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Commodity markets: shocks and spillovers[1]

Dislocations from the Russia-Ukraine war have buffeted commodity markets from both the financial and real sides. We argue that a substitution of Russian oil exports would be difficult, implying that restrictions on these exports may result in large and persistent price increases for oil-related products. Surging oil prices may be partly moderated by an increased use of biofuels, but this in turn could push up the prices of the staple crops that are biofuel feedstocks. In addition, persistently high prices for natural gas, key for electricity generation, could extend the recent electricity price hikes for final users – a strong headwind for all economic activity, especially industrial production.

JEL classification: Q02, Q43, G10.

Commodity markets seem to be undergoing sizeable transformations. The start of the Russia-Ukraine war gave rise to severe dislocations in many financialised commodity markets, which were followed by a sudden fragmentation of physical markets as Russian energy supply restrictions emerged. In this feature, we take stock of these developments in commodity markets and discuss their potential impact on the real economy as well as their financial market repercussions.

Current events are often compared with the 1970s oil shocks, but the global economy is very different today, with novel interactions in commodity markets. In contrast to 50 years ago, cleaner energy sources such as natural gas and renewables play a larger role in electricity generation, giving rise to new challenges. Biofuels – non-existent back then – have become an integral part of the fuel mix, leading to new interactions between oil and agricultural markets. Thus, understanding the potential consequences of the current developments requires fresh thinking, not least on the potential linkages across seemingly unrelated commodity market segments.

We argue that many economies will find it difficult to compensate for broad constraints on or withdrawal of Russian oil-related exports. For one, alternative producers do not seem to have enough idle capacity to fill the gap. In addition, investment in new production capacity appears to be subdued, particularly by advanced economy firms.

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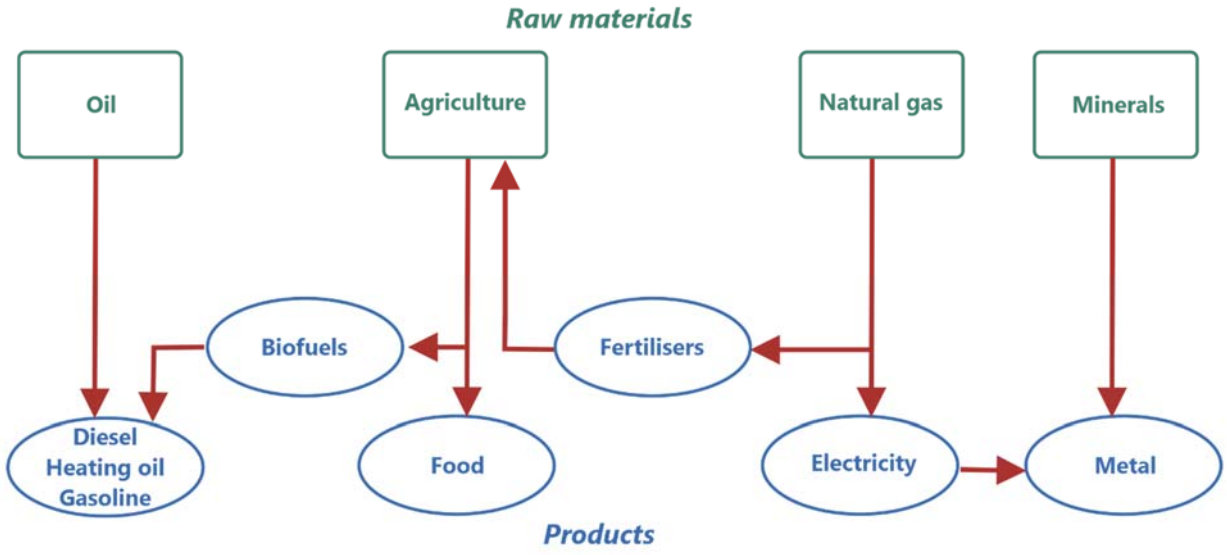
Key takeaways

- Replacing Russian oil output in global markets would be difficult, given limited spare capacity and subdued investment in new projects
- Persistently high oil prices may add upward pressure to the price of grains and oilseeds by boosting their use in the production of biofuels, such as ethanol and biodiesel.
- The recent outsize shock to natural gas prices could have a large and protracted impact on electricity prices for final users, which would be a major headwind to industrial production.

In discussing the spillovers of these shocks, we focus on a few key interactions in commodity markets (Graph 1). The direct effect of rising raw material prices would be to push up the prices of final products – eg from oil to gasoline/diesel, or from natural gas to electricity. Indirect effects are also important. For instance, enduringly high oil prices may add upward pressure to the price of corn and oilseeds, by increasing their use in the production of biofuels, such as ethanol and biodiesel. Shifts in the price of these crops, which are key livestock feedstuffs, could quickly propagate into other food prices.

The remainder of this article is organised as follows. The first section frames the discussion by reviewing recent market developments. The second considers the potential impact of a large withdrawal of Russian oil supply. We evaluate the prospects of other producers filling the gap and point out some indirect yet important interactions between oil and agricultural markets. The third section discusses the conditions that led to the current disarray in natural gas markets, the corresponding impact on electricity prices, and ultimately the potential fallout on economic activity, particularly industrial production. The final section concludes.

Some key connections in the commodity space — Graph 1



Source: Authors' elaboration.

An uneven shock to commodity prices

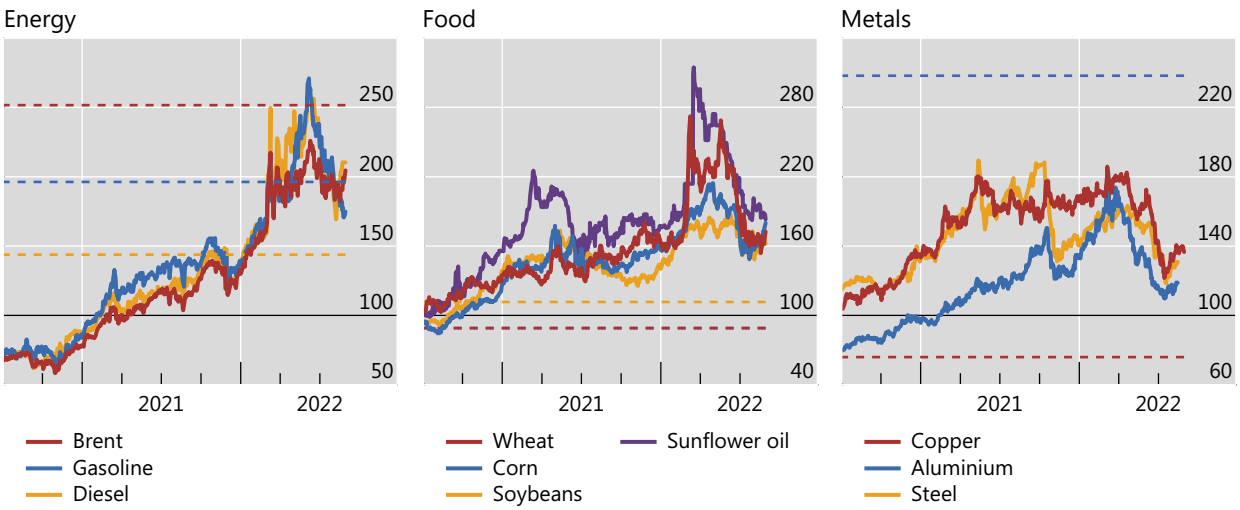
Key commodity prices have been on a pronounced upswing since early 2021. At first, the main driver was the rapid recovery of the global economy as the pandemic's effects began to ease. In 2022, the war in Ukraine added new momentum to price increases in some commodity markets, while disrupting the related financial markets.

