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Policy Uncertainty and Corporate Performance in Government-sponsored Voluntary Environmental Programs

Nicole Ning Liu (ning.liu@cityu.edu.hk)*

Shui-Yan Tang (stang@price.usc.edu) **

Xueyong Zhan (xueyong.zhan@polyu.edu.hk) ***

Carlos Wing-Hung Lo (carlos.lo@polyu.edu.hk) ***

* Department of Public Policy, City University of Hong Kong

** Sol Price School of Public Policy, University of Southern California

*** Department of Management and Marketing, The Hong Kong Polytechnic University

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Abstract

This study combines insights from the policy uncertainty literature and neo-institutional theory to examine corporate performance in implementing a government-sponsored voluntary environmental program (VEP) during 2004-2012 in Guangzhou, China. In this regulatory context, characterized by rapid policy changes, corporate performance in VEPs is affected by government surveillance, policy uncertainty, and peer pressures. Specifically, if VEP participants have experienced more government surveillance, they tend to perform better in program implementation. Such positive influence of government surveillance is particularly evident among those joining under high and low, rather than moderate uncertainty. Participants also perform better if they belong to an industry with more certified VEP firms, but worse if they are located in a regulatory jurisdiction with more certified VEP firms. At a moderate level of policy uncertainty, within-industry imitation is most likely to occur but within-jurisdiction imitation is least likely to occur.

Keywords: emerging economies, institutional pressure, policy uncertainty, voluntary environmental regulation

In the past two decades, business firms have increasingly participated in voluntary environmental programs (VEPs), which are sponsored and promoted by not only business associations but also regulatory agencies (Delmas & Montes-Sancho, 2010; Nishitani et al., 2012; Potoski & Prakash, 2005; Hsueh, 2013). VEPs, however, face many challenges such as policy uncertainty, inadequate monitoring capacities, lack of economic incentives, and over-time changes in political advocacy and social expectations (Boiral, 2007; Ruysschaert & Salles, 2014; Short & Toffel, 2010). Some of these challenges are especially severe in emerging economies. For instance, policy uncertainty may not be a problem for relatively mature programs such as ISO 14001, for which formal standards and procedures are well established. But it can be a challenge for new government-sponsored VEPs, which vary widely in goals, design, and implementation. This is especially the case in emerging economies undergoing rapid regulatory reforms, in which government-sponsored VEPs are often characterized by unclear design and loose enforcement (Blackman *et al.*, 2013). These program design and institutional issues may undermine participating firms' effort in program implementation.

In emerging economies, regulatory agencies may also lack adequate administrative capacities to facilitate VEP adoption and monitor participants' actual behavior (Liu *et al.*, 2015; Zhan, Lo, & Tang, 2014). The degree of "voluntariness" of some VEPs, especially those sponsored by governments, also varies across regulatory contexts. In China's authoritarian context, for example, some firms can safely hold off joining a VEP, but others face coercive pressure to join these "voluntary" programs. As government-sponsored VEPs have become more popular in emerging economies, a critical research question is how corporate environmental

practices in government-sponsored VEPs in emerging economies are jointly affected by program design and local regulatory context.

In this article, we combine insights from the literature on policy uncertainty and neo-institutional theory to address this research question, using a government-sponsored VEP in China, the Cleaner Production (CP) Program in the city of Guangzhou, as a case for analysis. As typical of similar programs in other emerging economies, program guidelines and related industrial standards were unclear when the CP Program was first established. Such policy uncertainty affects not only firms' internal motivations to implement the voluntary program, but also the way enterprise executives interpret signals from various institutional forces.

Our empirical findings suggest that if VEP participants have experienced more government surveillance, they tend to perform better in program implementation. Participants also perform better if they belong to an industry with more certified VEP firms, but worse if they are located in a regulatory jurisdiction with more certified VEP firms. The influences of these external factors are moderated by the levels of policy uncertainty a firm faced at the time of enrollment. Specifically, if a firm joins under high and low—in contrast to medium—uncertainty, it responds more strongly to the effect of government surveillance. If a firm joins under moderate—in contrast to high and low—uncertainty, it responds more strongly to the influence of industrial peers, but less to that of locational peers.

Our study contributes to the literature in several ways. First, it extends the institutional literature by examining how VEP firms respond to two different forms of peer influence—one from the same industrial sector and the other from the same location. Second, it extends the research on policy uncertainty (Hoffmann *et al.*, 2008) by highlighting how policy uncertainty

moderates the effects of various institutional forces on VEP firms' behavior. Third, unlike third-party certification common among industrial-sponsored VEPs, certification in this government-sponsored CP program was performed directly by government agencies. This program feature provided an objective measure to capture participants' actual implementation effort, thus avoiding the use of self-reported performance or other proxies. Fourth, the majority of VEP studies examine mainly North American and European experiences. The government-sponsored VEP we studied is unique in several aspects, which will be discussed thoroughly in later sections.

Policy Uncertainty and the Cleaner Production Program in China

Public policies can be punctuated by political elections and changes in public opinion (Cashore & Howlett, 2007). As noted by Doh and Pearce (2004), "uneven, and discontinuous change" is especially common in situations involving newly developed policies. In an empirical investigation of the European Emission Trading Scheme, Hoffmann *et al.* (2008) found that the program did generate various types of uncertainty to participants in its early launching period, including uncertainty in basic direction, measures and rules, implementation process, as well as regulatory requirements. In many transitional economies, political leaders can easily announce drastic policy changes and impose considerable risks on firms and investors (Delios & Henisz, 2003). In China, for instance, policy uncertainty may be caused by both regime factors (e.g., inadequate rule of law and insufficient checks-and-balances in policy processes) and administrative factors (e.g., low administrative capacity and inconsistent enforcement at the local level) (see Yee, Tang, & Lo, 2016; Zhan *et al.*, 2014). China relies heavily on its local governments for implementing environmental policies, but local governments may have very different priorities from those of the central government (Liang & Langbein, 2015); they may set

their regulatory and implementation targets in ways that deviate considerably from central intents (Wang & Wheeler, 2005). In addition, local rulemaking often lags behind central rulemaking creating situations in which a centrally mandated program may be formally in place but there are no clear guidelines from local jurisdictions (Acs, 2015). Such a disjunction between central and local rulemaking creates uncertainty to regulated firms in terms of how local governments will exercise their discretion, and how central mandates will be implemented locally. Another complication in China concerns how environmental standards and specifications are set for different industries (Ma & Ortolano, 2000). Due to the limited capacity of regulatory agencies and their varying priorities, promulgation and modification of these environmental standards occur unevenly across industrial sectors[1]. Uncertainty thus arises for firms that are interested in participating in an environmental program (e.g. environmental labeling) but without explicit industrial standards to refer to.

