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Why natural gas prices rose markedly in 2021, strongly driving up inflation



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Summary

Media and public opinion often trace the sharp acceleration in inflation seen in 2022 back to Russia's full-scale invasion of Ukraine at end-February 2022. The European Union (EU), among others, responded to Russia's war of aggression, which violates international law, by imposing sanctions against Russia. We do not in any way question that the sanctions are justified and appropriate. However, were the sanctions perhaps mainly to blame for the rise in wholesale prices for natural gas and therefore inflation? The answer is a clear no because, to date, the EU has not imposed any sanctions on natural gas imports from Russia. Still, while not targeting natural gas, did the EU's spring 2022 sanctions provoke Russia to restrict natural gas exports as countersanctions, which then caused the price of natural gas to skyrocket? Read on to get answers to these questions.

Natural gas prices rose sharply already before Russia's attack on Ukraine

Wholesale natural gas prices in the euro area had already soared in 2021, that is, before Russia's full-scale invasion of Ukraine. In other words, this price increase was due neither to the sanctions the EU imposed in response to Russia's invasion nor to Russian countersanctions.

In terms of annual averages, in 2021, wholesale natural gas prices increased to almost five times the 2020 level. The sharp rise was reflected in household prices for energy, including electricity, with a time lag, mainly in 2022. As a result, the rise in household energy prices accelerated markedly in 2022 and, hence, pushed up the overall consumer price index.

Natural gas prices increased much more strongly in 2021 than in 2022

In 2021, the prices of wholesale natural gas in the euro area rose several times faster than those of wholesale oil. Moreover, wholesale natural gas prices accelerated much faster in 2021 than in 2022. That also pushed up wholesale natural gas prices globally but natural gas prices rose considerably faster in the euro area than in East Asia.

Russia cut its gas deliveries massively already in 2021

The main reasons for the extreme rise in wholesale natural gas prices in the euro area in 2021 were (1) that Russia massively cut its natural gas supplies to the EU via Ukraine despite supply capacities and (2) that Gazprom was unusually reluctant to fill its own storage facilities within the EU. Several indications suggest political motives. The likely aim was to build up political pressure on German and EU authorities responsible for commissioning a new direct pipeline to Germany. At the same time, Ukraine was meant to feel its economic dependence to increase its willingness

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to make concessions. Moreover, we cannot rule out that Russia, already planning a full-scale invasion of Ukraine, intended to put pressure on the EU by triggering strong uncertainty on the natural gas market. Given that natural gas prices were already very high and stock levels very low, EU authorities might not react to the invasion of Ukraine with tough measures. This way, any sanctions against natural gas imports from Russia would become even more difficult and therefore less likely.

Although Russia continued to massively cut its natural gas exports to the EU in 2022 and 2023, the prices of wholesale natural gas rose at a much lower rate in 2022 than before and even declined in 2023. This is due to three measures the EU took in response to the sharp price increase in 2021 and following Russia's full-scale invasion of Ukraine: First, the EU further diversified its natural gas imports, particularly by increasingly importing liquefied natural gas (LNG). Second, it partly substituted the consumption of natural gas by using other energy products. And third, it reduced its total energy consumption.

China recorded strong demand for LNG at end-2020

A secondary factor was China's strong demand for LNG at the end of 2020 and beginning of 2021. It amplified the rise in the wholesale price of natural gas in the euro area at the start of 2021. In terms of sheer volumes, this factor was clearly of minor importance and was not to blame for the extreme increase in wholesale natural gas prices in 2021 as a whole.

China's total coal consumption continues to rise due to electricity generation, amounting to almost 60% of global consumption. At the same time, households and small industrial companies have been replacing coal with natural gas, which, since 2016, has contributed to a continuous increase in demand for natural gas. This trend cannot explain the spike in China's demand for LNG at the turn of 2020/2021, however. Instead, the spike is most likely to have resulted from an exceptional cold spell, also as a consequence of climate change.

In contrast to the euro area, however, the rise in the wholesale price of natural gas in 2021 did not lead to a surge in inflation in China. This was partly due to the fact that long-term gas contracts in East Asia are mostly linked to the price of oil and that natural gas accounts for a smaller share of the energy mix.

With a view to fostering supply security and mitigating climate change, the experience gained in 2021 shows how important it is to diversify the countries of origin of energy and raw materials imports and, above all, to phase out fossil fuels and expand renewable energy.

Natural gas prices driving the surge in inflation in 2021–2022 – insights into what pushed up natural gas prices

The wholesale price of natural gas had already soared in 2021 before Russia’s full-scale invasion of Ukraine: the EU sanctions were not to blame for this.

Media and the general public often hold Russia’s full-scale invasion of Ukraine at end-February 2022 responsible for the sharp acceleration in inflation in 2022. According to this view, the invasion led to a sharp increase in natural gas prices and thus overall energy prices for households. This is said to ultimately have accelerated the rise in the overall consumer price index (Harmonised Index of Consumer Prices – HICP) in 2022.

Note that we do not in any way question whether the sanctions imposed by the EU, among others, in response to Russia’s invasion, which violated international law, were just and appropriate. Still, the question arises whether the sanctions were perhaps the main cause of the rise in wholesale prices for natural gas and therefore inflation? However, to date, the EU has not imposed any sanctions on natural gas imports from Russia. Nevertheless, did the sanctions adopted by the EU in spring 2022 cause the price of natural gas to skyrocket? While not affecting natural gas, one could think that the sanctions might have provoked Russia to restrict natural gas exports as countersanctions and that this caused the natural gas prices to skyrocket.

