

# Government Engagement, Environmental Policy, and Environmental Performance: Evidence from the Most Polluting Chinese Listed Firms

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## ABSTRACT

This study empirically examines the implementation of environmental policies and how government engagement impacts on a firm's environmental performance based on a sample of Chinese listed firms in the eight most polluting industries over a 10-year period. The findings of the study demonstrate that government engagement, measured as ownership structure, is positively correlated with environmental performance, measured by environmental capital expenditure, for state-owned firms, but no significant relation is found for non-state-owned firms. In addition, non-state-owned firms are more likely to perform better in terms of environmental investment after the 2006 enactment of a new policy explicitly linking environmental issues with political incentives to regional governments. This study also reports that corporate environmental performance impairs firm value for state-owned firms but has no impact on firm value for non-state-owned firms, suggesting that investors negatively respond to environmental investments made by state-owned firms as a result of government engagement/political pressure. Copyright © 2013 John Wiley & Sons, Ltd and ERP Environment.

*Received 17 July 2012; revised 26 February 2013; accepted 11 March 2013*

**Keywords:** government engagement; political pressure; environmental policy; policy implementation; environmental performance

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## Introduction

**T**HIS STUDY EMPIRICALLY EXAMINES HOW GOVERNMENT ENGAGEMENT, REPRESENTED BY OWNERSHIP STRUCTURE, impacts the environmental performance, as measured by environmental capital expenditure, of firms in the eight most polluting industries in China over a 10-year period. We particularly examine the implementation of environmental policies and how policy enactment affects the corporate environmental behavior of firms. In addition, this study investigates whether environmental investments made by listed firms are recognized by market investors.

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Our research is motivated by a stream of previous studies focusing on stakeholder engagement and public policies relating to environmental issues (e.g. Delmas and Toffel, 2004; González-Benito and González-Benito, 2010; Gouldson and Sullivan, 2007) and exploring the effects of pressure from various stakeholders regarding environmental protection and the implementation of public policies. While business constantly interacts with various stakeholders and societal actors such as governments, civil society and organizations (Mathis, 2007), and all stakeholders jointly influence the environmental decisions and actions of firms, the government is considered the most important stakeholder in that public policies set by governments impose a tremendous amount of pressure on firms (Steurer, 2010; Delmas and Toffel, 2004; Delmas, 2002). However, these studies typically look at the developed world in which there exists a well-organized legal and political mechanism, while little, if any, attention has been paid to emerging markets. In these markets, policy implementation and legal enforcement are usually much weaker.

On the other hand, research on environmental performance is generally built around streams in which the predominant purposes underlying firms' environmental performance, the relation between environmental performance and economic performance, as well as between environmental performance and environmental disclosure, are examined. While previous studies offer various explanations as to why polluters might self-regulate and voluntarily improve their environmental performance, they report mixed results (Maxwell *et al.*, 2000; Johnston, 2005; Bui and Kapon, 2012). The failure to reach consensus in these studies may be due to the fact that multiple environmental impacts are used as proxies for environmental performance. As these measures are broad and indirect, they may not accurately measure environmental performance (Patten, 2005; Delmas and Blass, 2010). In addition, earlier studies, predominantly based on developed markets with better regulatory systems and enforcement mechanisms, have focused on the impact of regulatory factors on environmental performance (e.g. Johnston, 2005), but provide little evidence as to the effects of government engagement on corporate environmental behavior.<sup>1</sup> Following Patten (2005), we employ environmental capital expenditure as a direct measure to proxy environmental performance and explore whether government engagement plays a role in corporate environmental commitments in China.

While government engagement in environmental issues is still prevalent in many countries, the Chinese setting is particularly interesting for several reasons. First, the fact that corporations in China operate under political pressure imposed by various governmental bodies makes it a natural laboratory for researchers to directly investigate the role of government in corporate environmental issues. In China, different layers of government, especially regional governments, control almost all key production elements including capital, land, project authority, government subsidies, tax benefits and labor policy, which strongly affect corporate business activities and regional economic development. The two-tier ownership structure of Chinese firms, with a very high retained government concentration, offers a direct measure of government engagement.<sup>2</sup> Second, compared with developed economies, the mechanism of law enforcement in China is weak (Allen *et al.*, 2005). The practice of expending resources on restoring and protecting the environment (such as pollution abatement or control equipment) is not popular in China, possibly due to the political competition among regional government officials and the pursuit of a higher GDP growth rate (Li and Zhou, 2005). China's unique setting allows us to compare the effect of informal government engagement on corporate environmental performance with formal regulatory enforcement in a country with a weak legal enforcement mechanism. Finally, China is the world's largest emerging market and a key component of the global economy.<sup>3</sup> In view of China's influence on the global economy and environmental protection, understanding corporate environmental practices and the role of government in China is important for global ecosystem conservation groups, investors and corporate managers. Moreover, research based in a Chinese setting has theoretical and practical implications for making and implementing environmental policies in general and in emerging markets in particular because of China's central role in the developing world.

<sup>1</sup>It is not easy to directly measure government engagement, even in developed countries. Cho *et al.* (2006) use corporate political spending as a proxy to manage political pressure, which is also an indirect approach.

<sup>2</sup>According to our data, the largest shareholders on average are holding 40.3% of the voting rights (see column 2 of Table 1).

<sup>3</sup>As of the end of 2010, China's GDP amounted to USD5879.1 billion. In terms of GDP, China is now ranked the second largest economy, compared with the United States' GDP of USD14,657.8 billion and Japan's GDP of USD5461.2 billion.

Based on a sample of Chinese listed firms in the eight most polluting industries<sup>4</sup> from 2001 to 2010, we show that government engagement, measured by ownership structure, improves corporate environmental performance, measured by firms' environmental capital expenditure. Specifically, ownership concentration for state-owned firms is positively associated with environmental performance. However, we do not find a significant relation between ownership concentration and environmental performance for non-state-owned firms. Our findings also indicate that a new policy enacted in 2006 explicitly linking environmental issues with political incentives to regional governments resulted in non-state-owned firms making greater investments in the environment. Prior to that, these firms experienced less direct governmental pressure. However, for state-owned firms, no significant difference in environmental capital expenditure is found before or after 2006. Finally, we document that a firm's environmental performance impairs firm value for state-owned firms, but has no influence on firm value for non-state-owned firms, suggesting that investors respond negatively to capital expenditures on the environment resulting from political pressure.

Our investigation contributes to the existing literature in the following ways. First, a growing number of existing studies have examined relations between public policy pressure and corporate environmental behavior (Gouldson and Sullivan, 2007; Mathis, 2007; Steurer *et al.* 2012) in developed economies with organized political, legal and economic systems. By directly examining the role of government engagement in shaping corporate environmental performance in China, this study extends the current literature and provides additional evidence on corporate environmental issues in emerging markets where environmental protection and the legal/regulatory enforcement mechanism are much weaker than those of developed economies. In particular, we provide evidence to prove how useful/attractive economic/political incentives are in implementing public policies in an emerging market. Second, we add to the limited number of studies using environmental capital expenditure as a more accurate and direct measure of environmental performance, in support of arguments in Patten (2005). Finally, our study reduces the sample selection/size bias which exists in previous studies (Bui and Kapon, 2012); our results are more robust as our sample includes observations across the eight most polluting industries in China<sup>5</sup> over a 10-year period.

The remainder of this study is organized as follows. The next section gives a review of the relevant literature and identifies our research questions. The third section describes China's institutional background and develops our hypotheses. The fourth section discusses data gathering and methodology. The fifth section presents and explains empirical results, and the sixth section specifies the implications of government engagement on environmental policy implementation. Finally, the last section concludes the study.

