Commodity Special Feature: Market Developments and the Commodity Price Channel of Monetary Policy
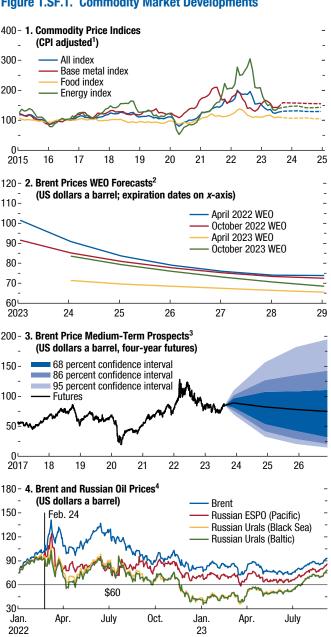
Primary commodity prices declined by 7.5 percent between February and August 2023. The widespread decline was led by base metals, with prices falling 15.7 percent, and European natural gas prices, plummeting 36.0 percent. The trend decline in cereal prices was temporarily halted by the collapse of the Black Sea Grain Initiative in July. Gold prices increased. This Special Feature analyzes the commodity price channel of monetary policy.

Commodity Market Developments

Supply curbs supporting oil prices. Thanks to a rebound in July and August, crude oil prices increased, by 4.4 percent, between February and August 2023, remaining, however, well below their peak of $115 in June 2022 (Figure 1.SF.1, panels 1 and 3). On the demand side, a weaker-than-expected rebound in China's oil consumption, temporary recession fears because of banking woes, and tighter monetary policy in many major economies all contributed to downward price pressures, especially in the second quarter of 2023.

On the supply side, output curbs by OPEC+ (Organization of the Petroleum Exporting Countries plus selected nonmember countries) of 1.2 million barrels a day (mb/d) announced in April—coupled with additional voluntary cuts of 1 mb/d and 0.3 mb/d by Saudi Arabia and Russia, respectively—were only partly offset by strong oil output growth in non-OPEC countries, most notably in the United States, where oil output is expected to increase by 1.1 mb/d this year. Western sanctions on Russian crude oil exports have had mixed effects: export flows of Russian oil have remained fairly steady, and its price discount relative to Brent oil has shrunk over time—Russian oil is trading above the $60 price cap imposed by the Group of Seven (G7) countries—as the size of the non-Western-aligned oil tanker fleet carrying Russian oil has increased, and as Russia appears to have set up its own maritime insurance.

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Figure 1.SF.1. Commodity Market Developments

1. Commodity Price Indices (CPI adjusted[1])
   - All index
   - Base metal index
   - Food index
   - Energy index

2. Brent Prices WEO Forecasts[2] (US dollars a barrel; expiration dates on *x*-axis)
   - April 2022 WEO
   - October 2022 WEO
   - April 2023 WEO
   - October 2023 WEO

3. Brent Price Medium-Term Prospects[3] (US dollars a barrel, four-year futures)
   - 68 percent confidence interval
   - 86 percent confidence interval
   - 95 percent confidence interval
   - Futures

4. Brent and Russian Oil Prices[4] (US dollars a barrel)
   - Brent
   - Russian ESPO (Pacific)
   - Russian Urals (Black Sea)
   - Russian Urals (Baltic)

Sources: Argus; Bloomberg, L.P.; Haver Analytics; Refinitiv Datastream; IMF, Primary Commodity Price System; and IMF staff estimates.
[1]US consumer price index adjusted. Last actual value is applied to the forecast.
[2]Forecasts based on *World Economic Outlook* (WEO).
[3]Derived from prices of futures options on August 18, 2023.
[4]Last data point is September 8, 2023. All prices are daily midpoints.
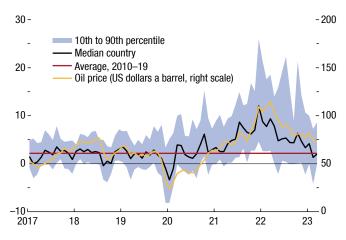ESPO = Eastern Siberia Pacific Ocean.