It is true that consumer price inflation accelerated sharply in 2022 and that the high rise in energy prices for households was the main reason for this. It is of course also true that the energy prices charged to households depend on wholesale prices on energy markets.

For some energy sources, such as oil, changes in wholesale prices are reflected in household energy prices relatively quickly. In contrast, wholesale prices for natural gas pass-through to household prices with a relatively long time lag. Wholesale prices for natural gas in the euro area had already risen massively in 2021, i.e. before Russia’s full-scale invasion of Ukraine. In other words, if the EU’s sanctions policy did not cause natural gas prices to soar, what did?

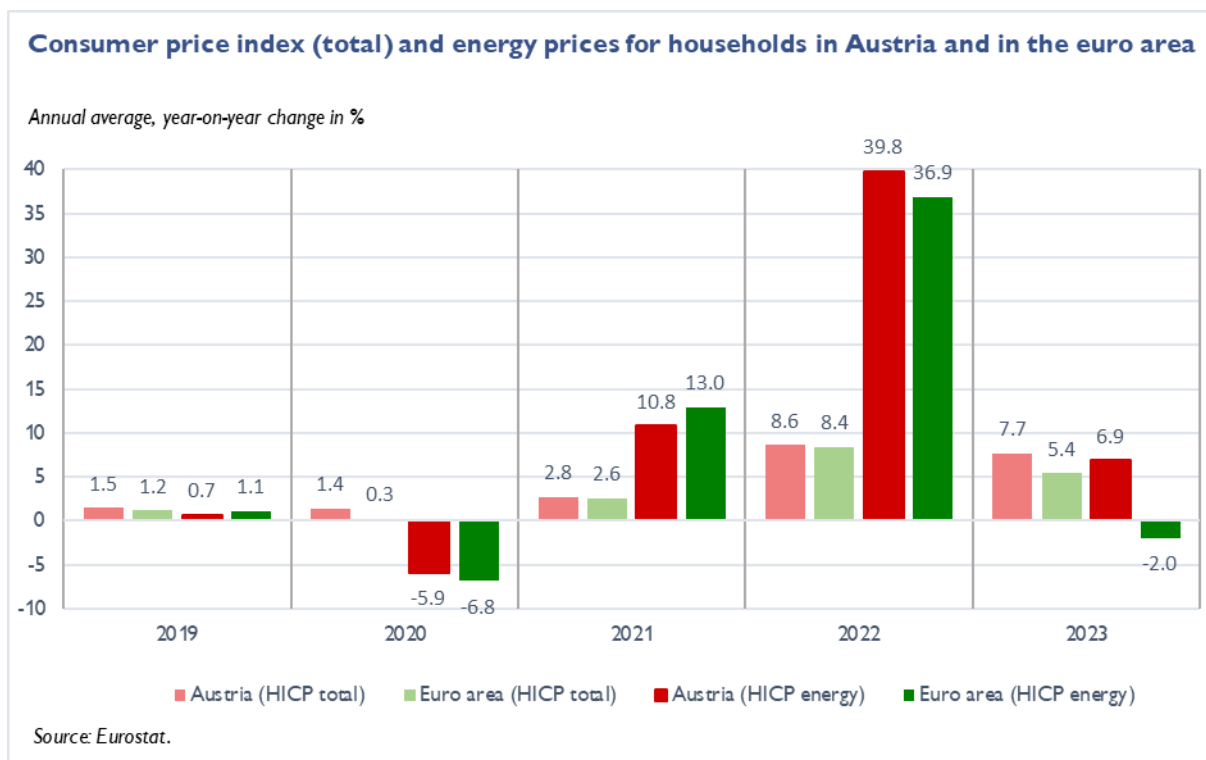
For one thing, overall economic demand increased rapidly after having sharply declined following the outbreak of the COVID-19 pandemic in 2020. The rise in wholesale prices for fossil energy in 2021 far exceeded the previous decline in 2020.

The increase in wholesale prices for fossil fuels was very uneven, however. In 2021, natural gas prices rose several times(!) faster than oil prices. What was the root of this particularly sharp rise in natural gas prices?

Already in 2021, energy prices for households rose much faster than the overall HICP – and the increase in both indices peaked in 2022.

In the euro area and in Austria, the rise in consumer prices increased significantly overall in 2022. It was driven by the acceleration of energy prices for households, which was also much sharper than in 2021 (see chart 1). In 2021, energy prices for households had already risen by more than 10% on average.

Chart 1



Energy prices for households increased largely due to the delayed effect of higher wholesale prices for fossil fuels in the euro area. The latter had already skyrocketed in 2021.