The price surge following the beginning of the war in late February 2022 was particularly pronounced for energy and agricultural commodities, but less so for metals. While crude oil prices never broke through the peak recorded in the run-up to the Great Financial Crisis (GFC) (Graph 2, left-hand panel, solid and dashed red lines), the price of oil distillates (eg gasoline and diesel) reached all-time peaks, pointing to the existence of severe bottlenecks in the supply chain of refineries. Turning to key agricultural commodities, their prices have reached or surpassed the levels seen in the mid-2000s "supercycle".[2] Since February, price rises have been particularly strong for wheat and sunflower oil (Graph 2, centre panel), of which Ukraine and Russia are big exporters. Corn and soybean prices saw less of a jump, but market-specific factors had been driving them upwards since late 2020 (USDA (2022)). Industrial metals have seen relatively limited price increases. The persistent weakness of the Chinese economy has kept a lid on those prices (Graph 2, third panel).

The start of the Russia-Ukraine war led to a surge in volatilities and sudden changes in correlations across many commodity prices. These shifts threatened to destabilise the corresponding futures and option markets. One example is the surge in the volatility of natural gas prices, which quadrupled over H1 2022. In parallel, the

Commodity prices have trended upwards since 2021, setting many records

2015–19 average = 100 Graph 2



Horizontal dashed lines indicate pre-GFC maximum price levels.

Sources: Bloomberg; Datastream; authors' calculations.

[2] Steep increases in agricultural prices between 2004 and 2008 are attributed to natural catastrophes that reduced supply and to strong demand growth from emerging market economies (especially China). See for instance Erten and Ocampo (2012).

correlations of Brent prices with those of corn and soybean, which are low or even negative in normal times, jumped to more than 0.7. And while nickel traded on the London Metal Exchange (LME) saw the most conspicuous market disruption (Bloomberg (2022)), stress engulfed most markets (see Box A).

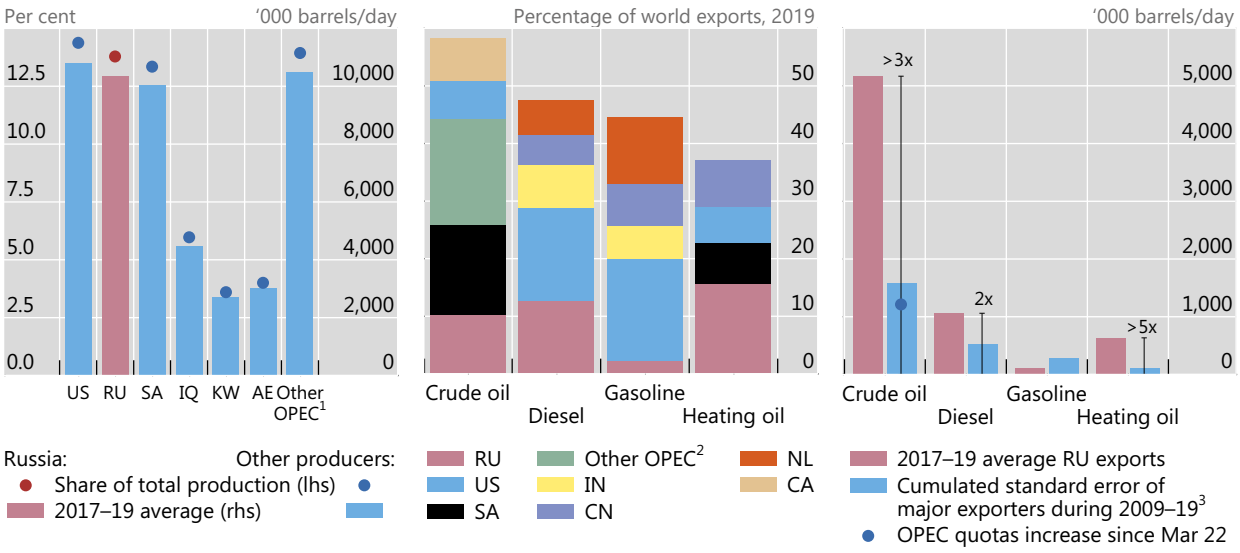
Oil markets: cascading down to agricultural markets?

The Russia-Ukraine war has led to a significant fragmentation of global oil markets, with Russian exports to some countries plummeting. Since further and broader oil supply shortages are possible down the road, it is important to gain an understanding of the potential to compensate for them and of how they may spill over to other commodity markets, eg via the links highlighted in Graph 1.

Finding new oil sources

Russian oil products have a massive footprint in global markets. As regards crude oil, Russia, Saudi Arabia and the United States are the only jurisdictions with daily output above 10 million barrels per day (bbl/d), each accounting for about 14% of global production, and vastly surpassing the output of any other producing country (Graph 3, left-hand panel). About half of Russian production is directly exported, representing 10% of global exports of crude oil. The rest is an input into the production of distillates, with Russian refiners accounting for about 15% of global exports of diesel oil and heating oil (centre panel). Thus, a material withdrawal of Russian oil products would be a major negative shock to the global economy.

The large footprint of Russian supply in oil-related markets — Graph 3



[1] AO, CD, DZ, IR, GA, GQ, LY, NG and VE. [2] AE, IQ and KW. [3] Standard errors of auto-regressive models of order one, for each country-commodity pair. Standard errors are the sum across countries for each commodity type, to gauge the variability of production patterns.

Sources: OPEC; UN Comtrade; JODI; national data; authors' calculations.

Current restrictions in Russian oil exports have led to fragmentation, with some consumers losing access to part of the market. Based on the available Comtrade data, US imports of Russian oil had fallen almost to zero by the second quarter of 2022, while the corresponding European Union (EU) purchases dropped by 29%. At the same time, the purchases of Russian crude oil by countries in Asia, Africa and Latin America have reportedly increased significantly (Reuters (2022a)). In the background, Russian oil production, after suffering a steep drop in April, gradually recovered to match 2021 levels in June, with some observers estimating that it will surpass 2021 levels by the end of the current year (OPEC (2022)).[3]

Looking forward, can the world easily compensate for effective restrictions on Russian oil supply? It seems unlikely that other producers currently have enough idle capacity to fill the gap that would be left by an extensive withdrawal of Russian oil products. Based on output levels during the pre-Covid decade, the typical variability of the exports of all OPEC members combined, including Saudi Arabia, is around 1.5 million bbl/d (Graph 3, right-hand panel). That is roughly the same as the production increases already agreed by members this year (blue dot).[4] Thus, for OPEC members, fully replacing Russian crude oil exports would represent more than three times the current effort. Turning to distillates such as diesel and heating oil, sectors which are also facing capacity challenges, the effort would be comparable if not greater.

