Special Feature: Market Developments and Food Price Inflation Drivers

Commodity prices rose 19.1 percent between February and August 2022. Energy—especially natural gas, up 129.2 percent—led the increase, as Russia cut gas supplies to Europe. Base metal prices declined by 19.3 percent, and precious metal prices fell by 6.0 percent, while those of agricultural commodities fell by 5.4 percent. This special feature analyzes developments in food prices in detail.

Energy Prices Stay Elevated

Crude oil prices, up by 3.5 percent between February and August 2022, surged to $120 a barrel in early March following Russia's invasion of Ukraine (Figure 1.SF.1, panel 1). Prices reflected fears of oil export disruptions at a time of tight supply-demand balances as well as a muted response by the Organization of the Petroleum Exporting Countries and other producers following prior divestments in the fossil fuel sector (see the April 2022 *World Economic Outlook* [WEO]).

Strategic oil reserve releases by members of the International Energy Agency and slower demand amid COVID-19 lockdowns in China caused oil prices to fall below $100 in April. However, announced bans on Russian oil imports and expectations of broader sanctions—including in the area of maritime insurance and trade finance—coupled with outages elsewhere led prices to surge to $120 in early June. Since then, rising interest rates and recession fears have weighed on prices as the International Energy Agency revised global 2022 oil demand growth down from 3.3 million barrels a day (mb/d) to 2.0 mb/d in September. As European and US firms reduced Russian oil purchases, Russian oil was rerouted to China and India at a discount to Brent (Figure 1.SF.1, panel 4). Refined-product prices reached multiyear highs as European refineries adjusted inputs and hit capacity constraints.

Futures markets suggest that oil prices will rise by 41.4 percent in 2022, to average $98.2 a barrel, but will fall in the coming years, to $76.3 in 2025 (Figure 1.SF.1, panel 2). Short- and medium-term risks to the oil futures price outlook are roughly balanced (Figure 1.SF.1, panel 3). Upside risks from additional supply disruptions as a result of sanctions and war as well as higher demand

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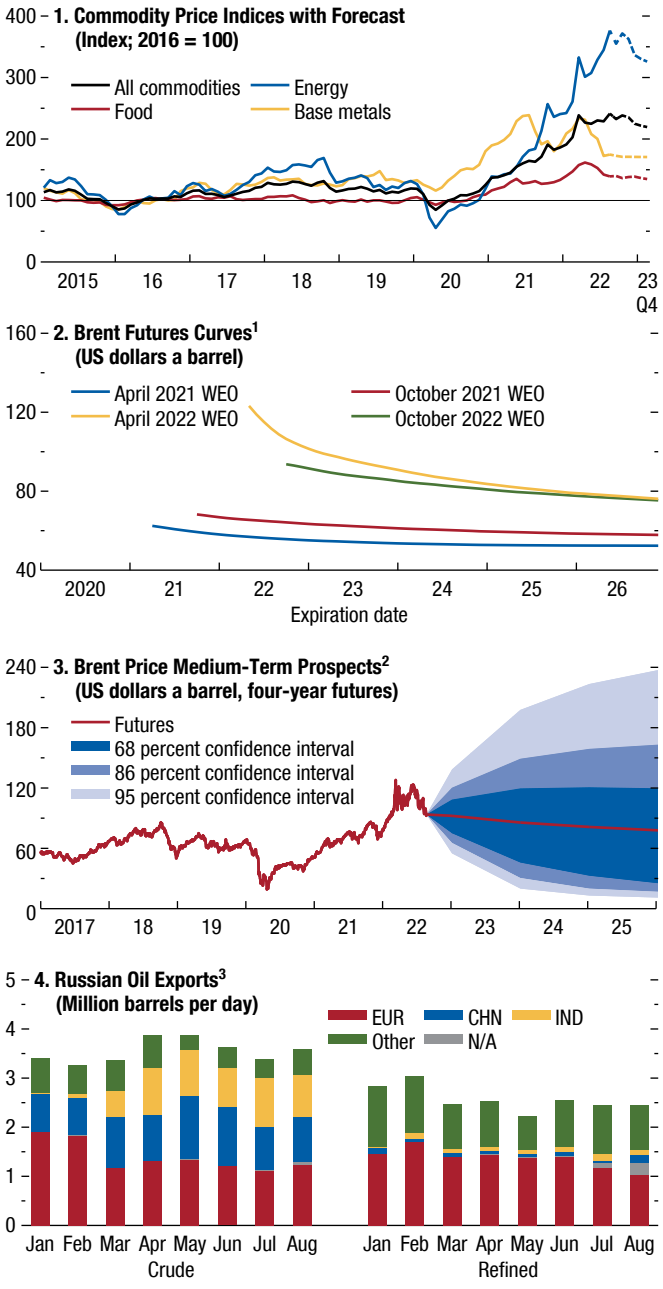
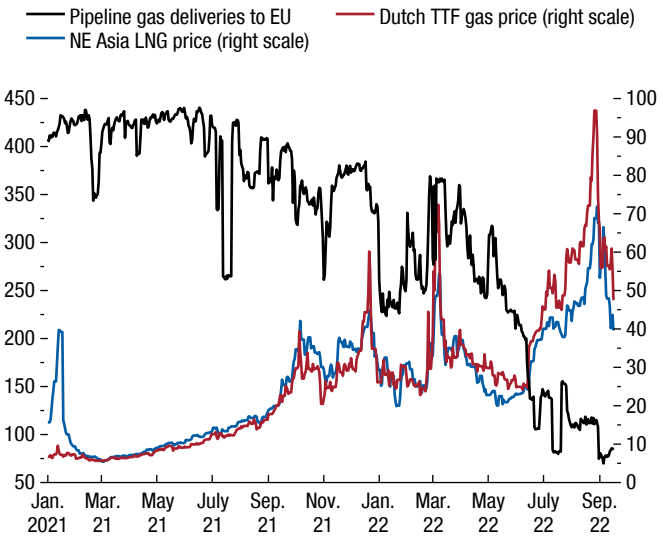
Figure 1.SF.1. Commodity Market Developments



