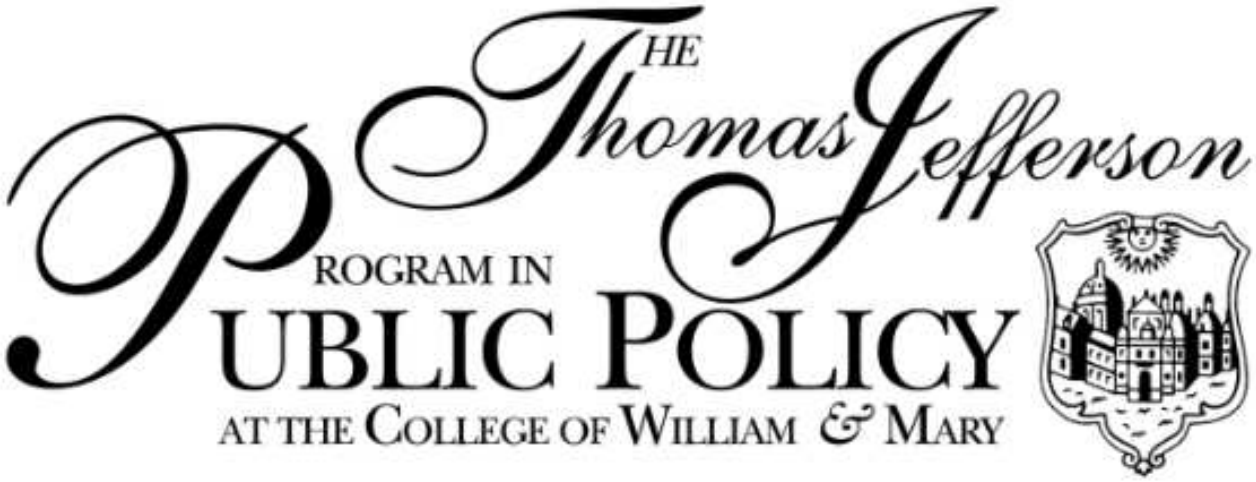

An Analysis of Trading Motivations in Phase II of the European Union Emissions Trading Scheme

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An Analysis of Trading Behavior in Phase II of the European Union Emissions Trading Scheme

"Our generation's response to this challenge will be judged by history, for if we fail to meet it boldly, swiftly and together, we risk consigning future generations to an irreversible catastrophe."
— Barack Obama addressing the UN summit on climate change / September 22, 2009

Executive Summary

Climate change is an issue of growing salience and significance. Nations across the world are addressing climate change with a sense of urgency and importance. The European Union's Emissions Trading Scheme (EU ETS) is the EU's policy response to climate change and the imminent threat of increasing greenhouse gas emissions. Evolving from the United Nations Framework Convention on Climate Change and the subsequent Kyoto Protocol, the EU ETS has proven to effectively reduce carbon emissions across the participating Member States. Upon completion of the first of three phases of implementation, the EU is postured to meet or exceed its Kyoto carbon emission reduction targets by 2012.

While many studies of the scheme have focused on the implementation of phase I of the EU ETS (2005 – 2007), this study seeks to examine how firms are behaving in phase II of the EU ETS (2008-2011). By conducting a survey of the firms participating in phase II, this research examines the motivational factors behind trading or not trading in the scheme. The study looks at the decision making process in both the primary and secondary markets of the EU ETS, as well as markets for the flexible trading mechanisms outlined by the Kyoto Protocol. The

primary question we looked to answer was, *do transaction costs play a significant role in a firm's decision to trade carbon permits?*

Based on the results received from the survey, we can confidently say that transaction costs do not play a significant role in a firm's decision to trade. This is important because high transaction costs would dissuade firms from trading, and create a less efficient carbon market. A less efficient market means the price will less accurately reflect the true value of the permits to society. Therefore, permits will not be allocated and utilized efficiently, unnecessarily increasing the cost burden to firms and increasing the adverse effects of carbon emissions on the environment. In order to keep firms internationally competitive and to minimize their adverse effects on the environment, it is essential that transaction costs remain low. While our survey did indicate that other factors were important, such as the price of carbon, allocation methods, the political environment, the fact that transaction costs are not burdening the system makes the authors of this paper optimistic about the future of the EU ETS.

I. The European Union Emission Trading Scheme

a. Evolution of the EU ETS

The origins of the EU ETS trace back to the formation of the Intergovernmental Panel on Climate Change (IPCC) in 1988. The Panel's first report, released in 1990, provided a global catalyst on the issue of climate change. The report gave an overall assessment on the status of global climate change, what impacts have been and would be seen, and possible strategies to combat climate change. It not only verified the existence of the greenhouse effect, but also quantified the effects of climate change and extrapolated future impacts. The data was enough to mobilize nations across the globe into action on climate change.[1]

Shortly after the report was released, the United Nations General Assembly began treaty negotiations in regards to climate change. These negotiations culminated in June of 1992, at the "Earth Summit" in Rio de Janeiro, where the United Nations Framework Convention on Climate Change (UNFCCC) was ratified by 154 nations. The UNFCCC entered into force in March of 1994. Its goals were for the 'Parties of the Convention' to gather and disseminate information on greenhouse gas (GHG) emissions and develop various strategies and policies on abatement. Furthermore, the Convention encouraged designing environmental strategies for developing countries.

Since its inception, a Conference of the Parties is held annually where countries who ratified the Convention meet and discuss how the UNFCCC is being implemented and what strategies can be utilized to combat climate change across the world.[2] A Conference of the Parties was held in Copenhagen, Denmark while this report was being drafted. Unfortunately, no legally binding agreements were made.

While the UNFCCC was the foundation for a global response to climate change, the Kyoto Protocol was the action mechanism that manifested the goals of the Convention. The Kyoto Protocol was the result of the third Conference of the Parties to the Convention. The Protocol sets legally binding targets for industrialized nations who ratified the Protocol to reduce GHG levels. The targets amount to a net 5% decrease in GHG emissions compared to 1990 levels.

Moreover, Kyoto outlines three market-based mechanisms for nations to meet their targets. The first is the establishment of an emissions trading scheme where carbon is bought and sold in a cap and trade scenario. The second is a Clean Development Mechanism (CDM)

where industries attempting to meet Kyoto targets can earn certified emission reduction (CER) credits, equal to one ton of carbon dioxide, by implementing emission reduction technologies in developing countries. The final mechanism of Kyoto is the Joint Implementation Mechanism (JI) where industries can implement emission reduction technologies in other industrialized countries to receive earned reduction units (ERU). Kyoto also set up the use of registries where participating nations could track emissions and carbon credits used to meet Kyoto targets. The protocol was ratified by 184 of the now 192 Parties of the Convention.[3]

The EU had taken action on climate change before Kyoto and the UNFCCC however. Prior to the Conference in Rio, the EU had attempted to institute a carbon tax across all Member States.[4] The proposition failed in 1997 due to intense lobbying by Member States to reject the proposal based on issues of sovereignty. Despite this hurdle, EU countries participated greatly in Kyoto negotiations. The result of these negotiations was a commitment to reduce EU-wide emissions by eight percent below 1990 levels and participate in an emissions trading scheme where the flexible mechanisms outlined in Kyoto would be utilized.[5]

In 2000, the European Commission (EC) circulated a green paper outlining plans for EU implementation of the Kyoto Protocol. The EC had a significant role in the design and implementation of the EU ETS. Not only did the EC draft the ETS legislation, they also retained the prerogative to develop National Allocation Plans (NAP) and perform enforcement mechanisms regarding emissions trading. After sufficient time for public comment, draft legislation on the implementation plan was sent to the European Parliament and the Council of Ministers. Finally, in 2003, the Directive establishing a scheme for greenhouse gas emissions trading within the Community was passed. Thus, the EU ETS was born and went into effect on January 1, 2005.[6]

b. Structure of the EU ETS

The EU ETS would be implemented in three phases. The first phase was intended to be primarily a trial phase from 2005 to 2007 where issues of allocation, monitoring and verification would be finalized. The EU ETS was initially composed of 27 Member States containing over 11,500 GHG producing installations.[7] Each Member State was assigned a respective Kyoto emission target that would contribute to the overall reduction of eight percent for the EU. To meet these targets, Member States autonomously submitted 25 NAPs s for the first phase. Once the NAP was approved by the EC, the Member State could begin allocating permits.[8] The EU Allowances (EUA) were to be allocated freely to the Member States and bestowed on the installations based on their previous year's emissions.

The overall goal of the allocation process is to reduce an installation's carbon dioxide emissions while not reducing a firm's competitiveness. Installations are also able to "bank" allowances during a phase for use in another year within that phase. This policy extends to "borrowing" allowances as well, where a firm can use a future year's allowances to meet a current year's target within a phase.[9] At the end of phase I, all participating installations surrendered their net allowances to negate reported emissions.[10]

As previously stated, participating installations may also utilize CERs and ERUs to meet their emission targets for a given phase. However, an annual EU ETS assessment prepared by the European Environment Agency reported that no firms had utilized the CERs or ERUs in the phase I.[11] These flexible mechanisms have been used and traded in phase II (2008-2012).