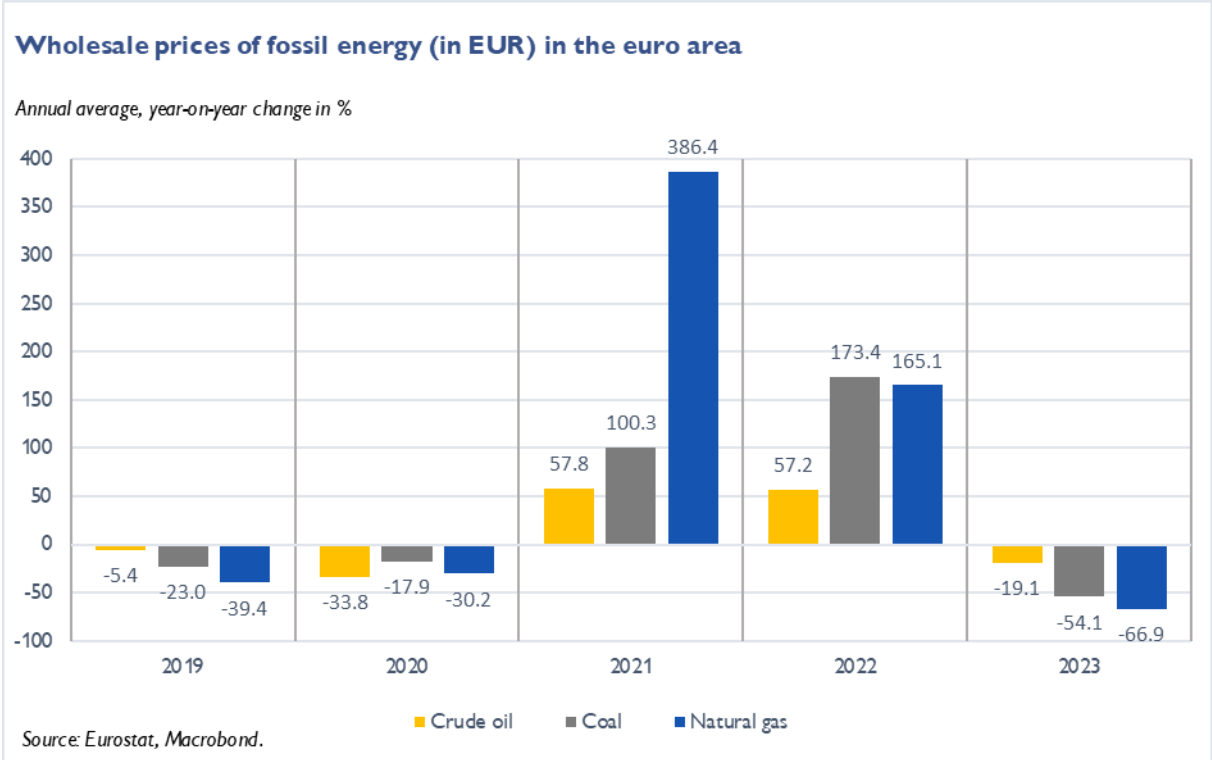
In 2021, wholesale prices of natural gas in the euro area already rose several times faster than those of crude oil – and at a much faster pace than in 2022.

Demand increased rapidly following the massive slump caused by the COVID-19 pandemic in 2020. Consequently, wholesale prices for fossil energy (annual average) rose sharply in 2021. That increase exceeded the decline in 2020 by far – both in absolute and relative terms.

However, wholesale prices for crude oil advanced at a much lower rate (by some 60%) than those for natural gas, which quintupled, rising by almost 400%. So, oil prices rose just enough to offset the cumulative declines in 2019 and 2020. By contrast, natural gas prices climbed to a level that was almost 3.5 times the 2019 level and more than double the 2018 level, i.e. before the declines in 2019 and 2020 (see chart 2).

EUR prices developed almost in synch with USD prices, as the EUR-USD exchange rate fluctuated only slightly between 2019 and 2021.

