ANALYZING THE IMPACT OF POLITICAL AND MARKET INSTITUTIONS IN ENVIRONMENTAL PERFORMANCE AND POLICY

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Date of Oral Examination
Shuang Zhao

ANALYZING THE IMPACT OF POLITICAL AND MARKET INSTITUTIONS IN ENVIRONMENTAL PERFORMANCE AND POLICY

This dissertation examines the relative effectiveness of political and market institutions in shaping environmental outcomes at the firm and regional level in the United States and China.

This dissertation consists of three empirical chapters. The first chapter focuses on the role of political institutions in dealing with China’s environmental performance. Drawing on evidence from thirty-one provinces from 2004 to 2013, I find provinces that have bigger, state-owned, enterprise tax bases tend to have higher levels of pollution. The results show that regional political leaders who are motivated by a promotion system would relax their efforts to control pollution once promoted. However, this situation has changed since the environmental accountability system is incorporated into the evaluation system such that political leaders additionally need to prove they will bring down pollution levels in order to be promoted.

The second and third chapters shift focus from public institutions to private institutions and their role in influencing firms’ environmental performance in the United States. In the second chapter, I find that in the power generating sector, it is the environmental programs adopted by the parent company rather than supply chain management that are associated with lower levels of release of TRI and hazard release. In the electronic sector, I find higher levels of supply chain management conducted by parent companies is associated with less environmental programs adopted by the suppliers and argue that it is because suppliers tend to rely on parent companies’ adoption of standards lacking incentives to adopt environmental control programs of their own.
In the third chapter, I show that both public campaign and shareholder resolutions are effective in pressuring firms to conduct higher levels of supply chain management with public campaign having a substantially larger effect. I also find regulatory pressure does not matter to firms’ decisions to adopt green supply chain management measures; rather, firms’ willingness to support environmental regulations matters relatively more in firm adoption behavior. However, this relationship is negative suggesting firms may simply express support for regulation as a way to avoid making costlier behavioral changes.
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## Curriculum Vita
Introduction

This dissertation examines the relative effectiveness of political and market institutions in shaping environmental outcomes at the firm and regional level in the United States and China. By adopting a “command-and-control” regulatory approach under the Clean Air Act (CAA) and the Clean Water Act (CWA) since the early 1970s, the United States has made tremendous achievement in pollution control in country’s land, air, and water in spite of a continually growing economy (Clark, 2005; Evan J Ringquist, 1993a). Because command-and-control instruments are criticized to be inefficient because of their inability to consider each firm’s abatement costs and promote innovation, the United States has gradually developed more market-based and voluntary tools in the past three decades (Evan J. Ringquist, 2011; Stewart, 1995; Tietenberg, 2002). Through these three decades of experimentation, the current U.S. environmental regulatory regime consists of a combination of command-and-control, market-based, and voluntary policy instruments. However, at the other end of the Pacific, the second largest economy, China, still primarily relies on political and administrative means, such as command-and-control regulations, to combat its extensive pollution problems (Z. Zhang, 2010, 2011a, 2011b).

The question is whether China, an economy in transition, could copy the history of the United States to achieve similar environmental protection goals by primarily adopting command-and-control strategies with its own political institutions or if China should avoid the costly prescriptive approach and focus on developing market-based and voluntary regimes to control pollution. Alternatively, China could pursue a combination of policy instruments. To answer these questions, two conditions need to be fully explored. The first is to consider institutional contexts in which market-based and voluntary programs fail. Even though a rich literature in environmental
economics has shown that market-based instruments are more efficient, Cole and Grossman (1999) show command-and-control and market-based approaches could both be efficient depending on the institutional environment. And the second condition is that one needs to fully understand China’s current political infrastructure to understand the promise and limitations of alternative policy instruments.

This dissertation contributes to the research on both conditions mentioned above: In the first chapter, I examine China’s political institutions and argue that two intuitional constraints are particularly important in the political economy of China, and these constraints have undermined its political institutions’ effectiveness in addressing environmental issues. The second chapter evaluates the effectiveness of one type of firm-initiated voluntary program – green supply chain management (GSCM) that has not drawn much attention of policy scholars. The third chapter explains which mechanisms could motivate firms to adopt GSCM.