In response to complaints about inequalities produced by free allocation, discussed in more depth later, Denmark, Hungary, Ireland and Lithuania auctioned allowances in phase I. With the inception of phase II, Austria, Belgium, Germany, Netherlands, and the United Kingdom began auctioning allowances. Also in response to an analysis of phase I, stricter regulations on NAPs were instituted in regards to emissions reporting and verification. This was in an effort to improve the equity of allocation processes across participating firms.[12] According to Neuhoff, Keats and Sato, EUA allocation methods have significant equity and distributional effects.[13] _ftn13 Furthermore, Skjaerseth and Wettestad show that carbon markets respond greatly to allocation methods.[14] These issues of competitiveness and equity were amongst the greatest concerns of participating installations during the first phase of the EU ETS.[15]

The final phase of the EU ETS will be from 2013 and beyond. Unlike the first two phases, the emissions cap will not be set on previous emissions and Kyoto targets. Instead, the EC has set a target for the EU to lower its emissions 20 percent below 1990 levels by 2020.[16] This new goal is in response to several Member States already meeting their Kyoto targets by the end of 2008: France, Germany, Greece, Sweden, Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Croatia and the United Kingdom.[17] Moreover, the new goal incentivizes other Member States to continue their abatement activities post Kyoto. There was a heated dialogue at the Conference of the Parties at Copenhagen, discussing what policy mechanism should extend or replace Kyoto after the protocol expires in 2012. The Conference also debated various methods to provide aid to nations being directly affected by climate change manifestations of flooding or natural disasters, and to seek new pledges by industrialized nations to drastically reduce GHG emissions.[18] The EU ETS will remain active post Kyoto despite the indecision of Copenhagen.[19]

c. Issues with Allocation

How the EU allocates emissions allowances is essential to meet Kyoto goals. Allocation of EUAs in phase I and phase II was done by Member States and submitted as National Action Plans to the European Commission for final approval.

When permits are allocated efficiently in a market economy, the price of the permit should represent the scarcity of available carbon emissions. These prices should internalize the opportunity cost of the firms' activities on the environment and the cost of the use of resources by the firm. As the firm uses up more permits, the marginal cost of the permits increase. The marginal cost of the permits indicates the "willingness of the firms to avoid reducing their emission by an additional unit."[20] ftn20 An increase in marginal costs of these permits results in higher willingness of the firms to invest in efficient and clean technology to reduce their emissions rather than buying permits for additional emissions.

Recently the prices of emission permits have been an issue for the EU ETS. The price of permits has been in a steady decline and is in danger of reaching the point where the opportunity cost of pollution is not covered by the price of permits. At the highest level the price of the permits was around €29.7 per ton in April of 2006.[21] Currently the price of EU ETS permits are around €13.[22] There have been suggestions that the prices may have decreased because of over-allocation of permits in the EU ETS, but we have seen little empirical evidence supporting the fact. Issues of over-allocation became apparent in 2005, when firms emitted 80 million tons less of CO2 than the allotted allocations. However, those who disagree with claims of over-

allocation believe that it was the effectiveness of the EU ETS that resulted in the reduction of emissions rather than allocation methods.[23]

There have been a number of studies evaluating the issue of over-allocation of permits. One of the notable assessments of over-allocation was done by Buchner and Ellerman who suggest creating a benchmark by calculating the level of emissions that would have been produced in the absence of EU ETS. If the total emission value of allocated permits is more than the benchmarked level of emissions, then it would be considered over-allocation. The final analysis indicated that benchmarked levels of emissions were 143 million tons higher than the actual allocated permits. Since the allocation levels were actually lower than the benchmark it implied that the claims of over-allocation of permits were not valid.[24]

Even though the permits were not over-allocated the problem of low cost permits still remains. Findings from the International Energy Agency suggest that the price of carbon permits needs to rise in the near future to make any high-tech solutions for lowering carbon emissions economically attractive. They suggest that the CO2 permit prices would need to rise to around €35 per ton by 2020 and to €75 per ton by 2030 in the industrialized nations; in the developing nations the prices would need to reach up to €20 per ton by 2020 and up to €35 per ton by 2030 to make abatement technology worthwhile.[25]

This problem of allocating and pricing permits can be addressed by using market-based systems, such as auctioning to efficiently distribute and accurately price permits. There are a number of difficulties when permits are allocated using the administrative allocation process. When permits are distributed free of charge there is a high incentive for the firms to invest in affecting the outcome of the distribution in order to gain more allowances, thus encouraging a rent seeking behavior among firms. With auctions, there is less of a rent seeking behavior. Many

authors suggest that if such behavior continues when permits are auctioned off, it is solely for the purpose of generating additional revenue and not to gain entitlements for permits.[26]

Another notable problem regarding administrative allocation of permits is the confusion over differing standards for distributing the permits among the incumbent and new facilities. It seems unwise for new facilities, which for the most part might have a better pollution abatement technology, to have to buy new permits where as the old facilities are allowed to retain their permits. This discourages retirement of old facilities, which are more likely to be less efficient than newly built ones.[27]

Auctioning permits for the EU ETS would make use of market demand to set the price of permits, cut the large overhead cost involved with administrative allocation of permits and more significantly, generate revenue for the EU ETS. The revenue generated through auctions could be utilized for a number of causes. Literature suggests the revenue from auctions could be used to cut down on existing distortionary taxes among the participating EU members.[28] Other uses of auction revenue include using it to promote environmental goals of the EU ETS by investing in research and development for efficient new technologies and providing tax incentives to firms utilizing innovative technologies.[29]

Price discovery through permit auctioning is not the most politically feasible solution. Here, the price of the permit internalizes the cost of emission and its impact on the environment. These additional costs of buying permits directly affect the cost structure of the firms involved and hence are represented on the price of the goods produced by these firms.[30] The burden of this additional cost eventually lies on the consumers and is predicted to be as high as eight times that for the producers for certain sectors such as the power generation and heat sectors.[31]

The revenue generated through auctions can also be used to offset the burden of extra cost to the firms as well as the consumers. It can be inferred that the in the EU, industries most affected by the introduction of ETS would also suffer the most if auctions are utilized as a method of disbursement of permits. The direct impact would largely be faced by the industries emitting the most, which is the energy sector, integrated steel industries and the cement industries. Studies have predicted that by using free allocations of permits, prices of carbon at €15 per ton would increase the marginal cost of production by 11% for steel industries and by 26% for cement industries.[32] It can be expected that the increase in cost of the product would be even higher if auctions are used. To aid the final consumers, the revenue from auctions of permits can be used to lessen the tax on the consumers. This method achieves both equity and efficiency goals by reducing the social cost of climate policy as well as decreasing its impact on the households.[33]

d. Emissions Reductions in the EU ETS

Currently the ETS includes CO_2 emissions from combustion plants, oil refineries, coke ovens, iron and steel plants, and factories making cement, glass, lime, brick, ceramics, pulp and paper. Together, these industries account for approximately 45% of the European community's total CO_2 emissions.[34] Ideally, a cap and trade scheme provides incentives for industries to invest in cleaner technologies and processes, which will in turn result in decreased emissions. As of 2008, emissions in Europe continue to decrease relative to the 1990 base-year levels and it is anticipated that at current rates, the community will be able to meet or exceed their Kyoto commitment of an 8% overall reduction.[35]

For measuring progress towards achieving Kyoto protocol commitments, the European Union is divided into two distinct groups. The EU-15 is comprised of the 15 Member States who initially agreed to the 8% reduction in emissions under the Kyoto Protocol in 1998. The EU-12 is made up of the new Member States that joined the European Union after the 8% reduction community agreement had been ratified. Together they are referred to as the EU-27.

Under EU law, the EU-15 countries are legally bound to reduce their emissions to 8% below 1990 base-year levels between 2008 and 2012. As of 2008, the EU-15 is approximately 6.2% below 1990 levels, and at current reduction rates, could possibly achieve an 8.5% reduction in emissions by 2012 by including some additional emission reduction measures.[36]

The emission reductions resulting from the global recession have also been considered recently. Unfortunately there is still a lack of substantial data to make any conclusions about the extent of unintentional emissions reductions caused by the recession.

One possible unintentional environmental consequence of the EU ETS is the potential for "carbon leakage."[37] Carbon leakage occurs when strict environmental regulations in one country result in a company choosing to relocate their industrial activities to another country with less stringent regulations so as to avoid large increases in production costs. Capital is becoming increasingly mobile with the advance of technology, and Europeans are worried that firms will start to move to locations not under the ETS umbrella.

The extent to which carbon leakage will prove to be an issue for the European Union emissions reduction efforts remains to be seen. The implementation of phase III in 2012 will be the first test of significant reductions of freely allocated allowances. EU carbon leakage policies must be able to retain high emitting industries from moving to countries with lower standards in

order for the European community to continue to be effective in making reductions through the ETS.

II. Research Objective

The majority of the analyses done on the EU ETS have been lessons learned from phase I of trading.[38] The results of these studies generally call for changes or problems with allocation methods,[39] monitoring and verification,[40] _ftn40competitiveness,[41] meeting Kyoto targets[42] and dealing with new entrants,[43] as discussed above.

However, research on phase II is very limited given how it began in 2008. The annual study by the European Environmental Agency assesses firm sentiment about the overall operation of the EU ETS. The survey showed that issues from phase I have carried over into phase II with respect to allocation methods, harmonization of monitoring and verification standards, and worries about competitiveness. Firms generally see these issues as improving, but continue to express concern.[44]

One of the major problems faced by the regulating body is the lack of available information about the participating firm. Firms are generally not willing to divulge information about their workings to the regulating body. It would also be an enormous task for the regulators to account for all the individual installations and prescribe them with unique recommendations and actions to achieve the environmental goals of EU ETS.[45] When an external body prescribes a policy to a firm it automatically sets up a minimum requirement for the firms to meet, thereby taking incentive away for firms to innovate beyond what is prescribed. The cap and trade mechanism provides an inherent incentive-based solution to the problem. It allows the firms to

choose the approach that would suit them the best in order to comply with the regulation without having to reveal information on cost or the technology being employed. It encourages firms to reach out for cost effective and efficient means of obtaining environmental goals, while still complying with the goals of EU ETS.[46] If firms reduce their own cost, the overall cost to the society is likewise reduced.

