Journal of Banking & Finance 42 (2014) 112–122

Contents lists available at ScienceDirect

Journal of Banking & Finance

journal homepage: www.elsevier.com/locate/jbf

Catalysts for price discovery in the European Union Emissions Trading System

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ARTICLE INFO

Article history:
Received 7 February 2013
Accepted 17 January 2014
Available online 27 January 2014

JEL classification:
G13
G14

Keywords:
Price discovery
Trading costs
Emissions trading

ABSTRACT

We provide the first evidence on catalysts for price discovery in the European Union Emissions Trading System. Specifically, by employing high frequency data across a wide range of fungible securities, we find that trading costs are a more important determinant of price discovery than either the implicit provision of leverage in securities such as futures and options or the existence of market segmentation. Moreover, securities with low trading costs display greater price discovery than those with high trading costs.

1. Introduction

The European Union Emissions Trading System (EU ETS) is a decentralised market place encompassing over-the-counter (OTC) trading of emission allowances as well as spot, futures and options trading on organised exchanges. With such a wide dispersion of tradable securities and trading venues, understanding both the source of, and catalysts for, price discovery is of crucial importance to regulators, practitioners and academics alike. A number of studies explore price discovery in Phase I of the scheme (see, for example, Uhrig-Homburg and Wagner, 2009; Benz and Hengelbrock, 2008), where an oversupply of allowances late in the phase saw prices collapse, as well as in the scheme's better functioning Phase II (see, for example, Chevallier, 2010a, 2010b; Mizrach, 2012; Cummins, 2012).[1] However, most of this work employs daily data to gauge the location of price discovery and, in doing so, obscures the important, granular aspects of the timeliness of price responses to information arrival. Moreover, studies that do perform intraday analysis (see, for example, Mizrach and Otsubo, 2011; Rittler, 2012) undertake a binary comparison of specific securities and do not consider which frictions drive the price discovery process in the market overall.

Against this backdrop, we contribute to the literature by employing high frequency data to fully characterise both the location and determinants of short- and long-run price discovery in Phase II of the EU ETS. Specifically, we first assess contemporaneity of returns using a regression approach similar to that of Fleming et al. (1996) and examine the contribution of each security to the long-term price equilibrium using Hasbrouck's (1995) information shares. Thereafter, we consider the identity and effect of market frictions on price discovery. If two securities are perfect substitutes for one another, or are identically affected by the same information, their prices should change simultaneously in a frictionless market. That is, neither security should display greater price discovery than the other. Similarly, given minimal short-term changes in carrying costs, the prices of derivative securities should simultaneously change to reflect information regarding the value of underlying assets. However, as discussed previously, despite EU ETS instruments being essentially fungible with one another, evidence suggests they do not impound new information simultaneously and, thus, that traders may have preferences for particular securities. This, in turn, suggests frictions exist within the market that impede price discovery. We study the effect of three specific frictions on this process, namely trading costs, leverage and market segmentation. Indeed, the large number of equivalent securities in the EU ETS provides an ideal opportunity to quantify the impact of market frictions on price discovery more generally.

The remainder of this paper is structured as follows: Section 2 discusses the development and structure of the EU ETS; Section 3

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[1] Studies such as Charles et al. (2013) investigate the efficiency of emissions markets during Phase II of the ETS.

http://dx.doi.org/10.1016/j.jbankfin.2014.01.012
0378-4266/

identifies potential catalysts for price discovery in these emissions trading markets; Section 4 discusses the methodology employed in testing avenues of price discovery; Section 5 discusses the data employed in testing; Sections 6 and 7 overview the results of our central and robustness testing, respectively; and, Section 8 concludes.

2. The EU ETS

Since 2005, the EU has operated an emissions trading system to assist in achieving its commitment to reduce greenhouse gas emissions. Implemented in 3 phases,[2] the EU ETS is a cap and trade system in which the quantity of emissions that the EU's large polluters emit is capped and set by the European Commission. The emission cap is lowered by approximately 1.74% per annum to meet emission reduction targets agreed internationally under the Kyoto Protocol. Polluters are allocated allowances, either free or via auctions, which they surrender annually against their assessed emissions. Where they have a surplus or deficit of allowances relative to their actual emissions, polluters can trade with other institutions in the EU ETS either in bilateral over-the-counter (OTC) transactions or in organised spot, futures and option markets facilitated by almost a dozen exchanges. By making the right to pollute increasingly scarce, the market mechanism should allocate emission rights to those with the highest value in continuing to pollute; those polluters for whom the cost of reducing their emissions by other means is highest.

