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Effects of regulatory uncertainty on corporate strategy—an analysis of firms' responses to uncertainty about post-Kyoto policy

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ABSTRACT

A better understanding of corporate strategy under regulatory uncertainty enables policy makers to improve policy making efficiency and enhance regulations' effectiveness. Based on a review of the literature on policy formulation, we propose that regulatory uncertainty is characterized by a dependence on political negotiation, a discrete scenario structure, and a discontinuous resolution. Data from a worldwide survey show that firms pursue response strategies to regulatory uncertainty that address these characteristics by participating in policy making and increasing strategic flexibility. Surprisingly, the results also show that regulatory uncertainty only partly causes firms to postpone strategic decisions. We find that existing regulation and a need to act quickly despite regulatory uncertainty are opposed to the pursuit of a postponement strategy. We conclude that improving the mechanisms by which firms participate in early stages of the policy making process could enable them to operate in a more target-oriented manner, allow for more efficient policy implementation, and increase a regulation's effectiveness.

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1. Introduction

Political scientists have extensively studied impediments within the political arena which reduce the efficiency of the policy making process (e.g., Besley and Coate, 1998; deLeon, 1992; Sabatier, 1991; Schulz and König, 2000) and lead to ineffective regulations (e.g., Fort and Rosenman, 1993; Mazmanian and Sabatier, 1981, 1983; Scharpf et al., 1978). Although the literature predominantly focuses on intragovernmental obstacles, aspects outside of the political arena also affect regulations' effectiveness (Ringquist, 1995). Firms' strategic responses toward a regulation constitute such an external influence (Rugman and Verbeke, 1998a) which may or may not be in accordance with the intentions and procedures of policy makers. Among other issues, firms concerned by a new regulation are typically exposed to regulatory uncertainty that is intrinsic to policy formulation (Birnbaum, 1984;

Hoffmann et al., 2008). As a consequence, these firms often pursue specific strategies that enable them to cope with this uncertainty (Delmas and Tokat, 2005; Smith and Grimm, 1987). However, insufficient knowledge about the impact of regulatory uncertainty on firms' strategies can affect the efficiency of the policy making process and makes it difficult for policy makers to design effective regulations (Arentsen et al., 2000; Scharpf, 1988). For example, uncertainty associated with a specific regulation can impede firms' compliance with this regulation (Hoffmann, 2007; Levy, 1997; Paulsson and von Malmberg, 2004), thereby thwarting the regulation's objectives. Therefore, it is important for policy makers to develop a detailed understanding of firms' responses to regulatory uncertainty. However, this research area has not systematically been explored. This paper contributes to closing this gap by investigating which strategies firms pursue in response to regulatory uncertainty.

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Multilateral environmental regulations are particularly difficult to design and anticipate because they often only specify environmental goals and require individual governments to pass national regulations to achieve these goals (Christmann, 2004; Levy, 1997). Accordingly, the growing number of environmental regulations implemented and enforced at an international level increasingly exposes firms to regulatory uncertainty (Hoffmann and Trautmann, 2008; Kolk and Pinkse, 2004; Rugman and Verbeke, 1998b). Long periods of regulatory uncertainty are not only challenging for business, they are furthermore particularly critical from a societal perspective. This is due to the fact that the resulting ineffective environmental regulations and firms' possibly unwitting contravention of regulatory objectives might have severe and potentially irreversible consequences for the natural environment (Faucheux and Froger, 1995).

To address the effect of regulatory uncertainty on corporate strategy, we review the literature on policy formulation and identify three characteristics of regulatory uncertainty that distinguish this type of uncertainty from other uncertainties in firms' business environment. From these characteristics we derive hypotheses on strategies firms are likely to pursue when facing regulatory uncertainty. Focusing on environmental regulation, we then test our hypotheses with data from a worldwide survey of corporate response strategies to uncertainty associated with post-Kyoto regulation on climate change. Our results show that lobbying is strong and widespread across industries and regions. Similarly, firms across all industries and regions prepare for a range of different outcomes of the post-Kyoto policy process, indicating an inefficient use of resources due to regulatory uncertainty. At the same time, however, only a minority of firms actually postpone investment decisions, contrary to the frequent threats of firms not to invest if governments do not provide predictable investment conditions.

2. Theoretical background and hypotheses

2.1. Uncertainty associated with governmental regulation

Regulatory research has at length studied the policy formulation process that leads to the enactment of new or the adaptation of existing regulations (Gerber and Teske, 2000; Keim and Zeithaml, 1986; Rajagopalan and Rasheed, 1995; Stigler, 1971; Ullmann, 1985). Regulatory rules are laid out and enacted in a formal procedure and are typically designed for the public benefit (Selznick, 1985). Firms affected by the regulation are exposed to high uncertainty during this formulation process (Farnham, 2004; McCaffrey, 1982; Morana and Sawkins, 2000; Robinson and Taylor, 1998; Tarui and Polasky, 2005; Ullmann, 1985). In general, uncertainty refers to the unpredictability of variables internal or external to the firm (Miles and Snow, 1978; Pfeffer and Salancik, 1978) or the inadequacy of information about these variables (Duncan, 1972; Galbraith, 1977). In contrast to risk situations in which each outcome of events has a known probability, no probabilities can be assigned to uncertain future events (Knight, 1921). In line with Birnbaum (1984), we use the term 'regulatory uncertainty' to refer to the unpredictability of the actions of governmental agencies which create and enforce

