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Is the European Union Emissions Trading Scheme (EU ETS) informationally efficient? Evidence from momentum-based trading strategies

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HIGHLIGHTS

- This paper examines the informational efficiency of the EU ETS.
- In particular, it examines momentum – a form of price predictability.
- It applies a time series approach to momentum.
- It finds that momentum exists which leads to profitable trading strategies.

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ABSTRACT

Since 2005, the European Union Emissions Trading Scheme (EU ETS) has seen a rapid growth in trading volume activity, with 1.44 billion tons of CO_2 traded in 2007. The total value of these trading transactions was €24.1 billion in 2007, confirming the EU ETS as the largest emissions trading system by transaction value. In this paper, we test whether this market exhibits predictability of prices in terms of momentum (i.e., positive/negative changes continuing) and overreaction (i.e., positive/negative changes reversing). We test whether momentum and overreaction exist in the carbon price, and if they do, whether they result in profitable trading strategies. We document a robust short-term momentum and medium-term overreaction within the EU ETS. We also find statistically significant returns in a number of strategies tested. The strategies employed provide excess returns that remain achievable in a practical sense even after transaction costs have been taken into consideration. Our results therefore provide evidence that the EU ETS is not informationally efficient.

1. Introduction

In this paper, we test whether the European Union Emissions Trading Scheme (EU ETS) is informationally efficient. The issue of market efficiency has very important implications for investors in the carbon market. If markets are not efficient, it opens a door for investors in this market to achieve abnormal returns. According to Fama [1], a market is efficient, at least in the weak form, if prices do not exhibit predictability. Through an examination of momentum, we investigate whether or not prices in the EU ETS exhibit predictability. First described by De Bondt and Thaler [2], "overreaction" refers to the circumstance where investors overreact to new information and drive asset prices beyond their fundamentals before they reverse predictably through time. Researchers advocate a strategy of buying past losers and selling past winners to profit from this behavior. Momentum, on the other hand, describes the apparent behavior of asset returns continuing in their current direction (either positive or negative). Momentum strategies advocate buying past winners and selling past losers to generate abnormal profits. Momentum and overreaction indicate predictability of prices based on past information which is a violation of the tenet of one of the most important theoretical foundations in financial economics – the efficient market hypothesis (EMH).

Since Jegadeesh and Titman [3], many studies have found momentum to exist and persist in many different asset classes and markets including foreign equities, currencies and commodities [4–6]. In this paper, we aim to investigate whether these two phenomena also exist in the carbon market – a new market that is relatively unique compared to other asset markets. We examine whether profitable trading strategies based on momentum and overreaction can be identified in this market. Though there are

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Table 1
Evolution of trade within the EU ETS 2005–2009. *Source:* Barberis et al. [60].

	EUA volume traded (millions of tons)	Value of Transactions (millions of Euros)	Average price (Euros/tCO_2)
2005	262	5400	20.60
2006	828	14,500	17.50
2007	1,458	25,200	17.30
2008	2,731	61,200	22.40
2009	5,016	65,900	13.10

Note: This table excludes OTC transactions without clearing.

studies relating to market efficiency in the carbon market, to the best of our knowledge, our paper is the first to investigate momentum and overreaction within the market.

We undertake our investigation of momentum and overreaction with respect to the EU ETS. The EU ETS is the most mature CO_2 emission-trading market and largest market for emissions trading, accounting for more than 90% of the world's transaction volume and value for CO_2 allowances [7]. However, it is only in its 8th year having commenced only on January 1st, 2005 with all 15 then members of the European Union participating. The first phase (Phase I) of the EU ETS – regarded as a trial period – ran from 2005 to 2007 covering more than 12,000 installations responsible for approximately 40% of the European Union's CO_2 emissions. The second phase (Phase II) of the EU ETS covers the period from the beginning of 2008 to the end of 2012 with all 27 current member states participating.

Since the commencement of the EU ETS in 2005, the market has seen dramatic growth in both the volume of EU Emission Allowances (EUAs) permits traded and the value of transactions. Table 1 shows the evolution and growth of this emerging market, where the volume and value of transactions have increased greater than ten times from 2005 to 2009, although the growth from 2008 to 2009, corresponding to the Global Financial Crisis (GFC) period, was relatively flat. This dramatic growth in the market is further illustrated in Figs. 1 and 2.

