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Voluntary Corporate Climate Initiatives and Regulatory Loom: Batten Down the Hatches

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Abstract

The rationale of voluntary corporate initiatives is often explained with anticipation of future regulation. We test this hypothesis for the Chicago Climate Exchange (CCX) and the Climate Leaders (CL), two popular voluntary US environmental programs to curb carbon emission that were operating during a decisive regulatory event. In 2009 the Waxman-Markey Bill surprisingly passed the House of Representatives and brought the US economy a big step closer to a nationwide CO_2 emission trading system. In an event study we assess how the stock market adjusted prices when the likelihood of CO_2 regulation unexpectedly increased. We develop a simple model to investigate the empirical results. Our findings suggest that only membership in the CCX was considered beneficial, an initiative whose market oriented design happened to dovetail with the bill's. Earlier stock market reactions to membership announcements in these voluntary programs paint a complementary picture. But membership alone cannot account for the entire price adjustments. Our results show that a substantial part of the market reaction can be traced back to industry-wide effects.

JEL-Classifications: G38, Q53, Q54, Q58

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1 Introduction

The latest assessment report of the Intergovernmental Panel on Climate Change once again stresses the critical impact of CO_2 emissions on the environment. Yet it does not seem likely that an agreement on a global framework to tackle climate change is achieved anytime soon. Notably the United States, one of the leading nations in greenhouse gas emissions, lacks federal legislation that addresses carbon emissions on firm level.[1] This was bound to change on 26 June 2009, when the US House of Representatives passed H.R. 2454, the "American Clean Energy and Security Act of 2009" with a razor-thin margin. Dubbed the Waxman-Markey Bill, this act aimed to cap CO_2 emissions in the US with an emission trading system. The passage of this bill caught the public off guard. Even though the bill was gradually defeated later on, its success in the House of Representatives unexpectedly increased the likelihood of federal carbon legislation in the US. Suddenly it seemed more likely than not that the government would mandate an emission trading system in the near future.

The passage of the bill conveyed new information to the stock markets. Some firms seemed better equipped against this shift in probability of impending legislation. Membership in binding voluntary environmental initiatives can credibly signal commitment and provide a learning environment to improve the corporate footprint. The costs of membership are traded off against savings in future compliance costs. In this paper we ask whether being a member in such an initiative pays off when new regulation looms ahead more clearly. To this end, we conduct an event study to compare the implications of corporate membership in two major CO_2 abating programs that were operating during the passage of the Waxman-Markey Bill; the Chicago Climate Exchange (CCX) and the Climate Leaders (CL). More precisely, we analyze whether membership in the CCX and CL initiatives was immediately rewarded by the stock market when it adjusted to the unanticipated rise in likelihood of federal legislation.[2] We are particularly interested in juxtaposing the two program designs. The CL initiative pursued a broad and non-market based approach with support from the US government. The CCX program, a voluntary carbon market, was more streamlined and relied on independent verification. As it happens, a similar mechanism was foreseen in the bill. We argue that the particular fit of an initiative's de-

[1] There are regional efforts: California has recently introduced a cap-and-trade program. However, the large number of allocated pollution permits has lead to a price decay. Other initiatives encompass several states. The Regional Greenhouse Gas Initiative aims to reduce greenhouse gases in nine US states in the northeast and is limited to large fossil fuel power plants.

[2] Before the Waxman-Markey Bill the probability that the US might restrict its corporate CO_2 emissions by law was not zero. However, the passage of this bill was not anticipated and unexpectedly increased the probability of legislation, which lends itself to an event study. We elaborate on this argument in Section 2.1.

sign bears importance for its designated economic value, which may become especially evident during regulatory events. Our comparison thus adds another determinant to the relationship between environmental and economic performance (for a survey, see Blanco et al., 2009).

The comparative impact of the Waxman-Markey Bill on CCX and CL program members is the main analysis of this paper. In order to round up the picture and gain a more conclusive insight, we compare in a complementary event study how differently, if at all, the earlier announcements to join these programs had been gaged by the stock market. The direction of a possible reaction to such membership announcements is not readily obvious. On the one hand, the new engagement could be perceived as detrimental from an investor's point of view. This is the case if the expected marginal benefit of the endeavor is judged to be lower than its marginal cost. Oberndorfer et al. (2013) for example show that the inclusion in a sustainability stock index is valued negatively by the stock market. On the other hand, investors might perceive voluntary carbon reduction programs as a fitting training ground to acquire technical knowledge and improve operational efficiency. If so, stock market reactions upon membership announcements could be neutral or even favorable. For CL firms, this very question has been answered in an event study by Fisher-Vanden and Thorburn (2011). They find that newly declared CL firms were penalized in terms of falling stock prices. Because this paper employs the same identification and statistical inference method, we can directly integrate and discuss their results in our analysis.

In contrast to the CL membership announcement analysis, we cannot make use of existing research on CCX market reactions. Gans and Hintermann (2013) assess membership announcement and Waxman-Markey Bill effects for CCX firms and conclude that for both instances, the market reacted highly favorably. However, there are a couple of drawbacks to the research design which cast doubt on the validity of the empirical analysis. Gans and Hintermann's CCX sample was not screened for contemporaneous confounding events affecting firm value. This issue is exacerbated by the statistical inference method. Instead of an event study with daily data, the study employs a difference-in-differences framework with monthly stock returns. Such a research design is at odds with the established understanding and inference how markets adjust to new information. Markets absorb new information quickly. Event studies are the method of choice for assessing this reaction; indeed, it is the reason the method was developed in the first place. These are not just minor technical quibbles. One cannot isolate the effect of CCX membership and thus cannot make a reliable statement about whether the estimated returns in Gans and Hintermann are causally attributable to the events in question. So in addition to our main analysis, where we follow up on both initiatives during the Waxman-Markey Bill, we conduct a complementary event study to investigate the impact of the CCX membership announcements. We add to these findings the aforementioned

CL membership announcement reactions from Fisher-Vanden and Thorburn.

The CCX analysis in our paper differs from Gans and Hintermann in two important aspects. First, we screen for confounding events up to two days before and two days after every CCX membership announcement and up to two days after the Waxman-Markey Bill. This research design embraces the critical inference problem raised by confoundings illustrated in McWilliams and Siegel's (1997) seminal paper. Any confounding event that might have affected a given firm's value prompts us to exclude said firm from the samples. This leads us to drop 31 of our 123 observations. Second, we employ the state of the art method for analyzing market reaction to new information, an event study with daily data. For Brown and Warner (1980) stress that the degree of misspecification that emerges by using monthly data instead can be severe. These empirical concerns turn out to be well-founded; our results differ from Gans and Hintermann.

We study the findings of our two event studies in a very simple theoretical framework of market expectations and reduced compliance costs from voluntary initiatives in light of regulatory pressure. This study hence pieces together a puzzle by extending, rectifying, and refining existing findings to outline a clearer picture of the perceived value of membership in voluntary corporate climate initiatives. This fills two gaps in the literature. First, we establish a direct comparison of two distinct initiatives for two separate events. We compare how valuable membership in the CCX and CL initiatives was when push came to shove with the Waxman-Markey Bill. To complement the comparison, we juxtapose the prior market reactions towards the CCX and CL membership announcements. It turns out that not all initiatives should be measured by the same yardstick. The combined pattern suggests that an initiative that is tailored to the market's expected regulatory threat can be an effective tool to mitigate the effect of an upcoming shock. By not lumping together a pool of highly diverse initiatives or focusing on a single initiative, we gain a more nuanced understanding about beneficial aspects of voluntary initiatives. To our knowledge, ours is the first event study to compare two environmental initiatives for two different events against the background of a theoretical framework.

In our second contribution to the literature, we highlight the crucial role of industry-specific effects when assessing the economic ramifications of regulatory events. If a regulation impacts different industries differently, it is potentially misleading to analyze initiatives without accounting for their members' industry affiliations. In our case, one might mistakenly praise the value of voluntary initiatives when in fact their members merely happen to be disproportionately operating in an industry which was impacted particularly favorably. Our calculations show that for the Waxman-Markey Bill such industry-specific effects explain a substantial part of the observed market reaction for CCX firms and fully account for the reactions for CL firms.