One cost that may be difficult for a firm to internalize however, are transactional costs. The extent to which firms can avoid transactional costs remains unexamined in phase II of trading. Transaction costs can arise at various stages of trading. For example prior to entering the market, the firm has to learn the rules of the market, forecast demand, work out its optimal production plan, and determine whether it is necessary to buy or sell permits. These processes require gathering information about the market and finding trading partners. For firms that employ the use of brokers, they will incur additional costs as well. According to Gangadharan, firms participating in the EU ETS will buy allowances if the marginal product of emissions is greater than the price of the allowance plus marginal transaction costs. They will sell allowances if the marginal product of emissions is less than the price of the allowance minus the marginal transactions costs. Thus, transaction costs are likely to play a large role in a firm's decision to trade or not.[47]

Our research seeks to examine the micro-behavior of firms now that the "trial" first phase is completed. Whether or not these transactional and information costs have manifested into reasons for firms to trade in the second phase of the EU ETS has yet to be discovered. Specifically, our research asks the question, *what determines firm motivation for trading or not trading permits within the EU ETS and what roles do transaction costs and information barriers play?*

A questionnaire was disseminated to the universe of firms participating in the EU ETS and asks questions to probe this research question and provide insight into firm behavior within the EU ETS during its second phase of operation.

III. Presentation of the EU ETS Registry Data

The Community Independent Transaction Log (CITL)[48] is the central registry for the EU ETS, providing publicly accessible information for the affected installations across 27 Member States. CITL collects data from the mandatory national registry of each Member State, and its published 2008 data covers 12,229 installations. For each installation, we employ the information including its national registry, what main activity the installation engages in, its initial annual allocation of allowances, its verified emissions for the year, the total amount of allowances surrendered in compliance, and the number of CERs surrendered.

The numbers listed in Table 1 draw a general picture of all installations within the EU ETS. For each variable - allocation, emissions or surrendered allowances, a highly right-hand side skewed distribution is demonstrated by: 1) the much higher value of the mean than the associated median; and 2) the large difference between the number at the 90th percentile and the maximum. Also, the large standard deviations suggest the installations are widely distributed.

Table 1. Basic Description at the Installation level (2008)

	Mean (Std. Dev)	25%	Median 50%	75%	90%	Max
EUA Allocated	174,105 (758,135)	6,086	18,742	62,232	302,945	26,937,155
Verified Emissions	188,197 (914,461)	3,978	14,525	52,738	301,971	30,862,792
Allowances Surrendered	199,894 (943,131)	5,456	16,540	59,263	342,082	30,862,792

Note: author's calculation
Data source: European Commission, Community International Transaction Log, data downloaded on September 2009, accessible at: http://ec.europa.eu/environment/climat/emission/citl_en.htm

In the first year of Phase II, the total amount of allocated permits is less than the actual emissions, short by 190.17 $MtCO_2$. This difference varied among Member States, which is shown in Table 2. The existence of imbalanced allocation among countries implies the possibility of intrastate permit flow. The above number for overall allocations is the amount of allowances granted for free to installations. It does not, however, include 60Mt that have been auctioned to be used for compliance in 2008.[49] The difference is not critical on the whole because auctioning or selling allowances by Member States has been very limited so far.[50] Assuming that all planned auctioning had occurred, the 2008 shortfall is closer to 130 $MtCO_2$. There were plenty of 2009 EUAs to cover the gap.

Table 2. The Difference between Allocation and Emissions by Registry States (2008)

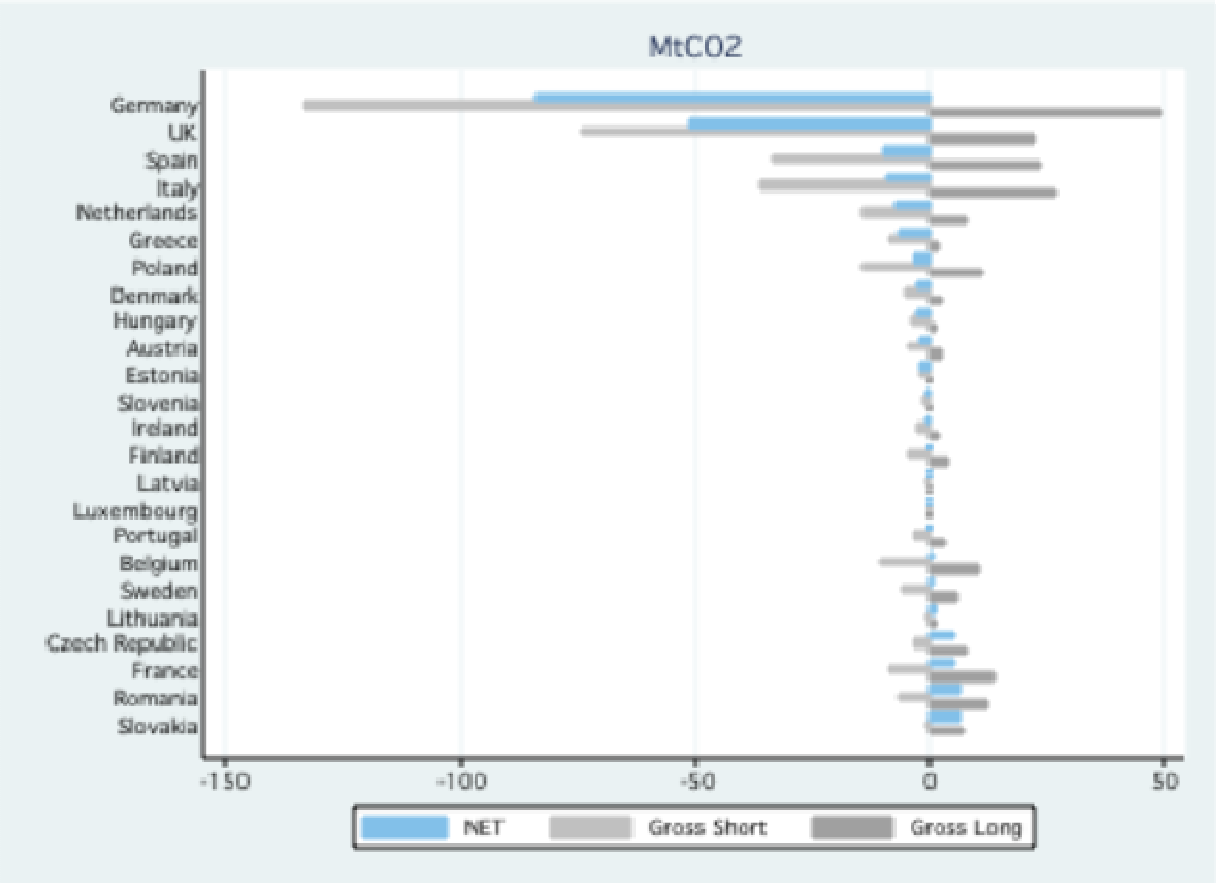
Nation	Allocation ($MtCO_2$)	Emissions ($MtCO_2$)	Absolute Net ($MtCO_2$)	Percentage Net (%)
Total	1,902.04	2,092.20	-190.17	-10.00
Germany	388.76	472.58	-83.82	-21.56
UK	213.56	265.03	-51.47	-24.10
Italy	211.69	220.66	-9.41	-4.24
Poland	200.94	204.11	-3.17	-1.58
Spain	154.05	163.45	-9.41	-6.11
France	129.57	124.27	5.30	4.09
Czech Republic	85.52	80.40	5.12	5.98
Netherlands	76.74	83.49	-6.75	-8.80
Romania	70.65	63.65	7.01	9.92
Greece	63.69	69.85	-6.17	-9.69
Belgium	55.38	55.46	-0.08	-0.14
Bulgaria	n/a	38.30	-38.30	n/a
Finland	36.24	36.16	0.07	0.21
Slovakia	32.17	25.34	6.83	21.23
Portugal	30.37	29.91	0.45	1.49
Austria	30.14	32.00	-1.86	-6.18
Hungary	25.03	27.25	-2.22	-8.86
Denmark	23.98	26.55	-2.56	-10.68
Sweden	20.77	20.01	0.77	3.69
Ireland	19.97	20.38	-0.41	-2.06
Estonia	11.68	13.54	-1.86	-15.95
Slovenia	8.21	8.86	-0.65	-7.86
Lithuania	7.51	6.10	1.41	18.72

Latvia	2.94	2.74	0.20	6.66
Luxembourg	2.49	2.10	0.39	15.65
Cyprus	n/a	n/a	n/a	n/a
Malta	n/a	n/a	n/a	n/a

Note: author's calculation
Data source: European Commission, Community International Transaction Log, data downloaded on September 2009, accessible at: http://ec.europa.eu/environment/climat/emission/citl_en.htm

Figure 1 aggregates installation-level data to indicate net positions (the difference between allocation and emissions) by Member States. The data labeled "Gross Long" presents the sum of differences for all the installations having long positions (more allocation than emissions). The data labeled "Gross Short", on the contrary, presents the sum of differences for all the installations having short position (less allocation than emissions). The aggregated net position (gross long minus gross short) for each country may either be positive or negative, shown as the blue bars in the graph. Overall, the negative net position countries outnumber those with positive net positions, with Germany and the United Kingdom having dominant net shorts in particular.

Figure 1. Net Positions by Member State in $MtCO_2$ (2008)



Note: Author's calculation
Data source: European Commission, Community International Transaction Log, data downloaded on September 2009, accessible at: http://ec.europa.eu/environment/climat/emission/citl_en.htm

Installations are put into five size categories according to the amount of free allocations they received (Table 3). Again an imbalance has also been identified, that is, the top 4% largest installations emitted over 60% carbon dioxide. In addition, we noticed two interesting patterns: 1) the proportion of firms participating in the Clean Development Mechanism market (those that surrendered CERs) increases as the firm size gets bigger; and 2) companies of medium size are more likely to hold extra permits and become potential sellers; while companies in either the extreme small or extreme large categories are more likely to emit over the cap and become potential buyers in the market.