China’s environmental problems have increasingly become global. The U.S. Energy Information Administration (EIA) projects China’s CO₂ emission will double its current level and exceed the U.S. by the year 2013 (Congressional Research, 204). Identifying political constraints of China is the first critical step to design more effective institutions and policies to address China’s paramount environmental problems. The exercise of evaluating voluntary programs compared to prescriptive regulations offers policy options for China and contributes to U.S. academic and policy debates about environmental policy instrument design.
A Combined Regulatory Regime

A command-and-control approach uses prescriptive regulatory mechanisms based on law and policy to induce behavioral change and usually involves sanctions for noncompliance (Karp & Gaulding, 1995). Market-based instruments, in contrast, use economic incentives to ensure firms control their pollution according to their own marginal abatement costs, resulting in a cost-effective allocation of abatement cost (R. W. Hahn & Stavins, 1991). Environmental voluntary agreements (VAs) are negotiated between firms and regulators in which firms voluntarily reduce pollution and improve the natural environment in exchange for governments’ offer for positive publicity, technical assistance, and exemption from future regulations (Delmas & Terlaak, 2001; Lyon & Maxwell, 2007).

In comparing these alternative regulatory approaches, scholars tend to view them as dichotomous: inefficient command-and-control versus efficient market-based instruments (Cole & Grossman, 1999) and an inflexible and adversarial command-and-control versus a flexible and cooperative voluntary approach (Darnall & Sides, 2008; Delmas & Terlaak, 2001). Policy instruments are not necessarily alternatives to one another but rather have potential to complement each other (Eisner, 2004). As shown by Cole and Grossman (1999), depending on the institutional environment, command-and-control and market-based instruments can both show strengths and weaknesses in different institutional settings.

I focus on command-and-control versus voluntary approaches in the following discussion. Command-and-control instruments generally create an adversarial environment, which lacks flexibility and generates high enforcement and litigation costs because the dictum of “one-size-fits-all” overlooks the marginal abatement costs of each firm. Voluntary agreements, in contrast,
offer flexibility to firms, reduce enforcement costs, and create cooperative regimes. However, regulators may risk poor compliance from firms because of the legally non-binding nature of VAs (Delmas & Terlaak, 2001). The negotiation process between the government and firms also offers more opportunities for capture (Eisner, 2004). Rather than choosing one over another, it is more productive to consider how policy instruments could be combined and integrated to reach optimal outcomes (Eisner, 2004). In order to design an integrated regulatory regime, scholars need to offer systematic evidence about whether VAs are effective and specify the conditions under which VAs could complement the current command-and-control structure.

Theoretical literature generally categorizes voluntary programs (VPs) developed under voluntary agreements are government sponsored (e.g. EPA 33/50), industry sponsored (e.g. American Chemistry Council’s Responsible Care) and third party sponsored VPs (ISO 14001) (Delmas & Terlaak, 2001; Eisner, 2004). And a small body of empirical literature has emerged to evaluate the performance of these three types of voluntary programs.1 The results from this empirical work in general suggest VP have little or no effect on firms’ environmental performance (Eisner, 2004; Lyon & Maxwell, 2007). What is missing in both theoretical and empirical literature of VAs is a discussion of firm-initiated VPs. The following figure represents an illustration of a combination of regulatory regimes. My dissertation focuses on the often-overlooked part: Firm-initiated VPs, specifically, green supply chain management.

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1 For comprehensive literature review on voluntary programs see Lyon and Maxwell, 2007 and Delmas and Terlaak, 2001.
Figure 1: Illustration of Combination of Regulatory Regimes.

<table>
<thead>
<tr>
<th>Command-and-Control Instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Government identify market failure and prescribe &quot;end-of-pipe&quot; solutions.</td>
</tr>
<tr>
<td>2. Cost: Monitoring and enforcement.</td>
</tr>
<tr>
<td>3. E.g.: Technology standards</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Market-Based Instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Based on market incentives.</td>
</tr>
<tr>
<td>2. Cost: Monitoring and enforcement.</td>
</tr>
<tr>
<td>3. E.g.: tax, subsidies, pollution trading market</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Voluntary Agreements (VAs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Neogotiated agreements between government and industries or firms.</td>
</tr>
<tr>
<td>2. Cost: negotiation cost between government and firms and among firms could be high.</td>
</tr>
<tr>
<td>3. E.g.: 30/55, Climate Wise</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Private Governance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Industry self-regulation.</td>
</tr>
<tr>
<td>NGOs sponsored standards.</td>
</tr>
<tr>
<td>2. Cost: negotiation cost between firms and firms and NGOs.</td>
</tr>
<tr>
<td>3. E.g.: Responsible Care, ISO14001</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Firm-Initiated VPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Environmental programs that are designed and enforced by individual firms.</td>
</tr>
<tr>
<td>2. Cost: negotiation cost between firms, monitoring and enforcement cost of contracts.</td>
</tr>
<tr>
<td>3. E.g.: green supply chain management (GSCM)</td>
</tr>
</tbody>
</table>

