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What makes carbon traders cluster their orders?

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ABSTRACT

The ability to trade large amounts of assets at low costs could be hindered when the size of the orders is concentrated at specific trade sizes. This paper documents evidence of size clustering behavior in the European Carbon Futures Market and analyzes the circumstances under which it happens. Our findings show that carbon trades are concentrated in sizes of one to five contracts and in multiples of five. We have also demonstrated that more clustered prices have more clustered sizes, suggesting that price and size resolution in the European Carbon Market are complementary and that carbon traders round both the price and the size of their orders. Finally, the analysis of the key determinants of the size clustering reveals that traders use a reduced number of different trade sizes when uncertainty is high, market liquidity is poor, and the desire to open new positions and cancel old ones is very strong.

1. Introduction

Since the inception of the European Union Emission Trading Scheme (EU ETS) in 2005, an increasing number of empirical papers have studied the microstructure of the European Carbon Market. Benz and Hengelbrock (2008) were the first to study market liquidity in carbon markets and observe that trading frictions in the form of transaction costs decreased over the first years of the EU ETS; Mansanet-Bataller and Pardo (2009) and Conrad et al. (2012) show that the decisions of the European Commission have a strong and immediate impact on carbon prices; Mizrach and Otsubo (2014) find that imbalances in the order book of the European Climate Exchange (ECX) help predict carbon returns for up to three days; and Medina et al. (2014) analyze the timeline of trading frictions in the European Carbon Market to conclude that the EU ETS market breakdown in 2006 had a persistent negative effect on the quality of the EUAs prices.[1]

Although the previous papers have studied a broad range of topics about carbon market liquidity, none of them have focused on the quantity dimension of liquidity. This is an important aspect to consider when trading. Following Meng et al. (2013), to the extent that investors fail to accommodate size along with price in their optimal allocation decisions, their overall costs may increase. As Black (1971, p.30) indicates, an asset is perfectly liquid when (i) there are always bid and ask prices for the investor who wants to trade small amounts of assets and the difference between those prices is always small; (ii) an investor can trade a large amount of the asset over a long period of time at a price not very different from the current market price; and (iii) an investor can buy or sell a large block of stock immediately, but at a premium or discount that depends on the size of the block. According to Harris (2003, p. 399), a trader must minimize the cost of trading a given size or, similarly, maximize the size she trades at a given cost. However, the ability to trade large sizes at low costs could be hindered when the size of the orders is concentrated at specific trade sizes. This empirical fact, known in the literature as the size clustering effect, has recently been observed in foreign exchange, equity, index futures, and credit default swap (CDS) markets (see Alexander and Peterson, 2007; ap Gwilym and Meng (2010); Meng et al., 2013; Moulton, 2005, respectively).

The financial literature offers some theories to explain clustering. Firstly, the price negotiation hypothesis, introduced by Ball et al. (1985) and by Harris (1991), indicates that the presence of uncertainly leads the traders to round both trade sizes and their equilibrium prices, with the aim of minimizing the costs of the trading process. Secondly, there are some papers that suggest that the tendency to round sizes and prices is due to trader's preferences. This is the case of different behavioral hypotheses suggested by Wyckoff (1963), Goodhart and Curcio

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[1] See Zhang and Wei (2010) for a comprehensive review of the main arguments of empirical studies on the EU ETS, in terms of the operating mechanism and economic effect of the EU ETS.

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(1991), and Ikenberry and Weston (2007), among others, that argue that investors prefer certain numbers over others without any rational explanation. By using a rounded set of numbers, the quantity of information that has to be processed by the traders is less. Combining these hypotheses, clustering appears because traders use a restricted set of prices and trade sizes to simplify their negotiations. Therefore, the higher the market volatility and the less the trading frequency, the higher the trading costs and the higher the level of clustering.

Finally, Hodrick and Moulton (2009) examine liquidity and how it affects the behavior of uninformed traders. One of the implications of their model states that in a market with many heterogeneous uninformed investors, the number of different sizes traded increases in accordance with their desire for satisfaction. If the desire for satisfaction is very high, they choose to trade a wide range of different sizes. Therefore, the degree of size clustering should be very low at times in which the desire of portfolio managers to satisfy their negotiations is very intense.[2]

The finding of coarse price grids, or price clustering, is common across a broad range of markets, including, among others, energy, water, foreign exchange, stock, bond futures, stock index futures, and carbon futures markets. However, as we have cited, the literature about the presence of size clustering is far less extensive.[3] This study offers the first analysis of observed patterns in European Union Allowances (EUAs) trade sizes. Specifically, the purpose of this paper is to document empirical evidence of size clustering behavior in the ECX EUA futures market and to understand under what circumstances it happens. The investigation of clustering in trade sizes could offer new insights into the liquidity of the European Carbon Futures Markets as long as its presence would be indicative of the fact that carbon traders might not negotiate their desired quantities at a given price. As we will show in this paper, size and price rounding will result in lower transactions costs. Additionally, the results of this study contribute to the debate by providing further empirical evidence on whether price and size clustering are coincident or not.