Table 3. Distribution of Allocation and Emissions By Installation Size (2008)

	Extreme Small (0~5,000)	Small (5,000~ 20,000)	Medium (20,000~ 100,000)	Large (100,000~ 1,000,000	Extreme Large (>1,000,000)
Number of installations	2,446 (22.3%)	3,224 (29.4%)	3,269 (29.8%)	1,600 (14.6%)	429 (3.9%)
Total allocation $MtCO_2$ (%)	3.33 (.18%)	37.25 (1.95%)	147.08 (7.7%)	534.42 (28%)	1,187.51 (62.3%)
Total emissions $MtCO_2$ (%)	37.64 (1.82%)	39.65 (1.92%)	132.26 (6.38%)	539.93 (26.1%)	1,322.27 (63.8%)
Number of installations Surrendered CERs	143 (5.8%)	371 (11.5%)	612 (18.7%)	480 (30%)	147 (34.3%)
Potential Seller/Buyer ratio	1018/1128 =. 90	2335/884 =2.64	2465/803 =3.07	1045/553 =1.96	197/232 =. 85

Note: author's calculation; number of EUAs allocated are shown in the parentheses.
Data source: European Commission, Community International Transaction Log, data downloaded on September 2009, accessible at: http://ec.europa.eu/environment/climat/emission/citl_en.htm

IV. Survey Methodology

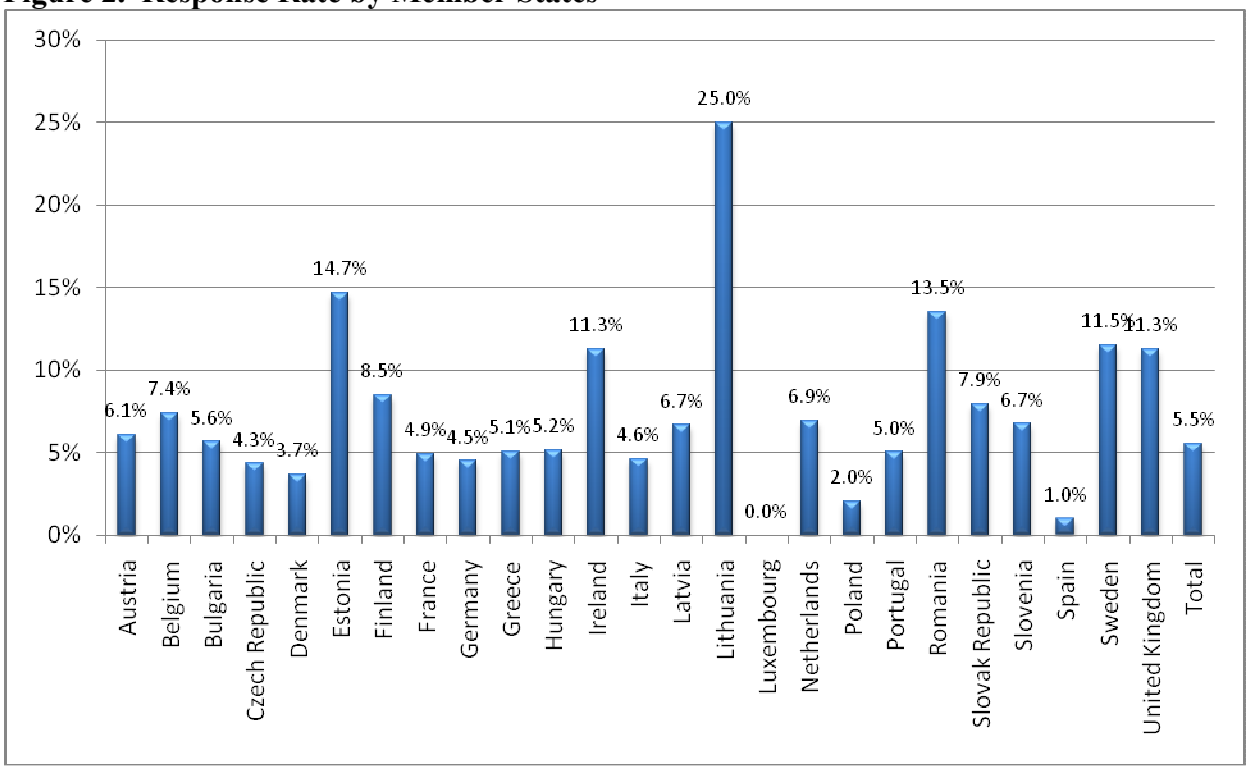
The target population of the survey contains firms that received allocations in 2008 and are required to meet carbon emission obligations under their national registries within the EU ETS. The theoretical and accessible populations were almost the same as listed in the CITL, except for the exclusion of accounts with zero allocation in 2008.[51] However, the "account holder" instead of "installation" is employed as our sampling unit. In CITL, each installation account is represented by a registered person, known as the "account holder", who has also released the contact information that we use to send out the questionnaire. Normally, a firm owning multiple installations will assign the same person to represent all its installations. Therefore, after integrating the original "installation" level data into the "account holder" level,[52] the population size becomes 6,294 observations. Each observation (account holder) may contain the information generated from a single installation or several ones.

The online survey was available in three languages: English, German, and French. It was disseminated via email in two stages. The first round started on November 22nd with several follow-up emails to increase the response rate, and it was closed on December 31st, 2009. 1,965 invitees,[53] about one-third of the population, received the email containing a link to the online questionnaire. The second round followed from January 15th to February 5th, 2010, during which the rest of the population, 3,767 account holders, received the survey link via emails. The difference between the population size and the number of total invitees from both stages is due to the availability and validity of particular account holders' email addresses.

Based on the research purpose, we totally identified 348 valid respondents that answered the essential question of trading or not; and the response rate is 5.9% (116 valid responses in the first round) and 6.2% (232 valid responses in the second) respectively. Specific response rates for each national registry are shown in Figure 2. A perfect circumstance should have given a uniform response rate across all Member States, which is difficult to achieve in reality. Generally, major countries that have a greater amount of emissions and a greater number of companies in the population, such as Germany, UK, Italy, France, Czech Republic, Netherlands and Bulgaria, have response rates close to the average. However Spain, having the largest number of companies under the scheme with 800, and its total emission in 2008 ranked the 5th among the Member States, only gave a 1% response rate. Similarly, companies in Poland, whose total emission ranked 4th and has about 550 companies surveyed, only responded at a 2% rate. One possible explanation is language difficulty. Further studies could be designed to target companies in the two countries. The high response rate from Lithuania is due to the small population in the country (4 in total), where only 1 respondent brings the 25% response rate. Other high rates have a similar story. Conversely, none of the surveyed account holders in

Luxembourg, a small population of 12 firms, responded. These anomalies in response rate do little to bias the results of the study.

Figure 2. Response Rate by Member States



Note: Author's calculation.
Data source: European Commission, Community International Transaction Log, data downloaded on September 2009, accessible at: http://ec.europa.eu/environment/climat/emission/citl_en.htm

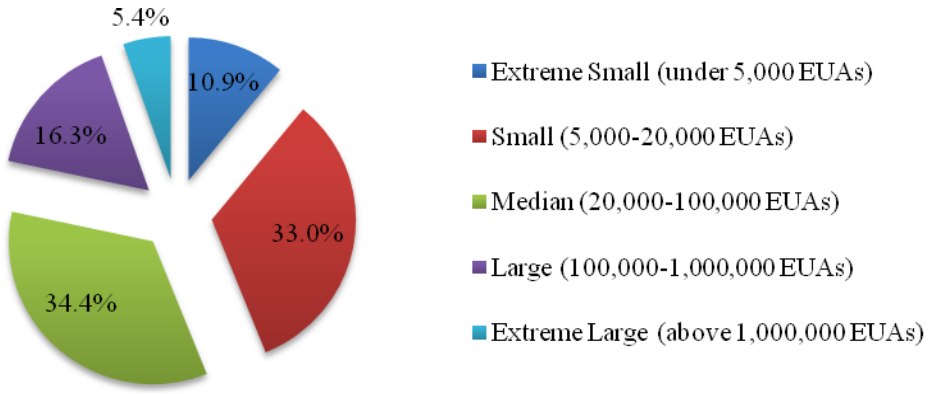
V. Results

a. Descriptive Analysis

Figure 3 shows the distribution of the "account holder" population over the five size categories. Figure 4 shows the distribution of valid respondents across those categories. In comparison, it seems that "big players" (with allocations in the large or extreme large categories) occupy a larger portion within the respondents than in the entire population. As we discussed

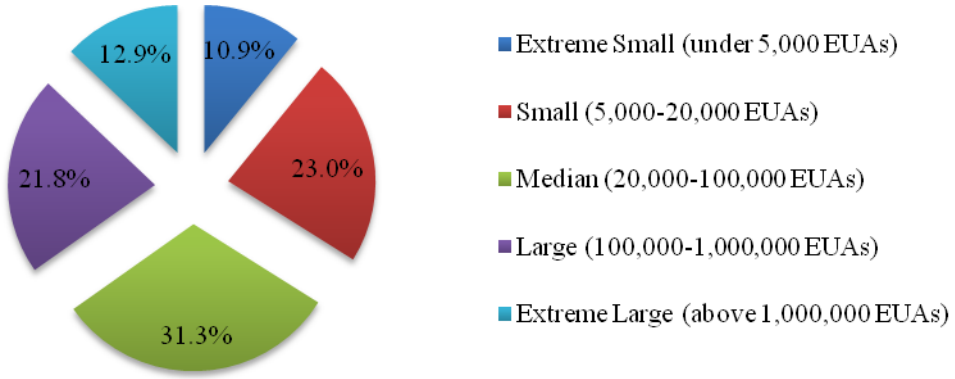
above, it is these big players that account for most emissions and contribute to most volumes in the trading market.