**Firm-Initiated Voluntary Program: Green Supply Chain Management**

Green supply chain management (GSCM) aims to integrate social and environmental goals into firms’ general economic goals through inter-firm collaborations (Ageron, Gunasekaran, & Spalanzani, 2012). There are important reasons firm-initiated VPs such as GSCM should be given much attention from public policy scholars. The nature of environmental problems have changed: environmental problems have evolved from localized “end-of-pipe” emissions that could largely be attributed to industrial activity on a regional and even global dimension, such as global air pollutants and global warming (Kraft & Vig, 1990). But the U.S.-designed command-and-control and market-based instruments are focusing on domestic firms and have no effect on
firms’ overseas subsidiaries and business partners. Having the opportunities to place subsidiaries or identifying their business partners in countries where environmental laws and regulations are weak, U.S. firms could reduce cost in the short-term but it could undermine U.S. firms’ competitiveness in the future to adapt to a new generation of global environmental issues (Eisner, 2004).

Focusing on voluntary initiatives can further help us move from "end-of-pipe" considerations to the integral parts of product development and design that, through informed decision making, can yield major advances in environmental performance (C. a. S. R. Geffen, 2000; Sarkis, 2003; Srivastava, 2007). Having to manage firms involved in a whole supply chain, supply chain management also offers opportunities to deal with firms across national boundaries that normally limit traditional regulatory regimes.

Supply chain management has gained popularity in the business field but has not drawn much attention from public policy scholars (Fiorino & Bhan, 2013). A lack of an understanding of the effectiveness of supply chain management from a public policy perspective prevents us from incorporating it to public policy. My dissertation contributes to the broad environmental regulation literature by identifying the current lack of attention to firm-initiated VPs and offering new empirical evidence regarding one type of firm-initiated VP: green supply chain management.

Evaluating the effectiveness of supply chain management on firms’ environmental performance is difficult because great variation of supply chain structures makes it difficult to quantify supply chain management. The current field of supply chain management does not offer consistent, objective, and quantifiable measurements of GSCM. (Seuring & Müller, 2008; Walker, Di Sisto,
& McBain, 2008; Zhu & Sarkis, 2006). In order to analyze the effectiveness of GSCM, I develop and analyze two key dimensions of GSCM: (1) the adoption of a code of supplier conduct and (2) publicizing a list of suppliers. Developing consistent and quantifiable measures of GSCM is an important step to generating consistent empirical studies and eventually theorizing in the field of GSCM.

Because of the complexity of supply chains and a lack of a widely-used analytical framework and systematic tools for studying relationships in supply chains, I start with the basic supply chain relationship: the parent company and its first tier suppliers. Studying the basic relationship between parent companies and their first tier suppliers is an important first step in conceptualizing supply chain relationships (Anderson & Gerbing, 1988; Choi & Hartley, 1996; De Toni, 1999). In addition, first tier suppliers normally take on large responsibilities for product design and quality, and they work more closely with parent companies than second and third tier suppliers (Flynn & Belzowski, 1996; C. A. Geffen & Rothenberg, 2000). Further, interesting patterns are easier to identify from the basic relationship, which can be applied to other tiers of suppliers. In addition, in my third chapter, I present internal and external mechanisms that shape stakeholders involvement in supply chain management.

This dissertation advances the field of environmental regulations by drawing on scholars’ attention to firm-initiated voluntary programs. By focusing on green supply chain management, this dissertation offers new empirical evidence that firm-initiated voluntary programs have the potential to change firms’ environmental behavior. Through the process of empirical analysis, this dissertation also contributes to the study of green supply chain management by offering innovative quantitative and consistent measurements for green supply chain management. This dissertation also presents novel insight on the relationship between a parent company and its
suppliers and shows that environmental programs that a parent company adopts could have significant impact on its suppliers’ environmental behavior. The dissertation also conducts stakeholder analysis that identifies mechanisms that stakeholders could use to motivate firms to conduct a higher level of green supply chain management. These findings are important to U.S. policy makers who look for less costly policy alternatives as the supply chain relationship presents opportunities to rely on market power to motivate firms to self-regulate.

