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Liquidity and market efficiency in the world's largest carbon market☆

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ABSTRACT

We investigate liquidity and market efficiency on the world's largest carbon exchange, *IntercontinentalExchange Inc.*'s European Climate Exchange (ECX), by using intraday short-horizon return predictability as an inverse indicator of market efficiency. We find a strong relationship between liquidity and market efficiency such that when spreads narrow, return predictability diminishes. This is more pronounced for the highest trading carbon futures and during periods of low liquidity. Since the start of trading in Phase II of the EU Emissions Trading Scheme (EU-ETS) prices have continuously moved nearer to unity with efficient, random walk benchmarks, and this improves from year to year. Overall, our findings suggest that trading quality in the EU-ETS has improved markedly and matures over the 2008–2011 compliance years.

1. Introduction

The EU Emissions Trading Scheme (EU-ETS) is both the largest compulsory cap and trade scheme in the world and the most potent regional climate change policy tool arising from the EU's 2002 ratification of the Kyoto protocol, a global

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treaty on greenhouse gas emission reduction.[1] The operation and success of the EU-ETS will significantly inform the direction of global climate policy, identifying effective mechanisms for carbon trading and the effect of different restrictions on the price of emissions. The scheme may also affect the growth of the emission-constrained economies in Europe, New Zealand, the United States, Japan and other parts of the world. This is because regulatory arbitrage is likely to be greater when carbon trading is limited to significantly smaller geographical locations, as is the case at this time. The market is artificial and dependent on environmental policy and regulation; it is therefore exposed to greater levels of uncertainty than is the case for most 'natural' commodities. Emissions permits have to be surrendered on an annual basis. In principle, therefore, futures contracts on emissions permits offer significant benefits, both as instruments for hedging price risk and as mechanisms to assist in the smooth operation of the system as a whole. Understanding the microstructure of these markets therefore goes a long way in helping to inform global climate change policy. This paper contributes to an understanding of the market microstructure for an emerging market that addresses the climate change challenge.

Financial markets perform two key functions: the provision of liquidity, and price discovery (see O'Hara, 2003). The extent to which the price discovery process reflects all available information in the market can be described as an indication of the market's efficiency (see Fama, 1970). In regular financial markets liquidity plays an important role in enhancing price discovery and by extension, pricing efficiency. In this paper we first test whether this holds for the EU-ETS, and thus determine that intraday pricing efficiency is inextricably linked to daily liquidity. Specifically, we confirm that the predictability of intraday returns from intraday lagged order flows significantly decreases on days when the market enjoys greater liquidity. Fama (1970) view of market efficiency implies the absence of return predictability, while market microstructure literature emphasises the reflection of private information in prices as a measure of market quality (see Chordia, Roll, & Subrahmanyam, 2008). Kyle (1985) notes that even the most efficient of markets reflects different levels of private information. Naturally, when markets attain higher levels of liquidity due to an exogenous event they may more easily absorb private information, since increased liquidity may encourage more informed trading due to a fall in transaction costs (see Admati & Pfleiderer, 1988). The link between liquidity and pricing efficiency is even more important in the case of the EU-ETS, where EU policies are being implemented in order to increase transactions in carbon permits. Such policies can be regarded as exogenous events akin to policy regarding tick size changes on NYSE, for example. In this paper, where we identify the commencement of compliance years as an exogenous event corresponding to the tightening of trading spreads (see Fig. 2), a confirmation of the liquidity-return predictability link would imply that increased trading activity induced by EU policies could improve EU-ETS pricing efficiency. This is the first empirical study to directly examine the intraday evolution of this relationship in an environmental market like the EU-ETS. Secondly, we test whether market efficiency improves over the course of 40 months in Phase II of the EU-ETS, by using compliance years as exogenous regimes which correspond to reductions in trading spreads. The study thus presents the longest period study of intraday analysis of intraday pricing dynamics in the EU-ETS. Thirdly, we test whether intraday prices move closer to random walk benchmarks from compliance year to compliance year in Phase II. Deviations from a random walk benchmark would implicitly suggest higher levels of noise in the trading process, and vice versa. These three issues hold significance for several stakeholders. Firstly, policy makers who aim to improve trading activity as well as efficiency of the trading process may benefit from a clearer understanding of the links between return predictability and liquidity. Secondly, market makers on EU-ETS platforms, whose job it is to provide liquidity, platform operators and regulators may learn how the evolution of liquidity could affect the price discovery process. Thirdly, investors in carbon financial instruments may also find this study beneficial, as intraday prices rather than end of day prices mostly influence trader sentiment, and trades clustered around the opening/closing of the market (at which point it is most volatile – see Rotfuβ, 2009) may be the basis for settling derivative contracts.

As market participants require time to incorporate new information into their trading strategies, a market deemed efficient over a daily horizon does not necessarily translate into a market that is efficient at every point during the day (see for example Chordia et al., 2008; Epps, 1979; Fama, 1970; Hillmer & Yu, 1979; Patell & Wolfson, 1984). Confirmation of this notion is available in the contributions of Cushing and Madhavan (2000) and Chordia, Roll, and Subrahmanyam (2005), showing that short-run returns can be predicted from order flows. However, Chordia et al. (2008) find that this predictability diminishes with improving market liquidity and across different tick size regimes on the NYSE. Similarly, Chung and Hrazdil (2010a) confirm the diminishing predictability proposition in a large sample analysis of NASDAQ stocks. These studies thus provide evidence of a strong relationship between liquidity and the enhancement of market efficiency through the impact of liquidity on the pricing process.

Another stream of literature examines the connection between liquidity and returns through the demand for *premia* when trading in illiquid instruments. Pástor and Stambaugh (2003) find a positive cross-sectional relationship between stock returns and liquidity risks. Their results are underscored by similar findings from Datar, Naik, and Radcliffe (1998) and Acharya and Pederson (2005). Similarly, Amihud (2002) documents evidence supporting the hypothesis that expected market liquidity provides an indication of stock excess return in a time series. This implies that the excess return, to some extent, typifies an illiquidity premium. Chang, Faff, and Hwang (2010) also report consistent findings for the Tokyo Stock Exchange.

[1] At present there are at least 18 of such market-based schemes worldwide, and the EU-ETS is the largest of them all, driving more than 90% of all global transactions in carbon financial instruments (see Ibikunle et al., 2013).

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