In addition, substitution of Russian oil output may require investment. However, 2022 investment in the exploration and development of new sources (ie upstream investment) is set to fall short of pre-pandemic levels (Graph 4, left-hand panel, blue dots), even if it were to grow by 10% from 2021 (IEA (2022)). This relatively modest rise would be spearheaded by national oil companies (NOCs), particularly in the Middle East, the only producers that would exceed pre-pandemic upstream expenditure. Advanced economy (AE) energy companies, in contrast, are expected to see their upstream investment fall by an average of 30% vis-à-vis 2019. The retrenchment by AE energy firms is not a new phenomenon: it can be traced back at least to the middle of the 2010s (Deloitte (2015)). As of mid-2022, these firms' participation in the 50 largest oil and gas projects worldwide amounted to about 37% of these projects' value (centre panel). The corresponding share for projects controlled fully by AE energy firms is only 5%. Overall, despite recent increases in oil and gas prices, there are no signs of rebounding investment in oil production.

Weak sentiment towards energy companies, perhaps driven in part by climate policies, may be denting their incentives to invest. The excess stock return specific to AE energy producers has been increasing since 2017, and was positive for most of them in 2020 (Graph 4, left-hand panel, red line and area). This hints at an unfavourable market sentiment that lowers the valuation of these producers' stocks. Such an interpretation fits a general pattern that prevailed during the last decade: global upstream investment was weaker when there was a larger share of undervalued firms according to this measure (right-hand panel, red regression line). If the undervaluation has persisted, it can explain why some managers have preferred to repurchase their stocks rather than invest in real assets.[5]

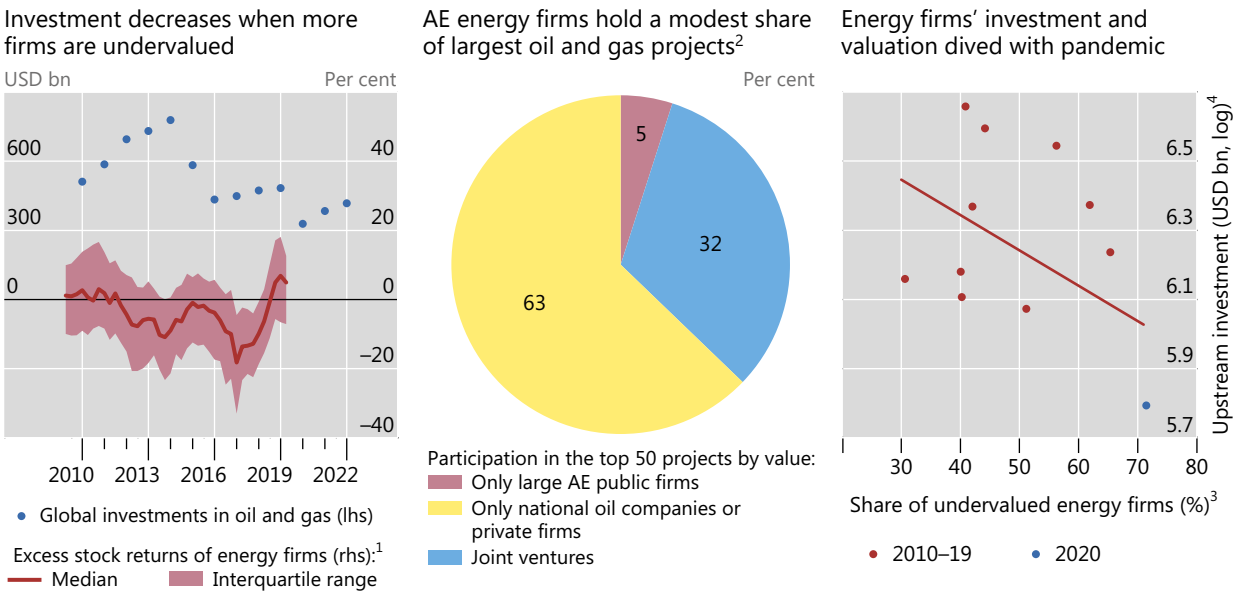
[3] As the supply disruptions began to ebb, weakening oil prices have led OPEC members to consider and implement cuts in production quotas.

[4] During the second quarter of 2022, Saudi Arabia has reportedly doubled its purchases of Russian fuel oil for power generation, in order to free up more crude oil for exporting (Reuters (2022b)).

[5] For instance, Glencore, BP, Exxon and Chevron spent more than $20 billion on buybacks in H1 2022.

Investment in new production capacity has been subdued

Graph 4



[1] Based on Fama-French regressions for S&P 500 companies and large global commodity producers with shares traded in US markets. [2] Share of the total value of the top 50 global oil and gas construction projects, by value as of July 2022. [3] Percentage of energy firms with positive excess stock returns. [4] Global investment in oil and gas.

Sources: K French, "US Research Returns Data", August 2022; Bloomberg; IEA; Offshore Technology; national data; authors' calculations.

Oil and agricultural prices: linked by biofuels

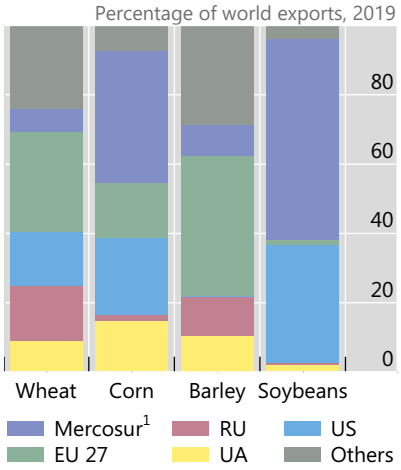
The Russia-Ukraine war has put upward pressure on the price of some agricultural commodities. In part, this pressure stemmed directly from supply restrictions, as the joint share of both countries in the global exports of key crops is substantial. There was also an indirect effect, from the increase in the price of crude oil and its distillates. In the short run, higher diesel and gasoline prices increase the costs of agricultural production and transportation. Large and persistent increases in oil prices may also result in a durable increase in the price of crops that are used as an input for the production of biofuels such as ethanol and biodiesel (Graph 1).