Figure 3. Distribution of *Population* According to Allocation Size Categories



Note: The range of allocations for each category is listed in the parentheses. Author's calculation.
Data source: European Commission, Community International Transaction Log, data downloaded on September 2009, accessible at: http://ec.europa.eu/environment/climat/emission/citl_en.htm

Figure 4. Distribution of *Respondents* According to Allocation Size Categories



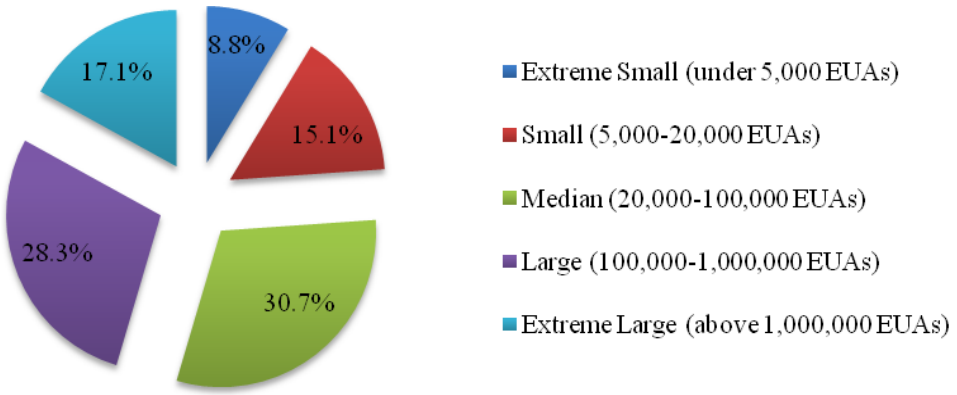
Note: The range of allocations for each category is listed in the parentheses. Author's calculation.
Data source: European Commission, Community International Transaction Log, data downloaded on September 2009, accessible at: http://ec.europa.eu/environment/climat/emission/citl_en.htm

We analyzed the firms' size on three different criteria. We split the sample according to the number of employees in the firm, the revenues of the firm, and the size of its emissions. Revenue proved to be an irrelevant and misleading characteristic, so it was ignored.

Figures 5 and 6 compare the allocation size distribution between traders and non-traders. 205 respondents answered that they did trade in the EU ETS in 2008, while 143 did not; that is, 58.9% of respondents participated the emission-trading scheme. There is an unexpected slight difference in the participating rate between the first and the second round respondents: 48.3% and 64.2% respectively.

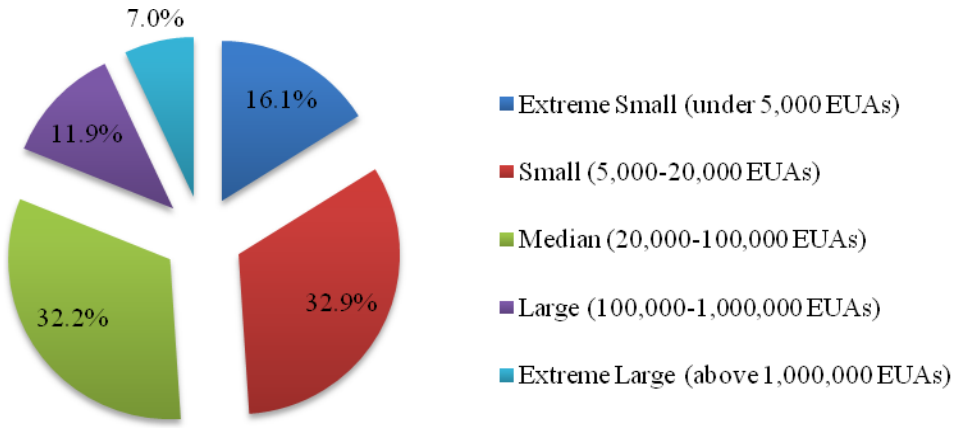
Consistent with our anticipation, bigger companies are more active in the trading market. Over 45% of traders lie within the "large" and "extreme large" allocation size categories, while non-traders occupy less than 20% in the same categories. On the other hand, only about 24% of traders are "extreme small" or "small" players, while the same two groups are 40% of the non-traders. Likewise, firms with more employees also have a large propensity to trade permits.

Figure 5. Distribution of Traders According to Allocation Size Categories



Note: The range of allocations for each category is listed in the parentheses. Author's calculation.
Data source: European Commission, Community International Transaction Log, data downloaded on September 2009, accessible at: http://ec.europa.eu/environment/climat/emission/citl_en.htm

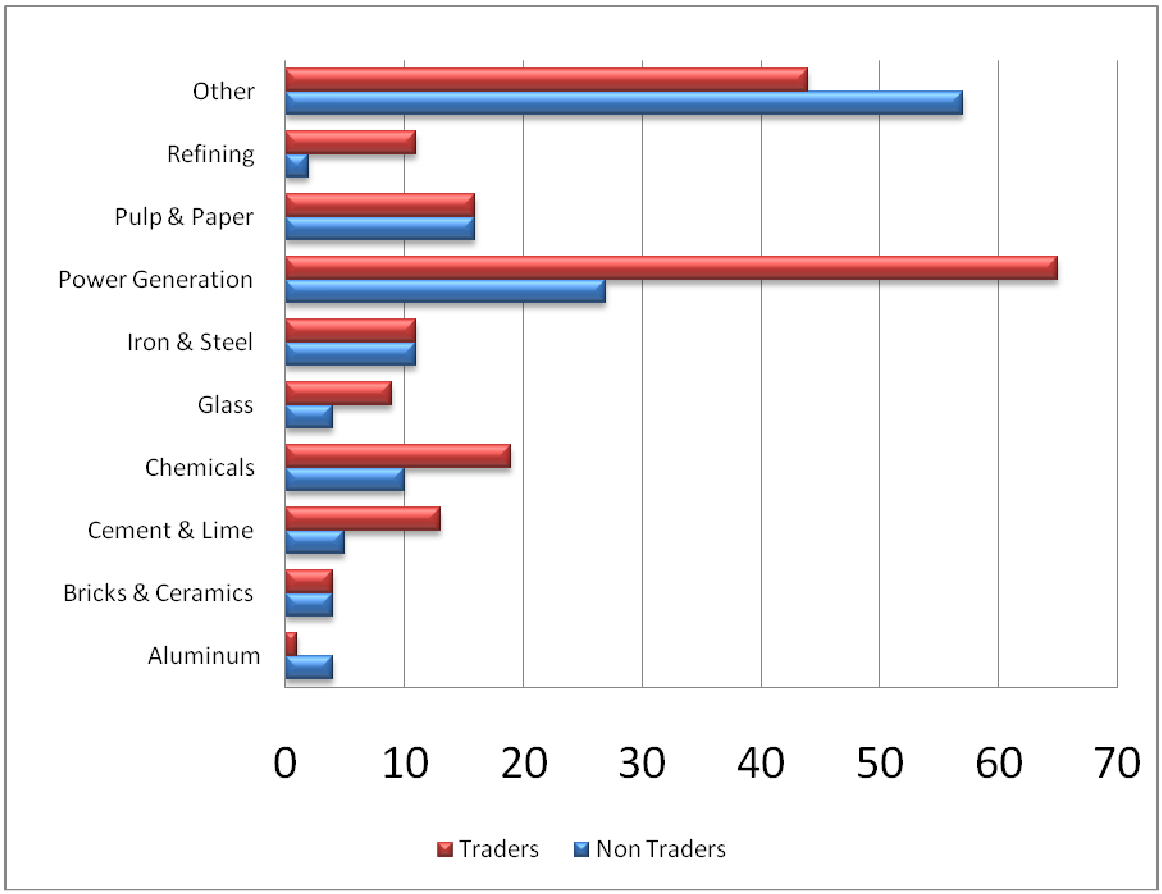
Figure 6. Distribution of Non-Traders According to Allocation Size Categories



Note: The range of allocations for each category is listed in the parentheses. Author's calculation.
Data source: European Commission, Community International Transaction Log, data downloaded on September 2009, accessible at: http://ec.europa.eu/environment/climat/emission/citl_en.htm

Segregating the firms based on what sector they operate in, most firms identified themselves as operating in the power generation sector. Due to the nature of their business, power generating firms tend to be large emitters, so it makes sense that 65 out of 92 firms traded permits. Aluminum manufacturing was the only sector in which fewer firms traded then did not trade (1 out of 5). The number of firms who traded was equal to the number that did not trade in both the pulp and paper sector and the bricks and ceramics sector. In all other sectors (except for 'Other'), more firms traded permits then those who did not.

Figure 7. Tendency to Trade Based on Sector



Note: Author's Calculation
Data source: European Commission, Community International Transaction Log, data downloaded on September 2009, accessible at: http://ec.europa.eu/environment/climat/emission/citl_en.htm

b. Analysis of Transaction Costs Among Traders and Non-Traders

The following two tables lists the responses to a number of behavioral questions the survey asked. Table 4 reports answers from firms that traded allowances in 2008, and table 5 reports answers from firms that did not trade. The firms responded to each statement saying whether they agree, disagree, or neither. There were several survey questions that elicited a strong response. For example, a vast majority of trading firms (84%) agree that it is important for firms to reduce their carbon footprint over time and not only rely on purchased allowances.

As shown in the Table 5, non-traders also felt strongly that reducing their carbon footprint was an important business strategy.

Most trading firms disagreed that their use of allowances was viewed negatively in the public eye. Perhaps this indicates that firms feel strongly that ETS incentives can be used to effectively lower their carbon footprint. Because the majority of firms disagreed that purchasing allowances was more efficient for the firm than lowering emissions, it can be inferred that most firms see reducing emissions as a valuable business strategy moving forward.

Transaction costs for trading firms did not appear to represent a significant barrier to trade. Firms widely rejected ideas that that language barriers, legal costs, and information disequilibrium impeded trade. Firms also did not feel that the time and effort needed to participate in EU ETS trading was substantial enough to inhibit trade. Nor did firms feel that it was "difficult to find a reliable partner or intermediary when it comes to buying or selling allowances." Moreover, non-trading firms felt these transaction costs were just as insignificant as trading firms. This is crucial, because it illustrates that whether a firm trades or not, transaction costs are not an important factor in their decision making process.

Given the lack of evidence that transaction costs inhibit trade, it stands to reason that most firms felt the decision to buy or sell allowances largely depends on the relative price of the allowances and the price of energy at the time. However questions probing why the firms decided to trade (i.e. were the allowance treated as assets) did not return any strong trends. Thus, it is possible that sampled firms have an array of individual reasons for trading in the EU ETS that were not captured by the broad questions provided in the survey.