As part of China's effort to incorporate voluntary tools into its environmental regulatory framework, the Cleaner Production program seeks to promote industrial pollution prevention throughout the production process to minimize waste and emissions (Geng *et al.*, 2010). After its promulgation in January 2003, the *Cleaner Production Promotion Law* was delegated to local governments for enforcement, and the design and implementation of CP programs vary across local jurisdictions. In Guangzhou city, for example, the municipal government initiated the program in 2004; yet participants have since faced considerable uncertainty due to two major policy factors: 1) the Guangdong Provincial Government did not release a definitive program guidebook until January 2009; and 2) national CP standards for different industries were released at different times during 2002-2010. At the national level, the program was implemented without

a clearly developed policy framework in the early years—the implicit *Provisional Measures of Cleaner Production Audit* was the only enforcement benchmark until a detailed *Cleaner Production Audit Guidelines* was released in May 2016. In Guangdong, the definitive local program guidebook, which clarified the auditing process, as well as the incentives and monitoring schemes did not come out until January 2009. Moreover, industrial CP program technical standards were not fully established when the program was initiated: CP standards for 35 industrial sectors were released during 2003-2008, while 21 others were not released until 2009-2010 by the Ministry of Environmental Protection[1].

Insert Figure 1 about here

Theoretical Foundations and Hypotheses

Neo-institutional theory has provided many insights on how various external forces affect participation and performance in VEPs (King & Lenox, 2000; Short & Toffel, 2010). For instance, some government-sponsored VEPs may target particular industries or facilities to "encourage", or even mandate, program participation. Regulatory pressures in the form of direct sanctioning of non-compliance or indirect threats of sanction were found to affect firm responses (Henriques et al., 2013; Potoski & Prakash, 2005). The threat of government sanctioning remains important in VEPs as the "rational myth" perspective suggests that VEP adoption is more likely to be merely ceremonial behaviors if no threats of sanctioning for underperformance are in place (Boiral, 2007). A review of recent empirical institutional studies suggests a lack of understanding of the conditions under which institutional demands explain proactive environmental strategies (Delmas & Toffel, 2011). As suggested by Oliver (1991), organizational responses to

institutional pressure are shaped by interactions among different aspects of the institutional environment (e.g. cause, constituents, content, control, and context). In this study, we argue that policy uncertainty undermines firms' ability to assess accurately the risks and opportunities associated with different institutional forces (see Figure 2).

Insert Figure 2 about here

Participants' experience in prior regulatory surveillance can motivate them to commit to VEP program requirements. Short and Toffel (2010), for example, showed that regulatory surveillance may help strengthen a firm's commitment to self-regulation. When no specific sanctions for noncompliance are in place and it is difficult for external stakeholders to monitor participants' practices, firms may not be committed to self-regulation as they can easily evade their compliance responsibilities without facing any negative consequences. Furthermore, firms may not intend to shirk, but policy uncertainty caused by unclear program design and inconsistent enforcement may undermine their resolve to act on program requirements.

The positive association between prior regulatory surveillance and a firm's VEP performance is likely to be stronger when policy uncertainty is lower for at least two reasons. First, when policymakers may fail to provide explicit policy directions and clarify specific firm obligations, it is difficult for participants to link their own experience to new regulatory actions. In this situation, prior lessons lost their reference meaning to guide current moves. This is particularly true in emerging economies where firms tend to adopt defensive rather than proactive strategies in response to environmental uncertainty (Tan & Litschert, 1994). Second, when detailed monitoring and sanctioning procedures are clearly specified, however, firms that experienced prior enforcement actions may expect comparable enforcement and monitoring

intensity in the current program. Highly regulated firms may also consider themselves more likely to be closely monitored. When local governments fail to specify local policy guidelines, firms are likely to perceive a weaker commitment to local policy implementation, and hence less likely to take substantive efforts in program implementation. Taken together, increased policy clarity enhances both the reference effect and deterrence effect from prior regulatory experiences, and these effects are likely to push firms to devote more efforts to satisfy program requirements (Rivera, 2004; Short & Toffel, 2010).

Hypothesis 1a: Participants that experienced greater regulatory surveillance before joining a VEP perform better in program implementation;

Hypothesis 1b: The above positive relationship is stronger for firms joining under lower policy uncertainty.

From an institutional perspective, a firm's environmental behavior is also affected by other firms' responses (Fremeth & Shaver, 2014). By observing others' responses, firms can better evaluate the costs and benefits of implementing a VEP. Specifically, we draw on emerging insights of the imitation literature (Marquis & Tilcsik, 2016; Okhmatovskiy & David, 2012) and suggest two key reference groups: (1) performance of other firms operating in the same jurisdiction (regional proximity), and (2) performance of peer firms operating in the same industry (industrial proximity).

In the same regulatory district, firms may share their knowledge about the voluntary program through informal managerial connections or seminars/workshops organized by local industrial associations. In addition to knowledge spill-over, incentives

to maintain current reputation or prepare for the future in the local area will also induce firms to follow others. These positive impacts of peer influence, however, may be reduced by policy uncertainty since whether and to what extent this peer-shared knowledge is in line with formal regulatory expectations is unknown (Marcus, 1981). Followers may also interpret such diffusion as evidence that the local government has its own policy priorities and has purposively lagged behind the central government in promoting the VEP. In this situation, peers' behaviors in the same regulatory jurisdiction are weak demonstrations of the benefit of implementing the VEP. Following "club" members' behavior improves one's reputation in the eyes of the regulators (Potoski & Prakash, 2005). Nonetheless, such club benefits are less attractive if the VEP club itself is not well developed because of policy uncertainty. Meanwhile, organizational efficiency will be further hampered when uncertainty reduces the potential club benefits of the VEP and prevents firms from developing long-term environmental strategies.

Hypothesis 2a: Participants in a regulatory jurisdiction with more VEP certified firms perform better in VEP implementation;

Hypothesis 2b: The above positive relationship is stronger for firms joining under lower policy uncertainty.

Proactive environmental actions of peers within the same industry (some of which may be direct competitors) signal that further engagement in the VEP is both feasible and potentially beneficial. In this case, market legitimacy and competitiveness become major reasons for extra environmental effort. Thus firms in an industry with more committed VEP adopters are more likely to devote effort to implementing a government-sponsored

VEP as they can benefit from knowledge sharing and knowledge spill-over. Existing literature on mandatory information disclosure has documented similar positive impacts of peer pressure by revealing that firms with proximate siblings in the same industry undertook more rapid environmental improvement than those with siblings from different industries (Doshi, Dowell, & Toffel, 2013). However, policy uncertainty may add to the difficulties and sunk costs for attaining a competitive advantage, thus undermining further voluntary effort (Tan & Litschert, 1994). Furthermore, firms are motivated to jump on the bandwagon when other competitors are committed to VEP implementation out of fear of losing out in market competition or in adapting to policy changes. Such expectations can hardly be formed in the absence of explicit regulatory signals, especially in settings where policy reform is still at an infant stage. It is also difficult for firms to claim their technical superiority over other participating firms without knowing the precise industrial benchmarks. In the CP program, for instance, each industrial CP standard specifies the performance criteria for top cleaner production methods at the domestic and international levels. When policy instructions and expectations become clearer, best practices in the peer industry can easily inspire firms to imitate. Thus, a reduction in policy uncertainty can help fuel diffusion of program implementation efforts among firms in the same industry.

