

TRV Risk Analysis

EU natural gas derivatives markets: risks and trends



ESMA Report on Trends, Risks and Vulnerabilities – Risk Analysis

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Financial Stability

EU natural gas derivatives markets: risks and trends

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Summary

Natural gas derivative markets came into the spotlight after the Russian invasion of Ukraine, as prices soared amid high volatility and a significant deterioration of liquidity. This article uses regulatory data to provide an overview of the structure and functioning of EU natural gas derivatives markets which complements other analyses published in recent months. The focus is on the assessment of risks for financial stability rather than detailed monitoring. Overall, the annual turnover on EU futures exchanges reached EUR 4,150bn in 2022, and open positions of EU counterparties amounted to around EUR 500bn as the end of 2022. The market is characterised by a high degree of concentration of market participants active in clearing and trading activity, and some energy firms hold relatively large derivative positions. In that context, liquidity and concentration risks are among the main vulnerabilities identified, along with data fragmentation and data gaps. The recent migration of some of the activity from exchange-traded to over-the counter derivatives trading, possibly related to lower margin requirements, raises concerns due to more limited transparency and more bespoke margin and collateral requirements in that market segment.

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Introduction

The invasion of Ukraine by Russia at the end of February 2022 triggered a sharp rise in natural gas derivative prices and volatility. Beyond fundamental factors, such as the reduction in the supply of natural gas from Russia and increased demand relating to the build-up of inventories ahead of the winter, the extreme volatility observed on derivatives markets was also related to the structure and functioning of these markets.

Energy derivatives markets — and natural gas markets in particular — display some characteristics common to financial derivative markets: trading activity is mainly concentrated on venues where market members can send buy and sell orders to a central limit order book, and trades are mainly cleared through central counterparties (CCPs), where clearing members have to post initial and variation margins to reduce market and counterparty risk.

At the same time, natural gas derivatives markets have some properties which are quite different from other financial derivative markets: a large share of the activity is carried out by non-financial corporates (mainly energy firms), while the role of financial intermediaries such as banks is lower, unlike traditional financial markets. In addition, constraints on physical delivery and storage of the underlying commodity can have an impact on energy derivative market functioning².

This article provides an overview of the structure and functioning of EU natural gas derivatives markets. This article does not cover in detail the monitoring and regular reporting on natural gas derivatives markets as required as part of the market correction mechanism introduced end-2022³.

The next section describes the structure, size and types of market participants. The subsequent

section analyses potential risks in these markets, building on the experience since the beginning of the war in Ukraine. The last section provides some concluding observations and discusses the implications for financial stability.

Structure of EU markets

Overview

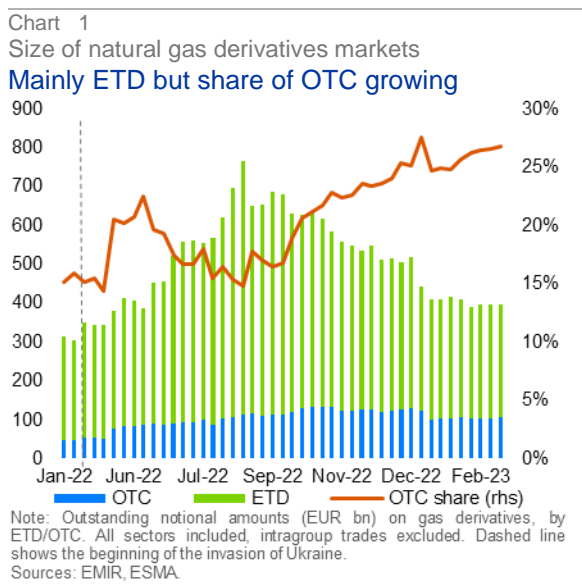
Natural gas derivatives can be traded on regulated markets (using futures and options) or OTC (mainly swaps and forwards)⁴. Regulatory data can be used to analyse the natural gas derivatives markets. EMIR provides information on trades and positions of counterparties on natural gas derivatives. MiFID Financial Instrument Transparency System (FITRS) contains daily information on the number of transactions and the total notional amounts exchanged for all natural gas derivatives traded on EU trading venues. Overall, as of end-2022, gross notional exposures of European Economic Area (EEA) counterparties to all gas derivatives amounted to EUR 500bn, mainly through exchange-traded derivatives (ETDs) (75%) rather than OTC. Notional amounts are highly correlated with the price of natural gas, as positions are valued daily. However, since the summer of 2022 the share of OTC has increased from 15% to 27%, with the increase driven especially by non-financial corporates (Chart 1)⁵.

² Storage operators can contribute to market efficiency by implementing arbitrage opportunities by buying and selling forward products with different delivery periods.

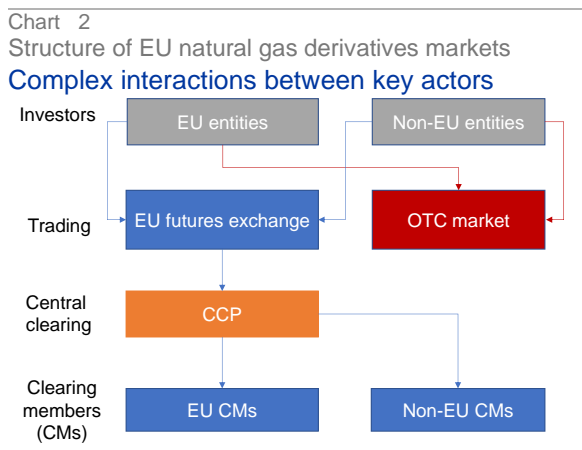
³ On 22 December 2022, the European Council adopted Regulation (EU) 2022/2578 (the Regulation) establishing a market correction mechanism (MCM) to protect Union citizens and the economy against excessively high prices. The Regulation entered into force on 1 February with application from the same day while the MCM only starts applying on 15 February 2023. For further details see ESMA (2023) and ACER (2023).

⁴ The analysis does not cover some wholesale physical natural gas products. Those energy derivatives traded on organised trading facilities with physical settlement are not considered financial instruments under the 'C6 carve-out' in MiFID and are therefore not subject to EMIR requirements. Instead, they are reported to energy regulators in the EU (ACER) under the Regulation on Wholesale Energy Market Integrity and Transparency (REMIT). These products constitute a significant portion of energy firms' non-cleared hedging activity.

