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Haute école de gestion
Genève

War in Ukraine: Impacts of extreme price levels and volatility of the European gas market on the liquidity management of Commodity Trading Firms

Bachelor Project submitted for the degree of
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by

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Executive Summary

This research provides an in-depth examination of the European natural gas market, specifically the Dutch Title Transfer (TTF), and its response to the disruptions caused by the Russia-Ukraine war in 2022. The research takes a critical look at the liquidity and cash management issues faced by commodity trading companies, particularly in the context of geopolitical turmoil, exemplified by the 2022 Russia-Ukraine war and the subsequent disruptions to the energy market. It also aims to propose solutions to help these companies better adapt to and anticipate such extreme market conditions.

Using a mixed-methods approach, the study integrates qualitative and quantitative data, including natural gas price volatility, macroeconomic data, real-life examples, and scenario analysis. Primary data sources include interviews with industry professionals to gain insight into their strategies for managing these challenges. Secondary data sources include industry reports, newspaper articles and analysis, and course content.

Market analysis shows that the European natural gas market, previously considered "quiet", has undergone an extreme transformation characterized by increased prices and volatility. These extreme conditions have posed significant challenges to the liquidity management of CTFs, exposing them to the risk of liquidity shortages and financial stress.

In response to the market changes, participants have adapted by for example trading lower volumes or shifting from exchange to OTC trading. Financial institutions, in particular banks, acted as important pillars of support during this period, providing flexible financing methods. The critical situation in the energy sector also prompted the European Union to intervene to secure its energy supply and maintain market stability.

The findings highlight the importance of proactive liquidity management and risk mitigation strategies to prepare for potential future market disruptions. Suggested solutions focus on improving liquidity resilience, implementing risk management strategies and regulations, key factors contributing to the long-term success and sustainability of CTFs in the natural gas trading industry.

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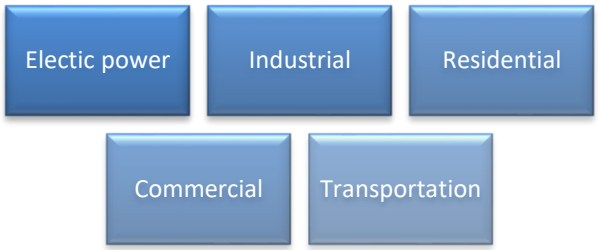

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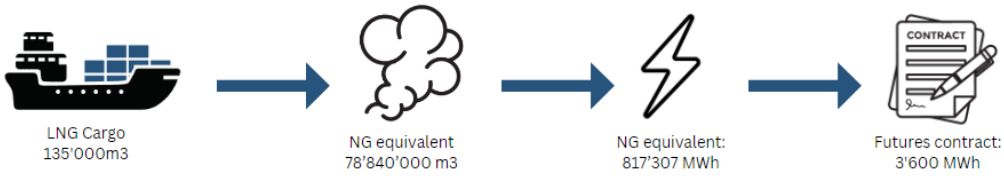

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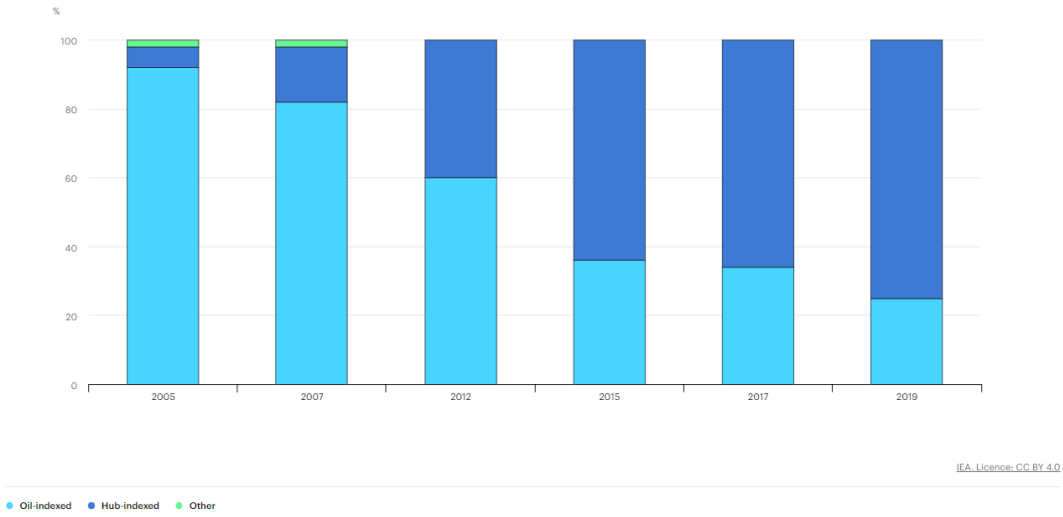

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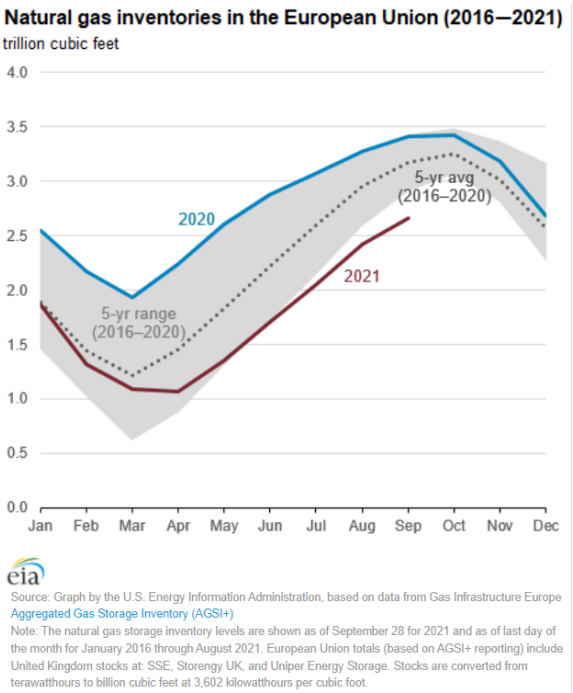

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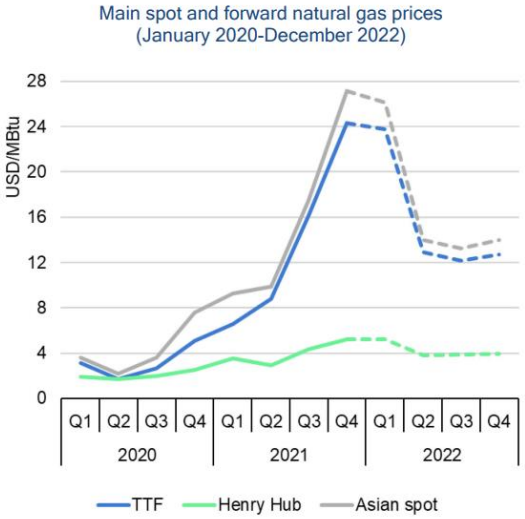

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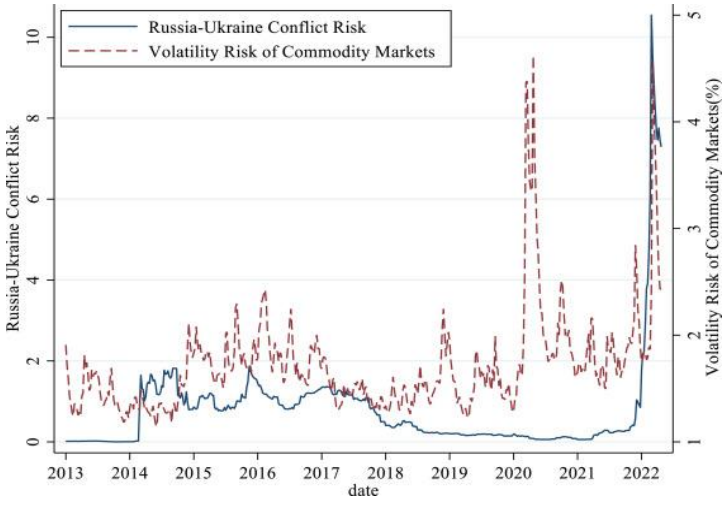

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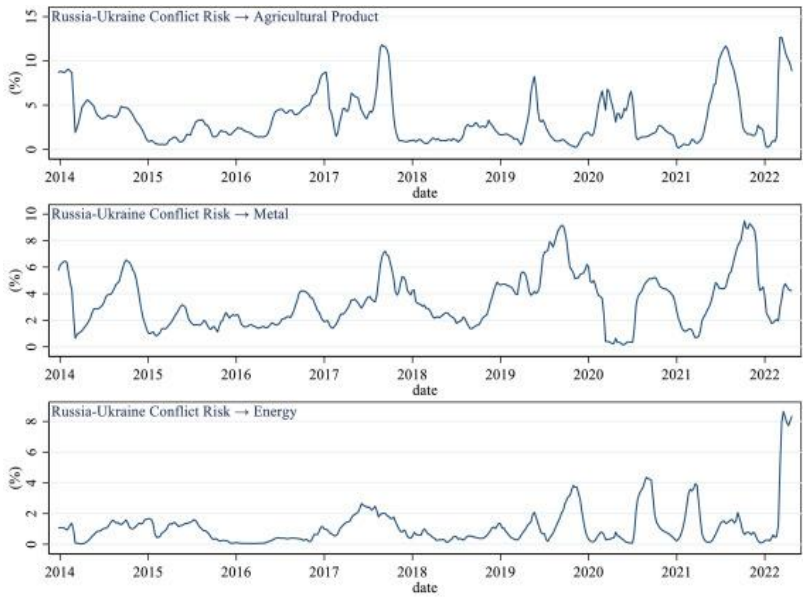

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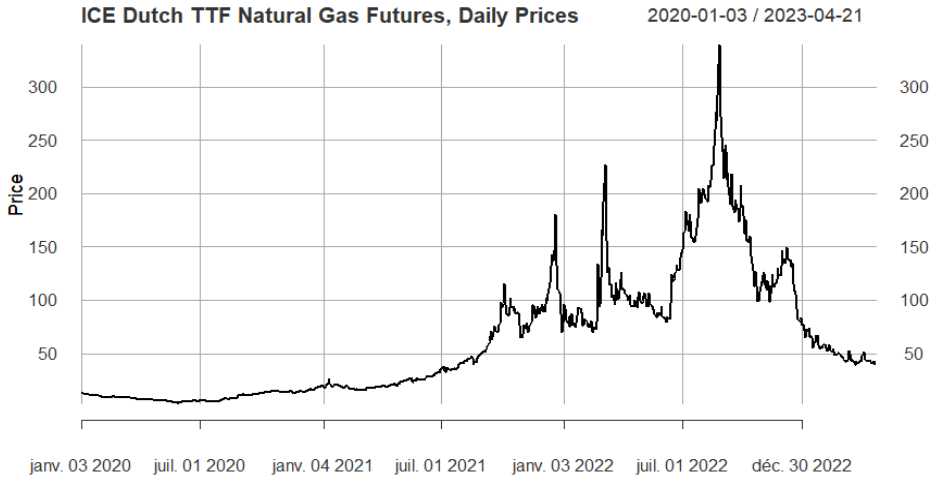

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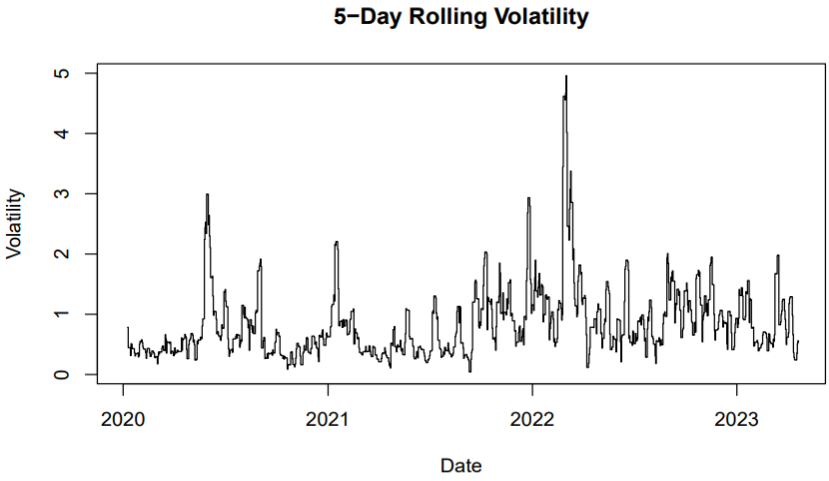

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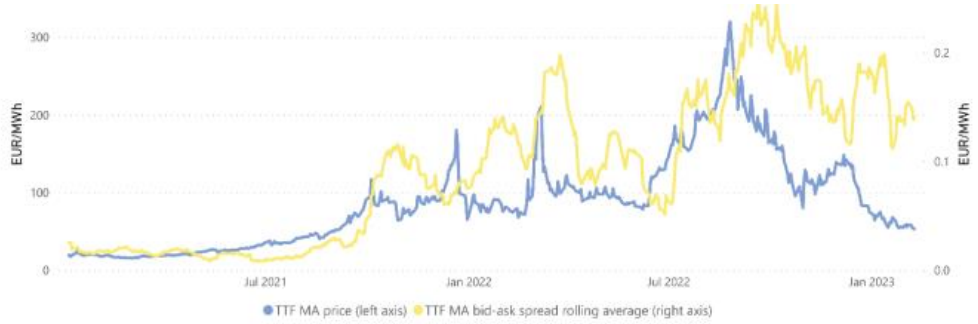

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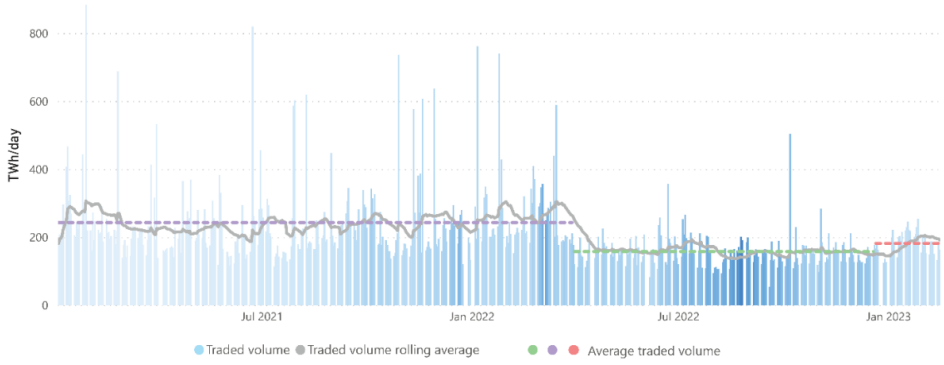

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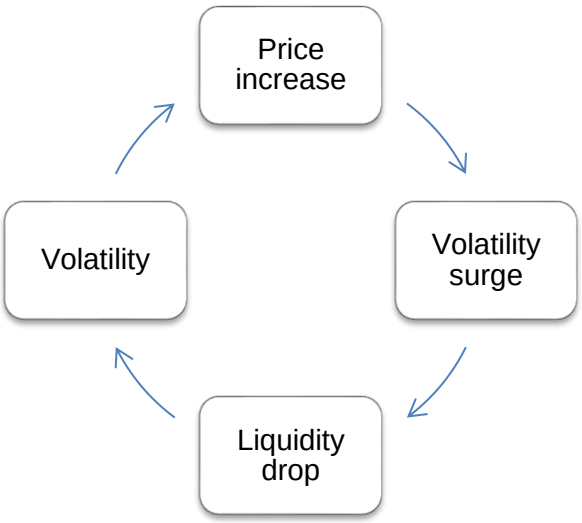

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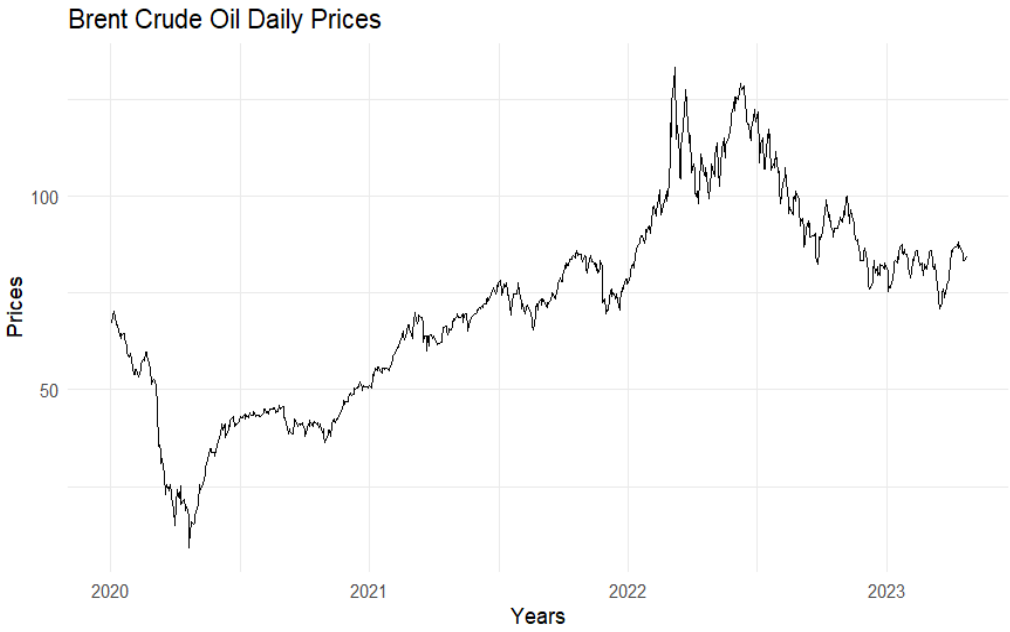

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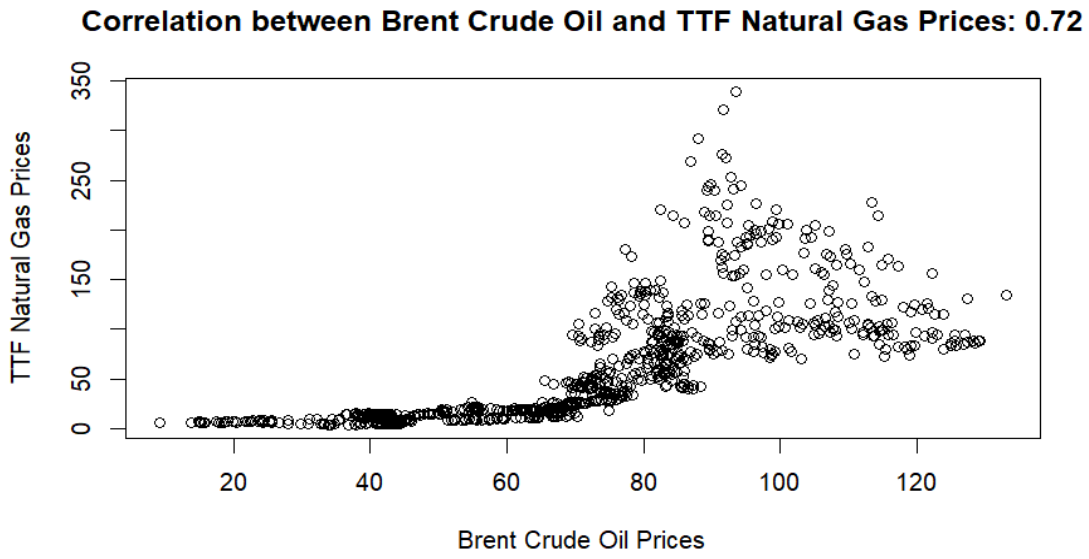