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## Literature Review

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Previous studies on environmental issues have typically been grounded in theories such as political economy (Maxwell *et al.*, 2000), legitimacy (Lindblom, 1994), stakeholder perspective (Henriques and Sadorsky, 1999; Delmas and Toffel, 2004), resource-based views (Russo and Fouts, 1997) and shareholder perspective (Levy, 1995).

Researchers emphasizing corporate environmental performance and voluntary environmental programs (VEP) and their determinants, consequences and relationship offer various explanations as to why polluters might self-regulate and voluntarily improve environmental performance (Maxwell *et al.*, 2000; Johnston, 2005; Bui and Kapon, 2012). For example, Bui and Kapon (2012) use the intention behind a firm's participation to explain why a firm would self-regulate and voluntarily participate in environmental programs. However, there are a number of factors in the relationship between companies and society underlying a firm's environmental strategies and decisions which help to explain why companies would behave in socially responsible ways. These studies identify regulatory compliance, competitive advantage, stakeholder pressure, ethical concerns, critical events and top management

<sup>4</sup>The polluting industries include: mining, textiles and clothing, metal and non-metal, biomedicine, petrochemicals, food and beverage, water-electricity-gas and pulp-paper-printing.

<sup>5</sup>Bui and Kapon (2012) summarize that weak identification strategies, sample selection bias, measurement error and variation in measured outcomes give conflicting evidence about voluntary environmental programs in the existing literature.

initiatives as motivations for corporate environmental initiatives (Paulraj, 2009; Fraj-Andrés *et al.*, 2009). Fraj-Andrés *et al.* (2009) reveal that competitive motivations and management commitments are the most important factors explaining why firms incorporate environmental issues into their strategic planning process. Ross and Wood (2008) found that regulations and stakeholder opinions are among the most important environmental controls (namely mandatory disclosure, regulations, subsidies and stakeholder opinion) perceived by Australian capital investment managers. Considering the two extreme positions of environmental reactivity and environmental proactivity by firms found in prior studies, stakeholder pressure is indicated as important in encouraging the development of proactive environmental strategies (González-Benito and González-Benito, 2010).

In fact, many researchers hold that the determining factor is the pressure exerted by different company stakeholders (Sá de Abreu, 2009). These studies provide insight into how stakeholders influence firms' environmental commitments; some further argue that governments are the most important stakeholders in terms of exerting pressure on firms, thus shaping their environmental behavior. Delmas and Toffel (2004) propose that stakeholders (including governments, regulators, customers, competitors, community and environmental interest groups and industry associations) impose coercive and normative pressure on firms in terms of environmental practices and suggest a variety of company factors to explain how managers perceive and act upon these pressures. This research refers to political pressure as the level of political support for broader or more stringent regulations. The pressure of such regulations represents the extent to which regulators threaten to or actually impede firms' operations based on their environmental performance. By investigating the effects of six relevant variables on stakeholders, González-Benito and González-Benito (2010) reveal two dimensions of stakeholder pressure: governmental and non-governmental. Tilt (1997) found that among various stakeholder groups influencing firms' environmental performance in Australia, government has the strongest influence with the 'public' ranked second. Delmas (2002) also found that governments play an important role in firms' decisions to adopt ISO 14001. It is thus clear that the most influential stakeholders exerting pressure on firms' environmental commitments are various governmental bodies.

On the other hand, governments are engaged in public policy-making, and making public policies related to corporate social responsibility is an important part of comprehensive governance for sustainable development. Steurer *et al.* (2012) argue that western European (particularly Anglo-Saxon and Scandinavian) governments are significantly more active in promoting CSR than governments in eastern European countries. These findings mirror the differences regarding the popularity of CSR as a management approach in Europe. Firms adopt heterogeneous sets of environmental management practices because they interpret political pressure differently in making public policy commitments (Mathis, 2007). In terms of policy implementation, it is crucial that policy makers deliberate methods that facilitate policy enforcement. Tracing the links between public policies and environmental performance using information in corporate reports and in pollutant releases and transfer registers, Gouldson and Sullivan (2007) found that corporate reports are of very limited value, and that a significant body of useful information is provided by public registers. This research represents a significant challenge to current conceptions of social responsibility and is therefore likely to lead to pressure on companies to have clearer policy statements and stronger and more transparent processes for the delivery of policy commitments. Moreover, Mathis (2007) argues that communication is of central importance to businesses and public authorities in climbing the sustainability ladder, and also indicates that various firms have the ability to lobby policy makers relating to environmental issues. This paper provides a perspective that proactively socially responsible companies are better positioned in their sectors, especially when interacting with public authorities, and that such companies are better able to influence the policy-making process compared with their competitors. Taking Brazil as an example, Sá de Abreu (2009) argues that continual efforts to work with government and society are crucial to persuading businesses to become better engaged in sustainability practices in developing countries as environmental regulations and enforcement, environmental risk and demands from stakeholders are central issues in increasing corporate commitment to the natural environment. Therefore, when policies are designed, all these factors should be properly considered.

There is another group of studies focusing on the association between environmental performance and financial/market performance. These studies generally compare financial performance with environmental performance over time, or analyze the effect of environmental performance on the market value of a firm through an event study. For example, Clarkson *et al.* (2011) show that positive (negative) changes in a firm's financial

resources in previous periods are followed by significant improvements (declines) in the firm's relative environmental performance in subsequent periods. In terms of the relation between environmental and economic performance (also referring to the relation between environmental performance and disclosure), researchers report mixed results (Russo and Fouts, 1997; Wagner and Schaltegger, 2004; Johnston, 2005) because too many economic impacts on the environment are used as measures of environmental performance. Results of event studies (Klassen and McLaughlin, 1996; Jones and Rubin, 2001) illustrate that the market reacts to discrete environmental events. Johnston (2005), using environmental capital expenditures as a proxy for environmental performance, finds that regulatory environmental capital expenditures and voluntary environmental capital expenditures have different firm-specific economic consequences.

There are limitations to the literature mentioned above. Although a few studies leverage institutional theory and address concerns about environmental issues in developing economies, most emphasize the theoretical aspects (See, 2009), with limited empirical evidence provided for reference (Sá de Abreu, 2009; Özen and Küskü, 2009; Roxas and Coetzer, 2012). In fact, institutional forces are important elements to address in terms of pressure imposed by environmental regulations/policies on firms. Given the well-organized enforcement mechanisms in developed economies, with strict laws and fair administration of justice, a solid foundation exists for economic prosperity and social stability. Li and Reuveny (2006) argue theoretically that democracy positively affects environmental quality. In such an institution, Cordano *et al.* (2010) found that strong norms positively influence the adoption of environmental management programs, thus fostering the implementation of sound environmental practices. However, in emerging economies where institutions, policy making/implementation, capital markets and law enforcement mechanisms lag behind those of developed economies, a thorough set of rules/policies might exist, but with a weak enforcement mechanism they are unlikely to be implemented satisfactorily. On the other hand, even in Western economies, the small and medium enterprise sector is often described as 'hard to reach' and lagging behind in terms of 'green business' due to resource poverty and a lack of management capability (Cassells and Lewis, 2011). See (2009) suggests that social, institutional, economic, personal, strategic and reactive drivers, as well as the existence of a variety of formal and informal institutional structures,<sup>6</sup> should be taken as determinants in the adoption of corporate social responsibility. Thus, the environmental practices of firms are shaped differently.