Our results imply that membership in the CCX initiative was considered valuable for the risk of a mandated carbon market whereas CL was not. Conservative estimates suggest that, on average, stock prices of CCX members experienced positive abnormal returns of 0.7 percent in reaction to the passage of the Waxman-Markey Bill. CL members did not exhibit any abnormal returns during that event. For firms announcing membership to the CCX, we do not find any measurable market response, unlike Fisher-Vanden Thorburns negative reactions for the CL announcements. Within the context of the model, the findings indicate that the market had already expected a carbon market during the membership announcements. A testable implication from the theoretical framework is empirically verified, supporting our confidence in its descriptive validity.

The rest of the paper is structured as follows. The next section provides background information on the Waxman-Markey Bill, the two voluntary corporate climate initiatives, and the related literature. It also puts forth the theoretical framework we will use to interpret our findings. Section 3 lays out the event study methodology, followed by the description of our data in Section 4. The results of the two event studies are presented and discussed in Section 5, and the last section concludes.

2 Background

2.1 Waxman-Markey

H.R. 2454, the "American Clean Energy and Security Act of 2009" was a Bill to propose, among other things, the introduction of a cap-and-trade system in the United States. The bill, also known as the Waxman-Markey Bill, would regulate the emission of greenhouse gases, in particular CO_2. The new law was to replace existing voluntary action with mandatory legislation. Over the next 40 years carbon emissions were to be increasingly capped up to 83% of 2005 levels. Allocated with CO_2 allowances, regulated firms would be free to trade their pollution rights at market prices.[3]

After months of negotiations, on Friday June 26, 2009, at 7:17 p.m. the House of Representatives narrowly passed the bill by a vote of 219 to 212. The media fallout proclaimed the legislation as historic for the United States and a victory for the Obama administration. For the the first time

[3]Although the cap-and-trade system constituted the most prominent element of the legislation, the contents of the bill extend beyond this market instrument. It was a comprehensive strategy to address climate change. As such, the bill included policies of "creating a combined energy efficiency and renewable electricity standard and requiring retail electricity suppliers to meet 20% of their demand through renewable electricity and electricity savings by 2020" and "setting a goal of, and requiring a strategic plan for, improving overall U.S. energy productivity by at least 2.5% per year by 2012 and maintaining that improvement rate through 2030". The bill was accessed on July 23 2016 on `http://www.govtrack.us/congress/bills/111/hr2454`

in US history a cap-and-trade legislation has passed through either House of Congress. The passage had remained unlikely to the end and stirred up emotional responses afterwards, pointing towards a controversial and unexpected outcome. Actual market data support the impression of the passing as a surprise.[4] In Section 5 we identify industry specific effects which, too, are in accord with the unexpected nature of the passage of the bill and its impact on the macroeconomy.

Although at that time it still remained to be seen whether the Senate would approve the bill by a filibuster-proof supermajority, there was suddenly more reason to believe that firms in the US would face substantial costs in terms of CO_2 reduction efforts in the near future. With the exception of the Republican Senator Lindsay Graham joining the Senate's climate efforts on November 4, 2009, there was gradually less support for the bill over the months following the passage in the House of Representatives (Meng, 2014). With Lindsay Graham dropping his support on April 23, 2010, the Democrats in the Senate followed suit and on July 22, 2010, abandoned the bill.

2.2 Chicago Climate Exchange and Climate Leaders

Two major initiatives to curb greenhouse gas emissions in the US were operating during the passage of the Waxman-Markey Bill. Both initiatives had been launched in the early 2000s. The so-called Chicago Climate Exchange (CCX) was a trade platform for CO_2 certificates. Its members agreed to a reduction goal and independent verification of their efforts. As such, the CCX could be considered a predecessor to the government-based emission trading system intended by the Waxman-Markey Bill. The second initiative was the Climate Leaders (CL) program, which was an industry-government partnership to help firms reduce emissions of six major greenhouse gases. Participating members pledged to a realistic reduction goal within a five to ten year time frame. Although these two initiatives pursued the same goal, their approaches differed in fundamental aspects. We present each initiative in turn.

In 2003, the Chicago Climate Exchange (CCX) started trading operations of the first cap-and-trade system in North America with 13 charter members that made voluntary but legally binding commitments to reduce six different types of greenhouse gas emissions.[5] The exchange was char-

[4]From 2009 to 2010, the online trading exchange Intrade hosted a prediction market contract on the prospects of a US cap-and-trade system titled "A cap and trade system for emissions trading to be established before midnight ET on 31 Dec 2010". The passage of the bill was the only event that raised the expected probability above fifty percent. These data from Intraday were accessed on May 19 2016 on `http://intrade-archive.appspot.com/contract.jsp?contract=674142`

[5]CCX Fact Sheet, November 2011. `https://www.theice.com/publicdocs/ccx/CCX_Fact_Sheet.pdf`, visited on July 23 2016

acterized by a market mechanism; a platform where prices were considered and allowances exchanged, and where strategic interaction took place. As part of its cap-and-trade scheme the CCX relied on a carbon offset program with its own standards for allowances and offset credits called "Carbon Financial Instrument Contracts". Established emission baselines and emission reports were verified independently. The CCX timeline can be divided into two distinct phases. From 2003 to 2006 members had to cut their emissions annually by 1% below their baseline average as defined from 1998 to 2001. In the second phase from 2007 to 2010, existing members had to cut emissions annually by 0.5% while new members had to cut emissions by 1.5%. In addition to the direct emitters (CCX *members*) there were associate members, offset providers, liquidity providers, and exchange participants. Over the course of its operation the exchange had had around 400 members with annual membership fees ranging from 1,000-60,000 USD, depending on firm size and membership type.[6] In November 2010, the CCX announced that it would shut down the program, arguing that firms were no longer interested in trading emission credits in the absence of government legislation (Financial Times, 2010).

Figure A1 in the appendix shows the daily traded volume in metric tons and the price per metric ton on the CCX from 2004 to 2010. Most of the trading took place in 2008 and 2009, with more than 3.5 millions metric tons being traded each year. During the CCX lifespan the price ranged from near zero to 7.5 Dollars. From 2005 to 2008, the average price was about 3 Dollars, before dropping to around 1 Dollar in 2009 and eventually fading out in 2010. These numbers go to show that the CCX constituted a lively marketplace.

The Climate Leaders Greenhouse Gas Inventory Protocol is the second major voluntary initiative that operated during the passage of the Waxman-Markey Bill. Formed in 2002, the Climate Leaders (CL) initiative was based on the Greenhouse Gas Protocol developed by the World Resources Institute and the World Business Council for Sustainable Development. The CL members did not restrict themselves to CO_2 reductions but dedicated themselves to six main greenhouse gas emissions. These emissions were grouped into direct emissions (known as Scope 1), indirect emissions (known as Scope 2), and offered the reduction of optional emissions (known as Scope 3). The CL program was an industry-government partnership initiated by the US Environmental Protection Agency (EPA) that worked with companies to develop comprehensive climate change strategies. Upon becoming a partner, the EPA assisted each company in developing inventory and inventory management plans. Partners then set a corporate-wide domestic or global five to ten year greenhouse gas reduction goal and reported annual inventory data to the EPA. In addition, partners were to document their progress

[6] `http://co2offsetresearch.org/policy/CCX.html`, visited on July 22 2016

towards the goal (Tonkonogy and Oliva, 2007).

Four types of reduction goals were eligible for CL members: absolute, normalized, indexed, and carbon neutrality. Upon engagement, the EPA evaluated the proposed reduction goals from all partners, requiring a reduction compared to the projected GHG performance of the sector. Partners were also allowed to develop their own mitigation offset projects or purchase certified mandatory or voluntary GHG reductions, provided that the projects adhered to approved EPA methodologies. According to the EPA, partners were sure to receive high level recognition via participation in meetings, public outreach, or press events (Tonkonogy and Oliva, 2007). Members also profited from the EPA's technical assistance. On September 15 2010, the EPA announced their decision to cease operation of the CL program in light of new political developments.

The two programs thus differed along two important dimensions. First, the CCX constituted a marketplace for trading CO_2 emission certificates, whereas the CL program was an industry-government partnership initiated by the EPA without a focus on market mechanisms. Upon joining the CL, it was not decision-making based on market prices that influenced the daily carbon business. Second, unlike the CCX, the CL did not rely on mandatory third party verification, rendering their environmental efforts less traceable. This difference can have serious consequences. In a field experiment, Telle (2013) finds evidence that firms under-report environmental violations in self-audits. To external parties, then, the CL might radiate less credibility than the CCX.

