

CLIMATE & DEBATES

Transaction behaviours of actors on the European carbon market - A focus on auctions

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In a context where the European Union Emission Trading Scheme (EU ETS) is a key climate mitigation policy tool designed by the European Union (EU), this series of Climate & Debates focuses on the different behaviours of actors in the European Carbon Market. This first document describes the regulatory framework of the system, stressing the specificities of the recent trading phase (starting in 2013), to put in perspective the different behaviours of actors according to their profile. Activity in the auction market is then described according to firm profiles and successful auction bidders are further identified at the firm level. Overall, financial actors and compliance firms from the energy sector shared most of the auctioned allowances. The auction market further appears to be heavily influenced by the regulatory framework, with the successful bidders' profile type changing accordingly throughout a trading year. The numbers and figures on this document rely on a consolidated database, specifically created for the purpose of this study, by merging Orbis data to the European Commission's Transaction Log data, to include firm level information on transactions.

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Introduction

Covering almost 40% of the the European Union's (EU) Greenhouse Gas (GHG) emissions, the European Union Emission Trading System (EU ETS) is a key instrument in the EU's strategy to combat climate change and decrease emissions cost-effectively. Several crises that drove prices down have led to criticism regarding the efficiency of the system. Among the main culprits are the over-allocation of emissions permits during the earlier phases of the system, the 2008 financial crisis, fraud, and the lack of coordination with the EU's renewable energy support policies. Many adjustments have been made to attempt to correct the failures of the system. The implementation of the Market Stability Reserve (MSR), created as a tool to control the number of excess allowances in the system is one example. A Carbon Border Adjustment Mechanism (CBAM), has been proposed by the European Commission (EC) last year, to reduce the risk of carbon leakage by putting a price on the carbon content of imports. This mechanism would be built based on the ETS. This proposal, at the center of the "Fit for 55" package¹, is also accompanied by a proposal on the extension of the current EU ETS scope to other sectors such as the maritime sector and buildings. This shows a strong will from the authorities in terms of commitment, suggesting that the ETS will continue to play a major role in the decarbonation strategy of the EU.

This Climate & Debates (C&D) is a first of a series of three, each focusing on one specific aspect of the ETS: the regulatory framework and the primary market, which is the focus of this first document, exchanges on the secondary market, and lastly, accumulated allowance surplus. With the broadening of the scope covered, as proposed by the Fit for 55 package, understanding the behaviour of actors already trading European Union Allowances (EUAs) is critical. Further, the predominance of financial actors in the ETS markets raises questions on implications in terms of market oversight of the system. Regarding this aspect, the European Securities and Markets Authority has recently concluded that the European Carbon Market does not have major market deficiencies². The EC is currently discussing banning financial actors from participating in the exchange of allowances. In this context, the focus of this C&D series is to analyse the different transaction behaviours of market players in the system. It is suspected that market player's characteristics influence their behaviour and impact their trading strategies. For example, while regulated firms have a compliance constraint, financial firms have other motives driving them to participate in the ETS. Identifying the different behaviours induced by heterogeneous actors is essential to design better-aimed policies.

In this first document, the structural factors shaping actors' behaviours are discussed. The institutional background is presented and different actor profiles are introduced. A focus is further put on the primary market for auctions. Introduced as a way to provide new allowances in the system, auctions are set to progressively replace free allocations. Although this primary market has been active since 2012, studies on this topic are still limited. This C&D complements existing reports³ on the functioning of auctions: to the author's knowledge it is the first analysis based on

¹European Commission, Communication on 'Fit for 55': delivering the EU's 2030 climate target on the way to climate neutrality, COM(2021)550. Access here: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX: 52021DC0550

²See the final report on emission allowances and associated derivatives. Access here: https://www.esma.europa.eu/sites/default/files/library/esma70-445-38_final_report_on_emission_allowances_and_associated_derivatives.pdf

³The auction reports can be found under the Documentation section on the EC platform on Auctioning. Access

official transaction data (and not market data), which enables the identification of auction winners.

Throughout this series of C&D, EU ETS transaction data is exploited (from 2005 to 2019^4) and augmented by linking it with firm information. This allows the identification of firms behind the transactions recorded on the European Transaction Log (EUTL). Results of the consolidation process can be found in the Appendix (ref. Appendix Graphs 12 & 13).

Box 1 - Methodology of the consolidation strategy: augmenting the available database at the firm level

As the interest of this series of C&D is to analyse the behaviour of actors in the ETS, the level at which an entity is considered must be described. The unit of study will be the national firm level, based on the hypothesis that the decision-making unit (DMU) with regards to EUA management is at this level⁵. Data on the ETS, made available by the EC is however presented in a more granular level, at the account level. An augmented database has thus been constructed by the author. Previous literature has also consolidated part of the data (refer to Jaraitė et al., 2013).

The European Commission publishes ETS transaction data on the European Transaction Log (EUTL) platform. This database is not user-friendly and there is a 3-year delay in the publication of transactions. It contains information on the regulated installations, their emissions volume and conformity status. Along with transaction amounts, the transaction table contains information about the date and the accounts involved in the transfer among other details. However, it does not specify the type of contracts that lead to the transaction. For instance, it cannot be known if the transaction occurred due to the issuance of a futures contract, or whether it is an internal exchange happening between accounts of the same entity. This is another reason why consolidating the data at firm level - instead of directly using account level data - is important. By considering transfers that happen between firms, intra-firm transfers are left out. The consolidated transaction dataset that is analysed should contain monetary transactions only. However, the consolidated dataset still lacks information on the type of transaction that resulted in the transfer: an auction transfer cannot be distinguished from a spot or derivatives contract transfer *prima facie*⁶.

The augmented database is constructed based on the dataset made available by Abrell $(2021)^7$. This dataset augments the original EUTL data by linking transactions to involved accounts, matching former operator holding accounts to the respective installations and eliminating duplicate account holders. Information on the variables included in the database as well as the relations in the database can be found in the Appendix

here: https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/auctioning_en

⁴Access here: https://ec.europa.eu/clima/ets/welcome.do

⁵As it is assumed to be the case in most of the literature on this topic (see for example Trotignon and Delbosc, 2008). National firms, as defined on the Orbis Database from Bureau Van Dijk. An Ultimate Owner (UO) on Orbis is identified if there is a 50% ownership path from a subject company to its UO. A company is also considered an UO if it has no identified shareholders or if its shareholder's percentages are unknown. Refer to a user guide for more details. Access here: https://moodle.fhgr.ch/pluginfile.php/103914/course/section/32329/MB_200327_Bibliothek_Orbis_UserGuide.pdf?time=159559226214

⁶Primary market transactions will be distinguished from transactions in the secondary market. Transfers of allowances auctioned will be flagged by isolating certain accounts. (ref. Figure 5)

⁷Augmented EUTL database information site. Access here: https://euets.info/background

(ref. Appendix Figure 15). The processed data is downloaded, and a relational database is created, following the Python routines made publicly available by Jan Abrell.