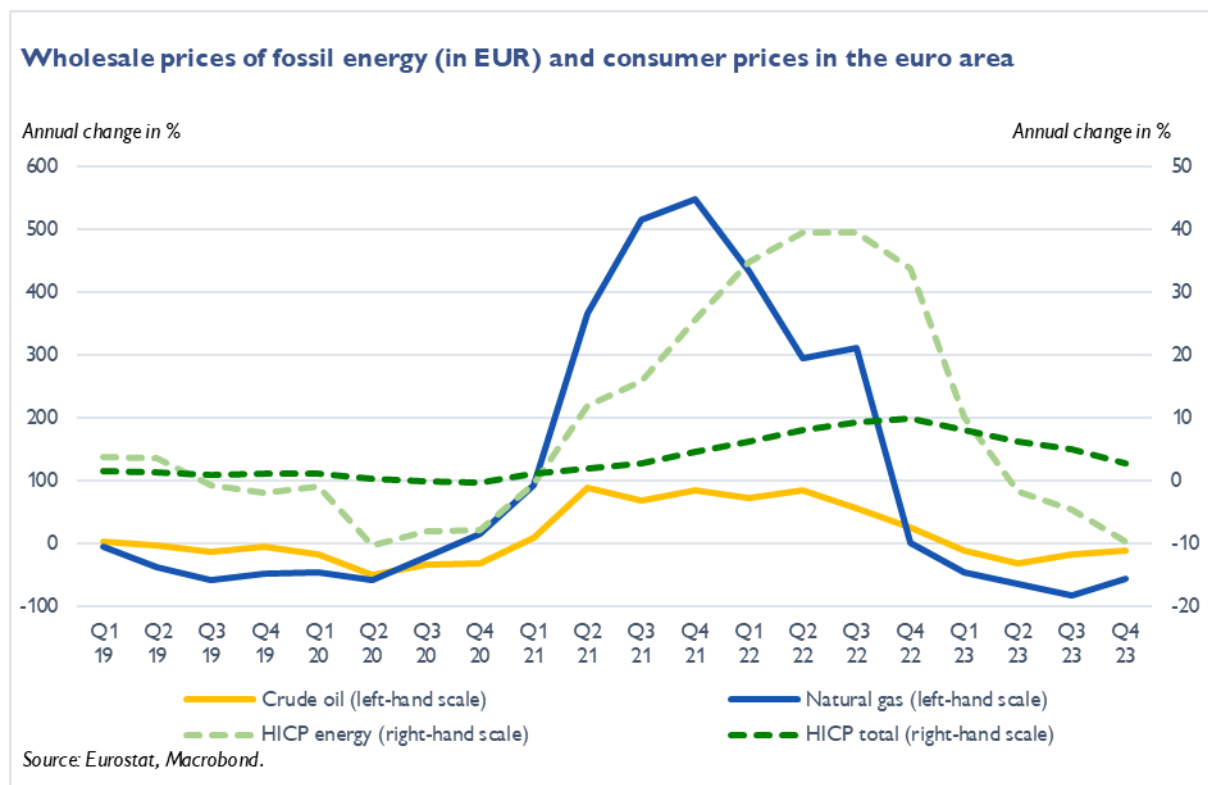
Chart 2



Both oil and natural gas prices continued to rise in 2022. However, at +165%, wholesale natural gas in the euro area increased at a much weaker pace than in 2021. Yet, the 2022 rise in euro-denominated energy prices was amplified by the depreciation of the euro against the US dollar. In USD, wholesale prices of crude oil in the euro area went up by around 40% and of natural gas by 135%.

Chart 3 provides an overview of the price trends in the euro area.

Chart 3



Already in 2021, wholesale prices of natural gas rose significantly faster in the euro area than in East Asia – and reinforced the uptrend in natural gas prices globally.

The development of natural gas prices in the euro area must of course be viewed in the context of the global natural gas market. While the EU and East Asia in particular, especially China, Japan and Korea, are important import regions, Russia and the USA are important exporters. Global interconnectedness is in particular evident in the LNG segment of the natural gas market. LNG accounts for around 40% of global natural gas imports, around 20% of EU imports and around two-thirds of China’s imports.

As import regions, the EU and East Asia are therefore particularly closely interlinked through their demand for LNG. Put differently, price formation in the wholesale markets for natural gas in these two regions influences each other. Accordingly, the 2021 surge in wholesale natural gas prices in the euro area also caused such prices to soar in East Asia. However, at an annual average increase of around 385%, the rise in the euro area was still significantly higher than in East Asia (around 330%; see chart 4).