2.3 Related Literature

The literature has identified a variety of economic motives for firms to join voluntary initiatives, some of which are based on imperfect markets (for an overview, see Khanna, 2002; Portney, 2008). These motives can be roughly divided into market motives and political motives (Fleckinger and Glachant, 2011).

Political motives seem particularly interesting for our case. Lyon and Maxwell (2003, 2008) argue that by participating in voluntary environmental initiatives firms seek to preempt or shape future public policies. On this note, perhaps the most pertinent argument that rationalizes voluntary participation in our setting is preparation for some expected legislation. If there is reason to believe that with a non-negligible probability future environmental legislation will impose costly regulation upon firms, it might be reasonable to dampen the impact of such a future shock by adjusting corporate behavior today and thus prepare voluntarily. For a smooth path towards the expected extent of the regulation entails lower overall costs than a sudden adjustment. Unexpected changes in the probability of impending legislation (such as the Waxman-Markey Bill) provide a testing ground for this hypothesis. If the market correctly interprets the impact of suddenly looming legislation, we should observe immediate changes for the prices of markedly affected stocks. The most promising way to causally assess the effect of such regulatory shocks on firm profitability are event studies (Lyon and Maxwell, 2013).

There is a large body of evidence from event studies that supports the view that a sudden increase in the likelihood of future regulation is taken into account as new information by the market.[7] For instance, Bowen et al. (1983) and Hill and Schneeweis (1983) suggest that the nuclear incident at the Three Mile Island facility in 1979 altered the investors' perception of future regulation by resulting in a sudden drop in stock prices for electric utility firms, in particular for those who were invested in nuclear power. The chemical disaster in Bhopal in 1984 had a similar effect. Once the extent of the tragedy had become clear, the market seemingly anticipated tighter regulation for the entire chemical industry (Blacconiere and Patten, 1994). Unexpected changes in regulatory direction can work as shocks, too. The sudden proposal by President George Bush in 1989 to revise the Clean Air Act triggered a drop in stock prices of notoriously polluting coal firms (Freedman and Patten, 2004; Kahn and Knittel, 2003). And very recently, the unexpected reaction of the German government to the Fukushima incident affected energy companies' shareholder wealth (Betzer et al., 2013).

By and large, this suggests that the market interprets new and strict regulation as impending threats. Yet some firms seem to fare better in harsh times. There is evidence that voluntary engagement and subsequent verified disclosure is rewarded by the market when external shocks materialize. For example, more extensively disclosing firms were at an advantage after the chemical leak in Bhopal (Blacconiere and Patten, 1994). The same held true after the sudden legislation in the US in 1986 to handle contaminated sites (Blacconiere and Northcut, 1997). And firms that were part of the Carbon Disclosure Project experienced an increase in shareholder value when Russia unexpectedly ratified the Kyoto Protocol in 2004 (Kim and Lyon, 2011).

These events qualify as external shocks that increased the likelihood for environmental regulation. The Waxman-Markey Bill, too, has the hallmarks of such a regulatory shock. The market suddenly needed to price in new information in light of pending future regulation. Against this background, the two voluntary initiatives in question, the CCX and the CL environmental programs, may have been signaling the members' preparedness for the seemingly upcoming CO_2 regulation. Market reactions as measured by abnormal returns might indicate if these initiatives were deemed advantageous.

[7] Price shocks can trigger market reactions as well. Bushnell et al. (2013) show that the 50% drop in the EU CO_2 allowance price in 2006 affected stock prices in carbon- and electricity-intensive industries.

2.4 Theoretical Framework

A comparison of the two initiatives for the membership announcements on the one hand and upon the Waxman-Markey Bill on the other hand may yield a more conclusive understanding of the market expectations and the prescribed values of the initiatives than a single observation. Moreover, we show that linking the two threads through time can invoke conditions to either buttress or refute the conclusions. We now present a very simple and general theoretical framework about market reactions to voluntary initiatives and increasing regulatory threat. The framework illustrates how connecting our two dimensions - initiative and event type - can increase the explanatory power in interpreting the initiatives' abnormal returns.

Consider first market reactions upon membership announcements to costly voluntary initiatives designed (for the sake of the argument) to curb CO_2 emissions. The market values membership in expedient initiatives for their savings on future regulation compliance costs. These expected costs are not yet realized and depend on the market's current assessment of the probability of said regulation becoming reality. For simplicity, let there be two different initiatives, which differ by their type of regulatory anticipation. Initiative x is a highly useful training ground for an upcoming permit market (regulation m with expected costs c_m). Initiative y, on the other hand, is highly useful should it come either to a tax regime or a command and control type of CO_2 regulation (regulation c with expected costs c_c). Because both initiatives have the same agenda, there may be collateral benefits to each initiative, that is, initiative x may also provide some benefit should regulation c become law (but obviously less than against m), and vice versa. In case of no expected regulation, membership in any initiative merely incurs their specific costs, c_x and c_y. Finally, assume that preparing for the regulation that the market actually expects will not yield negative abnormal returns, so $c_x \leq c_m$ and $c_y \leq c_c$.[8]

We do not directly observe what kind of regulation the market expects at the time of the announcements, but we can rule out some possibilities by looking at its reactions for the two types of membership announcements. Let there be three distinct scenarios: 1) The market expects no regulation, 2) the market expects regulation c, and 3) the market expects regulation m. What would the pattern of the market reactions look like in each scenario? 1) The market expects no regulation only if announcements to both initiatives are accompanied by negative abnormal returns. What is more, in this scenario we can say something about the initiatives' relative costs by the ordinality of their returns. 2) If the market expects regulation c, the model predicts that the abnormal returns for initiative y will be non-negative. In addition, initiative y will trump initiative x in terms of abnormal returns

[8] Note that the benefit is implicitly given by the opportunity to join. Formally speaking, this is a lose-lose situation.

(where x's returns may either be positive, zero, or negative, depending on whether the collateral benefit outweighs initiative x's costs).[9] In contrast to the no regulation scenario, however, we cannot say anything about the initiative's relative costs. 3) Finally and likewise, if the market expects regulation m, the model predicts that the abnormal returns for initiative x will be non-negative. In addition, initiative x will trump initiative y in terms of abnormal returns (where y's returns may either be positive, zero, or negative).

Analyzing the abnormal returns for a single initiative upon announcing membership cannot rule out more than one of the three scenarios at a time. Combining two initiatives, however, only leaves one single scenario consistent with the observed returns. For example, consider the case where y reveals negative returns and x does not provoke a market reaction. y's negative results are consistent with both no regulation and market regulation, whereas x's results are consistent with both market regulation and general regulation. The combined results, on the other hand, are only consistent with market regulation.

Let us now add to this membership announcement block a subsequent part with a regulatory event. Both, one, or none of the initiatives may experience positive abnormal returns upon a sudden and non-trivial exogenous increase in the likelihood of regulation, depending on whether regulation c, m, or some other regulation is center stage of mandatory implementation. Negative reactions would not be plausible: Initiative membership costs were priced in upon announcement, so membership at this stage cannot be detrimental. In light of the regulatory event, the (more) fitting initiative will benefit (more).

This completes our simple model of voluntary initiatives and market reactions in terms of abnormal returns. Adopting this framework to investigate empirical results offers considerable advantages. Comparing two initiatives at once brings about a rank order of their usefulness and offers an insight into the market's expectations. Linking the two different events in time yields two kinds of added value. First, it provides a clue whether the kind of regulation that the market expected is the same at both points in time. This would raise the confidence in the overarching conclusions. Second, some abnormal return configurations from the regulatory event constrain the predicted domains of the abnormal returns from the announcements. To illustrate, assume that initiative x exhibits positive abnormal returns during the regulatory event m but y does not. This immediately tells us that y does not provide any collateral benefit for regulation m. The an-

[9] We rule out the conflating case in which the costs of being a member of initiative x are so small and/or its collateral benefit is so large that initiative x is better than y even when the market expects c. Otherwise everybody would always join the superior initiative x. The equivalent reasoning holds for initiative y and market expectation m.

nouncement effects by themselves may not be telling in this matter.[10] But more importantly, this would imply that in scenario 3, where the market expected regulation m, initiative y must show unambiguously negative returns. This implication is a desirable feature of our model for it introduces conditions under which the model becomes empirically refutable. On the other hand, if we do find evidence that is consistent with the model, we can be more confident in the soundness of our conclusions. We empirically investigate these testable implications in Section 5.