_GSCM in China_

The research results on regulatory regimes and GSCM have great relevance to China, which is currently under a process to reforming its economic and political institutions toward market economy status. The fact of incomplete and weak political institutions in dealing with environmental problems in China offers opportunities to experiment and adopt market-based and voluntary regulatory regimes (E. Economy, 2004). Some scholars argue that market-based and voluntary environmental policies are effective regardless of whether the state has prior experience with command-and-control policies (Stewart, 1991). Further, because command-and-control policies normally require specific pollution technologies in their start-up costs, e.g., end-of-pipe technologies, this investment reduces the incentive to innovate if the state shifts to a policy that gives firms flexibility to choose their own abatement measures (Stewart, 1991). The rich experience of the United States’ experiment on market-based and voluntary programs in the past three decades could help Chinese policy makers to design their own policy mix that fits their own institutional context.

Thus, an understanding of China’s current political institutions is critical. Drawing on ten years of data from thirty-one provinces in China, my dissertation first analyzes the impact of current
political institutions on environmental outcomes. In particular, I outline two institutional constraints that may have impeded China’s environmental protection efforts: (1) competing for businesses to gain economic growth, provincial political leaders have no incentives to enforce environmental policies that could pose costs on businesses. Consequently, state owned enterprises (SOEs) that contribute significantly to the local economy operate under “soft budget constraints,” which enable these companies to continue to pollute in order to realize the output quota for local and regional government. And (2) the “tournament competition” system that China’s central government has adopted to evaluate regional leaders’ performance has overemphasized economic growth - often to the neglect of environmental quality considerations - as the main criterion of promotion.

The inability of China’s political institutions in combating its environmental problems offers opportunities for policy makers in China to consider alternative strategies. China’s domestic manufacturing industries are increasingly integrated into global production and the global network. Chinese firms are increasingly becoming targets of foreign companies that require adopting GSCM. For example, Bristol-Myers Squibb, IBM, and Xerox have encouraged their Chinese suppliers to develop environmental management systems consistent with ISO 14001, and Ford, GM and Toyota have required their Chinese suppliers to obtain the ISO 14001 certification (Zhu, Sarkis, & Lai, 2007). Thus, research on the effectiveness of supply chain management and its relevance to public policy can inform policymakers in China’s national and regional governments to design more effective environmental policies.

This dissertation examines the institutional constraints that Chinese governments face and provides evidence of the effectiveness of an alternative policy instrument—GSCM—to improve environmental performance. Facing an opportunity to reform its political institutions, the
Chinese governments may consider reform that directly deals with their own institutional constraints and in a way that exploits market-based and voluntary programs drawing on the experience of the United States. In fact, China has already started its pilot trading scheme in major provinces/municipalities (Z. Zhang, 2015). But green supply chain management has yet to be considered as a viable policy alternative. My empirical finding could also be instrumental for Chinese and U.S. policy makers to think creatively about utilizing existing market institutions for accomplishing environmental goals.

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2 The seven provinces/municipalities are: Shenzhen, Shanghai, Beijing, Guangdong, Tianjin, Hubei and Chongqing.
Bibliography


Chapter I: Have Chinese Political Institutions Failed to Address China’s Environmental Problems, and, if so, Why?

Introduction

In the past two decades, China has become an increasingly strong economic player in the global economy. This process is coupled with China’s impressively rapid industrialization and its status as the world’s largest manufacturer.\(^3\) At the same time, environmental conditions in China have deteriorated dramatically, which has raised concerns both in China and abroad. One explanation of China’s environmental deterioration is that it is due to the ideology of generations of political leaders who historically possessed Confucian views that nature should be satisfying man’s needs, and political leaders’ overemphasis on China’s economic development while neglecting environmental protection (E. Economy, 2004).

