Market Insights

The Impact of European Union Emissions Trading Scheme (EU ETS) National Allocation Plans (NAP) on Carbon Markets

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EXECUTIVE SUMMARY

This paper empirically examines the extent to which participants in the carbon market perceive EU ETS NAP and Verifications announcements to possess informational value. The study directs its attention to carbon return and volatility movements around official EU ETS PHASE II announcements. We find that:

- Phase II announcements have an influence on Phase II futures carbon returns.
- We also detect significant returns on days leading up to both NAP and Verifications information becoming public.
- Furthermore, we find no significant differences in the volatility of carbon returns before and after NAP and Verifications announcements.

Together, our findings suggest a systematic leakage of information across all types of announcements. Hence, consistent with previous academic research, our findings lend further support to the request made by the European Federation of Energy Traders (EFET, 2006) to the European Commission for carbon price sensitive information that is *accurate, final and published in such a way as to be available to all market participants at the same time*.

Introduction

The **European Union Emission Trading System** (EU ETS) is the largest multi-national, emissions trading scheme in the world, and is a major pillar of EU climate policy. The ETS, launched on 1 January 2005, currently covers more than 10,000 installations which are collectively responsible for approximately half of the EU's emissions of CO2 and 40% of its total greenhouse gas emissions.

The European Union Emissions Trading Scheme and the European Union Allowances (EU ETS carbon credits) are unique in several ways. The asset itself is a product of legislation[1], where individual governments under the supervision of the European Commission are responsible for setting emissions caps and allocating EUAs to firms. Therefore the National Allocation Plans (NAPs) essentially set the supply of EUAs, and the Verifications report the demand during the preceding period and the remaining supply. Further, because the supply and demand in the EU carbon market operates within constraints set by the ruling government, it creates a level of political risk not present in other markets. In addition, there is likely to be a higher degree of information asymmetry in the carbon markets. A select group of government employees and firm level auditors are apt to information regarding caps and yearly net positions in advance of the market.

Therefore information asymmetry and uncertainty is a dominant feature of the cap and trade EU ETS. The two major sources of information asymmetry and uncertainty are derived from the process of setting future emissions caps based on projected figures and past emissions (the supply constraint) and the yearly verification of emissions through audits. Inconsistencies in emissions data from the different agencies create a level of information asymmetry and uncertainty among market analysts and diminish their ability to make accurate assessments of the market.[2] Emissions data published by the European Environment Agency and the EU transaction log differ substantially. They are collected according to different procedures and sector definitions and sometimes by different government bodies. In addition, the allocation and reporting process for the national allocation plans in Phase I (2005-2007) and Phase II (2008-2008) both lacked transparency and hence led to further uncertainty.

Data

For carbon return data we use the European Climate Exchange (ECX) Carbon Futures Instrument (CFI) contract with December 2008 expiry for the period 1 February 2006 to 31 December 2008. The ECX accounts for approximately 87% of the total exchange-based futures contract transactions in Europe.[3]
We source the ECX futures contracts data from the Reuters DataScope Tick History (RDTH) Database provided by SIRCA, and includes every bid and ask price posted on each day along with the time stamps. The underlying asset of the futures contract is 1,000 spot EUAs, with the most liquid contracts being those with annual (December) maturities. The data correspond to the daily average mid-point of intraday quotes calculated from every quote update within a day. Finally, given that carbon prices are not stationary, they are converted into stationary returns by taking first logarithm differences. That is, we use continuously compounded returns constructed as $r_{c,t} = ln(P_{c,t} / P_{c,t-1})$ where $P_{c,t}$ is the carbon price at time *t*.

1 A European Union Allowance (EUA) gives the holder the right to emit one tonne of carbon dioxide. Each futures contract represents 1,000 EUAs.

2 CARBON TRADING AND PRICES, Market inefficiencies: regulatory effects (Chapter 4).

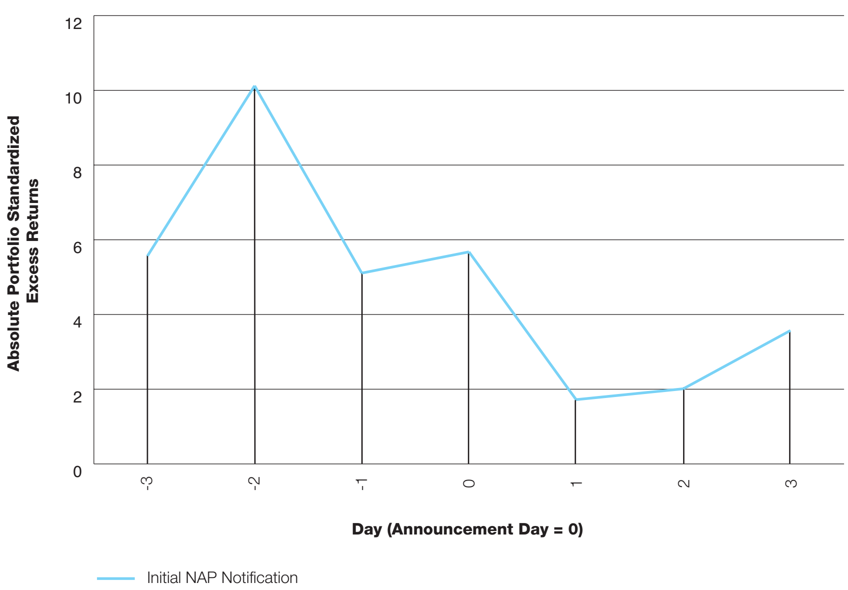
3 Frino et al, 2010.