Inconsistent results in previous studies have led to concerns regarding the measures of environmental performance used (Johnston, 2005; Patten, 2005). These measures include recycled hazardous waste, toxic releases, polluted discharged water, non-compliance with environmental statutes and firms' environmental ratings, as well as structural and functional initiatives taken to minimize environmental impacts (Xie and Hayase, 2007). These measures are criticized as being too broad to accurately measure environmental performance. There are trade-offs associated with the metrics and methodology used in socially responsible investing as well. For example, company ratings vary significantly depending on whether the screening is based on toxic releases and regulatory compliance or on the quality of environmental policy and disclosure (Delmas and Blass, 2010). Taken together, the use of these measures might restrict the scope of the multidimensional concepts to only one aspect, but it is important to examine multiple categories instead of simply showing differences across one measure of environmental performance (Walker and Wan, 2011). Although no universal indicator is used to calculate firms' environmental impacts, environmental capital expenditure may be a more accurate measure of environmental performance, since stringent environmental laws and regulations in many countries compel firms to increase their capital spending and operating costs for activities related to environmental protection (Adams and Kuasirikun, 2000). Patten (2005) found that actual spending on the environment (used as a performance measure) was lower than the projected amount, suggesting that the projections may be more misleading than meaningful. In addition, due to unavailability of data, sample sizes in previous studies are unusually small with severe data limitations and obvious sample selection bias, thus leading to an apparent disparity in results (Patten, 2002; Bui and Kapon, 2012).

This paper attempts to address some of the limitations of previous studies by integrating factors facing firms in China, so as to provide evidence applicable to emerging economies. Our focus is on China, the biggest emerging market in the world with a weak legal/regulatory implementation/enforcement mechanism. We study how environmental commitments are conducted and delivered by firms and how governmental engagement impacts firms'

<sup>6</sup>Even in developed economies in which the role of monitoring and enforcement (formal regulation) is a key determinant of environmental performance, informal regulation (e.g. the role of communities and capital markets) also exerts a crucial influence (Mamingi *et al.* 2006).



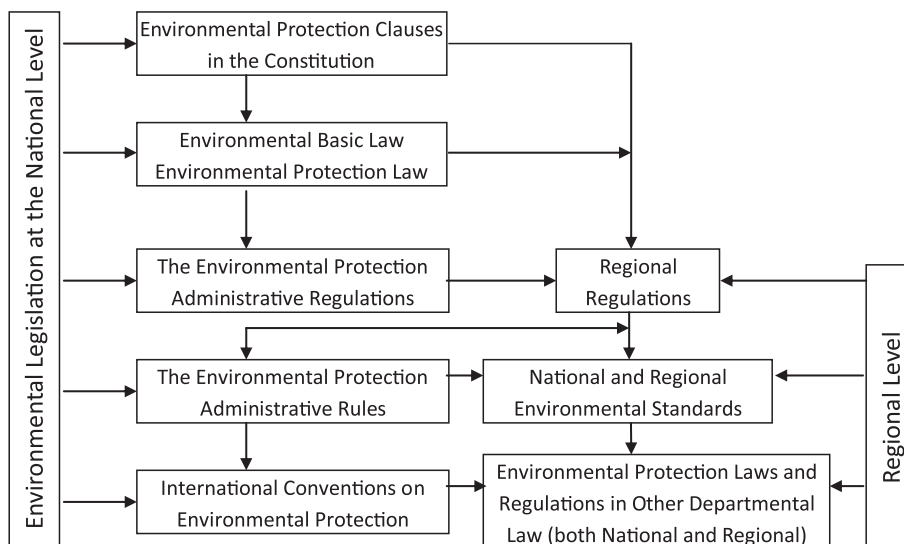
environmental performance when the legal/regulatory enforcement mechanism is weak. In addition, we address issues that public policy makers should consider in light of the reality of policy implementation in China.

## Institutional Background and Hypothesis Development

### Institutional Background

China's rapid economic growth of the past three decades is a result of market transition reform. Qian (2000) describes the path of market transition as government reform through regional decentralization, the entry and expansion of non-state-owned enterprises, financial stability through 'financial dualism' and a dual-track approach to market liberalization. These reforms shift economic management from central government, traditionally in charge of planning and coordination, to regional governments (Qian and Xu, 1993). Hence, regional governments are responsible for key production elements such as capital, land, project authority, government subsidies, tax benefit and labor policy. Furthermore, China's political system remains a highly centralized structure in which the Central Committee of the Chinese Communist Party (CCP) and the central government ultimately control the mobility of government officials within the system (Li and Zhou, 2005), in effect controlling regional governments. Taken together, central and regional governments have tremendous influence on economic development and corporate business strategies in China. Government engagement is the key institutional characteristic in Chinese economic and social life. It is not surprising that the majority of listed firms in China are controlled by the government and therefore subject to political pressure (Li and Zhang, 2010).

In China, environmental hazards are already at a critical level, and, to a certain extent, the situation is deteriorating. Associated with explosive growth are scars left across China's landscape. The cost of the country's rapid development includes severe pollution and environmental degradation. Attempts are being made to remedy the pollution hazard in China and to improve the environment. As part of this process, China essentially began to create a new legal system in 1979 to replace the system that had been entirely dismantled over the previous few decades. A trial version of the Environmental Protection Law of the People's Republic of China was instituted in 1979 and formally implemented in 1989. The Chinese government addressed concerns about the deteriorating environment and issued a number of laws, regulations and practice guidelines in an attempt to protect the environment, using international conventions and examples from other countries' legislation as references. Currently, environmental protection within China's legal system comprises the following three parts: laws, administrative regulations/rules and departmental rules at the national and regional level. Figure 1 depicts the hierarchy of China's environmental legislation



**Figure 1.** The hierarchy of China's environmental legislation system

system. China's State Environmental Protection Administration (SEPA) is the main regulator governing policy-making and program implementation. In addition, concerned citizens and groups exert pressure on polluting companies, filing lawsuits, organizing protests, exposing polluters on the internet and lobbying officials. As current and future bureaucrats are now required to take action, steps toward environmental renovation have accelerated. Promoting 'Green GDP' has become the tagline of China's sustainable development.

However, for China, the challenges of using the legal system to protect the environment are formidable. Unlike developed economies, with strong enforcement mechanisms and long histories and culture of using laws and courts, Chinese environmental laws often lack effective enforcement provisions. As noted in Li and Zhou (2005), the mobility of local government officials is ultimately in the hands of the central government, and the economic performance of provincial leaders is a crucial indicator in personnel performance evaluations. To win in the political game, local officials must attain a higher economic ranking than their peers. As such, regional governments and officials may subvert environmental law for local economic and political considerations. Moreover, China's environmental laws are general and often intentionally ambiguous, allowing the State Council, national agencies and local governments to add details that influence implementation (Ma and Ortolano, 2000). Given this unique institutional background, the role of China's State Environmental Protection Administration (SEPA) in the day-to-day implementation of environmental regulations/policies is limited despite its key role in designing pollution control policies and programs. Given this weak enforcement mechanism, it is not unexpected that even companies operating in polluting industries, where environmental regulations are already in place, are likely to avoid environmental commitments with a resulting diminution in the implementation of environmental rules.

To summarize, the following institutional features of the Chinese setting are important for this study. First, government engagement is a crucial element of China's economic system. This has a considerable impact on corporate decisions related to the environment and imposes political pressure on firms. Second, the central government's attempts to take action toward protecting and restoring the environment, demolished as a result of the rapid economic growth, has led to great pressure on regional governments' environmental behaviors. Third, the pursuit of rapid GDP growth by regional governments and officials in order to win the political game leads to ineffective enforcement of environmental laws/policies set by the central government to a certain extent. Thus, we can presuppose that when the central government explicitly links environmental issues to political incentives to regional governments/officials there will be a changing attitude by regional officials regarding environmental restoration and protection and in turn a change in firms' responses to environmental issues.