⁵ Throughout the article, the cut-off date is December 2022, unless stated otherwise.



The structure of EU natural gas derivatives markets can be broken down into distinct parts (Chart 2).

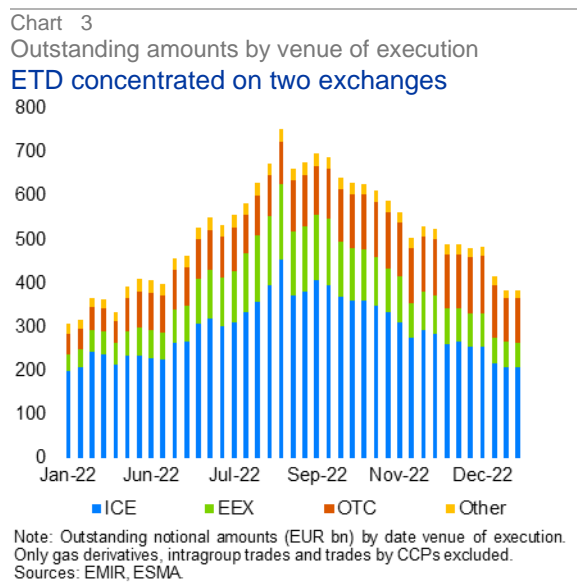


First, ultimate investors can be EU or non-EU entities, including energy firms (utilities or independent commodity trading firms). Professional investors can trade on regulated markets (futures exchanges) or bilaterally in the OTC market. There are two main regulated markets for natural gas derivatives in the EU⁶: ICE Endex in the Netherlands and European Energy Exchange (EEX) in Germany (Chart 3). Trades on these exchanges are cleared centrally through ICE Clear Europe in the UK for ICE

⁶ Natural gas derivatives contracts are also traded on Nasdaq Oslo, but notional amounts are small. See ESMA (2023) for further details.

Endex⁷ and through European Commodity Clearing (ECC) in Germany for EEX. Finally, CCPs have clearing members which can be EU or non-EU firms. EU clearing members for natural gas derivatives are mainly large banks and to a lesser extent energy firms.

In the ETD space, market participants trade standardised futures and options on regulated markets as market members or through direct market access (whereby a market participant trades using the trading code of a market member). As clients, market participants must post initial margins with a clearing member of the CCP when opening a future position. If the price moves adversely, clients have to post variation margins and, in some cases, additional initial margins. Relatedly, clearing members have to post initial and variation margins to the CCP on behalf of their clients. While eligible collateral and margin requirements might differ between clients and clearing members, all clearing members are subject to similar requirements regarding initial and variation margins posted to the CCP.



In the OTC space, counterparties enter into derivatives transactions that can have bespoke and more customized characteristics. Margin rules for bilaterally cleared derivatives require the mandatory posting of initial and variation margin when firms' derivatives exposures (average

⁷ Although ICE Clear Europe is domiciled in the UK, the CCP is supervised by ESMA because it qualifies as a systemically important third country CCP.

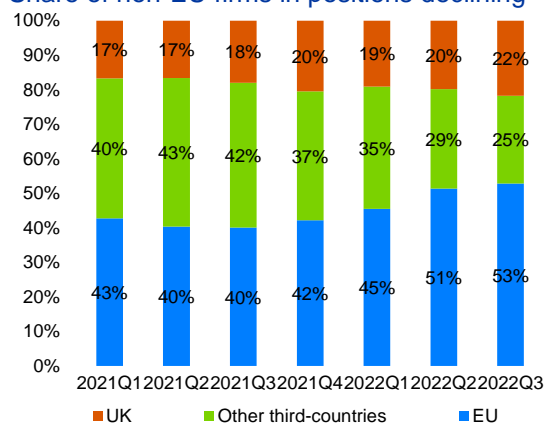
aggregate notional amounts) are above a certain threshold⁸, otherwise counterparties can decide their margins arrangements bilaterally. Eligible collateral is bilaterally defined by counterparties, although in practice cash and sovereign bonds are typically used (ISDA, 2021).

Main participants on futures exchanges

The main types of market participants in futures exchanges can be analysed using trading data in addition to position reporting at exchange level. Regarding trading activity, a large part of volumes traded on futures exchanges are performed by proprietary trading firms such as high frequency traders (FSB, 2023). As in other electronic markets, those firms tend to be very active in terms of intraday trading volumes but do not generally take directional positions overnight. Overall, trading volumes on EU futures exchanges amounted to around EUR 4,150bn in 2022⁹.

EU futures exchanges have to report position information of market participants to National Competent Authorities (NCAs) on a daily basis. This information can be used to analyse the participation of EU and non-EU entities and to assess the activity by types of market participants. End-of-the-day position data indicate that non-EU firms account for a large, albeit declining, share of positions (Chart 4). While in 2022Q1, non-EU firms represented around 57% of all positions, this share declined to 46% during the year. While the share of UK participants has increased, a large decline has been observed for firms located in non-EU countries other than the UK. Some heterogeneity can be observed among futures exchanges, with a higher participation of non-EU firms in ICE Exendex than in EEX.

Chart 4
Gross positions on natural gas futures exchanges
Share of non-EU firms in positions declining



Note: Gross positions per quarter and per geographical zone
Sources: MiFID II Daily positions ICE Exendex, EEX and Nasdaq, ESMA calculations

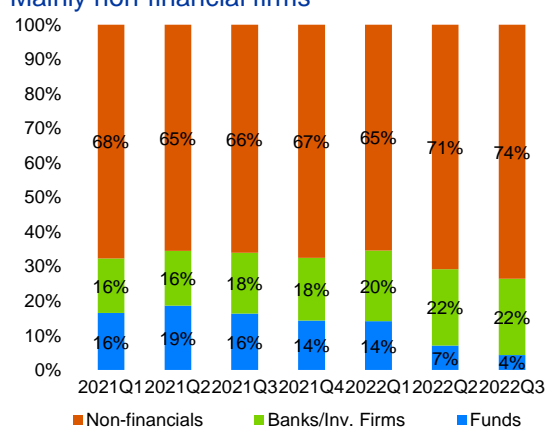
In terms of types of market participants, more than 70% of positions are held by non-financial corporates (NFCs), followed by banks at around 22% (Chart 5). In contrast, positions of investment funds have declined substantially, in line with the reduction of positions of non-EU hedge funds in the market. NFCs active on natural gas derivatives markets are mainly EU energy utilities and non-EU commodity trading firms. This significant role played by NFCs is a key characteristic of the natural gas market, which is also observed in other commodity markets, and stands in sharp contrast to other financial markets where financial institutions account for most of the activity.