regulations. Environmental regulation is a particular source of regulatory uncertainty (Hempel, 1996; McCaffrey, 1982; Tarui and Polasky, 2005) because it is typically based on very long-term considerations, with science playing an important role in agenda setting, policy making, and evaluation (e.g., Arentsen et al., 2000; Den Elzen et al., 2005; Hulme and Dessai, 2008; Van den Hove, 2000).

2.2. Policy making and characteristics of regulatory uncertainty

In the following sections we identify three special characteristics of regulatory uncertainty and develop hypotheses on strategies firms are likely to pursue in response to this uncertainty.

2.2.1. Dependence on political negotiation

Participants in the policy making process typically pursue different and often contradictory interests (Aplin and Hegarty, 1980), trying to use their political influence to induce an outcome that is advantageous for them (Art, 1973). Consensus can only be reached by negotiating long-term bargaining arrangements and compromises (Fiorino, 1988; H eritier, 2003). Thus, political negotiations are often incomprehensible from the outside and thus constitute high uncertainty regarding the final policy characteristics (Allison, 1971; Pettigrew, 1973). Even in an advanced stage of the policy making process the final outcome often remains uncertain (Farnham, 1990), being "the unintended resultant of bargaining, pulling, and hauling among the principal participants" (Art, 1973, p. 474).

Political negotiations on the design of a new regulation are not limited to the interaction among political actors. Governmental agencies also seek the participation of various non-political groups, such as those firms concerned by the regulation (Meidinger, 1987). Participating in these negotiations allows firms to obtain inside information with regards to the final outcome, and thus reduces regulatory uncertainty (Little and Li, 1995; Pfeffer, 1977). Furthermore, actively participating in the political debate to exert influence on the circumstances or political players determining the uncertainty can steer inconclusive negotiations toward the firms' preferred outcome (Henisz and Delios, 2004b). Consequently, if there is regulatory uncertainty, especially during the early stages of a policy making process when its outcome is largely unclear, firms have an incentive to participate in this process. The formulation of environmental regulation is particularly appropriate for such participation because of its openness to external inputs (Fineman, 2000; J anicke, 1996), e.g., from scientific experts (Arentsen et al., 2000) or environmental interest groups (Weber and Khademian, 1997) as well as from firms to be regulated (Tarui and Polasky, 2005). This leads to our first hypothesis:

Hypothesis 1. Firms that perceive high uncertainty regarding a specific regulation participate in the respective policy making process to a greater extent than firms that perceive low uncertainty regarding this regulation.

2.2.2. Discrete scenario structure

Policy makers' divergent initial positions and the unpredictability of political negotiations entail a broad range of

imaginable outcomes from a policy making process. The final outcome typically contains those elements most parties agree upon, as well as a balanced mix of the controversial aspects (Farnham, 1990, 2004; Stigler, 1971). Agreement typically develops around the individual contributions of political and non-political actors with divergent intentions (Allison, 1971; Arentsen et al., 2000), thereby forming the independent issues of a regulation that constitute its final design (Héritier, 2003; Schulman, 1975). Separating issues allows policy makers to generate distinct regulatory outcomes by combining, exchanging or trading off elements of existing alternatives, thus trying to increase acceptability among these divergent actors (Alexander, 1979; Ullmann, 1985). Each combination of elements can be considered a discrete regulatory scenario which constitutes a possible outcome of the policy making process (Fort and Rosenman, 1993; Lindblom, 1959). Consequently, several discrete alternate scenarios are typically possible until policy makers agree upon the final design of a regulation (Alexander, 1979; Courtney et al., 1997).

This variety of different regulatory scenarios constitutes high regulatory uncertainty. Firms can respond to this uncertainty by preparing to efficiently operate in as many scenarios as possible, which requires a high degree of strategic flexibility (Hitt et al., 1998; Swamidass and Newell, 1987; Wernerfelt and Karnani, 1987). In this context, strategic flexibility is defined as the possession of a diverse portfolio of strategic options (Aaker and Mascarenhas, 1984; Bowman and Hurry, 1993; Sanchez, 1995; Sanchez and Heene, 1997). Firms can increase strategic flexibility by creating such options, for example through the diversification of their business portfolio. The possession of multiple strategic options each applicable to one of the multiple regulatory scenarios facilitates the preparation for these scenarios and reduces the risk of suffering losses from an upcoming regulation. In particular, strategically flexible firms are generally better prepared for the uncertain realization of one of these scenarios than firms with only few options. For instance, Marcus (1987) illustrated the intention of firms to remain flexible when facing uncertainty using the example of U.S. firm behavior under changing environmental regulation. From this follows our second hypothesis:

Hypothesis 2. Firms that perceive high uncertainty regarding a specific regulation increase their strategic flexibility to a greater extent than firms that perceive low uncertainty regarding this regulation.