Method

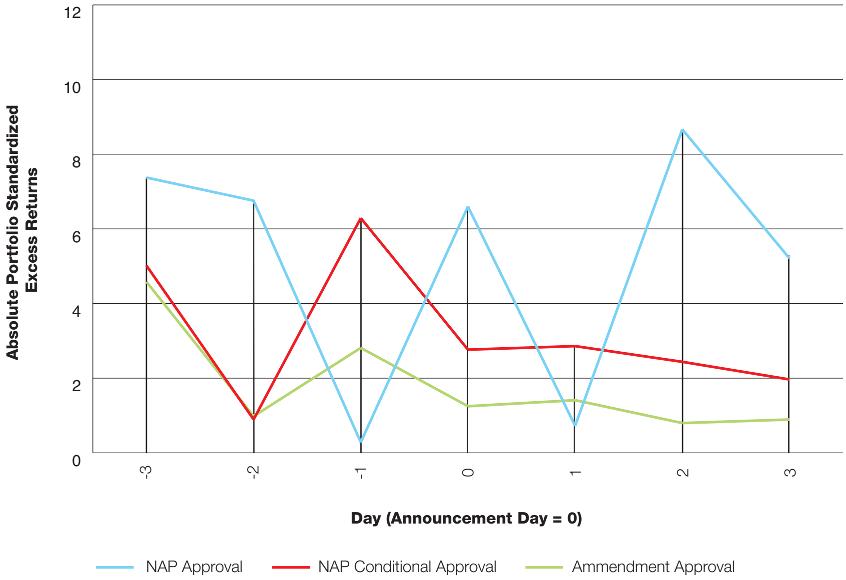
We apply event study methodology to the front carbon future return series to examine carbon return behaviour around NAP and Verification related events. Abnormal returns on the 3 days before and after the day of announcement (hereby known as the prediction period) are measured as the difference of the returns on those days minus a benchmark return. The benchmark return is estimated as the mean return of the 10 days preceding the prediction period with the top 10% and bottom 10% of returns truncated. Because we are examining a sole commodity (carbon prices) which is affected by a huge quantity of closed and sporadic announcements, the truncation minimizes the effect of large surprises in the estimation period. Graphs I –III illustrate the absolute abnormal returns during the 6 days surrounding the announcement (prediction period) of Notifications, Approvals, and Verifications, respectively.

We also review the impact of Phase II NAPs and Phase I Verifications announcements on carbon return volatility. This allows us to examine whether there is a systematic leakage of information. As the announcements are mainly unscheduled and sporadic, it is expected that upon becoming public, there would be a higher degree of volatility as the news is priced in. However, if there is no change in volatility, it may suggest a systematic leakage of information before it becomes public.