3 Methodology

Large time windows would make it difficult to isolate the causal effect of an event. Brown and Warner (1980), for instance, document the problem of using monthly data by illustrating that the degree of misspecification in event tests can be severe. In a well-known replication study, McWilliams and Siegel (1997) highlight the importance of accounting for confounding events at the firm level during the time of the event. In embracing these caveats, this section constructs an event study and uses daily financial market information (stock prices) to deduce the effects of our events on firm value.[11] This approach has the advantage that it isolates the causal chain quite effectively. An event has a direct impact on the stock price, similar to a treatment effect. The statistical inference in an event study relies on three assumptions (McWilliams and Siegel, 1997): market efficiency, a lack of confounding effects during the event window, and under-/overestimation of the event. Indeed, if the event in question had been perfectly anticipated, investors would have already had priced in the impact of the probability shift on firm value. Although the passage of the Waxman-Markey Bill was not out of question, Section 2.1 presents evidence that it was markedly unexpected and provided the market with new information. The next section proceeds by presenting the data and identifying confounding events.

The measurement of the value impact of an event is carried out by calculating the so-called abnormal return. The abnormal return (AR) is the observed return minus the normal return during a specified event window, where the normal return is the return that one would expect to occur if the event had not taken place. The abnormal return $AR_{i\tau}$ is given by equation 1, where $E(R_{i\tau}|X_\tau)$ is the expected return $R_{i\tau}$ given X_τ.

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|X_\tau) \tag{1}$$

[10] We can only identify these benefits if the lower ranked initiative in scenario 2 or 3 has non-negative returns.

[11] Event studies have become an indispensable tool in econometrics. MacKinlay (1997) gives a comprehensive overview of the history, theory, and application of event studies in economics.

In financial economics, the normal return is often modeled via the market model, which relates the return of interest $R_{i\tau}$ to the market return $R_{m\tau}$. In a nutshell, the market model isolates the fraction of the return that is associated with the market return, rendering the return of interest more informative. The parameter estimates of the market model are calculated in an Ordinary Least Squares framework on the basis of a preceding estimation window. In addition to the market return, our specification additionally employs Fama-French's "small minus big" (SMB) and "high minus low" (HML) factors on a daily basis as explanatory variables (Fama and French, 1992, 1993). Kolari and Pynnonen (2010) illustrate that the addition of these factors achieves the highest reduction of residual cross-correlation. Taken together, we estimate the following model specification:

$$R_{i\tau} \quad = \quad \alpha_i + \beta_{i1} \cdot R_{m\tau} + \beta_{i1} \cdot SMB_\tau + \beta_{i2} \cdot HML_\tau + \epsilon_{i\tau} \tag{2}$$

SMB in equation 2 denotes the daily difference of a portfolio of small and big firms and HML indicates the daily difference of a portfolio of low and high book-to-market value firms.[12] $\epsilon_{i\tau}$ is the remaining error term after estimating $E(R_{i\tau}|X_\tau)$ and follows from $\epsilon_{i\tau} = AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|X_\tau)$ via equation 1. We call the model in equation 2 the 3-factor model or our baseline specification. In equations 3 and 4 we extend this specification by adding two types of industry return factors, $ESret_{j\tau}$ and $BSret_{\gamma\tau}$ respectively, to control for industry effects. These extensions will account for industry-wide impacts of the event.

$$R_{i\tau} \quad = \quad \alpha_i + \beta_{1i} \cdot R_{m\tau} + \beta_{2i} \cdot SMB_\tau + \beta_{3i} \cdot HML_\tau + \beta_{4i} \cdot ESret_{j\tau} + \epsilon_{i\tau} \tag{3}$$
$$R_{i\tau} \quad = \quad \alpha_i + \beta_{1i} \cdot R_{m\tau} + \beta_{2i} \cdot SMB_\tau + \beta_{3i} \cdot HML_\tau + \beta_{4i} \cdot BSret_{\gamma\tau} + \epsilon_{i\tau} \tag{4}$$

In $ESret_{j\tau}$, j denotes one of 10 economic sectors and in $BUSret_{\gamma\tau}$, γ denotes one of 25 business sectors according to the Thomson Reuters Business Classification. The simpler baseline interpretation will highlight the possible caveat when neglecting industry returns.

The event takes place after the estimation window and is usually placed inside the so-called event window, during which the observed returns are compared to the expected ones. Because some events cannot be unambiguously dated, for example due to gradual information leakage or potential insider information, researchers often include several days around the event date $\tau = 0$ into the event window. However, this comes at a cost. A longer time series of $AR_{i\tau}$ increase the number of confounding events and diminishes the power of the test statistics. Not to mention that longer event windows are more difficult to reconcile with the notion of market efficiency.

[12]Downloaded from Kenneth French's website: `http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html`

Contrary to long-horizon event studies, the test statistics of short-horizon event studies are generally less sensitive to the benchmark model of normal returns and issues of both cross-sectional and time-series dependence of abnormal returns (Kothari and Warner, 2007).

In our data, $R_{i\tau}$ is the total return index based on closing prices. The closing price of day $\tau - 1$ is the opening price of day τ. In the event window notation $[T_2, T_3]$, T_2 refers to the opening price on day $\tau = 0$ and T_3 to the closing price on day τ. An event window $[1, 1]$ therefore captures the return on the day after the event day $\tau = 0$. We are interested in two events, the Waxman-Markey Bill and membership announcements. In our first and main event study, we define the Waxman-Markey event day, Friday 26 June 2009, as $\tau = 0$ and set the estimation window to 60 trading days from $T_0 = -59$ to $T_1 = 0$. For this first event, the event day $\tau = 0$, a Friday, is included in this estimation window, for two reasons: First, the vote took place at 7pm and therefore after the closing of the stock exchanges. Second, the issue of potential information leakage can be excluded in this particular case because the outcome of the vote was extremely close and not likely. Speaking in trading days, our event window $[1, 1]$ is set rather narrowly after the event and captures the abnormal returns on day one after the event, Monday June 29 (with $T_2 = 1$ and $T_3 = 1$). Note, however, that the weekend precedes this event window, which should provide enough time for the news to spread. We also employ a second, longer window that estimates the returns over $[1, 2]$.

For the second event in question, the membership announcements, we extend these narrow event windows to take into account potential prior information leakage. Recall that here we only need to study CCX announcements. To allow for a direct comparison of the CCX to the CL membership announcement effects in Fisher-Vanden and Thorburn (2011) we estimate the 3-factor model as put forth in equation 2 and adopt their three event windows $[0, 1]$, $[-1, 1]$, and $[-2, 2]$. Setting the estimation window to 60 days thus sets a span from $T_0 = -62$ to $T_1 = -3$. In turn, the cross-sectional abnormal returns $AR_{i\tau}$ in the event window are cumulated from T_2 until T_3. This yields the cumulative abnormal returns $CAR_{i[T_2,T_3]} = \sum_{\tau=T_2}^{T_3} AR_{i\tau}$. Average CARs are obtained by averaging the CARs across the observations: $ACAR_{[T_2,T_3]} = \frac{1}{n} \sum_{i=1}^{n} CAR_{i[T_2,T_3]}$.

The raw returns are useful for economic interpretations. Standardized returns, however, have been proven to exhibit better statistical properties (Patell, 1976). The scaled abnormal returns are equal to $SAR_{i\tau} = \frac{AR_{i\tau}}{S(AR_i)}$, where $S(AR_i) = \sqrt{\sigma_{\epsilon_i}^2 * [1 + x_t'(X'X)^{-1}x_t]}$ denotes the sampling error correction. The SARs can be cumulated over time as well: $CSAR_{i[T_2,T_3]} = \sum_{\tau=T_2}^{T_3} SAR_{i\tau}$. The cross sectional means of these cumulative standardized abnormal returns are equal to $ASCAR_{[T_2,T_3]} = \frac{1}{n} \sum_{i=1}^{n} CSAR_{i[T_2,T_3]}$.

