MARKET INSIGHTS

The effects of EUA supply disruptions on market quality in the European carbon market

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October 2008 • Edition 26

in association with

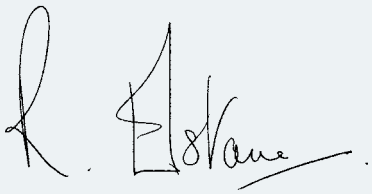
ASX
AUSTRALIAN SECURITIES EXCHANGE

FOREWORD

In this 26th edition of Market Insights Professor Alex Frino, Jennifer Kruk, and Dr. Andrew Lepone from the Finance Discipline at the University of Sydney examine the effects of EUA supply disruptions on price volatility and transaction costs in the European carbon market.

This research is of particular importance given the impending introduction of the Carbon Pollution Reduction Scheme in Australia. I trust you will find it both interesting and useful when examining the opportunities environmental products might present to your own particular organisations.

Regards



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EXECUTIVE SUMMARY

The aim of this paper is to analyse the effects of two supply disruptions on market quality in the European carbon market. Specifically, we examine the effects of (i) the release of 2005 emissions data indicating an oversupply of EUAs for Phase I, and (ii) the restriction on banking Phase I EUAs for use in Phase II. Our key findings are as follows:

- The nearest to delivery futures contract (December 06 futures) experienced severe price volatility over a three week period as a result of uncertainty surrounding the supply of Phase I EUAs.
- Institutions trading the nearest to delivery contract incurred substantially higher transaction costs over the same period; however, higher transaction costs persisted after the event.
- Although not reported in this paper, severe price volatility and higher transaction costs were also experienced by Phase II futures contracts as a result of Phase I supply uncertainty.
- The European Commission's ban on banking Phase I EUAs for use in Phase II exacerbated the natural shift from trading Phase I to Phase II EUAs, subsequently causing Phase I EUAs to trade at less than €1 for most of 2007. Further, liquidity in the futures market shifted from the December 07 contract to the December 08 contract. The December 08 contract traded heavily from November 2006 onwards, even though Phase II EUAs did not begin trading in the spot market until early 2008.

Introduction

The European Union Emissions Trading Scheme (EU ETS) dominates the global carbon market. According to the World Bank, a total of 2,061 million tonnes of carbon dioxide ($MtCO_2$) were traded via the EU ETS in 2007, worth USD 50.39 billion.[1] This figure incorporates trading in the spot market (<2%), the options market (2-3%), and the futures/forward market (95%).

The EU ETS operates as a cap and trade scheme, where EU Member States set annual emissions targets for each phase of the scheme.[2] Following the approval of the European Commission, Member States allocate European Union Allowances (EUAs) to firms covered by the EU ETS. One EUA gives the holder the right to emit one tonne of carbon dioxide. Once allocated, firms buy or sell EUAs depending on their individual requirements.

Thus, supply and demand in the European carbon market operate within constraints set by the Member States and the European Commission. This creates a level of political risk not present in traditional markets. The primary source of political risk in carbon markets is the setting of emissions caps (the supply of EUAs) in relation to actual emissions. For example, setting emissions caps too high creates an oversupply of EUAs and will result in a very low carbon price. This prevents the scheme from working effectively, as the carbon price needs to be sufficiently high to encourage companies to reduce carbon dioxide emissions internally and encourage investment in alternate energy sources.[3]

To date, the European carbon market has experienced two distinct supply disruptions. The first occurred with the release of 2005 emissions data in April/May 2006. The data showed that the market for allowances was long by 44 $MtCO_2$ in 2005, implying that emissions caps for Phase I were too high (i.e. an oversupply of EUAs).[4] This supply disruption was exacerbated by several Member States releasing their 2005 emissions data ahead of the official release by the European Commission. The second supply disruption occurred at the end of Phase I, as the European Commission had previously decided that Phase I EUAs were not fungible with Phase II EUAs. This created discontinuity in the supply of EUAs between phases.