2.2.3. Discontinuous resolution

The policy making process comprises a number of consecutive stages, which include the emergence of an issue to be regulated, the political debate over this issue, and the formulation and actual enactment of a regulation. Instead of debating over the final design of a regulation as a whole, segmenting the policy making process enables policy makers to subsequently negotiate discrete elements which form the regulatory scenarios, for example individual details of a regulation's design or the timing of its implementation (Farnham, 1990; Schulman, 1975). This staged approach to regulatory policy making is related to policy makers' own uncertainty (Robinson and Taylor, 1998) as "one [the policy

maker] cannot see probable outcomes too far ahead and [...] cannot know the desirability of the next move until one has seen the consequences of the present one" (Farnham, 2004, p. 454). The completion of each stage abruptly reduces regulatory uncertainty for firms (Reisz and Perlich, 2006). Thus, regulatory uncertainty is characterized by a discontinuous resolution (Arentsen et al., 2000; Schulman, 1975; Ullmann, 1985), differing therefore from uncertainties such as technology or market uncertainty which resolve continuously over time (Doh and Pearce, 2004).

In particular, the discontinuous resolution of regulatory uncertainty in one abrupt step provides more incentives for firms to postpone affected strategic decisions until after this resolution than the continuous resolution of other uncertainties over time. For instance, firms can avoid strategic errors due to inaccurate or incomplete information by postponing decisions until a later point in time when an agreement among policy makers has lowered regulatory uncertainty (Courtney et al., 1997). Discontinuously resolving uncertainty is especially prevalent within environmental policy, which is periodically reviewed based on increased scientific understanding or new circumstances (Tarui and Polasky, 2005). For example, in his work on the relationship between policy uncertainty and innovation, Marcus (1981) provided several examples of how firms in the energy and energy-related industries held back the adaptation of new technologies because of uncertainty in their political environment. We thus conclude:

Hypothesis 3. Firms that perceive high uncertainty regarding a specific regulation postpone affected strategic decisions to a greater extent than firms that perceive low uncertainty regarding this regulation.

3. Post-Kyoto regulatory uncertainty

We investigated our hypotheses by studying corporate strategies to respond to uncertainty associated with a regulation succeeding the Kyoto Protocol. The Kyoto Protocol is an international treaty that imposes national caps on the greenhouse gas (GHG) emissions of industrialized countries in an attempt to counteract climate change. While the Kyoto Protocol itself will expire in 2012 international talks on a succeeding scheme have been under way since 2005, provisionally culminating in the adoption of a roadmap for establishing a global emission reduction regulation beyond 2012 (UNFCCC, 2007).

However, the controversial attitudes of the countries setting the international debate regarding a post-Kyoto regulation and the cumbersome political process of reaching agreement expose firms to very high regulatory uncertainty (Hoffmann, 2007; Hoffmann et al., 2008; Kolk and Pinkse, 2005). Firstly, it is doubtful whether a global agreement can be reached at all, since three of the world's top five GHG emitters, the U.S., China, and India, are reluctant to join it. Secondly, it remains unclear what a post-Kyoto regulation would look like and how individual countries would design their national regulations (Kolk and Hoffmann, 2007; Rehan and Nehdi, 2005). Finally, the impact a post-Kyoto scheme would have on

regulated industries and companies remains largely unknown (Oberndorfer and Rennings, 2007).

4. Methods and data

4.1. Data collection and sample

We tested our hypotheses via ordered multinomial logistic regression analysis. Data was collected from a survey of firms in carbon-intense industries, at which a post-Kyoto regulation targeting the reduction of global CO₂ emissions is primarily directed and which were thus particularly exposed to regulatory uncertainty at the time of our study. Our sample included firms from the world's main economic regions to reflect such a scheme's likely global scope. We focused on publicly listed firms due to better data availability from archival sources.

The survey questions were incorporated in a more comprehensive questionnaire on climate change made available online between April and June 2007. Since the questions addressed issues related to firms' corporate strategy, target respondents were the firms' top executives, generally the CEO or, in case of multidivisional firms, the heads of those businesses operating in carbon-intense industries. Our sample originates from the 821 firms in the electric utilities, industrial goods, basic materials, chemicals, transportation, and oil industries listed in the Dow Jones Global Indexes at the end of March 2007. 167 firms completed the relevant questions and returned the survey, representing a 20.3% response rate comparable to other empirical studies on environmental issues (Christmann, 2000, 2004). We excluded 36 responses due to incomplete information, leaving a total of 131 responses for our analysis.

Following the administration of the survey, we conducted several in-depth interviews with executives of firms in main industries and regions to corroborate respondents' ratings and substantiate our conclusions. In addition, we used publicly available information collected from archival sources, such as annual reports, press releases, analyst reports, and company websites, for triangulation purposes.