⁸ For commodity derivative contracts the clearing threshold is EUR 4bn in gross notional value (excluding exposures related to hedging). If an NFC positions exceed this clearing threshold, the firm becomes subject to bilateral

margin requirements (initial and variation margins), for further details see ESMA (2022b).

⁹ For further details on recent developments see ESMA (2023).

Chart 5
Gross positions on natural gas futures exchanges
Mainly non-financial firms



Note: Gross positions per quarter and per sector
Sources: MiFID II Daily positions ICE Endex, EEX and Nasdaq, ESMA calculations

The EU network of natural gas derivatives markets activity

Understanding the interconnectedness between market participants is key to assess risks. EMIR data can be used to investigate interconnections between market participants active in the trading and clearing of natural gas derivatives in the EU, and potential concentration risk. Due to data limitations, data about non-EU counterparties with exposures to EU natural gas derivatives through non-EU entities are not included, even though non-EU entities can play a significant role in EU markets¹⁰.

Chart 6 displays the network of natural gas derivatives exposures among the clearing members, CCPs and top 30 EEA clients as of the end of November 2022 in gross notional amounts. The data are aggregated at group level and intragroup trades are removed. The size of each node is proportional to the gross exposures observed for each entity, with a common minimum size for all nodes. The size of the edges is also proportional to the gross notional amount traded between two nodes, with different colours for ETD and OTC.

In the ETD space (blue curved lines), most of the activity takes place between energy firms (red

squares) and clearing members (CMs), which are mainly banks (blue triangles). CMs tend to have a range of different clients, which are predominantly energy firms. A few energy firms trade ETDs on both futures exchanges, as shown by the links between those clients and CMs at the two different CCPs (yellow circles). The two CCPs clearing EEA natural gas futures have exposures to several EU CMs. The width of the blue edges — which is proportional to the relative size of gross exposures between CMs and CCPs — indicates that clearing is concentrated in a few banks.

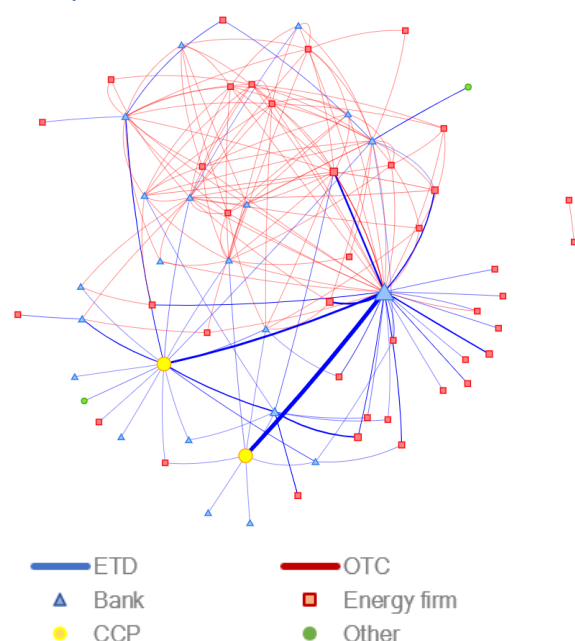
Focusing on the OTC space (red curved lines), most of the activity occurs between energy firms or through a few banks (blue triangles) which are usually not clearing members of EU CCPs. There are only a few 'other' firms (such as non-bank financial entities) in the network (green circles), showing that other financial firms play a limited role in EU natural gas derivatives markets.

Overall, the network analysis indicates some significant concentration of clearing activity in a few banks. This implies that in times of stress those CMs will have to post additional collateral and will have to request that their clients provide them with additional collateral as well. Since a large portion of the clients are energy firms, those entities might not have ample liquidity pools or liquidity facilities that could be mobilised quickly (unlike banks). While some firms used credit facilities provided by banks, financing conditions tightened, creating liquidity strains for energy firms between March and September 2022 (ECB; 2022a; 2022b). In addition, the network is characterised by a degree of separation between ETD and OTC activity, with only a few firms trading on exchanges and OTC.

¹⁰ More precisely, entities domiciled in the EEA have to report derivatives information under EMIR, which provides a broader scope than the EU. In consequence, non-EEA entities trading on EU regulated markets, whose

clearing is done in a third country CCP are not covered, unless these entities clear their trades with an EU clearing member.

Chart 6
Gross positions in natural gas futures
Mainly non-financial firms



Note: Gross positions of the top 30 counterparties in the natural gas derivatives markets as of end-November 2022. The size of each node is proportional to the relative size of the counterparty. Edges represent bilateral exposures in ETD and OTC derivatives and the width is proportional to the relative size of the bilateral position compared to the overall notional amounts.
Sources: EMIR, ESMA.

The properties of the natural gas network are further explored using a range of network metrics, which can then be compared over time and across derivatives markets (see Korniyenko et al., 2018 for a discussion of centrality measures).

Chart 7 displays different indicators of centrality for this network over three time periods: January, July and November 2022¹¹. Each centrality indicator is normalized and ranges between 0 and 1, with 0 the minimum level of interconnectedness and 1 the theoretical maximum.

The first measure is the *degree centrality*, which indicates the number of connections that each node (i.e. market participant) has to other nodes, with higher values indicating that such market participants are exposed to a high range of counterparties. A high degree centrality implies that shocks tend to be transmitted more broadly to other entities in the network. The normalized degree centrality has slightly increased

throughout 2022, from 0.48 to 0.50, implying that market participants have increased interconnection over time. Compared to other derivatives, degree centrality tends to be higher for natural gas derivatives than other asset classes which have degree measures below 0.50 (ESMA, 2021).