Next, as the processed data does not specify the identity of the firm managing the accounts, this information was retrieved from the Bureau Van Dijk - ORBIS database⁸. Previous research has also relied on this database to obtain additional company data (Jaraite et al., 2013). For this step, a file made available by the Joint Research Center (JRC) has been used⁹. This file links account holders in the EU ETS with the corresponding company on the Bureau Van Dijk - ORBIS database. Using this information, the list of firms participating in the EU ETS were identified and information concerning name and NACE codes at different level was retrieved. A table describing the results of this consolidation process can be found in the Appendix (ref. Appendix Figure 12 & Figure 13).

The following document exploits this consolidated database. Any number or figure, if not stated otherwise, is based on the author's consolidated database. Throughout this document, other methodological boxes are included where relevant, explaining how the data was further manipulated.



Figure 1: Overview of the compliance cycle EU ETS

Source: EU ETS Handbook (2015)¹⁰. Note: CA refers to Competent Authority.

⁸Orbis database information site. Access here: https://www.bvdinfo.com/en-gb/our-products/data/ international/orbis

⁹JRC, Firm level data in the EU ETS. Access here https://data.jrc.ec.europa.eu/dataset/bdd1b71f-1bc8-4e65-8123-bbdd8981f116

1 Institutional context of the EU ETS

Understanding the institutional context of the EU ETS and identifying all the different actors involved is essential to define the scope of this study. Describing the framework and the relationships linking the actors reveals an intuition on how different players at stake may behave in line with their motives. In this section, aspects specific to the third phase (2013 - 2020) are introduced. For a more detailed description of the functioning of the system and for details on transactions during the first phase of the system, refer to Martino and Trotignon, 2013.

Box 2 - Overview of the EU ETS compliance cycle (ref. Figure 1)

The ETS is organised in annual compliance cycles and every installation regulated under the system must monitor their emission levels annually. The emission monitoring period begins the 1st of January and ends the 31st of December. Below is an overview of the main regulatory steps:

- At the beginning of the year, on the 28th of February, free allowances are distributed to installations, if applicable. These free allowances are to be used for compliance of the year ahead. In practice, the period during which allowances are distributed is not fixed and delays in distribution is common.
- Each installation must report their annual emissions. Emissions reports of the previous year must be verified by an accredited verifier by 31 March.
- Compliance for the past year must be done before the 30th of April each year. This is done by the surrendering of allowances corresponding to the installation's volume of emissions. The surrendering of allowances -representing the right to emit- must be transferred through by the installation's account.
- Since the end of 2012, auctions are scheduled regularly to introduce allowances into the system (ref. section 2).

A strongly regulated market

By nature, the EU ETS is an artificially created market and is therefore strongly regulated. Introduced in 2005, the EU ETS has just entered its fourth trading phase, covering the period 2021 to 2030. The scheme is based on a cap-and-trade system set up to decrease emissions costefficiently by putting a price on Greenhouse Gas Emissions (GHG) through the issuance of permit rights and stimulate investments in carbon-reducing technologies. Every beginning of a phase, a trajectory for the maximum volume of emissions is fixed. During the third phase (2013-2020), the cap on the number of emission allowances decreased each year by a linear reduction factor of $1.74\%^{11}$.

¹⁰EU ETS Handbook, by the EC. Access here: https://www.sallan.org/pdf-docs/ets_handbook_en.pdf.

¹¹The way this cap was established, bottom-up based on national registries, changed during phase III. A single EU-wide cap was set, starting at 2 084 MtCO2e in 2013 (International Carbon Action Partnership). This amount corresponds to the average total quantity of allowances issued annually in Phase II (2008-2012). The reduction of the cap during phase III ensures that the maximum number of allowances that can be used by stationary installations is 21% lower in 2020 than in 2005. EC website. Access here: https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/emissions-cap-and-allowances_en. EC report on the functioning of the European Carbon Market. Access here: https://ec.europa.eu/clima/system/files/2020-11/com_2020_740_en.pdf

The European Commission and relevant national authorities are responsible for the functioning of the ETS. These entities have accounts opened in their respective national registry, dedicated to creating, allocating and deleting allowances. For instance, in France, this administrative role is played by Caisse des Dépôts¹². A registry specific to the European Commission's accounts also exists. All of these institutional accounts are classified as administrative participants, as all of their transactions happen for regulatory purposes (ref Figure 2).





Notes: Since the beginning of Phase III, freely distributed allowances have been allocated centrally by the Commission instead of being distributed by national administrative accounts. EU accounts have therefore gained importance in terms of administrative management of the ETS. The peak in the share of transaction volume from national accounts in 2015 can be explained by the creation of the Market Stability Reserve (MSR).

One of the role of these administrative participants is to allocate free allowances to regulated installations' accounts at the beginning of a trading year. Initially, this was a way to help regulated firms meet compliance. The main justification was to preserve firms from facing a competitive disadvantage to international firms and to avoid carbon leakage (ref. box 3). However, the free allowance allocation design has been highly criticised for being too generous. In the early stages of the system, the benchmark emissions had strategically been set higher by national entities to inflate the domestic volume received for free. Empirical literature on the topic agrees on the fact that the ETS has not impacted firm competitiveness and firms have benefited from windfall profits, especially by passing-through the costs to their consumers (Joltreau and Sommerfeld, 2019). The generous free allocations at the early stages led to a surplus of allowances and a fall in prices, questioning the functioning of the whole system. Moreover, when considered statically, the free allocation of

¹²Caisse des Dépôts. Access here: https://www.seringas.caissedesdepots.fr/?lang=fr

allowances does not impact abatement decisions, but when looking into the ETS dynamically, free allocations reduce the costs borne by regulated firms. This means that the profitability of low carbon investments is diminished, which does not incentivise low carbon investments as it is supposed to.