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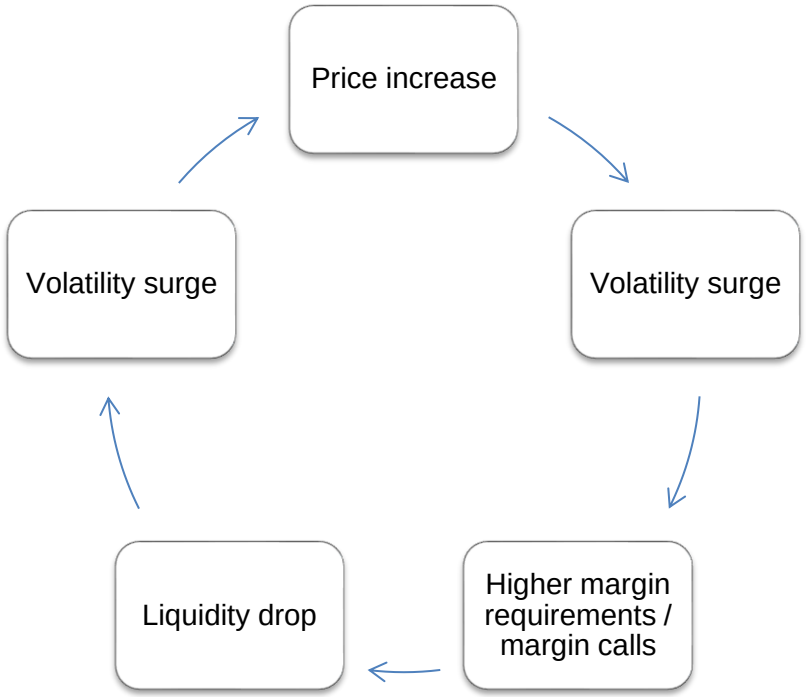

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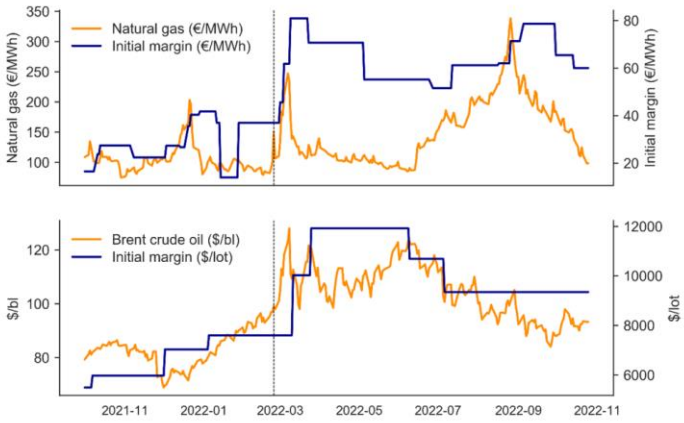

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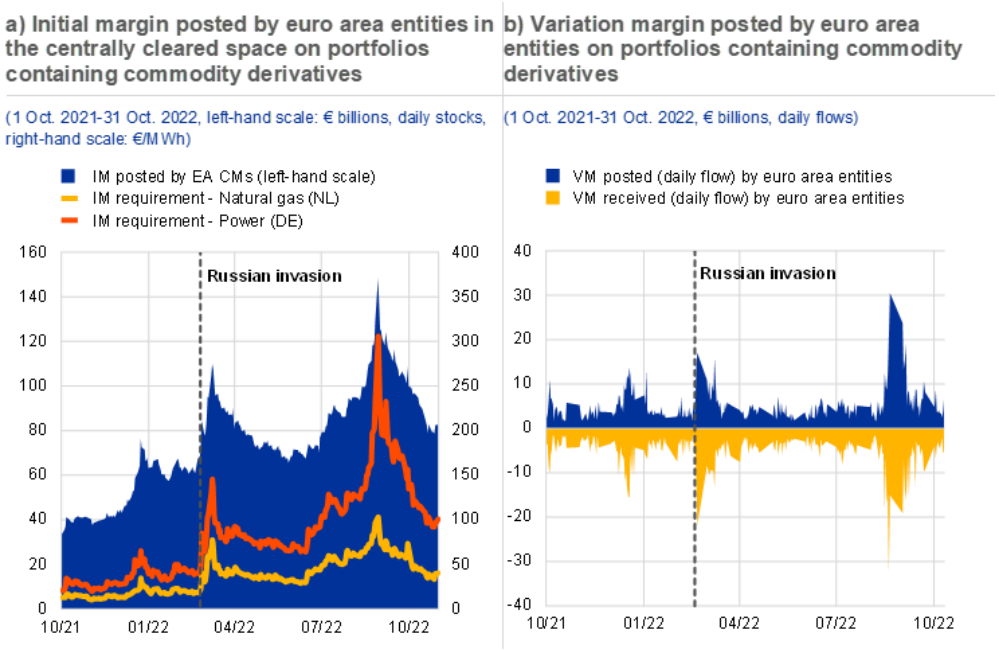

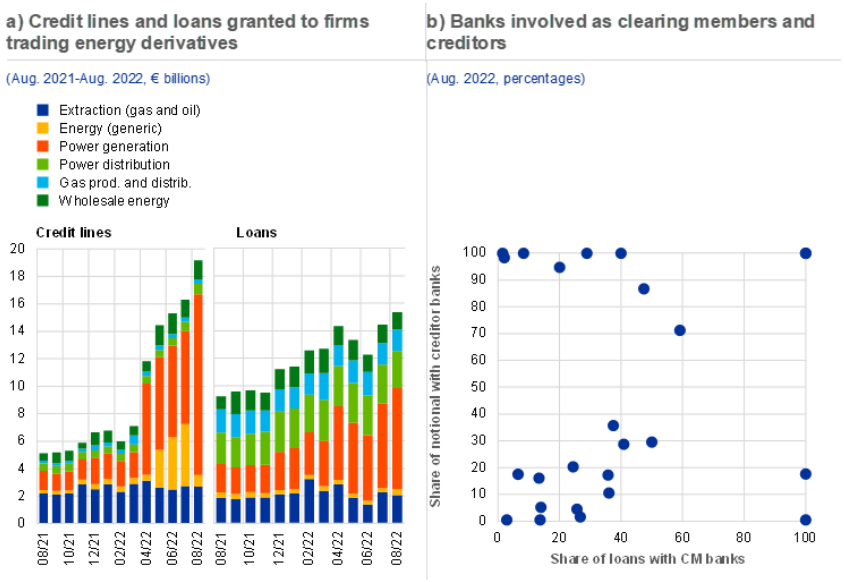

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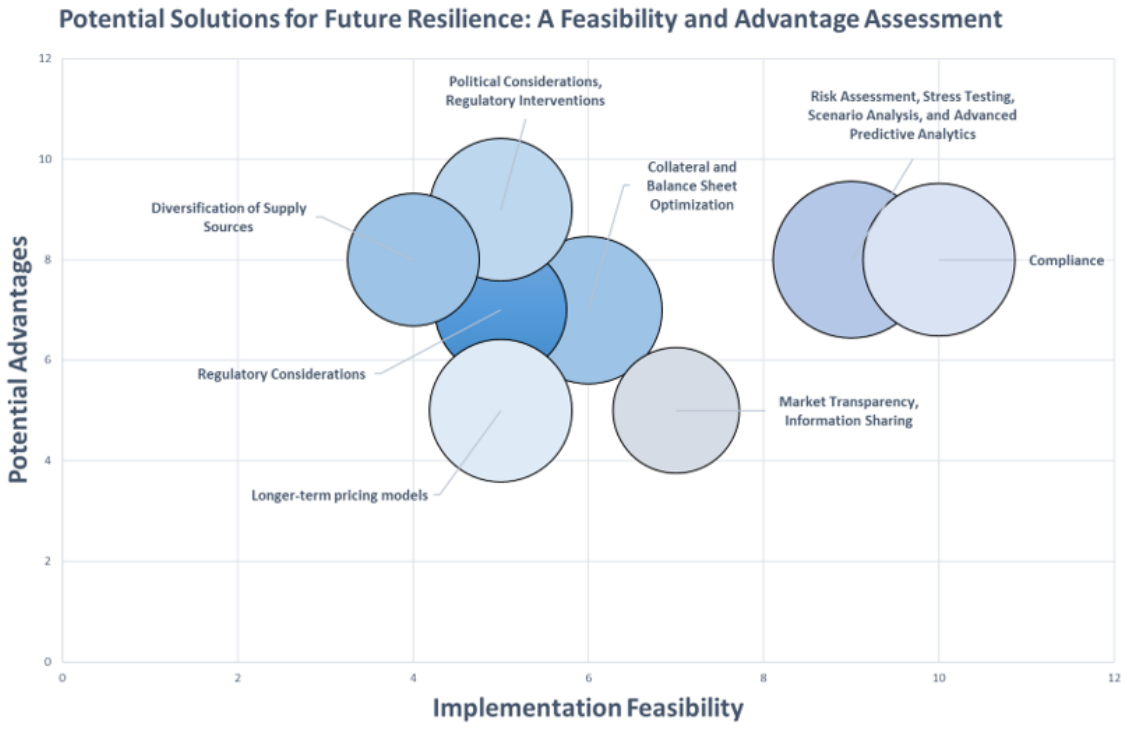

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Introduction

Since the 1970s, natural gas has become one of the most important sources of global energy consumption after oil and coal, used for domestic and industrial heating and power generation (EIA, 2022). Over the past decade, the use of natural gas has increased as it has emerged as a cleaner alternative to coal and oil due to its lower emissions of carbon dioxide and other air pollutants during combustion (IEA, 2019).

The European natural gas market and its analysis will be the focus of this thesis, especially during the particular event that began in February 2022, Russia’s invasion of Ukraine.

The impacts on the global economy, energy prices and market structure of this conflict have been enormous (World Economic Forum, 2022). Given Russia's leading role in the energy markets as one of the largest producers of natural gas and crude oil, this conflict has caused major disruptions to the global energy market, increasing prices, volatility and affecting liquidity, particularly in Europe (Macquarie, 2022). As European consumption is highly dependent on Russian gas exports, the need for a reshaping of its energy mix structure was a priority (European Council, 2023).

When price levels and volatility are affected, margin calls are triggered, challenging commodity trading companies to maintain their positions in the futures markets and manage their financial stability (Oxera, 2022).

The first chapter sets out the fundamentals of the gas market and gas trading and provides a description of the European gas market.

The second chapter analyses the price level and volatility of the European gas market because of the Russia-Ukraine conflict and its consequences on the liquidity of the market, focusing on the Dutch Title Transfer Facility (TTF).

The third chapter discusses and analyses the financial risks to commodity trading firms of sudden margin calls, with a particular focus on the management of cash and credit facilities. This analysis will allow consideration of possible solutions to prevent such impacts in the future.

Chapter 1: Fundamentals of the gas market and gas trading and description of the European gas market

1.1 Overview of Gas as an Energy Source

1.1.1 Natural gas: formation, extraction, and usage

Natural gas, a nonrenewable fossil fuel, consists of a blend of methane, carbon, and hydrogen. It forms within sedimentary rock layers, where organic material slowly transforms into natural gas under high pressure and temperature (IEA, 2019). The natural gas supply chain can be categorized into three primary segments:

1. The upstream segment includes the extraction and processing of natural gas.
2. The midstream segment is where natural gas is transported and/or processed for transportation and storage. Natural gas is transported in its gaseous or liquefied form, known as LNG. It is transported in liquid form by tankers and in gaseous form by pipelines (US Department of Energy, no date).
3. The downstream segment involves the sale and marketing of natural gas from utilities to end users, such as industrial and gas-fired power stations or households (Oxera, 2022).

Storage is an important aspect of the natural gas market as supply remains constant throughout the year, but demand varies seasonally. Storage facilities are filled during the spring and summer, starting in April or May when demand is relatively low, until October, in order to have natural gas available during peak demand periods in winter (EIA, 2023).

1.1.2 Advantages: Versatility and Environmental Benefits of Natural Gas

Natural gas serves multiple exploitation, from electricity generation to heating and cooking in residential and commercial properties, as well as a raw material in industries like chemical, fertilizer, and plastic manufacturing. Recently, natural gas has become increasingly popular as a transportation fuel, used in buses, trucks, and even marine vessels. As a cleaner alternative to coal and oil, natural gas, accounting for a quarter of the world's primary energy, is an essential transitional fuel for climate change mitigation

(IEA, 2019). In addition, natural gas can be stored and transported in different forms, such as pipeline gas or LNG, increasing its flexibility in meeting the energy needs of different regions (Palmer, 2021).

1.1.3 Supply and Demand

Supply

Various factors contribute to the global supply of natural gas, including production rates, storage capabilities, and the balance between imports and exports. Economic growth, climate fluctuations, and technological progress also considerably impact the natural gas market's supply side.

Natural gas production depends on the availability of reserves, investment in exploration and extraction, the development of drilling techniques such as horizontal drilling and hydraulic fracking processes[1], which have made previously inaccessible reserves accessible to production, and the development of new pipelines and LNG terminals.

Rising economic growth can result in increased investment in the natural gas sector, leading to augmented production to accommodate increasing demand. Furthermore, climate patterns may influence production, as severe weather events can disrupt drilling and extraction activities (EIA, 2022). To maintain a stable supply and address variable demand, natural gas is stored underground or as liquefied natural gas (LNG) in storage tanks, known as Floating liquefied natural gas (FLNG) technology (Shell)[2].

Changes in trade regulations or geopolitical conflicts can also affect the dynamics of natural gas imports and exports. A few major producers and exporters significantly influence the global natural gas market:

[1] Hydraulic fracturing, or 'fracking', is one of the drilling technologies used to extract oil and natural gas and is a method in the wider process of unconventional development of these commodities (BBC, 2022).

[2] Floating Liquefied Natural Gas (FLNG) technology involves using floating vessels or platforms to carry out the liquefaction of natural gas directly at the offshore gas fields (Shell).

United States: As the largest natural gas producer, the U.S. has benefited from the shale gas revolution and drilling advancements, which have revealed vast natural gas reserves. Consequently, the U.S. has become a significant natural gas and LNG exporter, primarily exporting to Mexico, Canada, Asia, and Europe (EIA, 2021).

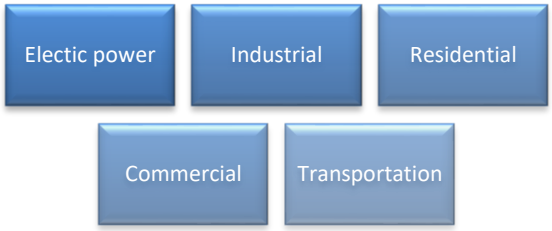
Russia: Russia is another leading natural gas producer and the world's foremost exporter, occupying therefore a crucial role in the global market. Russia's substantial reserves and expansive pipeline network enable it to supply gas to both Europe and Asia, reinforcing its dominance in the energy sector (EIA, 2021).

Qatar: As one of the world's major LNG producers and exporters, Qatar holds an important position in the global natural gas market. Its abundant reserves, primarily in the North Field, have facilitated the development of a robust LNG export industry. Qatar's LNG exports are predominantly directed toward Asia, with Japan, South Korea, India, and China as key importers (EIA, 2021).

Demand

Demand for natural gas is closely linked to economic growth, as increased industrial activity, power generation and residential consumption typically accompany a growing economy. Natural gas demand also varies depending on weather conditions, the availability of pipeline supplies and world gas prices (EIA, 2022). In colder months, residential and commercial heating needs increase, leading to higher gas consumption. Extreme weather events, such as prolonged cold snaps or heat waves, can also cause sudden shifts in demand (Zaretskaya, Wilczewski, 2022).

Figure 1 - Natural Gas Consumption by sector



Source: Own graph, data base (U.S. Energy Information Administration (EIA), 2022)

Natural gas is essential to produce chemicals, fertilizers and plastics, as well as for heat and power generation in industries such as steel, cement and glass (EIA, 2022). Residential consumption of natural gas is mainly for heating, cooking and water heating. According to the International Energy Agency (IEA), natural gas is the main source of heating worldwide, accounting for 42% of heating energy demand.

Moreover, as countries look to phase out coal-fired power plants and integrate more intermittent renewable energy sources, natural gas is increasingly seen as a reliable and flexible, thanks to the high efficiency, lower emissions and relatively short construction times of its power plants (IEA, 2022).

1.2 Pricing Mechanisms

1.2.1 Long-term contracts

The natural gas market is characterized by long-term contracts, typically for 10 to 25 years or more. These contracts are critical to the producer-buyer relationship, providing financial stability for major resource projects and security of supply for gas buyers through their take-or-pay clauses[3].

Long-term contract structures and stable pricing are supported by factors such as infrastructure dependency, asset specificity and capital expenditure (Slav, 2022).

In the European Union, for example, long-term gas contracts have historically served as the cornerstone of the region's security of supply. For many years, take-or-pay gas contracts have been the conventional means of securing the EU's supply, providing security of demand for producers and security of supply for the EU as a buyer (Energy Charter Secretariat, 2007).

Oil indexation is a notable feature of long-term gas contracts, linking the price of natural gas to the price of oil or oil products such as heating oil or gas oil. This link exists because oil and gas often compete in similar markets and applications (Energy Charter

[3] The take-or-pay clauses of long-term contracts require buyers to pay for a predetermined minimum volume of gas, regardless of whether they use it. The minimum quantity is usually specified as a percentage of the contract volume (Rogers, White, 2013).

Secretariat, 2007). However, the importance of oil indexation has declined in recent years as shown in Figure 5. The emergence of a more liberalized and integrated natural gas market in Europe and the United States has facilitated a shift from oil to gas indexation (CME Group, 2020). The growth of the LNG industry has introduced new sources of supply, making LNG more accessible and abundant allowing natural gas prices to better reflect supply and demand dynamics (IEA, 2019).

1.2.2 Spot markets

Spot markets are known as short-term markets where commodities such as natural gas are traded for immediate or near-immediate delivery. As mentioned above, the liberalization and development of the natural gas market has led to a more widespread use of spot market pricing for the commodity. In this model, prices are determined by the real-time interaction of supply and demand, rather than being linked to oil. Spot markets can also be referred to as hub-based pricing, gas-on-gas competition (GOG) or market-based pricing (Rui, Feng, Feng, 2020).

1.2.3 Trading hubs

Trading hubs are physical or virtual locations where natural gas is traded and where prices are determined based on market forces. They play a crucial role in price formation and market integration, providing transparent pricing information and enabling efficient gas trading (Rui, Feng, Feng, 2020).

There are four main regional trading hubs in the global natural gas market: Asia, Europe, North America and Central and South (Latin) America. Each hub uses its own pricing mechanism, resulting in different prices in different regions. Factors such as transportation costs, infrastructure constraints and regional supply and demand dynamics contribute to these differences. (Rui, Feng, Feng, 2020).

Physical hubs, such as Henry Hub in the United States, are locations where multiple pipelines intersect, allowing for the transfer of gas. Virtual hubs, such as the National Balancing Point (NBP) in the United Kingdom or the Title Transfer Facility (TTF) in the Netherlands, are notional points within a gas transmission system where gas has already been injected and where ownership can be transferred between parties (Fabini, 2012).

