on the relevance of developments in commodity markets for global economic activity. Alquist et al. (2020) find that the primary driver of commodity price movements is an endogenous response to non-commodity shocks, while (a single common factor of) exogenous commodity market shocks contribute only modestly to global economic fluctuations. Our result show, however, that not all commodities are alike. By distinguishing between different types of commodities, autonomous disturbances in commodity markets can account for a sizable share of global output variance; that is, the shocks jointly explain 22% of world output variation. This observation aligns with the "reduced-form" evidence of Fernández et al.

(2017, 2022), which shows that a combination of world shocks affecting oil, food, and/or metals and minerals commodity prices collectively explains one-third of output growth variance across countries, which is three times as large as a single (aggregate) world price specification.

A large body of work has examined the macroeconomic consequences of disruptions in specific commodity markets, particularly focusing on the oil market. While Kilian (2009), Lippi and Nobili, 2012, Kilian and Murphy (2014), and Juvenal and Petrella (2015) document that oil price innovations are primarily demand-driven, with modest output effects of oil supply shocks, other studies highlight a more relevant role for oil supply shocks (Peersman and Van Robays, 2009; Baumeister and Peersman, 2013; Caldara et al., 2019; Baumeister and Hamilton, 2019; Känzig, 2021). Evidence on the effects of global food commodity market disruptions is scarcer. Existing studies report a significant impact of food supply shocks on the macroeconomy (De Winne and Peersman, 2016, 2021; Peersman, 2022). However, to our knowledge, no empirical analysis exists on the effects of disturbances in prices of industrial commodities, such as metals and agricultural raw materials. Our contribution to this literature is twofold. Firstly, we provide evidence on the consequences of exogenous shocks to industrial input prices, finding that fluctuations in input prices are predominantly endogenous responses to other shocks. In particular, the shocks explain only 3% of industrial commodity price volatility, which is substantially lower than the own contribution of oil (21%) and food commodity price (30%) shocks. Secondly, we formally compare the pass-through and monetary policy responses to different types of commodity price shocks. The results reveal that food commodity price shocks resemble cost-push shocks that trigger second-round effects that intensify inflationary pressures, whereas oil price shocks act more like adverse aggregate demand shocks. Furthermore, we observe that monetary policy exacerbates the output effects of food price shocks and alleviate those of oil price shocks.

Our research also contributes to the literature that examines the characteristics of the Global Financial Cycle, which is a common factor identified in Miranda-Agrippino and Rey (2020) that explains an important share of the variation of risky asset prices, capital flows and financial aggregates around the world. Since the GFC is associated with worldwide domestic financial conditions, it is important to understand its drivers. Miranda-Agrippino and Rey (2020; 2021) show that monetary policy shocks, particularly from the US, have significant effects on the GFC. However, it is well-known that monetary policy shocks are quantitatively not important to explain variances of macroeconomic aggregates, because monetary policy actions are primarily endogenous responses to other shocks. Recently, Boehm and Kroner (2020) and Caggiano and Castelnuovo (2023) have documented significant effects of macro news shocks and financial uncertainty shocks, respectively, but little is known about other fundamental drivers of the co-movement in financial conditions globally. Notably, Miranda-Agrippino and Rey (2021) show that commodity prices exhibit the smallest factor loadings on the GFC, indicating the existence of a distinct commodity cycle.[2] The contribution of our paper to the GFC literature is twofold. Firstly, our analysis reveals that autonomous food commodity market disruptions can be considered as an important driver of the GFC, explaining about 8% of its forecast error variance. This turns out to be greater than US monetary policy shocks that are identified within the same VAR. Secondly, this is the first study that highlights the critical role of endogenous monetary policy in shaping the GFC; by amplifying as well as mitigating the repercussions of other shocks.

Furthermore, our results revisit the impact of central banks on the output effects of oil shocks. In an early influential study, Bernanke et al. (1997) find that a systematic tightening of monetary policy amplifies the decline in US output after oil price increases, and that this response is the main driver of subsequent recessions. However, Kilian and Lewis (2011) demonstrate that a policy tightening in the US occurs only after oil demand shocks raising oil prices, whereas there is a (modest) easing after oil supply shocks. They also conclude that the policy response does not lead to large aggregate fluctuations. We confirm a policy easing after oil supply shocks and document its robustness. Interest rate declines appear even greater and more persistent in recent periods. Moreover, we find that systematic monetary policy matters and significantly mitigates the output losses.

Finally, we shed more light on the transmission of oil and food price shocks to the real economy. De Winne and Peersman (2016) identify a reduction in durable consumption and investment as primary channels through which food price shocks impact the economy. However, our findings reveal that a significant part of the decline in these components results from the monetary policy reaction to such shocks. There is even a greater decline of nondurable consumption absent the monetary policy response. Regarding oil price shocks, our results align with several studies that conclude that energy price shocks are primarily adverse aggregate demand shocks through a decline in spending on goods and services other than energy (Hamilton, 2009; Edelstein and Kilian, 2009). Whereas the critical role of the automotive sector in these demand effects is well-documented (Davis and Haltiwanger, 2001; Lee and Ni, 2002; Edelstein and Kilian, 2009), our study is the first to show an important contribution of other spending categories that complement energy consumption, such as retail trade, leisure activities and construction. While purchases of motor vehicles appear to be responsible for half of the total decline in final consumer goods, these three sectors contribute to almost half of the decline in employment without a monetary policy intervention. Furthermore, we show that financial frictions cannot be ignored as a propagation mechanism of energy price shocks, particularly in the absence of a monetary policy response, which is consistent with the analysis in Gelain and Lorusso (2022).

[2] The low factor loadings of commodity prices within a "reduced-form" framework is not surprising. This can be the consequence of a positive correlation between endogenous changes in commodity prices and financial aggregates, whereas exogenous shifts in commodity prices tend to affect global economic and financial variables in the opposite direction. Juvenal and Petrella (2024) examine the linkages between commodity price changes and capital flows in emerging markets and developing economies, which is another common global financial factor.

3 Methodology

We use a 19-variables monthly structural VAR model that includes global and US macroeconomic indicators to quantify the effects of three different commodity price shocks. We achieve identification of these shocks by combining external instruments and sign restrictions. The methodology that we use to combine instrumental variables and sign restrictions is based on Cesa-Bianchi and Sokol (2022).[3]

3.1 Empirical Approach

We assume that the global economy can be summarized by the following linear VAR system:

$$A(L)Y_t = u_t \tag{1}$$

The constant term in the VAR system is omitted for simplicity. Y_t is an $n-$dimensional vector of endogenous variables that are described below, $A(L) = I - A_1L^1 - ... - A_pL^p$ is a polynomial matrix in the lag operator L, p is the number of lags considered, and $u_t \sim WN(0, \Sigma_u)$ are the reduced-form residuals of the system. The residuals are related to a set of mutually orthogonal structural shocks via a non-singular matrix B ($u_t = B\varepsilon_t$) such that $\Sigma_u = BB'$. By inverting $A(L)$ we obtain the structural moving average representation:

$$Y_t = C(L)B\varepsilon_t \tag{2}$$

where $C(L) = A(L)^{-1}$. Stock and Watson (2012) and Mertens and Ravn (2013) show that an external set of instruments can be used to identify a subset of columns of B (say the first k columns B^{IV}), provided that such instruments are correlated with the shocks of interest and orthogonal to all the other shocks (relevance and exogeneity conditions).

The decomposition $\Sigma_u = BB'$ is not unique, and we can equivalently write:

$$\Sigma_u = CHH'C' \tag{3}$$

where C is the Cholesky factorization of Σ_u and H is a generic orthonormal matrix ($H' = H^{-1}$). Cesa-Bianchi and Sokol (2022) show that, conditional on the shocks identified via external instruments (which are associated with the columns B^{IV}), it is possible to identify additional shocks with sign restrictions by carefully drawing H, which leads to the set-identification of (some of) the remaining columns of B, which we label B^{SR}.[4]

[3] Cesa-Bianchi and Sokol (2022) study the transmission of financial and monetary policy shocks from the US to the UK.

[4] The approach put forth by Cesa-Bianchi and Sokol (2022) can be summarized as follows:

3.2 Baseline VAR Model

The baseline VAR model includes a set of global variables and commodity price indices, as well as a battery of US macroeconomic indicators. The US variables can be justified by the hegemony role of the US in international markets (Gourinchas et al., 2019; Ilzetzki et al., 2019; Miranda-Agrippino and Rey, 2021). The use of a large-scale VAR, which is similar to other VAR models proposed in the literature (Miranda-Agrippino and Rey, 2020; Miranda-Agrippino et al., 2020), limits the potential problem of omitted variable bias that could emerge in smaller VARs. Mori and Peersman (2024) show that this matters for oil market VARs identified using an external instrument (see also section 5).

The VAR contains three global commodity prices: crude oil, food commodities and industrial input prices. These are collected from the IMF database on Primary Commodity Prices. Crude oil is the WTI crude oil price index. As in Roberts and Schlenker (2013) and De Winne and Peersman (2021), the food commodity price index is a trade-weighted average of the four most important staples (corn, wheat, rice, and soybeans). We select these commodities because they closely resemble the agricultural-weighted weather instruments and contribute to approximately 75% of the world's food production calorie content. They are also closely interchangeable allowing for their aggregation into a single index and they have been traded in global markets for decades, while other food commodities' prices are typically linked to these staple food items. The IMF industrial input price indicator includes agricultural raw materials and metals. All commodity prices are deflated by US CPI.

The other global variables in the VAR are OECD industrial production, which is our measure of world output, OECD consumer prices, the OECD producer price index and the GFC indicator of Miranda-Agrippino (2020, 2021).[5] The GFC is a unique global factor that accounts for over a quarter of the common variation in 1004 risky asset price series around the world between 1980 and 2019. Turning to US variables, we include the US dollar nominal effective exchange rate and a standard set of macroeconomic and financial indicators; that is, industrial production, consumer prices, house prices, housing starts, the term spread, the excess bond premium of Gilchrist and Zakrajšek (2012), an index of financial uncertainty (Ludvigson et al., 2021), nominal wages, core consumer prices and inflation expectations. Finally, the VAR includes the one-year treasury bill rate as our policy indicator,

- Estimate the reduced form VAR and find B^{IV} via standard proxy VAR techniques.
- Find a matrix h of dimension $n \times k$ that rotates the Cholesky factor C into B^{IV}, i.e., $Ch = B^{IV}$.
- Given h, build the remaining $n-k$ columns of H following a Gram-Schmidt process and check that the elements of B^{SR} (or in general of the $j-$ step ahead impulse response functions) satisfy the desired sign restrictions. If restrictions are met, retain the matrix H, otherwise discard it.

[5] Since the official OECD consumer price index is significantly affected by extreme realizations of inflation during the 1980s in a few countries, we follow Ciccarelli and Mojon (2010) by constructing a weighted price indicator based on a subset of the countries that do not feature such extreme realizations. See appendix for details.

which—as pointed out by Gertler and Karadi (2015)—also contains information on unconventional policy actions during the zero lower bound period. Table A1 in the online supplementary appendix lists the variables modeled in our VAR, as well as their sources.

We estimate the VAR in levels over the sample period 1982M1 to 2019M4. The start of the sample is determined by the availability of the OECD PPI, and the end by the GFC indicator.[6] The baseline VAR features equation-specific constants and twelve lags, and is estimated with Bayesian methods using Normal Inverse-Wishart and Minnesota-type priors, whose tightness is calibrated following Giannone et al. (2015). We report 68% and 90% credible sets that are based on 10,000 draws.

3.3 Identification

We identify three orthogonal commodity price shocks. We first identify oil and food commodity price shocks using instrumental variable techniques. Since we identify two shocks with two sets of instruments, covariance restrictions do not suffice. We therefore adopt the recursive assumption proposed by Mertens and Ravn (2013), whereby we prioritize the identification of oil shocks before food commodity price shocks. This assumption implies that a food price shock does not affect oil prices in "cyclically adjusted" terms; that is, after accounting for contemporaneous feedback from other variables. Hence, we rule out only direct food-oil feedback, while still allowing for general equilibrium effects.[7] Conditional on the identification of these two shocks, we then identify industrial input price shocks with sign restrictions.

For the identification of oil price shocks, we use the instrumental variable of Känzig (2021). Building on the pivotal role of OPEC in the global oil market and institutional features of OPEC, Känzig (2021) proposes a high-frequency identification design to identify oil supply news shocks. To do so, he quantifies the changes in oil futures prices in a narrow window around the OPEC quota decisions. Under mild conditions, such high-frequency revisions in market expectation can be interpreted as a direct and exogenous consequence of changes in markets' beliefs about oil supply due to the announcement. Thus, these revisions represent a sensible proxy for exogenous oil price swings.

We use the agricultural-weighted global weather innovations of De Winne and Peersman (2021) as instruments to identify food commodity price shocks. The weather innovations are constructed by modeling a quadratic function in average temperature as well as total precipitation. Specifically, De Winne and Peersman (2021) gather temperature and precipitation data on a 0.5° grid for the entire world, along with grid-level planting and harvest calendars for the four major crops, and information

[6]The start of the sample has the advantage of excluding the observations in the early 1980s, which have been shown to be problematic for the identification of the US monetary policy shocks (Castelnuovo and Surico, 2010; Coibion, 2012).

[7]The results are robust to ordering food price shocks before oil shocks.

on the percentage of each grid cell dedicated to growing these crops. By doing so, it is possible calculate monthly agricultural-weighted weather conditions on a global scale; that is, the weather outcomes within countries are weighted over the areas in which the four major crops are grown and the growing season. The instrumental variables represent the deviations of (quadratic) temperature and (quadratic) precipitation from both their historical averages and long-term trends. Whereas De Winne and Peersman (2021) use the innovations at the quarterly frequency, we use the underlying monthly time series. Overall, the weather outcomes cover 95% of global production of the four crops.

Conditional on the above two shocks, we identify industrial input price shocks by imposing supply-type sign restrictions. In particular, such shocks are identified by requiring: i) an increase in real industrial input prices, ii) an increase in US and global consumer and producer prices, and iii) a decline in US and global output. In addition, we require that such shocks generate iv) a decline of oil and food commodity prices on impact. The latter restriction is necessary to disentangle industrial input shocks from other global supply shocks (e.g., productivity) that shift output and all commodity prices in opposite directions. We impose the restrictions during three months after the shock.