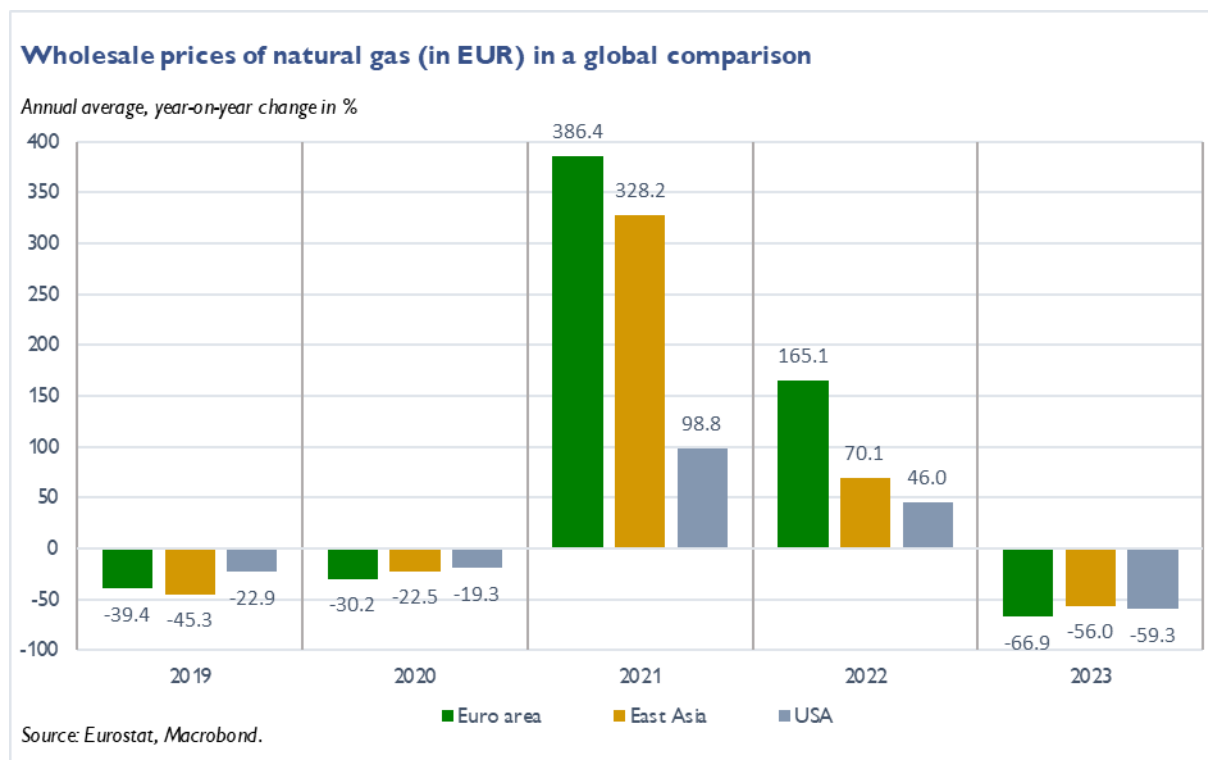
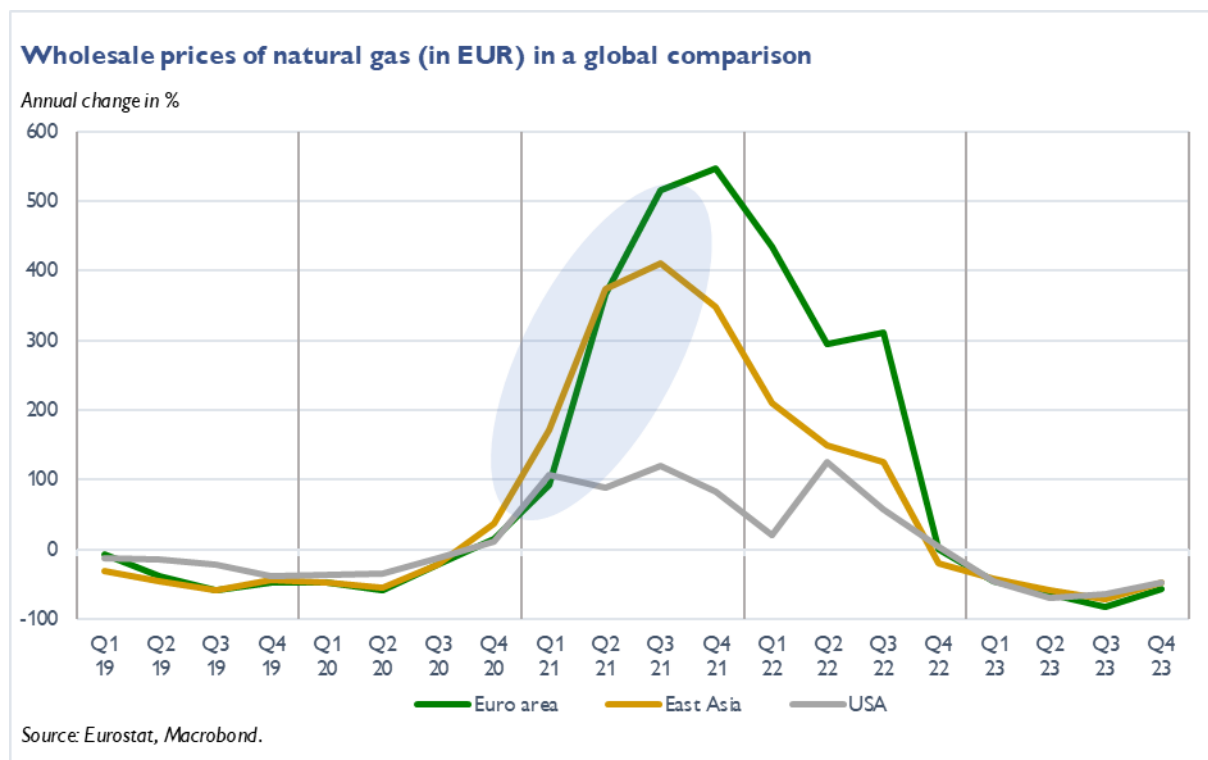


Chart 5 shows that, compared with the euro area, East Asia registered a stronger increase in the price of natural gas only in the first quarter of 2021. In the third and fourth quarter of that year, the increases were significantly higher in the euro area.² The euro area curve proved much steeper in the second, third and fourth quarters. This resulted partly from the fact that the euro area recorded significantly higher quarter-on-quarter increases than East Asia during that time. This suggests that, after the first quarter of 2021 at the latest, the price upswing was driven not by East Asia or China, but by the euro area.

² In the first quarter of 2021, the year-on-year price increase was higher in East Asia than in the euro area. That said, the quarter-on-quarter price increase was (slightly) higher in the euro area than in East Asia already in that quarter. Yet, the quarter-on-quarter change in the fourth quarter of 2020 had been markedly higher in East Asia than in the euro area. As a result, East Asia recorded a higher year-on-year change (36%) than the euro area (15%) in that quarter. Then, the year-on-year increase rose much more strongly from the fourth quarter of 2020 to the first quarter of 2021 in East Asia than in the euro area even though the quarter-on-quarter increase was (slightly) smaller in East Asia than in the euro area. This was due to the so-called base effect: the quarter-on-quarter change in the first quarter of 2020 did no longer factor in the year-on-year change in the first quarter of 2021. As the COVID-19 pandemic had started earlier in East Asia, the quarter-on-quarter change in the first quarter of 2020 proved more negative in that region than in the euro area.