Russian and Ukrainian exports account for a large share of the global market of several food staples. Their share is particularly large in wheat, at roughly 25%, but also in barley and corn (Graph 5, left-hand panel). The surge in wheat prices was most pronounced after the start of the Russia-Ukraine war, as it was expected to disrupt the approaching harvest season for winter wheat (Graph 2, centre panel). The price reaction in other crops such as corn, however, was more limited, as major producers in this market were unaffected, particularly the United States, the crop's largest single producer and exporter.

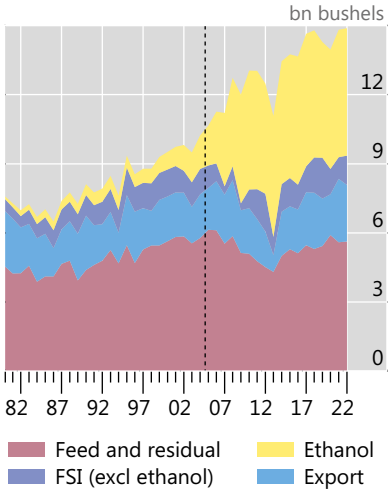
Interlinkages between oil and crops

Graph 5

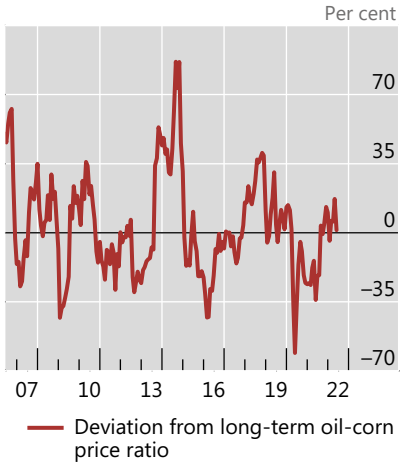
Global exports of grains and oilseeds



Uses of US corn production



Oil and corn prices move in tandem



FSI = food, seed and industrial. The vertical dashed line in the centre panel indicates 8 August 2005 (US Energy Policy Act).

[1] AR, BR, PY and UY.

Sources: UN Comtrade; national data; authors' calculations.

Corn is a major input in the production of ethanol, a biofuel commonly blended with gasoline.[6] In fact, ethanol production is the only use of corn that has materially increased during the last 20 years in the United States, having taken about 40% of the US harvest, on average, over the past five years (Graph 5, centre panel). The prices of corn and oil have thus moved in tandem since the mid-2000s, with occasional large deviations that eventually subside over time (right-hand panel).[7] Higher oil prices create incentives for gasoline blenders to increase the ethanol content in their product. Such a shift could moderate the oil price surge, but would also increase the demand for corn (alongside that for other ethanol feedstocks), pushing up its price.[8]

Shifts in corn prices could also spill over to other agricultural markets. As corn competes with soybeans for acreage, changes in corn prices usually are transmitted quickly to soybeans. Furthermore, both crops are used as livestock feedstuffs. In sum, persistent disruptions in global energy markets can spill over to raise the prices of a wide range of agricultural products through a variety of channels.

[6] Sugarcane and, to a lesser extent, also sugars from wheat, barley and sorghum are also common feedstocks for ethanol. Biodiesel has a much broader set of feedstocks, including oilseeds such as soybean, palm, rapeseed, canola and a variety of residual fats from animal and vegetable food processing. For an introduction, see US Energy Information Agency, "Biofuels explained": www.eia.gov/energyexplained/biofuels/.

[7] Avalos (2014) and Avalos and Lombardi (2015), among others, study the interactions between oil and agricultural prices after the passing of the US Energy Policy Act in 2005.

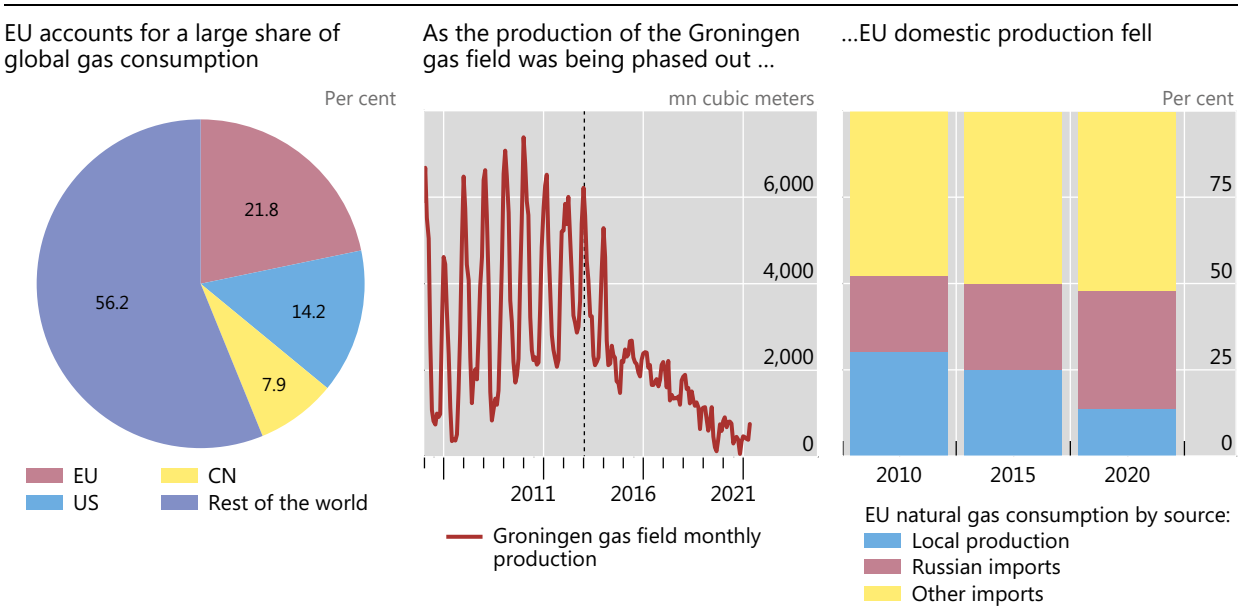
[8] In India, for instance, gasoline producers are currently offering substantial premiums over the government-mandated maximum prices of sugarcane ethanol (Reuters (2022c)).

Natural gas markets: the electricity connection

In contrast to the 1970s, oil now has a minimal footprint in electricity generation, as natural gas has risen in importance. The cleanest-burning fossil fuel among its peers (including oil and coal), gas has numerous industrial applications[9] and gas-fuelled generators are a key dispatchable[10] source of electricity (see Graph 1). Following many years of stability, gas prices have seen an extraordinary surge since mid-2021, in large part because of imbalances in EU markets. We now dig into the drivers of the surge and its potential impact on electricity prices and industrial production.