Sources: Bloomberg Finance L.P.; IMF Primary Commodity Price System; Kpler; Refinitiv Datastream; and IMF staff calculation.
Note: "N/A" WEO = *World Economic Outlook*.
[1]WEO futures prices are baseline assumptions for each WEO report and are derived from futures prices. October 2022 WEO prices are based on August 17, 2022, closing.
[2]Derived from prices of futures options on August 17, 2022.
[3]Kpler seaborn export as of September 19, 2022. "N/A" in legend means that oil is exported to unknown destination.

Figure 1.SF.2. Russian Gas Exports and Prices
(Million cubic meters a day; US dollars per million British thermal units)



Sources: Argus Media; European Network of Transmission System Operators for Gas; Gas Transmission System Operator of Ukraine; Refinitiv Datastream; and IMF staff calculations.
Note: Last observation is September 16, 2022. EU = European Union; LNG = liquefied natural gas; NE = Northeast; TTF = Title Transfer Facility.

owing to gas-to-oil switching are offsetting downside risks from a slowing global economy, possible additional oil supplies from Iran, and higher-than-expected oil production growth in the US. Sanctions and Russia's potential retaliation have raised uncertainty, and oil price projections may be subject to large revisions.

Supply concerns in Europe have been driving natural gas prices. Russia reduced pipeline gas exports to Europe by about 80 percent in September 2022 relative to the previous year, citing maintenance problems or some countries refusing to pay for gas in rubles. Dutch Title Transfer Facility gas futures rose by 159 percent from February to August 2022, to record highs (Figure 1.SF.2). This has led European countries to increase reliance on global liquefied natural gas supplies (see Albrizio and others 2022) and to discuss a price cap on Russian gas. Prices are expected to stay high until the end of 2023. Coal prices rose 61.4 percent over the reference period and remain historically high, reflecting gas-to-coal switching, an embargo on Russian imports by EU and Group of Seven countries, and production disruptions.