Three types of allowances can be used by polluters in the EU ETS: European Union Allowances (EUAs), Certified Emission Reductions (CERs), and Emission Reduction Units (ERUs). Although all three allowances act as abatement for emitting 1 metric tonne of carbon dioxide (CO_2) or equivalent upon surrender, they differ along several other dimensions. Specifically, EUAs are the most common allowance type in the EU ETS and are allocated or auctioned by European governments to Europe's large polluters. In contrast, CERs are generated when Annex I country organisations undertake emission reduction projects known as Clean Development Mechanism Projects in developing countries, predominantly China and India.[3] ERUs are similar to CERs but they are generated by an Annex I country organisation undertaking an emission reduction project in another Annex I country. Moreover, although they are much less common than CERs, ERUs predominantly originate from projects in Russia and the former Eastern Bloc countries.

Both CERs and ERUs trade in the EU ETS on the basis that greenhouse gases have global warming effects regardless of where they are emitted. However, while the European Commission allows CERs and ERUs to be surrendered by European polluters, thereby encouraging emission reduction schemes to be undertaken wherever they are most cost effective, a number of limitations apply to their use. For example, member governments have discretion over whether to cap the percentage of CERs and ERUs that can be surrendered for compliance purposes by installations in their jurisdictions (European Commission, 2004). Indeed, many governments have chosen to impose such limits amid concerns that a large, externally-generated supply of CERs and ERUs could flood the market and remove incentives for domestic installations to take direct action to reduce emissions themselves.[4] The European Commission also excludes particular types of CERs and ERUs from being surrendered for compliance amid concerns about the methodologies used in calculating the future emission reductions stemming from particular project types and/or projects' potential to have counterproductive environmental impacts. These limitations, coupled with more general uncertainties surrounding their use mean traders often prefer EUAs over project-based allowances. Consequently, eligible CERs and ERUs trade at a substantial discount to EUAs.

The EU ETS is comprised of bilateral OTC trading as well as spot, futures and option trading of allowances facilitated by exchanges. Exchange trading of emission allowances was originally conducted via specialist energy trading platforms that expanded to encompass emission allowances with the advent of the EU ETS. However, consistent with the increased consolidation of financial exchanges in the last decade, these emission exchanges are now predominantly owned by large global exchange groups or consortiums of banks and brokers. Nine exchanges have facilitated trade in EU ETS securities during Phase 2. Details of each exchange, including the instruments traded on them, are summarised in Table 1. Many of the instruments detailed in the table were not introduced until well after the start of Phase 2. These delayed introductions are not surprising given the financial crisis and the impact of over-allocation of allowances in Phase 1, which likely motivated exchanges to wait and see whether the reported emissions in April 2008 were above or below the system cap. Likewise, having been launched, some securities failed to attract much interest and were subsequently abandoned. In particular, a number of spot securities never reopened for trade after the European Commission's 2-week shutdown of the spot market in January 2011 following allowance thefts from national registries.

3. Catalysts for price discovery

Differential trading costs between securities are a prominent form of market friction. These costs can be explicit, such as brokerage and clearing fees, or implicit, such as the cost of a round trip in buying and selling a security (the spread between bid and ask prices). The explicit costs of transacting are difficult to measure as they will vary depending upon a market participant's relationship to their particular broker or, in the case of brokers themselves, their clearing fees may vary with their level of membership at a particular exchange. Regardless, these costs are often small compared to the implicit costs of trading,[5] particularly for less liquid securities which tend to have wide bid-ask spreads, little market depth and for which trades have a large impact on the price level. We assume transaction costs are largely exogenously determined and are likely the product of individual market characteristics such as the Designated Market Maker program used by the Intercontinental Exchange, which mandates maximum spreads for much of the trading day. If several securities are identical in all characteristics save trading cost, a market participant looking to profit by trading on new information will realise higher returns by trading the security with the lowest trading cost. Consequently, we hypothesise that price discovery in the EU ETS takes place in securities with the lowest trading cost. Although a number of metrics could be used to measure implicit trading costs such as those describing the market impact of trades, or market depth and breadth, we employ the most commonly used measure of implicit trading costs in the finance literature namely the bid-ask spread. The spread is simply calculated

[2] Phase 1 ran from the start of 2005 to the end of 2007 and saw the free allocation of allowances to polluters so as to familiarise them with the new arrangements. Phase 2 continued until the end 2012 and included a small number of allowance auctions in countries including Germany, the United Kingdom, the Netherlands, Austria and Ireland. EUAs will increasingly be auctioned during Phase 3, which will run until the end of 2020, with free allocations expected to decrease from 80 per cent to 30 per cent of issued allowances over this time (European Commission website (2012), http://ec.europa.eu/clima/policies/ets/index_en.htm, 20th November 2012).

[3] Wara (2008) provides an excellent discussion of the Clean Development Mechanism's performance and, in doing so, highlights some of its inherent limitations.

[4] The average annual limit across the EU ETS on the surrendering of project-based allowances is approximately 13.4 per cent (Mansanet-Bataller et al., 2011).

[5] Our analysis of the fee structures of several exchanges suggests that explicit trading costs range between one tenth and one third of the implicit cost (the bid-ask spread) on the most actively traded security.