To analyse the effects of these supply disruptions, we initially examine Phase I and Phase II carbon prices on the spot and futures market. We then examine the effects of each of the supply disruptions on the most liquid carbon market – the futures market. Specifically, we examine trading volume, price volatility, and transaction costs for carbon futures traded on the Intercontinental Exchange (ICE).[5] This paper utilises spot market data, provided by Bluenext, and ICE futures data, provided by Reuters and ICE, for the period 10 October 2005 to 16 June 2008. The data incorporate on-market trading in the spot market, and both on-market and off-market trading in the futures market.[6]

1 See The World Bank: State and Trends of the Carbon Market 2008.

2 The EU ETS is divided into three distinct phases. Phase I (2005 – 2007) is the trial period, Phase II (2008-2012) is the Kyoto Period, and Phase III (2013 – 2020) is the post-Kyoto period. Separate emissions caps are set for each phase.

3 Kanen (2006) suggests that in order for fuel-switching prices to drive the long-term carbon price, the market must be short of allowances. The fuel-switching price is the carbon price that is needed to make gas-powered plants favoured over coal-powered plants.

4 Kanen, J.L.M., 2006, "Carbon Trading and Pricing", Environmental Finance Publications, London.

5 ICE futures represent approximately 80 per cent of exchange traded volume (World Bank, 2008).

6 The Appendix contains a description of the data.

The carbon price: Spot and futures

Figure 1. The carbon price

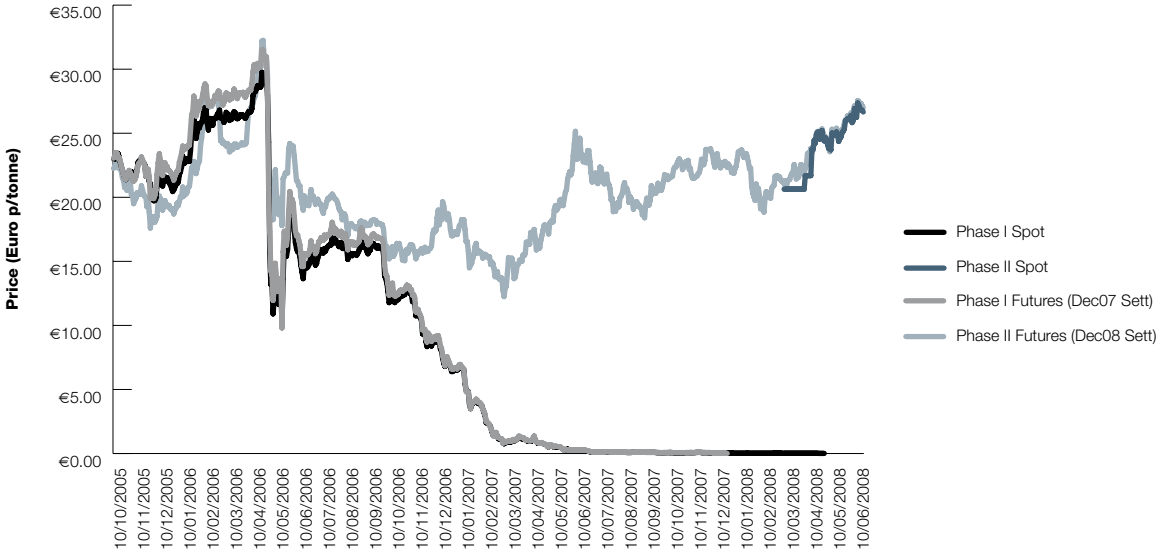


Figure 1 illustrates the effect of an oversupply of EUAs on the carbon price in the spot and futures markets. The market first became aware that Phase I EUAs were net long in late April 2006, when several Member States released their 2005 emissions data ahead of the European Commission's official release date.[7] From April 19, 2006 to May 15, 2006 the Phase I spot price fell by approximately 50 per cent (from €29.68 to €13.65), as did the Phase I futures price (€31.50 to €15.75). A similar effect is observed in the Phase II futures price, although the decline in price is less dramatic (€32.25 to €21.45).