The second measure is the *eigenvector centrality*, which estimates the influence of a node based on its connections to other influential nodes. High values indicate that some entities play a central role in the network, as they are exposed to other entities of significant importance. Eigenvector centrality has been decreasing during 2022, from 0.51 to 0.36, indicating that market participants have reduced their relative exposures to 'central' nodes. Compared to other derivatives, the natural gas network has lower eigenvector centrality, implying more fragmented exposures across counterparties.

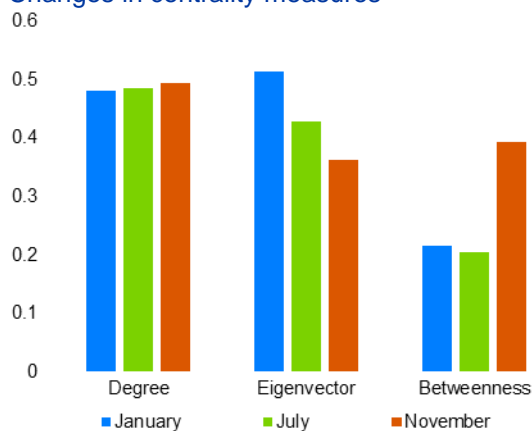
The third indicator is the *betweenness centrality*, which measures the number of times an entity lies in the shortest path between two other entities. A high value shows that some entities play the role of 'bridges' between other entities in the network. The betweenness indicator increased during 2022, from around 0.20 in the first half of 2022 to 0.39 in November 2022.

Overall, centrality measures indicate that the importance of central nodes has declined (as shown by the fall in *eigenvector centrality*), consistent with the migration from ETD to OTC. At the same time, the increase in *betweenness centrality* suggests that more entities play the role of bridges within the network (irrespective of the importance of their counterparties) than before the war.

¹¹ See Bardoscia et al. (2019) for an application of network analysis to the UK OTC derivatives markets or ESMA's

statistical reports on EU derivatives markets for similar approaches (ESMA, 2021).

Chart 7
Interconnectedness measures of the network
Changes in centrality measures



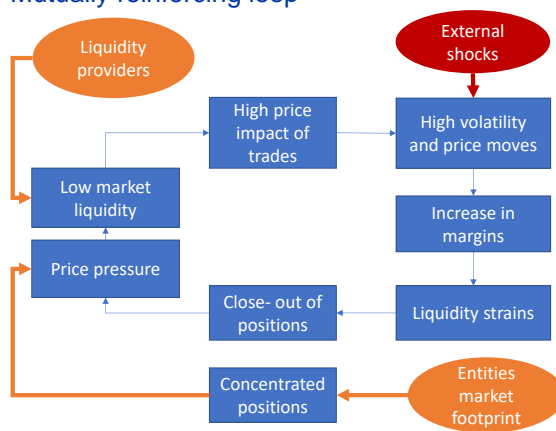
Note: Network interconnectedness statistics by date of 2022.
Sources: EMIR, ESMA

Risks and vulnerabilities

The use of derivatives enables market participants to hedge their positions (e.g. a natural gas producer can take short positions in derivatives to hedge against price declines in the future, or a firm needing natural gas in the future can take long positions to hedge against an increase in prices), take directional views on future prices and contribute to price discovery. The trading of derivatives on regulated markets also fosters liquidity through standardization and reduces counterparty risk through the use of CCPs. Indeed, CCPs act as systemic risk managers that cover counterparty risk in a centralised manner through a sophisticated set of models and financial resources supporting transparent and liquid markets.

However, natural gas derivatives markets have been subject to important tensions following the invasion of Ukraine by Russia end-February 2022. The surge in prices and volatility and the corresponding increase in margin requirements have shown how market and liquidity risks can be mutually reinforcing as shown in Chart 8.

Chart 8
Vulnerabilities in natural gas markets
Mutually reinforcing loop



External shocks can result in large price moves and an increase in volatility. As volatility surges, margins are increased to protect market participants against counterparty and market risk. Some firms might then face liquidity strains as they are requested to post cash as collateral over a short period¹². Entities might choose to reduce their exposures by taking opposite positions, but this could amplify the price pressure on derivatives. This risk is magnified for entities with large and concentrated positions. Given high levels of volatility and acute price pressure, along with risk management constraints or reduction in risk appetite, liquidity providers might retrench from the markets, resulting in even lower liquidity. This in turn could amplify the price impact of each trade, resulting in further change in prices and higher volatility.

Some of these risks crystallised in 2022, along the transmission channels outlined above.

Developments related to the war in Ukraine

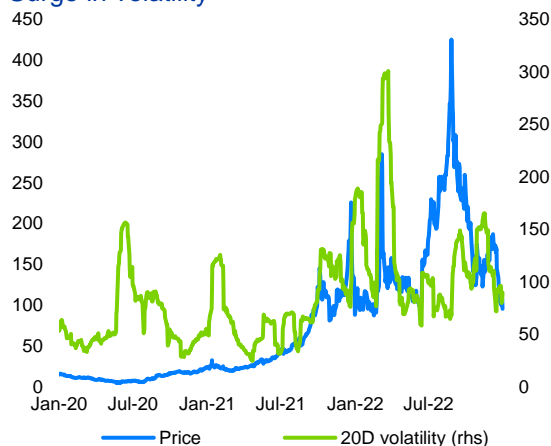
Following the Russian invasion of Ukraine, natural gas derivatives markets experienced very high volatility amid low market liquidity. Prices doubled in March 2022, before stabilising between April and June at levels close to before the invasion. Then over the summer prices

¹² CCPs collect initial and variation margin from clearing members on a daily and sometimes intraday basis. For non-centrally cleared derivatives transactions, margins

are expected to be exchanged on a regular basis (e.g. daily), see FSB (2023).

spiked again, peaking at the end of August. Prices were at that point around 350% higher than pre-war, as concerns about supply and heightened demand to fill storage facilities materialised. Volatility spiked as well, reaching a level of 300% in annualised terms in March and close to 150% in August (Chart 9). Since then, volatility and prices have substantially declined and were at the end of 2022 below pre-war levels.