## Hypothesis Development

Due to the incentives for pursuing higher economic growth in China, regional government officials approach environmental actions taken by state-owned firms and non-state-owned firms differently. Allen *et al.* (2005) argue that economic growth in China between the private sector, with fewer legal and financial control mechanisms, and the public sector are unbalanced and that the private sector dominates state-owned and listed firms in terms of both size of industrial output and growth trend. In achieving a higher GDP target, non-state-owned firms contribute more to regional development than state-owned firms. As such, regional governments are less likely to require non-state-owned firms to maintain a high level of environmental performance as it would probably lessen their investments and financial performance.

Nevertheless, regional governments also face high pressure from central government in terms of environmental commitments. Achieving a higher GDP growth rate is only one of the factors necessary to win the political game. To guarantee victory, regional officials must implement public policies that satisfy minimum requirements of the central government. These policies include regulations and rules set by the central government on environmental protection and restoration. In addition, as opposed to non-state-owned firms, state-owned firms have long been in a position of executing government policies on the ground. Bearing social and political responsibility, e.g. being committed to environmental protection, is a requirement for those firms backed by the government. Their commitment to environmental protection is most likely due to political pressure imposed by regional governments. Furthermore, the concentration of government ownership in state-owned firms suggests a high level of government engagement, which creates incentives for top management to achieve non-financial objectives related to the implementation of government policies (See, 2009). Therefore, it is easier for regional governments to exert pressure on state-owned firms to make environmental

investments even though these environmental commitments may harm the wealth of minority shareholders. Thus, we propose our first hypothesis:

*H1: State-owned firms are more likely to invest and invest more in the environment than non-state-owned firms.*

In order to directly examine the impact of government engagement on corporate environmental behavior, we further investigate the relation between ownership structure and corporate environmental capital expenditure. Among prior studies focusing on developed countries, Johnson and Greening (1999) argue that a less concentrated ownership structure heightens pressure on management to improve corporate social performance or to disclose socially responsible activities. However, the academic literature on emerging markets finds that the type of ownership structure has a differing impact on corporate social behavior. Li and Zhang (2010) argue that a highly concentrated ownership structure indicates a high level of political pressure toward CSR for state-owned firms, but a severe type II agency problem harms corporate social performance for non-state-owned firms in China. Following Li and Zhang (2010), we propose the following hypothesis:

*H1a: For state-owned firms, corporate ownership concentration is positively related to investment in the environment.*

*H1b: For non-state-owned firms, corporate ownership concentration is negatively related to investment in the environment.*

To avoid the problem of endogeneity, we attempt to examine the impact of exogenous events on corporate environmental performance. The fact that the central government includes regional energy consumption data (referring to environmental performance) as a key indicator in the evaluation of regional officials' economic/political performance provides such an opportunity. In 2005, the China National Development and Reform Commission, the State Energy Office and the National Bureau of Statistics of China jointly set a plan to establish an Energy Efficiency Public Announcement System,<sup>7</sup> effective from 2006, with the aim of reducing energy intensity (the amount of primary energy consumed per unit of GDP produced). Publicized energy consumption data are included as a measure of the comprehensive performance assessment scheme for regional officials. Thus, 2006 signifies a shift by regional governments and officials toward a commitment to the environment.

As discussed in Hypothesis 1, state-owned firms are under greater political pressure from regional governments than are non-state-owned firms in terms of environmental obligations. Therefore, these firms are in a position of making environmental investments for the purpose of fulfilling regional governments' environmental requirements. When the new Energy Efficiency Public Announcement System became effective in 2006, regional governments unsurprisingly began to impose more pressure on non-state-owned firms regarding environmental issues, leading to a corresponding increase in environmental investment by these firms. Accordingly, we envisage corporate environmental capital expenditures to increase substantially from 2006 for non-state-owned firms, due to this new policy of linking environmental issues with economic/political incentives of regional governments, but expect no significant change for state-owned firms. Accordingly, we propose our second hypothesis below:

*H2a: State-owned firms are not likely to invest more in the environment after 2006.*

*H2b: Non-state-owned firms are likely to invest more in the environment after 2006.*

As is known in the accounting literature, there are limitations associated with the use of some financial ratios [such as return on assets (ROA) and return on equity (ROE)] measuring financial performance, as ratio analysis is retrospective and based on accounting rather than economic data. However, Tobin's *Q* is a statistic that proxies for a firm's value from the investor's perspective. If a firm's concern for the environment is recognized by the market, there will be a positive association between Tobin's *Q* and the firm's environmental actions. Therefore,

<sup>7</sup>According to the Chinese State Council's 'Energy Efficiency Management Ordinance', each June the China National Development and Reform Commission, the State Energy Office and the National Bureau of Statistics of China jointly publicize energy consumption data for each area (province, city, county, etc.), including energy consumption on GDP output, percentage of decreasing energy consumption on GDP output, etc.



Tobin's  $Q$  is widely used in empirical studies on the relation between environmental and financial performance (Busch and Hoffmann, 2011; Konar and Cohen, 2001).

In a corporation in which the government is the biggest shareholder, it is believed that management will take action in favor of government interests that go against the corporate goal of value maximization. As environmental commitments made by state-owned firms in China are mainly a result of government engagement/political pressure, they are deemed to conflict with minority shareholder interests. In other words, environmental commitments made by state-owned firms reflect the needs and expectations of the state. As the costs and responsibilities are borne by all of the shareholders, the threat to the controlling shareholders of state-owned firms is less. The incentive of protecting government interests leads to embezzlement of the wealth of minority shareholders as a way of investing firm resources in the environment. Thus, we assume that state-owned firms' environmental capital expenditures are not recognized by the market and not reflected in their economic performance.

On the other hand, non-state-owned firms are deemed to take action to maximize value to controlling shareholders. When environmental investments are made, non-state-owned firms are more likely to act strategically. This is to say that management analyzes the costs and benefits of such investments to ensure that the firms' economic interests are not harmed. However, it is unclear whether the benefit of environmental investment to these firms is big enough to cover initial costs and whether the market will recognize such investments.

Thus, we develop hypothesis 3 as follows:

H3a: *for state-owned firms, Tobin's  $Q$  is negatively associated with environmental capital expenditure.*

H3b: *for non-state-owned firms, Tobin's  $Q$  is not significantly associated with environmental capital expenditure.*

## Research Methodology

### Data and Sample

The sample for this study consists of Chinese A share firms in the eight most polluting industries, including mining, textiles and clothing, metal and non-metal, biomedicine, petrochemical, food and beverage, water–electricity–gas and pulp–paper–printing, listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange from 2001 to 2010. We manually collected data on corporate environmental capital expenditures, such as investments in pollution abatement and control, energy savings, etc., from firms' annual reports, and obtained a total of 5418 firm-year observations for primary tests after eliminating missing data for control variables. Data sources include two datasets available to Chinese accounting and financial researchers: the CSMAR database and the CCER database. Ownership structure data were collected from the CCER database and financial data from the CSMAR database. To mitigate the influence of outliers, we winsorize each continuous variable in the top and bottom 1 percentile of their distributions.