Hypothesis 3a: Participants in an industry with more VEP certified firms perform better in VEP implementation;

Hypothesis 3b: The above positive relationship is stronger for firms joining under lower policy uncertainty.

Data and Method

We collected data in the city of Guangzhou, whose CP policy implementation is an ideal case for our analysis as it includes a variety of sources of policy uncertainty and firms that joined the program for different reasons. To test our hypotheses, we compiled a dataset of firm enrollment in the CP program by combining several public databases. We first selected firms that were assessed by regulatory agencies by the end of 2012, as identified in the database of "Cleaner Production of Key Enterprises" from the Ministry of Environmental Protection[2]. This database identified 296 participants and provided information on whether and when a participating enterprise was assessed by 2012. We then drew on the local database of "Cleaner Production of Key Enterprises" from the Guangzhou Environmental Protection Bureau (EPB)[3] to identify detailed firm features, auditing progresses, and final assessment. Table S1 in the supplementary material shows detailed information on industrial classifications.

A limitation of the study is that it does not include a control group of nonparticipating firms. During our study period, the total number of enterprises in Guangzhou city had increased substantially by more than 40 percent from 46,469 in the year 2004 to 65,583 in 2012. It is thus difficult for us to compare a small group of participants with over 60,000 non-participants in the selected city. Future research may narrow down to a few industrial sectors to explore how the impact of policy uncertainty varies among types of VEP adopters and non-adopters. Since our research focuses on participants' behavior under policy uncertainty, we believe that a sample that includes only program participants is sufficient for answering our specific research questions. With regard to the empirical analysis, the two-stage model we adopted together with the robustness check helps alleviate concerns about the influence of unobserved selection biases.

To supplement the archival data, we conducted an interview in January 2017 with the Director of the Cleaner Production Center at the Ministry of Environmental Protection (MEP) in Beijing. We then interviewed the Director of Cleaner Production Center of Guangdong Province and government officials at the Environmental Technology Center of Guangzhou City, where we collected firm-level data. Two of the authors participated in these interviews, which lasted between 60 and 90 minutes, following a semi-structured protocol. The former interview focused on overall policy implementation nationwide and the reasons for local governments' slow pace in rulemaking in local program design. Interviews with the local EPB officials focused on policy implementation progress in Guangzhou. Interview transcription was done by one of the authors and a research assistant, with follow-up cross-validation.

Estimated Models: A Two-stage Approach

A two-stage estimation procedure is used to correct for endogeneity (Greene, 2008), given that the decision to join a VEP and the ultimate performance in implementation may be influenced by the same factors (Delmas & Montes-Sancho, 2010; Rivera, 2004). The results from the first-stage model are used to estimate firm performance in the second-stage model, with the probability of enrollment at varying degrees of policy uncertainty included as an independent variable.

First stage: VEP enrollment decision in a transitional policy environment

An ordered logit model was run in the first stage since VEP enrollment decision under varying degrees of policy uncertainty has a natural order but the distance between the intervals is not perfectly interval scaled (Long, 1997). We categorize participants into three groups based on a descending degree of policy uncertainty due to the types of uncertainty sources at the time of

enrollment. Drawing on Doh and Pearce (2004)'s insights on policy uncertainty in transitional policy environments, we classify firms' enrollment into three groups based on the degrees of policy uncertainty they face (see table 1). The first group of firms joined the program under high policy uncertainty when both local program guidelines and specific industrial standards were absent, with the only policy benchmark being a less specified *Provisional Measures of Cleaner Production Audit* released at the national level. This group includes 42 firms and was coded "3". The second group of firms joined the program under moderate policy uncertainty when either local program guidelines or specific industrial standards were absent. A total of 150 firms fall in this group, and they were coded "2". The third group of firms joined the program under low policy uncertainty when both local program guidelines and specific industrial standards were in place. A total of 104 firms enrolled during the period of low policy uncertainty. These firms were coded "1".

Insert Table 1 about here

Our study is distinct from existing studies that differentiate between "early" and "late" participants by reference to a specific date (Bansal & Hunter, 2003; Delmas & Montes-Sancho, 2010; Montiel & Husted, 2009). In these other studies, policy uncertainty may not be a problem; but in our study, firms joining at the same time might have been facing different degrees of policy uncertainty because the release times of industrial standards varied across industries. For example, the *CP Standards for the Petroleum Industry* was released in April 2003, and the *CP Standards for the Chemical Fiber Industry* was released in August 2007. Therefore, a chemical-fiber manufacturing firm joining the program in January 2007 falls in a period of high policy

uncertainty, while a petroleum-refinery enterprise joining the program earlier in 2004 falls in a period of moderate policy uncertainty.

The key independent variable in the first-stage model is *direct targeting pressure*. As part of the targeting enforcement strategy of the local EPB, firms were under different degrees of direct targeting pressure to join the program. The local government issued a list of "invited firms" annually after program initiation. These firms received not only direct coercive pressure from the regulatory agency but also potential societal attention since these lists were publicized on the EPB's websites[3]. From 2004 to 2012, the provincial EPB released 7 invited lists, with the total number of firms on a single list ranging from 30 to over 1,000 at the provincial level[4]. Based on these lists, 21 municipal governments would directly mandate or encourage firms to enroll in their jurisdictions. A firm was invited if 1) its pollution emission exceeded the national or local environmental standards or its total pollution discharge exceeded the "binding environmental targets" assigned by the local government, or 2) it produced with or emitted hazardous/toxic chemicals (as identified in GB12268 and other national environmental standards)[5]. Each listed firm was then formally invited by the municipal EPB to join the program. Due to the local EPB's limited enforcement capacity[6], a firm on a list with more "invited" firms was likely to receive less regulatory attention. For each targeted firm, we calculated its prominence in the targeting list by taking the reciprocal of the number of firms listed on it. In this way, firms on a shorter list attained higher scores and were exposed to greater targeting pressure than those on a longer list. Firms that joined the program entirely voluntarily were coded "0", indicating no direct targeting pressure at all.

Controls. Since corporate environmental performance also differs along firm features (Christmann & Taylor, 2001; Darnall, Potoski, & Prakash, 2010), we added the following control variables into the analysis: (1) "*Located in industrial zone*" was code "1" if a firm operated in an industrial zone (more than half of selected firms), and "0" otherwise. Industrial zones were usually far away from local communities, and firms there were less likely to face direct community pressure. (2) "*Firm size*" was measured by the number of employees in each firm. Based on the official categorization of manufacturing enterprise scale in China, we included three firm size types: 1) large (over 1000 employees); 2) medium (300-1000 employees) and 3) small (20-300 employees). (3) "*Listed firm*" was coded "1" if the participant was a publicly traded firm (around 22% of selected firms), and "0" otherwise. (4) "*Ownership*" included four types for differentiating among state-owned firms (about 20% of selected firms), state-controlled joint ventures (19%), foreign-owned firms (18%), and privately-owned firms (43%). (5) "*Affiliated to industrial trade association*" was coded "1" if the participant was a member of an industrial trade association before joining the program (around 52.7% of selected firms), and "0" otherwise. The existing literature indicates that in developing economies, affiliation to industrial associations is a key determinant of firms' timing to join VEPs (Montiel & Husted, 2009). In addition, 15 industry dummies were included to control for sectoral effects (in both stage models).