Global gas consumption has doubled in the last 30 years. The United States and the European Union are the two largest global consumers (Graph 6, left-hand panel). While the United States has become self-sufficient in the wake of the shale gas "revolution" (Stevens (2012)), the EU relies on a wide range of supply sources. For decades, a third or more of that supply used to come from domestic sources, underpinned by the massive Groningen gas field in the Netherlands. As late as 2013 its output, at 53 billion of cubic meters per year (bcm/year), represented 40% of the total EU natural gas production. The field was also important as it could accommodate large seasonal swings in demand (centre panel). With the phase-out

EU's gas consumption significantly exceeds domestic production — Graph 6



The dashed vertical line in the centre panel indicates January 2014 (first annual cap on Groningen production is announced).

Sources: European Commission; IEA; BP; NAM; national data; authors' calculations.

[9] Natural gas generates about 25% less carbon dioxide emissions than oil distillates, and it is a major input in the production of nitrogenated fertilisers (another connection between energy and food prices), plastics, batteries, clothing, solar panels and many more items. See, for instance, US Energy Information Agency, www.eia.gov/energyexplained/natural-gas/.

[10] Dispatchable sources of electricity are those that can be turned on and off at will, in response to current demand. This is the case for all fossil fuels, nuclear and usually hydropower. The main renewable sources, wind and solar power, are not dispatchable but "intermittent", since they can be used only when the right external conditions are present (the wind blows or the sun shines).

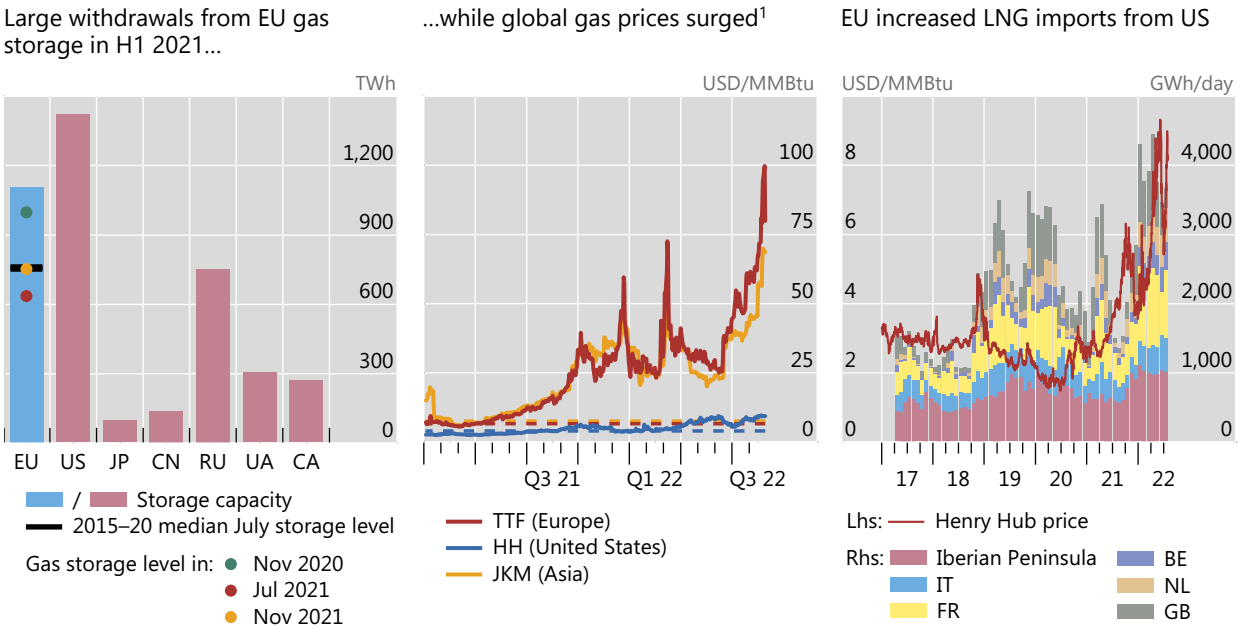
of Groningen starting in 2014, production within the EU declined quickly.[11] Instead, Russian supply took on a larger role, increasing its share of total EU gas consumption to almost 35% by 2020 (right-hand panel).

Gas markets have become globally interconnected in recent years. They were traditionally regional, with most of the trading based on regionally produced gas moving through pipelines. The construction of large liquifying/regasifying facilities in both producing and consuming countries has led to a sizeable global trade in liquified natural gas (LNG). The EU plays a pivotal role in this trade as it is one of the largest consumers and is tightly connected to regional and global markets through pipelines and LNG facilities. Typically, to counter supply-demand imbalances, the EU relies on its large storage capacity, second only to that of the United States (Graph 7, left hand panel, blue bar). In recent months, however, this practice has been put to the test.

As EU storage levels ebbed and flowed after the Covid outbreak, gas prices swayed. The sudden shutdown of the global economy in 2020 led to a glut of supply that drove prices to all-time troughs. Title Transfer Facility (TTF), the European benchmark, was trading at about $6 per million BTU in early 2021 (Graph 7, centre panel, red line). EU storage was replenished at low prices, reaching very high levels by late 2020 (left-hand panel, green dot). However, during the first half of 2021, a number of factors gradually tightened market conditions, mainly an unusually cold winter and the disconnection of several LNG hubs for technical reasons (Heather (2022)). EU gas reserves fell steadily to unexpected lows during the summer of 2021

Natural gas markets under stress

Graph 7



HH = Henry Hub; JKM = Japan-Korea Marker; TTF = Title Transfer Facility.

[1] The dashed lines indicate long-term medians starting from 2000 (subject to data availability).

Sources: AGSI; Bloomberg; Refinitiv Eikon; national data; authors' calculations.

[11] From early on, gas extraction from the field led to minor earthquakes, which became more frequent and intense from the mid-2000s. In 2014 the production of the field was capped for the first time, and a programme of gradual cuts that stretched out to 2030 was introduced. In October 2019, the government decided to accelerate the shutdown of Groningen to September 2022.