4.2. Representativeness of sample

Because the collection of self-reported data entails the potential presence of response bias, we scrutinized sample representativeness to ensure finding generalizability. *t*-Tests comparing respondents to the population controlled for self-selection bias, revealing no significant differences in industry affiliation, 2006 sales, market capitalization, and profitability, but deviations in regional distribution. Due to a higher share of European and a lower share of Asian firms in the sample we included a location control in the statistical analysis. Level of uncertainty and strategy choice did not significantly differ between early and late respondents, indicating similarity between respondents and non-respondents (Fowler, 1993). While some self-selection bias might be expected, these analyses suggest sample representativeness.

It is conceivable that respondents claimed to be pursuing socially desirable climate activities without actually pursuing

them. We controlled for such bias by contrasting respondents' strategy ratings with comments made in open text fields included in the survey after each question. In these fields, respondents were asked to specify their activities in dealing with uncertainty and to provide further information supporting their ratings. Answers typically included details on firms' lobbying activities, e.g., engagement in trade associations or direct interactions with regulatory authorities at national and international levels, descriptions of scenario planning techniques and the preparation for different scenarios, as well as explanations concerning postponed decisions or the reasoning behind not postponing them despite regulatory uncertainty. Random verification of these answers with information from archival sources did not reveal noteworthy discrepancies. Likewise, follow-up interviews consistently supported the findings, indicating that a social desirability bias is unlikely to be strong.

4.3. Measures

Industry experts and a group of strategic management scholars focusing on climate change reviewed the questionnaire items, which were then pretested with executives from selected companies for clear understanding and relevance to carbon-intense industries. Unless otherwise noted, all measures used were rated on a five-point Likert scale.

4.3.1. Corporate strategies to respond to regulatory uncertainty

The questionnaire included questions on the three response strategies, each representing either activities conducted to participate in the policy making process, to increase strategic flexibility, or to postpone strategic decisions. An item asking whether respondents were actually pursuing a respective activity at all preceded each question. Scoring the extent to which respondents pursued an activity was omitted for both respondents not pursuing it at all and respondents indicating a lack of knowledge. In line with our focus on the relationship between firms' perceived regulatory uncertainty and the extent to which these firms actually pursue a specific strategy in response to this uncertainty we only used scored answers for the regression analysis.

Because firms have to actively get involved in political negotiations in order to provide policy makers with beneficial, or indeed to challenge unfavorable, information (Aplin and Hegarty, 1980), we asked respondents to what extent they participated in the policy making process regarding a post-Kyoto regulation so as to contribute to decision making.

Following the notion that strategically flexible firms possess multiple strategic options with which to take advantage of different possible regulatory outcomes (Aaker and Mascarenhas, 1984; Sanchez, 1993), we measured strategic flexibility by asking to what extent respondents prepared for more than one potential outcome of the policy making process regarding post-Kyoto regulation.

As decision makers have to determine whether uncertain information underlying a decision is sufficient or whether they want to postpone the decision until the uncertainty subsides (Fauchaux and Froger, 1995), we asked to what extent respondents deferred strategic decisions in the light of post-Kyoto regulatory uncertainty.

4.3.2. Perceived regulatory uncertainty

Regulatory uncertainty in a firm's environment does not influence the decisions of the firm's management and, hence, the firm's corporate strategy if it is not perceived by its executives (Anderson and Paine, 1975; Child, 1972; Pfeffer and Salancik, 1978). Different information availability or deviating interpretations of ambiguous information associated with the same event such as post-Kyoto regulation likely result in different levels of perceived regulatory uncertainty among executives. Specifically, they might perceive this uncertainty to be high or low. Accordingly, the importance of examining executives' perceived uncertainty when studying the influence of uncertainty on corporate strategy has long been established (Bourgeois, 1980; Hambrick, 1981). Drawing on Milliken's definition of perceived uncertainty as "an individual's perceived inability to predict something accurately" (Milliken, 1987, p. 136) we measured perceived regulatory uncertainty with three items, encompassing the extent to which respondents perceived themselves able to predict the future existence of a post-Kyoto regulation, its design details, and the impact of such a regulation on their firm (Cronbach's $\alpha = .80$).

4.3.3. Control variables

For each of the three regression models each testing one hypothesis, we identified specific factors potentially affecting the hypothesized response strategy. In addition, we included common control variables on existing regulation, firm size, location, and industry affiliation in all three models.

Members of interest groups with experience of participating in previous political negotiations are more likely to also engage in current policy making (Hillman and Hitt, 1999; Potters and Sloof, 1996). To control for firms' experience in political participation, we included a dummy variable indicating membership in at least one established interest group influencing previous climate change policy making in model 1. In total we selected eight industry interest groups, thereof one global and three regional general business associations as well as four environmental groups.