Trading hubs provide standardized contracts and promote liquidity, enabling producers, consumers and intermediaries to trade gas and manage price risk efficiently. The growth and maturity of these trading hubs has supported the shift towards more market-based pricing mechanisms and helped unify regional gas markets.

1.3 Gas Trading

Gas trading is an essential aspect of the natural gas market. It is a complex and dynamic activity that takes place through various channels, allowing buyers and sellers to lock in prices, manage cash flows and protect against potential price fluctuations (Agarwal, 2018). There are two primary types of gas trading markets: over the counter (OTC) markets and exchanges.

1.3.1 Over the counter (OTC) market

OTC trading occurs between private parties outside of exchange-based platforms usually with the help of intermediaries such as brokers or trading companies. OTC trading allows for greater flexibility in contract terms, but it also entails counterparty risks and is subject to less regulation than exchange-based trading.

Due to the lack of a centralized exchange, OTC markets can also be less transparent compared to exchange-based trading. Pricing information is not as readily available, and market participants rely on the broker-dealers to facilitate transactions and provide market insights.

OTC markets play a significant role in the natural gas industry, especially in the physical delivery of natural gas to end-users, such as power generators and industrial plants (Fabini, 2012).

1.3.2 Exchanges: standardized contracts, transparency, liquidity

Gas exchanges, also known as natural gas trading centers or hubs, serve as the central point of gas infrastructure networks, including pipelines and LNG terminals. These hubs facilitate physical transactions and also serve as the place where futures contracts are traded. They typically comprise both a spot market and a futures market (Tong, Zheng, Fang, 2014).

Exchange-based trading acts as an intermediary between market participants and allows for standardized contracts with pre-defined terms such as delivery, volume, or duration. Examples of standardized contracts are futures derivatives and options. Derivatives are financial instruments that obtain their value from underlying assets such as commodities and are used to manage the risks associated with price volatility (PwC, 2020).

Exchange trading ensures transaction transparency and increased liquidity due to the broad array of participants (CFA, 2021).

The availability and price of natural gas has a direct impact on the cost of power generation, industrial production and heating in homes and businesses. As a result, natural gas prices are closely monitored by market participants, policymakers, and energy consumers, as recently demonstrated by the European Union's intervention in 2022 to cap the price of the European benchmark, the Dutch Title Transfer Facility (TTF) (Abnett, 2022). The details of this intervention are discussed later in this report.

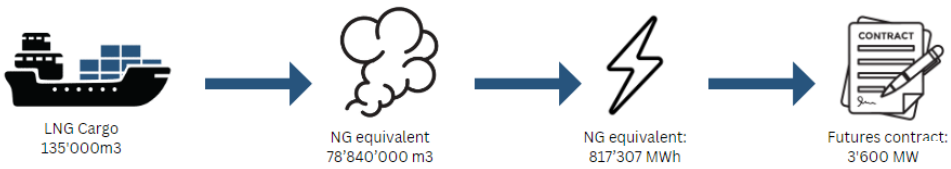
To better understand how natural gas trading works, let's consider a commodity trading firm (CTF), SarahTrading, which operates in the natural gas market. Suppose SarahTrading owns a 135'000 m^3 physical cargo of LNG and wants to protect itself against a potential drop in prices. To do this, it decides to hedge its entire physical exposure by entering short futures contracts.

Figure 2 - Hedging in Natural Gas Markets: A Practical Example

Source: own graph

As the company's market analysis indicated that the TTF natural gas futures contract, priced in EUR per MWh[4], is an appropriate benchmark for its hedge, it needs to convert the quantity of natural gas (m^3) into energy units (MWh).

Figure 3 - Hedging in Natural Gas Markets: A Practical Example



Source: own graph

The details of the calculation are explained in Appendix 1.

When natural gas prices fall, losses on the physical position (long) are offset by gains on the futures position (short) and vice versa. The impact of price increases on the futures position is analyzed further in the report (see Chapter 3, Section 1.10 “Margin Pressures in the European Natural Gas Market)”.

1.3.3 Regulatory Framework

In many jurisdictions, the regulation of commodity trading activities is the responsibility of either governmental bodies or independent agencies. These bodies oversee the trading of commodity futures, options on futures and other derivatives. Their responsibilities include the establishment and enforcement of rules and regulations covering aspects such as licensing and registration, reporting and record keeping, and the prevention of manipulative and fraudulent practices and excessive speculation. They also aim to promote fair and efficient markets (IOSCO, 2011).

In addition to national regulators, international organizations have a significant influence in shaping the global regulatory environment for commodities trading. Key organizations

[4] On the ICE, the contract price for Dutch TTF Natural Gas Futures is in euros and euro cents per MWh (ICE, no date).

include the International Organization of Securities Commissions (IOSCO)[5] and the Financial Stability Board (FSB)[6], which play an important role in the global regulatory landscape.

Detailed explanations and listings of the differing regulations between the United States and the European Union can be found in the Appendix 2.

[5] The International Organization of Securities Commissions (IOSCO) is the leading international body of securities regulators, which aims to promote and uphold high standards of regulation in global securities and futures markets.

[6] The Financial Stability Board (FSB) is an international organization that monitors and makes recommendations about the global financial system with the aim of promoting financial stability.

Chapter 2: Analysis of the European Natural Gas Market: Dynamics, Policy, and Global Impacts Amid Geopolitical Crises

1.4 European Gas Market

The European market is a complex and complete wholesale market that ensures the efficient production, transport, import, consumption, and storage of natural gas, and therefore plays an important role in the global gas trade (Oxera, 2022).

1.4.1 Supply

Europe's gas infrastructure is extensive, consisting of pipelines, storage facilities and LNG terminals that facilitate the transport and storage of natural gas across the continent, allowing Europe to import gas from different regions of the world (Zachmann, Sgaravatti, McWilliams, 2023).

Over the last 10 years, European natural gas production has fallen drastically from 183 billion cubic meters in 2010 to 44 billion cubic meters in 2021[7] (Statista, 2023). The main reasons for the decline in production were the depletion of a major source of natural gas, the North Sea gas fields, and the shutdown of the Dutch Groningen gas fields (Clifford, 2022).

Therefore, to compensate for Europe's consumption, which can be expressed in trillion cubic meters, the European Union has no choice but to import from other countries (Statista, 2023). The European Union's main exporters include major producers such as Russia, Norway and Turkmenistan (Statista, 2023).

1.4.2 Demand

Natural gas has become an important source of energy for the European Union, accounting for around a quarter of the region's energy consumption, which is expected to increase further by 2050. Most of the consumption is used for power generation and

[7] These numbers exclude production from the United Kingdom (Statista, 2023)

industry. Gas is also widely used in EU households, with more than 30% of households using gas for heating (European Council, 2023).

The use of natural gas has increased due to its reputation as a cleaner energy source. The liberalization of energy markets in Europe has also increased competition and made the resource more readily available. In addition, gas-fired power plants can quickly adjust their production compared to coal or nuclear power plants, making them a desirable option to complement renewable energy sources[8].

However, European countries have been concerned about the security of their energy supply, particularly considering geopolitical tensions with major natural gas suppliers such as Russia, which will be discussed in more detail later in this report.

1.4.3 The Role of Liquefied Natural Gas (LNG) in Europe's Energy Mix and the Global Natural Gas Market

Liquefied Natural Gas (LNG) is produced by cooling natural gas to -162°C, turning it into a liquid. This process is used to reduce the volume of natural gas for more efficient transport by specialized vessels. On arrival at its destination, the LNG is stored and then converted back into gas for injection into the transmission network (European Commission, 2023).

LNG has transformed the natural gas industry, increasing Europe's energy security and flexibility by reducing dependence on a single supplier or pipeline. Its efficient transport and storage capabilities offer a significant advantage over traditional pipeline gas, encouraging more dynamic use. Furthermore, the use of natural gas and LNG is in line with Europe's long-term energy and climate objectives, including the transition from coal to natural gas, as it has a lower carbon footprint than other fossil fuels, as outlined in Gas Infrastructure Europe (2023). Technological advances, such as floating storage and regasification units (FSRUs), have improved LNG's global competitiveness by reducing transport costs and promoting more economical natural gas transportation. As shown in

[8] See Chapter 1, Section 1.1.2, "Overview of Gas as an Energy Source"

Figure 4, these innovations have resulted in a complex but increasingly efficient European LNG infrastructure (Gas Infrastructure Europe, 2023).

1.4.4 Key European Trading Hubs

With the 28 gas trading hubs that counted the European Union in 2021, the European gas infrastructure is extensive, consisting of pipelines, storage facilities, and LNG terminals that facilitate the transportation and storage of natural gas across the continent. The Dutch Title Transfer Facility (TTF) and the National Balancing Point (NBP) were recognized as being the two 'mature' European hubs.

The maturity in a trading hub is characterized by transparency, liquidity, and depth (Oxera, 2022). The liquidity of a hub can be calculated using the "churn rate", a ratio that compares the volumes traded to the physical volumes consumed in the area of the hub. With a churn rate of around 100, TTF is the second most liquid gas hub after Henry Hub (Heather, 2020).

National Balancing Point (NBP): Located in the UK, the NBP is a virtual trading point for natural gas that allows market participants to trade gas without the need for physical delivery. The NBP serves as the main reference price for gas traded in the UK and is also widely used in the European wholesale gas market (Fabini, 2012).

Gaspool and NetConnect Germany (NCG): these two German trading hubs were covering together the whole country, with Gaspool covering the north and east of the country and NCG covering the south and west. NCG has been merged on October 2021 to Gaspool to form "a single nationwide German gas market area", named "Trading Hub Europe GmbH (THE GmbH)". It plays an important role in meeting the needs of the country, Europe's largest gas importer (Statista, 2023).

TTF: The TTF, the focus of this research, is the largest and most liquid gas trading hub in Europe, located in the Netherlands. It has become the leading price reference for European gas, reflecting the dynamics of supply and demand across the continent.

Established in 2003, the TTF has developed into a major European and global gas trading hub thanks to its transparency, diversity of tradable products and strategic location in the Netherlands, where the gas infrastructure and industry expertise are available. Another reason for its success has been its ability to trade natural gas in MWh

rather than by type of gas, allowing a move away from oil-indexed pricing (Heather, 2020).

In addition to hedging natural gas exposure, the TTF is also used to arbitrage global LNG supplies and to hedge underlying assets other than natural gas in any location. This is a direct result of gas market liberalization and the use of hub pricing as a hedging and risk management trade. Natural gas trading in Europe, and more specifically for the Dutch Title Transfer Facility (TTF), has evolved over the years from a predominantly OTC market to a more exchange-based market. This shift has been driven by the entry of international players and market liberalization. As a result, TTF trading volumes have increased, with around 90% now occurring on exchanges (Expert 4).

Liquidity is an important requirement for market participants to manage the risks associated with their gas positions, particularly when these extend beyond the spot market and short-term forward contracts, as is the case with the TTF (ACER, 2023). Indeed, according to a report published by the European Union Agency for the Cooperation of Energy Regulators, an efficient internal gas market based on the development of liquid hubs is the best guarantee of security of supply throughout the Union and the TTF has proven its resilience in all recent weather and political/technical situations (ACER, 2023).

Other gas trading hubs in the EU, including the Point d'Échange de Gaz (PEG), Trading Region France (TRF) located in France or Zeebrugge, located in Belgium (Heather, 2020).

1.4.5 European Energy Policy and Dependency on Russia: Challenges and Opportunities for Greater Energy Security and Sustainability

The European Union's energy policy, based on Article 194 of the Lisbon Treaty, aims to "achieve an integrated energy market, security of energy supply and a sustainable energy sector". However, its dependence on Russian gas and the resulting lack of diversification of supply sources, the volatility of energy prices and the growing demand while achieving the goal of decarbonization are some of the challenges the EU has been facing in recent years (European Parliament, 2022).

With rising consumption and declining domestic production, the European Union (EU) is dependent on imports for its gas needs. The EU's largest supplier is Russia. The extensive and developing pipeline network between Russia and the EU has made transport easy and available for the continent's need for imported natural gas. In 2021, Russian natural gas accounted for 40% of the EU's gas demand, showing a clear dependence on Russia (IEA, 2022).

Since the beginning of the conflict between Russia and Ukraine, the European Union has recognized the need to reduce its dependence on Russian fossil fuels, including gas, oil, and coal, and to move towards cleaner and more sustainable energy sources[9].

1.4.6 The Impact of Global Events on the European Natural Gas Market: From COVID-19 to Geopolitical Tensions

In 2019, a global pandemic emerged, causing significant macroeconomic disruptions, including impacts on commodity markets. Demand shortages triggered by enforced lockdowns led to supply chain disruptions and escalating volatility in commodity futures markets (Zhang, Wang, 2022). The natural gas market has been particularly affected. In 2020, the International Energy Agency (IEA) declares "the largest recorded demand shock in the history of global natural gas markets" (IEA, 2020). Although the market has adjusted to recover from "historically low prices and high volatility", the pandemic has certainly had a long-term impact on the market (IEA, 2020).

2020: TTF prices were extremely low during the year, falling below 1 USD/MMBtu in May 2020, but recovered during the heating season to reach 4 USD/MMBtu in October (IEA, 2020).

2021: Global demand, driven by the economic recovery from the pandemic, increased significantly, so much so that supply couldn’t meet demand, causing the market to tighten and prices to rise to a “record high spot prices” of 15.8 USD/MMBtu and record levels of volatility, “reaching an all-time high of close to 200% in December” (IEA, 2022). These strong price variables were at the root of this volatility and were the result of a tight market and uncertainty about supply and storage levels. Indeed, during the summer of this year, some concerns were raised about the low natural gas storage levels, which were indeed

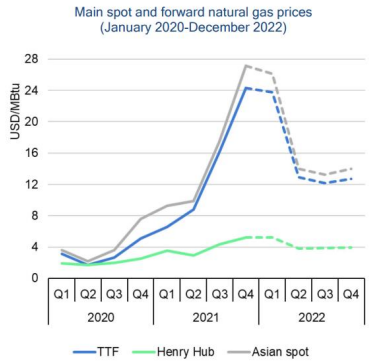
[9] See Appendix 2.

22% below the 2020 level, threatening Europe with a storage shortfall and a potential energy crisis in the winter of 2021 (EIA, 2021).

Figure 6 shows the magnitude of the changes in natural gas stocks. The need to replenish stocks before winter lead to a sharp increase in demand, which in turn would increase volatility and prices. Figure 7 shows the upward trend in prices that started in 2020 and escalated in 2021, demonstrating the clear uncertainty and volatility of the global natural gas market over this period.

According to Expert 3, the end of 2021 was the beginning of a series of volatilities that the European gas market would experience, with prices already rising.

Figure 7 - Main spot and forward natural gas prices (January 2020 - December 2022)



Source: IEA analysis based on CME (2021), Henry Hub Natural Gas Futures Quotes; Dutch TTF Natural Gas Month Futures Settlements; CME Group (2021), LNG Japan/Korea Marker (Platts) Futures Settlements; EIA (2021), Henry Hub Natural Gas Spot Price; ICIS (2021), ICIS LNG Edge; Powernext (2021), Spot Market Data.

2022: At the start of 2022, the natural gas market, particularly in Europe, is still uncertain in terms of price and supply, as the market is still tight compared to the previous year due to limited supply flexibility from Russian pipelines and low storage levels, as well as temperature fluctuations (IEA, 2022). The effects are not limited to Europe, as markets throughout the world experience the painful consequences of high gas prices. Moreover, Expert 3 stated, the fear of a possible declaration of war between Russia and Ukraine was on everyone's minds at the time, which was another reason why the market was uncertain, demand was high, and prices were high.

1.5 The Ripple Effects of the Russia-Ukraine Conflict: Energy Security, Geopolitics, and the Global Economy

1.5.1 The Russia-Ukraine Conflict: Historical Roots and Putin's Quest for Power

On 24 February 2022, Russia launched a war against Ukraine, a neighboring independent nation. The causes of this war are rooted in history as Russia and Ukraine share political, economic, and cultural ties.

During the Cold War, Ukraine was a prominent and influential country within the Soviet Union. Since gaining independence, Ukraine has begun to align itself with Western institutions such as the EU and the NATO security alliance. The Council of Foreign Relations stated that Russia viewed Ukraine's independence as a sovereign state as a "historic mistake", a significant blow to its reputation abroad (Masters, 2023). Moreover, the Russian president Vladimir Putin's described the growing resentment of this NATO membership as a "humiliating imposition" and a "hostile act against Russia" - stems from his belief that the alliance has broken its 1990s promise not to expand into the territory of the former Soviet Union (Masters, 2023).

One of the driving forces behind the Vladimir Putin's decision to strike Ukraine was his concern that it would evolve into a prosperous nation embracing a "Western-style democracy," thereby extinguishing any chance of reestablishing an autocratic domain. Another contributing factor, as well as Putin's primary aim, was to reassert Russia's position as a leading world power (Nagourney, 2023).

The two countries also had strong trade links, with Russia being Ukraine's main supplier of gas and the latter having a vital gas pipeline network to Moscow and natural gas has been a source of friction between Russia and Ukraine for many years. About half of Ukraine's domestic gas needs are met by Russian supplies, giving Russia substantial political sway over Ukraine. In recent years, Russia has built alternative pipelines to bypass Ukraine, reducing Ukraine's leverage in negotiations and its revenues from transit fees (Baldwin, 2022). Disputes over natural gas have grown beyond simple business disputes and have become transnational political issues.

In 2006, Russia cut off gas supplies to Ukraine for three days over pricing and transit terms, which escalated into a political conflict (Kramer, 2006). In 2008, Russia ceased

supplies to Ukraine due to negotiations over outstanding debts and accusations of corruption and gas theft meant for Europe (Reuters, 2009). More recently, in 2021, Gazprom, a major global Russian energy company, made the decision to only supply the contractual minimum, depleting European reserves and exacerbating the ongoing "gas crunch" (Mazneva, 2021).

"While in the United States we talk about a Ukraine crisis, from the Russian standpoint this is a crisis in European security architecture."

- *Thomas Graham* (Arms Control Association, 2022)

1.5.2 The Far-Reaching Impacts of War: Energy, Food, and Economic Crisis

While this ongoing conflict has already caused human tragedy, it has also caused, or at least accelerated, an already fragile and volatile global energy market.

Russia is a big player in terms of resources and is often referred to as a "commodity powerhouse" because of its wealth of natural resources and its leading position in the export of metals, wheat, fertilizer, crude oil and natural gas (Bloomberg, 2022). As one of the world's leading producers and exporters of grains and oilseeds, Ukraine also occupies a significant place on the global agricultural scene (U.S. Department of Agriculture, 2022). Moreover, Russian pipelines enter Europe through Ukraine as well as Germany or Poland (Oxera, 2022). It is therefore not surprising that this war would have a huge impact on the global economy.

Food crisis:

As Russia and Ukraine are large producers and exporters of key food items but also fertilizers and energy, the conflict resulted in an important disruption to supply in the agricultural sector, leading to higher prices, pushing up the inflationary rate. The food crisis has hit low-income communities hardest, exacerbating problems of food insecurity and malnutrition. In a report published in May 2022 by the World Food Programme (WFP), a non-profit association, the war in Ukraine would be damaging the already alarmingly high food insecurity, causing to an estimated number of 345 million people to be food insecure or at high risk (World Food Programme, 2022)

Economic Crisis:

As well as damaging Ukraine, the conflict has shaken the global economic landscape, financial institutions, and geopolitical stability. Rising commodity prices, particularly for food and energy, higher inflation and uncertainty have hampered economic growth in developed countries, including the US, China, and several European countries (United Nations, 2022). Less developed countries in Europe and East Asia saw their economies collapse just months after the fighting began.