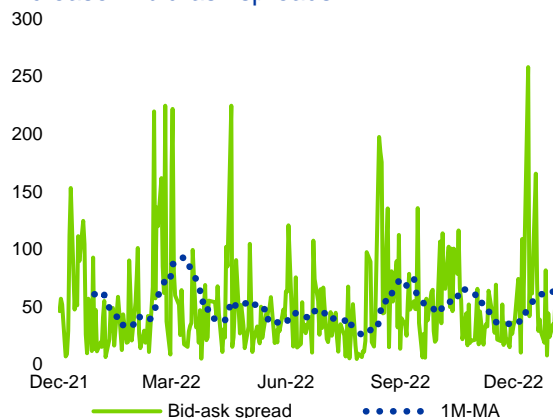
Chart 9
Price and volatility
Surge in volatility



Note: Natural gas future prices (Dutch TTF front-month contract) in EUR, rebased at 22 Feb. 2022=100 and 20D annualised volatility, in % (rhs).
Sources: Refinitiv Datastream, ESMA.

The extreme volatility of prices was associated with a sharp deterioration in market liquidity. For example, on ICE-Endex, bid-ask spreads rose to more than 200 basis points (bps) in March 2022 (up from 50 bps pre-war) and reached similar levels at the end of August as liquidity dried up.

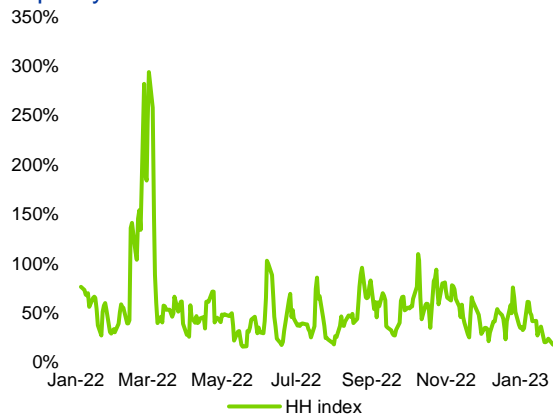
Chart 10
Bid ask spreads on TTF futures on ICE-Endex
Increase in bid-ask spreads



Note: Bid-ask spread of the front-month TTF natural gas future traded on ICE, in bps, computed using bid and ask close prices. 1M-MA=one-month moving average.
Sources: Refinitiv EIKON, ESMA.

Other liquidity measures indicate similar deterioration. The Hui-Heubel liquidity ratio (Hui and Heubel, 1984) measures the price impact of trades by comparing intraday changes in prices to the turnover ratio. The higher the ratio is, the lower the number of trades behind each percentage price change and thus the lower the market breadth of liquidity. As shown in Chart 11, the ratio jumped in March 2022, pointing to lower liquidity, as large intraday price changes occurred amid relatively low trading volumes. However, the liquidity drop during end-August price spike, as measured by the HH-measure, was less pronounced.

Chart 11
Liquidity of front-month futures
Liquidity deterioration in March 2022



Note: Hui-Heubel liquidity ratio for ICE Endex TTF front-month contract, and one-month moving average. Higher values indicate less liquidity.
Sources: Refinitiv EIKON, ESMA.

High intraday volatility was observed in particular on 7 March 2022, with prices increasing by 70% compared to the previous close (Textbox 1).

Textbox 1

High intraday volatility of 7 March 2022

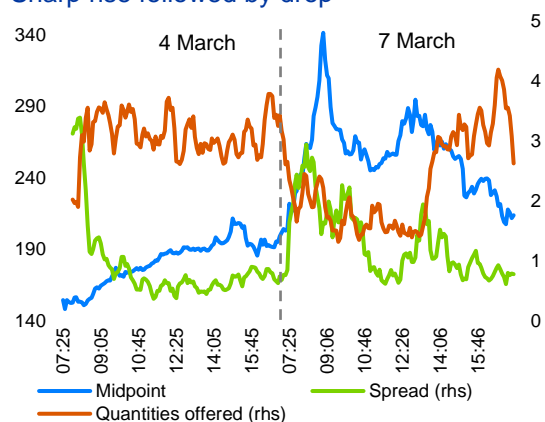
On 7 March 2022, intraday movements reached 70%, including a 30% increase in prices between 8:00 and 8:30, before prices bounced back to their initial levels around 9:00 (Chart 12). Ahead of the surge in prices, liquidity deteriorated substantially, with an increase in spreads (green line) and a sharp decline in quantities offered at the spread (red line). During the episode, circuit breakers were not triggered as traded prices remained within the bands set up by the exchange.

A statistical analysis using the V-shaped statistic of Flora and Renò (2021) was performed to assess whether a flash event took place on Dutch Title Transfer Facilities (TTF) futures (as in Bouveret et al., 2022). The analysis did not identify any flash events over this period.

As price volatility surged, margin requirements on derivatives positions increased as well, in line with CCP risk models. For ETDs, initial margins increased from around 20% of notional in November 2021 to 40% in February 2022 on ICE Endex and EEX and up to 70% on ICE in March 2022. Variation margins also increased for counterparties with mark-to-market losses, mainly firms with short positions on natural gas derivatives.

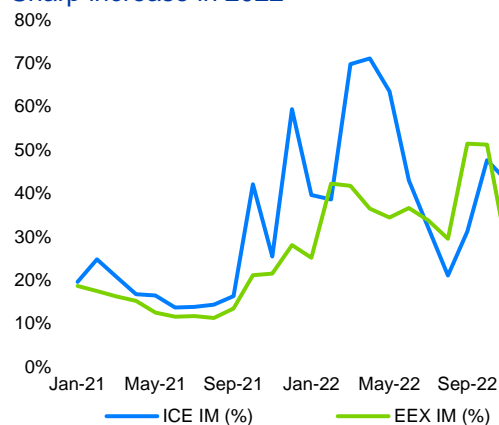
As counterparties faced margin calls, it was challenging for some non-financial corporates to obtain liquidity on a short-time horizon, as their balance sheet is typically less liquid than that of financial firms, and non-financial corporates might have limited access to short-term funding sources. In essence the price shock, and the increase in margin requests led to liquidity strains for some firms (JA, 2022). In some cases, those liquidity strains resulted in public intervention, with governments providing liquidity support through public guarantees or capital injections into troubled companies. Sgaravatti et al. (2023) estimate that those facilities amounted to EUR 194bn.

Chart 12
Dutch TTF prices – 7 March 2022
Sharp rise followed by drop



Note: Midpoint price of TTF future, relative spread (in basis points) and quoted quantities (in tens of contracts) at 5-minute intervals. Spread and quoted quantities are 25 minutes moving averages.
Sources: Morningstar Real-Time, ESMA.