Futures markets suggest that crude oil prices will slide by 16.5 percent year over year to average $80.5 a barrel in 2023 (from $96.4 in 2022) and continue to fall in coming years, to $72.7 in 2026 (Figure 1.SF.1, panel 2). The International Energy Agency expects oil demand to increase by 2.2 mb/d, reaching 102.2 mb/d in 2023, outstripping supply in the second half of the year. Uncertainty around this price outlook is elevated (Figure 1.SF.1, panel 3). Upside price risks stem from additional OPEC+ production cuts, a military escalation in the Black Sea, and insufficient investment in fossil fuel extraction. Downside price risks stem from a widespread global economic relapse, a slowdown in Chinese oil demand, and faster penetration of electric vehicles.

Natural gas prices continue to normalize. European Title Transfer Facility trading hub prices declined 36 percent from February to August 2023 to a monthly average of $10.7 a million British thermal units (MMBtu) and within the upper range of historical prices. Lower demand, high storage overhang from this past winter, and ample supplies of liquefied natural gas (LNG) and of pipeline gas from Norway and northern Africa have all lowered prices. Asian LNG prices declined by 26.4 percent, roughly in lockstep with EU prices. US Henry Hub prices increased by 8.6 percent from February to average $2.6/MMBtu in August 2023. The price differential between US and European gas is expected to slow gradually as US LNG export capacity expansion picks up in 2024 and beyond. This is reflected in a slowly narrowing gap between the US and EU futures price curves. Title Transfer Facility futures prices suggest that average annual prices could move from $13.6/MMBtu to $17.5/MMBtu in 2024 but then down to $9.1/MMBtu by 2028. US Henry Hub prices are expected to rise from an annual average of $2.7/MMBtu in 2023 to $3.9/MMBtu in 2028.

Metal prices have weakened. After a short-lived rebound during the winter, base metal prices declined by 15.7 percent from February to August as China's reopening lost steam and its real estate sector, which together with construction accounts for roughly 20 percent of global metal consumption, kept faltering (Figure 1.SF.1, panel 1). Higher interest rates and weak European industrial demand also contributed to the negative market sentiment. Forecasts for base metal prices have also been revised downward since the April 2023 *World Economic Outlook,* with prices now projected to decline by 4.7 percent in 2023 and 7.1 percent in 2024. Gold prices remain high following a slowdown in the Federal

Figure 1.SF.2. Headline Inflation
(Month-over-month percent change, seasonally adjusted)

Sources: Haver Analytics; IMF, Primary Commodity Price System; and IMF staff calculations.
Note: Distribution (shaded area) covers countries accounting for 83.9 percent of World GDP (purchasing-power-parity-weighted).

Reserve's tightening pace and continued demand for inflation hedges and alternatives to the dollar.

Agricultural prices continue their downward trend. Between February and August, the IMF's food and beverage price index lost 6.7 percent, continuing its decline, though at a slower pace than in the second half of 2022. Prices of all major food commodities except sugar, rice, and pork contributed to the downward trend. As a result of a robust supply response in the 2022–23 season, grain prices fell consistently and in August stood 20.7 percent lower than in February. Grain prices remain, however, 7.7 percent above the average of the past five years. Food security concerns prompted recent export restrictions in India, the world's largest rice exporter. Risks to prices are tilted to the upside, stemming mostly from the ramifications of the end of the Black Sea Grain Initiative and uncertain effects of El Niño (see chapter text), possibly exacerbated by the proliferation of food export restrictions.