### Multivariate Analysis

We propose the following structural equations as empirical models to test our hypotheses. To test H1, H1a and H1b, we employ the Logit model and the Tobit model (see Equation 1 below), after controlling for factors affecting firms' environmental commitments.

$$\frac{ENV_{DUM}}{ENV_{INV}} = \beta_0 + \beta_1 TOP1 + \beta_1 STATE + \beta_2 Year2006 + \beta_3 DR + \beta_4 ROA + \beta_5 SGROW + \beta_6 size + \beta_7 MKTB + \beta_8 Year + \beta_9 Industry \quad (1)$$

Variables included in these models are defined below. As environmental performance measures in previous research have been criticized as being inaccurate and indirect (Patten, 2005), we employ firms' actual capital

expenditures on the environment as a direct measure to examine the level of environmental action taken by companies.  $ENV_{DUM}$  is a dummy variable with a value of 1 for companies making environmental capital expenditures and 0 otherwise.  $ENV_{INV}$  is a continuous variable measured as firms' environmental capital expenditures divided by total assets. To examine how government engagement, represented by ownership structure and concentration, affects levels of environmental commitments by firms, we introduce variables  $TOP1$  and  $STATE$ , where  $TOP1$  represents the shareholding percentage of the largest shareholder and  $STATE$  is a dummy variable with a value of 1 for companies whose controlling shareholder is the state and 0 otherwise.

As mentioned previously, the year 2006 signifies a change in attitude by regional government officials as a result of the enactment of a new policy linking improvement in energy efficiency in a region with economic/political incentives to regional officials. With more pressure imposed by regional governments on non-state-owned firms, environmental capital expenditures made by these firms are expected to increase substantially after 2006. Several studies (Foulon *et al.*, 2002; Laplante and Rilstone, 1996) demonstrate that official regulatory pressure significantly impacts environmental performance and an increase in regulatory scrutiny is likely to improve a firm's environmental performance, thereby leading to pollution reduction. In keeping with this logic, we introduce variable  $YEAR2006$  in the model to test  $H2$ .

In order to ensure that the results are not driven by firm heterogeneity, we add control variables describing firm characteristics into our models. For example, Russo and Fouts (1997) show a positive relationship between a firm's financial and environmental performance. Hence, we use return on assets (ROA) scaled by net income to control the effect of financial resources on corporate environmental investments. We control for firm leverage (DR, representing a firm's debt ratio), capturing not only the impact of risks faced by a firm but also the influence of creditors on corporate environmental capital expenditures. DR is equal to a firm's total debt divided by its total assets at the end of the year. We include firms' market-to-book ratio (MKTB) in the regression models as a proxy to capture future growth opportunities (Gaver and Gaver, 1993). MKTB equals market value divided by shareholder equity. A firm's sales variance is also taken into account when examining growth.  $SGROW$  represents sales growth, measured as annual change in sales revenue and scaled by lagged sales. These two variables are included in the above regression equation as proxies for intangible assets (Porter and van der Linde, 1995). We expect that these two variables are positively related to firms' environmental capital expenditures. Larger firms tend to be more exposed to political attacks and thus have a stronger motivation to improve their corporate reporting. In addition, public visibility of large firms is generally expected to be higher; thus, these firms are more likely to be exposed to greater public scrutiny (Watts and Zimmerman, 1978). To apply the rationale that larger firms have a greater incentive for commitment to the environment in order to minimize possible political costs, we use firms' total assets as a control variable for firm size in the regression equations.  $SIZE$  is the logit form of firms' total assets. Finally, we control year dummies to capture the macroeconomic factors that may affect corporate environmental capital expenditure and introduce industry dummies to control industrial effects in the models.

To test  $H3$ , we employ the following model (see Equation 2), where  $TOBINSQ$  is the market value plus book value of debts divided by total assets, representing firms' economic performance. Other variables in the following models are similar to those in model (1). All the  $t$ -values in the regressions are based on robust standard errors clustered at the firm level to diminish the potential heteroscedasticity and firm level correlation across years (Petersen, 2009):

$$TOBINSQ_i = \beta_0 + \beta_1 \frac{ENV_{DUM}}{ENV_{INV}} + \beta_2 DR + \beta_3 ROA + \beta_4 SGROW + \beta_5 size + \beta_6 MKTB + \beta_7 Year + \beta_8 Industry \quad (2)$$

## Empirical Results

### Descriptive Statistics and Variable Correlations

Table 1 provides descriptive statistics of variables and the comparison between characteristics of state-owned and non-state-owned firms with two sample  $t$ -tests for differences across the two sub-samples. The mean of variable  $STATE$  is 0.673, meaning that of the 5418 firm-year observations, 67.30% are state-owned firms. This indicates that

Variables	Mean	Median	SD	SOEs	Non-SOEs	Diff.
ENV <sub>DUM</sub>	0.238	0	0.426	0.276	0.161	0.115***
ENV <sub>INV</sub>	0.002	0	0.007	0.002	0.001	0.001***
TOBINSQ	1.687	1.282	1.257	1.521	2.03	-0.509***
TOP1	0.403	0.391	0.167	0.436	0.333	0.103***
STATE	0.673	1	0.469			
YEAR2006	0.572	1	0.495	0.513	0.695	-0.182***
DR	0.510	0.501	0.243	0.507	0.517	-0.01
ROA	0.032	0.032	0.081	0.03	0.036	-0.006**
SGROW	0.205	0.151	0.452	0.202	0.209	-0.007
SIZE	21.449	21.282	1.195	21.642	21.052	0.59***
MKTB	4.188	2.814	8.458	3.841	4.902	-1.061***

**Table 1.** Descriptive statistics of variables

ENV<sub>DUM</sub>, a dummy variable with a value of 1 for companies making environmental capital expenditure and 0 otherwise; ENV<sub>INV</sub>, environmental capital expenditure divided by total assets of the year; TOBINSQ, sum of market value and book value of debts divided by total assets; TOP1, shareholding of the largest shareholder; STATE, dummy variable with a value of 1 for companies whose controlling shareholder is the state and 0 otherwise; DR, total debt divided by total assets at the end of the year; ROA, net income divided by total assets; SGROW, sales growth, measured as annual change in sales revenue, scaled by lagged sales; SIZE, log form of total assets; MKTB, market-to-book ratio, equal to the market value divided by shareholder equity; SD, standard deviation; SOE, state-owned enterprise.

the majority of firms in the eight most polluting industries in China are controlled by the state. The coefficient of variable TOP1 for state-owned firms (0.436) is higher than that of non-state-owned firms (0.333), meaning that state-owned firms have a higher level of ownership concentration. Coefficients of both the environmental capital expenditure dummy (ENV<sub>DUM</sub>) and the continuous variable (ENV<sub>INV</sub>) for state-owned firms (0.276/0.002) are much larger than those of non-state-owned firms (0.161/0.001), demonstrating that not only are state-owned firms more likely to invest but also to invest more in the environment than non-state-owned firms. This is consistent with our prediction and primarily supports H1. In addition, the coefficient of SIZE variable for state-owned firms is larger than that for non-state-owned firms. Variables MKTB (market-to-book ratio) and TOBINSQ for state-owned firms are smaller than those for non-state-owned firms, meaning that the economic performance of state-owned firms is lower. In general, descriptive statistics demonstrate that state-owned firms make more environmental investments, are more highly concentrated, perform worse, have larger size and have fewer future growth opportunities.

Table 2 presents Pearson correlations for the main variables in our models. There are significant correlations among dependent variables (that is the environmental capital expenditure dummy ENV<sub>DUM</sub> and the continuous variable ENV<sub>INV</sub> in the two equations, respectively) and the independent variables. The environmental capital expenditure dummy (ENV<sub>DUM</sub>) and the continuous variable (ENV<sub>INV</sub>) are positively related with each other and also positively related with variables of ownership concentration (TOP1), ownership type (STATE), debt ratio (DR), return on total assets (ROA), sales growth (SGROW), firm size (SIZE) and YEAR2006. However, negative associations are found between both ENV<sub>DUM</sub> and the continuous variable ENV<sub>INV</sub> and the two variables market value (TOBINSQ) and market-to-book ratio (MKTB). These are consistent with the literature and partially support H3 that Tobin's Q is negatively associated with environmental capital expenditures for state-owned firms.