Metal Prices Retreat after Rallying

The base metal price index surged, on account of Russia's invasion of Ukraine, before retreating amid slowing global economic growth to a net 19.3 percent decline from February to August (Figure 1.SF.1, panel 1). The price of aluminum is down by 25.0 percent, that of copper down by 19.6 percent, and that of iron ore down by 21.9 percent. New COVID-19 lockdowns in China, supply chain issues, and monetary policy tightening in the US and elsewhere have depressed both demand for metals and expectations about future demand. The IMF's energy transition metal index covering metals critical for electric vehicles and renewable energy fell 21.0 percent; precious metals fared better, with the IMF index slipping just 6.0 percent.

Base metal prices are expected to fall 5.5 percent, on average, in 2022, compared with a 9.9 percent increase projected in the April WEO, and to decrease by a further 12.0 percent in 2023. Precious metal prices are expected to decline more moderately, by 0.9 percent in 2022 and an additional 0.6 percent in 2023. Risks to this outlook are balanced as investors weigh potential supply reductions by European smelters amid higher energy costs against weakening global demand.

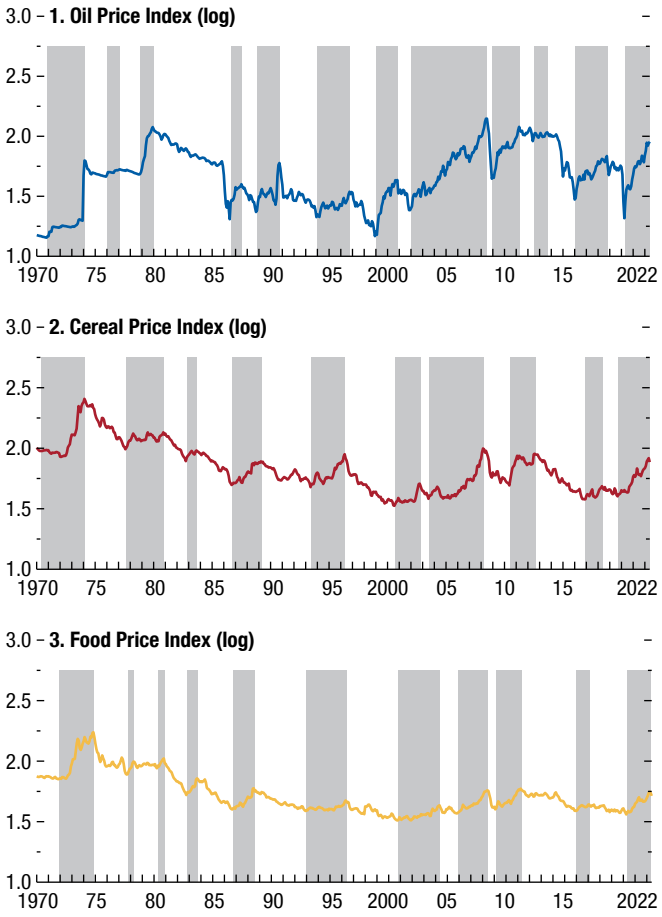
Agricultural Prices Correct from Peak Following Russia's Invasion of Ukraine

Food commodity prices surged after Russia's invasion of Ukraine but corrected to prewar levels in June and July, halting a two-year rally (see following sections). Improved supply conditions and a gradual end to Russia's blockade of Ukrainian grain exports drove the decline, along with macroeconomic factors—including rising interest rates and global recession concerns. Looking ahead, risks of renewed export restrictions (such as Indonesia's April 2022 ban on palm oil exports), droughts in part of China and the US, and pass-through from higher fertilizer prices—which reflect the reduced availability of fertilizers produced in Belarus and Russia—tilt the balance of risks to the upside.

Drivers of Global Food Prices and Transmission to Food Price Inflation

Global food commodity prices entered an expansionary phase in 2020, increasing by 54 percent, from trough to peak, with the prices of foods that make up large parts of diets increasing by 107 percent (Figure 1.SF.3). Although food prices are not new to cyclical fluctuations, this price rally stands out historically (Table 1.SF.1).

Figure 1.SF.3. Selected Commodity Price Indices
(Percent)



Sources: Haver Analytics; IMF, Consumer Price Index and Primary Commodity Price Series databases; World Bank; and IMF staff calculations.
Note: Shaded areas indicate periods of expansion. All series are deflated by the US consumer price index. Last observation is June 2022.