Harrington and Shrider (2013) show that the presence of heterogeneous effects induces so-called event variance. Tests that are robust against cross-sectional variation in the true abnormal return should therefore be preferred. In comparison to a conventional t-test or Patell's test, the test proposed by Boehmer et al. (1991) given in equation 5 satisfies this condition.

$$t_{BMP} = \frac{ACSAR \cdot \sqrt{n}}{\frac{1}{n-1}\sum_{i=1}^{n}(CSAR_i - ACSAR)^2} \tag{5}$$

A particular issue for the Waxman-Markey event is clustering. In contrast to the membership announcements, the bill affected the firms simultaneously at the same point in time. One might thus question the assumption that $\epsilon_{i\tau}$ is independent and identically distributed. MacKinlay (1997) suggests that clustering can be accommodated in two ways. Either by a portfolio approach which allows for cross correlation of the abnormal returns, or by analyzing the abnormal returns without aggregation, e.g. by including a dummy for the event day. The latter approach has two drawbacks. Such a test will generally suffer from poor finite sample properties and has little power against reasonable alternatives. As a remedy, Kolari and Pynnonen (2010) propose a modification of the test statistic developed by Boehmer et al. (1991) that is not affected by clustering. Kolari and Pynnonen's statistic increases the cross sectional variance used by Boehmer et al. (1991) by adjusting for the average covariance of the error terms $\bar{\rho}$ during the estimation window:

$$t_{KP} = t_{BMP}\sqrt{\frac{1-\bar{\rho}}{1+(n-1)\bar{\rho}}} \tag{6}$$

We consider this test statistic to be the appropriate one for our event studies. In addition, we make use of the non-parametric generalized rank test proposed in Kolari et al. (2010) to check the robustness of our parametric tests. We choose the generalized rank test because it has better properties for testing CARs than the conventional rank test and because it is equally well-suited for testing single day abnormal returns.

4 Data

This section describes our CCX and CL samples. Gans and Hintermann have kindly provided us with their CCX database and data on their selection process. We start with the same CCX database consisting of 109 members. Of these, 20 are government-affiliated and are cities, states, or universities. From the remaining 89 observations, we find listings for 57 firms in the US. From these listings we drop seven firms with discontinuous price indices, a sure sign of illiquid securities. From the remaining 53 firms, seven are American Depositary Receipts (ADRs) and three are not major listings or have their book values not denominated in USD. This leaves us with 40 identified CCX member firms for the Waxman-Markey event.

We next compile a database of CL firms for the same event. Our database starts with a CL member list retrieved from the US Environmental Protection Agency as of 8 May 2009, shortly before the Waxman-Markey date.[13] Of the 264 members at that time we focus on the 19 achiever and 87 setter firms. The remaining 158 so-called developer firms are by definition at a very early stage of their membership. That status is hardly an advantage in light of the Waxman-Markey Bill. Indeed, the majority of the developer firms later on opted out of the program, questioning their prior motivation and commitment.[14] Table A1 in the appendix illustrates the development of the CL program over time. Of the 106 Climate Leaders with setter and achiever status, we identify 65 as being listed on a US stock market. Among these stocks, there are five illiquid equity return indices and three ADR listings. This yields an identified sample of 57 CL firms for the Waxman-Markey event.

The first row of Table A2 lists the identified members in both programs, 40 CCX and 57 CL firms. We proceed by conducting a comprehensive check of confounding events happening from 26 June 2009 (Friday, the Waxman-Markey event day) through 30 June 2009 (Tuesday) for both the CCX and the CL sample. For each firm we search LexisNexis for unexpected announcements that were published in major US news outlets and which were likely to affect market value during the event window. The second row in Table A2 lists the number of confounding events for each program. For the 57 CL firms, we identify 16 confounding events, leaving us with a final CL sample of 41 firms. For the 40 firms in the CCX sample we identify confounding events for nine firms, leaving us with a final CCX sample of 31 firms. Altogether we drop every fourth observation from our samples. An overview of our final samples for the Waxman-Markey event is given in Tables A3 and A4. Table A3 lists our final CCX sample and indicates charter member status where applicable. Table A4 lists the final CL sample with the according membership status and whether the respective firms were charter partners.

In addition to the Waxman-Markey event, our main analysis, we are interested in membership announcement effects. Recall that Fisher-Vanden and Thorburn have already conducted this analysis for CL firms with the same methodology, so we restrict our analysis to CCX membership announcements and directly compare our results with Fisher-Vanden Thor-

[13] Obtained through www.archive.org on April 22 2016 via `web.archive.org/web/20090508120744/http://epa.gov/climateleaders/partners/index.html`

[14] `http://www.epa.gov/climateleadership/documents/partners_letter_15sep2010.pdf`, visited on November 28, 2015

burn's. We once again start with the CCX database consisting of 109 members and apply the same filters mentioned above. For the identified firms we then search both Google and LexisNexis for their membership announcement dates, resulting in the sample of 26 firms with identified dates shown in Table A2. In contrast to the Waxman-Markey event here we cumulate abnormal returns for longer event windows to account for the possibility of prior information leakage. We search for confounding events up to two days before and two days after each membership announcement. We find six confounding events and end up with a final sample of 20 CCX firms for the complementary membership announcement event study.

5 Results

This section presents the event study results for our two events. First, we investigate the market reaction to the Waxman-Markey Bill for the CCX and CL samples. Second, we take a look at the market reaction to membership announcements for CCX for a direct comparison to the same reaction towards CL firms observed in Fisher-Vanden and Thorburn (2011). All samples have been screened for confounding events in the previous section.

5.1 Event Returns: Waxman-Markey Bill

Table 1 presents descriptive statistics for the CCX and the CL samples. The CCX sample consists of 31 firms and the CL sample contains 41 firms. The distribution of the market capitalization distribution is positively skewed in both samples, with CL consisting of larger firms. The two samples also differ in the distribution of their sale volumes. Although CL firms have, on average, the same turnover as CCX firms, their median turnover is higher. A similar skew is visible in market-to-book numbers. While the average of market-to-book equity is the same in both samples, the medians indicate a proclivity for value firms in the CCX sample and for growth firms in the CL sample. Finally, the two samples differ in their industry exposures. Two out of the ten economic sectors from the Thomson Reuters Industry Classification are absent: Telecommunications and Energy. The other sectors are distributed differently across the CL and the CCX samples. For instance, the CCX sample harbors a larger fraction of basic materials and utilities firms, whereas the CL sample shows a tilt towards technology firms. This would raise an issue if these industries react differently to the Waxman-Markey Bill. We account for this caveat in our extended model specifications.

We first estimate our baseline specification. To allow for new, value-relevant information to distribute and sink in after the Waxman-Markey event, we conduct two separate analyses for two different event windows after the passage of the bill. We calculate the cumulated abnormal returns CAR[1,1] (for Monday, 29 June only) and CAR[1,2] (which includes the

Table 1: Descriptive Statistics for Waxman-Markey event

	CCX	**CL**
Number of firms	31	41
Market value (MV, billion USD)		
Mean MV	17.7	24.1
Median MV	4.8	11.1
Total sales (billion USD)		
Mean sales	23.2	23.1
Median sales	9.3	14.4
Market-to-book equity (MEBE)		
Mean MEBE	2.1	2.0
Median MEBE	1.3	2.3
Fraction of sample firms in TRBC sector:*		
Basic Materials	0.32	0.07
Consumer Cyclicals	0.06	0.20
Consumer Non-Cyclicals	0.00	0.07
Financials	0.03	0.02
Healthcare	0.03	0.07
Industrials	0.13	0.17
Technology	0.13	0.29
Utilities	0.29	0.10

*TRBC: Thomson Reuters Business Classification. The market value (MV) of equity is calculated seven trading days before June 29 2009. The mnemonic of sales is WC01001 and of book equity WC03501 following Tuesday) and calculate the cross sectional means ACAR[1,1] and ACAR[1,2]. Table 2 presents the abnormal returns and their respective derivatives. The results for the event windows [1,1] and [1,2] are depicted in panels A and B, respectively. Consider first the short event window in panel A. In both the CCX and the CL sample, the average cumulated abnormal returns (ACAR) are close to 0.5%. Their standardized counterparts (CSAR) are substantially lower. The CCX firms exhibit higher standardized returns than the CL firms. The two-sided BMP test statistic by Boehmer et al. (1991) is highly significant across the board. The null hypothesis of normal returns is rejected at the 0.1% significance level for the CCX firms and at a slighty higher level for the CL firms. As expected, the more conservative KP p-values according to Kolari and Pynnonen (2010) are higher (roughly 3% for the CCX firms and 7.6% for CL firms). Finally, the nonparametric generalized rank test also rejects the null hypothesis of normal returns for the short event window.

Let us now turn to the longer event window in panel B of Table 2. The cumulated abnormal returns over two days indicate that the ACAR of the CCX sample increased to over 0.7% whereas the ACAR of the CL sample declined to 0.35%. This suggests that the market kept incorporating new information on the second day after the event. The BMP statistic remains significant in both samples for this longer event window; for the CCX firms once again at the 0.1% level and, less significantly, for the CL firms at the 10% level. The stricter KP p-values, however, only remain significant for the CCX sample. Put differently, a conservative estimation suggests that the CL firms do not seem to exhibit abnormal returns when cumulated over two days. Again, the generalized rank test dovetails with the KP test.