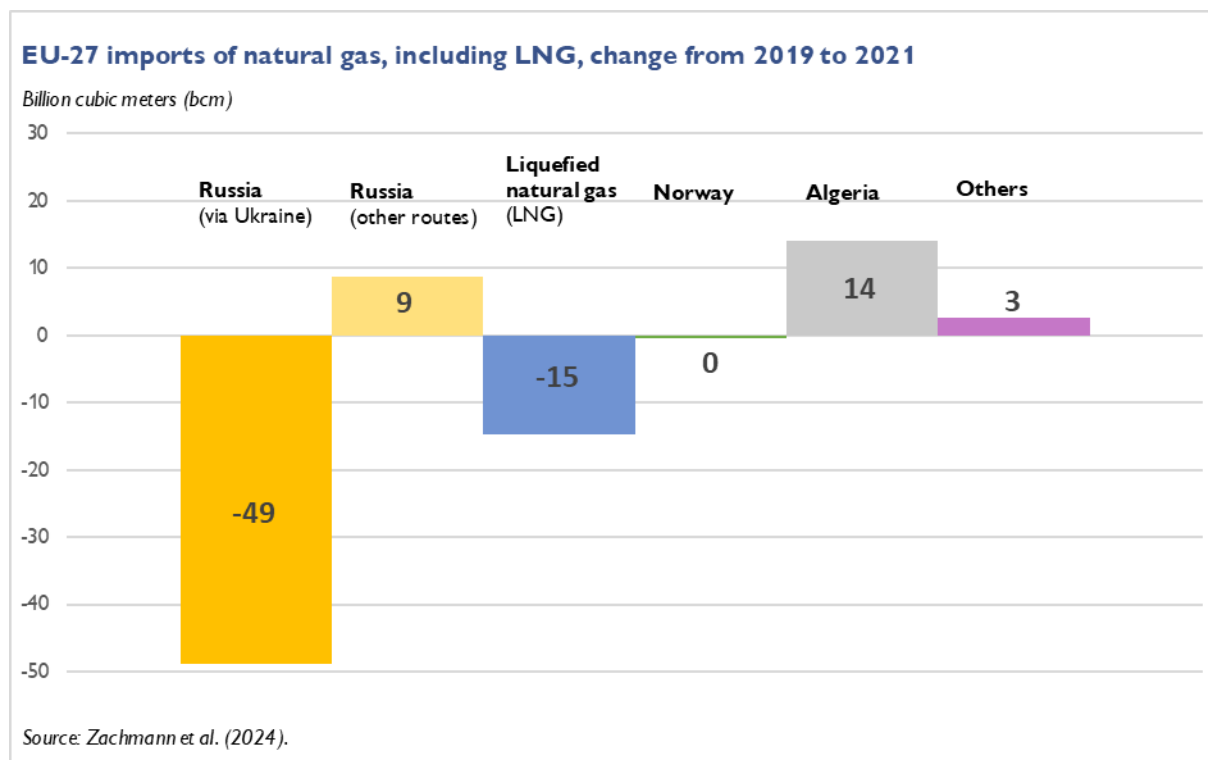


The extreme rise in wholesale natural gas prices in the euro area in 2021 was primarily due to Russia massively cutting its natural gas supplies, via Ukraine, to the EU.

The different price trends indicate that the euro area was driving the price surge. Nevertheless, another question comes to mind: did China's strong additional demand for natural gas perhaps divert LNG imports from the EU to East Asia on such a massive scale that the natural gas supply in the EU contracted sharply at a time when the post-pandemic demand in the EU increased, which then caused natural gas prices to go through the roof?

To answer this question, let us take a look at the EU's import volumes, in addition to the price data. After the slump in 2020, overall economic activity in 2021 nearly reached the pre-crisis level of 2019 again. Therefore, comparing the change in import volumes in 2021 against 2019 is relevant for better understanding why natural gas prices rose so sharply in 2021, namely to several times the 2019 level.

In fact, LNG imports declined significantly. This was, however, offset by the increase in natural gas imports from Algeria, via the Mediterranean pipeline Trans-Med. But natural gas imports from Russia, particularly those supplied via Ukraine, contracted drastically (see chart 6).



In 2020, the first year of the pandemic, total natural gas imports from Russia fell by around 20%. The reduction in deliveries was exclusively attributable to the pipeline through Ukraine (−47%). Deliveries via the other pipelines increased slightly overall (+5%). In 2021 as a whole, total natural gas deliveries from Russia did not expand despite the increased demand. They even decreased further against the low level in 2020. Again, the Ukraine pipeline exclusively accounted for the decline (−17% compared to 2020), while deliveries via the other pipelines increased slightly overall (+3%). Natural gas supplies from Russia contracted particularly strongly in the second half of 2021, when the cuts also affected the Yamal pipeline that runs through Belarus and Poland. As a result, supplies through all non-Ukraine pipelines combined likewise declined in that subperiod. One pipeline remained unaffected, however, as Russia did not cut the deliveries via the direct Nord Stream pipeline to Germany.

The cuts in natural gas supplies from Russia extensively depleted EU stockpiles. Already in May 2021, the EU stockpile was down at the minimum level of the years 2015–2020 and increasingly falling below that level from August onward. Strikingly, the level of natural gas storage facilities owned by the Russian state-owned natural gas export company Gazprom barely increased from May 2021. At the beginning of October 2021, it was around 80% below the 2015–2020 minimum. One year after Russia’s partial invasion of Ukraine, i.e. Crimea and the Donbas region, Gazprom had, in 2015, acquired large natural gas storage facilities in Germany from BASF subsidiary Wintershall. That deal involved a EUR 1.8 billion guarantee from the German government.

In the second half of 2021, the euro area saw a massive increase in uncertainty and wholesale prices for natural gas. Two factors were driving this, namely (1) exceptionally low inventory levels and (2) a lack of a gradual buildup before the start of the winter season in fall 2021. In quarter-on-quarter terms, wholesale prices of natural gas soared by 94% in the third quarter of 2021 and by 96% in the fourth quarter. Even without Russia's 2022 full-scale invasion of Ukraine, this would have caused both energy prices for households and inflation to surge in 2022.