Firms with a decentralized organizational design typically exhibit a high degree of strategic flexibility (Burns and Stalker, 1961). In particular, a recent decentralization of firms' organization, for example to adapt to highly unpredictable business environments, can increase their strategic flexibility (Volberda, 1999). To measure respondents' tendency toward decentralization under regulatory uncertainty and control for the resulting effect on their strategic flexibility, we included a survey-based dummy variable in model 2. This variable took the value 1 for respondents pursuing decentralization in the context of post-Kyoto policy making and the value 0 for all others.

Instead of postponing decisions, a high threat or high opportunity denotes a motivation for firms to act fast in order to alleviate the threat or seize the opportunity (Jackson and Dutton, 1988; Jackson et al., 1987). To control for the effect of the interpretation of regulatory uncertainty on firms' postponement of strategic decisions we included a survey-based dummy variable in model 3. To this end, we asked respondents to rate the extent to which they perceived post-Kyoto regulatory uncertainty as a threat or an opportunity. Four answer options were given, for a threat ranging from 'does not pose a threat to our firm's operations' to 'poses a threat to our firm's entire

Table 1 – Composition of sample.

Industry	Location				Total
	Europe	North America	Asia	Others ^a	
Utilities	15	9	4	1	29
Industrial goods	11	7	10	1	29
Basic materials	13	4	3	2	22
Chemicals	10	5	2	1	18
Transportation	11	1	4	1	17
Oil	7	4	1	4	16
Total	67	30	24	10	131

^a Australia, South America, and Africa.

operations'. Parallel wording was used for the opportunity scale. We then transformed ratings into a dummy variable that took the value 1 for respondents indicating a threat or an opportunity for their entire company and the value 0 for all others.

Current regulatory conditions are a key driver for firms' climate strategy (Okereke, 2007). Specifically, firms facing pressures from existing regulations are more likely to attempt to influence policy making (Tarui and Polasky, 2005). Furthermore, resource commitments required to comply with current regulatory conditions might also be advantageous under possible future regulation, thus allowing firms to pursue no-regret activities and reducing the need for flexibility (Courtney et al., 1997). Finally, regulated firms are less likely to postpone related strategic decisions to ensure compliance (DiMaggio and Powell, 1983; Hoffman, 1999). To control for the effect of the existing regulatory climate on corporate strategy, we used a survey-based dummy variable asking respondents to rate the intensity of CO₂ reduction pressures from existing climate regulation they were currently exposed to. This variable took the value 0 for respondents exposed to no or low pressures and the value 1 for all others.

A larger firm size facilitates participation in political negotiations (Hillman and Hitt, 1999), provides firms with more diverse resources which in turn allows them to increase strategic flexibility (Bowman and Hurry, 1993), and enables firms to overcome competitors' first-mover advantages resulting from the postponement of their own strategic decisions (Wernerfelt and Karnani, 1987). To control for firm size, we used the logarithm of 2006 annual sales, obtaining the latter from the financial database Compustat.

A variable based on the sector allocation applied by the Dow Jones Global Indexes controlled for potential industry dependent variations of corporate strategy under uncertainty (Gerwin and Tarondeau, 1989; Hoffmann and Trautmann, 2006; Hrebiniak and Snow, 1980). Finally, a location variable controlled for the potential effects of the sample's and the wider population's deviating regional compositions. The distribution of respondents across industries and locations is shown in Table 1.

5. Results

Table 2 shows descriptive statistics and correlation coefficients. Overall, respondents stated to perceive the uncertainty

Table 2 – Descriptive statistics and correlations.

Variable	n	Mean	S.D.	1	2	3	4	5	6	7	8	9
1 Participation in policy making process ^a	120	4.10	1.02									
2 Increase of strategic flexibility ^a	113	3.71	1.01	.36**								
3 Postponement of strategic decisions ^a	46	2.52	1.28	.19	.38*							
4 Regulatory uncertainty	131	3.01	1.03	.16	.24*	.26						
5 Lobbying experience ^b	131	0.65	0.48	.10	.08	.11	.06					
6 Decentralization ^b	131	0.19	0.39	.22*	.28**	.38**	.25**	.05				
7 Need to act fast ^b	123	0.16	0.37	−.05	.15	−.14	.24**	−.03	.22*			
8 Existing regulation ^b	131	0.55	0.50	.14	.00	−.31*	.08	.14	−.03	.03		
9 Firm size	131	4.16	0.47	.17	.08	−.10	.12	.33**	−.12	.01	.36**	
10 Europe ^b	131	0.51	0.50	.05	−.10	−.28	.02	−.11	.05	−.15	.31**	.23**
11 North America ^b	131	0.23	0.42	.12	.15	.19	−.16	.10	−.13	.09	−.13	−.13
12 Asia ^b	131	0.18	0.39	−.25**	−.02	.07	.20*	.10	.07	.20*	−.13	−.00
13 Others ^b	131	0.08	0.27	.06	−.04	.12	−.09	−.09	.01	−.13	−.20*	−.23**
14 Utilities ^b	131	0.22	0.42	.22*	.32**	.10	.00	−.07	.07	.08	.15	−.09
15 Industrial goods ^b	131	0.22	0.42	−.41**	−.17	.09	−.04	−.03	−.03	.02	−.29**	−.07
16 Basic materials ^b	131	0.17	0.38	.12	−.17	−.08	−.02	.16	−.11	−.07	.16	.08
17 Chemicals ^b	131	0.14	0.35	−.05	−.19*	−.03	−.15	−.03	−.02	−.10	−.04	−.15
18 Transportation ^b	131	0.13	0.34	.08	.12	−.37*	.18*	−.05	.04	.02	−.06	.18*
19 Oil ^b	131	0.12	0.33	.04	.04	.23	.05	.03	.06	.05	.10	.08

^a Only answers of respondents actually pursuing respective strategy.