Second stage: participants' performance in VEP implementation

An ordered logit model was run on the dependent variable of participants' performance in implementing the program. The model is specified by assuming that participants' performance is

affected by their decision to join the program under varying degrees of policy uncertainty, regulatory and market pressure, as well as a vector of firm features.

Most previous studies used emission reduction as a proxy of firm efforts in VEP implementation, partly due to the difficulty in directly observing the facilities' actual practices. These proxies may not gauge organizational efforts precisely since it is difficult to differentiate between VEP-induced improvements and other unrelated activities (Rivera, 2004). In the CP program, final verification and certification were the joint responsibility of two local government agencies, Environmental Protection Bureau (EPB) and Economy and Information Commission (EIC). We thus used this government assessment result to measure the *dependent variable* of a participant's performance in adhering to program requirements. This is a more precise measurement of actual corporate effort than using pollution emission as a proxy for two reasons. First, the performance evaluations were not done in the same calendar year but usually about one year after each firm joined the program, thus revealing participants' continuous cleaner production practices. Second, unlike self-reported effort, the assessment by regulatory agencies examines both adopted practices and their effectiveness in improving environmental performance. We follow the overall assessment by the local EPB, which divided participants' performance into five levels: applied for the program but failed to conduct third-party audit (coded "1", 19 firms), completed third-party audit but failed the final government assessment (coded "2", 37 firms), passed the final assessment and (a) met the minimum requirement of the municipal government (coded "3", 65 firms); (b) met the requirement of the municipal government with outstanding performance (coded "4", 87 firms); (c) met the higher requirement

of the provincial government (coded "5", 88 firms). A higher assessment score thus indicates better performance by the participant[7].

Independent and control variables for the second-stage model are as follows:

Predicted probability of VEP enrollment under varying degrees of policy uncertainty. We entered the probability of enrollment under high policy uncertainty and under low policy uncertainty as derived from the first-stage model into the second-stage model, with the probability of enrollment under moderate policy uncertainty being the reference group. We also ran an alternative model with the probability of enrollment under high policy uncertainty as the reference group for further comparison.

Prior regulatory surveillance[8]. To measure the prior regulatory surveillance that a participant experienced, we calculated the number of regulatory enforcement actions each firm had received (e.g. pollution fee collection, inspections, warning letters, monitoring) during the three years before joining the VEP by checking public records of regulatory enforcement provided by the local EPB's website. On average, participants experienced 3.56 enforcement actions in the previous three years.

Jurisdictional proximity and industrial proximity. These two variables measure the number of successful VEP participants within the same regulatory jurisdiction, and that within the same industry, respectively. Drawing on the imitation literature (Okhmatovskiy & David, 2012), we operationalized jurisdictional proximity as the proportion of prior successful participants (i.e., those that passed the final assessment by the municipal EPB) in the same district. In other words, we suppose that firms are likely to be influenced by firms operating under the same environmental regulatory authority. Guangzhou consists of 11 administrative districts, within

each of which a district EPB is in charge of regulatory enforcement. Followers could easily access progress information that was released periodically via the website of the local EPB and EIC, as well as seminars and workshops organized by these agencies. Similarly, industrial proximity was measured by the proportion of peer firms in the city that were successfully certified in the firm's industry before its initial enrollment. To identify industrial information, we relied on the local database of Cleaner Production that identifies the industrial sector for each participant.

Controls. We added the following controls[9] from the first-stage model: *location*, *firm size, listing status, and ownership.* Moreover, as the type of auditor also matters (Short, Toffel, & Hugill, 2016), we added a new control "*semi-government auditor* (i.e. local EPB-affiliated cleaner production centers and research institutes)" as measured by the type of external consulting entity selected and hired by the participant to conduct CP audit before the final assessment by the EPB and EIC. A firm was coded "1" if it hired a semi-government auditor and "0" if it hired the others.

Table 2 summarizes the descriptive statistics and correlations for all explanatory and control variables in the first and second-stage model.

Insert Table 2 about here

Results

As mentioned earlier, a two-stage model was adopted to test our hypotheses. Table 3 presents results of the first-stage model. To test the parallel lines/proportional odds assumption for the ordered logit model, we performed the Brant test in STATA. An insignificant test statistic (chi^2 =

6.59; $p = 0.68$) suggests that the proportional odds assumption has not been violated (Borooah, 2001). The results suggest that compared to privately-owned firms, state-owned joint ventures are more likely to join a government-sponsored VEP under higher policy uncertainty. Firms receiving stronger direct targeting pressure also joined the VEP under a higher degree of policy uncertainty. This corroborates with the literature on self-regulation (Bansal & Hunter, 2003; Delmas & Montes-Sancho, 2010) by suggesting that firms have limited reason to enroll in a less-established VEP or make an early-enrollment decision unless there are particular incentives or they are pressured to do so.

Insert Table 3 about here

Table 4 presents the ordered logit regression results of the second-stage model. As mentioned in an earlier section, the dependent variable divides VEP participants' performance into five levels. Model (i) includes control variables and independent variables. We entered the probabilities of enrollment under (1) low policy uncertainty and (2) high policy uncertainty as derived from the first-stage model and leave the probability of enrollment under moderate uncertainty out to avoid model over-specification. In model (ii), the probability of enrollment under high policy uncertainty was then set as the reference group. Results in models (i) and (ii) suggest that compared to participants joining under high or moderate policy uncertainty, those joining the program under low policy uncertainty are more likely to adhere to program obligations. The difference between those who joined under high and moderate uncertainty is negative and significant ($p < 0.05$). Model (i) indicates two institutional determinants—prior regulatory surveillance (positive effect) and jurisdictional proximity (negative effect)—are statistically significant ($p < 0.05$ and $p < 0.001$, respectively). Moreover, the impact of industrial

proximity is found to be positive and significant ($p < 0.001$). These results support the main effects stated in H1a and H3a, but not H2a. We will offer more discussion on the divergent result of testing H2a later. In combination, these results show that firms tended to do better in VEP implementation if they (1) were subject to stronger regulatory surveillance previously, or (2) were in a jurisdiction with fewer participants, or (3) were in an industry with more participants.

Insert Table 4 about here

One may be concerned that a few industries are driving the results because of the relatively small sample size of certain industries. We reran the analysis by excluding the top 2 industries (54 chemical manufacturing companies and 41 primary metal manufacturing companies). The results from using the remaining 201 sampled enterprises are consistent with our current results (available upon request). Our interviewees further suggested that peer effect exists in big industries partly due to powerful industrial associations that disseminate green information to members and government signaling through demonstration projects. In small industries, firms can easily get to know peer firms' green practices. Interviewee A told us a case that in 2011, 14 textile manufacturers in Jiangsu Province joined the CP program and exerted substantial environmental management effort after they had learned how a local peer enterprise benefited from the Cleaner Production initiatives.