The method for estimating the number of free allowances to distribute has been reviewed downward and free allowances are now allocated more sparsely. Since 2013, an auctions market was also introduced to progressively replace free allocations. A total of 57% of the supply of EUAs were auctioned in Phase III¹³. To further tackle the excess of supply of allowances in the market, a Market Stability Reserve (MSR) was also put in place¹⁴

Box 3 – Carbon leakage

Free allowances are distributed mainly to shield internationally competing firms against carbon leakage¹⁵. Carbon leakage can be defined as a displacement of carbon emissions from a region with stringent climate policies towards a region with less stringent climate policies (Naegele and Zaklan, 2019). This needs to be avoided for obvious reasons, as it defeats the purpose of climate policies aiming at reducing emissions on a global scale. The EC has established a carbon leakage list, identifying the installations that are the most at risk to suffer from this phenomenon¹⁶. The most exposed sectors receive free allowances equivalent to 100% of the relevant benchmark.

As the Commission is aiming towards a halt in free allocation, the EU has been working on a carbon border adjustment mechanism (CBAM) to avoid carbon leakage. The CBAM's goal would be to ensure homogeneity in pricing of carbon, both from imported and exported products¹⁷.

An output-based allocation mechanism is also a way to limit carbon leakage. The Chinese ETS for example, has been designed using a rate-based allocation mechanism¹⁸: the number of allowances granted to a facility depends on its emissions-output ratio at the end of the compliance period. Installations can influence the volume of allocation they will receive for free through their production choices made during the compliance period. This allocation method is effective to mitigate production losses from the regulated sectors¹⁹.

¹³According to the EU ETS Directive, at least 50% of auction revenues must be spent for climate and energyrelated purposes. EC website (access here: https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-euets/auctioning_n). Revenues generated from the auctions are managed by each country. In 2019, total revenue from auctions exceeded 14 billion \bigcirc . It has been reported that around 78% of revenues between 2013 and 2019 were used for "climate and energy-related purposes". Auctions, EC website. Access here: https://ec.europa.eu/clima/ eu-action/eu-emissions-trading-system-eu-ets/auctioning_en

¹⁴This mechanism was created to address the structural imbalance between the supply and demand of allowances and required administrative transfers to be done at the national level. Access here: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2015.264.01.0001.01.ENG

¹⁵For more details on carbon leakage and carbon border adjustments, refer to the policy paper by Baudry and Cameron, 2022.

¹⁶The updated list can be found on the EC's website. Access here: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014D0746from=EN.

¹⁷More information about the CBAM can be found on the EC's website. Access here: https://ec.europa.eu/ commission/presscorner/detail/en/qanda_21_3661

¹⁸also called a Tradable Performance Standard.

¹⁹For more about the different ETS designs to tackle carbon leakage, refer to Monjon and Quirion, 2011, Meunier et al., 2014. For more details about the Chinese ETS and for discussions on the strengths and weaknesses of this

A market for compliance firms

The ETS was created to diminish emissions in the EU, the priority being given to heavy emitters and actors that are easy to control and monitor. Regulated firms²⁰ include the power sector, industrial installations, and aviation. The installations – and therefore the firm they belong to – are subject to the regulatory framework in place and have a compliance demand for allowances. As of today, almost 13 000 installations are regulated by the EU ETS²¹. Germany (DE) is the country with the most installations, followed by France (FR) and Great Britain (GB) (ref. Appendix Figure 18).

The overall reduction in the number of allowances distributed freely to installations can be seen in the graph below (ref. Figure 3). It clearly appears that after 2012, which corresponds to the end of phase II, the volume of allowances allocated for free drops. On average after 2012, free allocations remain at a level twice below the total volume of surrendered units. During phase III (2013 onward), the electricity sector did not receive any free allocations, albeit some exceptions remain²².

The heterogeneity in the way emissions are freely allocated to regulated installations leads to three different profiles²³. The installations that are over-allocated - long - can be distinguished from installations whose freely distributed allowances do not cover their annual emissions – short. Another category of installations, although they represent a very small proportion, is distributed free allowances that match their emissions, which means that they do not have to take part in exchanges to meet compliance obligations.

The evolution of short and long installations across the years follows the dynamics of free allocations (ref Figure 4). The count of long installations drops at the beginning of phase III in 2013, replaced by short installations. Even if it is on a decreasing trend, the number of over-allocated installations (count of long installations) still remains high, whilst their corresponding total surrendered allowance volume is low, reaching below 400 million allowances. This hints that since the beginning of phase III, over-allocated installations are numerous small emitters. A change in trend can be noticed from 2018 onwards, where the count of long -short- installations increases -decreasesagain. This may be explained by the fact that overall surrendered emissions have been decreasing at an increasing rate since 2018 (ref Figure 3), thus making some historically short installations long. This trend needs to be monitored, and volume of allocated allowances may need to be adjusted accordingly.

system design, refer to Goulder and Morgenstern, 2018, Goulder et al., 2022.

 $^{^{20}}$ or emitting/compliance firms

 $^{^{21}}$ The combustion sector is the most regulated one under the system, with more than 10 000 installations, representing 76% of all regulated installations.

 $^{^{22}}$ Some installations in the power sector obtained an optional derogation for the modernisation of the electricity sector in certain Member States whose GDP per capita was below 60% of the EU average in 2013. For more details about the derogation, refer to article 10c dedicated to the modernisation of the electricity sector. Access here: https://ec.europa.eu/clima/system/files/2016-11/hungary_com_en.pdf

²³This installation categorisation only relies on the differential between allocated and surrendered emissions, without considering the trade balance accumulated from exchanges on the secondary market and via auctions. This will further be discussed in the document on allowance banking.



Figure 3: The total volume of free allocation of EUAs (2008 - 2020)



Figure 4: Evolution of installation's position (2008 - 2020)

Notes: This figure is made using the compliance database. Firms are separated into different categories: short, for when the amount of EUAs allocated is below the volume of surrendered allowances; long, when it is above; and equal, when this amount is equal to the surrendered allowances. As the count of "equal" installation and their volume of surrendered allowances are both very low, this category is therefore not shown in the graph. The Commission's objective is to progressively end free allocation (ref section 1, subsection 1). This implies that regulated firms will all eventually be in a short position, relying on auctions or the secondary market to acquire allowances to match their emissions. Studying the behaviour of regulated actors that are short on the market is all the more relevant in the view of an increase in these types of actors on the market in the coming years.

A market open to all^{24}

On the European carbon market, allowances are traded in the same way as commodities through financial instruments and non-regulated actors are also allowed to participate in the trading of allowances. These include actors from the financial sector and service providers such as retail banks, investment banks and institutional investors, commodity trading houses or commodity trading units of big industrial companies, as well as brokers.