^b Dummy variables, applicable = 1.

* $p < .05$, two-tailed.

** $p < .01$, two-tailed.

Table 3 – Results of ordered logistic regression analyses^a.

Independent variables	Dependent Variables		
	Model 1: participation in current policy making	Model 2: increase of strategic flexibility	Model 3: postponement of strategic decisions
Regulatory uncertainty	0.52 [*] (0.20)	0.24 [*] (0.11)	0.62 ^{**} (0.21)
Lobbying experience ^b	0.88 [*] (0.43)		
Decentralization ^b		0.90 ^{**} (0.30)	
Need to act fast ^b			–1.78 [*] (0.72)
Existing regulation ^b	0.28 (0.44)	0.03 (0.25)	–1.82 ^{**} (0.62)
Firm size	0.91 (0.50)	0.75 ^{**} (0.28)	1.72 [*] (0.80)
Location ^b			
Europe	–1.73 (0.93)	–0.75 (0.45)	0.70 (1.19)
North America	–0.47 (0.89)	–0.18 (0.45)	1.55 (1.14)
Asia	–3.27 ^{**} (1.09)	–0.70 (0.51)	0.53 (1.25)
Industry ^b			
Utilities	0.12 (0.69)	0.77 [*] (0.37)	–0.63 (1.17)
Industrial goods	–1.91 [*] (0.78)	–0.27 (0.39)	–1.26 (1.18)
Basic materials	–0.16 (0.73)	–0.27 (0.39)	–1.40 (1.23)
Chemicals	–1.36 (0.81)	–0.18 (0.42)	–1.42 (1.12)
Transportation	0.69 (0.79)	0.23 (0.42)	–19.50 (0.00)
χ^2	44.19 ^{**}	38.12 ^{**}	35.41 ^{**}
df	12	12	12
Pseudo-R ² (Nagelkerke)	.33	.31	.57
n	120	113	46

^a Standard errors are in parentheses.

^b Dummy variables, applicable = 1.

^{*} $p < .05$

^{**} $p < .01$

regarding a post-Kyoto regulation to a medium extent (average score of 3.01 on the five-point scale), but deviated considerably in this perception (standard deviation of 1.03). To respond to this uncertainty, almost all (120) of the 131 responding firms participated in the policy making process, also pursuing this strategy to the highest extent (average score of 4.10). The increase of strategic flexibility was similarly widespread, with 113 firms pursuing this strategy (average score of 3.71). Both strategies were particularly followed by utilities, likely reflecting the enormous investments this industry will have to make in the coming years. In contrast, only 46 firms postponed strategic decisions to respond to their perceived regulatory uncertainty. Similarly, the average score of 2.52 representing the extent to which these respondents pursued postponement was the lowest among the three strategies. Although firms in the transportation industry perceived the highest uncertainty of all firms, they applied postponement to an even lower extent, likely caused by the high amount of policy attention the to date unregulated industry was exposed to at the time of the study.

Regression results are shown in Table 3. As hypothesized, model 1 shows a positive relationship between firms' perceived regulatory uncertainty and participation in the policy making process ($p < .05$). Similarly, it shows a positive effect of lobbying experience on firms' participation in the policy making process ($p < .05$). Location in Asia and affiliation with the industrial goods industry affect this participation negatively ($p < .01$ and $p < .05$, respectively). In total, the data supports Hypothesis 1.

As shown in model 2, Hypothesis 2 stating that firms' perceived regulatory uncertainty is positively related to

strategic flexibility also receives support ($p < .05$). Likewise, reorganization toward decentralization and firm size positively affect strategic flexibility ($p < .01$), as does affiliation with the utilities industry ($p < .05$).

The data also supports Hypothesis 3, according to which firms' perceived regulatory uncertainty is positively related to the postponement of strategic decisions (model 3, $p < .01$). Furthermore, existing regulation and the need to act fast have a negative effect on postponement ($p < .01$ and $p < .05$, respectively). The effect of firm size on postponement is positive ($p < .05$).

Omission of insignificant explanatory variables for industry and location in the regression models did only slightly change regression estimates, while still confirming our hypotheses and other conclusions drawn from the results with decreased predictive power of the models. Regression analyses of perceived regulatory uncertainty on region, location, and lobbying experience did not yield significant estimates.