The idea that the Chinese government’s choice of economic growth and industrialization over environmental protection resulted in the deterioration of China’s environment is also espoused by many scholars who work in the field of China’s environmental issues (Ma & Ortolano, 2000; Ren & Shou, 2013; Stalley, 2010; Zusman & Turner, 2005). It is therefore not surprising that most work focuses on how political institutions and politics shape China’s path toward environmental development and its role in institutional change (E. Economy, 2004; Ma & Ortolano, 2000; Zusman & Turner, 2005). Scholars are not always optimistic about China’s ability for governmental change to improve China’s environment. Economy (2004) casts doubts

\(^3\) David Sims, “China Widens Lead as World’s Largest Manufacturer”, Thomasnet news, (March 14\(^{th}\), 2013), [http://news.thomasnet.com/TMT/2013/03/14/china-widens-lead-as-worlds-largest-manufacturer/](http://news.thomasnet.com/TMT/2013/03/14/china-widens-lead-as-worlds-largest-manufacturer/)
on the power-driven government’s ability to balance its desire for both fast economic development and society pressure for environmental protection (E. Economy, 2004).

In the first chapter, I outline two institutional constraints that may have impeded China’s environmental protection efforts: (1) while competing for businesses to gain economic growth, provincial political leaders have no incentives to enforce environmental policies that could pose cost on businesses. Consequently, state owned enterprises (SOEs) that contribute significantly to local economy operate under “soft budget constraints,” which enable these companies to continue polluting in order to realize the output quota for local and regional government. And (2) the “tournament competition” system that China’s central government has adopted to evaluate regional leaders has overemphasized economic growth—often to the neglect of environmental quality considerations—as the main criterion of promotion.

I empirically test the above two propositions by leveraging a panel data on China’s thirty-one provinces from 2004 to 2013. Through estimating a set of fixed effects models, I find evidence supporting a soft budget constraint that prevents Chinese governments from effectively controlling their pollution problem; in particular, provinces that have a large tax base from SOEs tend to have higher pollution levels. I also find some evidence that suggests political leaders are inclined to grow the economy of their province at the cost of environmental protection, such that there are higher air pollution levels in provinces just after a governor is being promoted. Political leaders seem to be more attentive to environmental matters since the adoption of an environmental accountability system, after which pollution levels have been much lower.
Literature Review

Soft budget constraint and fiscal decentralization

Kornai (1979, 1986) identifies an economic phenomenon in socialist systems that firms receiving financial assistance by the state do not face a “hard” constraint like firms competing in the free market, who could only survive when their cost is covered by profit made from selling products or services on the market (J. Kornai, 1986). Instead, firms’ budget constraints in socialist systems is relatively “soft” because the state could bail them out through subsidies, tax breaks, relaxed environmental standards, and other administrative initiatives (Cole, 1998; J. Kornai, 1986). This is especially the case for state-owned enterprise (SOEs) in China.

In 1978, at the beginning of China’s economic reform, the state controlled and owned SOEs completely (Xu, 2000). As the reform progressed, the state started to gradually decentralize SOEs such that SOEs were allowed to sell products to a competitive market after they had fulfilled their mandatory output quota (Xu, 2000). SOEs could obtain part of their input from the state at a subsidized price and they purchased the rest from a free market (Jefferson & Rawski, 1994; Perkins, 1994). The portion of SOEs participating in a competitive market has grown steadily since the reform period. By far, SOEs have been downsized and do not play the same important role in the economy that they had before the reform (Ralston, Terpstra- Tong, Terpstra, Wang, & Egri, 2006). However, SOEs still contribute heavily to the economy, and they dominate sectors that the Chinese government views as strategic such as raw materials, petrochemicals, and telecommunications (Ralston et al., 2006). Since the economic crisis in 1998, the Chinese government enacted a three-year stimulus plan worth of 400 million RMB mainly targeted on SOEs (Chan, 2004; Hu, 2012). This process strengthened SOEs since 2000.
and in 2013 and there are currently 18,197 SOEs in China and that produce 24% of the industrial output.\(^4\)

The sectors where SOEs are concentrated such as raw materials and petrochemicals also generate heavy pollutions. According to the soft-budget argument, because these SOEs generate considerable profit and employment opportunities for regional governments, regional governments have an incentive to help SOEs to reach their output by providing subsidies, tax breaks, and relaxed environmental regulations. The use of these policy instruments to stimulate economic development is well-documented in a variety of studies on China’s SOEs (Lin, Cai, & Li, 2001; Qian, 1996; Ralston et al., 2006). The following table shows an extremely low bankruptcy rate in selected sectors in China in 2011, which is likely due to Chinese government bailouts through policy instruments to stimulate economic development and thereby create soft-budget constraints. The total number of businesses that went bankrupt in China is 3,016 in 2011 compared to the United States, in which 57,964 did so in 2012 and 44,111 firms went bankrupt in 2013 (Hales, 2014).