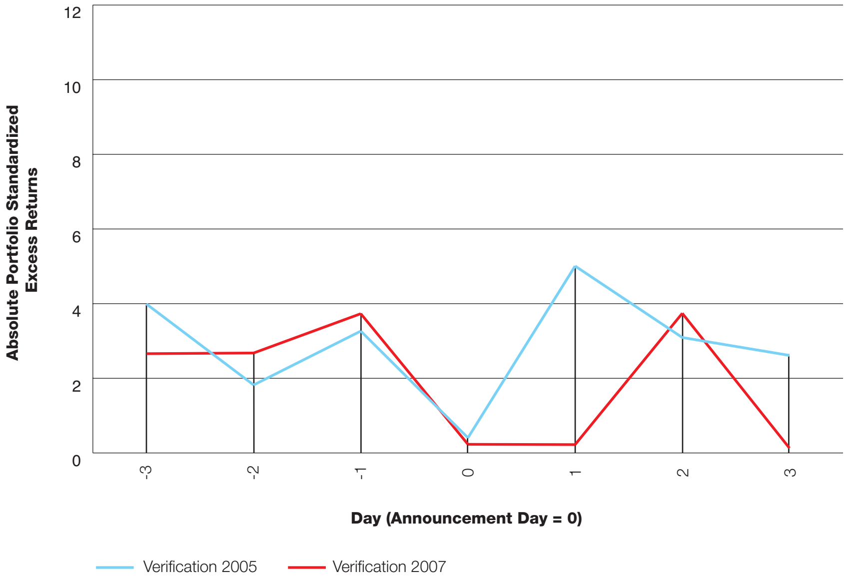
Graph 1: Notifications



Graph 2: Approvals



Graph 3: Verifications



In Graphs I, II, & III we present results to the event study which only considers announcements without any other announcement in the six days surrounding it. Examining Graph I, it is apparent that there are greater abnormal returns leading up to, and including, the announcement (day 0). Similarly, NAP Conditional Approvals, and Amendment Approvals in Graph II also exhibit higher abnormal returns on the day before the announcement. NAP Approval announcements, however, are surrounded by higher abnormal returns throughout the 3 day period, both before and after. Reviewing the reactions on the days surrounding Verifications announcements[4], we observe that they fail to cause a significant reaction on the day of the announcement. However, there are significant price movements leading up to the announcement day. These confounding findings suggest that there is considerable leakage of NAP and verifications data before the information becomes public, and that the information is already impounded into prices. These findings lend further credence to the allegations of a high degree of information asymmetry surrounding EU ETS official announcements. In many cases the significant price reaction leading up to an announcement is also in the same direction. This provides further evidence of the existence of information leakage.

We also find significant reactions beyond t=0 across all announcement types in the graphs above. This may suggest that there is uncertainty following information releases in the EUA market and that it requires several days to resolve the uncertainty and accurately price in the information, bringing into question the efficiency of the market.

In addition, our volatility tests reveal that the majority of announcements cause no statistical difference in variance following the announcement. In the isolated case where the variance before and after the announcement is statistically different, an increase of the variance is detected after the announcement. These results are consistent with the notion that NAP-related announcements do not have a significant effect on carbon volatility.

Conclusion

This study is based on the notion that commodity markets are information driven mechanisms which determine equilibrium prices. If markets are active, the information is quickly disseminated among market participants who, upon trading, determine a fair price. Prices can also reflect information which is not publicly announced by a governmental agency but yet successfully forecasted by private agents or leaked by insiders. Therefore this investigation has the ability to shed light on the effectiveness of regulatory agencies in providing the market with useful and reliable forecasts.

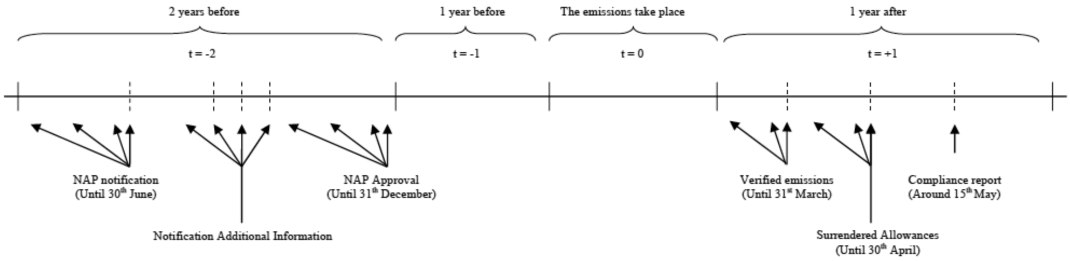
Concerning the effects of NAP announcements on carbon returns, we find that Phase II NAP announcements have a significant effect on Phase II futures contracts. In contrast, Phase I verifications announcements have no effect of the Phase II futures returns. This is consistent with the information inherent in Phase I verifications and the no banking of allowances between phases restriction. We also detect significant returns on days leading up to both NAP and Verifications information becoming public. Furthermore, we find no significant differences in the volatility of carbon returns before and after NAP and Verifications announcements. Together, our findings suggest a systematic leakage of information across all types of announcements.

4 Verifications for 2006 are not in the analysis because they were eliminated from the sample as they had other announcements in the 6 days surrounding it.

APPENDIX

Release of Information in the European Union Emission Trading Scheme

The NAP is a document in which Member States determine both the total quantity of CO2 allowances available in the Member State and the allocation made to each installation covered by the Scheme, which must subsequently be approved by the European Commission. The Draft of this document must be published for public consultation before the Member State final version is delivered to the European Commission. Once the NAP is notified, the European Commission has 3 months for its assessment, and the publication of the corresponding Commission Decision. It is compulsory that the European Commission approves the NAP of each country. If it is not the case, the NAP will be modified until the European Commission approves it. All NAPs must be submitted to the European Commission by the end of the June two years before the start of the corresponding Phase, so that the final NAP can be approved at the end of that year. The procedure makes it difficult to know in advance the exact date of publication of new information.[5] Figure I depicts this process graphically.