6. Discussion and conclusion

6.1. Corporate strategy under regulatory uncertainty

The objective of our study is to investigate corporate strategy under regulatory uncertainty. To this end, we identify specific characteristics of regulatory uncertainty from the literature on policy formulation and analyze appropriate strategies particularly directed at these characteristics. The results confirm

our hypotheses that the strategies firms pursue specifically respond to the characteristics of regulatory uncertainty. Findings show that the higher the uncertainty firms perceive regarding the considered regulation, the greater the extent to which they participate in the corresponding policy making process and prepare for a variety of possible regulatory scenarios through increased strategic flexibility. In addition, participation and flexibility are commonly pursued to a great extent across most industries, with utilities especially applying these two strategies to a greater extent than other firms. At the time of our study, these firms were emphatically asking policy makers for planning reliability for the large investments in plant replacements required over the next decade. Moreover, one utility had just initiated the construction of a pilot coal power plant with integrated components to separate CO₂ from other emissions and capture it, while at the same time investing in technologies to generate energy from renewable resources. This behavior toward the post-Kyoto debate seems to replicate the successful strategy enacted by the European utilities industry during the political negotiation on the design of the EU Emission Trading Scheme (EU ETS), with utilities lobbying extensively to secure an abundant and free allocation of allowances (Michaelowa and Butzengeiger, 2005) while at the same time seeking increased flexibility through diversification (Hoffmann, 2007).

However, despite the demonstrated adequacy of participating in the policy making process and increasing strategic flexibility when facing regulatory uncertainty, the high prevalence of both strategies is surprising given that they also entail unfavorable effects for firms. Firstly, effectively contributing to the policy making process requires the deployment of additional resources and the complicated development of a credible reputation with policy makers (Hillman and Hitt, 1999). For example, the Cement Sustainability Initiative, a vehicle used by basic material firms to influence the design of a post-Kyoto regulation of their industry, is investing about one million dollars per year for monitoring members' compliance with their voluntary CO₂ emission reduction targets (Busch et al., 2008), thereby demonstrating proactive and socially responsible behavior. Secondly, firms also have to commit considerable resources to hold ready alternative strategic options (McGrath and Nerkar, 2004). Follow-up interviews in the aviation industry revealed that airlines with localized route networks, such as regional or leisure carriers, were often trying to diversify their business portfolio by adding intercontinental flights that were potentially to be excluded from regulation in a much discussed regulatory scenario. Similarly, besides trying to increase current engine efficiency, most car manufacturers simultaneously worked on alternative fuels, for example biofuels or compressed natural gas, and also developed electric and fuel cell vehicles that do not produce direct CO₂ emissions.

As expected, the study also indicates that firms that actually postpone strategic decisions do so due to a perception of higher levels of regulatory uncertainty. Surprisingly, however, postponement was not as widespread as derived from theoretical considerations or as frequently claimed by firms, for example prior to the policy makers' decision on how to allocate emission allowances in the EU ETS (Sullivan and Blyth, 2006). Only about one-third of the respondents pursued a postponement strategy in the light of post-Kyoto regulatory

uncertainty, while the remaining firms did not postpone strategic decisions to respond to regulatory uncertainty. Likewise, firms applied postponement to a considerably lower extent than participation and flexibility. Reasons for the latter can be derived from the control variables. First, our results show that the exposure to pressures from existing regulation counteracted firms' postponement of strategic decisions. While this finding is not surprising per se, it emphasizes the importance of providing a regulatory framework for firms' CO₂ emission reduction activities. The exposure to existing regulatory pressures to reduce CO₂ emissions seems to have prevented firms from holding back with strategic decisions, many of them likely related to emission reductions such as investments in increased energy efficiency. As expected because of the EU ETS, such pressures were significantly higher for firms in Europe than for those in other regions. Consistently, European firms postponed strategic decisions to a lower extent than other firms ($p < .10$). Second, results show that firms' perceived need to avert a threat or take advantage of an opportunity resulting from regulatory uncertainty was opposed to the pursuit of a postponement strategy.

The rationale for firms to participate in policy making and to increase their strategic flexibility but to not postpone strategic decisions despite the high level of regulatory uncertainty could be ascribed to the stage of the political negotiation. At the time of our study, the decision making process of a post-Kyoto regulation was still far from any agreement, with the range of potential regulatory outcomes being correspondingly broad. Early stages of regulatory policy making provide numerous possibilities for firms to exert influence on policy makers and to direct the outcome of their negotiations toward a particular objective (Ullmann, 1985). Furthermore, the wide array of possible regulatory scenarios requires a large number of strategic options to be available to the firm, i.e., a high degree of strategic flexibility (Aaker and Mascarenhas, 1984; Bowman and Hurry, 1993). In contrast, respondents' comments in the open text fields and during follow-up interviews suggest that there might be situations during early policy making in which it is more beneficial for firms to not postpone strategic decisions. The low extent to which transportation firms postponed strategic decisions substantiates this notion. The high regulatory uncertainty perceived by these firms is reflected in the fact that policy makers had, at the time of our survey, just started to discuss the post-Kyoto handling of CO₂ emissions from road traffic and aviation. Follow-up interviews in the industry revealed that firms attempted to build up their levels of credibility with policy makers to add authority to their lobbying activities. They hoped to prevent an overly strict regulation by emphasizing their proactive behavior and voluntarily demonstrating environmental responsiveness early on in the policy making process. As a result, instead of postponing strategic decisions firms in the transportation industry took action on short notice, for example by launching comprehensive energy efficiency initiatives or investing in fleet modernization programs.