## Regression Results

Statistical results of the two models that we construct to test our hypotheses are depicted in Tables 3 and 4, respectively. Hypothesis 1 predicts that government engagement, by means of state ownership concentration, is the main factor driving firms' corporate environmental capital expenditures. Hypothesis 2 predicts that the new policy launched in 2006 will lead to a change in environmental commitments for non-state-owned firms. Hypothesis 3 predicts that the economic consequence for state-owned firms is negatively correlated with corporate environmental capital expenditures because the value of such investments is not recognized by investors.

	ENV <sub>DUM</sub>	ENV <sub>INV</sub>	TOBINSQ	TOP1	STATE	YEAR2006	DR	ROA	SGROW	SIZE	MKTB
ENV <sub>DUM</sub>	1										
ENV <sub>INV</sub>	0.461***	1									
TOBINSQ	-0.064***	-0.037***	1								
TOP1	0.094***	0.045***	-0.201***	1							
STATE	0.127***	0.064***	-0.190***	0.291***	1						
YEAR2006	0.066***	0.043***	0.309***	-0.237***	-0.173***	1					
DR	0.038***	0.022	0.046***	-0.130***	-0.018	0.101***	1				
ROA	0.041***	0.044***	0.149***	0.125***	-0.034**	0.092***	-0.413***	1			
SGROW	0.039***	0.032**	-0.010	0.098***	-0.007	-0.013	-0.010	0.280***	1		
SIZE	0.183***	0.099***	-0.280***	0.259***	0.232***	0.157***	0.018	0.210***	0.117	1	
MKTB	-0.006	-0.007	0.274***	-0.051***	-0.059***	0.118***	-0.001	0.040**	0.020	-0.130***	1

**Table 2.** Variable correlations

Variable definitions are given in Table 1.

\*\*\*, \*\*and \*denote significance at the 1, 5 and 10% level, respectively.

Variables	ENV <sub>DUM</sub> (Logit model)			ENV <sub>INV</sub> (Tobit model)		
	Full sample	SOEs	Non-SOEs	Full sample	SOEs	Non-SOEs
TOP1	0.674* (1.78)	1.048** (2.36)	-0.432 (-0.64)	0.005** (2.18)	0.008*** (3.27)	-0.006 (-1.17)
STATE	0.592*** (4.65)			0.005*** (6.40)		
YEAR2006	0.176 (1.04)	0.107 (0.53)	1.260** (1.96)	0.003 (1.60)	0.001 (0.83)	0.014** (2.41)
DR	0.339 (1.60)	0.421 (1.34)	0.412 (1.34)	0.003 (1.58)	0.003 (1.52)	0.004 (1.39)
ROA	0.877 (1.50)	1.549* (1.91)	-0.473 (-0.52)	0.013** (2.50)	0.022*** (3.26)	-0.003 (-0.36)
SGROW	0.094 (1.19)	0.134 (1.16)	-0.005 (-0.04)	0.001 (1.34)	0.001 (1.42)	-0.000 (-0.01)
SIZE	0.218*** (3.90)	0.136** (2.07)	0.429*** (4.37)	0.002*** (5.14)	0.001** (2.08)	0.004*** (5.33)
MKTB	0.002 (0.43)	-0.006 (-0.80)	0.008 (1.59)	0.000 (0.14)	-0.000 (-1.46)	0.000 (1.43)
Year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Industry	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Constant	-7.323*** (-6.16)	-5.091*** (-3.67)	-12.82*** (-5.63)	-0.063*** (-8.69)	-0.039*** (-4.82)	-0.116*** (-6.36)
Obs.	5418	3646	1772	5418	3646	1772
Pseudo R <sup>2</sup> /chi-square	0.0708	0.0694	0.0676	405.2	295.9	107.9

**Table 3.** Multiple regression results for tests on determinants of corporate environmental capital expenditure

Variable definitions are given in Table 1.

\*\*\*, \*\*and \*denote significance at the 1, 5 and 10% level, respectively.

As predicted, both ENV<sub>DUM</sub> and ENV<sub>INV</sub> are significantly related to the largest shareholder (TOP1) and state-owned firms (STATE) in columns 2 and 5 of Table 3 for the full sample. Hypothesis 1 that state-owned firms are more likely to invest and invest more in the environment than non-state-owned firms is thus generally supported. In accordance with Hypothesis 1a, columns 3 and 6 of Table 3 demonstrate that the positive relationship

Variables	Full sample	SOEs	Non-SOEs	Full sample	SOEs	Non-SOEs
ENV <sub>DUM</sub>	−0.076** (−2.28)	−0.097*** (−3.31)	−0.031 (−0.36)			
ENV <sub>INV</sub>				−4.028** (−2.58)	−4.596*** (−3.69)	−3.068 (−0.73)
DR	0.707** (2.41)	0.0849 (0.45)	1.082*** (2.66)	0.706** (2.41)	0.083 (0.44)	1.082*** (2.66)
ROA	3.388*** (5.90)	2.832*** (5.00)	3.473*** (3.67)	3.395*** (5.90)	2.840*** (4.99)	3.474*** (3.66)
SGROW	−0.098* (−1.83)	−0.074* (−1.82)	−0.080 (−0.85)	−0.099* (−1.84)	−0.075* (−1.87)	−0.080 (−0.85)
SIZE	−0.400*** (−11.79)	−0.297*** (−9.76)	−0.633*** (−10.01)	−0.403*** (−11.83)	−0.300*** (−9.75)	−0.634*** (−9.98)
Year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Industry	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Constant	9.923*** (15.06)	7.942*** (12.46)	14.48*** (12.03)	9.978*** (15.09)	7.994*** (12.43)	14.50*** (12.00)
Obs.	5418	3646	1772	5418	3646	1772
Adj. R <sup>2</sup>	0.412	0.417	0.424	0.412	0.416	0.424

**Table 4.** Multiple regression results for tests on economic consequence of corporate environmental capital expenditure  
Variable definitions are given in Table 1.

\*\*\*, \*\*and \*denote significance at the 1, 5 and 10% level, respectively.

between the largest shareholder (TOP1) and corporate environmental capital expenditure is tighter (both coefficients and significance) for state-owned firms. However, columns 4 and 7 of Table 3 reveal that there is no significant negative correlation between TOP1 and investments on the environment for non-state-owned firms. Hypothesis 1b is rejected. As noted in Li and Zhang (2010), the ownership concentration variable TOP1 represents the degree of political pressure by the government on state-owned firms but poses a type II agency problem for non-state-owned firms. Our results indicate that government engagement plays a prominent role in corporate commitments on the environment, but the type II agency problem has no impact on the corporate environmental capital expenditure for non-state-owned firms.

In columns 2 and 5 of Table 3, variable YEAR2006 has no significant effect on firms' environmental commitments for the full sample. This might be due to the fact that the influence of this newly enacted government policy on firms' environmental commitments differs for state-owned firms and non-state-owned firms. For state-owned firms, there is no significant association between variable YEAR2006 and either ENV<sub>DUM</sub> or ENV<sub>INV</sub>. However, columns 4 and 7 reveal that for non-state-owned firms, both ENV<sub>DUM</sub> and ENV<sub>INV</sub> are positively correlated with YEAR2006, indicating that the newly enacted policy notably impacts non-state-owned firms' environmental actions as a result of the change in attitude of regional governments. Therefore, Hypothesis 2 is not rejected.