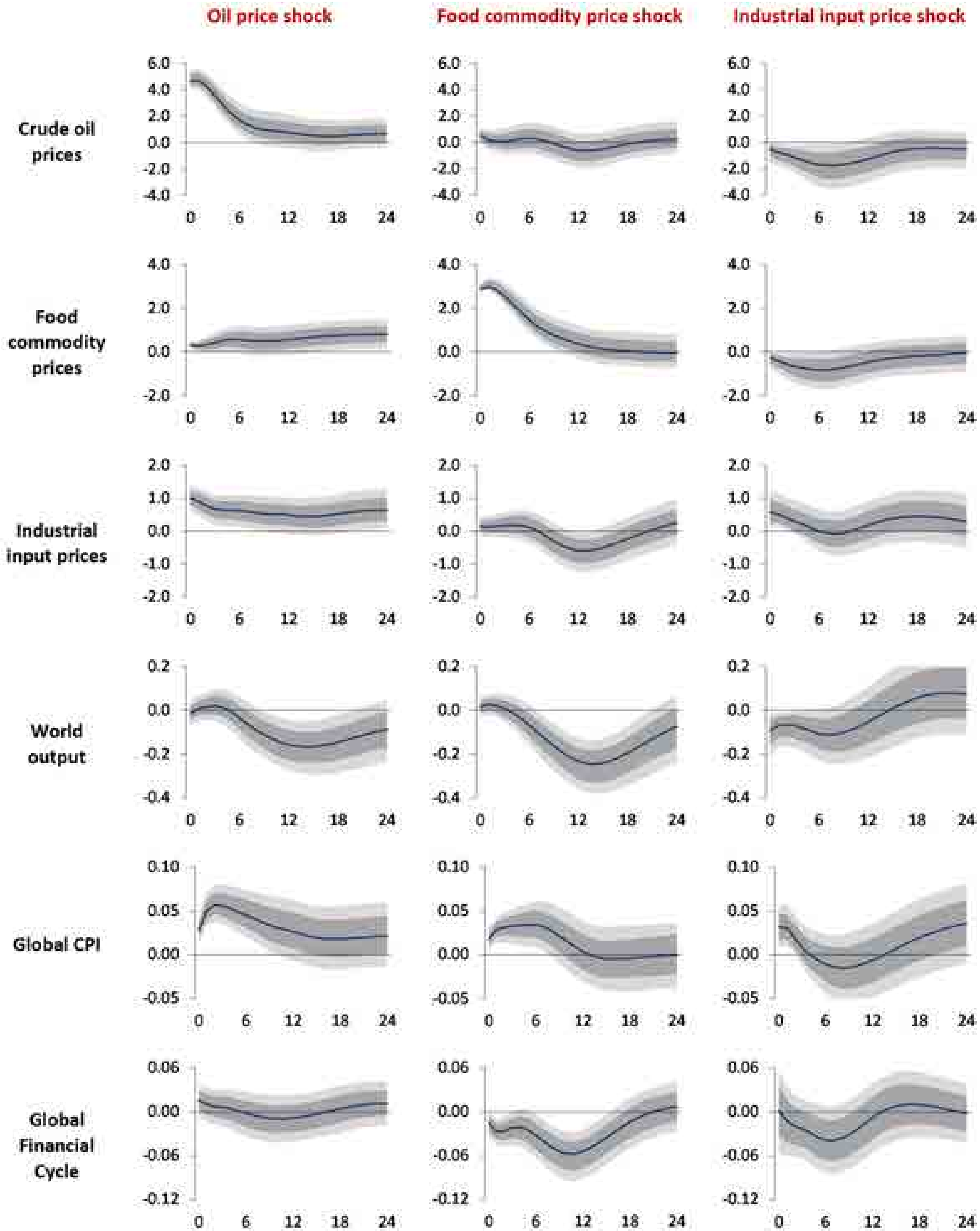
4 Baseline Results

The F-statistics are 10.3 and 10.4 for oil and food commodity price shocks, respectively, which is above the standard threshold for instrument relevance. The impulse response functions of several key variables to the three types of commodity price shocks are shown in Figure 1, while the contribution of the shocks to the forecast error variances are reported in Table 1. The impulse responses are for unit variance shocks, while we consider a (cumulative) two-year horizon for the variance decompositions. The results for the other variables can be found in the supplementary appendix. As a reference, Table 1 also shows the contribution to the variances for US monetary policy shocks. We identify such shocks using the high-frequency instrument of Miranda-Agrippino and Ricco (2021). In section 5, we will use these estimates to conduct the counterfactual analysis. The F-statistic of the monetary policy instrument is 10.0, while the impulse responses are shown in the appendix. The effects are very similar to those documented in existing studies (Miranda-Agrippino and Ricco, 2021; Degasperi et al., 2023).

4.1 Dynamic Effects of Commodity Price Shocks

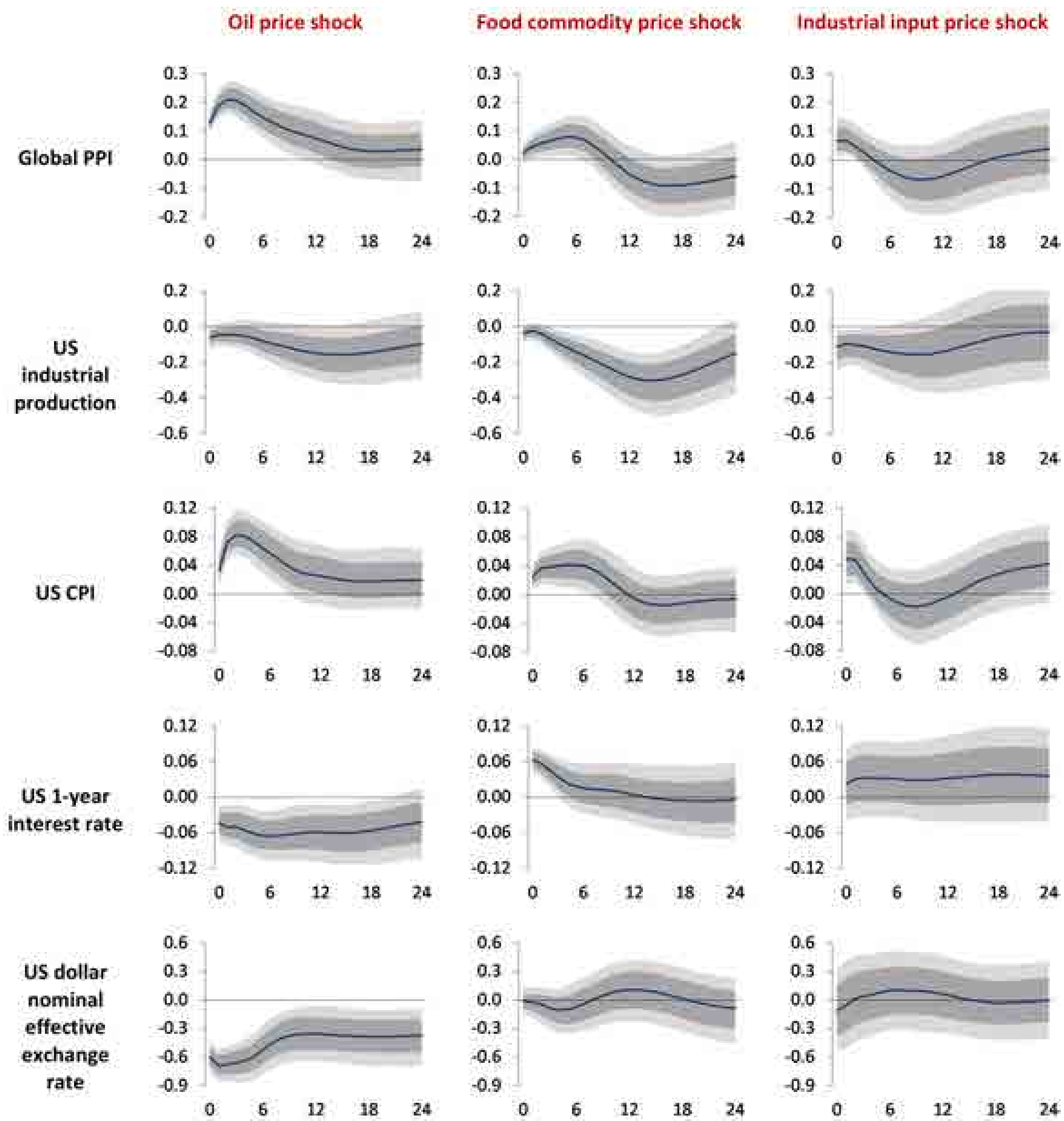
The results presented in Figure 1 show that all three types of commodity price shocks trigger a temporary rise in global consumer and producer prices, along with a significant decline in global economic activity. The effects on US macroeconomic variables mirror these dynamics. However, the repercussions of unit variance oil and food price shocks on economic activity are more substantial and enduring

Figure 1: Dynamic effects of commodity price shocks



Note: Impulse responses to unit variance shocks. Sample period 1982M1-2019M4. 68 and 90 percent credible sets.

Figure 1 (continued): Dynamic effects of commodity price shocks



Note: Impulse responses to unit variance shocks. Sample period 1982M1-2019M4. 68 and 90 percent credible sets.

than those of industrial input price shocks. Specifically, industrial input price shocks have relatively modest macroeconomic effects if one accounts for the 3-month horizon of the sign restrictions that we have imposed on several variables. Notably, in contrast to oil and industrial input price shocks, food commodity price shocks lead to a sharp decline in global financial conditions (GFC), conveying a significant increase in global financial stress.

Figure 1 also illustrates positive spillover effects of oil price shocks on food commodities and industrial input prices. Concerning monetary policy responses, an adverse oil price shock triggers a persistent monetary policy easing; that is, a decrease in the 1-year US interest rate. As discussed in section 5, this finding is robust and consistent with prior studies that employ different identification strategies. There is also a significant depreciation of the US dollar exchange rate. An interesting observation, however, is that the opposite holds for global food market shocks. There is a significant monetary policy tightening persisting for several months, while the exchange rate response is insignificant. This suggests that monetary policy amplifies the economic consequences of disruptions in the global food commodities market, while partially mitigating the output effects of oil market shocks. In section 5, we will examine this phenomenon in greater depth. Finally, the impact of industrial input price shocks on interest rates is positive, but statistically insignificant.

4.2 Relevance of Commodity Price Shocks

Table 1 shows that commodity markets disruptions play an important role in driving the global business cycle. The shocks account for 22% of the forecast error variance of world output. Thus, differently to Alquist et al. (2020), we do not find that commodity market shocks have only modestly contributed to global economic fluctuations. On the other hand, these values are lower than those reported by Fernández et al. (2017, 2022), but their approach does not distinguish between exogenous and endogenous commodity price shifts. The contribution to global consumer and producer price indicators is more modest, with values of 14% and 16%, respectively. Furthermore, the shocks explain 13% of the variability in the GFC. In comparison, US monetary policy shocks, a well-established driver of the GFC in the literature (Miranda-Agrippino and Rey, 2020) account within the same VAR for 7% of the forecast error variance of the GFC on impact, and 3% after two years. Therefore, commodity market disruptions can be considered as an important driver of worldwide financial developments.

The variance contributions reveal that commodity market shocks are not homogeneous. Our results indicate that food price shocks are the most important driver of world output and GFC fluctuations, explaining 12% and 8% of the forecast error variances, respectively. In contrast, crude oil price shocks contribute only 6% and less than 1%, respectively. The opposite holds true for global inflation, where oil price shocks account for 8% (10%) of global consumer (producer) prices variability, while

Table 1: **Contribution of the shocks to the forecast error variances**

	All commodities	Oil shocks	Food shocks	Input shocks	MP shocks
Crude oil prices	0.27	0.21	0.01	0.05	0.01
	[0.15 0.40]	[0.09 0.26]	[0.00 0.06]	[0.01 0.19]	[0.01 0.05]
Food commodity prices	0.40	0.06	0.30	0.04	0.01
	[0.23 0.48]	[0.01 0.13]	[0.15 0.35]	[0.01 0.14]	[0.00 0.06]
Industrial input prices	0.13	0.08	0.02	0.03	0.02
	[0.06 0.27]	[0.01 0.15]	[0.01 0.08]	[0.01 0.12]	[0.01 0.06]
World output	0.22	0.06	0.12	0.04	0.04
	[0.10 0.32]	[0.01 0.14]	[0.03 0.20]	[0.01 0.12]	[0.01 0.10]
Global CPI	0.14	0.08	0.03	0.03	0.02
	[0.07 0.25]	[0.02 0.15]	[0.01 0.08]	[0.01 0.10]	[0.00 0.08]
Global Financial Cycle	0.13	0.00	0.08	0.05	0.03
	[0.07 0.26]	[0.00 0.05]	[0.02 0.16]	[0.01 0.14]	[0.01 0.08]
Global PPI	0.16	0.10	0.04	0.03	0.02
	[0.09 0.27]	[0.04 0.16]	[0.01 0.10]	[0.01 0.10]	[0.00 0.07]
US industrial production	0.20	0.04	0.12	0.04	0.07
	[0.07 0.35]	[0.00 0.11]	[0.02 0.23]	[0.01 0.17]	[0.01 0.15]
US CPI	0.15	0.08	0.03	0.04	0.03
	[0.08 0.26]	[0.02 0.16]	[0.01 0.07]	[0.01 0.12]	[0.01 0.10]
US 1-year interest rate	0.15	0.09	0.02	0.04	0.03
	[0.06 0.32]	[0.01 0.18]	[0.01 0.07]	[0.00 0.19]	[0.01 0.07]
US dollar exchange rate	0.22	0.19	0.00	0.03	0.02
	[0.10 0.35]	[0.05 0.25]	[0.00 0.06]	[0.00 0.12]	[0.01 0.07]

Note: Contribution to the forecast error variances at 2-year horizon. 90 percent credible sets in parantheses.

food commodities contribute only 3% (4%).

Finally, the contribution of industrial input price shocks to the variability of all global cycles varies between 3% and 5%. Notably, the shocks explain only 3% of its own forecast error variance, which is negligible and substantially lower than the own-contribution of oil price shocks (21%) and particularly food price shocks (30%). Hence, along with crude oil, food commodities are subject to major independent supply disruptions, while fluctuations in industrial input prices predominantly reflect endogenous responses to other shocks.

5 The Role of Monetary Policy

In the previous section, we have documented a significant response of the US Federal Reserve to oil and food commodity price shocks. Moreover, these responses seem to be in opposite directions: a counter-cyclical response to oil price shocks and a pro-cyclical reaction to food price shocks. Given the pivotal role of the US in the global financial system, such asymmetry could amplify the negative effects of food price shocks on real and financial variables, while mitigating the consequences of oil price shocks. In this section, we first assess whether other major central banks also exhibit asymmetric responses to these two types of shocks (section 5.1) and discuss the robustness of this finding (section 5.2).[8] Next, we conduct counterfactual estimations to quantify the relevance of the monetary policy responses in shaping the effects (section 5.3). In section 6, we will explore the reasons behind the differential reactions of central banks to oil and food commodity price shocks.