The Commodity Price Channel of Monetary Policy

Sharp fluctuations in commodity prices, among other factors, have been blamed for the recent global surge in inflation and for its subsequent fall (Figure 1. SF.2) (see, for example, Gagliardone and Gertler 2023; Blanchard and Bernanke 2023; and Ball, Leigh, and Mishra 2022). Commodity prices, however, are not exogenous with respect to the macroeconomy. Indeed,

part of the recent monetary policy reaction to inflation may have operated through a *commodity price channel*, as policy actions from major central banks affect global activity and financial conditions, which are typically major drivers of fluctuations in commodity prices. How quantitatively important is the commodity price channel of monetary policy—especially US monetary policy—in driving inflation in the United States and worldwide?

Empirical analysis of this question has been limited.[1] This Special Feature contributes to filling the gap by estimating the effects of US monetary policy shocks on commodity prices and, through this channel, their spillback to the US economy and spillovers to consumer prices in other countries. It also looks at pass-through from commodity prices to consumer prices and potential asymmetries.

A Conceptual Framework

Among central banks, the Federal Reserve plays a special role. This is because the bulk of cross-border capital flows are denominated in dollars, and US monetary policy is a key driver of the global financial cycle (Dées and Galesi 2021; Miranda-Agrippino and Rey 2020). Changes in US interest rates thus have pronounced repercussions for the rest of the world (Rey 2013).[2] Therefore, this analysis will focus on the effects of US monetary policy shocks (for an analysis of the effect of European Central Bank shocks, see Online Annex 1.1).[3]

Conceptually, US monetary policy can affect commodity prices through (1) a cost-of-carry channel, by affecting the opportunity cost of commodity

storage; (2) a real-economy channel, by affecting current and future commodity consumption; (3) a liquidity-and-portfolio channel, by affecting financial conditions and thus trading liquidity in physical and derivative markets; and (4) an exchange rate channel, as most commodities are traded in dollars. Since monetary policy typically has long lags affecting the real economy, an immediate effect of a monetary policy shock through the real-economy channel can work only through expectations and thus only for easy-to-store commodities.[4]

The Effects of Monetary Policy Shocks on Commodity Prices: A High-Frequency Approach

Local projections are used in the analysis presented here to estimate the effects of monetary policy shocks—as in Jarociński and Karadi (2020)—on commodity prices.[5] The strongest impact is found for industrial metals (for example, nickel and copper) and oil. A 10 basis point monetary policy surprise leads to a 2.5 percent drop in the base metal price index and a 2 percent drop in oil prices, with the peak responses after about 20 days (see Figure 1.SF.3). Prices for raw materials, such as cotton and rubber, also have a similar decline, whereas the reaction of food prices, such as those for cereals, is smaller (less than 1 percent) and less precisely estimated.
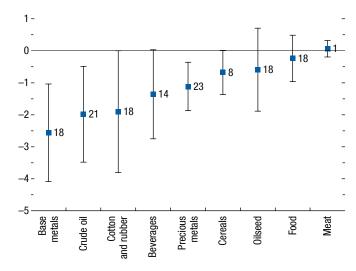
Results are consistent with the cost-of-carry and real-economy channels, as higher interest rates increase the opportunity costs of holding inventories and, through the delayed effect on economic activity of higher funding costs, reduce future demand. These effects are more relevant for commodities with high storability (for example, base metals).[6] The gold price reaction is very precisely estimated, with the price dropping by 1.1 percent after 23 days. For a given exchange rate, this sets a cap for the cost-of-carry channel, since gold prices are moved, during normal times,

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[1]Recent examples are Breitenlechner, Georgiadis, and Schumann (2022) and Ider and others (2023).

[2]The dollar is both an *intervention* currency and an *anchor* currency (Gourinchas 2019). This helps propagate US monetary policy impulses from the center to the periphery and provides a common component to the global monetary environment. The spillovers of US monetary policy to the rest of the world are further strengthened by the importance of dollar funding for global bank balance sheets, as well as the increasing length and complexity of global supply chains (Bruno and Shin 2015).