The potential detrimental role of financial actors in the EU ETS is a debated topic. Some countries such as Poland want to exclude financial speculators from the market²⁵, as they are suspected of harming the system²⁶. Given the recent proposition under discussion at the EC whereby financial actors no regulated by the ETS would be banned from the European Carbon market, it is of interest to see the activity of these actors on the primary market for auctions.

2 Auctions as a supply management tool

From the start of phase III (2013 - 2020), auctions have been held to progressively replace the distribution of free allowances and to enable regulated installations to acquire allowances for compliance purposes.

Box 4 - The auction design²⁷

To this day, 28 countries rely on one Common Auction Platform (CAP) to hold the auctions of their allowances: the European Energy Exchange AG (EEX) in Leipzig. Germany has opted-out of this common platform and holds its auctions separately on the EEX. The same holds for Polish auctions, which started auctioning through the EEX platform in 2017, until a national opt-out platform is established²⁸. Another auctioning platform is ICE Futures Europe (ICE), which acts as the auction platform for GB. Anyone with an account opened in a registry can participate in these auctions.

Having two different market platforms for auctions implies that firms can choose where to participate and how much to bid²⁹. The total volume auctioned is fixed by the EC beforehand, but the auction platform

²⁴Although they are not very exclusive, some criteria have to be met to be eligible of opening an account in a registry and participate in exchanges. Look at the EC registry regulation to get a detailed overview of the administrative justifications to submit in order to open an account. Access here: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013R0389

²⁵With the spike in prices before the Ukraine war, Poland has reitered its strong wish to remove financial institutions from the European carbon market. Reuters article. Access here: https://www.reuters.com/business/energy/ poland-calls-eu-remove-speculators-its-carbon-market-2022-02-15/

²⁶Note that all financial actors must not be considered in the same regards. For example, Cludius and Betz, 2020 have found the crucial role played by banks by analysing transactions from the second phase of the system.

is responsible for the auction calendars, which specify the dates, bidding windows and size of each auction, among other information. The EEX holds auctions three times a week and once a week on behalf of the CAP and DE, respectively. It also holds auctions for Poland (PL) every second week on Wednesdays. The ICE holds auctions every other Wednesdays throughout the year for GB³⁰.

The total yearly volume to be auctioned has to be distributed evenly throughout a year, except for the month of August, where the auctioned volume is set to be half the volume auctioned during the rest of the year. If the volume auctioned is not evenly distributed throughout a year, the volume should at least be auctioned on a quarterly basis.

Auctions are organised in single-rounds with a sealed bid setting, meaning that bids submitted by other bidders are not known. During a bidding window of at least two hours, participants can submit, modify and withdraw any number of bids with a lot size of 500 allowances. After the closing of the bidding window, the platform publishes the clearing price, the price at which the sum of volumes bid matches or exceeds the volume of allowances auctioned. All bids higher than the clearing price are successful. All successful bidders have to pay the same auction clearing price for their won allowances - the EUAs auctions are uniform-price auctions.

If the bidding volume is not auctioned entirely, the auction is cancelled. This situation arises when the bidding volume is less than the available volume for auction. The auction can also be cancelled by the auctioning venue if the clearing price is significantly lower than the price on the secondary market. This reserve price is however determined privately by the auctioning regulatory body, and no information is publicly available about the methodology to estimate this price³¹. The volume of allowances of this cancelled auction is then distributed evenly in the following auction dates³².

³²According to EC's carbon market report, in phase 3, a total of 15 auctions out of over 1 800 were cancelled either because the reserve price was not met or because the total bid volume fell short of the auctioned volume. Access the 2021 Carbon Market Report. Access here: https://ec.europa.eu/clima/system/files/2021-10/com_2021_962_en.pdf

²⁷More details on the auction's functioning can be found directly in the auctioning regulation document available on the EC's website. Access here: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX: 02010R1031-20191128&from=EN

²⁹The advantages of bidding in one auction platform over the other can be further studied to see if there were factors introducing a bias in participation.

 $^{^{30}}A$ UK ETS has been put inplace since Brexit took place. For the scope of this UK included ETS. launched study, operators are still inthe EU asthe UK ETS on May 2021. More information can be found on the EC's website. Access here: https: //www.gov.uk/government/publications/eu-ets-obligations-and-access-to-eu-registry-systems-in-2021/ eu-ets-obligations-and-access-to-eu-registries-systems-in-2021

³¹"The auction clearing price must be significantly under the price on the secondary market prevailing during and immediately before the bidding window when taking into account the short term volatility of the price of allowances over a defined period preceding the auction." No more details are made publicly available about the methodology for determining this auction reserve price. Auctioning regulation. Access here: https: //eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02010R1031-20191128. The emissions auctions notes, from the EEX (https://www.eex.com/fileadmin/user_upload/20200312_FAQ_EUA_Auctions_EN.pdf) and from the ICE (https://www.theice.com/publicdocs/Frequently_Asked_Questions.pdf

A substitution can be observed between the diminished allocated volume and the increased auctioned volume after 2013 (ref. Figure 5). A dip in auction volumes can be observed during the years 2014 to 2016. During this period, auction volumes were negatively affected due to the EC's decision to resort to "backloading". The delay in auctioning of allowances was done as a short-term fix to the problem of surplus of allowances and the fall in price of allowances, considered too low to incentivise certain low-carbon investments³³. The amount of allowances not auctioned as compared to originally planned amounts to 900 million EUA. The volume of allowances flagged as auctions is lower than the official volume for 2019, as the dataset stops at the end of April 2019³⁴.



Figure 5: Total yearly volume on the primary market (2013 - 2019)

"CAP-EEX" - Common Auction Platform (EEX); "DE" - German Auction Platform (EEX); "PL" - Polish Auction Platform (EEX); "UK" - United Kingdom's platform (ICE). Source: AFT³⁵, EC³⁶.

The global auction volume trends

The evolution of auctioned allowances can be found in Figure 5. Auctions officially started during the years 2011-2012 in 8 Member states countries -including Germany and Great Britainfor a trial period, before it was generalised to all countries of the ETS in Phase III. Since the beginning of the auction period, the auctioned amount has increased, and it has reached a total of

 $^{^{33}}$ European Parliament briefing notes. Access here: https://www.europarl.europa.eu/RegData/etudes/BRIE/2014/538951/EPRS_BRI(2014)538951_REV1_EN.pdf

³⁴Note that the last complete year available is therefore 2018.

³⁵French data was found on Agence France Trésor. Access here: https://www.aft.gouv.fr/en/carbon-market

³⁶Data for Germany and Great Britain was found on the EC website, via the different auction reports. Access here: https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/auctioning_en#ecl-inpage-443

more than 4 billion of EUAs from 2013 to 2019 (ref. Figure 5). Every year, most of the allowances are auctioned on the EEX, with on average 85% of the total volume being auctioned there³⁷.