Geopolitical Crisis and The Weaponization of Natural Gas:

The international community has put political pressure on the Russian government. Trade sanctions imposed on Russia by the United States and the European Union have hurt the Russian economy, strained relations between Russia and the West, and increased tensions (KPMG, 2022).

Russia's prominence in the energy industry allows it to pursue a strategy known as 'resource nationalism', using its abundant natural resources, particularly oil and gas, to exert geopolitical influence. This strategy is realized through increased control over its resources through Transneft and Gazprom, two state-controlled companies that allow Russia to exert greater influence over the energy market. By owning these companies, Russia not only maintains its global leadership position, but also uses its resources as strategic and political tools - often referred to as “political weapons” - in its dealings with numerous NATO and European countries (Ghaleb, 2011). Europe's dependence on Russian gas gives Russia a significant advantage in negotiations. Consequently, gas has been used as a pressure tactic and even as a form of blackmail, escalating the critical nature of the situation (Boute, 2022).

Energy Crisis:

The conflict has severely disrupted energy supplies as gas from Russia has been cut off to Ukraine, affecting the flow of gas to Europe, pushing energy prices to record levels and raising concerns about Europe's energy security.

Natural gas is a major issue in the Russia-Ukraine conflict. As mentioned above, Ukraine is very important for the transit of Russian natural gas to Europe, accounting for about a quarter of Europe's imports. The gas is transported via four main routes: Nord Stream,

Yamal (through Poland), Ukraine and Turkstream (through Turkey). These routes are at the center of the current tensions.

All these crises together emphasized the vulnerability of Europe's gas supply and energy security and the need for diversification to ensure reliable access to energy resources (European Parliament, 2022).

Although this issue has been highlighted before, Europe's dependence has grown over the years and does not seem to have been adequately addressed. The combination of declining domestic gas production, the closure of coal-fired power plants and the shift to renewable energy sources are the reasons for Europe's dependence. However, the European Union did not seem concerned about issues raised by some, such as the development of the Nord Stream 2 undersea pipeline to Germany, which would have increased Europe's dependence on Russian gas and made the region more vulnerable to political pressure, as occurred amid the war (NBC, 2021). Russia's Gazprom actually reduced the amount of natural gas transported through this pipeline later in 2022, putting even more pressure on the EU's energy security (Chambers, 2022). In addition, the high cost of building new pipelines and the lack of alternative suppliers have hampered Europe's efforts to diversify its gas supply sources (Clifford, 2022).

1.5.3 The European Union's Response to Rising Gas Prices and Reduced Russian Supply

The European Council stated in March 2022 that the EU should "phase out its dependence on Russian gas, oil, and coal imports as soon as possible". During the year, pipeline gas imports from Russia did indeed fall significantly from 41% to 9% at the end of the year. By reducing its dependence on Russian energy, the EU could increase its energy security and reduce its vulnerability to external pressure from Russia (European Council, 2022).

Some of the measures taken by the European Union to address its challenges, mainly to diversify its gas supply sources and reduce its dependence on Russian gas and increase its energy security, as well as to protect its economy can be found in Appendix 3.

1.5.4 Navigating the Turbulence: Price Levels, Volatility, and Market Liquidity in the European Natural Gas Market Amid the Russia-Ukraine Conflict

Many types of commodities have been affected by Russia's war in Ukraine, causing huge price rises and volatility in the markets. Indeed, a study of 15 "typical commodity futures indices" showed that the risk of volatility in commodity markets increased significantly following the Russia-Ukraine conflict. In particular, agricultural and energy markets proved to be more sensitive to the conflict, as shown in Figures 8 and 9 (Fang, Zhiquan, 2022).

Although the world energy market was already "stretched" by inflationary pressures before the war, the growing fear of such an eventuality was enough to make the market react and, as Expert 3 believes, sometimes overreact to certain news, resulting in extreme volatility[10].

Price level analysis

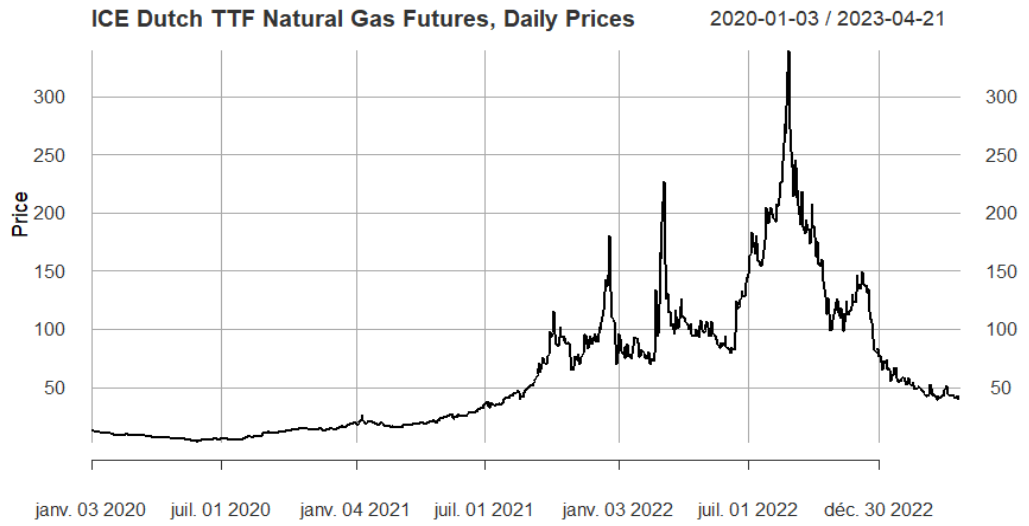
Short-term commodity price fluctuations are influenced by numerous factors, including natural disasters, political events and government actions (Deloitte, 2013).

The conflict between Ukraine and Russia has placed the already tight European natural gas market at the center of an energy crisis characterized by record high prices and significant disruptions along the supply chain (Adolfsen et al., 2022).

The chart below provides a detailed analysis of the daily prices of Dutch TTF Natural Gas month-ahead futures extracted from the ICE Futures Exchange, highlighting the main trends and fluctuations from 2020 to 2022.

[10] See Chapter 2, Section "The Impact of Global Events on the Natural Gas Market: From COVID-19 to Supply Shortages and Geopolitical Tensions".

Figure 10 - Daily Prices of Dutch TTF Natural Gas Month-Ahead Futures (2020-2023)



Source: own graph, data collected from the Intercontinental Exchange (ICE)

Note: prices are expressed in EUR/MWh

2020: Throughout the year, the Dutch TTF futures market showed relative stability, with prices remaining comparatively low. In January, prices started at 12 EUR/MWh and showed a modest upward trend, closing the year at 19 EUR/MWh.

2021: This year saw a more pronounced upward trend in response to increased global demand, a consequence of the economic recovery from the pandemic. According to Expert 4, the Asian market was absorbing a lot of LNG, making the prices of TTF increase because they are competitive market. Also, low storage levels, combined with concerns about a potential storage shortfall and a looming energy crisis, pushed prices up further during the summer. These elevated prices continued through to the end of the year, fueled by additional macroeconomic concerns. The December closing price reached an impressive 180 EUR/MWh, a 900% increase on the 18 EUR/MWh traded at the end of March.

2022: Characterized by drastic price fluctuations and record highs, 2022 will be a turbulent year for the European natural gas market.

Despite relatively mild winter temperatures, gas prices surged due to supply-side factors. At the beginning of March, gas stocks were well below average, prompting Europe to increase imports and reduce consumption during the summer to replenish reserves before the onset of winter. At the same time, the growing economic discord between the EU and Russia threatened the potential reduction or complete shutdown of pipeline flows, either through sanctions or retaliation. As a result, the EU was unable to build up sufficient stocks, with the benchmark Dutch TTF futures reaching a record price of 227 EUR/MWh.

The escalation of tensions and uncertainties can be seen in the numerous price movements so far. The second quarter of 2022 was particularly volatile, coinciding with the start of the Russia-Ukraine conflict. In fact, in May 2022, Russia decided to cut gas supplies to Europe, even though it generates a lot of revenue for the country. As a key input for power generation in Europe, this has contributed to energy crises in some countries, including Germany.

In addition, reliance on LNG imports has added another layer of volatility to the market, as LNG prices are influenced by global market conditions, including demand from other regions (Oxera, 2022). In June 2022, EU countries agreed on measures to secure energy supplies and protect end consumers from rising prices[11]. The average price for the second quarter rose to around 100 EUR/MWh, more than five times the average for the same quarter last year. Although prices eventually fell below 100 EUR/MWh, the market turbulence was far from over. In August 2022, prices broke through the 200 EUR/MWh mark again due to a combination of a sharp reduction in Russian pipeline supplies to the EU due to the shutdown of Nord Stream 1 and governments rushing to fill their gas storage facilities ahead of the winter season (Liboreiro, 2022).

In September 2022, following the discovery of leaks in Nord Stream 1 and Nord Stream 2, the benchmark reached a new record high of 339 EUR/MWh (Chestney, 2022). By

[11] See Chapter 2, Section 1.4.5 “European Energy Policy and Dependency on Russia: Challenges and Opportunities for Greater Energy Security and Sustainability”.

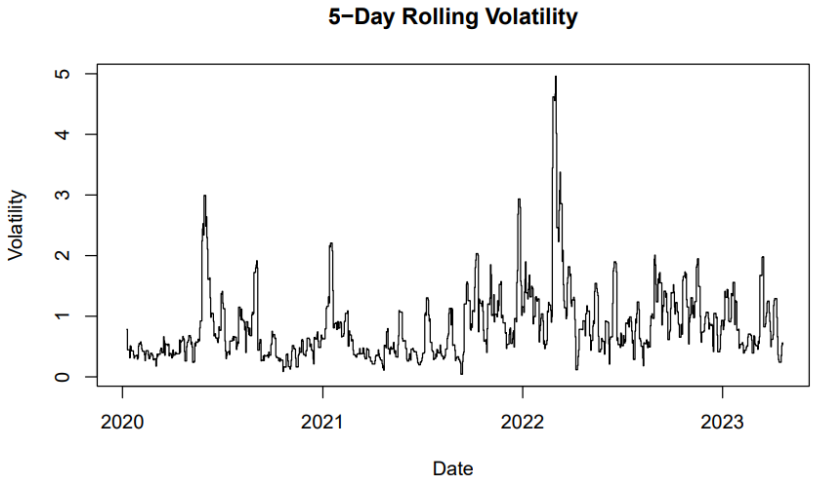
October 2022, around 80% of Russian supply had been cut but the level of European natural gas reserves had reached 90%, putting downward pressure on prices (European Council, 2023).

Volatility

Periods of high volatility have occurred in the past, but they were less frequent and short-term fluctuations, which Expert 1 described as " road accidents". However, since the beginning of 2022, volatility seems to be recurring and more pronounced, as illustrated in the chart below, which shows the daily volatility of the Dutch TTF Natural Gas.

The highest peak of volatility happened in March 2022, precisely when the war began, pushing the liberalized system to its extreme limits, increasing financial pressure on market participants and the risk of defaults, limiting the number of active market participants and resulting in further volatility (Oxera, 2022).

Figure 11 - 5-day Rolling Volatility Dutch TTF Natural Gas (2020-2022)



Source: own graph, data collected from the Intercontinental Exchange (ICE)

Note: Low volatility levels (0 to 1): When the chart shows values close to 0, it indicates that the market is experiencing low volatility, which means there are minimal fluctuations in the natural gas prices, suggesting a stable market with limited uncertainty. Moderate volatility levels (1 to 3): Values in this range represent moderate volatility, suggesting that there are some fluctuations in natural gas futures prices, but not at extreme levels. High volatility levels (3 to 5): When the chart shows values closer to 5, it indicates high volatility in the market, which means there are significant fluctuations in natural gas futures prices. This suggests increased uncertainty and potential stress in the market, possibly driven by major events, supply disruptions, or geopolitical tensions.

2020: TTF natural gas prices show low volatility, ranging between 0 and 1, due to the relative market stability and low prices. The sharp increase in volatility towards the middle of the year is due to the extreme fall in prices over a few weeks. However, as prices remained relatively stable throughout the year, with a slight upward trend, the market experienced reasonable volatility.

2021: The beginning of the year experienced a slight increase in volatility, mainly due to the recovery of demand from the global pandemic. The following months, price fluctuations seemed to be less frequent and rapid, showing a more stable market. The rest of the year shows an increase in volatility due to the concerns about storage levels. Indeed, according to Expert 4, volatility started to increase more significantly in the fourth quarter of this year, mainly due to low gas stocks for the upcoming winter. Prices followed an upward trend, starting from 18 EUR/MWh in March and peaking at 180 EUR/MWh in December.

2022: This year shows the highest volatility and record high prices. Some reasons for this increased volatility include:

- Russia-Ukraine conflict: supply disruptions
- Supply-side factors: reduced gas supplies from Gazprom through the North Steam pipelines, fire incident in one of the largest US export plants producing liquefied natural gas (LNG)
- Dependence of Europe on LNG imports[12]

All these events have resulted in a tight, uncertain and highly volatile market that reacts to these many external factors or events that influence natural gas prices. On the graph, this is represented by accelerating and tightening “swings” over the year. Rapid changes in volatility indicate a market that reacts quickly to various influencing factors or events, causing the price of natural gas to fluctuate significantly.

The lower volatility in certain periods can be explained by the following factors:

[12] See Chapter 2, Section 1.5.2 “The Far-Reaching Impacts of War: Energy, Food, and Economic Crisis” for a more detailed analysis.

- The EU's response to the energy crisis, including measures to secure energy supplies and protect end-consumers from rising prices
- Decreasing demand for LNG from Asian countries
- Mild winter
- New supply sources

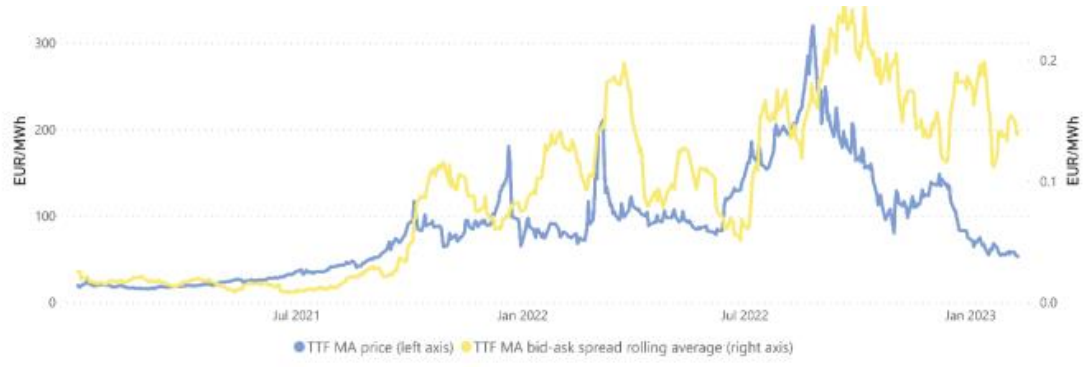
The market has now "cooled down", and Expert 4 declared, so he doubts that it will happen again, at least not on such a large scale. However, there are indications that the structure of the market has changed and may have completely reshaped the previously “quiet” market.

Liquidity

Liquidity is crucial to well-functioning markets, enabling quick trade execution by matching supply and demand. Measures of the liquidity of markets include the bid-ask spread, trading volume and the churn rate. Bid-ask spread measures liquidity by measuring the difference between the highest price a buyer is willing to pay (bid) and the lowest price a seller is willing to accept (ask). More liquid markets tend to have lower spreads and transaction costs (Oxera, 2022).

Figure 12 shows the evolution of the price of the TTF front-month futures contract, and its bid-ask spread, which allows an analysis of the relationship between price level and liquidity, as well as an insight into the behavior of market participants.

Figure 12 - Evolution of the TTF front-month hub product price and its bid-ask spread – 01 January 2021 – 09 February 2023 (EUR/MWh)



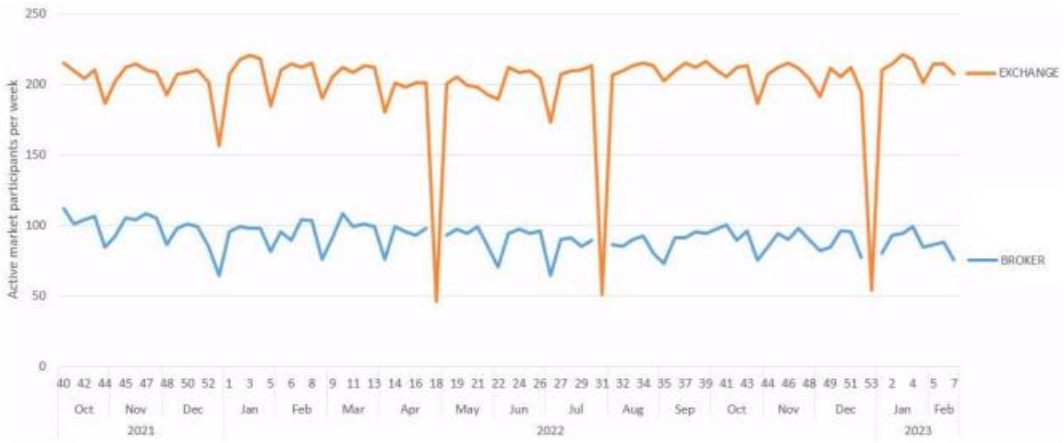
Source: ACER calculation based on ICIS Heren

As lower spreads are linked to lower transaction costs and higher market liquidity, the correlation of the price spread with total trading activity and the price of the front-month TTF seems to be relatively high. Indeed, as can be seen in the graph, from the fourth quarter of 2021 onwards, prices followed an upward trend and showed wider spreads. Previously, these had closely tracked the front-month TTF prices. Larger spreads indicate a reduction in trading volumes, driven by this increase in prices (ACER, 2023).

Active market participants began to feel insecure, and some withdrew from the market, which became more expensive due to margin requirements, leading to higher concentration, widening bid-ask spreads and thus lower market liquidity. With fewer buyers and sellers in the market, it becomes more difficult to match supply and demand (CME Group, no date).

To better understand the liquidity challenges that faced the TTF, it is important to look at the volume traded. Figure 13 shows the number of active participants trading Dutch TTF instruments on exchanges and brokers.