5.1 Monetary Policy Responses in Other Countries

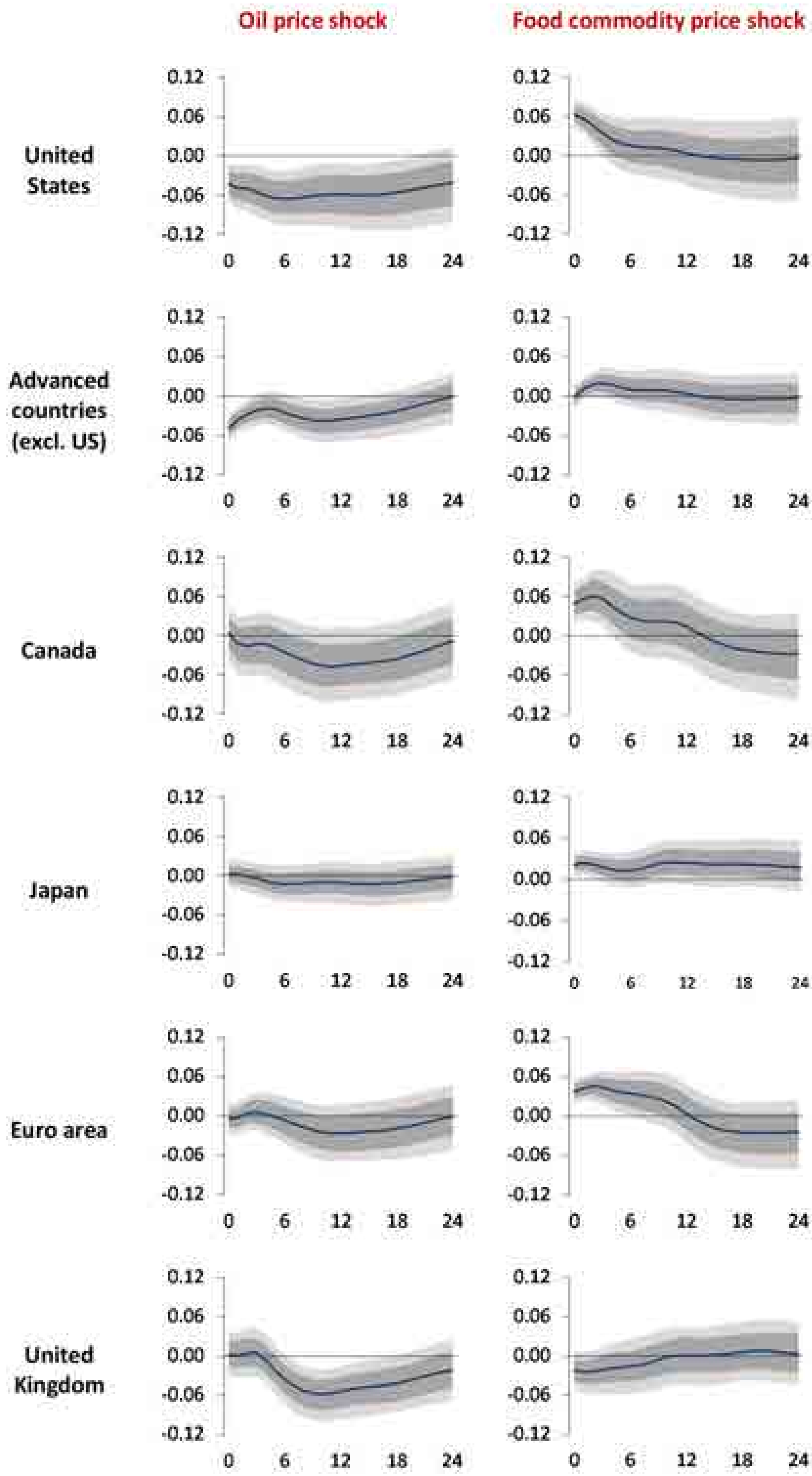
Figure 2 shows how central banks in various other advanced economies have responded to shocks in oil and food commodity prices. These impulse responses have been estimated by adding the relevant interest rates one-by-one to the baseline VAR model. For Japan and the United Kingdom, these are 1-year government bond rates. For Canada, we use the 3-month bond yield due to the absence of 1-year yield data for the entire sample period. Similarly, 3-month German bond yields are used as a proxy for the risk-free euro area interest rate. Additionally, the figure includes results for a (trade-weighted) composite of 35 advanced countries (excluding the US), compiled by the Dallas Fed. As can be observed, with the UK's response to food price shocks being the sole deviation, the pattern of asymmetric policy responses emerges as a global phenomenon.

5.2 Robustness of the Monetary Policy Reaction

Since food commodity price shocks raise inflation, it is not surprising to observe a restrictive monetary policy reaction in advanced economies. This finding proves also to be robust across several perturbations of the baseline VAR and is consistent with other studies. Specifically, De Winne and Peersman (2016) document a monetary policy tightening in the US after food commodity price increases that are caused by global harvest disruptions. In the same vein, Peersman (2022) shows that exogenous increases in international food commodity prices lead to a rise of interest rates in the euro area.

[8] We do not further investigate the role of monetary policy for industrial input price shocks due to the statistical insignificance and high uncertainty associated with the monetary policy response to such shocks.

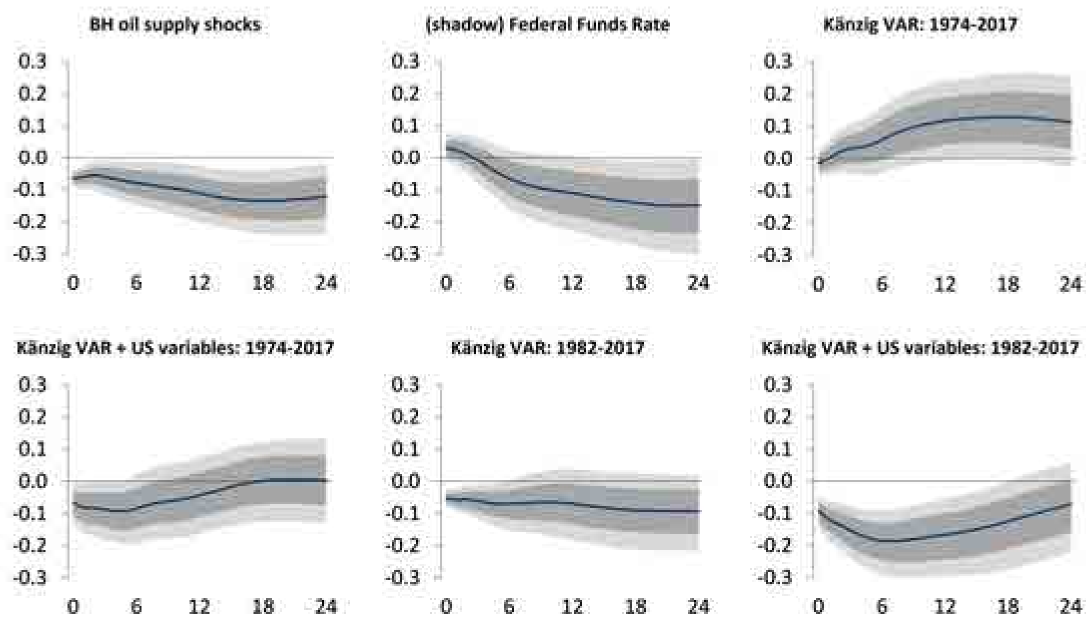
Figure 2: Monetary policy responses in other advanced economies



Note: Impulse responses to unit variance shocks. Sample period 1982M1-2019M4. 68 and 90 percent credible sets. Results are obtained by adding the interest rates one-by-one to the baseline VAR.

Several studies have documented the easing of monetary policy in the United States in response to exogenous oil price shocks. In particular, using very different identification strategies, Kilian (2009), De Winne and Peersman (2016), Degasperi (2022) and Barnichon and Mesters (2023) have each reported a decrease in the US Federal Funds Rate following oil supply shocks that lead to higher crude oil prices. As illustrated in Figure 3, the policy easing is also robust when we use the oil supply shocks identified in Baumeister and Hamilton (2019) as an external instrument to estimate the baseline VAR, and when we use the (shadow) Federal Funds Rate as the monetary policy indicator.[9]

Figure 3: Monetary policy response to oil price shocks that raise oil prices by 10%



Note: Response of US interest rate to oil price shocks. 68 and 90 percent credible sets. For details, see main text.

Känzig (2021) and Gagliardone and Gertler (2023) find, in contrast, a tightening of monetary policy in the US following unfavorable oil price shocks. Notably, both studies employ the same external instrument to achieve identification as we do. The primary distinction is their use of small-scale VAR models and a sample period that begins in 1974 rather than 1982. However, Mori and Peersman (2024) document that there is an omitted variables bias when using the Känzig (2021)

[9]For oil price increases that are endogenous responses to other macroeconomic shocks (i.e., reduced-form oil price innovations that are orthogonalized to the exogenous oil price shocks), we find a significant rise in the US one-year interest rate. Such endogenous responses also appear to dominate on average. In particular, there is a (short-lived) tightening in response to "average" oil price innovations (i.e., when we apply a Cholesky decomposition with the oil price ordered first). This finding is consistent with Kilian and Lewis (2011), who present evidence that the Federal Reserve has on average increased interest rates in response to oil price innovations driven by global demand pressures and oil-specific demand shocks, and eased its policy stance after oil price increases driven by oil supply disruptions.

instrument in a small-scale VAR model. As illustrated in Figure 3, this also applies to the interest rate response. The top-right panel shows that there is indeed an increase in one-year US government bond yields when we re-estimate the small-scale VAR model of Känzig (2021) over the sample period 1974-2017 using our Bayesian approach.[10] Yet, as shown in the bottom-left panel, the introduction of the additional US variables from our baseline VAR into his model results in a negative interest rate response, suggesting the presence of an omitted variables bias. Moreover, as depicted in the remaining two panels of Figure 3, there is consistently an expansionary monetary policy response for the period after 1982, even for the small-scale VAR of Känzig (2021). In sum, we can conclude that the policy easing after oil price shocks is a robust finding in our sample period.

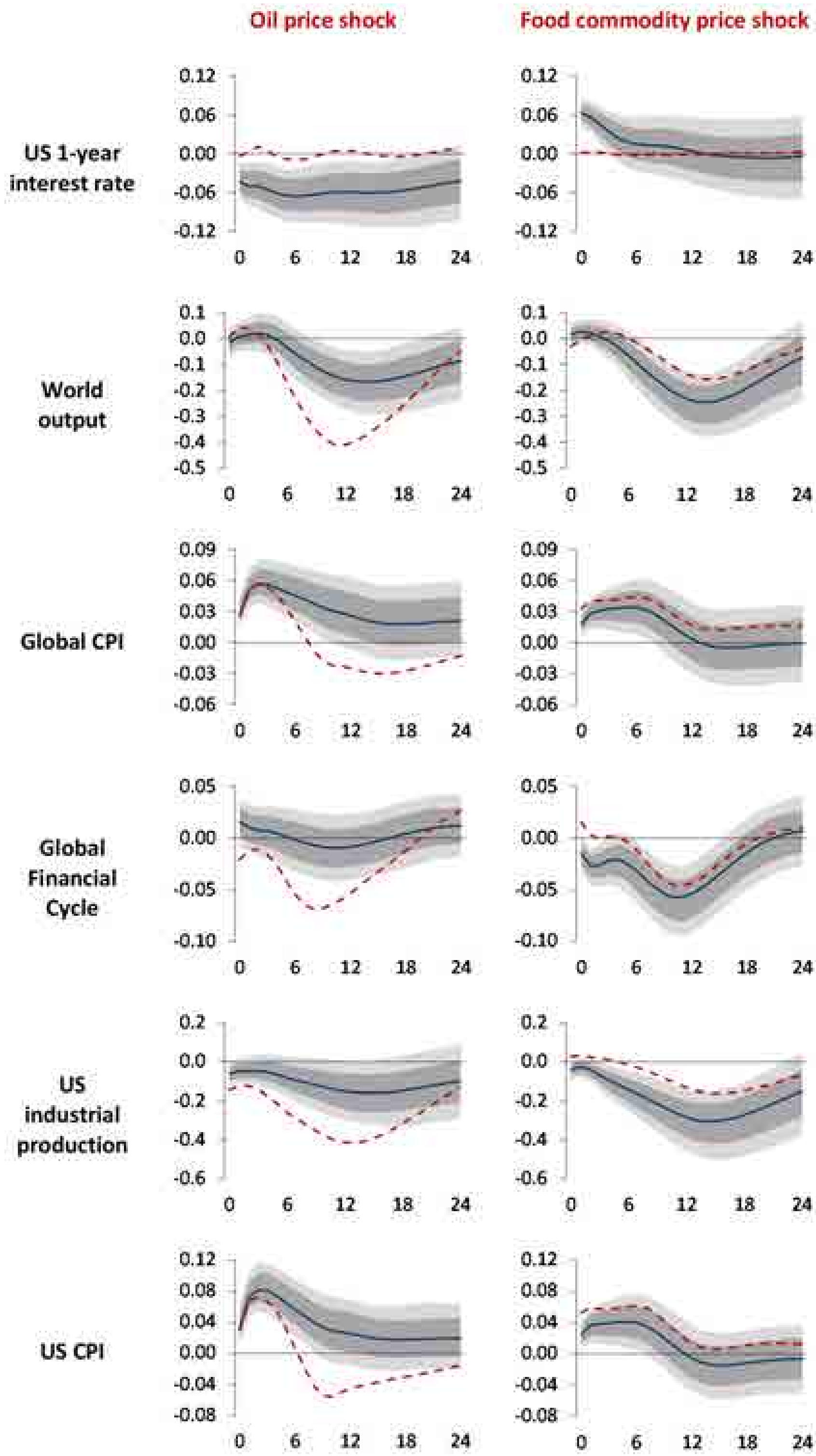
5.3 Counterfactual Analysis

To investigate the role of systematic monetary policy, we estimate the counterfactual impulse responses to oil and food commodity price shocks absent an interest rate response; that is, we document how the variables would have been affected if the Federal Reserve had not responded to the shocks. Traditionally, such counterfactuals are conducted by generating a sequence of monetary policy shocks that completely offset the impact of the commodity price shocks on the policy rate (e.g., Sims and Zha, 2006), while leaving all other elements (including the monetary policy rule) of the estimated VAR model unchanged. If the size of the imposed monetary policy shocks is modest compared to the historical variation in policy, it can be assumed that the counterfactual projections do not significantly alter private agents' beliefs about the prevailing policy regime or lead to the behavior changes highlighted by Lucas (1976). However, as emphasized by McKay and Wolf (2023), the persistence of a counterfactual path could still influence expectations regarding future policy that may undermine the VAR's forecast accuracy. To fully circumvent the Lucas critique, they propose to subject the economy to multiple distinct monetary policy shocks simultaneously at date 0 only; that is, a combination of contemporaneous and news shocks to a given policy rule, in order to closely mimic the counterfactual policy scenario. This approach ensures that no systematic surprises are introduced beyond the impact horizon that could trigger expectations about future policy. Put differently, by introducing the monetary policy shocks solely on impact, the contemplated counterfactual policy is both ex ante integrated in private-sector expectations and ex post enforced in the projections.

In the spirit of McKay and Wolf (2023), we estimate counterfactual impulse response functions by subjecting the VAR at date 0 simultaneously to two distinct types of monetary policy shocks. The first type, which is identified with the high-frequency instrument of Miranda-Agrippino and Ricco (2021)

[10]The baseline VAR model of Känzig (2021) includes six variables: the real price of oil, world oil production, world oil inventories, world industrial production, US industrial production, and the US consumer price index. In an alternative specification, Känzig (2021) augments the baseline VAR with the Federal Funds Rate.