Figure 1 also documents the effect on the carbon price of not permitting banking of EUAs between Phase I and Phase II. From September 2006, spot and futures prices for Phase I EUAs drop off dramatically, remaining at less than €1 for most of 2007. The lack of price support for Phase I EUAs was exacerbated by the European Commission rejecting a French and Polish government proposal to permit banking of unused Phase I EUAs for use in Phase II.

7 The European Commission released 2005 emissions data on May 15, 2006.

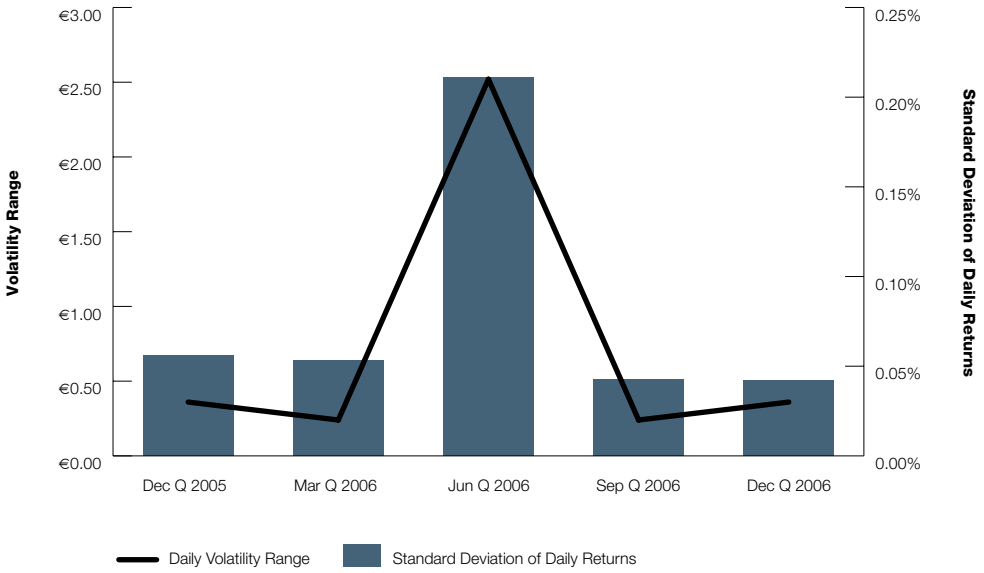
Supply disruption #1: Oversupply of Phase I EUAs

To observe the effects of the oversupply of Phase I EUAs on market quality, we examine price volatility and transaction costs surrounding this event. We focus on the nearest to delivery ICE futures contract at the time of the supply disruption, December 06 futures.[8]

1. Price volatility

Excessive price volatility is detrimental to any market as it increases transaction costs and reduces investor confidence. We measure price volatility in two ways – the daily price range in Euro and the standard deviation of daily returns. Figure 2 reports the average daily price volatility in each quarter.

Figure 2. Average daily price volatility: December 06 futures



Both measures of price volatility reported in Figure 2 indicate that volatility is highest in the June Quarter 2006. During this quarter, the average daily price range is €2.53 (approximately 50 times the minimum tick), and the average standard deviation of daily returns is 0.21 per cent. The documented increase in price volatility demonstrates one adverse impact of an oversupply of allowances on the carbon futures market. To examine the effect on volatility in detail, Figure 3 plots the daily price range for December 06 futures from April 1, 2006 to June 30, 2006.