The price surge has contributed to domestic inflation, making monetary policy more difficult, especially in low-income countries, where food accounts for half of total consumption, and has raised concerns about food security and social unrest (Bellemare 2015; Bogmans, Pescatori, and Prifti 2021; FAO and others, 2021). Moreover, food-importing countries have seen deteriorations in their balance of payments and fiscal balances, which typically occur when social protection increases in response to higher food prices (Ng and Aksoy 2008). The following sections examine trends in cereal prices and their drivers, providing evidence on the pass-through from international food prices to domestic food price inflation. The analysis focuses on cereals (wheat, corn, rice, and a few smaller crops) that are common in diets and hard to substitute;

Table 1.SF.1. Oil, Cereal, and Food Price Boom Phases

		Duration	Amplitude	Sharpness
Oil	Latest	25	322%	12.9%
	Average	29	165%	5.8%
Cereal	Latest	32	107%	3.3%
	Average	32	78%	2.4%
Food	Latest	24	54%	2.3%
	Average	22	45%	2.1%

Sources: Haver Analytics; IMF, Primary Commodity Price System; World Bank; and IMF staff calculations.
Note: Boom phases are identified using the Harding and Pagan (2002) algorithm. Duration is in months. Sharpness is amplitude divided by duration per cycle.

together, these cereals account for two-thirds of global food production.

Factors behind Food Price Movements

Food and energy prices have often moved in tandem, magnifying their macroeconomic effects. Food and oil prices have been in the same phase (boom or bust) about 66 percent of the time since 1970; this *concordance* increases to 75 percent for the period since 2004. There are at least three reasons behind the comovement: (1) oil is used *directly* as fuel for farm equipment and transportation, and gas affects farming *indirectly*, being the main input of nitrogen-based fertilizers and pesticides; (2) global economic activity is a common demand factor (even though it is more relevant for energy); and (3) some agricultural products are used as biofuels.

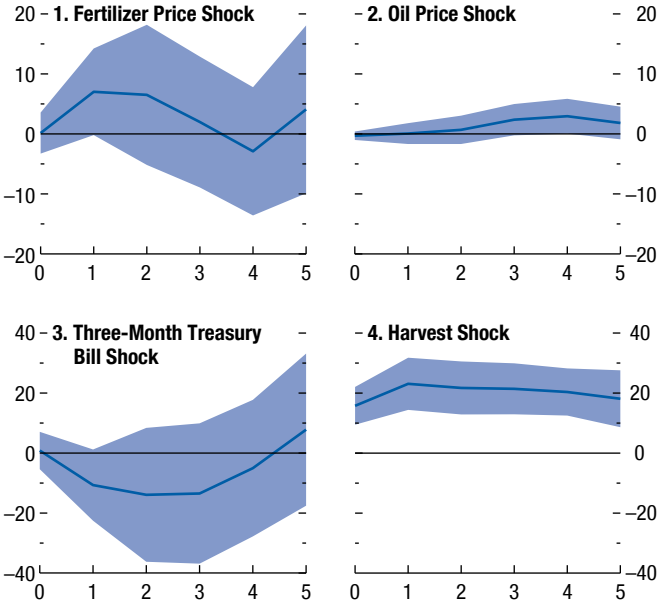
After the introduction of biofuel mandates in the European Union and US in the mid-2000s, the correlation between oil and cereal prices increased strongly (Table 1.SF.2). This was particularly true for corn, which was favored in biofuel policies relative to other cereals. The correlation also rose for vegetable oil. The higher correlation is not confined to commodities used as biofuels, in part because of price spillovers. A more prominent role of common shocks and the increased financialization of commodity markets in the mid-2000s may have also contributed. Finally, the US dollar value and interest rates are also common factors driving food commodity prices (Gilbert 2010; Baffes and Haniotis 2016).