Figure 4: Counterfactual impulse responses



Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets. Dashed (red) lines are counterfactual impulse responses.

that we discussed in section 4, tends to have a short-lived impact on the interest rate. The second type, which is a series of conventional and unconventional monetary policy shocks developed by Bu et al. (2021), has more pronounced effects on maturities in the middle of the term structure.[11] As a result, their combined effects can closely reproduce the intended counterfactual policy scenarios for oil and food commodity price shocks. This is illustrated in Figure 4, which contrasts the counterfactual impulse responses for several key variables with the baseline responses. As shown in the figure's first row, the counterfactual trajectories of the interest rate show minimal deviation from the baseline across all time horizons.[12]

The counterfactual impulse response functions in Figure 4 demonstrate the crucial role of monetary policy for the effects of both commodity market shocks on real and financial variables. In the absence of a monetary policy response to oil price shocks, the decline of world output would have been much stronger and the GFC would have substantially deteriorated. The counterfactual peak effect of oil price shocks on world output more than doubles (-0.41%, compared to -0.17% in the baseline), while the peak contraction of global financial conditions intensifies sevenfold (from -0.01 to -0.07). On the other hand, the counterfactual scenario suggests that oil price shocks would have exerted a smaller and less persistent effect on global consumer prices. In contrast, without a monetary policy response to food commodity price shocks, the impact would have been less severe, yet more inflationary. In particular, the peak decline in world output after a unit variance shock has historically been -0.24%, while this would have been -0.16% without central bank interventions. On the other hand, the rise in global consumer prices would have been 0.045% rather than 0.034%.

Table 2 reports the forecast error variances, which are calculated assuming that there is still a monetary policy response to all other shocks in the VAR model, except for the one under consideration. The table reveals that absent a counter-cyclical monetary policy response, oil price shocks would account for a substantial portion of the volatility in world output (24%) and the GFC (10%), while the contribution of food commodity prices to the volatility of both variables would only have been about 4% over the sample period. These findings highlight the critical importance of endogenous monetary policy responses to commodity market shocks for global economic and financial developments. Figure 4 and Table 2 show that this conclusion also applies to the US. In the appendix, we show the results where we fully offset the policy response by inducing a sequence of Miranda-Agrippino and Ricco (2021) their policy shock, as proposed in Sims and Zha (2006). The results are nearly identical for

[11]The effects of the Bu et al. (2021) monetary policy shocks on all variables are shown in the supplementary appendix. The shocks, which stably bridges periods of conventional and unconventional monetary policy, reflect a common component of changes in interest rates across the full maturity spectrum on FOMC announcement days.

[12]The magnitudes of the monetary policy shocks that generate the counterfactual policy scenarios in a standard least-squares sense are modest. For oil shocks, the policy shocks of Miranda-Agrippino and Ricco (2021) and Bu et al. (2021) that jointly generate the best fit of the counterfactual path are 0.47 and 1.55 standard deviations, respectively. For food commodities, the imputed shocks for the counterfactual scenario are 0.69 and 0.12 standard deviations, respectively.

Table 2: **Counterfactual forecast error variance contributions**

	Oil shocks		Food shocks	
	baseline	counterfactual	baseline	counterfactual
World output	0.06	0.24	0.12	0.04
Global CPI	0.08	0.06	0.03	0.05
Global Financial Cycle	0.00	0.10	0.08	0.04
US industrial production	0.04	0.19	0.12	0.03
US CPI	0.08	0.08	0.03	0.06

Note: Contribution of the shocks to the forecast error variances (2-year horizon).

food price shocks, whereas the counterfactual effects are even more pronounced for oil shocks.

6 The Transmission Mechanism of Oil versus Food Price Shocks

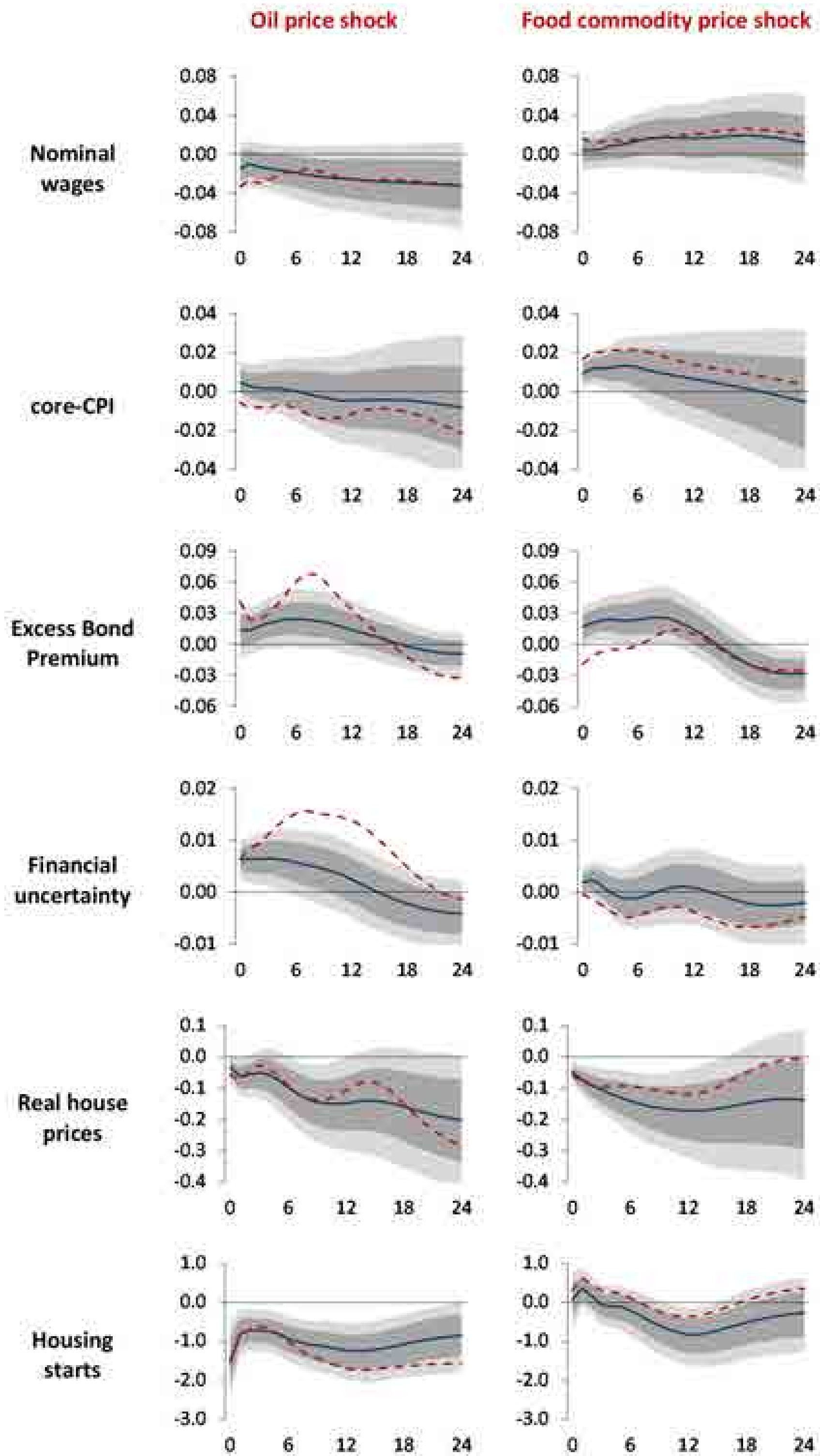
An important question that arises concerns the differential reactions of monetary policy to oil and food commodity price shocks. To gain deeper insight into this issue and improve our understanding of the transmission mechanisms through which these shocks affect the economy, we examine the counterfactual effects on the other US macroeconomic variables in section 6.1, and employ new counterfactual diff-in-diff estimations to analyze the pass-through to output components in section 6.2.

6.1 The Effects on US Macroeconomic Variables

The counterfactual effects on a number of US variables of the baseline VAR are depicted in Figure 5. Notably, while both shocks result in a contraction of output and an increase in the CPI, their impact on core inflation and nominal wages are clearly different. According to the baseline estimations, food commodity price shocks lead to a rise in both core CPI and nominal wages. However, without a reaction of central banks to such shocks, the rise in core inflation and nominal wages would even be more pronounced. This suggests that food price shocks trigger second-round effects that amplify their impact on core inflation, necessitating a tightening of monetary policy to alleviate such effects.

In contrast, oil price shocks lead to a significant decline in nominal wages, alongside a marginal increase in core CPI on impact that becomes insignificant at longer horizons. The counterfactuals suggest that core CPI might actually decrease without the expansionary monetary policy response. Furthermore, unlike food commodity price shocks, risk premiums and financial uncertainty would

Figure 5: Counterfactual impulse responses of US macroeconomic variables



Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets. Dashed (red) lines are counterfactual impulse responses.

surge considerably, while there would be a marked deterioration in the housing market. This distinction highlights that food commodity price shocks mainly propagate as cost-push shocks, which requires a policy tightening, while the effects of oil price shocks resemble adverse aggregate demand shocks exacerbated by financial frictions. These features justify why central banks reduce interest rates after oil price shocks; that is, to mitigate the recessionary effects. This interpretation aligns with Barnichon and Mesters (2023), who document that the counter-cyclical monetary policy response to oil price shocks in the US closely mirrors the optimal reaction function.

6.2 The Pass-Through to Output Components

6.2.1 Theoretical Mechanisms

Several studies indicate that energy price shocks function as adverse aggregate demand shocks for the US economy (Hamilton, 2009; Edelstein and Kilian, 2009). The key driver appears to be a decline in spending on goods and services other than energy. For example, Edelstein and Kilian (2009) argue that non-energy consumption falls because there is a reduction in households' discretionary income after paying the energy bills. Anticipating potential future income losses, households may also increase precautionary savings. In a similar vein, Kharroubi and Smets (2023) show that energy price shocks lead to a shortage of aggregate demand when sticky energy demand causes poor credit-constrained households to disproportionately cut demand for non-energy goods, while Auclert et al. (2023) elucidate that energy shocks cause a recession by depressing real wages in heterogeneous-agent models when the elasticity of substitution between energy and other goods is low. However, given the inelastic nature of food demand and the fact that the share of food in total expenditures is also very high for vulnerable households, an intriguing question is why this does not (less) apply to food price shocks.

A plausible mechanism for oil price shocks that is less applicable to food shocks involves a decrease in spending on goods and services complementary to energy. For example, when oil prices rise, the demand for automobiles may decline as consumers seek alternative transportation methods to save the operating cost of cars, or because they postpone new vehicle purchases due to uncertainties about future fuel prices. This could result in a decline of aggregate income that is a multiple of the discretionary income effect caused by the price increase itself (Hamilton, 2009). Davis and Haltiwanger (2001), Lee and Ni (2002), and Edelstein and Kilian (2009) show that oil price shocks indeed have a greater impact on the production and sales of motor vehicles than on other sectors and spending categories. The associated shift in the composition of spending is also expected to cause the reallocation of capital and labor between sectors, further exacerbating the decline in aggregate demand, especially when there are frictions in reallocating production factors (Hamilton, 1988). Finally, on the supply side, higher energy prices may act as a tax on capital that is complementary with energy, diminishing its value (Proebsting, 2023). This could, in turn, curb firms' investment demand and increase financial frictions throughout the economy. It is unlikely that food price shocks trigger similar effects.

6.2.2 Methodology

To ascertain the potency of the mechanisms outlined in section 6.2.1, existing studies have compared the effects of oil (energy) price shocks on distinct sectors or facets of household consumption (Davis and Haltiwanger, 2001; Lee and Ni, 2002; Edelstein and Kilian, 2009). Yet, this approach bears two important limitations. Firstly, because the effects of monetary policy also differ across sectors, such comparisons are distorted by the endogenous monetary policy response to the shocks. Secondly, certain sectors are more sensitive to macroeconomic fluctuations and aggregate shocks in general. For instance, the automotive sector is commonly perceived as more reactive to monetary policy as well as business cycle variations, potentially overstating its susceptibility to operational cost changes.

To account for these limitations, we employ a novel diff-in-diff analysis. Specifically, by adding the variables one-by-one to the baseline VAR, we estimate the counterfactual effects of oil and food price shocks on specific components of US industrial production and employment. In the next step, we calculate diff-in-diff counterfactual statistics for each component as follows:

$$\frac{IRF^{oil}_{component}/IRF^{food}_{component}}{IRF^{oil}_{aggregate}/IRF^{food}_{aggregate}} \tag{4}$$

$IRF^{i}_{component}$ and $IRF^{i}_{aggregate}$ are the counterfactual peak effects of shock i on the component and at the aggregate level, respectively. A statistic exceeding one implies that the component is more sensitive to oil relative to food price shocks, controlling for monetary policy and the aggregate business cycle effects, while a value below one suggests the reverse. Note that the results are very similar when we use cumulative impulse responses (from 0 to 24 months) instead of peak responses to calculate the statistics. The timing of the own peak may also be different from the overall peak. The results are summarized in Table 3 and 4. The tables report the actual peak effects (including the monetary policy consequences), the counterfactual peak effects absent monetary policy, the diff-in-diff statistics, as well as the (weighted) contribution to the aggregate peak responses. All (counterfactual) impulse response functions are shown in the appendix.

6.2.3 Impact on industrial production

The top-panel of Table 3 shows the effects on industrial production components by market groups, while its bottom part further decomposes final consumer goods. Several observations are worth mentioning. First, the counterfactual diff-in-diff statistic of 0.99 for equipment suggests that the transmission of both shocks to nonresidential investment of firms is nearly identical. Hence, the complementarity of energy and equipment in production does not seem to lower investment demand more when there is a rise in oil prices. Second, final consumer goods exhibit greater sensitivity to food commodity price shocks, whereas (nonindustrial) supplies of the industrial sector to the services and construction sector are relatively more affected by oil price shocks.

Table 3: Impact on components of US industrial production

	Actual (own peak)		Counterfactual (own peak)			Weight	Weighted CF (overall peak)	
	Oil	Food	Oil	Food	D-D		Oil	Food
Industrial Production	**-0.16**	**-0.30**	**-0.41**	**-0.16**		**1.00**	**-0.427**	**-0.170**
Final products								
Consumer goods	-0.14	-0.25	-0.30	-0.19	0.63	0.27	-0.070	-0.050
Equipment	-0.18	-0.42	-0.68	-0.27	0.99	0.14	-0.089	-0.037
Nonindustrial supplies	-0.29	-0.34	-0.52	-0.18	1.15	0.15	-0.077	-0.027
Materials								
Durable goods materials	-0.36	-0.57	-0.86	-0.33	1.03	0.18	-0.159	-0.062
Nondurable goods materials	-0.14	-0.29	-0.39	-0.16	0.97	0.11	-0.032	-0.017
Energy materials	-0.11	0.08	-0.38	0.10	>>>	0.15	0.000	0.021
Final products: consumer goods	**-0.14**	**-0.25**	**-0.30**	**-0.19**		**1.00**	**-0.286**	**-0.175**
Foods and tobacco	-0.04	-0.18	-0.06	-0.24	0.17	0.33	-0.013	-0.020
Consumer energy products	0.00	-0.06	-0.38	-0.04	5.92	0.15	0.012	-0.005
Other nondurable consumer goods	-0.09	-0.34	-0.23	-0.31	0.45	0.27	-0.061	-0.084
Automotive products	-0.71	-0.71	-1.65	-0.36	2.80	0.12	-0.152	-0.040
Other durable consumer goods	-0.29	-0.40	-0.54	-0.19	1.74	0.14	-0.071	-0.026

Note: "Actual (own peak)": estimated peak effect of a unit variance shock on the component. "Counterfactual (own peak)": counterfactual peak effect absent a monetary policy response. "D-D": diff-in-diff counterfactual statistics. A value greater (smaller) than one implies a relatively stronger impact of oil (food) price shocks. "Weight": average share of the component in the aggregate over the sample period. "Weighted CF": weighted contribution of the component to the peak counterfactual effect of the aggregate.