Model (iii) to (v) test H1b, H2b, and H3b by including the interaction terms of three independent variables and the probability of enrollment under varying degrees of policy uncertainty respectively. Model (vi) presents the fully specified model. First, it shows that there is a significant interaction effect between prior regulatory surveillance and policy uncertainty. Specifically, the positive impact of surveillance experience is stronger for those joining under

high uncertainty and low uncertainty than those joining under moderate uncertainty. This is perhaps because participants joining under high policy uncertainty barely knew anything about what was expected of them, and hence were likely to be more reliant on their prior experience (in a passive way, though) than those joining under moderate policy uncertainty with some knowledge of external expectations. Participants joining under low uncertainty already had a comprehensive understanding of what was expected of them and were better positioned than those joining under moderate uncertainty in assessing the signal embedded in prior experiences. These results thus provide mixed evidence to support the interaction effect in H2b, which proposes that the positive effect of prior regulatory surveillance is stronger for firms joining under lower policy uncertainty. Similar patterns of interaction effect were evident between jurisdictional proximity and policy uncertainty, in which the negative main effect was weaker for firms joining under high uncertainty and low uncertainty than those joining under moderate uncertainty. The moderating effect in H4b that policy uncertainty weakens the positive impact of industrial proximity was partially supported, with results suggesting that the positive impact of peer influence is weaker for those joining under high uncertainty and low uncertainty than those joining under moderate uncertainty.

As mentioned earlier, we found a negative main effect of jurisdictional proximity and its mixed interaction with policy uncertainty on firm performance. Our hypothesized positive impact due to knowledge spillover is absent probably because the know-how in cleaner production is industry specific in our research context, while firms located within the same region come from very different industrial sectors and have very different cost structures. In Fremeth and Shaver (2014), for instance, a positive impact of peer (firms in the same jurisdiction)

influence is noted when only a single electric industry is involved. In one of the districts (Liwan District) that we studied, however, ten enterprises from nine different industrial sectors joined the CP program and met the program requirements. Luogang District had the largest industry peer and jurisdiction peer overlap, with 12 chemical manufacturing companies and 13 electronic products manufacturers participating in the program. This is consistent with the local yearbook (2010) data that these two industries were the two major sectors in the district. Such an overlap is in line with a recent insight on "institutional equivalents" referring to the overlap between community and industry peer groups (Marquis & Tilcsik, 2016). To test the influence of institutional equivalents, we included an interaction effect of jurisdictional proximity and industrial proximity, but the test did not yield any significant findings.

The negative influence of jurisdictional proximity was found weaker for firms joining under high uncertainty and low uncertainty than those joining under moderate uncertainty. We argue that it is because policy uncertainty affects how participants interpret jurisdictional proximity by facilitating additional calculations on regulatory risks or benefits. Compared with those joining under moderate uncertainty, firms that joined during low uncertainty have more information about program guidelines and/or industry standards. Thus they can consider both regulatory risks (due to symbolic adoption) and benefits (due to genuine cooperation) more accurately by observing peer behaviors. Compared to firms joining under moderate uncertainty, firms that joined under high uncertainty received more mandatory pressure to join the program, and they may be more likely to overestimate regulatory risks (e.g. either being sanctioned or facing more inspections) as signaled by jurisdictional proximity. The additional considerations among participants joining under high and low uncertainty, as we explained, thus weakened the

negative impact of jurisdictional proximity. The overall results thus corroborate with the emerging literature that uncertainty does not necessarily enhance imitation (Gaba & Terlaak, 2013; Strang & Still, 2006).

Additional Analysis

Differentiating between two types of uncertainty. In our analysis, we assumed policy uncertainty stemming from a lack of local policy guidelines as similar to uncertainty stemming from a lack of industry standards. These two sources of uncertainty, however, may have different impacts on participants' performance. Although this is beyond the focus of this study, we did an additional analysis to compare two groups of companies under moderate policy uncertainty (one group facing uncertainty due to a lack of policy guidelines only, and one group facing uncertainty due to a lack of industrial standards only). Results in Table S2 (supplementary materials) show that a lack of local policy guidelines is associated with worse performance ($p < 0.001$). One possible explanation is that a lack of local regulations creates greater policy uncertainty given the fact that the local government is the major regulatory entity enforcing environmental rules.

The role of indirect government pressure. We also re-estimated the models by including a variable that measures other regulatory pressure a firm faced before joining the CP program. It is possible that firms facing pressure in other environmental issues may consider joining a VEP even when it is less established to deflect regulatory attention or for impression management. For instance, in 2007 the Guangzhou municipal government introduced the policy of "suppress the second industry and advance the third industry"—the so-called *Tuier Jinsan* policy, which mandated polluting firms to relocate to designated industrial areas, close down, or upgrade

technologically by the end of 2009, 2012, and 2015, respectively[10]. Although the list of firms was officially released in 2008, targeted firms were usually notified a few years before for adaptation and preparation. These firms were under greater government demand on its environmental performance. We controlled this factor by introducing a variable "*Indirect government pressure",* coded "1" if a firm was included in the local relocation plan and "0" if otherwise. We included this variable in the first-stage model and the findings fully corroborate with those of our main analysis. These results are available from the authors upon request.

Discussions

In an emerging economy like China, firms participating in government-sponsored VEPs face a different regulatory context when compared with their Western counterparts. Because of a lack of strong societal expectations on industrial environmental performance and weak corporate green commitment, central governments in emerging economies need to be more aggressive in initiating VEPs to complement mandatory regulations and existing industrial-sponsored VEPs (Bartley, 2007). Yet such an administrative intervention may be less effective than what the regulatory agency might have expected. As the state still plays a dominant role in resource distribution and market regulation, firms are willing to enroll in "voluntary" programs if they perceive pressure from the government. Problems arise as these early enrollees are less likely to exert genuine efforts in implementing program requirements. A lack of either policy guidelines or industrial standards discourages firms from aiming high in cleaner production, because (1) the former include not only monitoring mechanisms and sanctions for non-compliance, but also economic incentives to encourage better performance; (2) the latter specify available green technologies, industrial benchmarks, and sometimes proactive case examples.

Compared to an ineffective direct targeting strategy, prior regulatory surveillance with mandatory rules has a spill-over effect that induces firms to devote efforts to implementation. These results reveal how firms behave in a transitional policy environment that aims to integrate mandatory and voluntary regulatory tools. On the one hand, strict routine enforcement is important not only to ensure basic firm compliance but also to encourage beyond-compliance practices. On the other hand, there is a possible drawback in blurring the line between voluntary and mandatory regulatory tool designs. Regulatees may expect that government-sponsored VEPs be promoted through self-motivated diffusion as industrial-sponsored VEPs do, rather than through veiled coercion. This is a particularly important message for policymakers in emerging economies and authoritarian regimes, which have traditionally emphasized coercive enforcement styles (Liu *et al.*, 2015; van Rooij & Lo, 2010).