Our paper not only adds theoretical insight into the concepts of momentum and overreaction, but also provides practical strategies that investors can implement when entering the EU carbon markets. Research into existing trading systems will advance essential experience and understanding of the dynamics and mechanisms involved in this new and emerging market.

The remainder of our paper is organized as follows. Section 2 introduces the institutional background, explaining the formation and function of the EU ETS. Section 3 reviews relevant literature regarding emissions trading and the efficient market hypothesis, specifically, momentum and overreaction. Section 4 develops testable hypotheses, and presents our research methodologies and sample data. Section 5 provides the empirical results while Section 6 concludes.

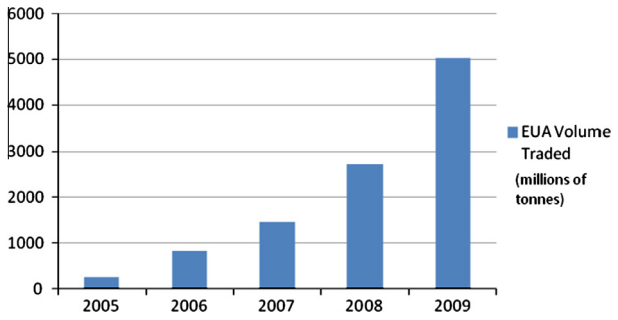

Fig. 1. Volume of EUAs traded in the EU ETS.

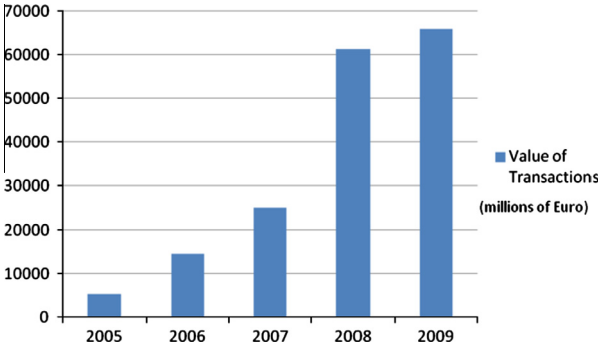

Fig. 2. Value of transactions within the EU ETS.

2. Institutional background

One of the primary functions of the EU ETS is to facilitate the interaction between four main participants, for the purpose of efficiently connecting the suppliers of carbon credits EUAs, Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) with buyers. Fig. 3 illustrates the relationship between these groups. The market participants are classified as suppliers, intermediaries, end users and regulators. The intermediaries in this market, consisting of brokers, traders and organized exchanges, work very similarly to those within other asset markets facilitating the transfer of emission credits between suppliers and buyers. The market as a whole operates within a legal framework, under the supervision of several regulatory bodies such as the United Nations Framework Convention on Climate Change, the EU Commission, and various European financial regulators.

A major feature of the EU ETS is the importance of organized exchanges. Trading on organized exchanges first appeared on the Nord Pool Exchange in February 2005, and has grown rapidly with the opening of exchanges in Leipzig, London, Paris, and Vienna [8]. In comparison to US allowance markets where virtually all trades are conducted in over-the-counter (OTC) markets, Ellerman and Joskow [8] illustrate that the EU ETS now boasts one-third of all trades taking place on organized exchanges. They contend that the appearance and continuance of these exchanges provides evidence that the law of one price emerged early in the EU ETS, because exchanges could not continue to operate if there were no convergence of prices. Bataller et al. [9] provide further evidence of prices converging very closely across all marketplaces, with cross-correlations at 0.943 or higher.

The EU ETS is a cap-and-trade system which is influenced by policy decisions (through regulators) and external economic variables. Regulators decide the total amount of EUAs available, whether they are auctioned or allocated, the allowable usage of CERs and ERUs, the penalties for non-compliance and the extent of banking and borrowing of permits between each year and phase [10]. Demand for EUAs, on the other hand, is driven primarily by the European Union's macro-economic factors, energy prices – particularly electricity, natural gas and oil prices – and weather events [11–14].

During Phases I and II, the National Allocation Plans (NAPs) were used to determine the EU ETS supply through the allocation of EUAs, and also to decide the amount of CERs and ERUs that could be used for compliance. The ability for installations to bank and borrow EUAs between periods can significantly influence supply. During Phase I, installations were able to borrow permits from future allocations to meet current shortfalls or to bank current excess permits for use in following years. However, this banking and borrowing was limited to Phase I allocations only, and could not be carried over into Phase II. From Phase II onwards