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\(^4\) Data calculated from national bureau of statistics of China. In 2013, China’s total industrial output is 6,283.1 billion and SOE’s output is 1,519.4 billion. 
http://data.stats.gov.cn/workspace/index;jsessionid=D3445DC44910B2A6CDB95C0344C1CEDD?m=hgnd
Table 1: Bankruptcy Rate in Selected Sectors in China

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of Enterprises</th>
<th>Number of Bankrupt</th>
<th>Rate of bankruptcy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal Mining</td>
<td>7,695</td>
<td>50</td>
<td>0.278644672</td>
</tr>
<tr>
<td>Food Processing</td>
<td>20,895</td>
<td>219</td>
<td>0.219401505</td>
</tr>
<tr>
<td>Apparel</td>
<td>11,750</td>
<td>114</td>
<td>0.12297204</td>
</tr>
<tr>
<td>Furniture</td>
<td>4,255</td>
<td>28</td>
<td>0.070715999</td>
</tr>
<tr>
<td>Oil Refining</td>
<td>1,974</td>
<td>11</td>
<td>0.182089058</td>
</tr>
<tr>
<td>Chemicals</td>
<td>22,600</td>
<td>193</td>
<td>0.201473996</td>
</tr>
<tr>
<td>Medical Products</td>
<td>5,926</td>
<td>33</td>
<td>0.203603159</td>
</tr>
<tr>
<td>Metal Products Manuf.</td>
<td>16,573</td>
<td>150</td>
<td>0.098357431</td>
</tr>
<tr>
<td>General Purpose Machinery</td>
<td>25,877</td>
<td>238</td>
<td>0.116085669</td>
</tr>
<tr>
<td>Special Purpose Machinery</td>
<td>13,889</td>
<td>124</td>
<td>0.109857009</td>
</tr>
<tr>
<td>Electrical Machinery and Equipment</td>
<td>20,084</td>
<td>102</td>
<td>0.090278269</td>
</tr>
<tr>
<td>Computers, Other Electronic Equip.</td>
<td>11,364</td>
<td>56</td>
<td>0.093654882</td>
</tr>
<tr>
<td>Measuring Instruments and Machinery</td>
<td>3,896</td>
<td>19</td>
<td>0.069226845</td>
</tr>
<tr>
<td>Electric Power Production and Supply</td>
<td>5,287</td>
<td>38</td>
<td>0.065589616</td>
</tr>
<tr>
<td>Gas Production and Supply</td>
<td>875</td>
<td>9</td>
<td>0.228658537</td>
</tr>
<tr>
<td>Water Production and Supply</td>
<td>1,153</td>
<td>9</td>
<td>0.058605196</td>
</tr>
</tbody>
</table>

Source: data is compiled from China’s yearbook of industry and commerce administration, 2011.

Fiscal Decentralization

Fiscal decentralization provides regional and local governments more opportunity to provide “soft-budget conditions” to SOEs operating within their jurisdiction. China’s financial system has undergone decentralization (1980s to 1993) punctuated intermittently by centralization periods (M. Economy, 2009; Su & Zhao, 2004). However, even with the centralization process...
since 1994, China is still quite decentralized compared to all other formerly centralized economies (M. Economy, 2009).

In order to provide incentives for regional governments to spur economic growth, the Chinese central government began reforming its finance system since starting in 1980 to allow regional governments more authority to finance their own needs and foster accountability (Su & Zhao, 2004). In 1994, the Chinese government initiated another round of reform to adjust to its market development (Su & Zhao, 2004). This reform defines a “tax assignment system” in which the taxes that concern national interests or macroeconomic adjustments is allocated to the central government whereas those related to local economic development belong to regional governments (Su & Zhao, 2004). Since the reform, the ratio of the central government’s revenue over the regional governments’ has increased as shown in the graph below:

**Figure 1: Central Government and Provincial Government’s Share of Revenue**

![Graph showing the percentage of revenue distribution between the central and provincial governments from 1980 to 2011.](image)

*Source: China’s National Statistical Bureau, 1980 to 2011.*
However, local governments were compensated by gaining other rights, such as obtaining the exclusive right to levy business taxes (M. Economy, 2009). According to statistics from the national statistical bureau, enterprise accounts for about 70% of local government revenue (Lan, Hart, Yujia, & Kovacic, 2014). This sustained tax revenue allows provincial governments to contribute support for SOEs in their jurisdictions. As shown in the graph below, provincial governments expenditure continues to grow.