We extend the imitation theory of organizational behavior (Gaba & Terlaak, 2013; Lieberman & Asaba, 2006) by suggesting how different mimetic forces send varying messages to followers in collective goods provision. We further found that the effectiveness of mimetic forces (based on the logic of appropriateness) depends on whether explicit regulatory risks or market benefits (based on the logic of consequences) can be identified. A negative main effect of jurisdictional proximity could be driven by some unique features of China's regulatory system. In China, a key environmental policy instrument is "binding environmental targets", in which a national policy goal set by the central government is assigned to specific provinces, and then sub-divisions (Kostka, 2016; Liu et al., 2015). Therefore, "key enterprises" that accounted for a large part of total industrial pollution are usually assigned pre-set targets for pollution reduction. In a government-sponsored VEP, firms may perceive that the program aims at targeting "key

enterprises" or encouraging interested firms to take further green steps. If no explicit incentives or deterrence are signaled, increasing jurisdictional proximity will reduce followers' commitment to the program because other firms have already made improvements, making them less susceptible to strict enforcement. However, diffusion of voluntary environmental practices through imitation among industrial peers seems to be more promising especially when the government is taking steps to reduce policy uncertainty. Apparently, industrial proximity encourages imitation behavior based on rivalry-based information and incentives it sends to followers, while jurisdictional proximity can hardly promote imitation behavior due to its signaling of limited reputation enhancement. These findings further corroborate with the information literature that peer behavior is more influential when it is considered to be independent decision-making rather than means of conforming to external pressures (Briscoe, Gupta, & Anner, 2015).

The divergent findings above also extend green club theory (Potoski & Prakash, 2005) and the literature on VEP sponsorship (Darnall *et al.*, 2010) that emphasize the brand reputation of voluntary programs. Our findings reveal that in addition to the overall club reputation of a VEP, membership composition also affects a VEP's attractiveness to business firms. Participants tend to value a government-sponsored VEP's brand reputation more if it is effectively recruiting peer firms within the same industry while valuing the brand reputation less if existing participants are from different industries within the same jurisdiction. From a collective-action perspective, free riding is unlikely to take place in the former scenario because reputation benefits and economic interests could only be gained from substantive VEP commitment. In the latter scenario, however, firm opportunism is likely to take place when other firms in the same

region have already provided the local environmental goods, creating incentives for followers in the same jurisdiction to evade their responsibilities to do the same.

Practical implications of this study are clear. Both policymakers and business firms need to understand that whether voluntary environmental programs can achieve "win-win" outcomes depends on both regulatory efforts in careful policy design and genuine business efforts in cooperation. In emerging economies, acknowledging that business motivations and regulatory contexts are different from those in developed economies is also important (Henriques *et al.*, 2013; Marquis, Zhang, & Zhou, 2011). Ways to buffer the negative impact of policy uncertainty through appropriate policy designs should be further explored. To encourage VEP diffusion within specific industries, governments may collaborate with industrial associations to promote the market benefits of VEP among member firms. To promote jurisdiction-based diffusion, governments need to either apply unbiased policy enforcement to avoid potential opportunism or create credible incentives that are directed at firms within specific geographical clusters.

Conclusion

The effectiveness of voluntary environmental programs in improving corporate environmental performance rests on internal firm efforts, external policy design, as well as the regulatory context in which the program operates (Lyon and Maxwell, 2007). In this research, we found that VEP participants' effort is shaped by their exposure to regulatory surveillance and peer actions (like their Western counterparts), and also by the contextual variable of policy uncertainty that is more prevalent in transitional economies. Overall, this research has improved our understanding of business responses towards government-sponsored VEPs in a transitional policy environment.

Our study has a few limitations and implications for future research. Although we believe the Guangzhou case can be considered an "influential" case (Gerring, 2006) to study the CP program in a transitional policy environment like China, this single city may not be representative of entire China. We also focus on firms that are regularly monitored by the government because they account for the majority of industrial pollution generation. Thus one must be cautious in generalizing our findings to firms that are not subject to intensive monitoring and control and those in other parts of China. Future research may use a comparative design by including more jurisdictions to explore policy uncertainty arising from differences in paces in rulemaking. By including different types of industrial dynamics, future research may examine whether and how the impact of policy uncertainty differs between industrial sectors with monopolistic competition and those with oligopolistic competition. Longitudinal studies could also be conducted to understand the role of evolving regulatory context over a longer period.

Notes

1. See a highlight of this issue in the country's 13th Five-Year Plan of Environmental Protection (in Chinese) http://www.mep.gov.cn/gkml/hbb/bwj/201704/W020170414581772760139.pdf, accessed on August 20, 2017. The interviewed officials (see interview design on p.12) also acknowledged that policy uncertainty stemming from a lack of policy guidelines and industrial technical standards has been a major challenge they have faced in implementing the Cleaner Production program.

2. Information source: Ministry of Environmental protection http://www.mep.gov.cn/, accessed on June 19, 2015.

3. One may be concerned that pressure could come from non-government as well. Based on our interviews with local governmental officials (conducted in March 2017) and local environmental NGO leaders (conducted in October 2016) in Guangzhou, we think that it is appropriate to assume that the most serious pressures faced by firms are still coming from government, but not from the public, for two reasons. First, Chinese civil society and environmental NGOs are still relatively weak, and they usually have limited direct influences on firms' decisions to join and to implement VEPs. Second, in China's environmental protection bureaus, there are well-established channels to collect public complaints. Thus, public pressures can be further translated into governmental pressures.

4. Information source: http://www.gzcpc.org/index.jhtml, accessed on December 10, 2013.

5. There could be other factors that explain why some firms are targeted by the local EPB but others are not. For example, firms operating in "strategic" industries for economic development or highly polluting industries might be more likely to be subject to direct targeting pressure. In both stages of estimation, industrial dummies (see the Supplementary material Table S1 for a sectoral decomposition) are used to control for sectoral differences.

6. Both archival data and our interviews indicate that EPB's resources have remained scarce over the years. The average number of enforcement official positions in Guangzhou EPB in 2000, 2006, and 2013 are 250, 220, and 280, respectively (Interview conducted by authors). The total number of industrial enterprises have increased from 31,416 to 65,598 during this period.

7. We consider these assessments of "implementation efforts" to be reliable given the existence of policy uncertainty. Uncertainty due to a lack of policy guidelines mainly results in procedural ambiguity (e.g. whether and how monetary incentives are available from the government) as perceived by firms, but does not affect the way local EPBs conduct performance assessment, which follows an explicit series of assessment criteria. Similarly, a lack of industrial CP standards generates uncertainty due to information related to "best available" green technologies as well as industrial benchmarks. Assessments conducted by the regulatory agency, however, are mainly performance-based. To minimize the potential measurement bias, future research may consider combining various objective data on pollution emission with the one-time "performance assessment" data.

8. In terms of regulatory surveillance during the VEP implementation period, the provincial government did not specify the amount of monitoring and sanction in its policy guideline issued in 2009. The Cleaner Production Law specified that non-compliance of firms under coercive pressure to join the program could lead to a penalty up to 500,000 RMB. It was enforced, however, in only a few jurisdictions such as Dalian city and Jiangsu province to some extent.