Figure 13 - The number of market participants trading TTF on energy exchanges and brokers – 01 October 2021 – 09 February 2023 (estimated on a weekly basis)

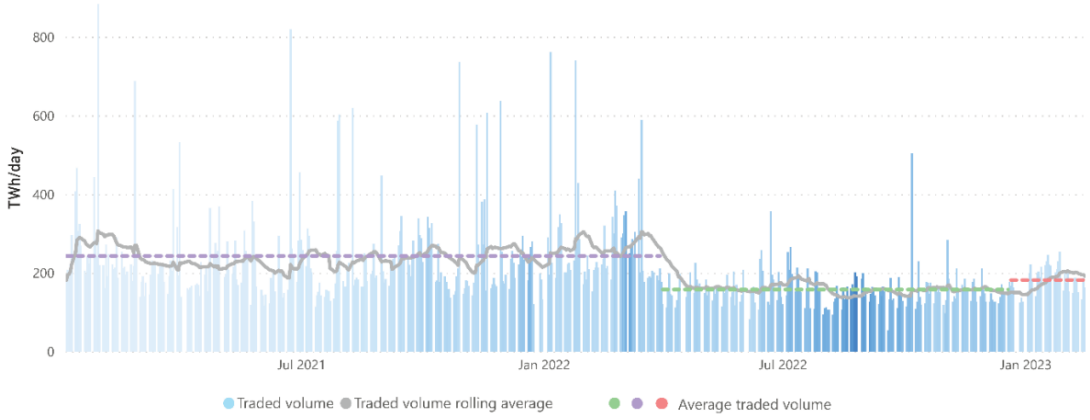


Source: ACER calculation based on REMIT data

Trading volume is directly influenced by the number of market participants: higher participation means higher trading volume, indicating a more liquid market. A larger number of participants also means greater market depth, i.e., the ability to handle large orders without significant impact on prices. Finally, more participants and therefore more liquidity mean that the market is more resilient, able to absorb shocks and bounce back more quickly (ACER, 2023).

Active participation does not seem to have changed dramatically over the period analyzed. across different organized markets (ICE Endex, EEX, Marex Spectron, GFI, etc.) and across different product types (day-ahead, month-ahead, etc.). However, a decrease in the number of participants was observed in 2022 levels. This reduction in participation is a direct result of the high price and volatile environment of the TTF market. Moreover, following the Russian invasion of Ukraine, the average trading volume fell below 160 TWh per day, a decrease from the pre-crisis 240 TWh traded daily, as shown in Figure 14 below.

Figure 14 - Exchange and brokered traded volumes at the TTF hub – 01 January 2021 – 15 February 2023 (TWh/day)



Source: ACER calculation based on REMIT

Note: The rolling average corresponds to the average trades concluded in the preceding 30 days on a rolling basis. The average traded volumes correspond to averages observed between 1 January 2022 – 31 March 2022 (purple); 1 April 2022 – 19 December 2022 (green); and 20 December 2022 – 15 February 2023 (red). The intensity of the colour of the bars is related to the TTF front-month price, with darker tones corresponding to higher price levels.

Possible reasons for this decline include that traders needed fewer contracts to maintain the same level of risk and faced higher collateral requirements and trading costs, as explained by Expert 2. The impact on margin requirements will be discussed later in this report.

The market correction mechanism (MCM) put in place in response to the extreme high prices during the Russian conflict by the European Union to cap the price of TTF gas price seemed to have had a moderate impact on the liquidity of the market as they are still below pre-crisis level (ACER, 2023).

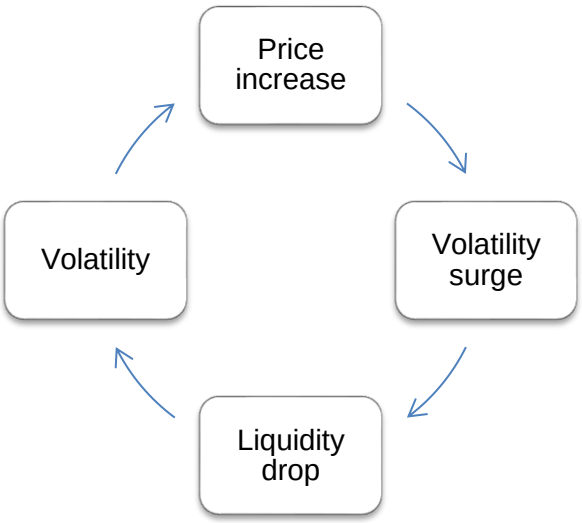
The results of my interview with Expert 4 support the point that traders indeed decided to reduce their exposure, thereby reducing the volume traded, but since "depending on the size of the company, one cannot just close the positions within a couple of days", traders mostly decided to pay the margin calls demanded by the exchanges by handing over cash or by borrowing from banks and not to take full advantage of the opportunity of higher prices. What has happened to the volumes of trading, and therefore the liquidity of the market, according to his expertise and analysis, is that new entrants seem to have entered the market, such as hedge funds looking to invest their capital in an opportunistic market.

Based on discussions with industry experts, the market should stabilize and not face such volatility in the future. However, the market should be prepared for short-term volatility to return as Europe is now competing for LNG with other buyers in the world, such as China, Korea or Brazil, and if there is a disruption in LNG supply, there would be a supply shock and volatility would return. In addition, the uncertainty of the weather due to climate change could bring back volatility if we are faced not only with colder winters but also with warmer summers.

Moreover, what could be argued is that the European natural gas market may become increasingly dominated by larger traders who are better able to absorb and manage the risks associated with existing volatility and liquidity issues. This concentration of trading power could create an environment that discourages smaller market participants from entering or remaining active in the market, further reducing liquidity and exacerbating volatility.

Price levels, volatility and market liquidity are all interrelated, creating a "vicious circle" as shown in Figure 15 below.

Figure 15 - Liquidity "vicious cycle"



Source: own graph

The escalating conflict led to higher prices, which in turn increased volatility, highlighting the market's sensitivity to external factors. This increased volatility contributed to liquidity problems as market participants reduced their exposure or withdrew from the market due to uncertainty. As a result, the reduced liquidity further fueled volatility and sustained higher prices.

In this complex and interconnected system, each factor had a direct impact on the others, highlighting the delicate balance that governs the natural gas market in times of crisis.

1.5.5 Correlation and Transition in Energy Benchmarks: TTF Gas Prices versus Brent Crude Oil Prices

The relationship between TTF gas prices and Brent crude oil prices show a significant correlation, as shown in Figures 16 and 17, despite the declining use of oil indexation in long-term contracts[13].

[13] See Chapter 1, Section 1.2.1 " Long-term contracts: oil indexation and take-or-pay clauses".

In the first half of 2021, the Dutch Title Transfer Facility (TTF) price emerged as a significant rival to Brent crude, with more buyers, trading companies and portfolio suppliers in Asia linking their transactions to this benchmark.

The declining use of oil indexation in long-term contracts could potentially affect and weaker this correlation in the future, as more buyers and traders shift their focus to benchmarks that better reflect gas market fundamentals[14]. However, the high volatility of the TTF towards the end of the year led some buyers to reassess this relationship, reaffirming the essential role of Brent in pricing LNG term contracts for the time being (Rou Urn, Chua, 2022).

[14] See Chapter 2, Section 1.5.3 “The role of LNG in Europe's energy mix and the global natural gas market".

Chapter 3: Margin Calls in Commodity Trading: Strategies and Solutions for Managing Financial Risk and Liquidity

1.6 The Unique Balance Sheet Structure, Financial Dynamics and Funding Strategies of Commodity Trading Firms

Commodity trading firms (CTFs) are intermediaries in the supply chain, linking commodity producers with processors and end users. They play a crucial role in the economy by identifying and optimizing commodity transformations that reconcile mismatches between supply and demand. These firms operate in highly capital-intensive markets, which necessitates a particular focus on liquidity management and risk management (Pirrong, 2015).

The balance sheet structure of CTFs is unique due to the nature of their business activities. CTFs indeed operate in a very dynamic environment, involving short-term transactions or the use of short-term financial instruments to hedge against price fluctuations. These derivative contracts are usually marked-to-market daily, creating short-term assets and liabilities on the balance sheet.

Moreover, CTFs may prefer short-term financing to maintain flexibility in managing their cash flows and to adjust their capital structure in response to changing market conditions. This preference can lead to a higher proportion of short-term liabilities, such as revolving credit facilities and short-term loans. Equity represents generally a small portion of a commodity trading firm’s balance sheet (Pirrong, 2015).

To better understand the complex and unique structure of a CTF's financial statements, a comprehensive analysis of the balance sheet structure of Trafigura, a leading global commodity trader in energy products, metals and minerals, is presented in Appendix 5.

Due to their significant capital requirements, CTFs mostly rely on borrowing from various sources to finance their trading activities, for example, using short-term bank debt to finance their current assets such as inventories (Pirrong, 2015). Financial institutions are

essential partners for commodity trading companies, providing the funding needed for their capital-intensive operations - sourcing, storing, blending, and delivering commodities around the world, as well as investing in infrastructure to improve operational efficiency - regardless of market conditions. Banks are often willing to lend to CTFs because commodities can be used as collateral, a process known as "commodity-backed financing". It is worth noting, however, that using commodities as collateral doesn't eliminate the risks associated with lending, especially in a volatile environment.

Some common financing methods include letter of credit, borrowing base, repurchase agreements, or syndicated prepayment deals. Large trading companies, such as Trafigura, typically choose to diversify both in terms of funding sources and structures (Trafigura, 2015). The financing methods listed are explained in more detail in Appendix 5.

1.7 Margining in Commodity Trading: Risk Management, Liquidity Challenges, and Mitigating Strategies

The practice of margining, as applied to futures derivatives, is a risk management mechanism involving the provision of collateral to secure derivative contracts (CME Group, no date). For commodity trading firms, margin requirements can be influenced by several factors, such as the creditworthiness of the borrower, the type of commodity being financed, and market conditions (Basel Committee on Banking Supervision, 2021).

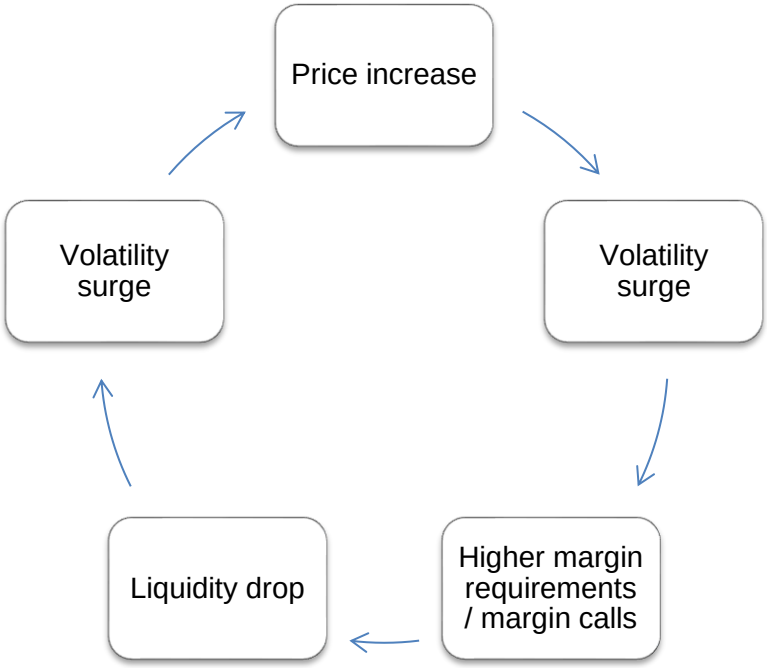
Futures trading involves two types of margins: initial margin and maintenance margin. The initial margin is required to open a futures position and is set by the exchange or clearing house. It generally ranges from 3% to 12% and can be met with cash or eligible securities. Maintenance margin, also known as mark-to-market margin, ensures that the minimum account balance is maintained in response to daily price movements. Traders can provide cash, securities, or other collateral to meet margin requirements (CME Group no date).

The volatility-dependent nature of margin requirements in futures trading means that clearing houses may periodically issue margin calls to traders, requesting additional funds to maintain minimum account balances when the participant’s experience an adverse movement in its position (Basel Committee on Banking Supervision, 2021).

Margin calls are designed to protect clearing members and the central counterparty (CCP) from potential losses due to counterparty default.

The principles of volatility, price fluctuation and margin requirements are closely interlinked, each influencing the other. This relationship creates a self-perpetuating cycle, often referred to as a 'vicious circle'. Figure 18 below expands on Figure 15 to further illustrate the interrelationship between these three concepts.

Figure 18 - Relationship between volatility, price movements and margin requirements, a "vicious cycle"



Source: own graph

When price volatility increases, it represents greater risk and uncertainty in the market. When prices rise, volatility rises, which increases the margin requirements of CCPs. This is because higher volatility can lead to larger price swings, increasing the potential for significant losses. To protect against the risk of a counterparty being unable to meet its obligations due to these losses, a CCP may issue a margin call, requiring the counterparty to deposit additional funds in its account to meet the increased margin requirements.

Margin changes can affect futures market liquidity. Research has shown that large margin changes reduce liquidity in grain, soft commodities, and energy markets. A 10% increase in margin requirements results in an average liquidity reduction of 5.24% over a 20-day horizon (Daskalaki, Skiadopoulos, 2015).

Margin requirements also play a critical role in mitigating the risks associated with commodity trade finance transactions. They act as a safeguard for lenders by ensuring that a certain amount of collateral is posted to cover potential losses arising from price volatility in the commodity market (Basel Committee on Banking Supervision, 2021).

However, margin calls can put CTFs under pressure during periods of high price volatility, as failure to meet margin calls can lead to forced liquidation of positions or even default on credit facilities. To maintain an adequate and sufficient cash position (liquidity) and to ensure that they have sufficient funds to meet increased margin calls, CTFs allocate cash to contingency funds and work closely with banks and use financial arrangements such as revolving credit facilities (RCFs), borrowing bases or syndication to secure the necessary funds to meet margin calls.

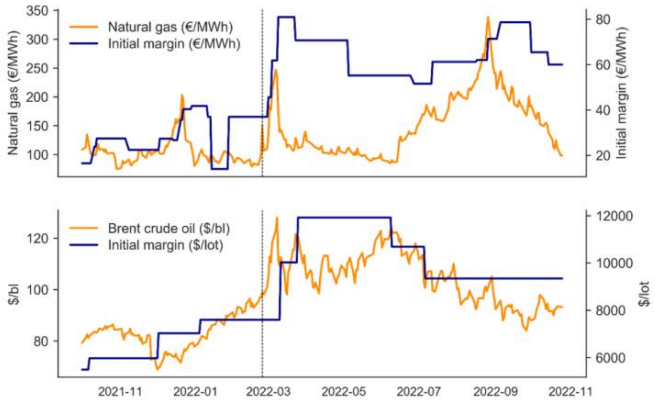
1.8 Margin Pressures in the European Natural Gas Market

The previous analysis of the Dutch TTF concluded that 2022 was characterized by high prices, high volatility and challenged market liquidity. The vicious circle began; margin calls were triggered. Due to the high value of their transaction and the magnitude of the volatility, the amount of margin calls in 2022 was colossal, putting pressure on the liquidity and solvency of CTFs (Ferrara et al. 2023).

In addition, CCPs increased their initial margin requirements, which are a percentage of the contract value. This increased the cost of trading and required CTFs to post additional cash or appropriate securities as collateral (Ferrara et al. 2023).

For the Dutch TTF, the initial margin on ICE was multiplied by 6 from January to April 2022 and remained at a high level for the rest of the year, as shown in Figure 19.

Figure 19 - Prices and margin scanning range of front-end futures: TTF gas and Brent oil



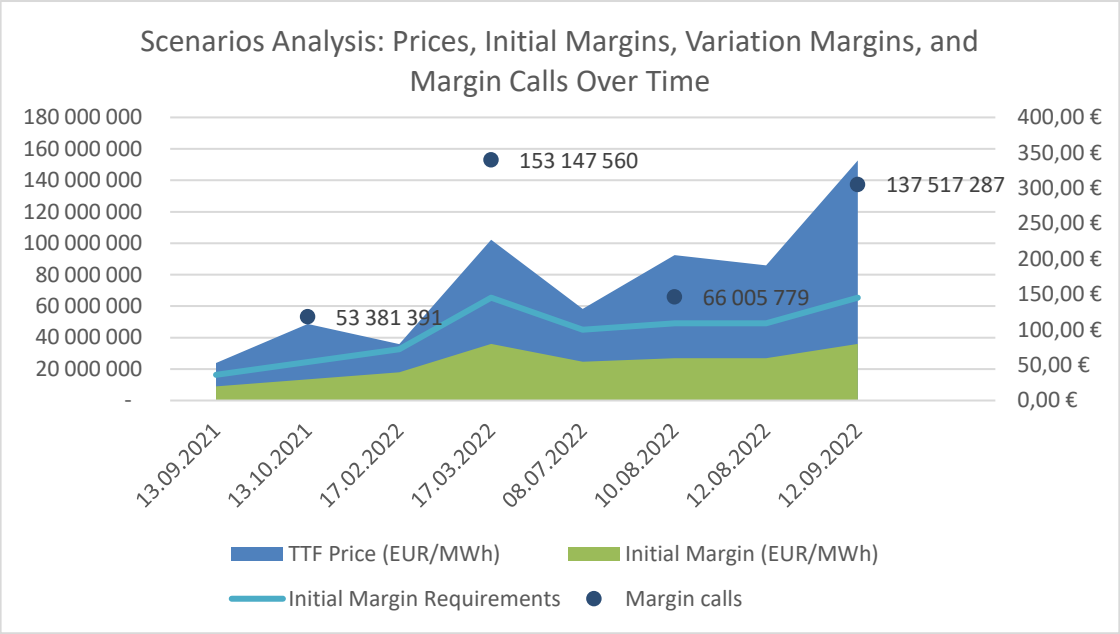
Sources: Bloomberg, ICE Clear Europe and Bank calculations

To illustrate the magnitude of this problematic and challenging situation, let's look at the graph below, which is the continuity of the example of SarahTrading, that represents the interplay of the variables 1) prices, 2) initial margin requirements, 2) margin calls over time. For this scenario analysis, specific time points of month-ahead Dutch TTF prices were selected to compare the evolution and relationship of these variables[15].

As can be seen in this scenario analysis, an increase in gas prices leads to a corresponding rise in the contract value, which, in turn, results in higher initial margin requirements. The calculations demonstrate that due to the extreme increase in prices, the changes in contract value (or losses on the short futures position) exceed the initial margin posted, creating colossal margin calls.

[15] The detailed calculation can be found in Appendix 6.

Appendix 6 - Scenarios Analysis: Prices, Initial Margins, Variation Margins, and Margin Calls Over Time



Source: own graph, data collected from the Intercontinental Exchange (ICE), Bloomberg, and Bank calculations

When prices rise, variation margin is paid by those with short positions on the exchange, which are usually offset by other market participants such as speculators (Ferrara et al. 2023).

As SarahTrading owns the physical cargo, it cannot consider exiting its position on the exchange. Furthermore, as the sale of its cargo is not immediate, it cannot consider selling its assets and is therefore obliged to meet its margin calls. The timing mismatch between the margin calls and the sale of the physical product creates a liquidity squeeze.

Real-life examples of margin calls faced by commodity trading firms (CTFs) illustrate the financial difficulties and liquidity pressures faced during volatile market periods in 2022. Here are two notable examples:

- Shell: Shell reportedly used $7 billion of its cash flow to cover margin calls in its oil and gas position as early as April 2022 (Reuters, 2022). This demonstrates the significant financial commitment required to meet margin requirements and highlights the impact of market volatility on CTF liquidity management.

- Glencore: Glencore, another prominent commodity trader, reported a net increase of $2.4 billion in net margin calls paid and an additional $2.2 billion in initial margin requirements (Glencore, 2022). These figures illustrate the scale of margin-related obligations faced by CTFs during periods of heightened volatility and highlight the importance of managing liquidity and collateral effectively.

It is important to emphasize that the impact of these margin calls went beyond the realm of traders. Indeed, they also had a significant impact on European utilities and energy companies, as shown in Figure 20.