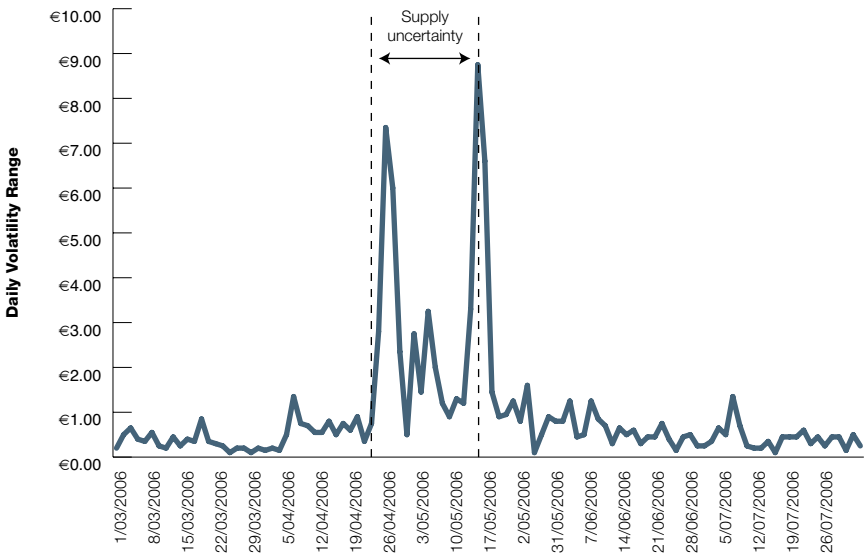
The area identified by the dashed lines in Figure 3 incorporates the time from which the market first became aware of a potential oversupply of Phase I EUAs (April 24) to the day the European Commission released 2005 emissions data (May 15). Severe price volatility persisted over these three weeks; however, Figure 3 documents two distinct volatility spikes. The first volatility spike (€7.35) occurs on April 26, when several Member States leaked their 2005 emissions data. The second volatility spike (€8.75) occurs on May 15, when the European Commission officially released 2005 emissions data for the entire scheme.

Figure 3 documents persistently high volatility and two extreme volatility spikes during a period of supply uncertainty, highlighting another detrimental outcome of supply disruption in the carbon market.[9]

8 Figure 6 in the following section breaks down trading volume by contract maturity and shows that at the time of the supply disruption, on-market liquidity is concentrated in December 06 futures.

9 Severe price volatility is also documented in Phase II futures.

Figure 3. Daily price volatility: April 1, 2006 to June 30, 2006



2. Transaction costs

The bid-ask spread provides a direct measure of the round-trip cost of a transaction. In addition to a narrow bid-ask spread, traders require sufficient depth at the best bid and ask to accommodate their trades and to minimise market impact costs. Figure 4 reports the quoted bid-ask spread and the number of contracts available at best bid and best ask prices for December 06 futures.