Table 4 - Firm Attitudes (134 Trading Firms)

Question	Agree	Disagree	Neither	Mean
In the long run, it is important for the firm to reduce its carbon footprint and not rely on purchased allowances.	83.5	6.7	9.8	4.2
Using purchased allowances opens our firm to public criticism.	15.7	50.0	34.3	1.4
Trading allowances helped make our firm profitable.	24.6	35.8	39.6	2.8*
The global recession of 2008 affected how the firm traded allowances.	36.1	35.2	28.7	3.0
Selling allowances helped our firm solve liquidity constraints brought on by the global recession.	17.2	55.2	27.6	2.4
The number of allowances needed by our firm in 2008 were lower because of the global recession.	43.5	38.0	18.5	3.0
It is more profitable for my firm to purchase allowances than to reduce emissions internally.	26.9	42.5	30.6	2.7*
The decision to trade allowances depends on the relative price of allowances and energy.	57.5	20.9	21.6	3.4
It is difficult to find a reliable partner or intermediary when it comes to buying or selling allowances.	3.0	77.6	16.4	2.0*
The time and effort it takes to trade allowances is substantial.	28.4	45.5	26.1	2.8*
Language barriers between Member States affected the firm's decision to trade.	4.5	77.6	17.9	2.0*
Legal costs associated with trading allowances affected the firm's decision to trade.	8.2	68.6	23.1	2.2*

Note: A five-point scale was collapsed into a bimodal distribution, retaining the "neither" category.
*Significant Difference between traders and non-traders

Table 5 - Firm Attitudes (105 Non-Trading Firms)

Question	Agree	Disagree	Neither	Mean
In the long run, it is important for the firm to reduce its carbon footprint and not rely on purchased allowances.	85.7	6.7	7.6	4.2
Holding allowances helped make our firm profitable.	12.4	46.7	40.9	2.4*
Holding allowances helped our firm solve liquidity constraints brought on by the global recession.	12.4	56.2	31.4	2.3
It is more profitable for my firm to purchase allowances than to reduce emissions internally.	12.4	60.0	27.6	2.3*
The decision to trade allowances depends on the relative price of allowances and energy.	49.5	20.0	30.5	3.3
The time and effort it takes to trade allowances is substantial.	31.4	22.9	45.7	3.1*
It is difficult to find a reliable partner or intermediary when it comes to buying or selling allowances.	20.3	37.9	41.8	2.7*
Legal costs associated with trading allowances affected the firm's decision to trade.	7.6	48.6	43.8	2.5*
Language barriers between Member States affected the firm's decision to trade.	7.6	61.0	31.4	2.3*

Note: A five-point scale was collapsed into a bimodal distribution, retaining the "neither" category.
*Significant Difference between traders and non-traders

The most curious responses procured by the Likert scale element of the survey were those on if and how the firms used allowances as assets in the 2008 global recession. Traders and non-traders alike disagreed that trading or holding allowances helped their firm with liquidity constraints throughout the recession. Trading firms also disagreed that their activity in the EU ETS helped make the firm profitable, even though they were able to sell off allowances

when production was lowered during the recession.[54] It may be that treating the allowances as assets is a business strategy that firms prefer not to report. Nevertheless, the relative price of allowances and energy appear to be the main deciding factor a firm uses when choosing whether or not to trade allowances in the EU ETS. These issues are given further treatment in the section on market analysis.

In an effort to view any trends with more particularized data, the Likert responses were broken down into size and sector categories. While none of the results exhibited significant correlations with variables of size or sector, there are some visible trends where sectors responded differently from one another. However when the data is broken into sector categories, response rates become very low for some of these sectors. Hence, none of the responses discussed above statistically appear to rely on what the firm produces or what scale they produce at.[55] For an analysis of sector information on several Likert responses, see the Appendix.

In addition to the Likert scales, non-traders were asked to provide primary reasons why they did not trade in 2008. The majority of firms responded that they had already met their emissions targets. This could suggest that allocation of allowances plays a major role in determining if and how a firm will trade in the EU ETS. If firms are being over-allocated trading permits, then the market may not be functioning as efficiently as it can. However, with the introduction of auctioning in phase II and III, some of these issues with allocation can be alleviated.

Table 6 - Firm Responses for Why They Did Not Trade (127 respondents)

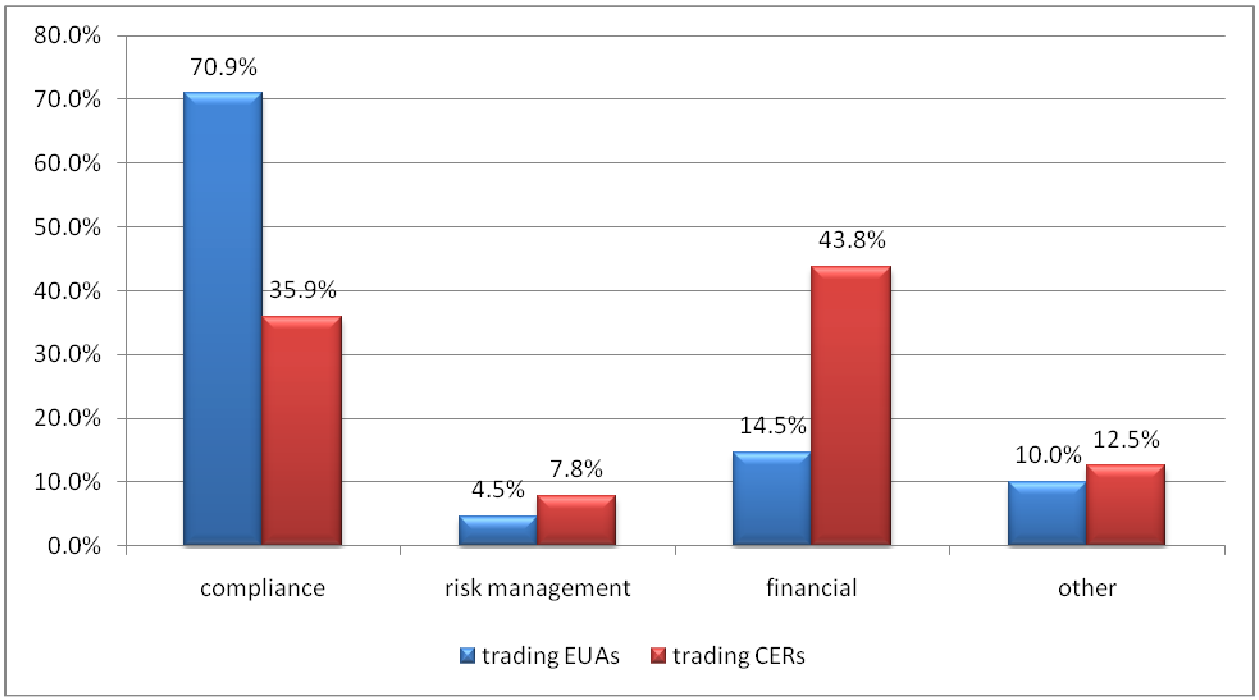
Reason for Not Trading	# of Firms
Firm already met emissions target.	51
Firm was not familiar with EU ETS.	11
Firm invested in abatement technologies.	28
Firm lowered production.	22
Firm combined processes to lower emissions.	7
Firm altered shipping methods to lower emissions.	1
Firm redistributed allowances across installations.	12
Other reasons	53

Note: Firms could make multiple selections

Conversely, firms that did trade permits were asked what their primary motivation was. The survey asked firms this for both EUAs and CERs, and Figure 8 illustrates that there was a large difference between the two permit types. For EUAs, the large majority of firms, 71%, answered that meeting compliance regulations was the most important reason. However, for CERs, most firms, 44%, claimed that financial reasons were the most significant, and only 36% answered that compliance was. This demonstrates the different nature of the two permits. CERs tend to be used more as a financial asset because firms can only use a certain level of CERs to meet their overall emissions standards. Also CERs are cheaper and originally came from the Kyoto Protocol, so they tend to be used as an asset to raise cash.

As with other questions in the survey, these results were analyzed on a size and sector basis. Surprisingly, there were no significant correlations between the size or sector of the firm and what they deemed important.

Figure 8. Reasons for Trading EUAs and CERs (205 respondents)



Note: This graph displays what each firm ranked as its number one motivational factor

c. Regression Analysis

We used a probit regression model in order to investigate the effect and the level of impact that different characteristics of the firm have on their decision to trade or not to trade the allocated permits. A binary response of the firm to trade or not to trade was taken as the dependent variable and a combination of a number of different variables including amount of allocation of permits to the firm, amount of emission of the firm, amount of permits surrendered by the firm, the revenue, number of employees, along with their decision to bank or borrow were taken as independent variables.

The regression results indicate that none of the dependent variables were statistically significant. One of the reasons for this might be due to the limited number of complete responses that were received. An under-sized study could prevent us from getting useful results. However

the limited number of responses that have been received do provide us with good descriptive statistics of the firms and their reasons to trade or not to trade. A higher response rate and a larger number of observations might be required to provide any conclusive regression results.

VI. Market Analysis

The following section gauges the implications and accuracy of our survey results by examining how the carbon markets have performed throughout phase II. We sought to determine whether the trading behavior indicated by our survey was consistent with what was actually happening in the market. We examined both the primary and secondary markets, and compared the volume, volatility, and trends of the market to how firm's suggested they make trading decisions. We found nothing that might contradict the insignificance of transactions costs or the market behavior described in our survey results. Additionally, assuming our conclusions are correct, what implications do they have for the price, efficiency and the future of the markets.

a. Primary Markets

In phase II, the carbon markets have increased both in terms of volatility and trading volume since phase I. In 2008, the ETS saw approximately $92 billion (63€) of trading, a 53% increase from $49 billion in 2007.[56] The price of EUAs followed global markets in 2008 and climbed to a high of 29€ in July, as Figure 3 illustrates. As the realities of the financial crisis and the global recession were realized, the price fell and bottomed out at 8€ in the first quarter of 2009. However, 8€ was an overcorrection, and the market bounced up to 13 €, where it has been surprisingly stable, staying between 12 and 15€ since mid June.