Bidder type and participation frequency on the EEX^{38} – data from the EC reports

Since the start of auctions, the EC has released some reports summarising key trends according to the different auction platform³⁹. Participation trends in terms of bid volume and frequency as disclosed in these reports is summarised below. These information cannot be observed through the transactions data⁴⁰ and we thus rely on official reports.

According to the EC, three different categories of bidders can actively take part in auctions: operators, investment firms and credit institutions. Regulated actors are the most numerous in terms of eligible $actors^{41}$. They – ETS operators and their parent, subsidiary, or affiliated under-takings – are allowed to take part in auctions alone, or as part of a group. During the period of study, no such grouping has been identified on the EEX platform. Other eligible actors include investment firms and credit institutions authorised and regulated under EU financial markets law⁴².

There is an overall increase in the number of participants eligible to bid in the EEX auctions. Despite this rise in eligible bidders, the average number of bidders per auction has not seen the same increase: going from 18.4 bidders in 2013, to 21.2 bidders per auction on average in 2017⁴³. Analyses on frequency of participation show that more than 50% of registered participants in the EEX do not take part in auctions⁴⁴. Another tendency emerges: from the admitted total bidders, those that participate in auctions are very active. They usually participate in more than 10 auctions monthly. The fact that auction participants are not numerous hints that a big portion of the auctioned allowances are distributed between a few of the eligible bidders. Analysing transaction data is necessary to check if this holds true (ref section 3).

 $^{^{37}\}mathrm{This}$ corresponds to the auctions from the CAP, the DE and the PL platforms.

³⁸No information on the type of bidders could be found concerning the UK auctions held by ICE Futures Europe. This subsection will therefore be based on the biders registered in the EEX auctions only (applying to the CAP, DE and PL auctions). The trends for successful bidders will be analysed for both auction platform in section (3).

³⁹The auction reports can be found on the EC's website. Access here: https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/auctioning_en.

⁴⁰The transaction data only records the transfer of allowances resulting from a successful bid.

⁴¹The number of regulated operators eligible to bid increased from 38, by the end of 2013 to 54, by the end of 2017. The proportion of this type of actor has increased as compared to other types of bidders. Auction report for 2017 and 2013. Access here: https://ec.europa.eu/clima/system/files/2019-01/cap_report_201712_en.pdf, and https://ec.europa.eu/clima/system/files/2016-11/cap_report_201312_en.pdf

 $^{^{42}}$ and other entities that have been authorised under rules laid down in the Auctioning Regulation (*The EC refers to this category of actors as "person exempt"*). Non-regulated actors were less numerous than operators: by the end of 2017, 8 investment firms (11% of the total number of registered firms), 5 credit institutions (6% of total registered firms) and 5 *person exempt* (5 of total registered entities) were eligible to participate in auction on the EEX. Auction report 2018. Access here: https://ec.europa.eu/clima/system/files/2019-06/cap_report_201812_en.pdf

⁴³These numbers refer to activity in the common auction platform only. Auction report for 2017, and for 2013. ⁴⁴Estimations from the author's analysis exploiting the monthly EC auction reports

3 Successful bidders

Box 5 - Tracking auctioned allowances (ref Figure 6)

In theory, the distribution of allowances resulting from successful bids in auctions should be identified through a specific identification code when registered in the EUTL, but in practice, this information is not complete⁴⁵. Following the EUAs transiting through the administrative accounts dedicated to auctions, it is possible to track the accounts that received the auctioned allowances⁴⁶.

The source of supply of allowances for auction purposes is done by a specific EU auction account. The centralised EU account distributes the supply of EUAs to be auctioned to a specific auctioning platform account, such as the "GBUK auction trust" or the "DE ECC AG auction delivery account EU".

For transfers resulting from auctions held on the ICE platform, the allowances are then directly transferred to the winners of auctions. For transfers resulting from auctions held on the EEX, the market platform accounts transfer the auctions to 3 different intermediary accounts. These accounts then distribute the auctions to the successful bidders.

To check for the success of the identification methodology, the volume of allowances flagged as resulting from auctions is compared to the ones reported by the EC (ref. Appendix Figure 18). The amount of EUAs exchanged flagged as being part of an auction corresponds roughly to the amount of EUAs reported in the EC reports, showing the flagging of transactions resulting from auctions was successful⁴⁷.

Successful auction winners have been categorised in 4 groups, according to their sectoral activity: Financial sector; Electricity, gas & heat; Other energy sector; Other carbon intensive sector. This categorisation method relies on the NACE codes of the firms identified as successful auction winners (for more details on the NACE categorisation, ref. Appendix Figure 16.)

Market segment evolution on the primary market for auction

After describing the actors allowed to take part in auctions and summarising the trends in auction participation on the EEX platform, the focus here is to discuss the transfer of allowances that occurred resulting from a successful bid in the auction's market. The aim is to complete the official EC auctions reports by identifying the successful bidders, the frequency of a successful bid and the volume of allowances won. To the author's knowledge, estimating auction volume acquired by entities, directly based on the transaction database has never been done before, even less so at the firm level. Data manipulation to isolate the transactions of interest is described in the methodology

 $^{^{45}}$ This information is only specified for transfers that happen between the central EU auction account and the specific auction platforms, corresponding to the administrative allocation of auction allowances to each auction platform. The transfers leaving the auction platform accounts to the successful bidders are not identified as auctions.

⁴⁶Note however that transfers resulting from auctions held on the EEX (CAP, DE, PL auctions) cannot be dinstinguished from each other (ref. Figure 6

⁴⁷Note that auctions are delivered with a delay of up to five days, so the transactions are registered with a few days delay compared to the actual date that the auction took place. The volume of allowances flagged as being transferred for auction purposes does not perfectly match the official volumes found in the EC's report. This could be explained by data errors from the transaction database.

⁴⁸This is the result of a collaborative work with colleagues working at the research department of the French utility firm EDF.

Figure 6: Auctioned allowances distribution illustration



Source: EUTL data, augmented by Abrell (2021), author's illustration ⁴⁸

box above (ref. Box 5 and Figure 6).

The graph plotting the proportion of volume of successful bids per bidder category reveals that two sectors are the most active on the primary market for auctions: the non compliance firms that belong to the financial sector and the compliance firms from the energy sector - the Electricity, gas & heat and the other energy actors combined (ref. Figure 7). On average, these two types of actors have each received half of the total auctioned allowances during the study period. Some industrial firms not in the energy sector have also received auctioned allowances, although they remain very rare.