Third, the decomposition of consumer goods reveals that the pass-through effects of both shocks are fundamentally different. As expected, absent monetary policy interventions, food consumption significantly declines following food price shocks, whereas energy consumption declines more after oil price shocks.[13] However, the contribution of both spending components to the overall reduction in final consumer goods appears to be minimal. As shown in Figure A8 of the appendix, the main reason is an immediate decrease in food and energy consumption after the own price shock, with a return to the baseline within one year, mirroring the price evolution of oil and food commodities. The aggregate effects, in contrast, unfold more slowly, suggesting that other mechanisms are dominant over time.

Fourth, a striking difference between both types of commodities is that food commodity price shocks lead to a notable decrease in nondurable consumption (excluding food and energy), accounting for about half of the total drop in consumer goods. This contrasts with oil price shocks, where the decline constitutes less than one-quarter. Without a monetary policy response, the impact of food price shocks on nondurable consumption is even greater than durable consumption. Notably, the opposite applies to the actual observed impact on both components, which is the consequence of a stronger impact of the monetary policy tightening on durables. Oil price shocks, conversely, primarily affect durable goods consumption, mitigated to some extent by an expansionary monetary policy response.

Most importantly, purchases of automotive products substantially decline following both types of shocks. For oil price shocks, this explains half of the total decline in consumer goods purchases in the counterfactual scenario without a monetary policy intervention, which is considerably larger than the contribution after food price shocks. This finding confirms that reduced spending on energy-complementary goods is an important mechanism that leads to adverse aggregate demand effects, calling for distinct monetary policy responses. Again, since automotive products are also highly sensitive to interest rates changes, the endogenous monetary policy response mitigates the consequences of oil price shocks on this category, whereas it amplifies the actual effects of food price shocks.

In the appendix, we report the results when we decompose industrial production by (NAICS) industry groups (Table A3). In line with the market groups decomposition, "motor vehicles and parts" turns out to be a key driver of the total decline in industrial production to both commodity market shocks, but considerably more for oil price shocks. The industries "plastics and rubber products", "nonmetallic mineral products", "primary metal" and "machinery" also exhibit diff-in-diff statistics exceeding one. Interestingly, according to input-output tables, these industries are crucial input providers to the "motor vehicles and parts" and the construction sector. Another observation worth mentioning is that the correlation between diff-in-diff statistics and the energy intensity of industries appears out to be low (0.08). This suggests that the stronger effects of oil price shocks on these industries are

[13] Since we employ a diff-in-diff that controls for the business cycle effects, this implies that the price elasticities of food and energy demand are both negative. An interesting observation is that the negative impact of higher oil prices on energy consumption seems to be fully offset by the expansionary monetary policy response. Specifically, whereas the counterfactual peak impact of oil price shocks on consumer energy products is -0.38, the actual peak decline is 0.00.

"demand-driven" and not "cost-driven".[14]

6.2.4 Impact on employment

Table 4 summarizes the broader macroeconomic effects by focusing on the employment effects across sectors. Except for "transportation and warehousing" and "mining and logging", there is no relationship between energy intensity and the diff-in-diff statistics, underscoring predominantly demand-driven sectoral differences between both shocks. In line with the evidence for the components of industrial production discussed above, we find that the consequences of oil price shocks turn out to be relatively stronger for the consumption of goods and services that are complementary with energy. Specifically, sectors like "retail trade" and "leisure and hospitality", which are reliant on transportation, display diff-in-diff statistics greater than one, reflecting their vulnerability to oil price shocks.[15]

The table further shows that construction emerges as another critical sector profoundly affected by oil price shocks. This sector experiences a nearly fourfold larger employment decline than the average, while the diff-in-diff statistic is 1.48. Given the limited contribution of energy inputs to the construction sector's gross output, this suggests that the stronger decline after oil price shocks is again primarily due to an adverse demand effect from such shocks. Similar to purchases of cars, a possible explanation is that higher energy prices discourage construction investments in energy-consuming installations such as saunas or air conditioning systems. In addition, fuel prices influence commuting costs. Hence, households may postpone new home purchases because uncertainties regarding future fuel expenses makes it harder to decide where to buy it. Such hesitation aligns with the marked drop in housing starts depicted in Figure 5.

Another mechanism that could contribute to the strong impact of oil shocks on the construction sector is a decline in residential investment by firms, prompted by a depreciation of residential capital that is complementary with energy at the supply-side. Finally, financial frictions may further intensity the adverse demand effects of these mechanisms on the housing market, as well as a rise in precautionary savings due to the increased likelihood of unemployment and income losses after oil price shocks. According to the analysis of Browning and Crossley (2009), households can significantly increase their savings without a significant decline in consumption if they concentrate their spending cuts on durables, because existing stocks of durables could continue to provide a flow of services. This may, in turn, explain the stronger impact of oil price shocks on durable relative to nondurable consumption, which contrasts to the pass-through of food price shocks.

[14] The energy intensity is calculated as the share of energy inputs in gross output of each industry over the period 2017-2019, based on BEA statistics.

[15] Also "private education and health services" appears to react much more to oil price shocks. However, the magnitudes of the effects are small. Moreover, the (weighted) contribution to the total decline of employment is negligible.

Table 4: Impact on components of US employment

	Actual (own peak)		Counterfactual (own peak)			Weight	Weighted CF (overall peak)	
	Oil	Food	Oil	Food	D-D		Oil	Food
Total Nonfarm Employment	**-0.10**	**-0.10**	**-0.14**	**-0.08**		**1.00**	**-0.158**	**-0.061**
Government	-0.01	-0.04	0.01	-0.05	-0.09	0.16	0.003	-0.004
Manufacturing	-0.17	-0.18	-0.24	-0.15	0.65	0.12	-0.030	-0.018
Construction	-0.40	-0.25	-0.53	-0.14	1.48	0.05	-0.024	-0.007
Mining and Logging	0.02	-0.11	-0.35	-0.05	2.54	0.01	-0.002	0.000
Wholesale Trade	-0.13	-0.11	-0.18	-0.08	0.81	0.04	-0.008	-0.004
Retail Trade	-0.12	-0.10	-0.25	-0.05	1.87	0.11	-0.028	-0.006
Transportation and Warehousing	-0.11	-0.12	-0.18	-0.04	1.54	0.03	-0.005	-0.001
Utilities	-0.10	-0.12	-0.11	-0.10	0.41	0.01	0.000	0.000
Information	-0.21	-0.77	-0.16	-0.77	0.08	0.02	-0.004	-0.005
Financial Activities	-0.10	-0.09	-0.03	-0.11	0.10	0.06	0.000	-0.007
Professional and Business Services	-0.18	-0.13	-0.23	-0.10	0.86	0.12	-0.028	-0.011
Leisure and Hospitality	-0.07	-0.06	-0.23	0.00	73.55	0.09	-0.021	0.000
Other Services	-0.04	-0.09	-0.10	-0.05	0.81	0.04	-0.004	-0.001
Private Education and Health Services	-0.02	-0.02	-0.05	0.00	>>>	0.13	-0.006	0.003

Note: "Actual (own peak)": estimated peak effect of a unit variance shock on the component. "Counterfactual (own peak)": counterfactual peak effect absent a monetary policy response. "D-D": diff-in-diff counterfactual statistics. A value greater (smaller) than one implies a relatively stronger impact of oil (food) price shocks. "Weight": average share of the component in the aggregate over the sample period. "Weighted CF": weighted contribution of the component to the peak counterfactual effect of the aggregate.

7 Conclusions

In this paper, we have explored the effects of exogenous shocks to crude oil, food commodities and industrial input prices on the global and US economies. We used a Bayesian structural VAR model to measure the consequences and to assess the role of monetary policy in shaping the effects. Our analysis reveals that disruptions in commodity markets account for a sizable portion of variation in global output variation and the Global Financial Cycle. Importantly, we found that the way monetary policy reacts to these disruptions is critical in determining their impact.

Not all commodity prices affect the economy in the same way. We discovered that industrial input price shocks are not important since fluctuations in industrial input prices are almost entirely endogenous responses to other shocks. The monetary policy response is also statistically insignificant. In contrast, food commodity price shocks exert the most profound impact on both real and financial conditions worldwide. Yet, our counterfactual estimations indicate that the significant effects of food price shocks are largely driven by pro-cyclical monetary policy reactions to such shocks. On the other hand, counter-cyclical policy responses in advanced economies substantially mitigate the repercussions of crude oil price shocks on economic activity and the GFC. In particular, a policy easing in response to an exogenous rise in oil prices can mitigate the consequences.

In the next step, we have delved into the mechanisms through which oil and food commodity price shocks affect macroeconomic variables. Food price shocks, akin to aggregate cost-push shocks, lead to a rise in nominal wages and core CPI, intensifying their impact on inflation. These additional inflationary pressures could explain the observed tightening of monetary policy in response to these shocks, despite their negative impact on economic activity. Interestingly, absent a monetary policy intervention, food price shocks also result in a relatively stronger decline in nondurable consumption (excluding food and energy). Conversely, oil price shocks act more like adverse demand shocks, causing a notable reduction in durable consumption and particularly spending on goods and services related to energy consumption. For example, such shocks lead to a substantial decline in purchases of motor vehicles and spending on retail trade, leisure activities, and construction. They also raise risk premiums and financial uncertainty, while nominal wages and core CPI tend to drop in the absence of a monetary policy reaction. These characteristics justify the rationale for central banks to ease monetary policy in response to oil price shocks.

Overall, our findings underscore the pivotal role of endogenous monetary policy in shaping global economic activity and financial developments. Furthermore, our results suggest that theoretical models exploring the relationship between energy markets and the macroeconomy need to account for the relationship between energy and non-energy consumption and the corresponding adverse demand effects of higher oil prices. Similarly, models investigating the macroeconomic impacts of food price fluctuations should be able to capture the second-round effects on inflation and the relatively stronger impact on nondurable consumption.

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Commodity Price Shocks and Global Cycles: Monetary Policy Matters

Efrem Castelnuovo Lorenzo Mori Gert Peersman

Supplementary Appendix

This supplementary appendix includes the following tables and figures:

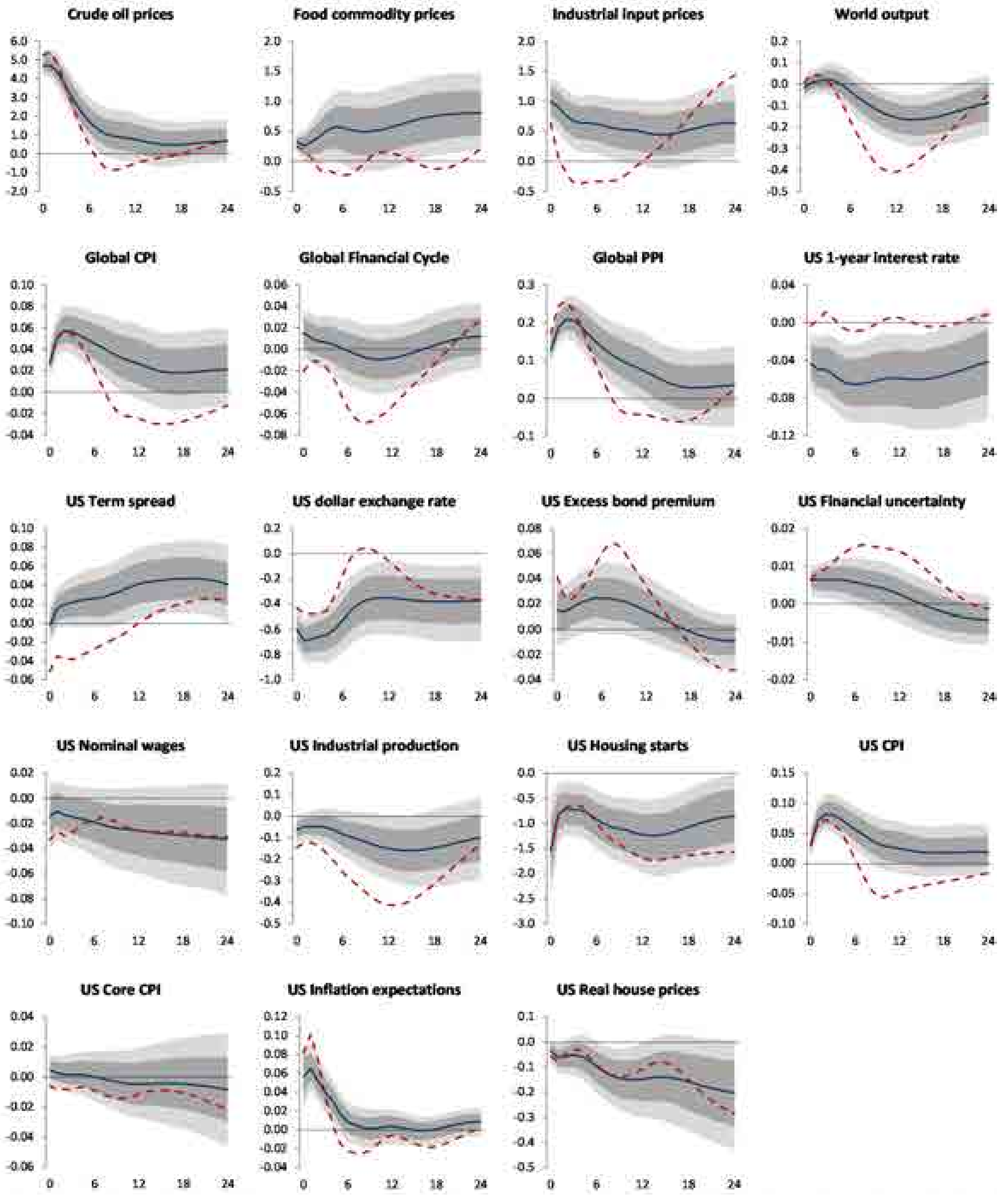
Table A1: Data sources

Global variables	**Source**	**Logs**
Food Commodity Prices - deflated by US CPI	IMF and De Winne and Peersman (2021)	✓
Crude Oil Prices (WTI) - deflated by US CPI	Fred	✓
Industrial Inputs Prices - deflated by US CPI	IMF	✓
OECD Industrial Production	OECD	✓
OECD CPI	OECD and own calculation	✓
Global Financial Cycle	Miranda-Agrippino & Rey (2020)	
OECD PPI (Manufacturing, domestic market)	OECD	✓
US variables	Source	Logs
1 Year Treasury Rate (DGS1)	Fred	
Term Spread 10Y-1Y (DGS10-DGS1)	Fred	
USD nominal effective exchange rate	BIS	✓
US Credit Spread (EBP)	Gilchrist & Zakrajšek (2012)	
US Financial Uncertainty (h=1)	Jurado et al. (2015)	
US Nominal Wages (CES3000000008)	Fred	✓
US Industrial Production (INDPRO)	Fred	✓
US Housing Starts (HOUST)	Fred	✓
US CPI (CPIAUCSL)	Fred	✓
US Core CPI (CPILFESL)	Fred	✓
US Inflation Expectations 1Y (MICH)	Michigan University	
US Real House Prices	US National Case Shiller Home Price Data	✓
Non-US policy rates	Source	Logs
Adv. Countries Excluding US	Federal Reserve Bank of Dallas (DGEI)	
Canada	OECD	
Japan	Ministry of Finance Japan	
Euro Area (Germany)	OECD	
UK (1-year gilts)	Cesa-Bianchi & Sokol (2022)	

Note: "Logs" indicates logarithmic transformations; that is, 100*logs.