Figure 4. Average market depth and bid-ask spread: December 06 futures

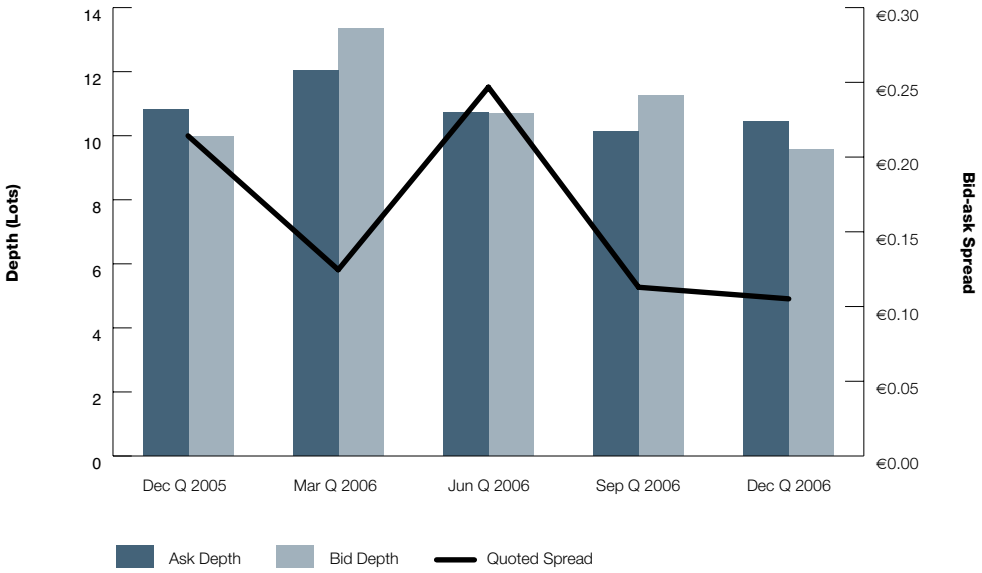
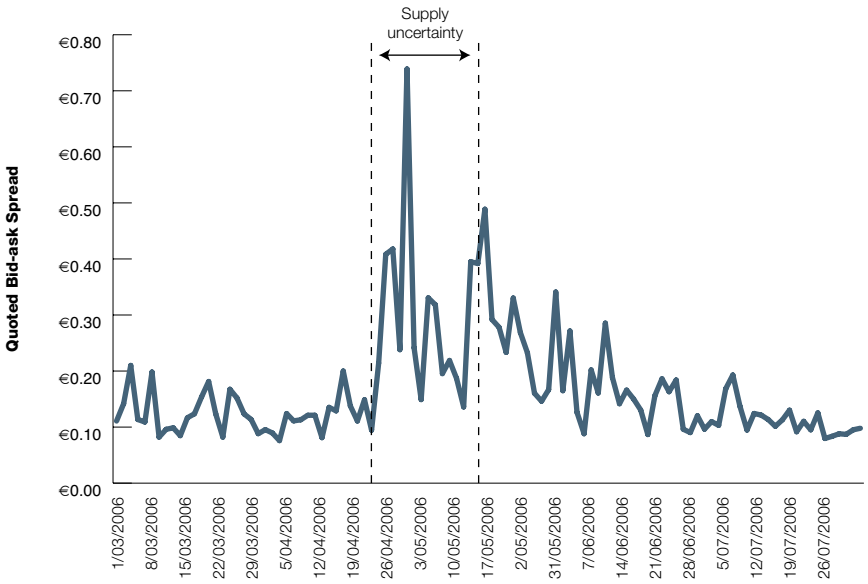


Figure 4 shows that market depth was unaffected by the oversupply of Phase I EUAs. This is unusual considering the extreme price volatility at the time. However, in the months following the supply disruption an increasing proportion of futures transactions were executed off-market.[10]

Excluding the June Quarter 2006, the quoted bid-ask spread decreases monotonically over time. Figure 4 shows that the bid-ask spread is widest during the June Quarter 2006.[11] The average bid-ask spread during this quarter is €0.24, approximately five times the minimum tick of €0.05.[12] The June Quarter bid-ask spread is approximately twice that of the March Quarter, representing a sharp increase in transaction costs for traders executing market orders. This again provides evidence of the far-reaching implications of a supply disruption in the carbon market.

To examine the bid-ask spread in detail, Figure 5 plots the average daily bid-ask spread for December 08 futures from April 1, 2006 to June 30, 2006.

Figure 5. The bid-ask spread: April 1, 2006 to June 30, 2006



As with Figure 3, the area identified by the dashed lines in Figure 5 incorporates the time from which the market first became aware of a potential oversupply of Phase I EUAs (April 24) to the day the European Commission released 2005 emissions data (May 15). The bid-ask spread is considerably wider over this period and remains wide after the event, suggesting that supply uncertainty increases transaction costs for a sustained period in the carbon futures market. [13]

10 See Figure 6 in the following section.

11 This is consistent with theoretical models of the bid-ask spread, which predict that the spread should widen in response to increased information asymmetry. See Easley, D. and M. O'Hara, 1987, "Price, trade size, and information in securities markets", Journal of Financial Economics 19, 69-90.