Also, Russia produced more natural gas in 2021 than in 2019 and had sufficient supply capacity. Incidentally, this also applied to global natural gas production. Therefore, the hypothesis is not highly plausible that natural gas prices were pushed up by a global supply shortage due to underinvestment in natural gas production.

Several indications suggest that Russia's massive cut in natural gas supplies to the EU via Ukraine was politically motivated.

Why did Russia, specifically Gazprom, which is controlled by the Kremlin, cut the supplies to the EU?

- For starters, Gazprom might have “only” been interested in maximizing its profits: by exploiting its monopoly position and skimming off the monopoly rent (lower volume, higher price, same or even higher profit). Yet, deliveries were cut selectively according to transport lines. In addition, it is very unlikely from a business perspective that Gazprom suddenly pushed for short-term profit maximization in 2021 while ignoring long-term profit maximization. After all, Gazprom had to assume that the EU would respond to price increases by diversifying its suppliers, substituting gas with other energy sources at a faster pace and taking measures to increase energy efficiency.
- Another motive appears more likely: building up political pressure on German and EU authorities responsible for approving a new direct pipeline to Germany. Plus, driving home Ukraine's economic dependence in the hope of increasing its willingness to make concessions. This explanation is also supported by Germany's Federal Ministry for Economic Affairs and Climate Action in an information paper dated August 6, 2021, which became public on June 2, 2024.
- Moreover, we cannot rule out that Russia, already planning for a full-scale invasion of Ukraine, aimed at putting pressure on the EU by triggering strong uncertainty on the natural gas market. Natural gas prices were already very high and stock levels very low. Under such conditions, the EU authorities might not react to the invasion of Ukraine with tough measures. And it would make it more difficult, if not impossible, for the EU to impose sanctions on natural gas imports from Russia. Russia's gamble worked to some extent. For example, it was not fully excluded from the SWIFT payment system to keep payment channels open for natural gas imports from Russia, among other things.

In any case, it was not the first time that Russia would use its natural gas exports as a political instrument.³

As a matter of fact, after February 2022, Russia further cut its natural gas exports to the EU massively. One might have expected that wholesale natural gas prices would continue to rise at least as much as in 2021. But the increase was much lower – for at least two reasons.

- First, the extreme price increase, particularly in the second half of 2021, had already triggered a counterreaction. Natural gas imports from other countries of origin were on the rise. Among other things, LNG imports expanded starting from the fourth quarter of 2021. For one thing, the USA exported more LNG and for another, LNG deliveries were redirected from China to the EU.
- Second, Russia’s full-scale invasion increased the willingness to react quickly and comprehensively to the cut in natural gas supplies. The EU decried Russia’s energy blackmail and aggressive intentions. Natural gas imports were diversified further and its consumption was reduced notably. At the same time, the EU’s total energy consumption contracted even more strongly in absolute terms (measured in terajoules), with coal consumption falling only marginally. Apart from genuine energy savings, the economic slowdown also played a role here. The reduction in natural gas consumption was also attributable to a rather minor extent to substitution with coal.

China’s particularly strong LNG demand at the end of 2020 and beginning of 2021 contributed to the increase in the wholesale natural gas price in the euro area at the beginning of 2021 – but it was only of secondary importance for the extreme rise in 2021 as a whole.

East Asia’s and particularly China’s natural gas imports were higher in 2021 than in 2019, especially due to additional LNG imports. The additional volumes were mainly supplied by the USA, which had expanded its LNG exports. In the fourth quarter of 2020 and first quarter of 2021, China’s demand for LNG rose particularly strongly, causing, in addition, a redirection of LNG supplies to China instead of the EU. Almost the entire decline in EU LNG imports in 2021 compared to 2019 (see chart 6) resulted from these two quarters. As noted above, in the closing quarter of 2020, the quarter-on-quarter increase in natural gas prices was higher in East Asia than in the euro area. In each of the four quarters of 2021, it was higher in the euro area, although only slightly in the first quarter of 2021.

³ Ukraine (and indirectly the EU) faced this after the Orange Revolution in 2005, and the situation came to a head in early 2006, just before the parliamentary elections in March. In addition, in 2009, Prime Minister Yulia Tymoshenko was put under massive pressure to conclude a contract at comparatively high prices – just months before the presidential elections in February 2010. This also proved to be her downfall, as during the election campaign her Russian-backed opponent Viktor Yanukovich accused her of having committed treason by signing that contract. He won the elections and, in an unlawful trial, Tymoshenko was sentenced to prison for several years on charges of treason.

China's additional demand for natural gas therefore impacted on the increase in the wholesale price of natural gas in the euro area at the start of 2021. However, in terms of sheer volume, this factor clearly only played a secondary role when it comes to the enormous increase in the wholesale price of natural gas in 2021 as a whole.

China's rising demand for natural gas is partly due the drive to replace coal in various sectors – but overall China's coal consumption is still on the increase.

Is China trying to consistently reduce its coal consumption for climate policy reasons? And does it instead rely on natural gas as a bridging technology, which is why its demand for natural gas has been soaring?

Even if this were the case, the previous section already showed that China's demand for natural gas was only of secondary importance to driving up wholesale natural gas prices in the euro area in 2021 and thus inflation in 2022. Therefore, there is no evidence of a climate policy-induced inflationary surge ("greenflation").

But we could paraphrase the above question as follows: Has China for years been actively replacing coal with natural gas to achieve – interim – climate policy goals?