In Table 3, variable ENV<sub>DUM</sub> is positively associated with SIZE for the full sample and the two sub-groups, meaning that size affects a firm's attitude toward environmental issues. In columns 3 and 6, variable ENV<sub>INV</sub> is positively associated with ROA, signifying that, for state-owned firms, profitability affects a firm's environmental capital expenditures. These findings are consistent with Li and Zhang (2010).

Table 4 reports regression results for model (2). As predicted, a significantly negative relationship exists between dependent variable TOBINSQ and independent variables ENV<sub>DUM</sub> and ENV<sub>INV</sub> for state-owned firms (columns 3 and 6) and the full sample (columns 2 and 5), but no significant relation is found for non-state-owned firms (columns 4 and 7). These findings support Hypothesis 3, indicating that state-owned firms' environmental commitments are mainly the result of government engagement since governments impose more pressure on these firms, and that such commitments may not be the choice of other shareholders. The fact that no significant relation is found between the above two variables for non-state-owned firms might be explained, to some extent, by these firms choosing which environmental actions to take, and the market is unclear whether these actions are in the shareholders'



interests. We also find that for state-owned firms, the dependent variable TOBINSQ is positively associated with ROA but negatively associated with SGROW and SIZE, demonstrating that the higher the profit, the higher the firm value. However, state-owned firms with high sales and big size do not necessarily have high market value.

### Endogeneity

This study employs an exogenous event to test the impact of government engagement on corporate environmental capital expenditure, thus the endogenous problem is effectively controlled. However, the analysis of the relation between market performance and corporate environmental capital expenditures may be affected by endogeneity. In previous studies there has been concern about inadequate sample selection (Patten, 2002). Due to data unavailability, sample sizes are unusually small in most previous studies with severe data limitations and obvious sample selection bias, which may lead to an apparent disparity in results (Bui and Kapon, 2012). To correct self-selection bias, the endogenous sample selection bias resulting from firms' environmental decisions, we further implement the two-step Heckman treatment model (Heckman, 1979) which enables researchers to utilize simple regression methods to estimate behavioral functions by least-square methods. The Heckman model involves estimating a Logit model of environmental decisions (in model 1) in the first step and includes the inverse Mill's ratio (IMR) in the second step as a control (in model 2). As presented in column 3 of Table 5, with the correction of self-selection bias for state-owned firms, the coefficient on the dummy variable ENV<sub>DUM</sub> is  $-0.729$ , still significantly negative at the 5% level, meaning results are stable even after endogenous effects have been controlled. However, it is interesting to find that for non-state-owned firms (column 4), the estimate on ENV<sub>DUM</sub> is significantly positive (2.333) at 5% with the self-selection bias correction. This result probably indicates that investors tend to give a positive evaluation to environmental capital expenditures by these firms, meaning that environmental decisions made by non-state-owned firms are likely to be strategic and their environmental investments are apt to increase firm value.

To capture the marginal impact of corporate environmental capital expenditure on firm performance and to further mitigate the endogeneity concern regarding the economic consequence of corporate environmental decisions, we also implement a multivariate analysis on the variation of Tobin's  $Q$  as follows (equation 3):

Variables	Full sample	SOEs	Non-SOEs
ENV <sub>DUM</sub>	0.460 (1.31)	$-0.729^{**}$ ( $-1.99$ )	2.333 <sup>**</sup> (2.48)
DR	0.685 <sup>**</sup> (2.36)	0.118 (0.62)	0.938 <sup>**</sup> (2.22)
ROA	3.348 <sup>***</sup> (5.89)	2.990 <sup>***</sup> (5.29)	3.626 <sup>***</sup> (3.85)
SGROW	$-0.107^*$ ( $-1.94$ )	$-0.056$ ( $-1.33$ )	$-0.080$ ( $-0.86$ )
SIZE	$-0.430^{***}$ ( $-10.15$ )	$-0.274^{***}$ ( $-8.12$ )	$-0.766^{***}$ ( $-9.84$ )
IMR	$-0.317$ ( $-1.53$ )	0.376 <sup>*</sup> (1.75)	$-1.320^{**}$ ( $-2.58$ )
Year	Controlled	Controlled	Controlled
Industry	Controlled	Controlled	Controlled
Constant	10.46 <sup>***</sup> (13.05)	7.555 <sup>***</sup> (11.14)	17.35 <sup>***</sup> (10.90)
Obs.	5418	3646	1772
Adj. $R^2$	0.413	0.417	0.426

**Table 5.** Endogenous tests

Variable definitions are given in Table 1.

\*\*\*, \*\*and \*denote significance at the 1, 5 and 10% level, respectively.

Variables	Full sample	SOEs	Non-SOEs	Full sample	SOEs	Non-SOEs
ENV <sub>DUM</sub>	0.004 (0.21)	−0.003 (−0.18)	0.021 (0.47)			
ENV <sub>INV</sub>				−1.085 (−1.31)	−1.498* (−1.82)	−0.506 (−0.24)
DR	0.112 (1.27)	−0.032 (−0.58)	0.165 (1.27)	0.113 (1.28)	−0.031 (−0.56)	0.166 (1.28)
ROA	0.555** (2.07)	0.354 (1.56)	0.603 (1.43)	0.559** (2.09)	0.363 (1.60)	0.602 (1.43)
SGROW	−0.004 (−0.10)	−0.008 (−0.34)	0.021 (0.26)	−0.004 (−0.09)	−0.008 (−0.33)	0.021 (0.26)
SIZE	−0.104*** (−9.85)	−0.0639*** (−6.89)	−0.195*** (−9.64)	−0.104*** (−9.84)	−0.0638*** (−6.87)	−0.194*** (−9.58)
Year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Industry	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Constant	2.015*** (9.90)	1.225*** (6.32)	3.784*** (9.08)	2.005*** (9.89)	1.224*** (6.32)	3.756*** (8.98)
Obs.	5359	3625	1734	5359	3625	1734
Adj. R <sup>2</sup>	0.470	0.469	0.483	0.470	0.469	0.483

**Table 6.** Multiple regression results for tests of change model

Variable definitions are given in Table 1.

\*\*\*, \*\*and \*denote significance at the 1, 5 and 10% level, respectively.

$$\left( \Delta \text{TOBINSQ} = \beta_0 + \beta_1 \text{ENV}_{\text{DUM}} / \text{ENV}_{\text{INV}} + \beta_2 \text{DR} + \beta_3 \text{ROA} + \beta_4 \text{SGROW} + \beta_5 \text{SIZE} + \beta_6 \text{MKTB} + \beta_7 \text{Year} + \beta_8 \text{Industry} \right) \quad (3)$$

where  $\Delta \text{TOBINSQ}$  is the variation between  $\text{TOBINSQ}$  and the lagged  $\text{TOBINSQ}$ ; other variables in model (3) are similar to those in model (2). Table 6 reports the regression results on the variation of Tobin's  $Q$ . We document similar results between dependent variable  $\Delta \text{TOBINSQ}$  and independent variable  $\text{ENV}_{\text{INV}}$ <sup>8</sup> (see column 6 of Table 6), which is significantly negative and consistent with what we find testing model (2). In other words, investors do not value environmental investments made by state-owned firms. Taken together, endogeneity is not a concern in our multivariate analysis.

### Robustness Check

To increase the reliability of our research results, we conduct robustness tests as follows. First, we test the value of the variance inflation factor (VIF) for models (2) and (3). The results indicate that the mean values of VIF for all variables are less than 3, suggesting that little multicollinearity exists for the regression analysis. Second, we employ the sum of squares on the shareholding percentage for the top 5 or top 10 largest shareholders as measures of ownership concentration which represent government engagement/political pressure on state-owned firms. We repeat the regression analysis for model (1) and report similar results.<sup>9</sup>

<sup>8</sup>However, we fail to find any significant link between  $\Delta \text{TOBINSQ}$  and  $\text{ENV}_{\text{DUM}}$  (see column 3 of Table 6).<sup>9</sup>Results can be obtained on request.