[3]Policy rate comovement among central banks is elevated. Moreover, US monetary policy shocks seem to lead to policy reactions and policy surprises from other central banks, such as the Bank of Canada and the European Central Bank (see Online Annex 1.1 for details). Kearns, Schrimpf, and Xia (2023) document that spillovers from other central banks are modest. In the case of China, typically it is fiscal policy that is more prevalently used for business cycle fluctuations rather than monetary policy. All online annexes are available at www.imf.org/en/Publications/WEO.

[4]Sizable monetary policy shocks can also have a nonlinear effect on commodity prices (Miao, Wu, and Funke 2011).

[5]Only dollar-denominated commodity prices are considered for 1990–2019. The *pure* monetary policy surprise from Jarociński and Karadi (2020), which does not consider central bank information effects, is used. More details are presented in Online Annex 1.1.

[6]The responses of natural gas prices (Henry Hub) are not considered, as gas markets present important structural changes throughout the sample. For the period 1990–2019, natural gas prices do not respond to US monetary policy. However, for the 2016–19 subsample only, when US natural gas exports increased dramatically, a significant decline in gas prices after US monetary policy tightening is observed.

Figure 1.SF.3. Peak Commodity Price Responses to a 10-Basis-Point US Monetary Policy Shock
(Percent change)

Sources: Bloomberg L.P.; IMF, Primary Commodity Price System; UN Comtrade; and IMF staff calculations.
Note: The numbers next to the boxes represent the horizon (day) of the maximum decline in commodity prices. 90 percent error bars are displayed.

Figure 1.SF.4. Impulse Response Functions for a 10-Basis-Point US Monetary Policy Shock
(Percent)

Sources: Bloomberg L.P.; Board of Governors of the Federal Reserve System; UN Comtrade; US Bureau of Labor Statistics; US Energy Information Administration; and IMF staff calculations.
Note: Red (yellow) lines show the response of the variables under the assumption that oil prices (oil and food prices) do not react. Blue areas are 68 percent confidence bands. Oil and food prices are expressed in current-year dollars. CPI = consumer price index.

mostly by the opportunity cost of storing gold.[7] Monetary policy shocks also affect the dollar, which appreciates by 0.4 percent, but the impact is short-lived.[8]
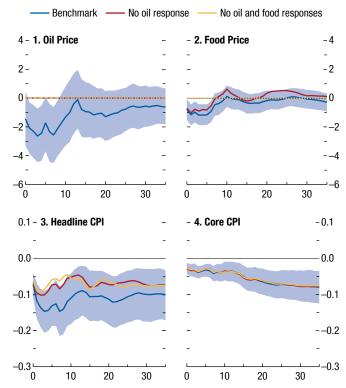
The Effects of Monetary Policy Shocks on Commodity Prices, Spillbacks, and Spillovers

Next, to gauge domestic spillbacks and spillovers from US monetary policy to other countries, a monthly proxy–structural vector autoregression approach is used. The analysis first looks at the effects of the commodity price channel on US inflation. It then moves on to the effects on other countries' inflation. The focus is on prices of food and oil, which have the most direct effects on headline inflation.

[7]Except in the case of natural gas, the results are robust to choosing different subsample periods, suggesting that the relationship between monetary policy and commodity prices has not changed over time. This remains the case even if the sample is broken into segments before and after 2004, a year typically used to distinguish between periods before and after the financialization of commodity markets (Tang and Xiong 2012).

[8]This suggests that, conditional on a monetary policy shock, the correlation between the dollar and commodity prices is negative at high frequencies. Although there is evidence that the unconditional correlation between commodity prices and the dollar has changed since 2015 (Hofmann, Igan, and Rees 2023), the analysis presented in this Special Feature does not find evidence of a change in the relationship between US monetary policy and commodity price indices for that period (see Online Annex 1.1 for details).