The situation reached extreme levels when the entire energy trading industry faced an estimated $1.5 trillion of margin calls in September 2022, putting pressure on governments to intervene. In addition to the measures to increase its energy security, the European Union has taken additional measures to protect the energy sector[16]. For example, at the request of the European Commission, the European Securities and Markets Authority (ESMA) set temporary 'market fixes' for market participants to provide collateral other than cash, and conditions under which bank guarantees could be accepted. The EU's financial markets and securities regulator was concerned that the increase in initial margin may have contributed to a pro-cyclical effect, potentially exacerbating market volatility, and therefore highlighted the need for regulatory or supervisory action (Jones, 2022).

The European Union also spent a lot of effort and money to help households and businesses, the end consumers, not be hit too hard by high energy prices (Jones, Rashad, 2022).

[16] See Chapter 2, Section “1.5.3The European Union's Response to Rising Gas Prices and Reduced Russian Supply” and Appendix 3.

1.9 CTFs' Liquidity Strategies and Financing Challenges Amid Margin Calls

In this section we explore the intricacies of liquidity strategies and the funding challenges faced by commodity trading firms (CTFs) in the wake of increased margin calls. We examine how CTFs have adapted to these conditions, focusing on the use of credit lines, syndicated loans and risk management tactics. The discussion also looks at the impact of regulatory constraints and market dynamics on trading operations, providing insights into the resilience of CTFs in a turbulent market environment.

As CTFs rely mostly on credit lines with banks for their liquidity needs, when margin calls increased, traders sought to increase their borrowing capacity in addition to using their existing cash buffers (Furtuna et al. 2022). As explained by Experts 1 and 2, revolving credit facilities (RCFs), bilateral lines and borrowing bases were commonly used, especially during the critical situations of record high prices and volatility in 2022.

When large sums of money were needed, syndication was used, where several banks came together to provide the necessary funds. Major banks with exposure to the commodities trading industry, such as ING, Societe Generale, Rabobank, Credit Agricole, Groupe BPCE and UBS, acted as lenders in syndicated facilities to CTFs such as Trafigura, Glencore, Gunvor, Vitol and Mercuria Energy during the first wave of high volatility in March 2022 (Fitch Ratings, 2022).

An example of such intervention is the large CTF Trafigura, which reported in March 2022 that it had signed a USD5.3 billion European syndicated revolving credit facility with 55 banks, which, according to the group's CFO, "provides us [Trafigura] with sustainable access to liquidity and capital, including during periods of extreme volatility in the global economy and at times of profound geopolitical tensions" (Trafigura Group, 2022).

In addition, Trafigura reported in the same month that it had signed a USD 1.2 billion liquidity facility with four banks in record time, to be used for “general corporate purposes” to “safely navigate through unprecedented market conditions and extreme volatility in the global economy as a result of the crisis in Ukraine” (Trafigura Group, 2022).

Although it is a lucrative business for banks, banks and governments have imposed sanctions and restrictions on transactions involving Russia, making it difficult for traders dealing in Russian gas to obtain credit during the war. The risky and uncertain

environment also made it difficult for banks to sell shares when they were involved in syndication (Expert 2). As a result, banks became more risk-averse in terms of taking on new clients and financing transactions, as Expert 1 explains: "We have seen a decrease in risk appetite and an increase in selectivity in operations. At the beginning of the war, when there was a lot of demand to finance margin calls, we decided not to take on new clients or new risks to better control the flow of operations".

Moreover, some traders were moving away from exchanges and into over the counter (OTC) trading because of the absence of margin requirements, a view supported by interviews with industry experts (Furtuna et al. 2022). In addition, to cope with sudden margin calls, CTFs used Exchange for Physical (EFP) trades[17]. Although this involves counterparty risk, which is not the case on exchanges, this solution was less costly for traders than facing margin requirements and the cost of borrowing from banks (Expert 4).

Evidence of the impact of such extreme market conditions suggests that energy companies need to develop strategies to better meet the liquidity needs arising from their activities in the energy market. Although these events are recent and, for some, still unfolding, key players in the commodity trading sector have already adapted their liquidity management strategies, financial solutions, and business operations in response to commodity price dynamics (Expert 2).

“Everyone in this room has been working towards adjusting their liquidity, their financial solutions, but also adapting the size of their business in view of commodity prices.”

- *Muriel Schwab, Chief Financial Officer, Gunvor* (Dempsey, Hume, 2022)

[17] EFP trades allow traders to switch between a position in the physical commodity and a position in futures, offering flexibility for managing their exposures. They are typically used by traders who have a physical commodity that they want to hedge or swap for a futures position without going through the traditional process of buying or selling on the open futures market.

Let's look at some real-life scenarios of CTF adaptation actions to understand how organizations have navigated through the turbulence.

Glencore reported in its 2022 annual report an additional $2.2 billion added to working capital due to increases in initial margin requirements from various commodity exchanges and margin calls paid (Glencore, 2022).

BP's 2022 annual report showed an increase in funds set aside to meet margin requirements on trading exchanges and cash balances subject to exchange controls. As a further liquidity measure, BP maintained "an appropriate level of cash and cash equivalents of $29.2 billion" invested in readily available short-term investments. In addition, the company emphasizes in its report the need to assess whether the potential impact of margin calls on derivative contracts used to manage risks associated with the physical portfolio have been adequately considered in light of the price volatility in the market (BP, 2022).

Trafigura's response to the margin calls and fears of a cash drain was to secure USD 2.3 billion of additional liquidity from a number of key lenders to provide a cash buffer. They also reported a reduction in their trading volumes, focusing on higher margin business. As part of a prudent approach, Trafigura's risk management has adopted additional alternative strategies to manage its risks effectively, assessing and managing the liquidity risks and costs associated with hedging in the futures markets, which is now an even greater part of the company's responsibility (Trafigura Group, 2023).

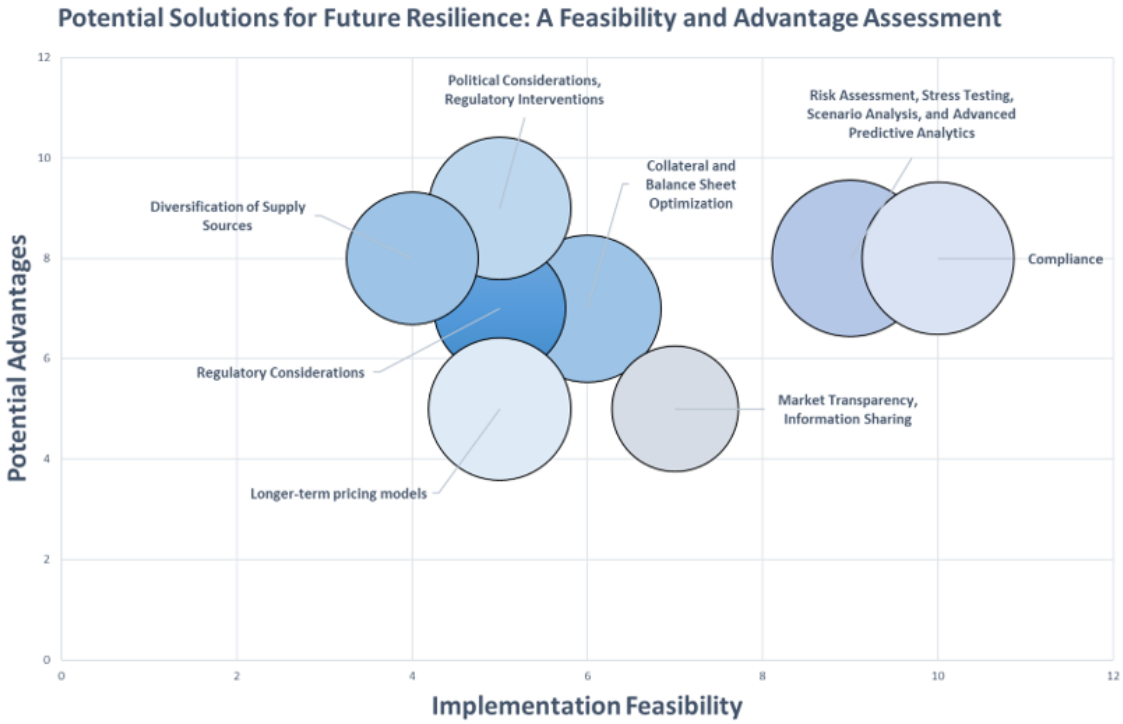
“That perhaps is the biggest learning of the past year – a greater awareness of what can happen in financial markets and the impact that can have on our day-to-day business.”

- Mike Wainwright Executive Director and COO of Trafigura (Trafigura Group, 2023)

1.10 Exploring Solutions for Future Resilience

In this final section, we consider potential solutions that can be employed to prevent, reduce, and minimize the impact of margin calls on the liquidity management of commodity trading firms. Drawing on insights from interviews and industry perspectives, we examine a range of strategies to improve the resilience of CTFs and mitigate liquidity shortfalls caused by margin calls.

Figure 21 - Potential Solutions for Future Resilience: A Feasibility and Advantage Assessment



Source: own graph

This chart provides a visual representation of the feasibility, potential benefits, and overall value of different strategies for managing future market volatility and extreme margin calls. It can help these firms make more informed decisions about which strategies can better adapt to and anticipate extreme market conditions.

One of these strategies is to diversify supply sources, both geographically and among suppliers. This approach not only secures the supply chain but also mitigates the risk of price spikes caused by geopolitical issues.

In an industry that has traditionally been less regulated, the review of regulatory requirements, in particular the possible introduction of capital requirements, could be an important safeguard against potential liquidity crunch scenarios. While implementation may be complex, the potential benefits are significant.

An increased and constant political presence can serve as an essential measure. Although natural gas trading is more of a free market, it offers protection against extreme price spikes and security of energy supply to reduce systemic risk.

In addition, increasing market transparency and promoting information sharing can create a more conducive environment for risk assessment. It would also facilitate timely responses to potential liquidity shortages, thereby enhancing the stability of the industry.

An effective risk management and liquidity strategy also requires efficient collateral management and balance sheet optimization systems. These would not only enhance the financial strength of CTFs, but also provide avenues to facilitate the management of margin requirements.

In addition, trading support and compliance should not be overlooked to ensure that trading activities comply with relevant regulations and internal policies. Implementing a strong and well-functioning middle office structure and systems such as a “risk limit system” is key to ensuring that the risks associated with trading are effectively managed.

CTFs could also consider continuing to use longer-term contracts. Despite the potential reduction in flexibility, these contracts offer the possibility of more predictable and stable cash flows. This strategy can effectively dampen the impact of short-term price fluctuations, thereby strengthening the financial stability of firms.

Finally, the use of advanced forecasting techniques and real-time mitigation measures such as stress testing, scenario analysis and predictive analytics could serve as proactive risk mitigation tools. These methods would allow CTFs to better anticipate market uncertainties and potential margin call situations.

For a more detailed exploration of these strategies, their benefits, and their feasibility, refer to Appendix 7.

Conclusion

This research paper examined the reactions of the European natural gas market, more specifically the Dutch Title Transfer (TTF), to the disruptions caused by the war between Russia and Ukraine in 2022. The study analyzed the impact of these market conditions on the liquidity management of Commodity Trading Firms (CTFs). The study aimed to understand what CTFs put in place to deal with these challenges and propose solutions and strategies that could help these entities to better adapt, anticipate and mitigate the consequences of such a challenging market environment.

The evidence presented demonstrates the difficulties faced by CTFs in managing their natural gas market positions and liquidity during this period of extreme market conditions and the risk of liquidity shortages and financial stress. The previously inflexible and 'calm' European natural gas market was taken by surprise and experienced extreme price and volatility.

As the natural gas trading environment was disrupted, participants reacted by trading lower volumes, shifting from exchanges to OTC or trading EFPs. As CCPs and exchanges had no choice but to adjust their margin requirements to reflect the risk of default, trading costs rose to extreme levels. The colossal margin requirements and margin calls put a strain on all energy trading and put pressure on financial institutions and politicians to intervene to prevent a collapse, a situation where the “not too big to fail” nature of CTFs was called into question.

From a complete change in its security of supply to a price cap, the European Union has intervened in this rather private sector, an aid that can be seen as a stopgap measure, but a necessary one.

Moreover, financial institutions, such as banks, acted as "shock absorbers" in this energy crisis. Thanks to their flexible financing methods and cooperation, most CTFs were able to rely on them to finance the "extra cash" resulting from higher hedging costs and the time lag before selling the physical transaction.

Commodity trading companies have already adapted, probably taking a lesson from the energy crisis. One of the most important changes has been a review of their balance sheet structure, with more cash set aside as a reserve for future potential market disruptions. Indeed, the findings of this paper highlight the importance of proactive liquidity management and risk mitigation strategies for CTFs to be prepared for extreme market conditions.

The solutions identified provide valuable insights for CTFs to improve their liquidity resilience and mitigate the impact of margin calls, ultimately contributing to their long-term success and sustainability in the natural gas trading industry.

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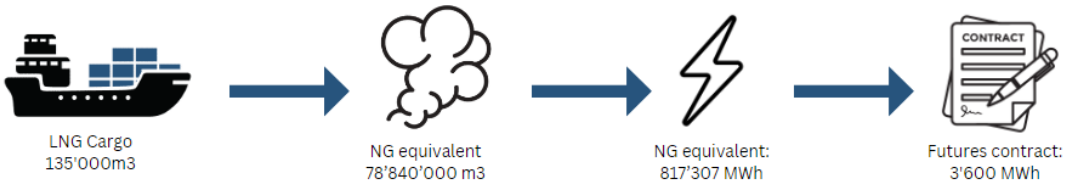
Appendix 1: Hedging in Natural Gas Markets: A Practical Example



First, given that LNG reduces the volume of natural gas by 584 times, the volume of the natural gas is:

Total volume of natural gas: 135'000 m^3 * 584 = 78'840'000 m^3

Total volume of natural gas in MMBtu: 78'840'000 m^3 / 28.263682 m^3[18] ≈ 2'789'445 MMBtu

Now, we can convert the total MMBtu to MWh using the given conversion factor (1 MMBtu = 0.2930 MWh):

Total volume of natural gas in MWh: 2'789'445 MMBtu * 0.2930 MWh/MMBtu = 817'307 MWh

The contract size for TTF futures traded on ICE is 5 MW in the contract period, with a duration of one month and 24 hours per day:

5 MW x 24 hours x 30 days = 3'600 MWh

Number of futures contracts = 817'307 MWh / 3'600 MWh ≈ 227 contracts

[18] 1 MMBtu = 28.263682 m3 of natural gas (Energy conversion calculators - U.S. Energy Information Administration (EIA), 2022)

Appendix 2: European Energy Policy and Dependency on Russia: Challenges and Opportunities for Greater Energy Security and Sustainability

United States: CFTC and the Dodd Frank Act

In the United States, the trading of commodity futures and other derivatives falls under a federal law, the Commodity Exchange Act (CEA), overseen and enforced by the independent the Commodity Futures Trading Commission (CFTC).

Following the 2008 financial crisis, the Dodd-Frank Act was implemented to enhance the CFTC's regulatory authority to supervise the swaps market.

European Union: MAR, EMIR and MiFID II

In the European Union, trading in gas derivatives is subject to various financial regulations designed to promote market integrity and investor protection, oversight, transparency, and enforcement.

Market Abuse Directive (MAD) and Market Abuse Regulation (MAR): are part of the European Union's efforts to prevent and combat market abuse in financial markets. MAD was originally aimed at maintaining market integrity and protecting investors but was replaced by MAR in 2016 to provide a more uniform and comprehensive set of rules. MAR extends its scope to cover different trading venues, strengthens market abuse provisions, clarifies the rules for participants and empowers the European Securities and Markets Authority (ESMA) and national authorities to improve supervision and enforcement. (European Parliament and Council of the European Union, 2015)

European Market Infrastructure and Regulation (EMIR): This regulation focuses on over the counter (OTC) derivatives, central counterparties (CCPs) and trade repositories. Its main objectives are to increase transparency, reduce systemic risk and improve risk management in the OTC derivatives market (European Parliament and Council of the European Union, 2012).

Markets in Financial Instruments Directive (MiFID II and MiFIR): These aim to create a more transparent, competitive, and integrated financial market, with better protection for

investors. MiFID II addresses issues such as market structure, high frequency trading, algorithmic trading and the provision of investment services. MiFIR complements MiFID II and focuses on aspects such as pre- and post-trade transparency, the obligation to trade on regulated platforms and transaction reporting to regulators (European Parliament, 2022).

TTF gas futures and options are classified as critical commodity derivatives and are therefore subject to MiFID position limits enforced by the Netherlands Authority for the Financial Markets (AFM). This regulatory framework is overseen by the European Securities and Market Authority (ESMA) and the relevant national competent authorities in each EU Member State. Exchanges also contribute to compliance by monitoring and supervising activities on their platforms (European Securities and Markets Authority, 2022).

In addition, gas derivatives trading is subject to energy market-specific regulations, including the Regulation on Wholesale Energy Market Integrity and Transparency (REMIT), which is overseen by the Agency for the Corporation of Energy Regulators (ACER). REMIT aims to maintain the integrity and transparency of the wholesale energy market in the European Union by focusing on the prevention of market manipulation, insider trading and other abusive practices in the electricity and gas markets (European Parliament and Council of the European Union, 2011).

Appendix 3: The European Union's Response to Rising Gas Prices and Reduced Russian Supply

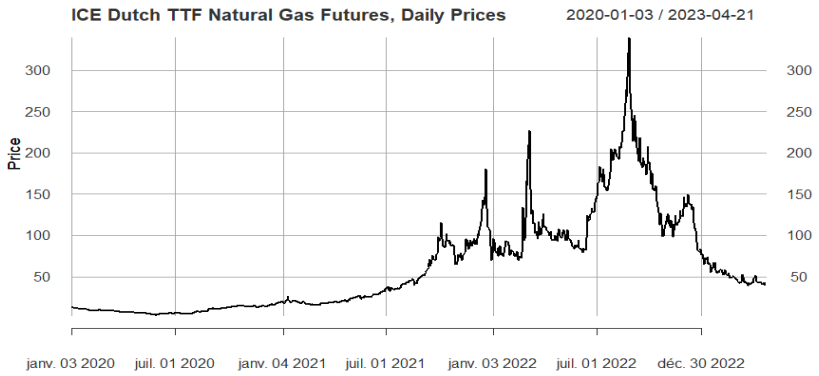
Some of the measures taken by the European Union to address its challenges, mainly to diversify its gas supply sources and reduce its dependence on Russian gas and increase its energy security, as well as to protect its economy, include:

1) Implementation of trade sanctions by the EU on Russia since March 2022, aiming to reduce Russian revenues from trade with the EU and undermine its ability to finance military operations in Ukraine (European Council, 2022).
2) Creation of a "joint purchasing" system by pooling demand, allowing EU countries (excluding Russia) to buy gas at lower prices and avoid competing with each other.
3) Extension of pipeline connections from other countries, such as Norway and Algeria, and development of the Southern Gas Corridor (Aitken, Langenbrunner, Zimmerman, 2022).
4) Establishment of a "solidarity agreement" among EU members to secure gas flows and avoid supply shortages (European Council, 2023).
5) Introduction of an "automatic" market correction mechanism to set a maximum price, a price cap, for TTF derivative contracts, to "limit episodes of excessive gas prices in the EU that do not reflect world market prices, while ensuring security of energy supply and the stability of financial markets" and to "protect citizens and the economy against excessively high gas prices", the Council announced in December 2022 (European Council, 2022).
6) Increase in LNG imports by 70% by 2022 to face Russian gas cuts. By accelerating the development of new LNG import terminals, the EU is focusing on diversifying its gas supply sources, allowing it to import LNG from various countries such as the United States, Qatar and Australia (Umbach, 2023).