9. Other variables, such as firms' ISO 14001 certification and connection to the global markets, might affect firms' implementation performance in a local VEP. It is, however, difficult for us to find solid data sources for these variables because some sampled firms are very small plants. Future research may consider controlling for these variables if relevant data sources are available.

10. Source: the Guangzhou Municipal Government: http://www.gz.gov.cn/gzgov/s2811/200804/160548.shtml, accessed on June 18, 2015.

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Figure 1. The timeline of policy transitions in the Cleaner Production Program

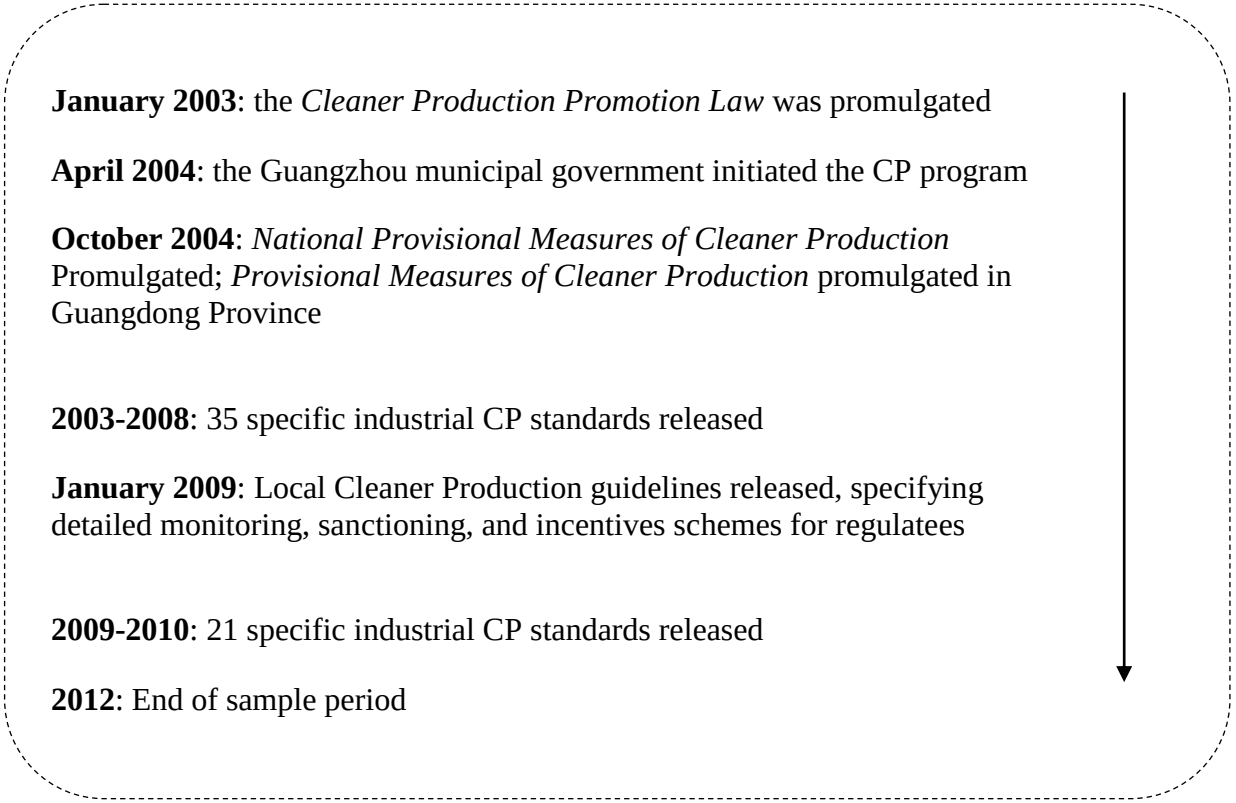

Figure 2. Conceptual framework for predicting corporate performance in VEP

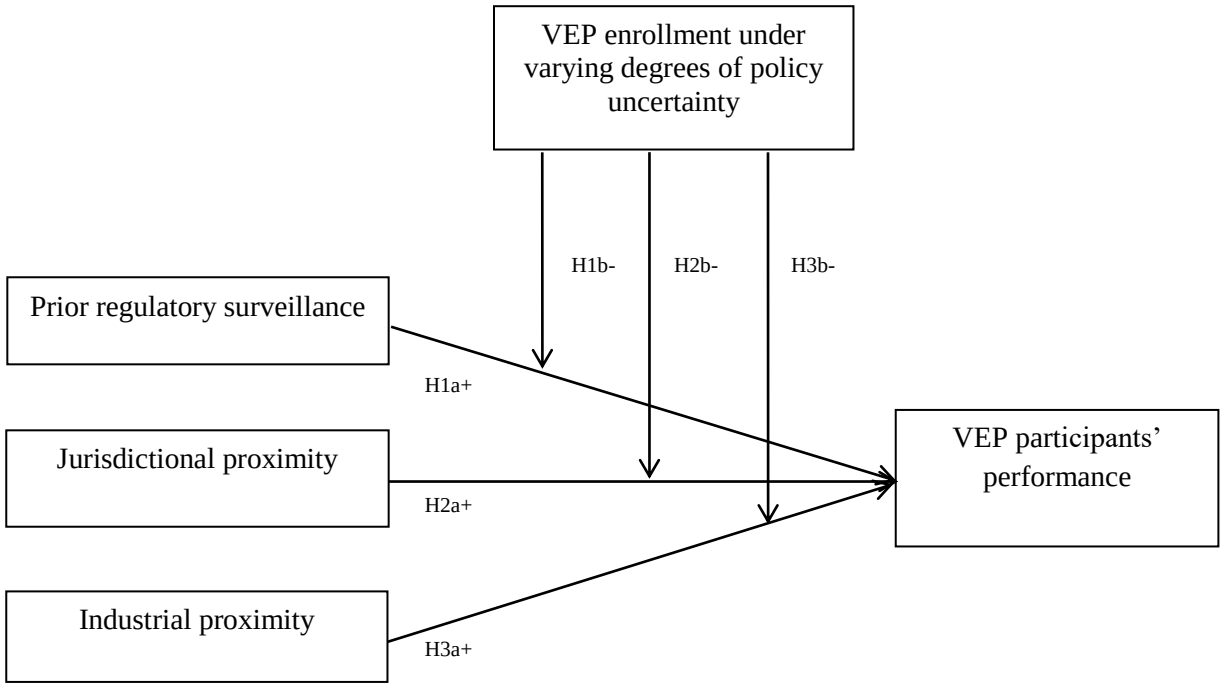

Table 1. Operationalization of degrees of policy uncertainty (high, moderate, and low) in the Cleaner Production Program

		Industrial standards	
		Enroll when industrial standard is absent	*Enroll when industrial standard is in place*
Local program guidelines	*Enroll before 2009 without local program guidelines*	**High** degrees of uncertainty	**Moderate** degrees of uncertainty
	Enroll after 2009 with local program guidelines	**Moderate** degrees of uncertainty	**Low** degrees of uncertainty