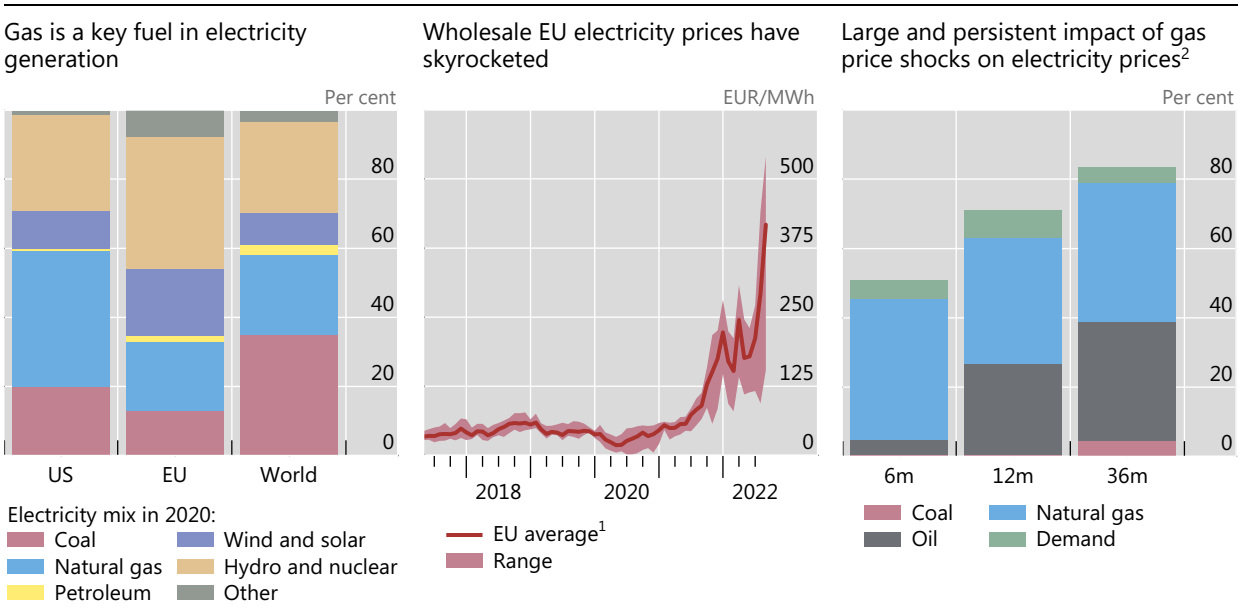
(red dot) and remained low until the beginning of the winter (yellow dot). By the end of 2021, TTF had surged to $60, eight times the average price of the previous 10 years (centre panel).[12] The stress spilled over to global markets, as indicated by the Japan Korea Marker (JKM), the Asian benchmark.

The stress in EU gas markets became even more acute with the war in Ukraine. With the Russian pipeline flow severely limited,[13] replenishing EU storage became complex and expensive, as it required substantial cuts in consumption (European Commission (2022)) or outbidding other LNG consumers. In fact, during 2022, the EU increased its LNG imports from the United States to all-time highs, thus contributing to the rise in the Henry Hub price, the US benchmark (Graph 7, right-hand panel). However, this rise has been moderate (centre panel), as the relatively limited US liquifying capacity insulates the local market from the surge in demand in the rest of the world.

Natural gas is a major input in electricity generation. It accounts for about 40% in the mix of US electricity sources, and about 20% in the EU (Graph 8, left-hand panel). The EU share is close to the world average and is surpassed in the region only by hydroelectric and nuclear power. Since nuclear generation in the EU dropped substantially in 2022, mainly due to a series of technical issues in France, the role of gas as a key dispatchable source of electricity gained further relevance just when its price was reaching historical peaks.

Gas price shocks have a large and persistent effect on electricity prices

Graph 8



[1] BE, BG, CZ, DK, ES, FR, HU, IT, NL, NO, Nordpool, PL, RO, SE and SI. [2] Variance decomposition for the electricity price over three time horizons, based on a VAR system with industrial demand, oil price, gas price, coal price and electricity price.

Sources: IEA; Our World in Data; Refinitiv Eikon; national data; authors' calculations.

[12] Translated into barrels of oil equivalent (boe), that price is about $350/boe, while Brent's all-time high was $147.50/bbl, recorded on 11 July 2008.

[13] According to Gazprom, sales to EU customers in the first seven months of 2022 fell by 35 billion cubic metres, which amounts to about 30% of the consumption over the same period in 2021.

Shocks to gas prices are bound to have a material effect on the price of electricity. Not surprisingly, the average wholesale electricity price in the EU has increased more than fivefold since mid-2021, while dispersion around the different regional trading hubs has also risen dramatically (Graph 8, centre panel). Such high and sustained wholesale electricity prices are unprecedented. Turning to the United States, an empirical analysis reveals that gas price shocks account for roughly 40% of the unexpected variation in industrial electricity prices over six months, with the share remaining stable for at least three years (Graph 8, right-hand panel). The impact of oil price shocks is initially small but increases materially over time. Since the footprint of oil is minimal in the electricity generation mix (left-hand panel), the estimated impact is likely the result of oil-indexing provisions in long-term contracts for the delivery of pipeline gas, which tend to kick in gradually over time.

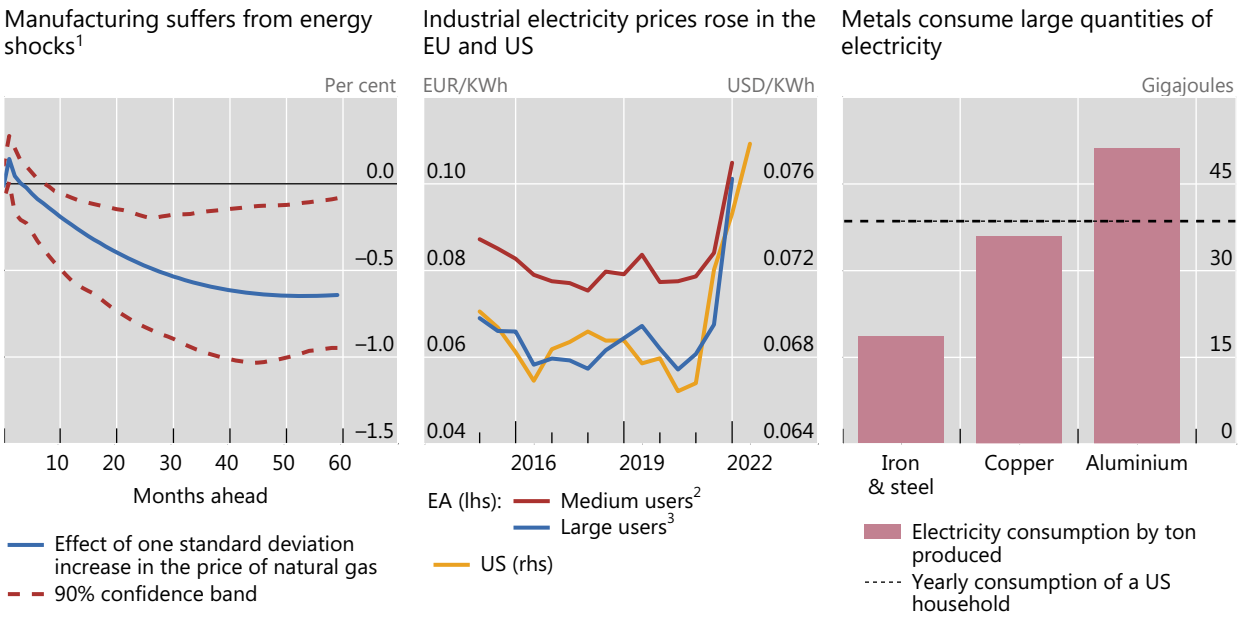
In general, the manufacturing sector is the main user of electricity, averaging more than 40% of total usage at the global level, according to IEA data. The share varies with country and economic specialisation. The electricity consumption of the EU manufacturing sector is in line with the global average, while in China manufacturing gobbles up 60% of total electricity usage. In the United States the share of manufacturing is only 20%, while the services sector accounts for about 35%, and residential consumption for about 40%.