Other measures taken by the European Union include increasing gas storage capacity, investing in renewable energy and improving energy conservation and efficiency.

Appendix 4: Navigating the Turbulence: Price Levels, Volatility, and Market Liquidity in the European Natural Gas Market Amid the Russia-Ukraine Conflict

Figure 10: Daily Prices of Dutch TTF Natural Gas Month-Ahead Futures (2020-2023)

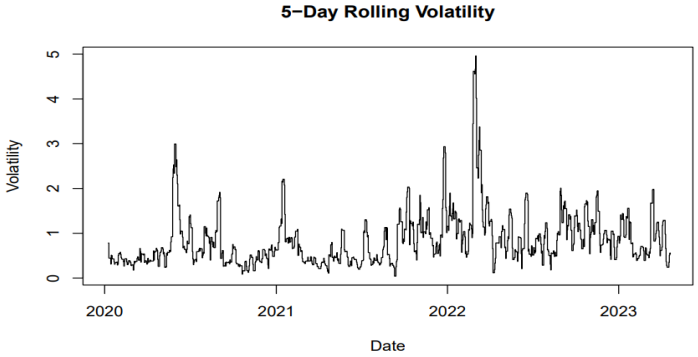


Source: own graph, data collected from the Intercontinental Exchange (ICE)

Note: prices are expressed in EUR/MWh

This graph was created using R Studio and represents the daily prices of the Dutch TTF month-ahead natural gas futures contract, obtained from the ICE Exchange. To create this graph, the first step was to extract the data, capturing the relevant price details for the period from 2020 to 2022. In order to accurately represent the daily movements, the raw data was transformed. Specifically, the logarithm of daily prices was calculated, a process that helps to normalize price fluctuations and improve the interpretability of the data.

Figure 11: 5-day Rolling Volatility Dutch TTF Natural Gas (2020-2022)



Source: own graph, data collected from the Intercontinental Exchange (ICE)

The graph in Figure X, generated using R Studio, illustrates the daily volatility of the Dutch TTF month-ahead natural gas futures contract. The data for this graph comes from the ICE exchange and spans a period of three years. To construct this volatility graph: daily logarithmic prices were calculated to normalize price fluctuations and improve the interpretability of the data. Secondly, a 5-day standard deviation of these daily logarithmic prices was calculated, a procedure designed to effectively capture and quantify short-term price fluctuations. The rationale behind the use of a 5-day standard deviation lies in its ability to provide a clear understanding of the market's reactions to various events over the period under consideration. By focusing on short-term fluctuations, the graph encapsulates transient market behavior, which is crucial for understanding the dynamics of the Dutch TTF Natural Gas month-ahead futures.

Appendix 5: Balance sheet structure of Trafigura, a major CTF

ASSET TYPE	Balance Sheet	USD'M
Current Assets	Include: cash and cash equivalents, trade and other receivables, prepayments, derivatives, income tax and inventories.	$ 78,767.30
Non-current Assets	Include: property, plants and equipment, intangible fixed assets, loans receivable, derivatives, right-of-use assets, equity-accounted investees	$ 19,432.50
Current Liabilities	Include: loans and borrowings, short-term lease liabilities, trade and other payables, current tax liabilities, other current liabilities, derivatives. These liabilities arise from their trading activities and the need to finance inventories and working capital.	$ 66,994.10
Non-current Liabilities	Include: loans and borrowings, long-term lease liabilities, derivatives, provisions, other non-current liabilities, deferred tax liabilities. These liabilities are used to finance investments in fixed assets or other long-term projects.	$ 16,531.80
Equity	Include: loans and borrowings, long-term lease liabilities, derivatives, provisions, other non-current liabilities, deferred tax liabilities. These liabilities are used to finance investments in fixed assets or other long-term projects.	$ 15,078.60

Source: own graph, data extracted from Trafigura's Annual Report

Current assets VS Non-current assets: Trafigura has a higher proportion of current assets than non-current assets. This is consistent with the nature of the CTF business model, which typically requires a higher level of liquidity to manage short-term commitments such as margin requirements, inventories and trade receivables. It also reflects the fact that CTFs are often more focused on trading activities, which require more working capital, rather than investing in long-term assets such as property, plant and equipment.

Current liabilities VS Non-current liabilities: Trafigura has a higher proportion of current liabilities than non-current liabilities. This is also consistent with the CTF business model, where current liabilities such as trade payables, short-term borrowings and other current liabilities are more prevalent than non-current liabilities such as long-term debts.

Equity: Trafigura's equity is relatively low compared to its total assets (8%). This suggests that CTF relies more on debt financing than equity financing, which is common in the commodities trading industry due to the capital-intensive nature of the business and the potential to leverage the balance sheet to increase returns.

The different credit facilities used by CTFs:

Borrowing base: In areas where sizeable and frequent transactions occur, large trading companies set up borrowing bases, which are the amount of money a bank will loan based on the value of the collateral the company pledges, determined by a method called margining. Lender determines a discount factor that is multiplied by the value of the collateral. Periodically, the trading firm gives a summary of its entire inventory and receivables to one or more banks, which is then used to negotiate a credit line.

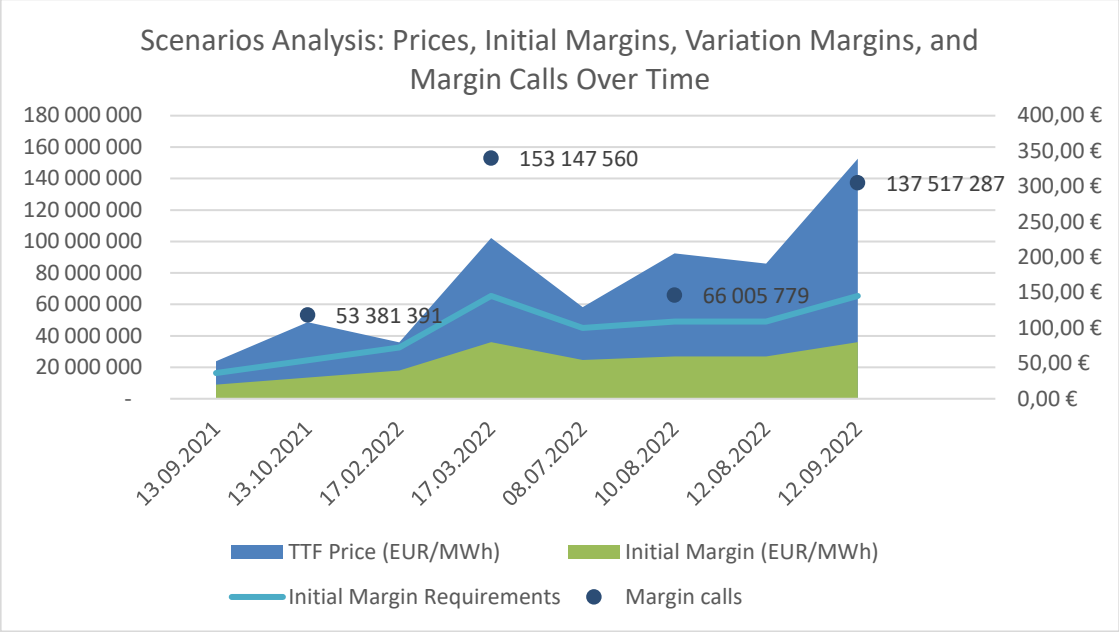
Repurchase agreement: Repurchase agreements entail a trading company selling a commodity to a bank while concurrently committing to repurchase it later. Banks prefer owning the commodity over financing it, as it offers a more appealing return on equity and demands lower capital requirements for asset ownership compared to lending activities.

Prepayment: Pre-payment agreements work as sales contracts where a buyer agrees to purchase a specific quantity and quality of a commodity from a producer for a fixed term, in exchange for an upfront payment. The funds are advanced by the lending institution against confirmed orders from the buyer to enable the exporter to make and supply the ordered goods. These agreements typically originated by trading houses, industrial buyers, and specialty hedge funds.

Revolving credit facility (RCF): This structured trade finance tool works as a line of credit where the customer, i.e., CTF, pays a commitment fee and is then allowed to use the funds when they are needed. These are used generally for operating purposes and can fluctuate each month depending on the customer's current cash flow needs. To cover sudden liquidity needs, trading firms maintain sizable credit lines from banks.

Securitization: To be able to finance their capital-intensive activities, trading firms can turn also to securitization, which is a process of pooling various commodity trade finance assets, such as letters of credits or receivables, and sell the related cash flows to third parties investors. This provides traders with extended fundings needed for their transactions while allowing banks or other financial institutions to transfer/share the credit risk with the investors. Generally, securitization involves issuing long-term bonds backed by the receivables from the CTF.

Appendix 6: Scenarios Analysis



Prices: Prices are expressed in EUR/MWh, obtained from TTF price analysis, and extracted from ICE.

For each of these time points, the contract notional value can be calculated by multiplying the prices by the position to trade on TTF ICE futures and the number of contracts (ex: 52.87 EUR/MWh * 3'600MWh * 227 = 43'205'364 EUR)

	EUR/MWh	Notional value EUR	Initial Margin Requirements	Initial Margin EUR/MWh
13.09.2021	52,87 €	43 205 364	16 346 140	20,00
17.02.2022	79,60 €	65 049 120	32 692 280	40,00
08.07.2022	129,46 €	105 794 712	44 951 885	55,00
12.08.2022	190,92 €	156 019 824	49 038 420	60,00

		Notional value EUR	Initial Margin Requirements	Initial Margin EUR/MWh
13.10.2021	108,19 €	88 413 685	24 519 210	30,00
17.03.2022	227,00 €	185 504 400	65 384 560	80,00
10.08.2022	205,23 €	167 713 956	49 038 420	60,00
12.09.2022	339,20 €	277 190 971	65 384 560	80,00

Initial Margins (IM): Initial margins are expressed in EUR/MWh and were taken from Figure 19, obtained from Bloomberg, ICE Clear Europe and Bank calculations. By multiplying the total natural gas hedged using TTF contracts (i.e., 817'307 MWh) by the initial margins (EUR/MWh), we get the total initial margin requirements for the hedge of the physical transaction.

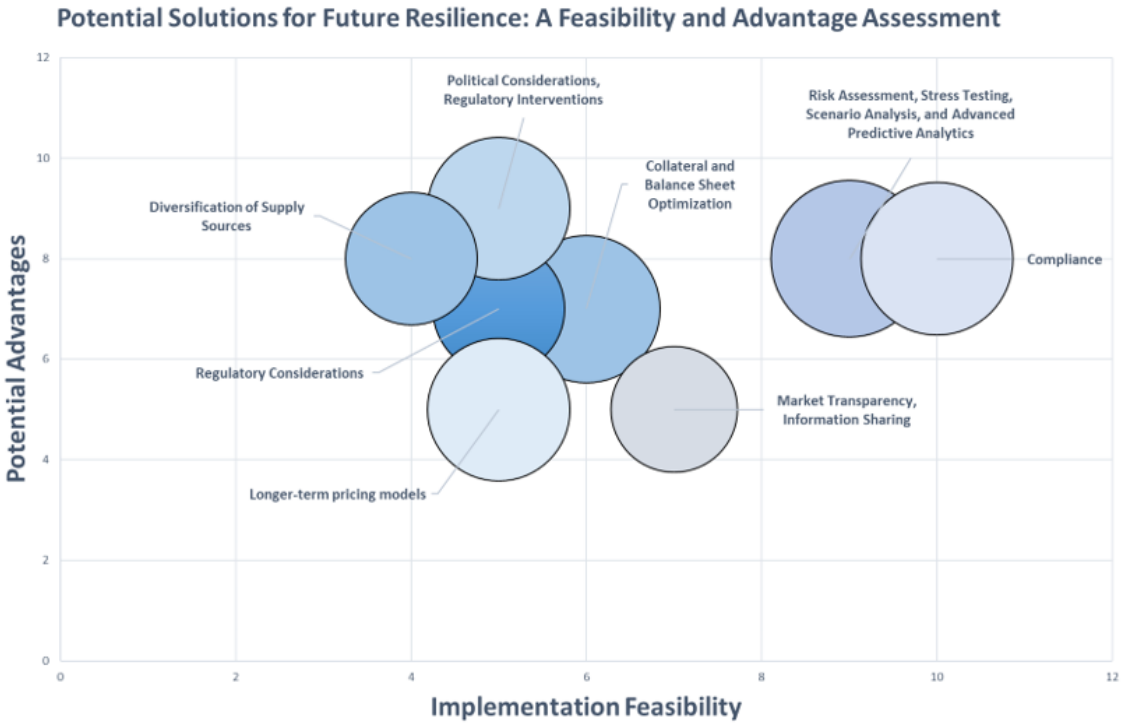
Variation Margins (VM): The variation margin for each period was calculated by determining the change in contract notional values from one month to another (ex: EUR 43'205'364 contract notional value on 13.09.2021 – EUR 88'413'685 contract notional value on 13.10.2021 = EUR -45'208'321 variation margin/loss on futures position). As we are in a short futures position, an increase in prices is against the position and results in "unrealized" losses.

	Change in IM	Change in price	Change in contract value
13.09 - 13.10	**8 173 070**	**55,32 €**	**(45 208 321)**
17.02 - 17.03	**32 692 280**	**147,40 €**	**(120 455 280)**
08.07 - 10.08	**4 086 535**	**75,77 €**	**(61 919 244)**
12.08 - 12.09	**16 346 140**	**148,28 €**	**(121 171 147)**

Margin Calls: Calculating margin calls with increasing initial margin requirements was simplified for this example as information for a precise calculation is missing due to the lack of accurate information. Firstly, the change in initial margin requirement from one month to another was calculated based on the initial margin provided by Figure 19 (EUR/MWh). These were added to the variation margin in order to show the total additional funds SarahTrading would have to put, i.e., the margin calls in order to keep its hedge.

	Change in IM	Change in contract value	Margin call
13.09 - 13.10	**8 173 070**	**(45 208 321)**	**53 381 391**
17.02 - 17.03	**32 692 280**	**(120 455 280)**	**153 147 560**
08.07 - 10.08	**4 086 535**	**(61 919 244)**	**66 005 779**
12.08 - 12.09	**16 346 140**	**(121 171 147)**	**137 517 287**

Appendix 7: Potential Solutions for Future Resilience



Implementation Feasibility: This axis represents how feasible it is for commodity trading firms to implement each solution. A higher score suggests that a strategy is more achievable.

Potential Advantages: This axis measures the expected benefits or effectiveness of each solution in managing extreme margin calls and market volatility. A higher score suggests greater potential benefits.

Bubble Size: The size of each bubble represents an additional metric representing the overall value of a solution, combining its feasibility and advantages.

<u>Detailed examination of the solutions, their benefits and feasibility:</u>

Diversification of Supply Sources

The war in Ukraine has taught many lessons, but one of the most important has been to address and manage Europe's dependence on Russian gas. New sources of supply have been found and it is important not to make the same mistake in the future, as it has been proven that a geopolitical conflict and dependence can lead to a critical situation. In addition to geographical diversification, trading companies can also diversify their

supplier base. By contracting with a larger number of suppliers, companies can reduce their dependence on any one supplier and minimize the risk of supply disruption.

Regulatory Considerations

Compared to banks or other financial systemically risky institutions, CTFs may be less regulated and are commonly referred to as “unregulated” (Pirrong, 2015). However, CTFs are highly regulated. The report published by Trafigura (2015) questions, but agrees, that they should not be regulated as banks in terms of capital requirements, regulations designed to reduce systemic risk. However, given the extreme conditions in 2022, it is legitimate to reconsider this "not too big to fail" status given to CTFs and to question the need for regulation of capital requirements (Pirrong, 2015).

According to Expert 4, such a regulation may be an adequate solution to deal with the possible cash crunch that the European gas market may face in the future, as it is no longer a calm market. Nevertheless, the fact that these companies are often privately owned makes it difficult to impose such rules.

Political Considerations and Regulatory Interventions

The results of my interviews and research show that the European natural gas market has become more politicized due to the scale of the impact of the Russia-Ukraine conflict[19]. The European Union is now involved in implementing regulations to protect the market. A stronger political presence in a free market has seemed to be an "emergency" solution to protect the economy from suffering from too high prices, and even for some countries to "save" energy and power companies[20].

This political commitment could become a prerequisite for a restructured and "stable" European gas market, without dependence on any one country or on LNG. Moreover,

[19] See Appendix 3

[20] Germany nationalized Uniper, the country's largest gas importer, as a bailout (Knolle, Kauranen, 2022)

the EU's commitment to combating climate change and achieving net-zero emissions, involving a shift from fossil fuels to renewable energy sources, justifies and even requires political involvement.

Advocating the possible introduction of capital requirements as a regulatory measure to address the challenges associated with margin calls and liquidity management in the utility and trading sectors, with a focus on securing energy supply and mitigating systemic risk, may be an interesting solution, despite its controversial implications.

Market Transparency and Information Sharing

Promoting market transparency in the trading sector can be a solution for better risk assessment and decision making by market participants. Competitiveness in the trading sector may discourage firms from disclosing sensitive information, as was the case in the primary information gathering exercise. Also, facilitating information sharing between CTFs, intermediaries and regulators to identify emerging risks and take timely action to mitigate potential liquidity shortages.

Collateral and Balance Sheet Optimization

The nature of the business of commodity trading involves significant exposure to price volatility, which requires effective risk management and liquidity strategies. Collateral management optimization and balance sheet optimization are critical components of their overall risk mitigation and liquidity management efforts.

The establishment of robust systems and processes for efficient management and tracking of collateral is crucial. The collateral posted by CTFs must meet the requirements of clearing houses and counterparties and be readily available when needed. CTFs can collaborate with their banks to explore alternative collateral solutions that would improve liquidity buffers and ease margin requirements.

Intermediaries such as banks and clearing houses play an instrumental role in preparing CTFs to effectively manage collateral and liquidity. They can provide guidance and share industry insights on collateral optimization, helping to mitigate the impact of margin calls.

Balance sheet optimization enhances CTF’s ability to manage risk effectively and maintain a strong financial position. Adequate levels of cash and equity can serve as a cushion to absorb unexpected losses and provide the necessary liquidity to meet margin calls. Tailoring reserves to the volatility of different markets can help CTFs better

anticipate and mitigate potential risks. Additionally, assessing the optimal capital structure is crucial for CTFs to strike a balance between risk-bearing capacity and cost of capital. Recognizing the unique characteristics and risk appetite of each CTF is key to finding the right capital structure, ensuring financial strength to support operations while managing the cost of funding.

Compliance

Compliance is an essential aspect of any trading operation, and particularly so for CTFs given the complex and rapidly evolving regulatory landscape in which they operate. The adoption of robust compliance frameworks based on strict internal policies, in addition to stringent reporting requirements (e.g., disclosure of significant trades), can help CTFs reduce operational risks. In addition, it may be beneficial to implement a "risk limit system" designed to regulate the potential for financial loss. This system would involve setting pre-defined limits on the size of trades and the firm's overall exposure to a single commodity, counterparty or market. These limits should be regularly assessed and adjusted to reflect changing market conditions and the firm's risk tolerance.