On the one hand, China has indeed for years now been pursuing a policy of phasing out coal in certain sectors. Since 2016, the use of coal in small industrial boilers and in small kilns to produce building materials has been actively reduced. Smaller, inefficient plants have partly been replaced by larger, more efficient plants that also use coal. But some mini plants have also been shut down, either without replacing them or by replacing them with electric plants or plants powered by natural gas. Moreover, since 2017, the direct use of coal in private households has also been actively reduced – either through coal-to-electricity or coal-to-gas switching.

On the other hand, the coal phaseout policy does not mainly aim at climate protection, but local air pollution control. In any case, the two objectives overlap in part. Keeping the air clean also reduces greenhouse gas emissions in the respective areas. This is naturally true when plants are decommissioned without replacement and when coal is replaced by electricity (especially if stemming from renewable energy). As to the coal-to-gas switch, this holds insofar as the CO₂ emissions per unit of energy are 40% to 50% lower for natural gas than for coal. At the same time, it should not be overlooked that both coal and natural gas generate substantial methane emissions.

However, the focus on local smog abatement means that the coal phaseout policy only covers a comparatively small segment of total coal use in China. In the baseline situation in 2015, the affected sectors (small industrial boilers, small kilns for building materials, and households; split evenly) accounted for around 60% of final coal consumption, i.e. use in non-energy companies and households, which in turn represented less than 30% of total coal consumption. Even then, coal-fired power generation accounted for the bulk of coal consumption. Since 2015, final consumption has also fallen due to the abovementioned coal phaseout policy.

In contrast, the consumption of coal for producing electrical energy (so-called transformation input of coal) continued to increase, also from 2019 to 2021, so that its share now amounts to around 85% of total coal consumption. Therefore, overall coal consumption increased as well: by 3.5% from 2015 to 2019 and by a further 9.5% from 2019 to 2021, and by almost 5% from 2021 to 2022. At the same time, the share of coal in China's total primary energy consumption trended downward, from 67% in 2015 to 61% in 2019, but then remained unchanged at 61% until 2021. So, China lags behind in implementing a comprehensive climate change policy. And while it has announced plans for CO₂ emissions to peak in 2030, coal use is still being expanded. As total coal consumption in the rest of the world fell by 2.7% from 2015 to 2019 and by another 2.6% from 2019 to 2021, China's share in global coal consumption increased from 52% (2015) to 57% (2021).

China's replacing coal with natural gas in various sectors cannot explain why its LNG demand spiked at the end of 2020 and beginning of 2021. Instead, that spike is most likely to have resulted from an extraordinary cold spell, also as a consequence of climate change.

China has for years now pursued a policy of partially phasing out coal. This has, to some extent, also gradually increased the demand for natural gas. According to estimates, from 2015 to 2019, the coal phaseout policy accounted for around three-quarters of the total increase in demand for natural gas. In that period, additional imports covered around 60% of the total additional demand for natural gas. China's increased demand for imports did not lead to massive distortions on the global natural gas market, however. As US natural gas exports rose even more sharply, wholesale prices for natural gas also fell significantly in East Asia in 2019 (see chart 3). 2020 and 2021 saw a slowdown of the annual increase in demand for natural gas as a result of the coal phaseout policy. This was due to the fact that the most pressing industrial polluters had already been addressed from 2016 to 2019. The total increase in demand for natural gas in 2020 and 2021 therefore resulted to a lesser extent than before, namely around 50%, from the coal phaseout policy. Hence, the increase was therefore roughly the same as in 2018 and 2019. It would therefore be a bit far-fetched to trace China's spiking LNG imports at the end of 2020 and beginning of 2021 and the accompanying sharp rise in the wholesale price of natural gas primarily back to China's coal phaseout policy.

Instead, a historic cold spell in northeastern China, in fact the worst since the 1960s, is most likely to have played a decisive role. Chinese climate researchers have been pointing out that, with climate change, cold waves are becoming ever more intense and frequent as the relative warming in the Arctic is pushing the cold polar winds southward. In short, the rise in the price of natural gas in early 2021 was a consequence of climate change rather than climate policy.

In contrast to the euro area, the rise in the wholesale price of natural gas in 2021 did not lead to a surge in inflation in China – partly because long-term contracts are linked to the price of oil and because natural gas has a smaller share in the energy mix.

Several factors are responsible for this. First comes the price formation of natural gas imports. In particular, the extent to which wholesale prices for natural gas (especially LNG) that result from trading in short-term deliveries on the spot market are applied to other import volumes. In the EU, import contracts have been dominated by market price orientation for a number of years. In contrast, in East Asia it is common practice to apply spot market prices only to short-term or spot imports of LNG. Long-term supply contracts for LNG and pipeline gas, by contrast, are not based on the direct market price but are often indexed to the oil price. In China, LNG accounts for around two-thirds of gas imports and only around 35% of these LNG imports are short-term or spot imports. For this reason, the 2021 increase in the wholesale price for natural gas, which exceeded that for crude oil by far, pushed up the average import price in the EU much more strongly than in East Asia.

Second, the importance of natural gas in China's overall energy consumption pales in comparison with the role it has in the EU even though its share has been growing since 2015 in China. In 2021, natural gas accounted for 8% of China's primary energy consumption (EU: 25%).

Third, China's regulations for the household price of natural gas and for wholesale electricity pricing as well as the price of electricity for households may differ significantly from the regulations in the euro area, the EU and individual EU countries.

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