Chart 13
Initial margins on natural gas futures
Sharp increase in 2022



Note: Initial margins in % of notional for front-month future contracts.
Sources: ICE, EEX, ESMA.

Market and funding liquidity risks

In general, the use of derivatives can entail two types of liquidity risk: market liquidity risk and funding liquidity risk (Brunnermeier and Pedersen, 2009).

Market liquidity refers to the ability of the market to absorb large trades quickly without moving the price significantly. Following the war in Ukraine, the deterioration of market liquidity made it more

costly and difficult to execute trades on natural gas derivatives.

Funding liquidity is the ability to quickly borrow money to finance positions. The use of derivatives usually requires the posting of *initial margins* by counterparties at the inception of the derivative contract (mandatory for ETDs, optional for OTC derivatives) to protect against the default of a counterparty, and the posting of *variation margins* on a daily basis to reflect the current market-to-market value loss of the trade for the counterparty. Following the invasion of Ukraine and the steep increase in prices, counterparties with short positions had to post variation margins (as their positions had mark-to-market losses) and both counterparties had in some cases to post additional initial margins (as margin models used by CCPs required higher levels of collateral to compensate for the heightened volatility of natural gas derivatives).

Concentration risk

Concentration risk encompasses a range of dimensions.

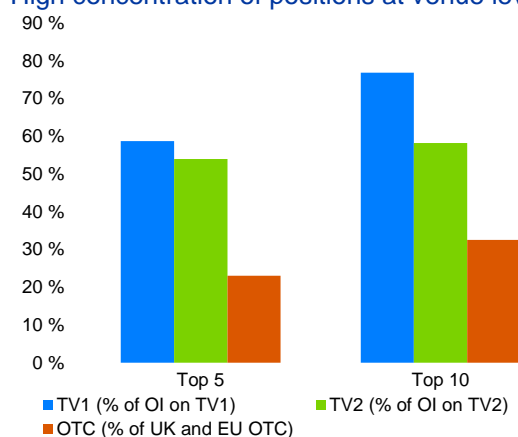
First, as shown previously, there is a high degree of *concentration at clearing level*: a few CMs account for most of the clearing activity performed by EU entities on behalf of EU and non-EU clients.

Second, *trading* tends to be concentrated in a few firms which account for most of the trading volumes. Some of those entities, such as proprietary trading firms, might withdraw from the market in times of stress, resulting in a significant reduction in liquidity offered to market participants in times where it is needed most.

Some degree of concentration is also visible at *position and trading venue levels*, although market participants are subject to position limits on EU venues for critical or significant commodity derivatives¹³. Chart 14 shows that the top-5 and top-10 EU counterparties (in terms of gross notionals) accounted for more than 50% and 60% respectively of reported notionals by EU entities on each of the two EU gas regulated markets.¹⁴

Chart 14
Notionals of top trading firms

High concentration of positions at venue level



Note: Market share of natural gas by venue in % of reported notionals excluding CCPs and clearing members. Data as of November 2022. OI: Open interest; TV: trading venue.
Sources: Trade repositories (TRs), Bank of England, ESMA.

In addition, the market footprint of the largest entities is also significant when assessed at the broad market level. Notional exposures amounted to more than 40% of all reported positions on natural gas derivatives (irrespective of the venue of execution or trading type) as indicated by Chart 15. While concentration remains lower in the OTC space than in ETD (Chart 14), the shift towards OTC from large entities is also increasing concentration measures in this market. Such high concentration implies that if those firms were to reduce their positions, the market impact would likely be substantial.

The potential impact of liquidating those positions can be estimated by combining exposure information from EMIR with market data on trading volumes.

EMIR data is used to obtain two snapshots of positions on Dutch TTF futures in February (right before the invasion of Ukraine) and November 2022. For each EU reporting counterparty, positions are aggregated across all Dutch TTF futures but also split by individual future contracts. Liquidity is measured by average daily

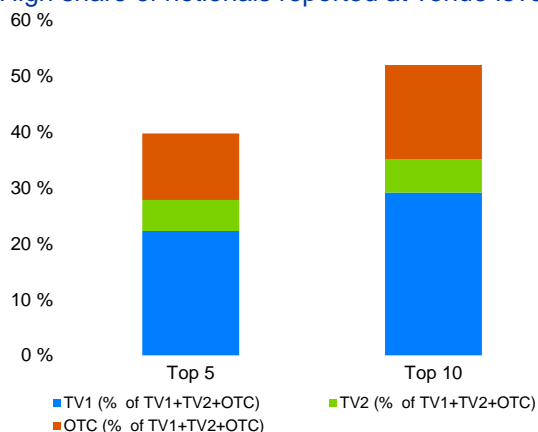
¹³ A commodity derivative whose net open interest is above 300,000 contracts on average over a one-year period is considered critical or significant commodity derivative under MiFID II and hence subject to position limits. Currently, only TTF futures traded on ICE Endex are subject to position limits. Spot month positions are limited

to 10% of deliverable supply and other months' positions to 10% of open interest (ESMA, 2022c).

¹⁴ ESMA prepared a similar study on the two most dominant power futures in Europe. This study is forthcoming in the Financial Stability Review of Banco de España.

trading volumes on those contracts on the basis of MiFID FITRS data.

Chart 15
Notionals of top trading firms
High share of notionals reported at venue level



Note: Market share of natural gas by venue in % of reported notionals excluding CCPs and clearing members. Data as of November 2022. TV: trading venue.
Sources: TRs, Bank of England, ESMA.

Two measures of concentration are calculated. For the NFC participants with the highest exposures, their aggregated position is expressed as percentage of average daily trading volumes (ADV), to indicate how long it would take for those positions to unwind¹⁵. A high figure implies that the liquidation of positions would either take a long time to take place and/or would result in large price moves if executed quickly, as the trades could be multiples of average trading volumes¹⁶.