Note: This Figure shows how the deadlines are organised in the EU ETS. Two years before the compliance period, the NAPs have to be submitted before 30 June to the European Commission. They have to be approved before 31 December of that year. When the real emissions take place two years later, the verified report has to be presented by each the companies before 31 March to their government. Before 30 April the companies must surrender the allowances that correspond to their real emissions. On 15 May the compliance report of the Member States is published.

Source: Mansanet-Bataller & Pardo (2007)

Participating companies are required to indicate the amount of carbon emitted in the previous calendar year by March 31, and surrender the allowances by April 30 each year. The number of allowances must be equal to the total verified emissions from that installation during the preceding calendar year. Additionally, around 15 May, the Member States must submit a report of the verified emission to the European Commission including all the companies in the country covered by the European Directive. When this information is published the agents in the market know whether the companies are long or short in respect of the allowances that they have received from their governments.

5 Mansanet-Bataller & Pardo (2007).

Models/Tests

The Truncated Mean Model

The truncated mean model approach which is a truncated version of the Constant Mean Return Model (Brown and Warner, 1985). The abnormal returns are measured as the difference of the returns in *t* minus a mean return from some benchmark of the estimation period. However, the benchmark return is a truncated average of the estimation period. That is, to calculate the truncated mean return, we exclude the 10% highest returns and the 10% lowest returns of the estimation period. Because we are examining a sole commodity (carbon prices) which is affected by a huge quantity of closed and sporadic announcements, the objective is to minimize the effect of large surprises in the estimation period.

The Brown & Forsythe Test

The Brown-Forsythe test allows testing for seasonality in the unconditional variance. The Brown-Forsythe test statistic is calculated as

$$F = \frac{\sum_{j=1}^{J} n_j(\bar{D}\cdot j - \bar{D}\cdot\cdot)^2}{\sum_{j=1}^{J}\sum_{t=1}^{n_j}(D_{tj} - D\cdot j)^2}\,\frac{N-J}{J-1}$$

Where $D_{tj} = \left|r_{tj} - \widehat{M}\cdot_j\right|$; r_{tj} is the return for the day *t* and the interval *j*; $\widehat{M}\cdot_j$ is the sample median return for the interval *j* over the relevant n_j days; $\bar{D}\cdot j = \sum_{t=1}^{n_j}\left(\frac{D_{tj}}{n_j}\right)$ is the mean absolute deviation from the median $\widehat{M}\cdot_j$ for the time interval *j*; and $D_{..} = \sum_{j=1}^{J}\sum_{t=1}^{n_j}\left(\frac{D_{jt}}{N}\right)$ is the grand mean where $N = \sum_{j=1}^{J} n_j$. The test statistic is distributed $F_{J-1,N-J}$ under the null hypothesis of equality of variances across the J time intervals.

The Sign Test

The null hypothesis of the sign test is that the variance of the standardized returns (residuals) during the five days preceding the announcement of a particular event is equal to the variance of the standardized returns (residuals) in the period starting from the announcement day and finishing 4 days after. We represent this as follows:

$$H_0:\ \sigma_0^2 = \sigma_1^2 \qquad or \qquad H_0: \theta = P(X > \sigma_0^2) = P(X < \sigma_1^2) = 0.5$$

That is, if the sample data for each type of event is consistent with the hypothesized variance value for this particular event, half of the sample observations related to the event will lie above σ_0^2 and half below. Thus the number of observations larger than *K* can be used to test the validity of the null hypothesis. The two possible alternative hypotheses are:

$$H_1: \sigma_0^2 > \sigma_1^2 \qquad and \qquad H_1:\ \sigma_1^2 > \sigma_0^2$$

As the distribution of the random variable K is the binomial probability with parameters N and _, with _ rejection region for the $H_1 : \sigma_0^2 > \sigma_1^2$ for an _-level test is:

$$K\_R \qquad \textit{for} \qquad K \quad k_\alpha$$

where k_α ' is chosen to be the largest integer which satisfies:

$$P(K \geq k_\alpha' | H_0) = \sum_{i=k_\alpha}^{N} \binom{N}{i} (0.5)^N \leq \alpha$$

where N is the number of announcements of a particular event.

For $H_1 : \sigma_1^2 > \sigma_0^2$, the rejection region for an _-level test is:

$$K\_R \qquad \textit{for} \qquad K \quad k_\alpha$$

Where k_α is chosen to be the smaller integer which satisfies:

$$P(K \geq k_\alpha | H_0) = \sum_{i=k_\alpha}^{N} \binom{N}{i} (0.5)^N \leq \alpha$$

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