The Spillbacks

A 10 basis point increase in the US federal funds rate induces a decline in oil prices of 2 percent on impact, and the effect persists for eight months. Food prices decline by 1 percent, and the effect is less persistent. The responses of the headline consumer price index (CPI), industrial production, and the exchange rate are in line with the textbook implications of a monetary policy tightening (see Figure 1.SF.4 and Online Annex 1.1).[9]

[9]In addition to the monetary policy instrument, the first specification considers seven macroeconomic variables: the one-year Treasury bill, US headline CPI, US core CPI, US industrial production, the excess bond premium, the US dollar, the West Texas Intermediate oil price, and a food price index. The data span 1990–2019. The focus on food and energy commodities is because their pass-through to headline inflation is more direct and less delayed than those of other commodities, such as metals, fertilizers, and raw materials.

Table 1.SF.1. Average Response of CPIs
(Percent)

		0–6 Months	0–12 Months	12–24 Months
United States	Benchmark	−0.12	−0.12	−0.02
	No oil	−0.09	−0.07	−0.02
	Contribution[1]	(32)	(40)	−
	No oil, no food	−0.07	−0.06	−0.01
	Contribution	(41)	(47)	−
	Contribution MA[2]	(43)	(40)	−
Other Countries	Benchmark	−0.07	−0.07	0
	No oil	−0.04	−0.03	−0.01
	Contribution	(48)	(57)	−
	No oil, no food	−0.02	−0.02	0
	Contribution	(66)	(74)	−

Sources: Board of Governors of the Federal Reserve System; US Energy Information Administration; World Bank; and IMF staff calculations.
Note: Average response of CPIs to 10 basis point increase in interest rate. Time ranges in each column are average period of decline. CPI = consumer price index; MA = Mediation Analysis.
[1]Percentages in parentheses are contributions of commodity channel.
[2]"Contribution MA" presents the contribution of the overall commodity index from instrumental variables local projection (IV-LP) mediation analysis (MA).

Figure 1.SF.5. Contribution of Oil and Food Prices in the Transmission of US Monetary Policy Shocks
(Percent)

Sources: Board of Governors of the Federal Reserve System; US Energy Information Administration; World Bank; and IMF staff calculations.
Note: Blue and red squares are the average one-year response of CPIs after an increase of 10 basis points in the US interest rate. Error bars are 68 percent confidence intervals. Data labels in the figure use International Organization for Standardization (ISO) country codes. CPI = consumer price index.
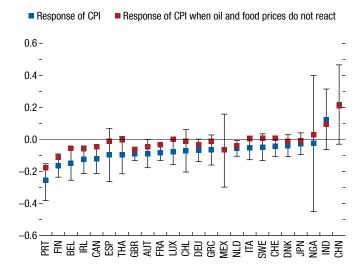
To isolate the commodity price channel of US monetary policy, in the spirit of Bernanke, Gertler, and Watson (1997), the impulse response functions are estimated again, with the condition imposed that US monetary policy has no effect on (1) oil prices and (2) both oil and food prices. If the commodity price channel is shut down, US monetary policy has smaller effects on the CPI. As Table 1.SF.1 shows, absent oil and food price responses, headline CPI would have declined by 0.07 percentage point rather than by 0.12 percentage point in the first half-year, implying a 41 percent contribution of the commodity price channel. The contribution is similar for the first year, but it declines over time as core inflation becomes the main driver (see Figure 1.SF.4, panel 4). Oil prices have a dominant role, since oil prices affect food prices but not vice versa.

An instrumental variable–local projection mediation analysis tends to confirm these results, with an average commodity price contribution of 43 percent over a half-year period (see Table 1.SF.1 and Online Annex 1.1).