The impact of gas supply disruptions on electricity prices is thus likely to affect global economic activity, particularly as a headwind for manufacturing. The results of an empirical investigation suggest that the effects build up slowly over time. In the United States, a one standard deviation increase in gas prices, transmitted through industrial electricity prices, starts affecting manufacturing production only a year after the onset (Graph 9, left-hand panel). And the negative effect continues to build up over time, reaching a maximum about 50 months after the shock. The delay probably reflects large consumers' cost hedges or long-term contracts with electricity generators or distributors. The impact of the shock grows as those hedges expire and contracts' indexation activates. With the current shocks still evolving, the empirical estimates are merely indicative. They do not account for potential non-linear repercussions of shocks larger than those observed historically.[14]

Industrial electricity prices are already on the rise in the United States and the EU (Graph 9, centre panel). A persistent rise in such prices would deal a particularly strong blow to sectors that use electricity intensively, such as metal production. For example, producing a ton of aluminium consumes more electricity than a US household does in a whole year, with copper a close runner-up (Graph 9, right-hand panel). Given the recent increase in electricity prices, there are already frequent reports of stoppages of metal production in the EU and other jurisdictions.

[14] A shut-off of natural gas in Europe could reduce Germany's GDP by an estimated 0.5–3% during 2022 (Lan et al (2022)). The most vulnerable countries in central and eastern Europe could face a GDP decline of up to 6% (Di Bella et al (2022)).

Shocks to electricity prices may be a substantial headwind for manufacturing Graph 9



[1] Based on a VAR model of industrial production index, consumer price index and the real electricity price, with gas shocks as an instrument. Bootstrapped confidence bands. [2] Average price for users with annual consumption of 500–20,000 MWh. [3] Average price for users with annual consumption of 20,000–150,000 MWh.

Sources: IEA; Refinitiv Eikon; national data; authors' calculations.

Conclusion

While it is hard to miss the immediate direct effects of a negative commodity supply shock on the broader economy, it is inherently difficult to gauge how these effects will play out down the road and in the relevant transmission channels. This article has argued that material restrictions on Russian energy exports will probably keep energy prices elevated. It has also pointed to two salient spillover mechanisms, from oil via biofuels to crops, and from natural gas via electricity to manufacturing. Some of these effects may still have not unfolded in full, due to structural delays in production chains, or may pick up steam if there are reversals in the recently subdued demand in key sectors (eg Chinese construction). That said, persistent disruptions to the markets for energy commodities may also accelerate the green transition, and in so doing reduce the global economy's dependence on fossil fuels and eventually lower their price. In the meantime, understanding the complex interlinkages across commodity sectors is essential for policymakers if they are to ward off the debilitating effects of energy and agricultural output reductions on economic activity.

References

Avalos, F (2014): "Do oil prices drive food prices? The tale of a structural break", *Journal of International Money and Finance*, vol 42, pp 253–71.

Avalos, F and M Lombardi (2015): "The biofuel connection: impact of US regulation on oil and food prices", *BIS Working Papers*, no 487.

Bloomberg (2022): "The 18 Minutes of Trading Chaos That Broke the Nickel Market", www.bloomberg.com/news/articles/2022-03-14/inside-nickel-s-short-squeeze-how-price-surges-halted-lme-trading.

Deloitte (2015): "Oil and gas reality check 2015: A look at the top issues facing the oil and gas sector".

Di Bella, G, M Flanagan, K Foda, S Maslova, A Pienkowski, M Stuermer and F Toscani (2022): "Natural gas in Europe: the potential impact of disruptions to supply", *IMF Working Papers*, no 2022-145.

Erten, B and J-A Ocampo (2012): "Super-cycles of commodity prices since the mid-nineteenth century", *DESA Working Papers*, no 110, February.

European Commission (2022): "REPowerEU: Joint European Action for more affordable, secure and sustainable energy", March.

Heather, P (2022): "A series of unfortunate events: Explaining European gas prices in 2021 – The role of the traded gas hubs", Oxford Institute for Energy Studies, March.

International Energy Agency (2022): "Energy investment report 2022".

Lan, T, G Sher and J Zhou (2022): "The economic impacts on Germany of a potential Russian gas shutoff", *IMF Working Papers*, no 2022-144.

Organization of the Petroleum Exporting Countries (OPEC) (2022): "Monthly oil market report", August.

Reuters (2022a): "Russia seeks new fuel markets in Africa, Middle East as Europe turns away", www.reuters.com/markets/commodities/russia-seeks-new-fuel-markets-africa-middle-east-europe-turns-away-2022-06-23/.

——— (2022b): "Saudi Arabia doubles second quarter Russian fuel oil imports for power generation", www.reuters.com/business/energy/exclusive-saudi-arabia-doubles-q2-russian-fuel-oil-imports-power-generation-2022-07-14/.

——— (2022c): "Indian oil firms to compensate ethanol makers for higher energy costs", www.reuters.com/world/india/indian-oil-firms-compensate-ethanol-makers-higher-energy-costs-2022-06-10/.

Stevens, P (2012): *The shale gas revolution: Developments and changes*, Chatham House.

US Department of Agriculture (2022), "The Ukraine conflict and other factors contributing to high commodity prices and food insecurity", April.

Box A

The financial implications of volatile commodity markets

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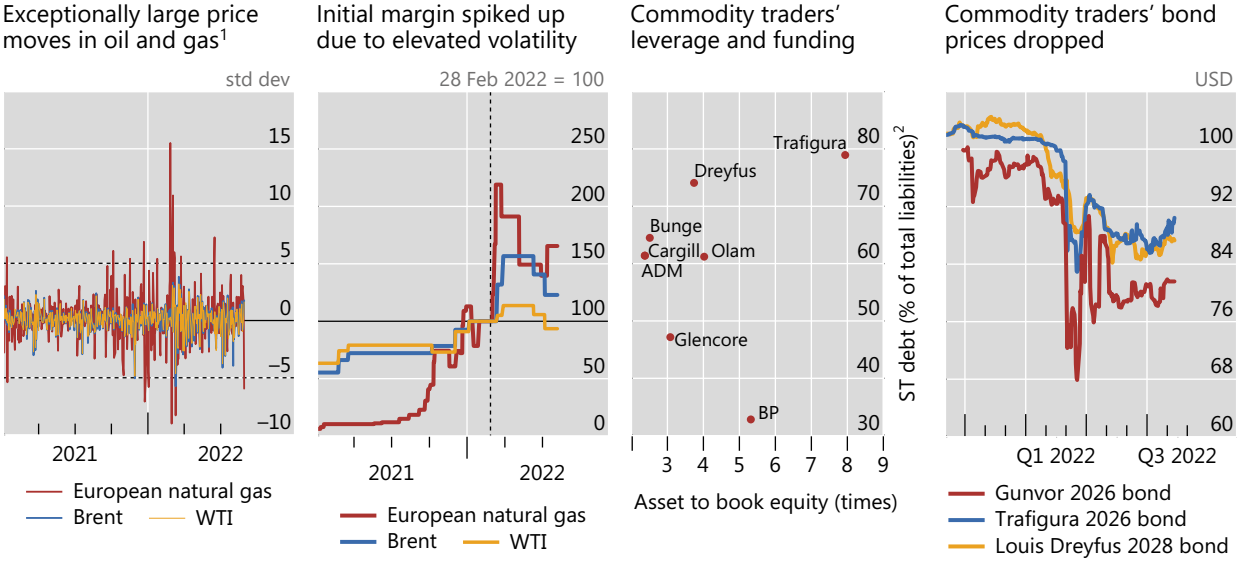
The financialised commodities market – comprising mainly derivatives such as futures and options – is fairly concentrated, dominated by a few large commodity traders. These traders' main role is to intermediate between producers and consumers of commodities, taking advantage of arbitrage opportunities when they arise. This box discusses how recent developments in physical markets affected financial markets and the attendant vulnerabilities.