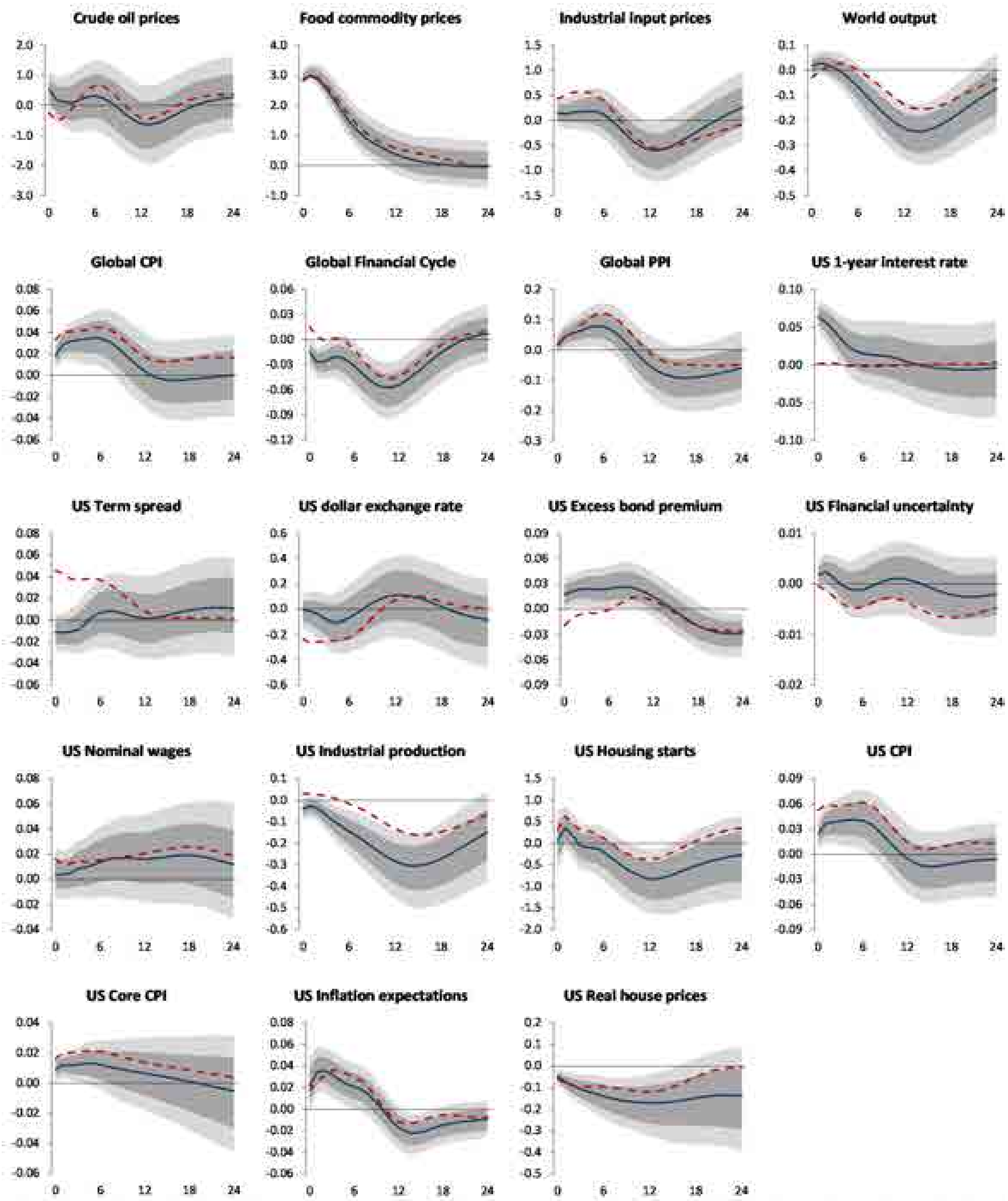
The index of global CPI is based on the following countries: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States. These countries account for about 85% of OECD GDP historically. Country-specific CPI inflation rates are aggregated according to the official OECD weights. The index has also been seasonally adjusted using the X-11 method.

Figure A1: (Counterfactual) impulse responses to oil price shocks



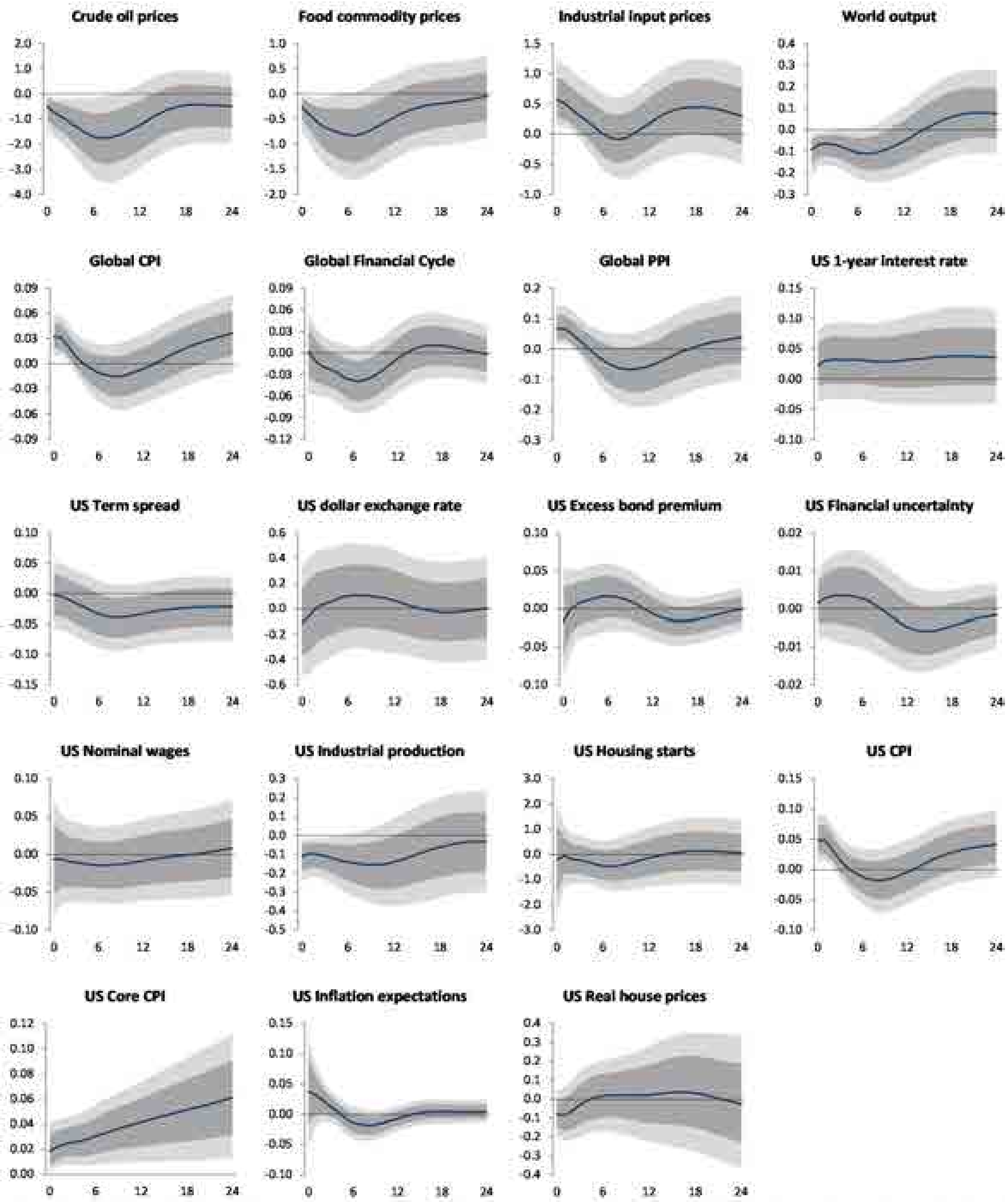
Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets. Dashed (red) lines are counterfactual impulse responses.

Figure A2: (Counterfactual) impulse responses to food commodity price shocks



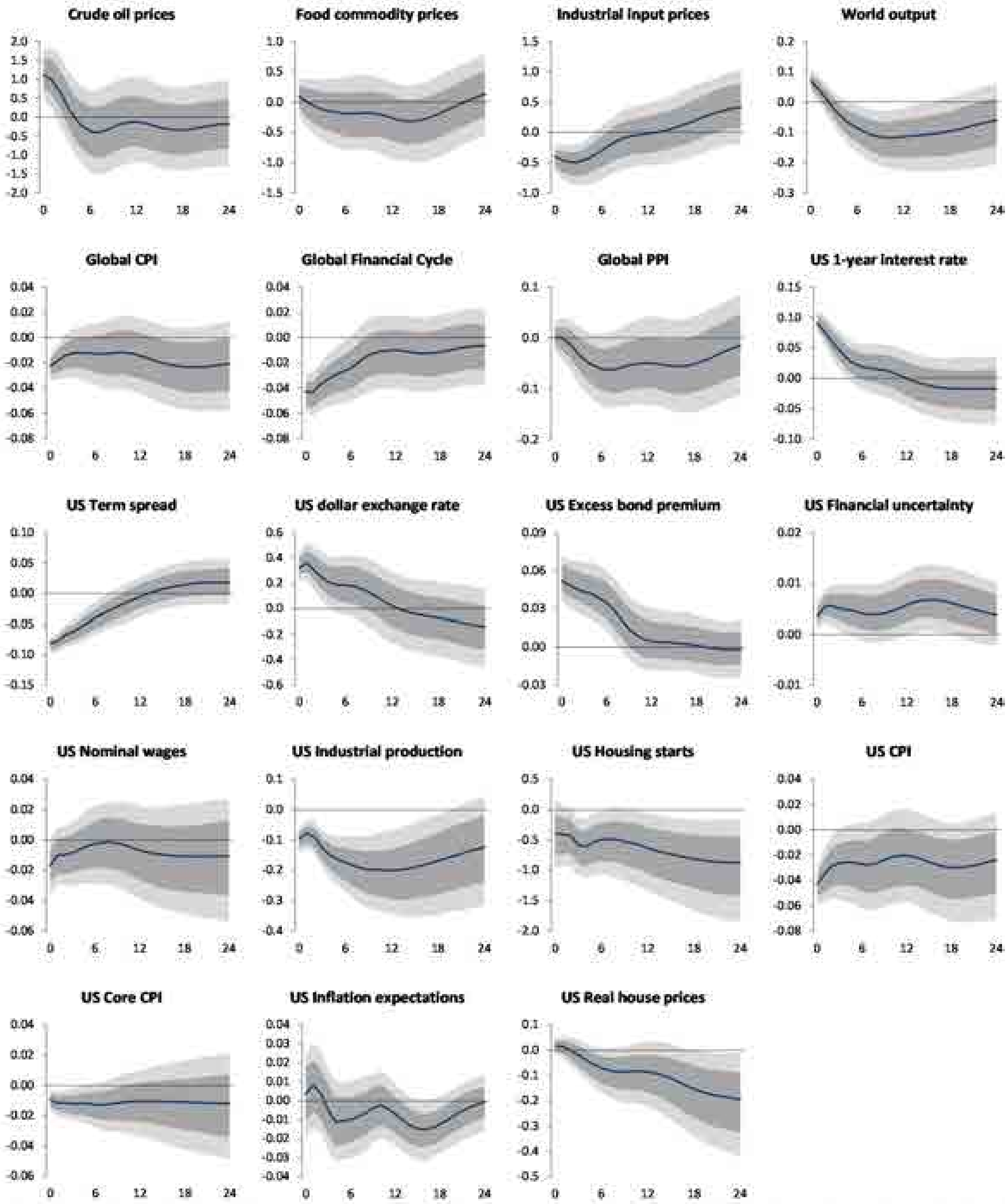
Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets. Dashed (red) lines are counterfactual impulse responses.