Taken together, these results are consistent with the conjecture that the stock market believed that firms engaging in these two voluntary initiatives of carbon emission reduction get a head start in preparing for imminent federal carbon emission legislation. But the two programs did not encounter equal praise. Based on the results of the baseline market model, membership in the CCX is considered more beneficial in light of the Waxman-Markey Bill compared to membership in the CL program.

Recall that the CL and CCX samples differ in their sector distribution. The empirical evidence listed in Section 2 suggests that some sectors exhibit a higher vulnerability to regulatory shocks. Such industry-specific effects could stem from two sources. For one, firms from industries that are generally positively affected by a mandatory emission cap-and-trade system could be more likely to opt into voluntary emission reduction programs. Second, the Waxman-Markey event took place in the midst of an economic recession, a recession which did not affect all industries alike. In order to isolate the CCX and CL membership value effect during the Waxman-Markey event from such overarching trends, we now proceed by controlling for industry-specific confoundings and extend the baseline specification model with both

Table 2: 3-Factor Model

	CCX	**CL**
Panel A: Event Window [1,1]		
ACAR	0.437	0.476
ACSAR	0.324	0.230
BMP t-statistic	2.960	2.533
BMP p-val	0.006	0.015
KP t-statistic	2.280	1.820
KP p-val	0.030	0.076
GRank Test	2.605	2.248
GRank p-val	0.012	0.028
No. of Observations	31	41
Panel B: Event Window [1,2]		
ACAR	0.789	0.347
ACSAR	0.540	0.275
BMP t-statistic	3.087	1.924
BMP p-val	0.004	0.061
KP t-statistic	2.378	1.383
KP p-val	0.024	0.174
GRank Test	2.354	1.619
GRank p-val	0.022	0.111
No. of Observations	31	41

ACAR & ACSAR are in %. There is a 60 days estimation window from 2 April to 26 June 2009. The event window [1,1] captures the abnormal returns on 29 June 2009. The event window [1,2] adds 30 June 2009. The BMP test (Boehmer et al. 1991) is an extension of Patell (1976) and robust against event induced variance. The KP test (Kolary & Pynnönen, 2010) is adjusting the BMP test for cross sectional correlation. The average correlations of abnormal returns $\bar{\rho}$ in our samples are $\bar{\rho}_{cl\&ccx} = 0.020$, $\bar{\rho}_{ccx} = 0.022$, and $\bar{\rho}_{cl} = 0.023$. The non-parametric GRank test is the generalized rank test for cumulated returns from Kolari and Pynnönen (2010a).

economic and, to reach a deeper level, business sector returns.

In a first step, we incorporate industry return factors from 10 economic sectors. For each security i in sector j we add to the baseline market model the economic sector return j as defined in equation 3. Table A5 summarizes the results of this second specification. It turns out that economic sector returns explain a substantial part of the positive effects estimated in the baseline specification. In the baseline specification in Table 2, the CL sample only showed significant returns in the short event window. This significance now disappears altogether with the inclusion of industry-specific effects. The CCX sample, on the other hand, keeps showing significant abnormal returns, in particular for the longer event window. In this window, the ACARs and ACSARs for the CCX firms are only slightly reduced. The second model specification thus indicates that sectoral effects have been at work during the Waxman-Markey event, much more so for the CL than for the CCX sample.

To further check the robustness of the economic sector results in Table A5, we extend the baseline specification further by adding to each security i in business sector γ the business sector return $BUSret_{\gamma}$. In contrast to 10 economic sectors, this differentiates more accurately by controlling for 25 business sectors. The event study results of this third and strictest model specification, which is formally given by equation 4, are shown in Table 3. The pattern reinforces the direction of the previous specification with 10 economic sectors. In addition to the CL sample, the CCX sample now starts losing some of its verve: While there remains evidence of abnormal returns for the longer event window in panel B, controlling for business sectors renders the statistical significance of abnormal returns in the short event window non-significant.

Let us take a closer look at the longer event window for the CCX sample in Table 3. The CARs are positively skewed, with a substantially higher mean than median value. This holds true for the standardized CARs as well. The previous specifications have shown consistently lower p-values for the BMP test in comparison to the KP test. This order has now switched. While the BMP test statistic implies a p-value above the 10% level, the stricter KP p-value retains statistical significance at this level. This switch can be explained by the average correlation of the abnormal returns $\bar{\rho}$, which has become slightly negative. The significance of the KP p-value is supported by the generalized rank test. This third specification suggests that business sector effects explain an additional part of the positive abnormal returns. Further indication that controlling for sectoral effects has increased the explanatory power is reflected by the changes in correlation of the abnormal returns $\bar{\rho}$ (see the notes in the according tables). This value decreases steadily with an increasingly detailed industry specification and tends to converge towards zero.

In sum, our results suggest that, in the wake of the Waxman-Markey

Table 3: 4-Factor Business Sector Model

	CCX	**CL**
Panel A: Event Window [1,1]		
ACAR	-0.260	-0.063
ACSAR	0.082	0.021
BMP t-statistic	0.694	0.213
BMP p-val	0.493	0.832
KP t-statistic	0.712	0.199
KP p-val	0.482	0.844
GRank Test	0.644	0.577
GRank p-val	0.522	0.566
No. of Observations	31	41
Panel B: Event Window [1,2]		
ACAR	0.684	0.270
ACSAR	0.303	0.074
BMP t-statistic	1.679	0.507
BMP p-val	0.103	0.615
KP t-statistic	1.722	0.472
KP p-val	0.095	0.639
GRank Test	1.674	0.815
GRank p-val	0.100	0.419
No. of Observations	31	41

ACAR & ACSAR are in %. There is a 60 days estimation window from 2 April to 26 June 2009. The event window [1,1] captures the abnormal returns on 29 June 2009. The event window [1,2] adds 30 June 2009. The BMP test (Boehmer et al. 1991) is an extension of Patell (1976) and robust against event induced variance. The KP test (Kolary & Pynnönen, 2010) is adjusting the BMP test for cross sectional correlation. The average correlations of abnormal returns $\bar{\rho}$ in our samples are $\bar{\rho}_{cl\&ccx}$ = 0.000, $\bar{\rho}_{ccx}$ = -0.002 , and $\bar{\rho}_{cl}$ = 0.004. The non-parametric GRank test is the generalized rank test for cumulated returns from Kolari and Pynnönen (2010a).

event, CCX firms have profited from the increased threat of regulation in *addition* to being overrepresented in favorable sectors. CL firms, on the other hand, were merely riding on their sectors' coattails.

5.2 Event Returns: CCX membership announcement

Fisher-Vanden and Thorburn (2011) have shown that CL firms lost considerable market value upon announcing their memberships. As this paper's complementary event study we therefore now investigate the same reaction towards CCX membership announcements. After screening for confoundings we identified a final sample of 20 firms with CCX engagement declaration dates, ranging from the founding members in 2003 up to the last announcements in 2008.

The Waxman-Markey event took place at a single point in time and had potential ramifications for the entire macroeconomy, simultaneously affecting different industries differently. Such industry-specific effects are not a concern with membership announcements scattered through time over several years. For this event study we thus estimate the 3-factor model, congruent with Fisher-Vanden and Thorburn. In contrast to the Waxman-Markey Bill, however, information leakage poses a potential problem. To address the possibility that insider information had affected the stock price before the firms' public statements, we extend the event window symmetrically around the announcement dates. In addition to calculating the cumulated abnormal returns over the short window [0,1] we add two longer windows, [-1,1] and [-2,2]. This also makes for a direct comparison with the CL membership announcement event windows in Fisher-Vanden and Thorburn.

Table 4 presents the abnormal return estimates for the CCX membership announcements. Over the short window, both the ACAR and the ACSAR are slightly positive. This changes when expanding the event windows, with the longest window exhibiting negative returns across the board. However, none of the results are statistically significant. All test statistics are well above conventional significance levels and hence cannot reject the null hypothesis of normal returns upon the firms announcing their CCX memberships.