Longer-term pricing models

The use of long-term pricing models could help smooth the impact of short-term price fluctuations, which are associated with higher volatility. This is because long-term contracts can provide more predictable and stable cash flows, making it less likely that a firm will be caught out by sudden price movements and face a margin call. However, this would involve less flexibility, counterparty risk and market liquidity issues.

Risk Assessment, Stress Testing, Scenario Analysis, and Advanced Predictive Analytics:

Effective management of margin calls, especially during periods of high volatility or rising prices, requires preparation by both intermediaries (such as banks and clearing houses) and commodity trading firms (CTFs). This includes analyzing historical data, conducting stress tests and identifying potential scenarios to better understand and anticipate margin call situations.

Intermediaries play a critical role in sharing best practices and industry insights to help CTFs improve their risk management capabilities. They can provide guidance on collateral optimization, liquidity management and effective hedging techniques to mitigate the impact of margin calls. In addition, central counterparties (CCPs) could consider a more conservative margin requirement: if the margin requirement is set too low, even small price movements can trigger margin calls. Increasing the margin requirement could reduce the potential for such calls.

CTFs also need to use advanced predictive analytics techniques to enhance their risk management functions[21]. Using machine learning and artificial intelligence, these techniques analyze historical and current data to predict future trends, including price movements, market volatility and other factors that may trigger margin calls. With the increasing availability of real-time data, predictive models can incorporate the latest information, enabling trading firms to make more accurate predictions and respond quickly to sudden market changes. This comprehensive risk assessment approach helps CTFs to be better prepared and equipped to deal with future market uncertainties.

[21] Advanced predictive analytics refers to the use of advanced data analysis techniques, including machine learning and artificial intelligence, to predict future trends based on historical and current data (IBM, undated).

Appendix 8: Interview Transcripts

Interview 1 (15.02.2023, Geneva CH)

SM: Sarah Mesot

Respondent: Expert 1, Senior Relationship Manager Trade Commodity Finance Director in one of the major banks active in Commodity Trade Finance

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SM: Can you tell me how you discovered that there was an "emergency" for energy trading companies to have access to funding for their margin calls?

Expert 1: A series of events in 2021 and 2022 lead to such an emergency. First, it is important to note that already in 2020, banks were taking less risks as they have lost lots of money during the year. In March 2021, there was a huge volatility in the LNG market due to increased demand in the EU, driven by the energy transition and closing of coal plants in the United Kingdom. This led to the first wave of margin calls. In summer and September 2021, it was realized that stocks were too low, causing an increase in demand for LNG and volatility in TTF. Traders with long-term maturity contracts were exposed, resulting in the second wave of margin calls. In December 2021, the market calmed down, but the need for financing margin calls persisted. In 2022, volatility spread to other energies and commodities, further stressing the need for financing margin calls. Banks reached but pushed their maximum limits trying to help big traders. For smaller traders, cash was asked to cover their margin calls. The war in Ukraine indeed acted as a catalyst, exacerbating the existing underinvestment and market volatility issues. The industry's focus on energy transition led to an underestimation of the rebound in demand, causing further strain on the market. These events highlighted the need for energy trading companies to have access to financing.

SM: Have the margin calls that traders have faced recently affected your strategy? If so, in what way?

Expert 1: Yes, the recent surge in margin calls has led to a change in strategy. We have seen a decrease in risk appetite and increased selectivity in operations. In the beginning of the war, when there was lots of demand for financing margin calls, we decided not to take on new clients or new risks to better control the flow of operations.

SM: Between a bilateral line and a revolving credit facility (RCF), which is the most adequate solution to manage margin calls?

Expert 1: Big traders tend to use RCFs and borrowing bases to manage margin calls. This provides them with greater liquidity and security compared to bilateral lines.

SM: Have any of your clients, active in gas, experienced margin calls? If so, what tools/solutions were used to manage them?

Expert 1: Yes, I have experienced clients that have experienced huge margin calls, not especially active in the gas market but other commodities as well. As an example, we had a client that had a LNG cargo and when the prices surged, they asked for 30 to 40 million to pay for their margin calls. To manage them, we have put in place RCFs, borrowing bases, and tri-party agreements, depending on their size and specific needs.

SM: Could the impact of the war in Ukraine have been anticipated (in terms of margin calls)?

Expert 1: The impact of the war was not anticipated by many in the industry, as the focus was primarily on the energy transition and a perceived reduction in demand for fossil fuels. The war acted as a catalyst, amplifying existing issues such as underinvestment and market volatility.

SM: Do you think that traders need to adapt their liquidity, cash management, company size, or financial arrangements to be able to manage these types of problems in the future?

Expert 1: Yes, adaptation is necessary. We are already seeing changes in the industry, such as a preference for tri-party agreements, a decrease in risk appetite, and more compliance. Traders are becoming more selective in their operations, and alternative sources of financing, such as funds and insurance, are being explored.

Interview 2 (15.02.2023, Geneva CH)

SM: Sarah Mesot

Respondent: Expert 2: Director, Relationship Manager Commodity Trade Finance in one of the major banks active in Commodity Trade Finance

SM: How do traders generally handle their positions in relation to margin calls when prices increase?

Expert 2: Traders are generally short, long physical but short derivatives, so when prices rise, margin calls are triggered. With more volatility, higher initial margins and margin calls are required, leading to cash flow problems, which was indeed a big problem at the beginning of the war.

SM: What are some financial arrangements that traders ask/use to manage margin calls?

Expert 2: Large traders are used to this, especially if they trade in volatile markets, but they still need to have back-up facilities in place, such as RCFs, which don't require guarantees. RCFs, bilateral lines and borrowing bases are commonly used. Backup facilities were put in place when the situation was critical. Backup facilities are put in place when such extreme cases occur and it is money that exceeds the dealers' "limit". In my experience, backup facilities have never been used. They generate money for the banks through fees and increased interest rates, so it could be a really costly solution for traders.

SM: Can you provide an example of a recent situation where a client needed significant financing for margin calls and how the bank responded?

Expert 2: A recent example I dealt with was a client who came to us because he needed 3 billion in 2 days. The solution we found to get that much money quickly was to create syndication. If I remember correctly, 3 banks got together to provide the funds, which is the principle of syndication. This method has been widely used to support CTFs, but it's risky for banks to sell shares in times of war and uncertainty. Also, banks are subject to sanctions and restrictions on doing business with Russia, which are subject to interpretation, so they prefer not to get involved, which creates problems for traders dealing with Russian gas to get credit.

SM: How has the industry adapted to the challenges posed by the war in Ukraine and its impact on margin calls?

Expert 2: The market has adapted to manage the resulting volatility and risk. For example, in the oil products market, traders adjusted the pricing formula in contracts to mitigate risk. They bought and sold on the same day to avoid price risk and received higher margins as the premium in the pricing formula increased. There were also changes in the flow of products from Russia to other sources. Other than that, banks are taking less risk on transactions, and traders have reduced their volumes because they couldn't maintain their positions due to the high prices requiring higher collateral. I believe that this event will change their way of doing business, especially the monitoring of margin calls and credit facilities.

SM: What measures can traders take to better prepare for future challenges related to liquidity, cash management, and financial arrangements?

Expert 2: Traders should further adapt their strategies to meet the challenges of increased volatility and risk, including the monitoring of margins, collateral and their balance sheet liquidity. However, I think there is a need for governments or regulators to have a say in these issues. Governments seem to have helped and made deals with traders for gas, which can have a big impact on the whole industry, especially the power plants.

Interview 3 (09.03.2023, Geneva CH)

SM: Sarah Mesot

Respondent: Expert 3, Treasury and Commodity Management Consulting Practice at PwC Switzerland a treasury and risk expert at in one of the “Big Four” firms

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Sarah: How did you see the war affecting the traders? When?

Expert 3: At the end of 2021, market prices were rising due to expectations of war, the market kind of overreacted. However, climate issues such as drought, France's dependence on nuclear power and the fire incident in the US also caused the uncertainty in the market. This situation already led to huge margin calls. In the summer of 2022, prices spiked, especially for gas and electricity. The utilities sector was particularly affected by the negative value of futures contracts. Traders faced a trilemma of market

risk, liquidity risk and credit risk - one of these risks is always present when dealing with hedge funds, bilateral contracts and other financial instruments.

Sarah: What about from a consulting perspective? How have dealers managed these risks?

Expert 3: Risk management is everywhere. We've seen an increase in liquidity stress testing, cash flow at risk calculations, a shift in the triangle trilemma, traders moving towards credit risk. We've also seen traders moving from exchange-based hedging to OTC, changes in the type of collateral (away from cash towards letters of credit) and a reduction in hedging activity because they couldn't afford it. Advanced cash flow risk analysis and risk mitigation were applied. Having huge cash buffers to support operations means that all resources become more expensive due to expensive financing. I think there was no magic solution, but rather a combination of all these tools. I also tend to think that this situation is exceptional. The answer is to make sure that investment in the EU energy sector and diversification of energy sources are prioritized.

Sarah: What are the limits of a leveraged balance sheet for CTFs? If they have physical assets, maybe it's not so bad, but if they don't, is there a limit to credit facilities?

Expert 3: (no answer given)

Sarah: Can regulations on capital requirements now be a solution? Are there any voices in the energy and utilities sector on this issue?

Expert 3: Yes, from a political point of view, there are voices in the energy and utilities sector. The concept of "too big to fail" is being discussed in the utilities and trading sectors, with the aim of securing supply. The introduction of capital requirements could be a potential solution to these challenges.

Interview 4 (03.05.2023, Geneva CH)

SM: Sarah Mesot

Respondent: Expert 4, Natural Gas Trader based in Geneva in a major energy and commodities company

SM: How would you describe the European natural gas market in the last 3 years, especially in terms of volatility and liquidity?

Expert 4: In Europe, there are different hubs, but TTF is the most important market we have in Europe. It's the most liquid market that means most volumes are traded there, the most products are traded there, options are traded there. So, it's very liquid and for everyone who wants to hedge LNG, for example, an Asian player or an US player, they always trade the TTF so that's the reason why the TF market is the most important. If you take the price curve of the TTF price curve from 2019 until now, I think this is a good representation of everything you had. Nothing really happened in 2019; it was a very boring year. 2020 was also a boring year. Demand was going up a little bit, but not too much, prices were dropping somewhere in, like, let's say June 2020 to 20 euro per MW hour. Then after the pandemic was the first wave was done, demand came back a little bit so, but you can see we were always trading the range between 0 and €50 per MW hour. It really started then to become interesting in May, June, when the demand for LNG, so for liquefied natural gas became quite strong in the Asian markets. Mainly China, Japan, Korea but also India, who were coming out of the first two ways from the pandemic and were coming back into the market. Growth figures were big, so the Asian market was absorbing a lot of LNG, and so the prices also in Europe went up because it's a competitive market. Then it got a little bit worse, when Gazprom, important Russian supplier of natural gas via pipeline started to not sell so much anymore and they also started not refilling the storage. Gazprom used to have a lot of underground gas storages in Europe and what they would do every year in the summer months through their daughter companies, they would buy gas or take their gas and put in the underground storage so that during the wintertime you have enough gas. But they didn't do this. So the market became nervous for the winter coming. The price were going suddenly above 50 euros until we had the first spike in October, November 2021 above €100 because there was not enough gas, everybody was a little bit afraid what might happen, this is when volatility started to really to increase in the Q4 21 until we reached some highs around 180 euros per MW hour on some days in December, January 2022, then everything calmed down in the beginning of 22 because basically the winter wasn't that cold. But then, unfortunately, the war started in February 2022 and then immediately

prices went up. This was the whole year of 2022 and the fourth quarter of 2021. This is when things really happened. On top, capacities through the North Stream, that means one of the pipelines where Gazprom was supplying to Europe under the North Sea, they cut the capacities, and there was a fire in the US in a LNG capacity where the gas is cooled down. Everyone was worried: less gas coming from Russia, perhaps less LNG in the world as the US is a big exporter. From May-June 2022 until the end of the year, there was a big jump and since then, we can see that the market cooled down a little bit as the winter was not too cold and there was enough gas as the Asian demand was decreasing so LNG was coming to Europe. In terms of volatility, from Q4 2021 until the beginning of this year, we have never seen that in any commodity market in the energy sector and think that we will never see that again. The market until 2018-19 was mainly an OTC market with a broker as intermediary, with a credit risk associated with it but this was handled pretty well by companies that knew how to do it. The, there was a shift for a more exchange-based market with a TTF traded 90% on exchanges because more international players came into the market and they do not have bilateral contracts, which is required to trade OTC. It worked fine until everything happened and margin calls skyrocketed because margin calls means that as a participant, you have to give securities to the exchange as the exchange is the counterparty in this transaction. The exchange needs margin calls every day in case one of its counterparty goes bankrupt. At the same time, exchanges raised the initial margin, the amount needed to be able to trade on the exchange because this is also linked to the market price. Even for companies that have lots of cash it was a complicated situation.

You can also see that until a certain period, June-July 2022, JKM and TTF were relatively close to each other. After that, TTF became so high compared to the TTF that every producer of LNG in the world sent their ships to Europe to make more money. This is also why the mild winter helped us to keep the prices down.

Henry Hub, which is the US, is an interesting market as the US became from a net importer of gas to one of the biggest exporters of gas because of fracking. They do not experience such volatility, protecting their market.

What is also interesting is to see that marketwise everyone was indeed affected but in terms of flow, not every country had the same situation. In the Western Europe with

countries such as Germany, there was more dependency on the Russian gas than countries like Europe that have more LNG terminals and imports from Qatar or US. Trading gas is not only via exchange there is also long-term contracts with producers such as Gazprom but it they do not send you the gas anymore then suddenly, you see companies being nationalized to be saved, as Uniper in Germany. Natural gas market became now political.

It is also interesting to look at power energy prices as natural gas is often used to produce power. So, when natural gas prices went up, power prices went up and as power prices went up, it was attracting more gas, demand was still huge so prices for gas remained high.

SM: Because of these margin calls, were participants exiting the market, resulting in a less liquid and also much more volatile market, a vicious cycle kind of situation?

Expert 4: Yes, you can say that, but you cannot say that market participants exited the market as it would mean that a company that is involved in gas trading doesn't have position anymore. Every company cannot just close the positions within a couple of days, depending on the size of the company. So, what people did was to reduce their exposure, bringing down the need to trade lot of volumes. So the volume went down a little bit, but you cannot say overall that if you look at the traded volume, that they did really go down because a lot of new participants came into the market: funds, hedge funds that were looking for this, looking for investing their capital in other markets So what would be correct to say is that there was a change of the participants of the market participants and that traders had to reduce their positions and did not try to increase their positions notably, due to the fact that they're just too expensive with the margins. You're a trader and you see the market is going up, with moves within one hour that were like 30-40 euros per MWh, naturally you want to dive into this, I wanted to buy another and another thinking that it can only go up and make profit but that is something that you wouldn't do because then trading companies wouldn't allow this because the costs of extra margin would be too high. So it's rather stabilizing not using every opportunity fully let's say.

SM: Are margin calls only cash?

Expert 4: It depends, it is a cashflow, daily cashflow in and out companies that can amount to millions. It is therefore affecting cash deposits in the company. Collateral is more in OTC transactions, which can ask for bank securities or something like this.

SM: In the context of the ongoing crisis in Ukraine, do you foresee any long-term consequences for the natural gas market and the cash management practices of commodity trading firms?

Expert 4: The consequences are already there today and will be even more. First, I believe, more political involvement in certain countries. What happens now is that countries, politicians and even the European Union are seeking and already buying gas in the market. In Germany it's a grid operator, THE (Trading Hub Europe), who is responsible for the German market, is buying gas by an order from the German Government to fill the German storages as security of supply for the next winter. So, you've got a political component now coming into the freely traded market, which is always difficult. European Union also put a price cap in place, and I believe it is a tendency that we will see again because the next change is for Europe to change the way they use gas, as they are now dependent on LNG, and they are competing now with buyers in Korea or China or India or Brazil. There is a wider picture now. Also, market participants are wondering if it is wise to stay on the exchange and better have counterparty risk with OTC rather than margin calls, cash flows but this is difficult to say.

SM: Do you think volatility is going to last longer and is going to be a characteristic of the TTF?

Expert 4: I do not think that volatility is going to stay like this. What can happen is that as we are now competing for LNG with other buyers but if something happens like fire in one of the big LNG plants, there would be a supply shock, volatility would then be like to come back. Volatility can also come back if we have a cold winter as storage alone in Europe is not enough for cold days because demand is too high these days. This you can only do via pipeline, that Russia could do.

SM: How come the prices are going down now?

Expert 4: First, the mild winter and the fact that there is an industrial demand distortion in EU. As their electricity bill went up so they had to find new ways. Some switch from natural gas to LPG, which is gas from oil, then there are certain companies burning waste, or production stopped and exported in other countries where prices are lower. This is also why food has become more expensive. The industry is still not back as the macro picture is not looking good everywhere. The demand will come back, but lower I believe and in terms of volatility, I do not think we will see that again.

SM: What measures or strategies have natural gas traders employed to mitigate the risk of sudden margin calls and to better manage cash and credit facilities?

Expert 4: Companies must find ways to finance these margin calls, increasing borrowing base and using RCF or also use cash, which made it difficult for smaller companies. Also, what companies did was so-called EFP trade, Exchange for Physical to find a counterparty. As we have different payment dates. On an EFET contract, which is the framework contract of the European Federation of Energy Traders under which you can trade OTC. Under this, you have always the same date on the next month so you would need to find a counterparty with an opposite position to trade with them, switching the payment on the exchange every day to the counterparty, which gives a whole month, more time to find money. This was also a reason why volume traded did not decrease that much as it was a lot used. Traded volumes on the TTF in 2022 were going up but the positions were going down. It's just because of the EFP trades. Because everybody was trying to save and it was the cheapest form you can do even if you are bound again to the counterparty risk, but. It is better than a margin call coming after the other and taking away the cash and better than signing securities with banks, paying loans that cost a lot in interest rates.

SM: What are some of the key lessons learned and best practices that have emerged from the recent challenges faced by commodity trading firms in managing cash and credit facilities amidst the extreme price levels and volatility in the natural gas market?

Expert 4: I think the awareness that extraordinary events can happen and can have catastrophic, and they can impact everyone from politicians because suddenly politicians are looking at your fingers and in the market households you must be very careful to say that you're a gas trader because friends perhaps might not be your friend anymore. On the other side for the company itself, it's about cash management. Having tools in place,

less for bigger trading companies but for smaller ones that don't have so much experience and could not anticipate such events. So, the involvement of everyone of cash management, treasury. Risk management less I would say because for risk nothing has really changed. The only thing that went up is the value at risk because of the volatility. Compliance departments are, however, very important: it is important not to have manipulations of how you behave in the market, that you be conformed, that you follow the rules. This is something I think awareness general awareness for all, for all the basic components that the company has was raised and is now part deep, deep part of every culture of every company that is trading gas or power or any other energy. It is a positive sign; training is coming more and more. As it was a quiet market, it is important to be aware and trained in case it can / when it happens again. I think that there is a lot to learn from the last 2-3 years, to keep as a textbook example let's say. Also, it is important to raise general awareness of how natural gas trading is perceived even more due to the fact that there is now more political implication.