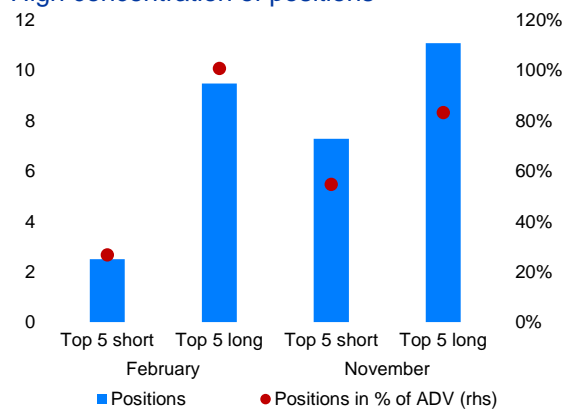
The ability to liquidate a position also depends on the behaviour of other market participants. In the case of a large symmetric shock to prices and liquidity, as observed after the invasion, several energy firms might try to move out of their positions at the same time, making it more difficult for each of them to dispose of their assets. To assess this scenario, the time it would take to liquidate the short and long positions of the top 5

energy firms if those participants were to reduce their positions at the same time is estimated.

Chart 16 indicates that in February 2022, before the invasion, short positions for the top-5 NFC trading firms amounted to around 26% of ADV and around 100% for the long positions. As of November 2022, short positions increased by almost 200% while ADV increased by only 40%, resulting in a higher position to ADV ratio to 55%. Long positions remained stable in absolute terms, leading to a decline in the position-to-ADV ratio to 83%. Such measures indicate that if several firms with similar directional positions were to reduce their exposures, they could amplify market moves. In turn, these market moves could lead to other firms liquidating their positions, creating a vicious circle observed in other markets¹⁷.

Overall, the results indicate that liquidation costs could be significant in the case of a simultaneous winding up of positions, pointing to concentration risk.

Chart 16
Positions on Dutch TTF futures
High concentration of positions



Note: Absolute value of net positions in EUR bn for the top 5 long and short NFC counterparties and positions in % of average daily trading volume (ADV), in % rhs.
Sources: EMIR, ESMA.

¹⁵ This approach is in line with the methodology used for concentration modelling in the ESMA CCP stress tests (ESMA, 2022a).

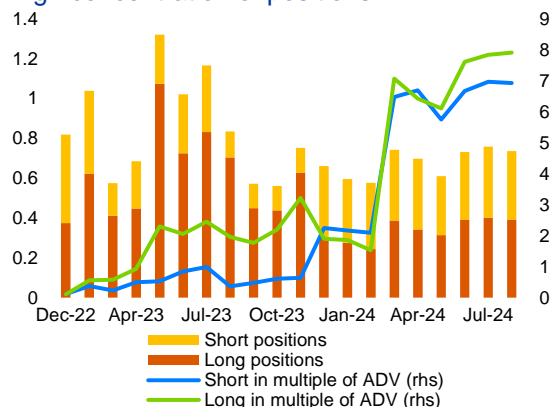
¹⁶ The default of a clearing member with large positions can result in losses for the CCP and other clearing members, as observed in September 2018 for Nasdaq Clearing (Bell and Holden, 2018; Finansinspektionen, 2021) and in extreme cases the failure of the CCP as occurred in 1974 in France (Bignon and Vuilleme, 2020).

¹⁷ For example, in September 2022 abrupt rise in GBP sovereign yields led to a surge in liquidity demands for

leveraged funds using Liability Driven Investment strategies, as the sovereign bonds used as collateral in repurchase agreement transactions fell in value and the funds also faced margin calls on their interest rate derivatives portfolio. To meet the liquidity demands, some funds started liquidating their GBP sovereign bonds, resulting in heightened pressure on the bond market and an inability to trade. Tensions waned after the intervention by the Bank of England (Breedon, 2022).

We follow a more granular approach by computing a similar measure at instrument level: for each future contract, the position is divided by the ADV for the instrument. Since liquidity is highest for the front-month contract, positions in longer maturities tend to be more costly to liquidate. Chart 17 shows aggregated positions of the top-5 long and short NFCs by future contract (maturity dates) as of November 2022. Short and long positions can account for several multiples of ADV, especially for longer-dated maturities. For example, positions on contracts maturing in 2024 account for more than five times the average daily trading volumes, implying high liquidation costs in case of simultaneous sales.

Chart 17
Positions on Dutch TTF futures per contract
High concentration of positions



Note: Positions of top 5 short and long NFC counterparties in EUR bn and in multiple of ADV by future contract (maturity date). Only positions above EUR 100mn in absolute terms are shown. Data for November 2022. Sources: EMIR, ESMA.

Interaction between liquidity and concentration risks

Trading on natural gas derivatives markets remained orderly despite the high volatility and the sharp reduction in liquidity. However, the risks identified above could crystallise if large shocks were to be accompanied by a lack of preparedness by market participants in terms of liquidity risk management, and the risks could be amplified by a high concentration of positions.

The events related to nickel derivatives on the London Metal Exchange (LME) on 8 March 2022 illustrate how this type of risk can materialise (Textbox 2).

Textbox 2

Extreme nickel price moves of 8 March 2022

Between 7 March and 8 March prices of nickel derivatives surged by 270% on the LME (Chart 18) to reach more than USD 100,000 per tonne in the morning of 8 March. The extreme price moves led LME to suspend trading and margin calls, which otherwise would have amounted to an estimated USD 19.75bn (Oliver Wyman, 2023).

The surge in prices was related to a 'short squeeze'. Some market participants with large short positions on Nickel derivatives faced significant margin calls, resulting in the short covering of those trades to reduce risks (by purchasing futures) which further accelerated the increase in prices leading to a feedback loop.

The existence of those large short positions was for most part not visible to the exchange, its CCP, regulators and market participants as the short positions mainly included positions in OTC not subject to reporting requirements and were fragmented across clearing members.

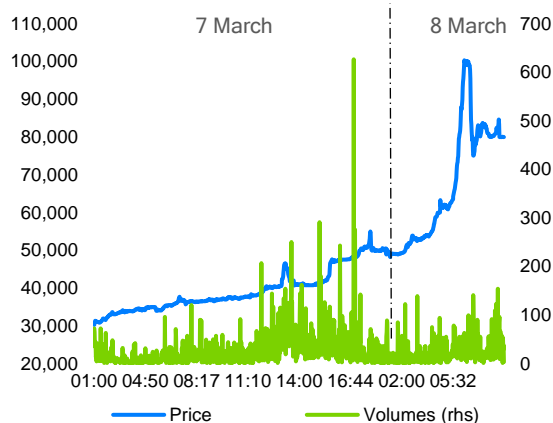
The nickel event caused significant liquidity stress among market participants that were unprepared for the scale of volatility and price moves and related margin calls, including non-financial corporates that own physical assets which cannot be quickly monetised and that may have limited access to funding. Some clearing members might also have faced acute liquidity stress if margin calls had occurred.