Figure 8: EUA Price Over the Last 18 Months

Source: European Carbon Exchange, "Historic Data" (2009) http://www.ecx.eu/ECX-Historical-Data

Some analysts predicted the price of carbon would continue to fall last July because there was an excess supply of permits in the system. They assumed firms would continue to sell unneeded permits in order to raise capital in this harsh economic environment. However, this has not been the case.

Generally, firms seem to be waiting for the economy to rebound. As the economy rebounds, so will the demand for energy, and thus the demand for carbon permits. Our survey asked firms if they saved "2008 allowances for the remainder of phase II." 42% said yes. This is a high number when one considers that firms had to meet emissions targets, and it is consistent

with the above analysis. Consequently, it seems many firms are saving their permits to use or sell in brighter times.

Furthermore, permits offer firms new flexibility in their capital structure because they can be traded in the market. With such a liquid asset, surprisingly few firms used permits to raise cash last year, at a time when cash was king. In our survey, only 17.2% of firms that traded permits last year agreed to the statement "*Selling allowances helped our firm solve liquidity constraints brought on by the global recession*." Only 12.4% of firms that did not trade either agreed or strongly agreed with the same statement. While this response goes against what most analysts predicted, it agrees with how the market actually reacted. Rather than the EUA and CERs price plummeting, surprisingly few firms sold permits during the credit crunch.

b. Secondary Markets

The secondary markets have grown dramatically since the beginning of phase II. Almost two billion EUA permits were traded on the futures market in 2008, and over 3.5 billion have been were traded in 2009.[57] This dwarfs the 1.5 billion that were traded in all of phase I. Obviously the futures price followed the primary markets, peaking at 30.5€ in June, 2008, before falling to 8.50€ in February, 2009. It currently is floating around 13€. Of course, the EUA options market has witnessed similar exponential growth. In phase I, 58 million tons of carbon were traded, but since the beginning of phase II over 638 million tones have been traded.

Likewise, CER options trades have skyrocketed, reaching 67.8 million in 2008, and 85 million in 2009. It makes sense that the CER secondary market has grown faster than the EUA secondary market because as Figure 8 (Reasons for Trading EUAs and CERs) illustrated, firms primarily use CERs for financial reasons.

The open interest volume of futures and options contracts has increased significantly with each consecutive year.[58] This indicates the intensity of trading in these derivative markets and demonstrates that more and more firms are trading in the secondary markets. Also, this insinuates increased volatility in the market.

Clearly the secondary markets have developed very fast in terms of volume, liquidity, and institutional expertise. The risk transferring aspect of these derivatives will allow firms to reduce exposure to the often volatile market, and allow them to make long term plans. In fact, a substantial portion of the transactions in the secondary market reflects the desire of firms to hedge their position.

However, it is important to note that an increase in trading in secondary markets does not necessarily mean a reduction in emissions, as it does in the primary markets. Speculators without any physical permits try and profit from guessing the direction of the market. Also, many firms use options as hedges, and never exercise their contracts. Therefore, often there is no physical delivery of permits in the secondary market.[59]

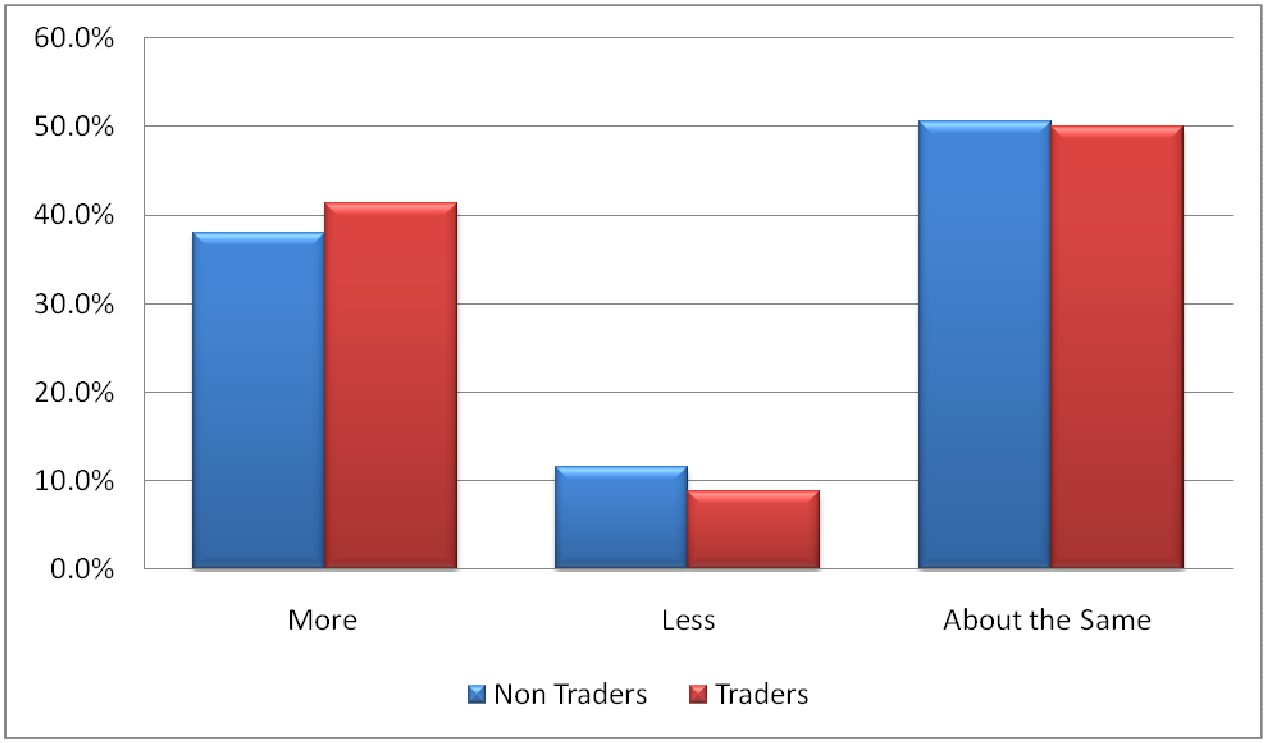
Studying these markets does give us one easily identifiable and quantifiable transaction cost; the transaction fee that firms must pay to brokers for each future or options contract. For example, the European Climate Exchange charges €.004 for daily futures contracts of both EUAs and CERs, and €.002 for longer options and futures contracts. Both the sellers and buyers must pay this fee for each transaction. The exchange BlueNext charges €.017 for its EUA and CER spot trades, and made over €38 million in 2009.

Our survey asked firms what method they use to trade, whether it was through 1) Banks or Brokerage Firms, 2) Public Agencies, 3) Non-Governmental Organizations, 4) Installations owned by your firm, 5) Installations not owned by your firm. The vast majority of firms answered that they traded through Banks and Brokerage firms 100% of the time.

c. Market Implications

Looking at the trends, it appears the trading volume and liquidity will continue to grow. In fact, our survey asked firms if they expect to trade more, less, or the same in phase III. Figure 9 illustrates how most firms plan to trade more or the same, regardless of whether they were traders already. Obviously, when a firm that did not trade in the past, answers that they will trade about the same in the future, it does not signify an increase in trading. Still, we think it is safe to assume the markets will continue to grow.

Figure 9. Do You Expect to Trade More, Less, or About the Same? (347 respondents)



As markets continue to grow their price discovering ability will become more accurate. This will increase the efficiency of the system, and Europe will more appropriately allocate and utilize carbon emissions. While transaction costs do not seem to play a significant role it distorting the markets, uncertainties do.

Political, regulatory and economic uncertainties are likely lowering the price of carbon. The geo-political environment and the willingness of countries outside the EU to regulate carbon remains unclear. This is especially true after the heated, but indecisive Copenhagen Climate Conference. Ideally, a global carbon market would be the ultimate solution, but rifts between developing and developed countries make the political feasibility of any such solution unlikely. Australia, Japan, and Norway plan to implement their own CO2 cap and trade system,[60] but major players like China and the United States have yet to make any solid legal commitments.