This result qualifies the findings in Gans and Hintermann, where a strongly positive market reaction was inferred, and stands in contrast to CL firms. In Fisher-Vanden and Thorburn, newly announced engagement in the CL initiative was vigorously punished with negative abnormal returns of -1 percent for ACAR[-1,1] and -1.5 percent for ACAR[-2,2].

5.3 Discussion

We now discuss these empirical results in the context of the theoretical framework put forth in Section 2.4. Our main event study in Section 5.1

Table 4: Three event windows for CCX announcement effects based on the 3-factor model

	[0,1]	**[-1,1]**	**[-2,2]**
ACAR	0.150	-0.213	-0.513
ACSAR	0.185	0.168	-0.024
Patell t-statistic	0.813	0.738	-0.107
Patell p-val	0.420	0.464	0.915
BMP t-statistic	0.517	0.319	-0.043
BMP p-val	0.607	0.751	0.966
KP t-statistic	0.455	0.281	-0.038
KP p-val	0.651	0.780	0.970
GRank Test	0.897	0.454	0.011
GRank p-val	0.374	0.651	0.991
Nr. of Observations	20	20	20

ACAR & ACSAR in %. There is a 60 days estimation window from 2 April to 26 June 2009. The BMP test (Boehmer et al. 1991) is an extension of Patell (1976) and robust against event induced variance. The KP test (Kolary & Pynnönen, 2010) is adjusting the BMP test for cross sectional correlation. The average correlation of abnormal returns $\bar{\rho}$ in our sample is $\bar{\rho} = 0.015$. The non-parametric GRank test is the generalized rank test for cumulated returns from Kolari and Pynnönen (2010a).

shows that CCX members enjoyed a positive market reaction upon the regulatory event, the Waxman-Markey Bill. It also shows that the CL initiative did not prove beneficial, provoking no measurable market reaction. The direct insight of these results is that the market only deemed the CCX initiative as economically advantageous in light of a sudden increased likelihood of federal legislation. Membership in the CCX, but not in the CL, seemed to entail profitable compliance cost savings in a future mandatory carbon market.This conclusion is in accord with the pattern of the prior membership announcement effects. When investigating the membership announcements in Section 5.2 we find no market reaction for joining the CCX initiative. Announcing membership in the CL initiative provoked notoriously negative market reactions. This pattern only fits scenario 3 from the theoretical framework, where the market expected a permit regulation. In that scenario, the initiative preparing for a permit market exhibits non-negative returns while, at the same time, faring better than the other one. Connecting the two threads in time gives coherence. It seems that the market expected a permit regulation already, and that the CCX members made a sensible choice by joining. At the time of the announcements, the CCX initiative only just broke even. Initiative costs and expected compliance costs balanced each other in times of lower regulatory pressure. It was during the Waxman-Markey event when the CCX could really shine. Firms joining the CCX had made the right choice by acting in the pecuniary interest of their shareholders. The CL initiative, on the other hand, offered no apparent advantage during the Waxman-Markey Bill, a conclusion that is consistent with the negative reaction firms encountered upon their CL membership announcements.

The results tell us more. In terms of the model, the lack of a CL reaction upon the Waxman-Markey Bill suggests that the market judged the CL initiative to harbor no collateral benefit for the expected carbon market. The model then directly implies that the CL announcement effects must be negative, an implication which is empirically verified. If they were neutral or positive, our model would have been refuted. This empirical finding lends support to the descriptive validity of the model.

Finally, the negative reactions raise the question why firms had joined the CL initiative in the first place. Our model suggests that the CL design did not align with the regulatory expectations of the market. Fisher-Vanden and Thorburn may tell us why. They find that firms joining the CL initiative are more likely to have weak corporate governance structures and more likely to have a higher number of shareholder resolutions directed at climate change. It seems that the corporate governance structure of these firms was giving less weight to shareholder value maximization than it did to other stakeholder interests. Fisher-Vanden and Thorburn conclude that this combination of institutional pressure and less shareholder oversight gave CL firms more discretionary leeway in their decision to join. Their conclusion would explain why, in our model, CL firms did not abide by the market's expectations and thus interests. On that note, recall that the EPA made the CL initiative palatable to firms by highlighting high level recognition via participation in meetings, public outreach, and press events. These amenities for firm executives might help explain why the interests of the market and weakly governed CL firms do not align.

6 Conclusion

A better understanding about corporate motivation for joining voluntary initiatives informs about the benefits of expedient program design and lets investors know under which conditions such engagements may be profitable. This paper uses event studies to compare the perceived market value of two voluntary climate initiatives by exploiting two decisive and unexpected events. In our main analysis we compare the immediate effect of the Waxman-Markey Bill on stock prices for members of the Climate Leaders (CL) and the Chicago Climate Exchange (CCX), two initiatives that pursued the goal of curbing CO_2 emissions with different strategies. The Waxman-Markey Bill intended to establish a mandated carbon market in the US and surprisingly passed the vote in the House of Representatives in June 2009. This translates into an increase in the economic threat of upcoming compliance costs. The incident thus lends itself well to an event study. To round up the picture, in our complementary analysis we compare the market reaction to the preceding membership announcements to these two initiatives. We interpret our findings with the help of a very simple theoretical framework.

On the surface, the estimated market reaction to the Waxman-Markey Bill in our main analysis would indicate a positive value correction for both CL and CCX firms, suggesting that the market considered membership in these initiatives an advantageous headstart for the now seemingly impending mandated carbon market. It stands to reason, however, that the implementation of the Waxman-Markey Bill would likely have affected different industries differently. In a more detailed specification, we isolate the firm level effect by extending our baseline model specification with economic and (more detailed) business sector returns. This puts the positive market reaction vis-à-vis the CL and the CCX firms into perspective. Members of the CCX continue to show positive abnormal returns, albeit at lower levels. For the CL firms the industry effects fully account for the observed positive returns during the passage of the bill.

In our complementary analysis, we investigate and compare the earlier market reactions towards membership announcements to these initiatives. In their event study, Fisher-Vanden and Thorburn (2011) found significant negative effects when firms announced their CL engagement. New CCX members fared better. Our results cannot reject a neutral market reaction for CCX membership announcements, rectifying previous findings by Gans and Hintermann (2013).

Taken together, the pattern of market reactions for the two initiatives at these two different points in time paints a nuanced and compelling picture. Our model is consistent with the hypothesis that the CL initiative was never deemed useful for a cap-and-trade system, and that the market was entertaining expectations for a carbon market all along. At the time of the CCX membership announcements the initiative's cost and its expected benefit for the possibly upcoming carbon market were still balancing each other. The membership advantage became palpable once regulation suddenly loomed closer. The positive market reaction for the CCX members during the passage of the bill are likely to be explained by the fact that this initiative had already effectively mirrored the workings of a regulatory cap-and-trade system as intended by the bill. This prepared them for the imminent regulation and attenuated their compliance costs in the process. In keeping with this argument, Bruce Braine, vice president of strategic policy analysis for American Electric Power described the motivation to participate in the CCX as follows: "Many of us were doing this not only to make voluntary commitments, but as a way that we could get prepared for a mandatory future. [...] We were learning the ropes, learning about trading and trying to become more proficient in reducing our carbon footprint over time." (National Geographic News, 2010) Third party verification of the environmental effort of the CCX members only added to the credibility of their commitment.

In contrast, the CL initiative had been penalized upon participation, and neither was membership considered an advantage when the going got tough with the Waxman-Markey Bill. CL members acquired firm internal knowledge on how to implement an emission management system and how to identify and pursue reduction opportunities in general. But they could not gain actual trading experience and knowledge from participation in an active carbon market. Moreover, they relied on self-auditing, raising doubts about their commitment. Fisher-Vanden and Thorburn's announcement effect study provides additional reason why the CL initiative did not fare well. Their members were characterized by weak corporate governance structures. Rather a platform for valuable public relations, joining the CL seemed more in line with the interest of managers than that of the market.

Our results corroborate the notion that, given a proper design, the market can consider membership in fitting voluntary programs a worthwhile venture if related regulation is foreshadowing. But we caution against generalizing our results. Membership in these initiatives was voluntary and therefore endogenous. It therefore seems plausible that the positive market reactions for the CCX would establish an upper bound compared to, say, a scenario in which members were to be picked randomly. On the other hand, one could argue that the Waxman-Markey event cannot be considered fully dichotomous. The probability of regulation did not switch fromo zero to one. This, then, would underestimate the market response in light of the increasingly likely regulation; for completely unexpected events trigger more pronounced reactions.