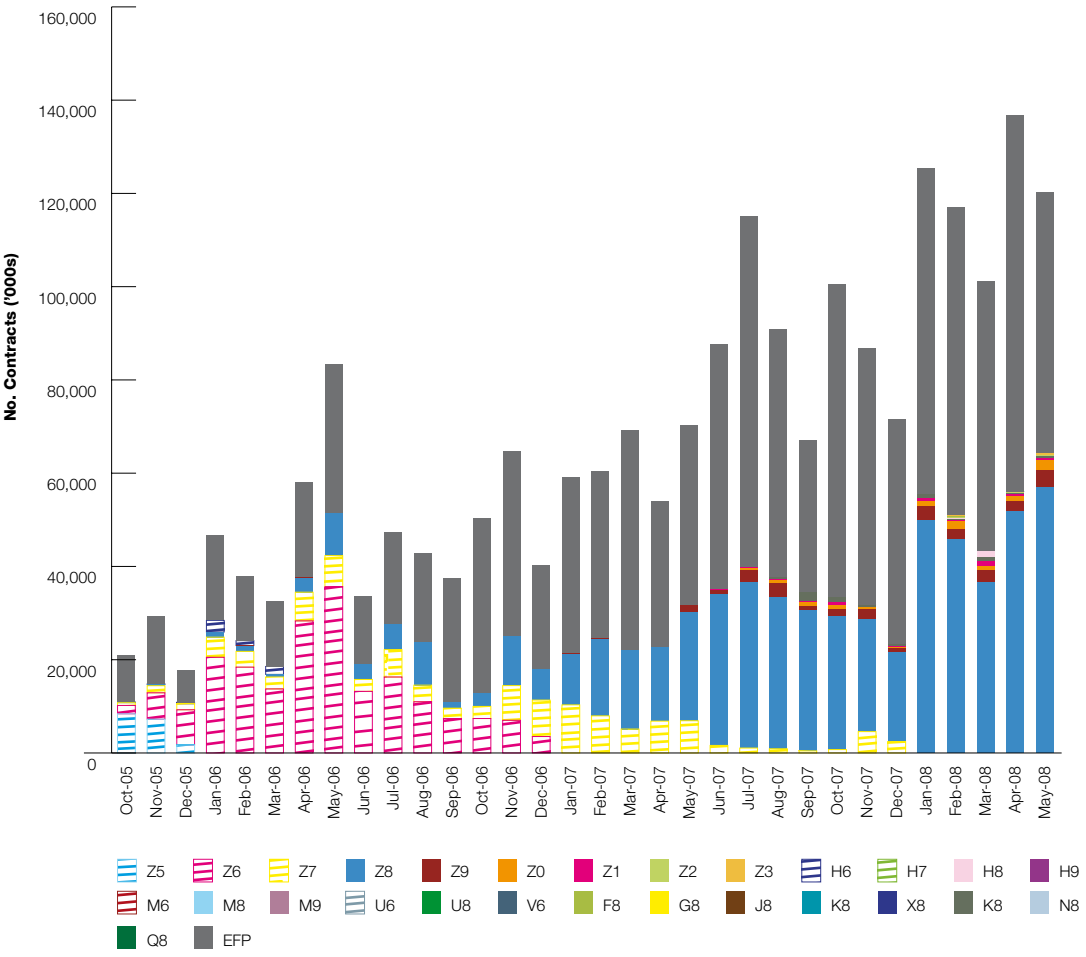
12 On 27 March, 2007 the minimum price increment decreased from €0.05 to €0.01.