## Implications of Government Engagement for Public Policy Implementation

Previous research related to public policy making and implementation has mostly focused on developed economies in which a well-developed regulatory system is already in place and public policies are more easily and effectively enforced and implemented. Given the institutional nature of emerging markets, the regulation/policy enforcement mechanism is weak and, without economic/political pressure imposed on firms, regulation/policy implementation is not likely to be as effective/efficient even given a legal system that does not significantly lag behind those of Western countries. Thus, our research findings suggest a number of considerations regarding the role of government in making and implementing public policies in emerging economies.

First, the Chinese market has implications for all emerging economies. Our research results specify that, for policy makers, it is more significant to consider facilitating public policy implementation in an emerging market such as China. As environmental conduct in a region is shaped both by governments and firms, and mainly driven by pressures imposed on firms by regional governments, only in policies with an explicit linkage between environmental performance and economic/political pressure/incentives by regional governments is there any possibility of a significant impact on the environmental performance of firms leading to effective enforcement. Therefore, when making public policy, enforcement should be given more weight than is currently the case.

Second, we see that firms with different ownership structures react to public policies differently, with dramatic variance in the levels of participation in environmental initiatives. This phenomenon is largely due to the nature and consideration of regional governments/firms. In China, regional government officials are both enforcers of regulations/policies and representatives of regional political and economic interests. Along with decentralization and increased powers to the regional governments, the pursuit of high economic growth leads to prioritized local interests. As a result, the bulk of corporate activities related to environmental protection truly reflect the attitude of regional governments. While state-owned firms are more likely to act in favor of regional governments' interests, non-state-owned firms tend to take action in light of maximization of corporate value. Therefore, in making and implementing environmental policies, the role of government, regional government in particular, becomes increasingly crucial.

Third, we see that market investors do not value environmental investments made by state-owned firms because such investments are deemed to be in the government's best interests and potentially harmful to minority shareholders. Policy-makers have the ability to guide market investors in giving a more positive evaluation to firms' environmental commitments. If, in making public policies, more emphasis is given to designing provisions that lead to increasing the value of environmental investments, for example by providing more environmental subsidies to proactive firms, implementing tax rebates, etc., the market will eventually recognize the value of such environmental actions.

China is already equipped with a relatively thorough system of environmental laws and regulations, yet measures of pollution continue to rise and serious environmental deterioration is a reality China faces today. To make environmental policies effective in an emerging economy such as China requires a change in the mindset of regional officials, but more important is a change in the institutional mechanism. However, before a well-organized system is established, policy makers must emphasize policy enforcement and implementation when making public policies. In this regard, government engagement leading to increased pressure on firms can be considered an effective method of policy enforcement and implementation. Policies that explicitly link environmental performance with economic/ political interests/incentives to regional governments and firms should be encouraged, in which credible information is available and assessed to support efforts by regional officials related to environmental protection.

## Concluding Remarks

Based on China's unique institutional background, this research empirically tests determinants and economic performance of environmental investments made by Chinese listed firms in the eight most polluting industries

from the perspective of government engagement/political pressure. Findings of the study indicate that, compared with non-state-owned firms, state-owned firms tend to invest and invest more in the environment. In addition, for state-owned firms, the higher the shareholding percentage of the largest shareholder (usually the government), the higher the environmental investment. However, no significant correlation is found between the shareholding percentage of the largest shareholder and environmental investments made by non-state-owned firms. Our results also demonstrate that, after the 2006 enactment of a new policy explicitly linking regional environmental issues with the performance evaluation scheme of regional officials, non-state-owned firms tend to experience more pressure from regional governments, thus increasing their level of environmental investment. Results of the study further illustrate that environmental investments made by state-owned firms are negatively correlated with firm value measured by Tobin's  $Q$ , but no correlation is found for non-state-owned firms, suggesting that the environmental actions of state-owned firms are not valued by market investors. Evidence documented in this study indicates that, in China, firms' environmental capital expenditures mainly result from government engagement in firms and political pressure imposed on firms.

It is worth noting that there should be a differentiation between political pressure imposed on firms by governments and legal/regulatory pressure. Although China has set up a legal system to protect the environment, it is far from perfect. Implementation is primarily in the realm of regional government officials and prioritization by regional governments is often given to practices that bring about potential economic benefit to the region rather than those that protect the environment. As a result, environmental laws and regulations are not adequately implemented due to the ineffectiveness/inefficiencies of the enforcement system. Our research implies that social, political, legal and cultural contexts in an emerging economy such as China are very different from those in developed economies and the enforcement mechanism is weak. Laws and regulations alone are insufficient, though important, to keep firms from shirking from their responsibilities to the environment.

Our research highlights that in-depth government engagement in environmental issues is useful in implementing public policies given the weak enforcement mechanism in China. Not only do these unique characteristics amplify the degree of government engagement in business operations, but lead to the approach taken by the central government of integrating environmental performance with economic/political incentives to regional government officials when setting new public policies. This approach has been proven to be an effective way of changing the attitude of regional governments and increasing the likelihood that firms will engage in environmental practices as a result of pressure imposed by regional governments. Combining economic and political incentives to solve pollution problems has proven to be somewhat useful in reducing the discharge of pollutants and healing the environment.

In all, corporate environmental performance is an indefinable and debatable metric. Yet it is unquestionably becoming an important issue, as proven by the increasing amounts of data provided by corporations, regulators and concerned groups. Firms, as well as regional governments, are facing mounting pressure to assess the impact of their business activities on the environment and modify their behavior accordingly. We perceive that a large part of the damage to China's environment is due to the business activities of non-state-owned firms, many of which are small and medium enterprises with limited resources and weak management. However, the private sector is deemed to drive growth and is largely relied upon for the country's economic development. In the absence of regulation and pressure from the government, together with an absence of resources and pollution treatment technologies and an unwillingness to cover pollution abatement costs, these firms are the worst environmental performers. Based on our research findings, although active government engagement in firms' environmental performance and more integrated policies are proven to be effective tactics, environmental protection cannot entirely depend on governmental action alone.

For improvement to occur, there are a number of recommendations to be addressed, especially in the realm of public policy making. First, as non-state-owned firms are deemed to be the heaviest polluters due to the factors mentioned above, by providing advanced technologies and training, governments can help these firms reduce pollution abatement costs. To encourage these firms to take environmental action, environmental subsidies must be provided not only to state-owned firms but also to non-state-owned firms. Second, the government should create policies to substantially increase costs to polluters. These policies must include increased punitive measures against polluting releases, higher charges to major polluters and the establishment of a more solid pollution levy system. Third, public policies should be designed to support firms making more environmental investments. In order for environmental investments to be recognized by market investors, a significant amount of environmental subsidies and substantial tax rebates should

be given to firms that are proactive in making environmental investments. If public policy is such that firms investing in the environment are rewarded and firms releasing more pollutants are heavily punished, firms will be encouraged to protect the environment and avoid releasing pollutants. As a consequence, market investors will be more likely to value environmental actions taken by firms. Hence, future research can emphasize the results of these measures and how firms respond to assess their effectiveness.

## Acknowledgements

The authors gratefully acknowledge the research funds provided by the Chinese Ministry of Education (grant no. 10YJA790127) and financial support from the Natural Science Foundation of China (grant no. 70802024, 70872018, 71272214).

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