In addition, postponing strategic decisions during the early stages of a lengthy regulation formulation process might entail unfavorable effects for the firm which outweigh the potential benefits gained from making strategic decisions later under more certainty. This may be particularly true if the time span

before the resolution of regulatory uncertainty is long as a firm runs the risk of losing competitive advantages or missing opportunities in the meantime until it makes the decision. Moreover, the longer the period a firm has to postpone strategic decisions for, the more difficult it is to assess the potential risks associated with this postponement and to evaluate the impact the postponement might have on the firm's corporate performance. Accordingly, similar to participation and flexibility strategies, pursuing a postponement strategy involves shortcomings firms have to cope with, particularly during the early formulation of a new regulation. As a result, postponing strategic decisions might be more prevalent in the more advanced stages of regulatory decision making when firms expect regulatory uncertainty to be resolved soon.

6.2. Implications for policy

The results of our analysis allow the drawing of conclusions for policy makers that could help to improve the economic performance of the firms to be regulated, increase the efficiency of the policy making process, and enhance the effectiveness of the regulation. To this end, policy makers should note that factors external to the political arena, such as firms' responses to regulatory uncertainty, can considerably affect the course and outcome of policy formulation. On the one hand, regulatory uncertainty can impede firms' compliance with a regulation. On the other hand, interrelations between policy and firms caused by regulatory uncertainty can influence political agenda setting and constrain efficient and effective policy making. As a result, it is important for policy makers to become aware of how widely the different response strategies to regulatory uncertainty identified in this study are disseminated among firms and to which extent firms pursue them.

Almost all firms, regardless of their industry affiliation or region, aggressively pursue participation and flexibility strategies as a response to regulatory uncertainty. The high intensity of these responses requires the commitment of a considerable amount of time, resources, and management attention. Likewise, the widespread and intensive lobbying activities of numerous firms divert policy makers' focus and thus reduce the efficiency of the policy making process. As a result, firms' unstructured participation in this process temporarily obstructs a regulation's effectiveness by often slowing down political decision making and delaying the enactment of the regulation. Accordingly, policy makers should strive to reduce the uncertainties firms are exposed to. This would allow firms to more effectively deploy their resources toward their commercial and, possibly, environmental objectives, remove distractions from the policy making process, and thus expedite regulations' coming into effect.

To this end, improving the mechanisms by which firms participate in political negotiation could increase the transparency of policy making and thus reduce the regulatory uncertainty firms are exposed to, particularly in the early stages of the decision making process (Santos et al., 2006; Van den Hove, 2000). At the same time, institutionalizing firms' participation in policy making, for example by conducting official hearings of representatives from industry associations as in part already done in countries such as Germany or Sweden (Hillman and Hitt, 1999), could confine firms' unstructured

individual lobbying activities and reduce the resource intensity of participation for both sides.

In addition, policy makers should also recognize that, as opposed to participation and flexibility strategies, it is not only the number of firms pursuing a postponement response to regulatory uncertainty which seems to be low across all regions and industries, but also the extent to which these firms actually postpone strategic decisions. Consequently, this puts the common practice of firms of threatening policy makers with postponing investments during the formulation of a new regulation into perspective (Hoffmann et al., 2009).

6.3. Implications for research

The special characteristics of regulatory uncertainty identified in this study and the long period of uncertainty typically associated with international environmental regulations seem to fundamentally differentiate this type of uncertainty from other uncertainties in firms' business environment. As a result, additional research focusing on regulatory uncertainty is warranted so as to further enhance the understanding of its influence on firms' strategies. To this end, scholars could build on our initial explanations to investigate in more detail the reasons why firms forego a postponement strategy. Furthermore, a cause for the varying extent to which firms pursued the different strategies could lie in firms' differing possession of specific capabilities (e.g., Aragón-Correa and Sharma, 2003; Barney, 1991; Teece, 1986). We therefore encourage studies focusing on the role of organizational capabilities in efficiently pursuing a specific strategy under regulatory uncertainty. Finally, while our research focused on three strategies presumably particularly appropriate for firms facing regulatory uncertainty, the applicability and actual usage of other strategies to cope with general uncertainty in firms' business environment, such as the imitation of competitors' activities (Anderson and Paine, 1975; Bourgeois and Eisenhardt, 1987) or the building of alliances (Thompson, 1967; Wernerfelt and Karnani, 1987), should be studied in the context of regulatory uncertainty as well.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.envsci.2009.08.003.

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