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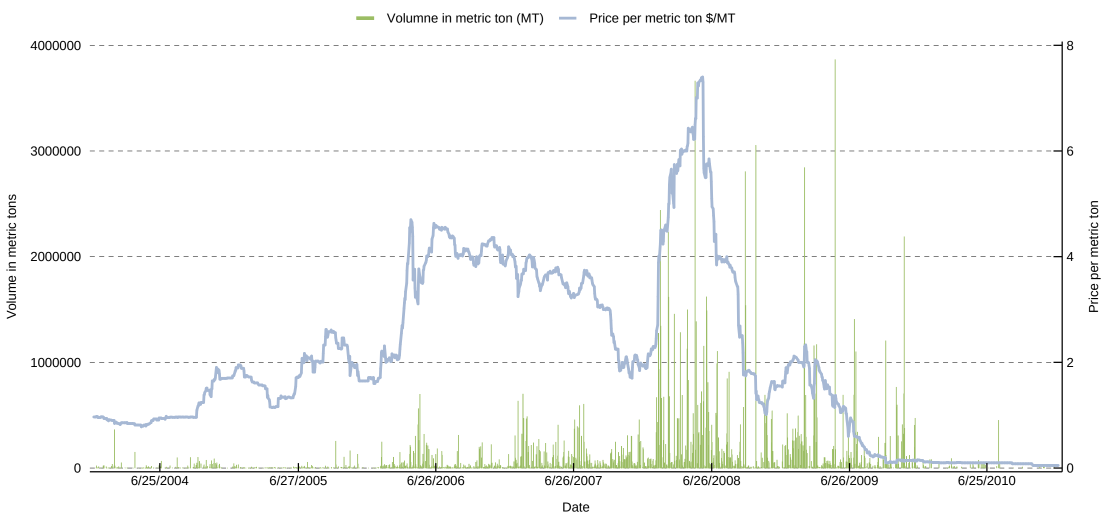
7 Figures and Tables

Figure A1: CCX Daily Average Volume (metric ton) and settlement price



Source: Intercontinental Exchange (ICE)

Table A1: Climate Leader Membership Development

Date	**# Firms**	**Achievers**	**Setters**	**Developers**
28.03.2008	162	11	69	82
21.05.2008	172	11	69	92
03.01.2009	249	18	85	146
08.05.2009	264	19	87	158
01.08.2010 *	191	26	93	72
13.02.2011	183	32	100	51

* Retrieved on September 20 2012 from:

`http://www.epa.gov/climateleadership/documents/directory.pdf`

All other dates are from lists retrieved from `www.archive.org`

Table A2: Number of Firms in Samples

	Waxman-Markey Event		Membership Announcements
	CCX	**CL**	**CCX**
Identified*	40	57	26
Confounding events	9	16	6
Final sample	31	41	20

* Identified firms without illiquid firms or ADRs.

Table A3: Chicago Climate Exchange Firms (CCX) and Event Samples

Firm name	**Sample membership***		**Charter member**
Abbott Laboratories	MA		
Agrium U.S. Inc.		W&M	
Alliant Energy Corporate Services Inc.		W&M	
American Electric Power	MA	W&M	charter member
Avista Corporation	MA	W&M	
Bank of America Corporation		W&M	
Baxter International Inc.	MA	W&M	charter member
Boise Paper Holdings, LLC	MA	W&M	
CLECO Corporation		W&M	
Central Vermont Public Service	MA	W&M	
Dow Corning		W&M	
DTE Energy Inc	MA	W&M	
DuPont		W&M	charter member
Eastman Kodak Company		W&M	
FMC Corporation		W&M	
Ford Motor Company		W&M	charter member
Genon Energy Inco.	MA		
Green Mnt.Power Corp.	MA		
Intel Corporation	MA	W&M	
Interface, Inc.	MA	W&M	
IBM	MA	W&M	
International Paper		W&M	charter member
Knoll, Inc.	MA	W&M	
MeadWestvaco Corp.	MA	W&M	charter member
Mirant Corporation		W&M	
Motorola, Inc.		W&M	charter member
Neenah Paper Incorporated	MA	W&M	
Nrg Energy Inco.	MA		
Plum Creek Timber Company, Inc.		W&M	
PSEG Energy Resources & Trade LLC		W&M	
Puget Energy Inco.	MA		
Safeway Incorporated	MA		
Steelcase Inc.		W&M	
TECO Energy, Inc.		W&M	
Temple-Inland Inc	MA	W&M	charter member
United Technologies Corporation		W&M	
Waste Management, Inc.	MA	W&M	charter member

Sample membership*: - W&M; Waxman-Markey event sample
- MA; Membership Announcement sample.

Table A4: Sample of Climate Leader Firms (CL) for Waxman-Markey Event

Firm name	CL status*	Charter partner	Reduction region
3M	achievers		U.S. GHG
Advanced Micro Devices, Inc.	achievers	charter partner	global GHG
Agilent Technologies	setters		global GHG
American Electric Power	achievers		U.S. GHG
Applied Materials, Inc.	setters		global GHG
Bank of America Corporation	setters		U.S. GHG
Baxter International Inc.	achievers	charter partner	U.S. GHG
Best Buy Co., Inc.	setters		U.S. GHG
Calpine	setters		U.S. GHG
Campbell Soup Company	setters		U.S. GHG
Caterpillar Inc.	achievers		global GHG
Cisco Systems, Inc.	setters		global GHG
Cummins Inc.	setters		global GHG
Dell Inc.	setters		global GHG
DuPont Company	setters		global GHG
Eastman Kodak Company	setters	charter partner	global GHG
Ecolab, Inc.	setters		U.S. GHG
EMC Corporation	setters		U.S. GHG
Fairchild Semiconductor	setters		U.S. GHG
Hasbro, Inc.	achievers	charter partner	U.S. GHG
Intel Corporation	setters		global GHG
Interface, Inc.	setters	charter partner	U.S. GHG
IBM Corporation	achievers	charter partner	global GHG
International Paper	setters	charter partner	U.S. GHG
Johnson Controls, Inc.	setters		U.S. GHG
LSI Corporation	setters		U.S. GHG
Marriott International, Inc.	setters		U.S. GHG
Merck & Co., Inc.	setters		global GHG
Millipore Corporation	setters		global GHG
Coors Brewing Company	setters		U.S. GHG
FPL Group, Inc.	achievers	charter partner	U.S. GHG
NVIDIA Corporation	setters		U.S. GHG
Owens Corning	setters		U.S. GHG
PepsiCo	setters		U.S. GHG
PPG Industries, Inc.	setters		global GHG
PSEG	setters	charter partner	U.S. GHG
Staples, Inc.	setters	charter partner	U.S. GHG
Steelcase Inc.	setters		U.S. GHG
Gap, Inc.	setters		U.S. GHG
United Technologies Corporation	achievers		global GHG
Xerox Corporation	achievers		global GHG

CL status*: Status of Climate Leader member with regard to emission reduction pledge.

Table A5: 4-Factor Economic Sector Model

	CCX	**CL**
Panel A: event window[1,1]		
ACAR	0.102	-0.082
ACSAR	0.204	0.011
BMP t-statistic	1.829	0.118
BMP p-val	0.077	0.907
KP t-statistic	1.796	0.100
KP p-val	0.082	0.920
GRank Test	1.903	0.513
GRank p-val	0.062	0.610
Nr. of Observations	31	41
Panel B: event window[1,2]		
ACAR	0.717	0.294
ACSAR	0.436	0.063
BMP t-statistic	2.479	0.432
BMP p-val	0.019	0.668
KP t-statistic	2.435	0.367
KP p-val	0.021	0.715
GRank Test	2.247	0.664
GRank p-val	0.028	0.509
Nr. of Observations	31	41

ACAR & ACSAR are in %. There is a 60 days estimation window from 2 April to 26 June 2009. The event window [1,1] captures the abnormal returns on 29 June 2009. The event window [1,2] adds 30 June 2009. The BMP test (Boehmer et al. 1991) is an extension of Patell (1976) and robust against event induced variance. The KP test (Kolary & Pynnönen, 2010) is adjusting the BMP test for cross sectional correlation. The average correlations of abnormal returns $\bar{\rho}$ in our samples are $\bar{\rho}_{cl\&ccx}$ = 0.004, $\bar{\rho}_{ccx}$ = 0.001 , and $\bar{\rho}_{cl}$ = 0.009. The non-parametric GRank test is the generalized rank test for cumulated returns from Kolari and Pynnönen (2010a).

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