The remainder of the paper is organized as follows. Section 2 describes briefly the European Carbon Market and the data used to perform this study. Section 3 analyzes the distribution of the trade sizes. Section 4 presents the findings on size clustering and its key determinants. Section 5 summarizes and concludes.

2. Market structure and data

Next, we provide a brief description about the main characteristics of the EU ETS. For further information, see Ellerman et al. (2010) for a detailed explanation of the origins and development of the EU ETS, and Ellerman et al. (2014) for a descriptive analysis of the history and structure of the EU ETS from its inception through 2012.

The EU ETS was launched in January 2005 and is, at the moment, the first international emission trading system to address greenhouse gas emissions from companies. The EU ETS covers emissions from power plants, factories and companies belonging to energy-intensive industry sectors in the 28 EU countries and the three European Economic Area states (Iceland, Liechtenstein and Norway). Flights to and from the EU and the three European Economic Area states are also covered. These installations and flights represent around 45% of the EU's greenhouse gas emissions.

The EU ETS has evolved from a system with 25 national caps and decentralized allocation based on national allocation plans dealing with CO_2 emissions alone towards a centralized system that includes several greenhouse gases (GHGs) and features an EU-wide cap (see Ellerman et al., 2014). Within this cap, companies may receive or buy emission allowances each year. These allowances give the holder the right to emit 1 tonne of CO_2 and are known as European Union Allowances, or EUAs. If a company considers that it has more allowances than it is going to need, it can sell them in the market. However, each company must surrender enough allowances to cover all its emissions for the previous year by the 30th of April of the following year, otherwise heavy fines are imposed.

The EU ETS is organized in Phases. Pilot Phase I ran from 2005 to 2007. The number of allowances allocated was so high that the EUA price fell to zero in 2007. Phase II ran from 2008 to 2012 and coincided with the Kyoto Commitment Period. The cap was lowered by 6.5% with regard to the level in the previous period. However, the economic crisis again caused an unexpected surplus of allowances. Phase III, spanning 2013 to 2020, will cover new industries and has a prolonged compliance cycle. It will incorporate a centralized EU-wide allocation of allowances with a yearly linear decrease of the emissions cap of 1.74% per year, even beyond 2020. During Phases I and II the majority of the allowances were allocated freely. From 2013 on, there is a combination of free allocation and auctioning, and the ETS legislation has set the goal of phasing out free allocation completely by 2027.[4]

Several electronic trading platforms currently offer trading on EUAs. However, the ICE ECX EUA Futures Market is considered as the benchmark as it concentrates by far the majority of the total trading volume. In fact, following the Futures Industry Association, the ICE ECX EUA Futures contract is among the top 20 most-traded Energy Futures & Options Contracts in the world.[5] The ICE ECX market is an electronic order-driven market whose daily session commences with a pre-open period of 15 min (from 6:45 a.m. UK local time) and ends with a single call auction. Throughout the continuous session, from 7:00 to 17:00, brokers and market makers are able to submit limit orders, stop limit orders, market orders, and block orders. The futures contracts are traded in lots, with each lot equaling 1000 tonnes of CO_2 equivalent, in other words, 1000 EUAs. The minimum tick size was €0.05 until 27 March 2007 when it changed to €0.01. Futures contracts cease trading at 17:00 h UK local time on the last Monday of the contract month.[6]

To carry out this study, we have chosen the complete lifespan of the ECX EUA futures contracts with maturities in December 2010, 2011 and 2012, all of them belonging to Phase II. The data sample periods run from 21 September 2006 to 20 December 2010, from 23 March 2006 to 19 December 2011, and from 23 March 2006 to 17 December 2012, for the December 2010, 2011 and 2012 futures contracts, respectively. A total of 304,180, 359,003 and 491,205 transactions took place, for the first, second and third contracts analyzed, respectively.

Specifically, our database contains, for every screen trade, the following concrete information: the time stamp measured in GMT, the traded price in euros, the contract maturity date, the traded volume, the daily settlement price, and the sign of the transaction specifying whether it is buyer- or seller-initiated. Following Alexander and Peterson (2007), a trade that has been buyer-initiated is more likely to be followed by another buyer-initiated order if the trades are rounded. Therefore, we will take into account the sign of the transaction to check if trades initiated by one of the sides could be more size clustered than trades initiated by the other side.

[2] Moulton (2005) analyzes size clustering in the foreign exchange market and shows that customers trade more precise quantities at quarter-ends because this is when investors could have a stronger desire to satisfy their quantity demands. A similar explanation is provided by Garvey and Wu (2014) to justify why US equity traders submit more non-rounded order sizes and more order sizes overall leading up to a day's market close.

[3] See Brooks et al. (2013) and ap Gwilym and Meng (2010) for excellent reviews of the literature on price and size clustering, respectively.

[4] See ec.europa.eu/clima/policies/ets/index_en.htm for further details about the European Union Emissions Trading Scheme (last accessed on December 30, 2014).

[5] See http://www.futuresindustry.org/volume-.asp for trading volume statistics on Global Futures and Options (last accessed on September 30, 2013).

[6] For further details on the EUAs futures contract, see the user guide of ECX Contracts at www.theice.com (last accessed on September 26, 2013).