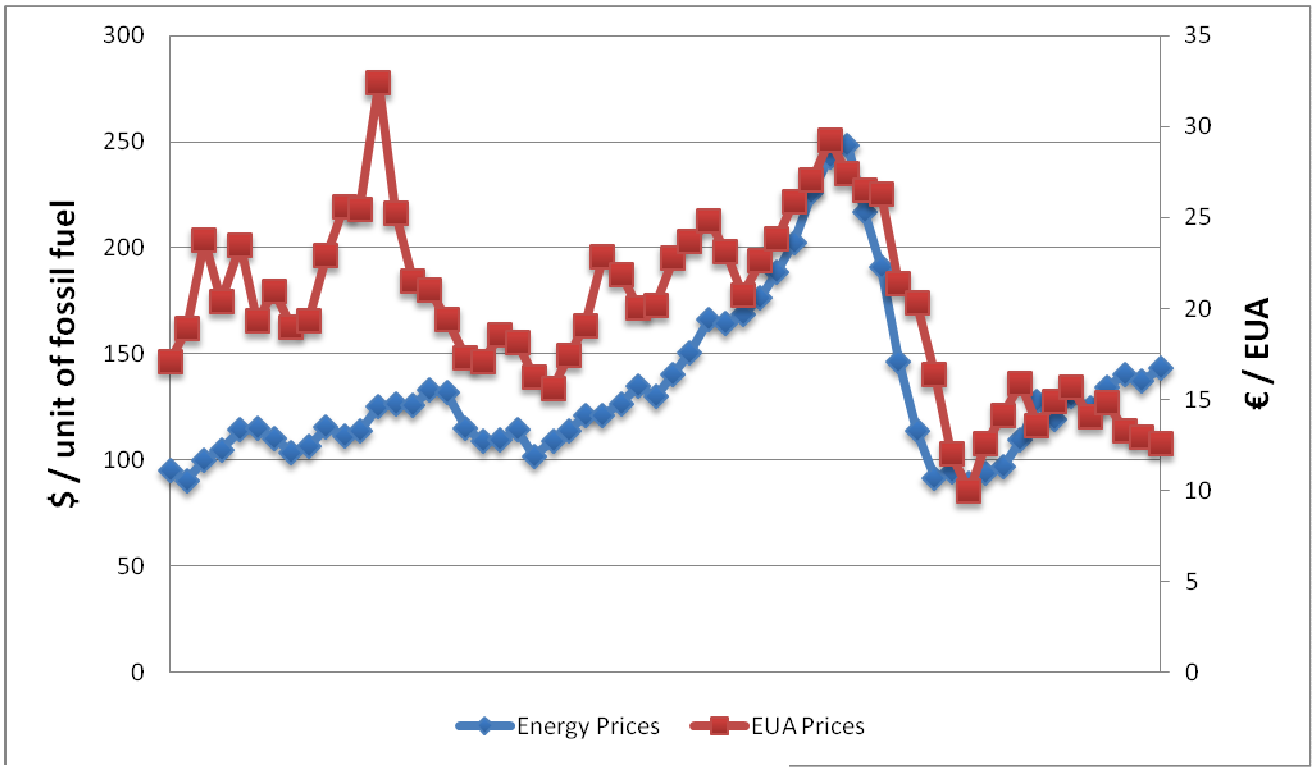
Not only would this be good for the environment, but for the economies of Europe as well. European firms' competitive positions are being hurt by the extra costs they have to incur that their foreign competitors do not. Many firms have noted that the cost of carbon is hurting their bottom line and adversely affecting shareholder return.[61] However, there are already regulatory issues within the EU, and presumably these would be even greater in a world market. Recently, for example, there was a problem with used CERs turning up in the market. CERs from Hungary were sold to Japan, but then they somehow made their way back into the EU ETS. Officials noticed this and remedied the problem, but it still raised concerns of traders.

There are also financial regulatory uncertainties with regards to accounting procedures. There are no standardized accounting methods for allowances. With over 100 different national policies regarding how to manage emissions, members of the Big Four accounting firms are

calling for a universal rule.[62] Investors, regulators, accountants, and auditors all need to understand how emissions permits show up on a company's balance sheet.

One issue that is clearly linked to the price of carbon is the price of energy. Logically there is an intrinsic connection between the cost of fossil fuels and the cost of carbon emissions. While the topic investigated in this paper does not involve itself with fossil fuel prices, Figure 10 illustrates that there is certainly a strong relationship. The price of fossil fuels displayed is an index composed of coal, oil, and natural gas prices. The correlation between carbon and energy prices is .58 in phase I and phase II, and .90 in just phase II. Because the price of permits was found to be a major factor in a firm's decision to trade, and the price of fossil fuels is a major factor in determining the price of permits, the price of fossil fuels is consequently a major factor in a firm's decision to trade.

Figure 10. Fossil Fuel and Carbon Price Comparison



Note: The x-axis stretches from January 1, 2005 until December 31, 2009
Data Source: European Carbon Exchange, "Historic Data" (2010) http://www.ecx.eu/ECX-Historical-Data

VII. Conclusion

Analyzing the responses from the firms surveyed, we can conclude that there is no significant barriers such as transaction cost, language barriers, legal costs, information disequilibrium or time constraints in participating in EU ETS that would discourage firms from trading their allowances. In order to meet the compliance requirement of the EU ETS, firms found it that it was important to reduce their emissions rates rather than purchase more allowances. However the major reason for the firm to trade was to be in compliance with the EU ETS, followed by financial reasons. It was found that firms mostly trade EUAs for compliance reasons and CERs for financial reasons.

In the universe of 6,294 Account holders in the EU ETS database we received 5.53% or 348 valid responses with a majority of responses being generated from countries with a greater number of companies registered in the EU ETS such as Germany, UK and France as expected. Although some countries that were expected to have a better response rate such as Spain and Poland due to their size in the database did not live up to the expectation. The distribution of the respondents from the survey was also a close match to the distribution of the population of traders and non-traders.

Looking at the firms that traded based on the sector; power generation seems to be the sector that has the tendency to trade the most followed by general “other” industries, chemicals and pulp and paper. In terms of tendency to trade based on the size of firms, those industries that have the higher allocation of EUA appeared to trade more than those that have a smaller allocation.

Generally speaking, the survey results indicate an optimistic future for the EU ETS. Low transaction costs are essential to having an efficient market, and allowing permits to be appropriately priced and optimally allocated. Furthermore, firms seem to be taking the issue of climate change and carbon emission reduction very seriously. Moving forward, the EU can expect greener economies as more industries are placed under the ETS umbrella in Phase III. Also, as nations across the globe implement carbon regulations, the EU ETS will provide an important example of one method of how to reduce emissions with a minimal cost to one's economic competitiveness.

Appendix: Likert Scale - Sector Analysis

In the long run, it is important for the firm to reduce its carbon footprint and not rely on purchased allowances.		Likert	Sector										
			Aluminum	Bricks & Ceramics	Cement & Lime	Chemicals	Glass	Iron & Steel	Power Generation	Pulp & Paper	Refining	No Response	Total
	Freq	Strongly Disagree	0	1	0	0	0	0	1	2	0	0	4
	Percent		0	14.29	0	0	0	0	1.59	9.09	0	0	1.75
		Disagree	0	0	0	2	1	1	4	0	0	3	11
			0	0	0	9.52	10	7.14	6.35	0	0	4.41	4.8
		Neither	0	1	0	0	2	4	9	1	0	2	19
			0	14.29	0	0	20	28.57	14.29	4.55	0	2.94	8.3
		Agree	1	3	9	10	3	3	26	9	4	27	95
			20	42.86	69.23	47.62	30	21.43	41.27	40.91	66.67	39.71	41.48
		Strongly Agree	4	2	4	9	4	6	23	10	2	36	100
			80	28.57	30.77	42.86	40	42.86	36.51	45.45	33.33	52.94	43.67
		Total	5	7	13	21	10	14	63	22	6	68	229
			100	100	100	100	100	100	100	100	100	100	100

Trading allowances helped make our firm profitable.		Likert	Sector										
			Aluminum	Bricks & Ceramics	Cement & Lime	Chemicals	Glass	Iron & Steel	Power Generation	Pulp & Paper	Refining	No Response	Total
	Freq	Strongly Disagree	1	3	0	3	4	0	11	4	1	19	46
	Percent		20	42.86	0	14.29	40	0	17.46	18.18	16.67	27.94	20.09
		Disagree	2	1	3	7	4	5	12	3	1	7	45
			40	14.29	23.08	33.33	40	35.71	19.05	13.64	16.67	10.29	19.65
		Neither	1	1	8	8	1	7	22	11	3	31	93
			20	14.29	61.54	38.1	10	50	34.92	50	50	45.59	40.61
		Agree	1	2	0	3	1	2	14	4	1	9	37
			20	28.57	0	14.29	10	14.29	22.22	18.18	16.67	13.24	16.16
		Strongly Agree	0	0	2	0	0	0	4	0	0	2	8
			0	0	15.38	0	0	0	6.35	0	0	2.94	3.49
		Total	5	7	13	21	10	14	63	22	6	68	229
			100	100	100	100	100	100	100	100	100	100	100

Selling allowances helped our firm solve liquidity constraints brought on by the global recession.		Likert	Sector										
			Aluminum	Bricks & Ceramics	Cement & Lime	Chemicals	Glass	Iron & Steel	Power Generation	Pulp & Paper	Refining	No Response	Total
	Freq	Strongly Disagree	1	3	0	5	3	2	17	5	1	23	60
	Percent		20	42.86	0	23.81	30	14.29	26.98	22.73	16.67	33.82	26.2
		Disagree	3	2	4	8	3	5	18	4	2	18	67
			60	28.57	30.77	38.1	30	35.71	28.57	18.18	33.33	26.47	29.26
		Neither	1	1	6	3	3	3	20	9	3	19	68
			20	14.29	46.15	14.29	30	21.43	31.75	40.91	50	27.94	29.69
		Agree	0	1	3	3	0	4	7	4	0	6	28
			0	14.29	23.08	14.29	0	28.57	11.11	18.18	0	8.82	12.23
		Strongly Agree	0	0	0	2	1	0	1	0	0	2	6
			0	0	0	9.52	10	0	1.59	0	0	2.94	2.62
		Total	5	7	13	21	10	14	63	22	6	68	229
			100	100	100	100	100	100	100	100	100	100	100

It is more profitable for my firm to purchase allowances than to reduce emissions internally.		Likert	Sector										
			Aluminum	Bricks & Ceramics	Cement & Lime	Chemicals	Glass	Iron & Steel	Power Generation	Pulp & Paper	Refining	No Response	Total
	Freq	Strongly Disagree	0	3	1	4	2	2	11	6	1	10	40
	Percent		0	42.86	7.69	19.05	20	14.29	17.46	27.27	16.67	14.71	17.47
		Disagree	3	2	6	3	2	7	15	9	1	30	78
			60	28.57	46.15	14.29	20	50	23.81	40.91	16.67	44.12	34.06
		Neither	2	1	5	6	5	3	19	6	2	19	68
			40	14.29	38.46	28.57	50	21.43	30.16	27.27	33.33	27.94	29.69
		Agree	0	1	0	5	1	2	15	1	2	9	36
			0	14.29	0	23.81	10	14.29	23.81	4.55	33.33	13.24	15.72
		Strongly Agree	0	0	1	3	0	0	3	0	0	0	7
			0	0	7.69	14.29	0	0	4.76	0	0	0	3.06
		Total	5	7	13	21	10	14	63	22	6	68	229
			100	100	100	100	100	100	100	100	100	100	100

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