Table 1.SF.2. Oil-Cereal Price Correlation

	1970–2004	2005–June 2022
Cereal	–0.9%	17.4%
Corn	–2.3%	23.1%
Vegetable oil	–4.6%	44.5%

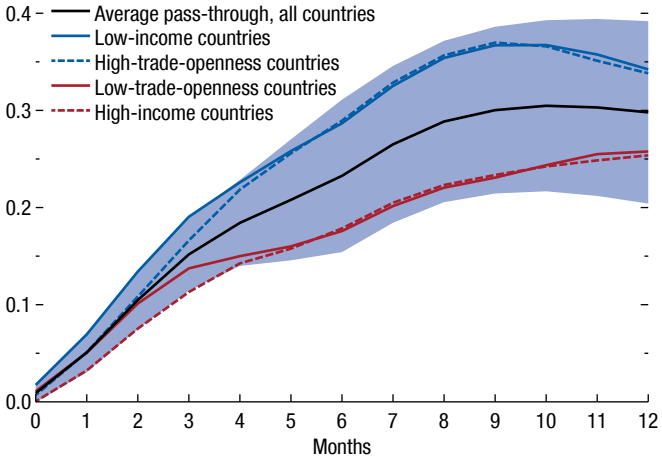
Sources: World Bank; and IMF staff calculations.
Note: Five-year rolling correlations of monthly log differences of oil prices with cereal, corn, and vegetable oil prices. All prices are deflated by the US consumer price index.

Figure 1.SF.4. Response of Cereal Prices to Major Drivers
(Cumulative percent)



Sources: Haver Analytics; IMF, Consumer Price Index and Primary Commodity Price Series; World Bank; and IMF staff calculations.
Note: Quarters on the *x*-axis. Panels show cumulative impulse response of cereal prices to (panel 1) 10 percent fertilizer price shock; (panel 2) 10 percent oil price shock; (panel 3) 100 basis point shock to three-month Treasury bills; and (panel 4) one-standard-deviation harvest shock. Shaded areas are 90 percent confidence intervals. See Online Annex 1.SF.1 for data descriptions and methodology.

Figure 1.SF.5. Response of Food CPI to International Food Price Shock
(Percent)



Sources: Haver Analytics; World Bank; and IMF staff calculations.
Note: Response of domestic food consumer price index (CPI) to a 1 percentage point shock to international food prices. Shaded areas are 90 percent confidence bands.

Econometric Analysis

Four drivers of cereal prices are studied here in detail: shocks to fertilizer and oil prices, cereal production, and US interest rates. Control variables include global GDP growth and the US dollar real effective exchange rate (see Online Annex 1.SF.1 for technical details).

Supply shocks dominate fluctuations in cereal prices. A typical (negative) global harvest shock induces a 16 percent rise in prices in the same quarter, with the increase peaking at 23 percent after one quarter (Figure 1.SF.4). Energy prices have a smaller effect especially those related to oil, acting with lags. A negative oil supply shock that raises oil prices by 10 percent leads cereal prices to rise by about 2 percent after three to four quarters (suggesting a modest effect from biofuels, since the cost share of oil in cereal production varies from about 10 to 15 percent). Prices of fertilizers, in contrast, have a delayed but important effect. A 10 percent rise in fertilizer prices (due to a natural gas supply shock) has no immediate effects but leads to a 7 percent rise in cereal prices after one quarter. Though persistent, the effect becomes less precisely estimated at longer horizons. Finally, a 100-basis point US monetary policy shock reduces cereal prices by about 13 percent with a one-quarter lag.

Domestic Food Price Inflation Rising Following Higher Global Food Prices

Taxes, subsidies, price controls, weak market integration, and local distribution costs often limit the transmission of international (producer) food price variations across borders to domestic retail food prices (Figure 1.SF.5). In fact, even though the recent rise in *domestic* food price inflation is broad-based, variation across regions is substantial, with recent inflation levels as low as 5.3 percent in south and east Asia and as high as 12.6 percent in central Asia and Europe.

It is therefore relevant to know the following: (1) What is the timing and the magnitude of the pass-through from international to domestic food prices? and (2) Do certain country characteristics, such as income level and trade openness, make countries more susceptible to such pass-through?

Pass-Through from Global Food Prices to Domestic Food Price Inflation

Panel data and local-projections methods are used here to trace the impact of food commodity prices (instrumented by harvest shocks) on domestic food price inflation. Several control variables are included, such as oil prices (to proxy for road transportation costs), the Baltic Dry Index (to proxy for shipping costs), headline

consumer price inflation (to capture monetary factors), and exchange rates (in local currency units per dollar).