13 The bid-ask spread also widens for Phase II futures.

Supply disruption #2: Banking restriction on Phase I EUAs

The effects of the banking restriction are best observed by analysing trading volume. Figure 6 documents on- and off-market monthly trading volume for the ICE Futures EUA contract. The underlying asset of this contract is 1,000 EUAs.[14] On-market trading takes place on the ICE electronic trading platform (WebICE) and off-market trading occurs via the ICE Exchange For Physical (EFP) facility.[15]

Figure 6. Total monthly trading volume: On-market and off-market



Phase I contracts are shaded. Phase II contracts and EFPs are in solid colour.

The banking restriction on Phase I EUAs exacerbated the natural shift from trading Phase I to Phase II contracts. Figure 6 documents a severe deterioration in on-market trading activity for December 07 futures during 2007, consistent with the rapid price decline depicted in Figure 1. Subsequently, December 08 futures are by far the most liquid contract. December 08 futures are traded heavily on-market from November 2006, even though Phase II EUAs did not begin trading on the spot market until early 2008.[16] These patterns in trading volume provide evidence that the banking restriction prematurely diverted liquidity away from the nearest to delivery contract and into the contract with the greatest supply certainty.[17]

Two additional patterns in trading volume arise in Figure 6. First, on-market trading activity is concentrated in the December expiry contracts, coinciding with annual emissions audits. Second, even though Phase III caps are currently unknown, there were four on-market trades executed in December 13 futures on June 5, 2008.

14 Full contract specifications are provided in the Appendix.

15 The average proportion of daily volume transacted on-market 39.04 per cent.

16 This provides evidence that price discovery occurs in the futures market.

17 In October 2006, the European Commission announced they would enforce stricter emissions caps in Phase II, creating additional supply certainty (and hence price support) for Phase II contracts. See Alberola, E., Chevallier, J., and B. Chèze, 2007, "European carbon prices fundamentals in 2005 – 2007: The effects of energy markets, temperatures, and sectoral production", Working Paper, Université Paris X-Nanterre.

APPENDIX

1. Data

The data used in this paper are sourced from Bluenext, ICE, and Reuters. The Bluenext data describe trading in the spot EUA market. Each trade record in the Bluenext data contain fields which document the date, time stamp, product, trade price, and trade volume associated with each trade. The ICE data describe daily on-market and off-market trading in the ICE Futures EUA contract. Each trade record in the ICE data contain fields which document the date, daily total volume, daily screen volume, daily Exchange for Physical (EFP) volume, daily open interest, and the daily settlement price for all December contracts. The Reuters data describe on-market trading in the ICE Futures EUA contract. Each trade record in the Reuters data contain fields which document the date, time, price, volume, best bid price and volume, and best ask price and volume associated with each trade. Bid and ask quotes are the prevailing best quotes immediately prior to the trade.

2. Contract specifications

Table A1. Contract specifications for ICE Futures EUA contract

Contract	**ECX CFI futures**
Unit of trading	1 lot = 1,000 CO_2 EU Allowances (EUAs) 1 EUA = entitlement to emit 1 tonne of CO_2 or equivalent
Minimum trade size	1 lot
Quotation	Euro (€) and Euro cent (c) per metric tonne
Tick size	€0.01 per tonne (€10 per lot)*
Max. price fluctuation	No limit
Contract months	Monthly – September 2006 to March 2008 (Phase I) Yearly – December expiries 2008 to 2012 (Phase II)
Expiry day	Last Monday of contract month
Trading hours	07.00 – 17.00 UK local time
Settlement price	Trade-weighted average during the daily closing period (17.00-17.15) with Quoted Settlement Prices if liquidity is low.
Settlement and delivery	Physically settled. Transfer of EUAs in a national registry three days after last trading day (LTD+3 delivery)
Margin	All open contracts marked-to-market daily

Source: **www.theice.com** and the Handbook of World Stock, Derivative & Commodity Exchanges 2007
*The tick size decreased to €0.01 from €0.05 on 27 March, 2007.

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