The strong presence of firms from the energy sector was expected, as auctions are held to replace free allowances allocations. As mentioned earlier, the power sector did not receive any free allowances since the beginning of Phase III, as such, they were therefore the main potential market players.

The market segmentation of successful bidders has evolved over time. In the first years, financial firms were winning slightly more allowances than the Electricity, gas & heat and Other energy actors combined. This trend has reversed over the years, as in 2018⁴⁹, the proportion of financial firms winning EUAs was lower than in 2013: it decreased from 52% to 38% of the total volume auctioned yearly. Conversely, among the energy firms, firms from the Electricity, gas & heat industries won a larger share of total auctioned volume, nearly doubling their share of volume won in 2018 as compared to 2013. Utilities, which belong to this category of actors have therefore considerably increased their share of won allowances. Historically, these firms are used to hedging their risks through the secondary market⁵⁰. With the introduction of a primary market for auctions, they

⁴⁹the last full auction year in the database

⁵⁰This has been confirmed to be the case for the French utility EDF, during discussions with researchers from the

may have started to rely more on it to cover their compliance needs. This trend will have to be confirmed throughout the following years.

The persistently small share of carbon intensive firms over the years could be explained by their latency. As they may not be used to taking part in auctions, it may take these industrial firms a longer time to get on this market and bid successfully. This phenomenon also raises the question of potential entry barrier costs. Moreover, as many of them still benefit from free allocations, they may still not face the need to participate and win allowances through auctions. With the progressive decrease of freely allocated emissions in the system, the share of regulated firms' auction volume won is expected to increase.





Refer to appendix Table 16 for the details on firm categorisation.

Seasonality in supply and in demand

From graph 7, a cyclical behaviour can be seen, with patterns repeating themselves intra-yearly. Before describing the intra-year seasonality in auction winners, the intra-year pattern of auctioned volume is studied.

Focusing on the supply side, a trend emerges looking at the monthly average volume of allowances auctioned throughout the study period (ref. Figure 8). The average amount of auctioned allowances

firm. EDF mainly hedges their allowances using year-ahead contracts, with time horizons of up to 3 years, and do not heavily rely on auctions to meet their compliance demand. This will be discussed in more details in the following C&D.

drops during the months of August. This is stipulated in the regulation about auctioning calendar in the auction regulations⁵¹. This may be in anticipation of the summer break that affect activity in all sectors during this period. Two peaks in auctioned volume appear for the months of March and December. The excess in amount auctioned in March could be explained by an anticipation of the compliance obligation to be met by the end of April. Regulators may do this on purpose in order to enable installations to meet compliance more easily. A more important share of volume auctioned won by regulated entities is therefore expected during this month and until compliance at the end of April. Lastly, the peak in volume auctioned in the months of December may also be caused by regulators foreseeing an increased need for allowances during that month. December being the end of the year, it corresponds to year ahead futures contract delivery, and regulators may put more allowances in the system to ensure there are enough allowances circulating for the issuance of the contracts on the secondary market. If that is the case, an increase in the proportion of auctioned allowances distributed to financial actors is expected during that period. Indeed, financial actors often appear to take short positions to be the counterparties of compliant firms in these year ahead futures contract⁵².



Figure 8: Average monthly volume of allowances auctioned on the primary market (2013 - 2019)

After looking at the trends in volumes put in auction, potential seasonality in the types of actors winning auctions is discussed. A cyclical behaviour can already be detected by looking at Figure 7. This can be further analysed by estimating the average monthly share of auctioned volume won by a category (ref Figure 9).

January appears to be a month during which financial actors receive the biggest share of auctioned allowances. On average, they win 60% of total auctioned allowances during this month. The

 $^{^{51} \}rm Access$ Auction regulation here: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX: 02010R1031-20191128

 $^{^{52}}$ As it was found to be the case for banks, Cludius and Betz, 2020. This will be discussed in more detail in the second C&D.

reason behind this remains uncertain. It may be due to the increase in the opening of futures contracts during that time of the year⁵³. Having opened new contracts, financial firms need to ensure they will be able to deliver the corresponding allowance volume by the end of the contract. Financial entities mainly rely on the spot market to buy the volumes of allowances needed in December⁵⁴. As auctions' reservation price is based on spot prices, they could also take part in auctions to acquire the necessary volume of allowances to deliver by the end of their future contracts. The increase in share won in January supports this hypothesis.



Figure 9: Average monthly volume of allowances won per bidder category (2012 - 2019)

Author's illustration. Notes: Auctions held on both platforms are included. Information on the different categories can be found in the appendix (ref. Appendix Table 16).

The months of March, July and December stand out for compliance actors: their market shares are at their highest level during this period: on average, more than 60% of auctioned volume is distributed to regulated firms, namely firms from the Electricity, Gas & Heat industry, other firms from the energy sector and other carbon intensive industries (ref Figure 9). The higher activity of compliance actors in March (and April) was expected, as mentioned above. This moment corresponds to a regulatory deadline on the system's calendar, as regulated firms face compliance obligation at the end of the month. This reveals that regulated firms also rely on the auctions market as a "last minute" adjustment tool to meet their allowance requirement. This seems to be particularly true for carbon intensive firms, whose share of won allowances is at its highest during the compliance month of April. The peak in volume won observed in December could be explained by the fact that some regulated firms get ready for compliance by the end of the calendar year. The higher share of allowances won during the summer may be related to the lower activity of the financial sector relative to the other sectors during these months.

 $^{^{53}}$ The open-interest of front-year futures contracts increases during that time of the year, showing the increase in new open positions (ref Appendix Figure 17)

⁵⁴This will further be discussed in the second C&D.

Computing the correlation coefficients between the share of different sectors with respect to auction volume reveals some interesting points. There is a negative correlation coefficient between the share of volume won by financial firms and the share of volume won by firms in the energy sector - both energy categories (ref Appendix 19). Financial firms may potentially be substituting compliance actors but further research must be done to confirm this observation.

Linking price to sectoral activity⁵⁵

Auction clearing prices have closely followed spot allowances prices (ref Figure 10). The average difference in prices is - 0.05 \oplus . For the most part of auctions, from 2013 to the end of 2018, the price differential was comprised within a mere 0.50 \oplus price range, except for some outlier observations (ref Figure 10). This trend is not surprising, as there is a reserve price⁵⁶ on the market for auctions. When testing for the difference in distribution between the spot prices and auction prices, the non parametric Mann-Whitney test revealed that the two distributions were significantly different from each other: auction price distribution was lower than the spot price distribution⁵⁷. This raises the question of the methodology used and calls for more transparency concerning the reserve price set by the EC. From the moment when spot prices picked up at the beginning of 2018, the price differential also increased. The increase in price differential starting in 2018 should further be investigated, as prices will most likely stay on an increasing trend.