The Spillovers

Figure 1.SF.5 reports the effects of US monetary policy on countries' CPI (in blue), along with the effect of US monetary policy on countries' CPI absent the commodity price channel (red).[10] As expected,

[10]To study the effects of US monetary policy on foreign inflation through commodity prices, the previous specification is augmented with the CPI of country *i* and the bilateral exchange rate for country *i* and the United States, with the estimate repeated for a set of 24 countries. The same decomposition is performed to study how much of the change in country *i*'s CPI is due to US monetary policy's effect on commodity prices.

most countries' CPIs decline after a US monetary policy tightening. The role of the commodity price channel is quantitatively important for several countries. As highlighted in Table 1.SF.1, for the average country, the commodity price channel accounts for 66 percent of the total spillover of US monetary policy onto inflation in the first half-year. The oil price alone contributes 48 percent.
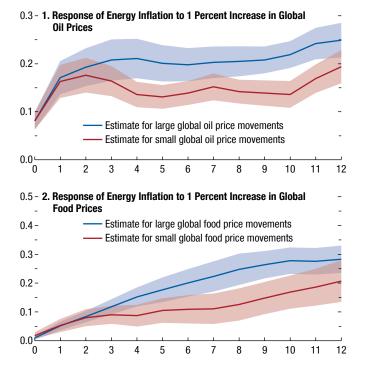
Asymmetric Pass-Through

Some observers have suggested that in the most recent episode of heightened inflation, the pass-through from global commodity prices to domestic consumer prices increased. It has also been suggested that producers are eager to pass cost changes on to consumers when commodity prices are on the rise but refrain from doing so when commodity prices decline. Finally, producers may also pass a larger fraction of commodity price changes on to consumer prices when the changes to commodity prices are larger and happen more quickly, attracting the attention of producers by virtue of their salience.

A series of local projections of domestic food and energy inflation on food commodity price and oil price

Figure 1.SF.6. Asymmetric Pass-Through of Commodity Price Shocks
(Percent)

1. Response of Energy Inflation to 1 Percent Increase in Global Oil Prices

Estimate for large global oil price movements
Estimate for small global oil price movements

2. Response of Energy Inflation to 1 Percent Increase in Global Food Prices

Estimate for large global food price movements
Estimate for small global food price movements

Sources: Ha, Kose, and Ohnsorge (2021); and IMF staff calculations.
Note: Shaded area is 90 percent confidence interval. Numbers on *x*-axis represent months after shock. Coefficient on large (small) price movements estimated on subsample of price changes larger than (smaller or equal to) one standard deviation.

shocks are conducted to test these hypotheses. For food inflation, there is no evidence that the pass-through is higher during commodity price booms than busts or that the pass-through for price increases is larger than that for price decreases. However, some evidence shows that the pass-through of large oil price shocks to domestic energy inflation could be twice the size of that for small ones (Figure 1.SF.6, panel 1). For food inflation, there is also evidence that the food price pass-through is heightened for larger and thus more salient shocks (Figure 1.SF.6, panel 2).

Conclusions

Monetary policy has a strong direct effect on commodity prices, especially those of industrial and storable commodities such as oil and metals. Spillbacks and spillovers to other countries from US monetary policy shocks are fast. After a 10 basis point monetary policy shock, the decline in oil and food prices over the course of six months reduces both domestic and other countries' inflation by 0.05 percent on average. This result implies that the commodity price channel of US monetary policy has relatively larger spillovers to other countries than spillbacks to the United States. Whereas the commodity price channel accounts for 41 percent of the total decline in US headline CPI, it accounts for 66 percent of the total decline in headline CPI for the average country in the sample.

Spillovers from US monetary policy shocks tend to be more relevant for consumer prices in other advanced economies, whereas the reaction of consumer prices in emerging market economies and their commodity price channels are less precisely estimated, as emerging markets tend to have more regulated prices. There is no significant commodity price channel for core inflation. Major central banks, when setting policy objectives, should consider their spillbacks and spillovers through a commodity price channel and expect stronger pass-through during times of sharp commodity price changes (relative to times of small changes). Finally, as the Federal Reserve tends to set the tone for the global monetary policy stance, and given that other major central banks such as the European Central Bank can also affect commodity prices, the commodity price channel could be strengthened in periods of high monetary policy coordination.