Figure A3: Impulse responses to industrial input price shocks



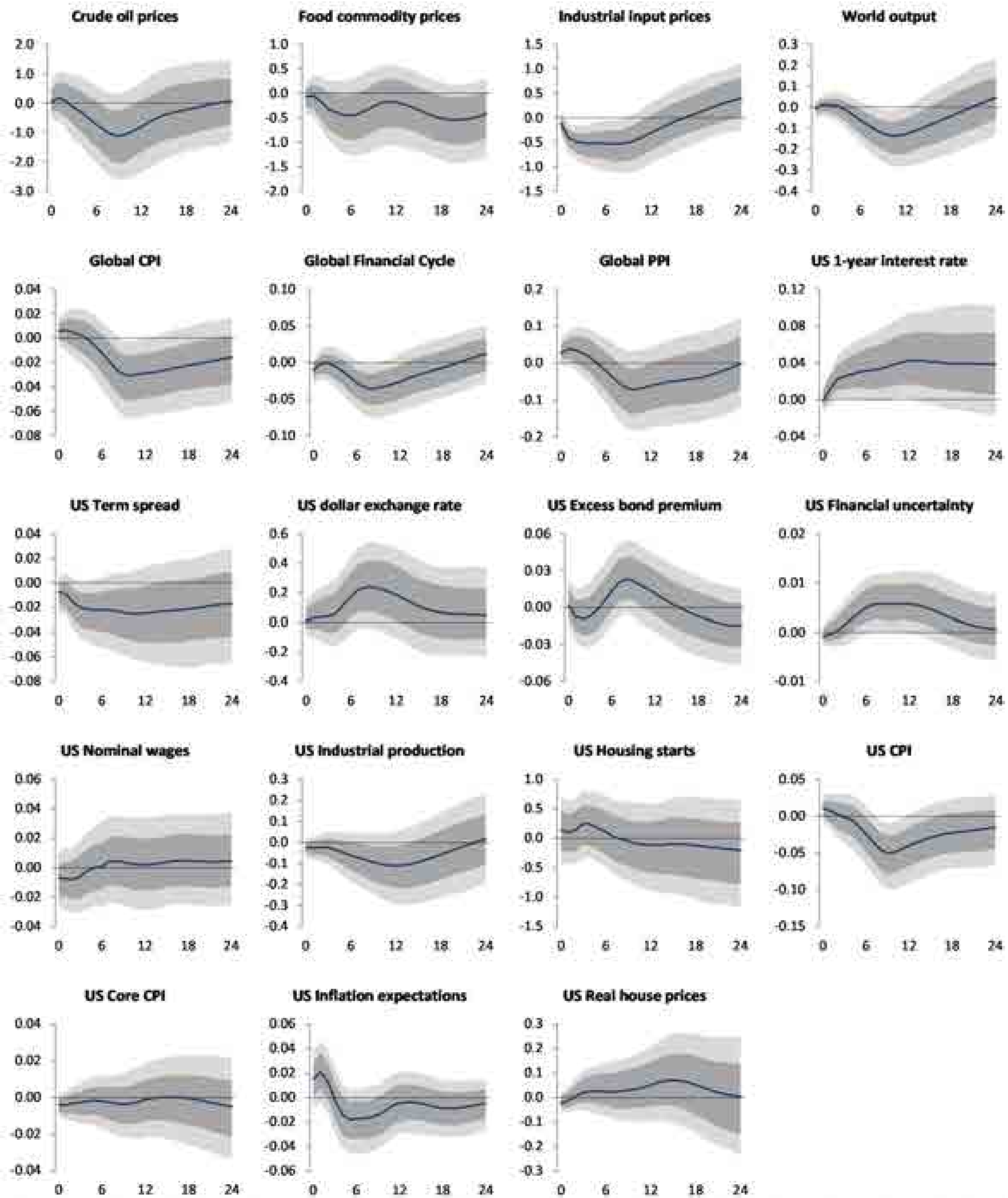
Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets.

Figure A4: Impulse responses to Miranda-Agrippino and Ricco monetary policy shocks



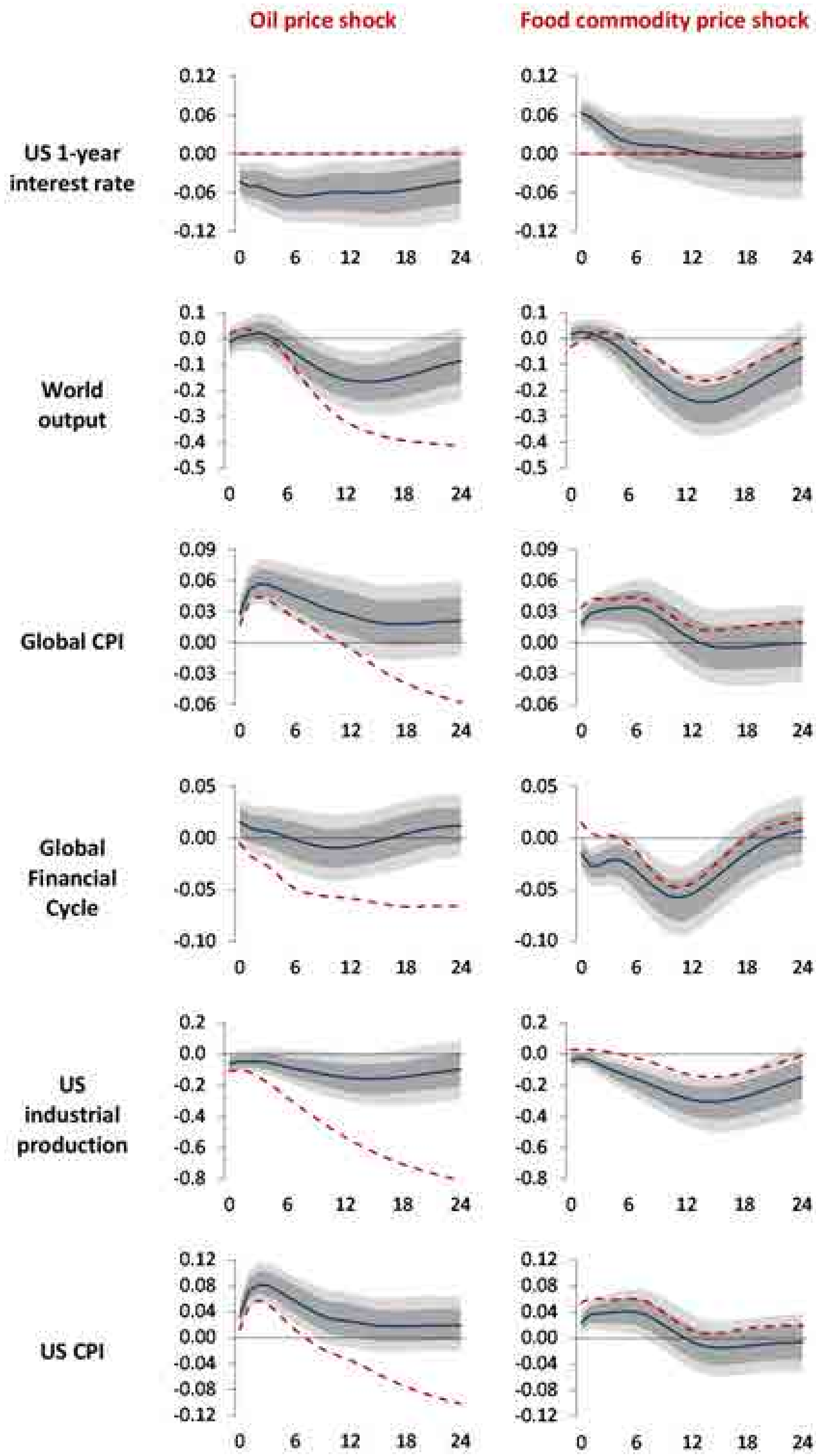
Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets.

Figure A5: Impulse responses to Bu, Rogers and Wu monetary policy shocks



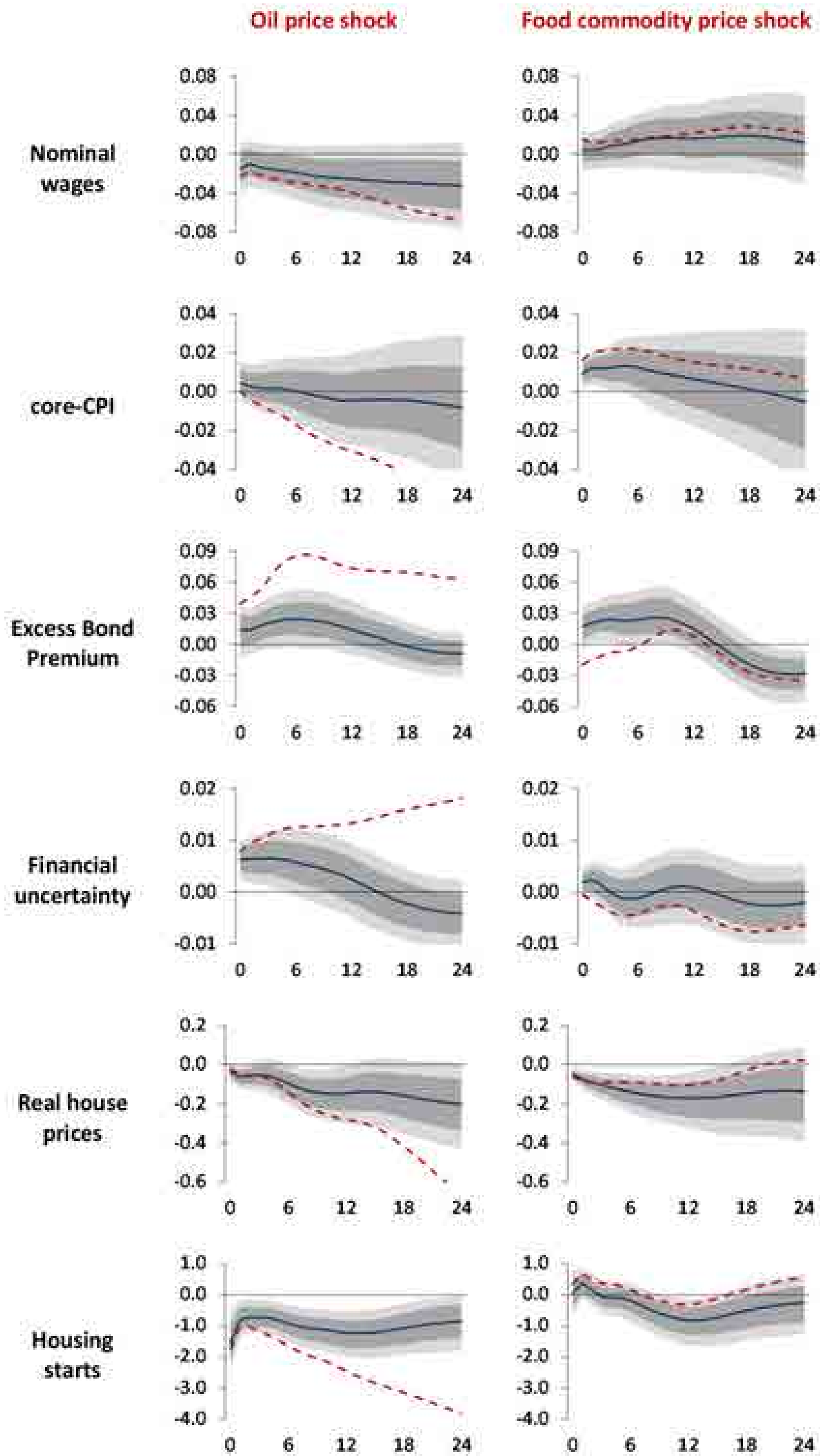
Note: Effective impulse responses to unit variance shocks, with 68 and 90 percent credible sets. We follow Bu et al. and order the cumulative shock series first in a monthly recursive VAR. As in Bu et al., the shock series starts in 1994.

Figure A6: Counterfactual impulse responses - Sims and Zha approach



Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets. Dashed (red) lines are counterfactual impulse responses.

Figure A7: Counterfactual impulse responses (continued) - Sims and Zha approach



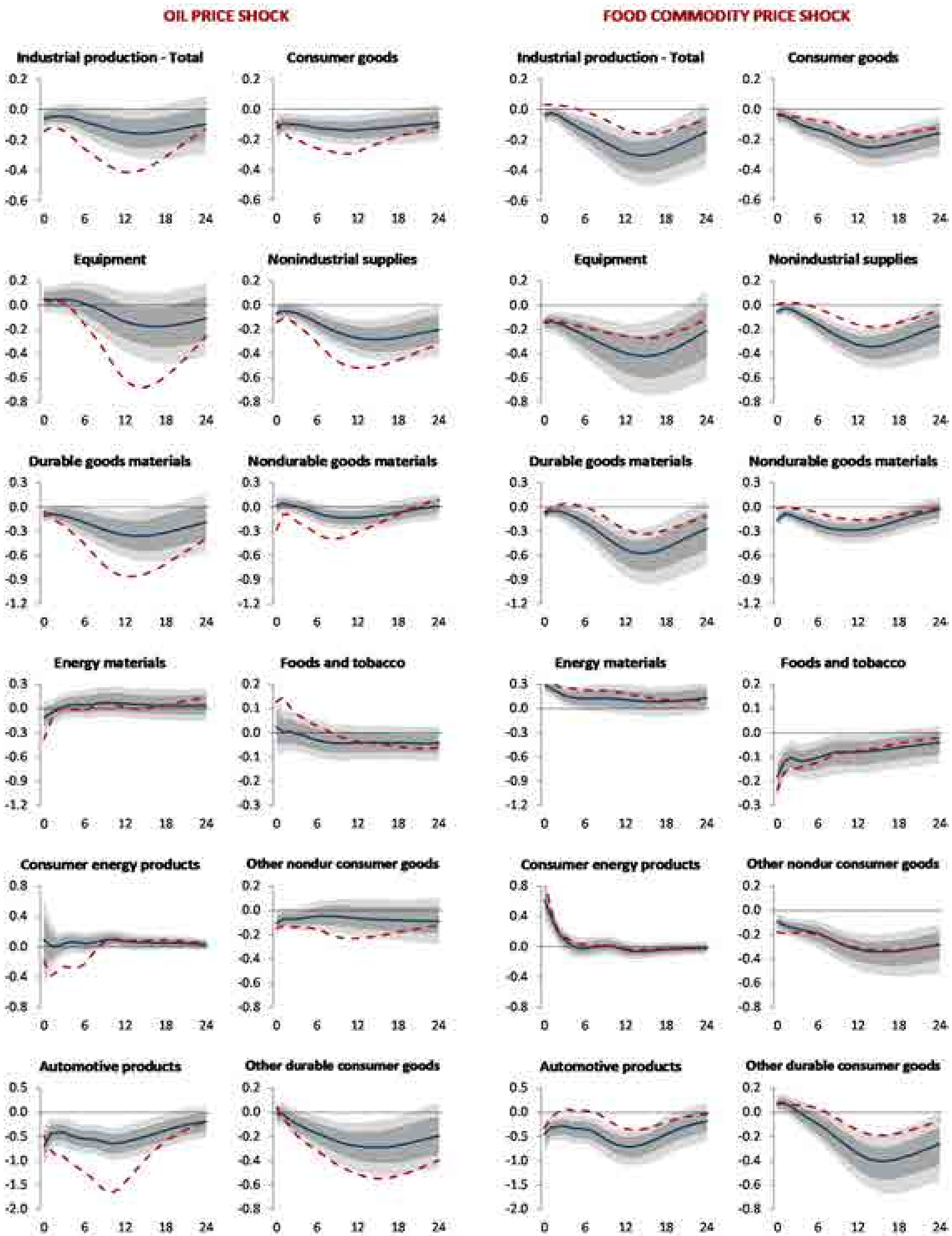
Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets. Dashed (red) lines are counterfactual impulse responses.