Figure 10: Auction clearing price and spot price differences (2013-2019)

Source : EEX platform data⁵⁸, spot prices retrieved from ICAP⁵⁹

⁵⁵The focus is on auctions held on the EEX only, as only EEX clearing prices are publicly available.

⁵⁹ICAP Allowance Price Explorer

 $^{^{56}}$ The minimum price that has to be reached for an auction to be cleared. For more details about this, refer to Box 4.

⁵⁷Mann-Whitney tests for the distribution of two data series without relying on the normality assumption.

⁵⁸EEX Auction clearing price can be found on the EEX website. Access here: https://www.eex.com/en/market-data/environmental-markets/auction-market

Associations between the auction clearing price and a sectoral presence have been tested by estimating correlation coefficients between the auction clearing prices and different actors' respective market shares (ref. Box 6 below).

A significant negative correlation coefficient of -0.21 was found when studying the correlation between the monthly auction clearing price and the market shares of actors from the Electricity, gas & heat industries. An increase in auction clearing price is thus negatively correlated with the presence of these firms as successful bidders. No link of significant correlation has been established between the auction clearing price and the prevalence of other actors. That is, the correlation coefficients between the auction clearing price and the share of a sector according to auctioned allowances won is non-significantly different from 0 (ref. Table 1). Knowing that auction clearing prices closely follow spot prices, it would be of interest to further investigate if the same link holds on the secondary spot market. More generally, further research must be done to uncover the relationship between the evolution of auction clearing prices and the presence of a category of actor on the primary market.

Box 6 - Correlation Estimation (ref Table 1)

The two variables of interest to estimate the correlation coefficients have been transformed in the following way:

- Concerning auction clearing price, monthly average auction clearing prices on the EEX is estimated, with weights attributed to prices according to the volume auctioned. Further, this series is log-transformed and the first difference is taken.
- Market shares have been estimated to get a sense of market segmentation throughout the study period. Sectoral shares were computed using the auctioned volume distributed to a category over the total volume of auctioned allowances. As the shares are ranging from 0 to 1, they are not normally distributed.

The variables are rounded to a monthly granularity as transactions are not registered on the same day and thus the market shares are not perfectly synchronous with the auction dates.

To test for associations between the clearing price and the predominance of a sector, two nonparametric⁶⁰ correlation estimations are used: Kendall's Tau and Spearman's rho⁶¹. The correlation coefficients estimated by these two methods take the values between minus one and plus one. For the interpretation of the correlation coefficients, Kendall's Tau is preferred as the P-values of the estimated coefficients are more accurate in small sample sizes, which is the case here.

Table 1: Correlation coefficients between sector shares and auction prices

	Financial sector	Electricity, gas & heat	Other energy sector	Other carbon intensive sector
Clearing price	0.12	- 0.21 **	0.10	- 0.08

Kendall's Tau are reported. **, indicates significance at the 5% level⁶².

⁶⁰meaning these are estimation that do not rely on any particular distribution assumption

⁶¹The most commonly used Pearson correlation estimation rely on a hypothesis regarding the distribution of the data series, which is not respected here.

Identifying the big players in the auctions market

Exploiting transactions data allows the identification of active firms in the primary market for auction. In what follows the differences between the two platforms are described.



Figure 11: Overview of biggest auction winners

Note: All the successful bidders are listed for auctions held on the ICE. The top 17 successful bidders is listed for auctions held on the EEX.

First, differences emerge in terms of the number of successful bidders over the study period. On the ICE platform for auctions -the platform dedicated to GB auctions-, a total of 17 different entities have received auctioned allowances from 2012 to 2019. The names of all the successful auction winners on the ICE appear in the graph above (ref. Figure 11). All these firms have also won auctions on the EEX platform. On the EEX, more firms have successfully received allowances, as 110 unique firms have been identified. This is an intuitive result, as the overall volume auctioned on the EEX is more important than on the ICE (ref Figure 5). However, in a market where the the-

⁶²Correlation coefficients following Spearman's methodology have also been estimated and give similar results.

oretical number of eligible participants is more than 1000^{63} , this shows that the successful auction market players are not very diversified and is composed of big players⁶⁴. When looking at overall received allowances over the study period, the top 5 firms in all firms reap 50% and 90% on the EEX and the ICE platforms respectively.

The second difference is the category of firms that won the auctions. The only compliant actor identified as a successful bidder on the ICE is Shell (ref Figure 11). From auctions held on the EEX, more than half of the entities identified in the top 17 ranking in terms of volume distributed are compliance firms (ref Figure 11). As expected, these companies are from the energy sector. Some carbon intensive actors also appear, although not on the top 17 successful bidders. The airline company Lufthansa, the car manufacturers Porsche, Volkswagen and Seat, the steel producer Thyssenkrupp, the glass producer Wiegand-Glas and the paper company SAICA, to name the most successful bidders in this category.

Whether the auction took place on the EEX or the ICE, a common trait is observed concerning the origin of the accounts participating. Most actors that received auctioned allowances are registered in the GB registry. From the total volume auctioned during the period 2013 to 2019, more than half of allowances are won by a firm with an entity registered in the GB registry (88% for auctions held on the ICE and 53% for auctions held on the EEX). There seems to be a bias for non-regulated firms when they decide to open accounts to participate in auctions. Due to Brexit, this tendency may change, with non-regulated accounts being opened in other EU registries⁶⁵.

Finally, on both auction platforms, financial actors are very present. This shows that the primary market for auctions in the ETS is very financialised. Financial actors participate in auctions from both platforms to benefit from price differentials. Although the difference in auction strike prices is not big, it can be questioned whether financial actors benefit from arbitrage opportunities between the two auction platforms. Another reason, which is more likely at the moment, is that financial firms' demand for allowances is such that they require participating in both platforms to win enough allowances to match their needs.

Conclusion

This Climate & Debate aimed at introducing the regulatory framework of the EU ETS, focusing on the third phase specificities and describing the different actors in the system. The goal was then to zoom in on the primary market of the system, from describing the design of auctions, to analysing successful bidders and their evolution across time. Auction winners were identified using an augmented database, enabling the identification of the entity at the firm level.

 $^{^{63}\}mathrm{Counting}$ all compliance firms under the ETS as well as all the non regulated firms that have an account opened in one of the registries.