After an international food price shock, consumer food price inflation rises linearly and peaks after 10 months, then starts declining but persists at a higher level. In total, food consumer price inflation increases about 0.3 percentage point in response to a 1 percentage point change in international food prices after about 10–12 months (Figure 1.SF.5). The pass-through, which is limited by the cost share of food commodities in food consumer prices, is about 30 percent for the average country.

Some Countries Are More Vulnerable to Global Food Price Shocks

The pass-through is larger for emerging market economies than for advanced economies, in part because food commodities have a higher cost share in the former group. It is also larger for countries that score higher on trade openness, as greater cross-border arbitrage opportunities raise domestic prices' responsiveness to global food price shocks. This greater responsiveness holds for both net food importers and net food exporters and can explain why food exporters are tempted to introduce food export restrictions when commodity prices rise (Laborde Debucquet and Mamun 2022). For a one-standard-deviation rise in GDP per capita, the pass-through declines by 6 percentage points, while it increases by 7 percentage points for a one-standard-deviation rise in trade openness above the global mean (Figure 1.SF.5). High degrees of trade openness can thus explain the relatively high levels of average food price inflation in central Asia compared with those in countries in south and east Asia.

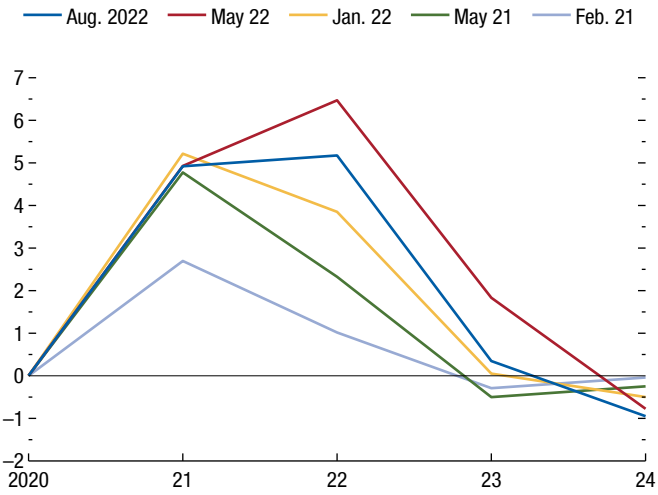
Conclusions and Outlook for Food Prices

International food prices are estimated to have added 5 percentage points to food price inflation for the average country in 2021 and are forecast to add an estimated 6 percentage points in 2022 and 2 percentage points in 2023 (Figure 1.SF.6). A combination of supply-side factors (the 2020–22 La Niña episode and food trade restrictions), cereal-specific demand (China's 2021 restocking), low interest rates, and more recently, the war in Ukraine and the Russian blockade of wheat exports from Ukraine created a perfect storm for global food commodity markets that kept prices on an upward trajectory between April 2020 and May 2022.

The outlook for domestic food price inflation remains uncertain, as global food prices could surprise again on the upside, given the high uncertainty about the impact of the war in Ukraine and weather events and the delayed effect of high fertilizer prices. Current estimates already suggest a negative shock for global cereal production equivalent to about a 0.6 standard deviation in cereal growth for 2022 (OECD-FAO, 2022)—contributing to a 23 percent rise in cereal prices this year and outweighing the effects of higher interest rates on food price inflation. Finally, differences in the timing and magnitude of the price pass-through make low-income and high-food-openness countries more susceptible to a resumption of the global food price rally.

Recent events underscore the importance of well-functioning international food markets and of appropriate (domestic) policies to address inevitable price swings, including targeted food aid to vulnerable consumers as well as incentives for the buildup of global food stocks over the medium term. Open food trade raises consumer variety, promotes deeper and more stable markets, and constitutes a hedge against the volatility of domestic production. Policies that promote self-sufficiency weaken the world food trading system and raise environmental costs through land conversion or more intensive farming practices. Especially for small countries (because of within-country spatial correlation of weather patterns), densely populated countries, and countries particularly vulnerable to climate change, international trade will remain indispensable.

Figure 1.SF.6. Conditional Forecast Domestic Food Price Inflation
(Percent)



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: Projected domestic food inflation based on recent commodity price forecasts on various dates.