The nickel market reopened on 16 March, after the LME introduced daily price limits of 15% and the CCP increased initial margin requirements.

After the event, the UK Financial Conduct Authority and the Bank of England announced a review of the nickel incident (FCA, 2022).

Chart 18
Nickel markets

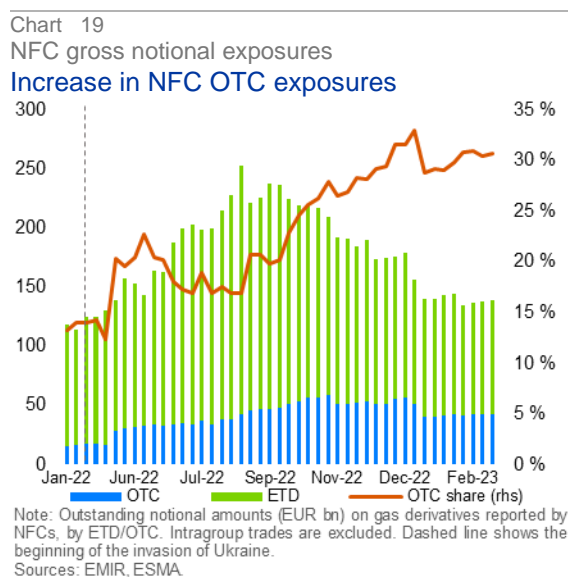
Nickel prices soared on 8 March 2022



Note: Traded price of 3-Month Nickel futures on LME in USD per tonne and volumes in number of contracts. Sources: Morningstar Real-Time, ESMA.

Migration from ETD to OTC

Most exposures to natural gas derivatives continue to be through the use of ETDs. However, there has been a significant shift towards the OTC market since the summer, in particular for NFCs and especially energy firms (Chart 19). Firms might have migrated to OTC to reduce margin requirements, as bilateral contracts might provide more flexibility to counterparties, including an absence of initial margins in some cases. By doing so, firms might trade off liquidity risk for counterparty risk and reduce the liquidity available on trading venues. This shift to OTC is also influenced by a different distribution of maturities between ETD and OTC derivatives, as ETD trades tend to have shorter tenors. While prices have come down since summer 2022 and notional amounts decreased accordingly, ETD trades have expired and been renewed relatively more than OTC trades.



Data fragmentation and data gaps

The analysis of risks in natural gas derivatives markets is hampered by data fragmentation and the availability of data to ESMA and NCAs. Data fragmentation relate to information on some derivatives being reported only to energy regulators or only to NCAs. Data gaps relate to reporting requirements for energy firms.

First, while transactions in those instruments are reported to the EU Agency for the cooperation of

Energy Regulators (ACER), physically settled wholesale energy derivatives do not qualify as financial instruments under MiFID. As such, they are excluded from MiFID transparency and reporting requirements.

Second, open positions of market participants at trading venue level, excluding positions in OTC derivatives, are reported to NCAs but not directly available to ESMA. EMIR provides detailed information on EU entities but does not cover non-EU counterparties even if they trade on EU venues, making the analysis of concentration of positions or trading activity at EU level difficult.

Finally, most energy firms are not regulated as investment firms and as such are exempted from a range of reporting requirements, making the analysis of liquidity risk at entity-level challenging. In addition, some large (non-EU) commodity trading firms are not listed, which further reduces the availability of public information on those entities.

Financial stability implications

The structure and functioning of EU natural gas derivatives markets shed light on potential risks to financial stability.

First, while aggregate direct exposures of financial institutions are limited in comparison with their size or their capital, stress in the natural gas market can spread through the real economy due to the exposures of NFCs. Such firms tend to have lower liquidity than financial institutions and therefore can be subject to liquidity strains related to margin calls on ETD and OTC positions.

Second, concentration risk is high in natural gas markets across several dimensions, including the concentration of clearing activity, the existence of large positions in ETD and OTC markets and the reliance on a few key liquidity providers. The unwinding of large positions could result in further pressure on prices, amplified by a reduction in market liquidity, ultimately leading to a substantial price impact of trades.

Third, natural gas prices can have an influence on pricing in electricity markets at large, and derivatives pricing through their weight in the price formation process plays a particular role in this relationship. This interconnection gets accentuated by the EU system of marginal pricing in electricity markets. Natural gas derivatives

markets therefore ultimately play a crucial role in the price formation of energy markets.

Finally, given that natural gas is an important input for most production processes and critical infrastructures, financial instability in this market can quickly spill over to the broader economy.

Conclusion

The Russian invasion of Ukraine has triggered a surge in natural gas prices amid heightened volatility and a deterioration of liquidity.

The analysis of EU natural gas derivatives markets has shown that the concentration of clearing activity in few clearing members and the high market footprint of a few energy firms can entail risks for financial stability through liquidation costs and funding liquidity issues for counterparties. In that context, the migration from ETD to OTC has resulted in a more fragmented network, with a declining role for central nodes, and an increase in the number of highly interconnected entities, which might propagate shocks to a wider range of counterparties.

In addition, energy firms play a central role in natural gas derivatives markets as suppliers and consumers of the commodity. This implies that energy firms and financial institutions have very direct interconnections. Such tight linkages can transmit shocks from one sector to the other and raise risks to financial stability through liquidity and concentration risks. Since energy firms are often non-financial companies, they are subject to less oversight and reporting requirements than financial institutions (e.g. investment firms or credit institutions), and there is generally less transparency on the balance sheet and liquidity profile of those energy firms.

Finally, as with any commodity and unlike usual financial instruments, natural gas is subject to storage and supply constraints which makes the pricing of derivatives more dependent on external factors, including geopolitical events.

Looking forward, the analysis of risks in natural gas derivatives markets requires further work to address data gaps and data fragmentation. In that context, further cooperation between energy and financial market regulators is warranted (ESMA; 2022c).

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