⁶⁴Note however that the official reports found on the EC's webpage find the HHI of the auctions is almost always in the moderately concentrated category. Access here: (https://ec.europa.eu/clima/system/files/2017-08/cap_report_201612_en.pdf)

⁶⁵Network analysis can be used to observe the potential impact of Brexit on the system's structure. Refer to the article written by Borghesi and Flori, 2019.

Overall, the number of auction winners throughout the years was very low, compared to the potential number of participants. Two main categories of actors have shared the bulk of the auctioned allowances throughout the years: financial firms and compliance firms from the energy sector. Other carbon intensive actors were not very present on the primary market.

Some cyclical patterns emerge in terms of shares of volume distributed according to sector. These patterns are mainly due to the regulatory calendar of the system. Compliance actors' share of won allowances was bigger in March and during the compliance month of April, suggesting these actors rely on the primary market as an adjustment tool to surrender their emission units. Financial firms appeared to be more active during the month of January - the reasons behind this recurrent phenomenon is most probably due to their activity in the secondary market for futures. Some weak relationships have also been identified. There is a weak negative relationship between the auction clearing price and the share of auctioned volume being distributed to Electricity, gas & heat firms.

As auctioning is going to be the only tool to introduce allowances in the system, further research must be done to ensure its smooth functioning. The potential power of financial actors must be determined, as the primary market is a market with few participants and may remain that way. The limited presence of compliance firms - especially industrial firms- raises the question of potential costs borne by these actors preventing them to enter the market and/or to win auctions. In the long-term, as they receive less and less allowances, would these costs deter them from participating in the auctions? Will they mainly rely on financial actors such as banks and brokers to ensure their compliance? The role financial actors will play in auction as they become the central tool for allowance issuance must be properly anticipated.

After having described the trends on auction winners of allowances, the next C&D will focus on the secondary market, where the activity of firms will be described, through the scope of different sectors. It will be interesting to see whether similar trends can be observed on the secondary market.

Appendix

Registry	% of success	
DE	92%	
GB	77%	
FR	68%	
IT	82%	
ES	89%	
PL	98%	
DK	42%	
SE	97%	
NL	91%	
FI	98%	
CZ	95%	
BE	93%	
RO	87%	
PT	96%	
HU	89%	
AT	91%	
GR	42%	
SK	89%	
BG	88%	
NO	87%	
IE	72%	
LT	96%	
SI	92%	
LV	63%	
LI	1%	
EE	78%	
LU	65%	
HR	85%	
СҮ	48%	
MT	51%	
IS	63%	
EU	0%	
XI	83%	
Grand Total	83%	
e. ana rotar	0070	

Figure 12: Results of the consolidation process - at the registry level

The registries are ordered decreasingly with respect to the count of account holders in the registry



Figure 13: Results of the fusion - transactions

The scope includes all transactions recorded on the EU ETS. Administrative transactions are not included in this graph. Note that for transactions flagged as auctions, all accounts have been assigned to a firm and the consolidation was complete.



Figure 14: Total emissions and installation counts according to registry (2019)



FIGURE 2. Relations in the EUTL Database

Notes: The header of each box states the table name. Primary keys are provided in gray boxes and bold font. Foreign keys in orange-yellow boxes. Not all fields are shown. For a complete list of fields and description of their content consult the respective table.

Source: Abrell, 2021

Energy Sector		Other carbon intensive sector		Financial Sector	
	Electricity, Gas & Heat	520	Mining of lignite	Adm	inistration of financial markets
3510	Electric power generation, transmission and distribution	1013	Manufacture of fruit and vegetable juice	6611	Administration of financial markets
3511	Production of electricity	1041	Manufacture of dairy products		Brokerage activity
3512	Transmission of electricity	1083 1090	Processing of tea and coffee Manufacture of prepared animal feeds	6612	Security and commodity contracts brokerage
3513	Distribution of electricity	1720	Manufacture of articles of paper and paperboard		Financial sector-others
3514	Trade of electricity	1721	and of containers of paper and paper board Manufacture of chemicals and chemical products	6419	Other monetary intermediation
3522	Distribution of gaseous fuels through mains	2000	Manufacture of other chemical products n.e.c.	6430	Trusts, funds and similar financial entities
3523	Trade of gaseous fuels through mains	2060	Manufacture of man-made fibres	6492	Other credit granting
3530	Steam and air conditioning supply	2223	Manufacture of builders' ware of plastic	6499	Other financial service activities, except insurance and pension funding n.e.c.
4322	Plumbing, heat and air-conditioning installation	2319	Manufacture and processing of other glass, including technical glassware	6619	Other activities auxiliary to financial services,
	Energy sector- others	2320	Manufacture of refractory products	6630	Fund management activities
610	Extraction of crude petroleum	2331 2351	Manufacture of ceramic tiles and flags Manufacture of cement		
1920	Manufacture of refined petroleum products	2391	Production of abrasive products Manufacture of basic iron and steel and of ferro-		
4610	Wholesale on a fee or contract basis	2410	alloys		
4619	Agents involved in the sale of a variety of goods	3312	Repair of machinery		
4610	Agents involved in the sale of fuels, ores, metals	3700	Sewerage Agents involved in the sale of machinery.		
4012	Wholesale of solid, liquid and gaseous fuels and	4614	industrial equipment, ships and aircraft		
4671	related products	4719	Retail sale of beverages in specialised stores		
4690	Non-specialised wholesale trade	4931	Urban and suburban passenger land transport		

Figure 16: Firm categories according to their NACE code

NACE codes - Statistical Classification of Economic Activities in the European Community have been used to group actors.⁶⁶

⁶⁶Access list of NACE code here.



Figure 17: Evolution of Open Interest around the month of January in 2022 (EEX)

According to the EEX, the Open Interest refers to the total of all derivatives contracts which are open at a given point in time, i.e. derivative contracts that have not yet been closed out, fulfilled by means of the physical delivery of the underlying asset or executed via cash settlement. Refer to Quemin and Pahle, 2021 for more complete graphs on Open interest evolution. *Source: the EEX. Access here.*



Figure 18: Evolution of auctioned volume (2012 - 2019)

"Flagged" shows the transactions that have been identified as resulting from a successful auction on the consolidated database. "EU" shows the total auctioned volume according to official reports.

Figure 19: Scatter plots between the share of volume won by financial firms and firms from the energy sector



Note: MS stands for the market shares. The correlation coefficient is respectively -0.54 and -0.57 for the relation in market shares of financial firms with the first category and with the second category of firms respectively.

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