Table 2. Descriptive statistics and correlations

First-stage model	Mean	SD	1	2	3	4	5	6	7	8	9
1. VEP enrollment under varying degrees of policy uncertainty	2.21	.67									
2. Affiliated to industrial trade association	.53	.50	.15*								
3. Direct target pressure	.02	.04	.43*	.03							
4. Located in industrial zone	.54	.50	-.16*	-.15*	-.15*						
5. Mid-size	.40	.49	.01	-.05	-.01	-.09					
6. Large-size	.29	.45	.05	.19*	.02	.09	-.52*				
7. Listed firm	.22	.41	-.01	.09	-.11	.04	-.08	.22*			
8. Foreign-owned firm	.18	.39	-.11	-.17*	-.05	.12*	.03	.06	.00		
9. State-controlled joint venture	.19	.39	.11	.11	-.06	-.10	.03	-.01	-.03	-.23*	
10. State-owned firm	.19	.39	.24*	.15*	.34*	-.14*	.01	.10	.24*	-.23*	-.24*

* $p < 0.05$

Second-stage model	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Participants' performance in implementing the program	3.63	1.21											
2. Prior surveillance	3.56	12.6	-.01										
3. Jurisdictional proximity	.36	.27	-.33*	.07									
4. Industrial proximity	.16	.25	.19*	-.03	.32*								
5. Semi-government auditor	.37	.48	.20*	.08	-.10	-.08							
6. Located in industrial zone	.54	.50	.19*	-.05	-.05	.01	.03						
7. Mid-size	.40	.49	.04	-.02	-.01	-.11	-.01	-.09					
8. Large-size	.29	.45	.05	.06	-.05	.06	.12*	.09	-.52*				
9. Listed firm	.22	.41	.26*	.19*	-.04	.06	.17*	.04	-.08	.22*			
10. Foreign-owned firm	.18	.39	.04	-.11	.13*	.00	-.02	.12*	.03	.06	.00		
11. State-controlled joint venture	.19	.39	.12*	-.04	-.06	-.04	.08	-.10	.03	-.01	-.03	-.23*	
12. State-owned firm	.19	.39	-.15*	.31*	.02	-.08	.07	-.14*	.1	.10	.24*	-.23*	-.24*

* $p < 0.05$

Table 3. First-stage model: ordered logit estimates of VEP enrollment under policy uncertainty

Independent variables	VEP enrollment under policy uncertainty
Direct target pressure	31.40***
	(5.67)
Affiliated to industrial trade association	0.31
	(1.18)
Located in industrial zone	-0.22
	(-.87)
Mid-size	0.00
	(0.00)
Large-size	0.06
	(0.18)
Listed firm	0.06
	(0.20)
Foreign-owned firm	-0.105
	(-0.30)
State-controlled joint venture	0.678†
	(1.93)
State-owned firm	0.519
	(1.30)
Industry dummy	Included
Pseudo R-square	0.152
LR chi^2	88.84***

N = 296
z statistics in parentheses
† $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4. Second-stage model: ordered logit estimates of participants' performance

	Models					
	(i)[a]	(ii)[b]	(iii)	(iv)	(v)	(vi)
Located in industrial zone	-0.114	-0.114	-0.0889	-0.159	-0.125	-0.133
	(-0.44)	(-0.44)	(-0.34)	(-0.61)	(-0.48)	(-0.50)
Mid-size	0.582*	0.582*	0.650*	0.655*	0.602*	0.731*
	(2.01)	(2.01)	(2.24)	(2.26)	(2.07)	(2.49)
Large-size	0.494	0.494	0.548	0.477	0.562	0.569
	(1.46)	(1.46)	(1.61)	(1.39)	(1.64)	(1.64)
Listed firm	0.891**	0.891**	0.830**	1.002**	0.961**	0.985**
	(2.84)	(2.84)	(2.64)	(3.15)	(3.00)	(3.04)
Foreign-owned firm	0.119	0.119	0.172	-0.0438	0.104	-0.0191
	(0.35)	(0.35)	(0.51)	(-0.13)	(0.31)	(-0.06)
State-controlled joint venture	3.154***	3.154***	3.182***	3.119***	3.233***	3.233***
	(6.89)	(6.89)	(6.87)	(6.75)	(7.00)	(6.86)
State-owned firm	1.947***	1.947***	2.046***	1.866***	2.008***	2.100***
	(4.16)	(4.16)	(4.37)	(3.98)	(4.28)	(4.38)
Semi-government auditor	0.737**	0.737**	0.691**	0.677**	0.793**	0.703**
	(2.86)	(2.86)	(2.67)	(2.60)	(3.04)	(2.65)
Probability of VEP enrollment under high policy uncertainty	-3.072*	-16.14***	-6.416***	-8.596***	-1.057	-8.358**
	(-2.35)	(-9.37)	(-3.53)	(-3.79)	(-0.69)	(-3.13)
Probability of VEP enrollment under moderate policy uncertainty		-13.07***				
		(-6.44)				
Probability of VEP enrollment under low policy uncertainty	13.07***		10.83***	6.936**	14.62***	7.800**
	(6.44)		(4.89)	(2.70)	(6.63)	(2.81)
Prior surveillance	0.0279*	0.0279*	-0.232**	0.0336**	0.0222	-0.156
	(2.24)	(2.24)	(-2.69)	(2.67)	(1.77)	(-1.87)
Jurisdictional proximity	-2.291***	-2.291***	-2.437***	-10.10***	-2.393***	-9.811***
	(-4.33)	(-4.33)	(-4.54)	(-4.81)	(-4.48)	(-4.59)
Industrial proximity	2.585***	2.585***	2.575***	2.620***	9.872**	10.54**
	(4.44)	(4.44)	(4.43)	(4.38)	(2.82)	(2.81)
Prior surveillance × Probability of enrollment under high uncertainty			0.440**			0.317*
			(3.08)			(2.29)
Prior surveillance × Probability of enrollment under low uncertainty			0.575**			0.386†
			(2.61)			(1.87)
Jurisdictional proximity × Probability of enrollment under high uncertainty				12.24***		10.69**
				(3.40)		(2.89)
Jurisdictional proximity × Probability of enrollment under low uncertainty				17.50***		16.92***
				(3.87)		(3.68)
Industrial proximity × Probability of enrollment under high uncertainty					-29.47*	-26.01*
					(-2.30)	(-1.98)
Industrial proximity × Probability of enrollment under low uncertainty					-12.30†	-15.12*
					(-1.89)	(-2.13)
Industry dummy	Included	Included	Included	Included	Included	Included
Observations	296	296	296	296	296	296
Pseudo R-square	.30	.30	.309	.315	.304	.330
LR chi^2	261.85***	261.85***	272.23***	277.97***	268.21***	290.57***

z statistics in parentheses

† $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[a] Probability of enrollment under moderate degrees of policy uncertainty is set as the reference group.

[b] Probability of enrollment under low degrees of policy uncertainty is set as the reference group.