The Ukraine-Russia war led to large and frequent margin calls in financialised commodities markets. The exceptionally large price movements, in some cases equivalent to roughly a 15-sigma event (Graph A1 first panel), resulted in sizeable daily or even intraday variation margin (VM) calls as derivatives contracts were marked to market. The elevated volatility also prompted central counterparties (CCPs) to increase initial margin (IM) substantially. For instance, the IM requirement for European natural gas futures at Intercontinental Exchange (ICE) more than doubled right after the start of the war and then hovered at around 50% above pre-war levels (Graph A1, second panel).

Leveraged commodity traders faced large margin calls and high funding costs

Graph A1



Dotted horizontal lines in the first panel indicate plus and minus five standard deviations. The dashed vertical line in the second panel indicates 24 February 2022 (start of war in Ukraine).

[1] Daily returns, divided by their standard deviation calculated over 2000–21. [2] Liabilities due within one year.

Sources: IMF; Bloomberg; company filings; ICE (the data have been made available in accordance with the terms of use); S&P Capital IQ; Trafigura; authors' calculations.

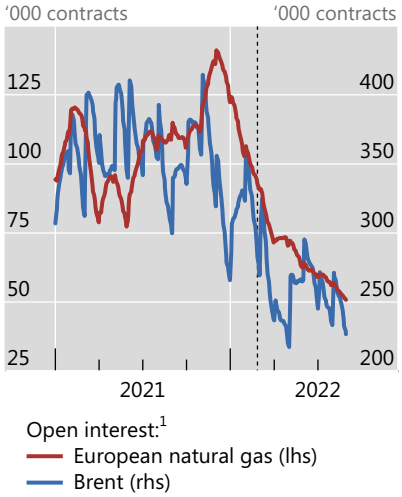
Higher IM requirements are costly for commodity traders. In order to maintain derivatives positions, they need to pledge more liquid assets as collateral. Furthermore, sizeable IM and VM calls can potentially drain the liquidity assets of commercial traders – possibly impairing their creditworthiness – as traders tend to be highly leveraged and reliant on short-term funding. For instance, one major trader in energy commodities has an asset-to-equity ratio of eight, while more than 75% of its liabilities are financed with short-term instruments of less than one year's maturity (Graph A1 third panel). Accordingly, bond prices for major commodity traders dropped by around 20% in the first half of 2022 (Graph A1, fourth panel). This has raised traders' funding costs, making it even more expensive to participate in commodities markets.

As the cost of trading on commodities derivatives markets increased in H1 2022, these markets became substantially thinner. After the war started, open interest in exchange-traded natural gas futures fell by more than 50%; and that in oil futures by almost 30% (Graph A2, left-hand panel). Trading volumes in both exchange markets and OTC markets also saw large declines and have remained at low levels ever since (Graph A2, centre panel).

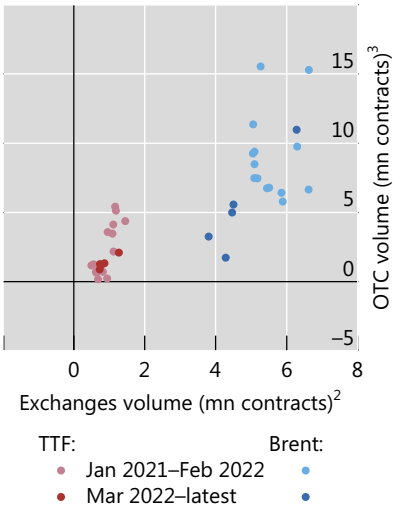
Commodity derivatives markets become thinner as activity dropped

Graph A2

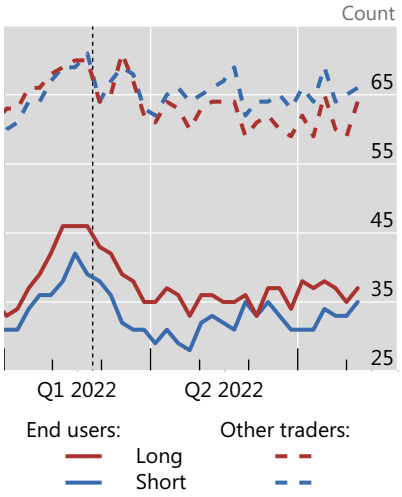
Exchanges' open interest saw sizeable declines



Volumes dropped on exchange and OTC markets



Biggest impact on end users[4]



The dashed vertical line in the left- and right-hand panels indicates 24 February 2022 (start of war in Ukraine).

[1] Monthly moving averages of open interest on ICE. [2] Numbers of futures contracts traded on ICE. [3] Monthly volumes of contracts traded over-the-counter (OTC) from DTCC SDR. Numbers of contracts based on the corresponding standard contract size on ICE. [4] Numbers of traders of WTI futures from CFTC commitment of traders reports.

Sources: Bloomberg; CFTC; DTCC; authors' calculations.

Setting aside their contribution to commodity price volatility, thinner derivatives markets are of particular concern if the reduction in open interest and trading volumes reflects declines in hedging rather than speculation activities. Indeed, US data on oil futures indicates that end users of commodities – such as producers, merchants and processors – were affected the most by the high trading costs.② The number of end users with long (short) positions in WTI oil futures dropped from 46 (36) in February 2022 to 33 (31) in May 2022, while the number of other types of user who are more likely to engage in speculation – eg money managers – remained relatively stable (Graph A2, right-hand panel). This suggests that some commodity end users tried to opt out of their usual hedging activities and to absorb price risks on their balance sheets. If they fail, there could be adverse consequences for commodity supply security.

① The views expressed are those of the authors and do not necessarily reflect the views of the BIS. ② US data from the CFTC commitment of traders report on WTI futures contracts.