Table A2: Counterfactual forecast error variance contributions - Sims and Zha approach

	Oil shocks		Food shocks	
	baseline	counterfactual	baseline	counterfactual
World output	0.06	0.29	0.12	0.04
Global CPI	0.08	0.07	0.03	0.05
Global Financial Cycle	0.00	0.17	0.08	0.04
US industrial production	0.04	0.42	0.12	0.02
US CPI	0.08	0.13	0.03	0.06

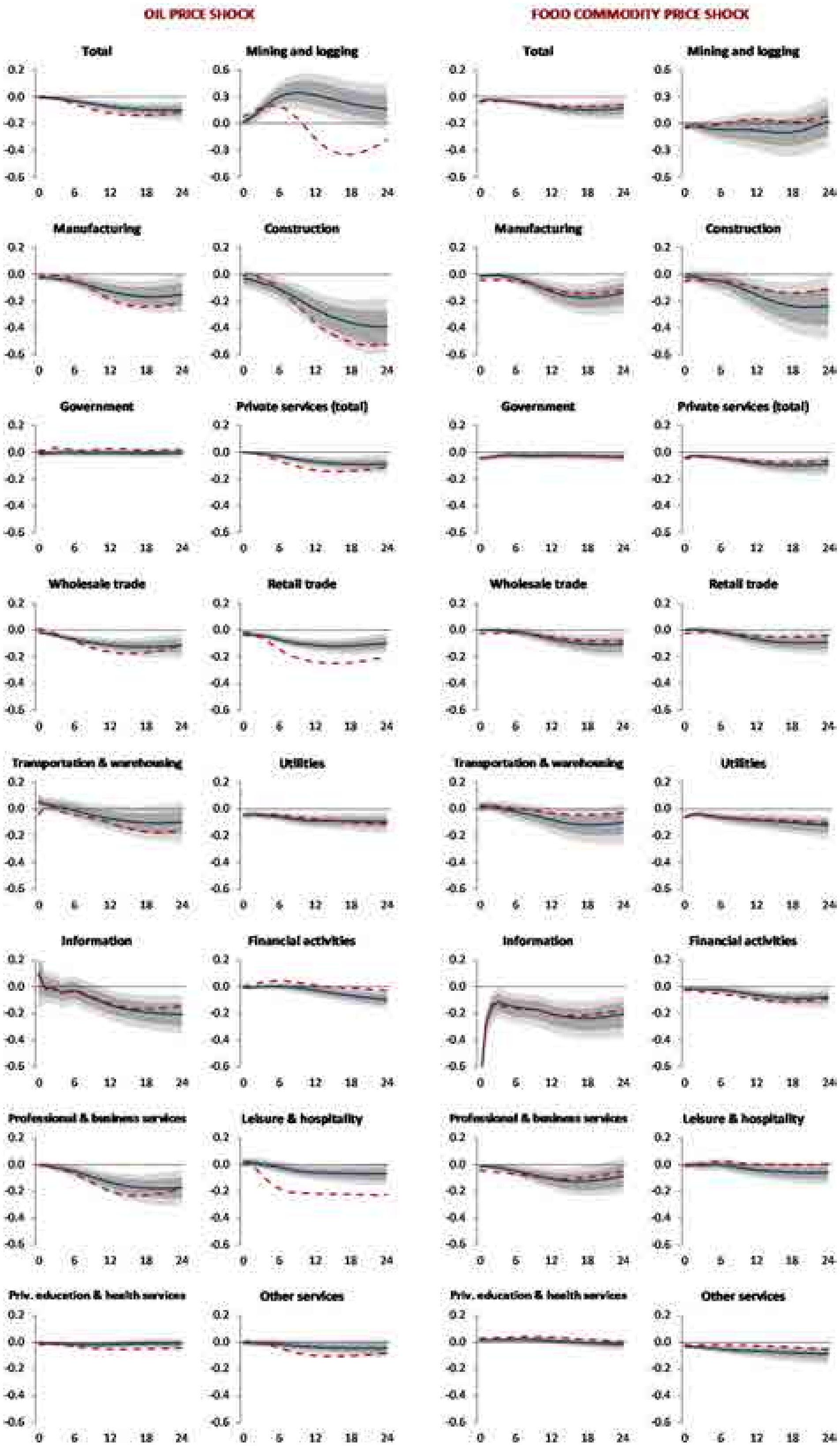
Note: Contribution of the shocks to the forecast error variances (2-year horizon).

Figure A8: (Counterfactual) impulse responses of industrial production components



Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets. Dashed (red) lines are counterfactual impulse responses.

Figure A9: (Counterfactual) impulse responses of sectoral employment



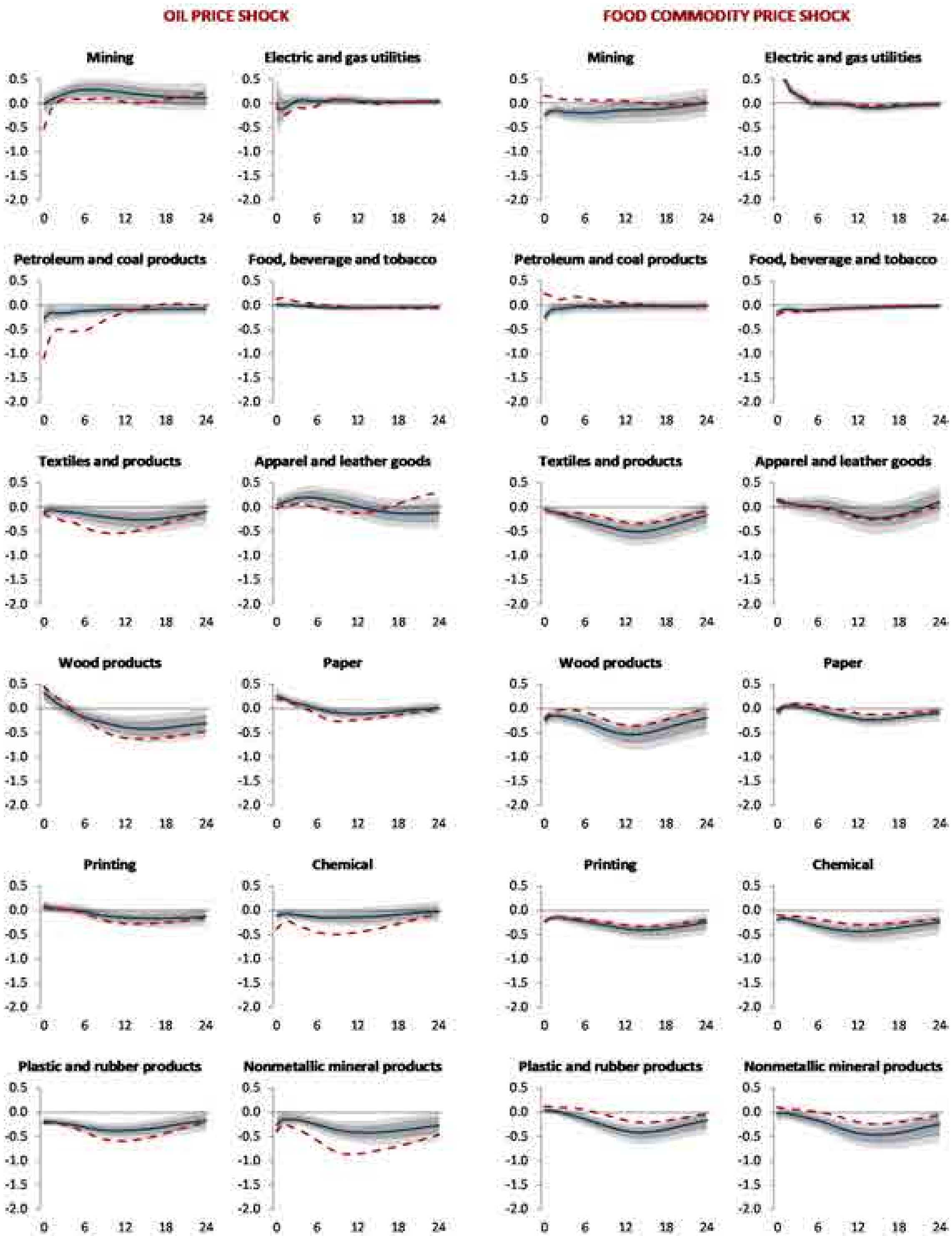
Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets. Dashed (red) lines are counterfactual impulse responses.

Table A3: Impact on components of US industrial production according to industry groups

	Actual (own peak)		Counterfactual (own peak)			Energy share	Weight	Weighted CF (overall peak)	
	Oil	Food	Oil	Food	D-D			Oil	Food
Industrial Production	**-0.16**	**-0.30**	**-0.41**	**-0.16**			**1.00**	**-0.384**	**-0.195**
Mining	-0.02	-0.24	-0.53	-0.03	9.57	0.039	0.11	0.000	0.000
Electric and gas utilities	-0.13	-0.10	-0.27	-0.05	2.59	0.127	0.10	0.000	-0.005
Nondurable manufacturing (NAICS)									
Food, beverage and tobacco	-0.06	-0.14	-0.07	-0.21	0.17	0.011	0.10	-0.006	-0.003
Textiles and products	-0.27	-0.51	-0.54	-0.34	0.81	0.021	0.01	-0.007	-0.004
Apparel and leather goods	-0.14	-0.23	-0.13	-0.26	0.25	0.025	0.01	-0.002	-0.003
Paper	-0.11	-0.23	-0.27	-0.13	1.09	0.049	0.03	-0.007	-0.004
Printing and related support activities	-0.16	-0.41	-0.28	-0.33	0.42	0.019	0.02	-0.006	-0.007
Chemical	-0.15	-0.43	-0.49	-0.29	0.85	0.026	0.10	-0.044	-0.029
Plastics and rubber products	-0.38	-0.41	-0.59	-0.21	1.44	0.023	0.03	-0.019	-0.007
Petroleum and coal products	-0.28	-0.25	-1.10	-0.02	26.12	0.022	0.02	-0.002	0.000
Durable manufacturing (NAICS)									
Wood product	-0.42	-0.54	-0.63	-0.36	0.89	0.021	0.01	-0.008	-0.004
Nonmetallic mineral product	-0.42	-0.46	-0.87	-0.24	1.81	0.046	0.02	-0.017	-0.005
Primary metal	-0.49	-0.53	-0.86	-0.30	1.44	0.030	0.03	-0.020	-0.008
Fabricated metal product	-0.26	-0.46	-0.59	-0.30	1.00	0.014	0.06	-0.033	-0.016
Machinery	-0.21	-0.41	-0.67	-0.22	1.53	0.007	0.06	-0.036	-0.011
Computer and electronic product	-0.22	-0.27	-0.40	-0.39	0.52	0.005	0.08	-0.031	-0.030
Electrical equipment etc.	-0.30	-0.39	-0.48	-0.25	0.98	0.006	0.02	-0.011	-0.006
Aerospace transportation equipment	-0.01	-0.59	-0.31	-0.38	0.42	0.008	0.04	-0.012	-0.011
Furniture and related product	-0.40	-0.70	-0.84	-0.44	0.96	0.010	0.01	-0.010	-0.006
Miscellaneous	0.01	-0.30	-0.07	-0.22	0.16	0.006	0.03	0.000	-0.006
Motor vehicles and parts	-0.78	-0.82	-1.94	-0.41	2.40	0.005	0.06	-0.091	-0.022
Other manufacturing (non-NAICS)	-0.34	-0.33	-0.62	-0.17	1.82		0.04	-0.022	-0.006

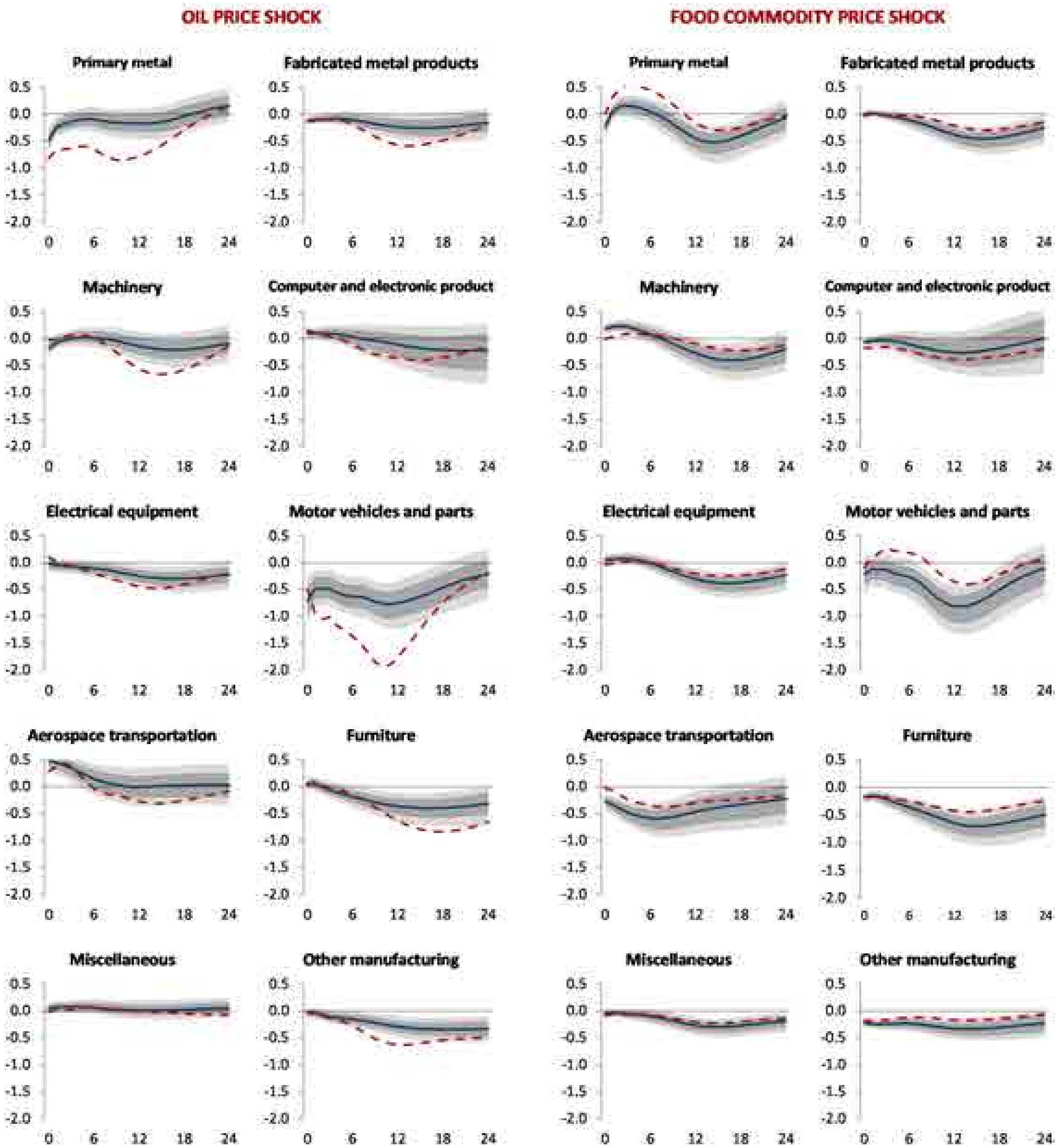
Note: "Actual (own peak)": estimated peak effect of a unit variance shock on the component. "Counterfactual (own peak)": counterfactual peak effect absent a monetary policy respons. "D-D": diff-in-diff counterfactual statistics. A value greater (smaller) than one implies a relatively stronger impact of oil (food) price shocks. "Weight": average share of the component in the aggregate over the sample period. "Weighted CF": weighted contribution of the component to the peak counterfactual effect of the aggregate.

Figure A10: (Counterfactual) impulse responses of industry groups



Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets. Dashed (red) lines are counterfactual impulse responses.

Figure A10: (Counterfactual) impulse responses of industry groups (continued)



Note: Effective impulse responses to unit variance shocks (blue), with 68 and 90 percent credible sets. Dashed (red) lines are counterfactual impulse responses.