**Figure 2: Central Government and Provincial Government’s Share of Expenditure**

*Source: China’s National Statistical Bureau, 1980 to 2011.*

**Party controlled promotion system**

The Communist Party of China (CPC) centralizes power through the so-called double-track system modeled on the Soviet nomenclature and administrative appraisals. Under the double-track system, each leading position in the administrative hierarchy is split into two offices, one occupied by a Party official and the other by a government cadre (Burns, 1994). Power is centralized by giving the Party appointees control of their civil service counterparts (Burns &
Xiaoqi, 2010). In addition, administrators are strongly motivated to meet the performance targets dictated by the Party because their career prospects may be adversely affected if they fail to meet the assigned targets (Edin, 2003a). These arrangements make it difficult for lower-ranking officials to dispute or challenge decisions dictated by upper level authorities.

In order to incentivize local officials to develop their economy, the central government creates a “tournament competition” among regional political leaders by promoting or demoting them based on their performances (Bo, 1996; M. Wu, 2010; Zheng, Kahn, Sun, & Luo, 2013). China’s regional officials are normally required to fulfill three categories of performance targets, with economic growth measured by GDP growth and tax revenue quotas as the “hard” targets, which are immediately linked to the awarding of bonuses or promotion (Whiting, 2006). Tsui and Wang (2004) show that 60% of the targets required by the central government to be met by leading provincial officials are related to economic matters (Tsui & Wang, 2004).

Good economic performance presents immediate rewards to officials; for instance, top-ranked township officials can be promoted to positions at the county level, whereas well-performing municipal officials have been transferred to other provinces as governors (Edin, 2003b). Analyzing top provincial leaders, Li and Zhou (2005) found that promotion of provincial leaders is more likely to increase with strong economic performance while the likelihood of termination decreases if such strong economic performance persists (Li & Zhou, 2005).

Because of the incentive of immediate promotional benefits, regional political leaders tend to focus on economic development while overlook environmental protection. Wu et al. (2013) found that city political leaders are more willing to spend on transportation when it is directly related to their promotion than on environmental protection (Jing Wu, Deng, Huang, Morck, & Yeung, 2013). Moreover, political leaders’ environmental protection efforts in general are not
rewarded as shown by Wu et al. (2013); a city government’s spending on environmental improvement is actually negatively related to a CCP secretary or a major’s promotion. Officials are not promoted or receive benefits when they spend on environmental improvement (Jing Wu et al., 2013).

*Environmental accountability system*

The tendency for regional leaders to overemphasize economic growth to the detriment of environmental performance has possibly changed in recent years. In 2006, China’s central government adopted an environmental accountability system that incorporated protection of the environment in the official evaluation of local government officials (Lan et al., 2014; Wang, 2013). In 2007, the central government announced that the COD and SO2-reduction targets identified in the 11th FYP needed to be attained by the end of 2011 and at the same time these targets need to be incorporated into the responsibility contracts signed with local governments at various levels (Kahn, Li, & Zhao, 2013). The purpose of this system is partly to correct the old promotion system that overemphasized economic growth as the main criterion to promote government officials and to ensure enforcing environmental regulations are considered in local officials’ job reviews and promotion decisions. (Wang, 2013).

In the tenth, eleventh, and twelfth “Five Year Plan (FYP),” the central government has set specific pollution reduction goals (Lan et al., 2014; Wang, 2013; Zheng et al., 2013). In particular, in the eleventh FYP, the government has set the target for major pollutants such as COD and SO2 to decrease by 10% each year from the 2005 level (Zheng et al., 2013). Regional officials are evaluated on the basis that COD and SO2 emissions are under the regulated level set

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5 Every five year, the central government of China set a “five year plan” to boost its economy and industrialization process to become the world-class power since 1949.
by the central government (Lan et al., 2014; Wang, 2013). Each level’s governmental officials\textsuperscript{6} are then evaluated based on quantitative measures. Specifically, the reduction of energy intensity accounts for forty points out of the total 100 points (Zheng et al., 2013). The additional sixty points include items such as regularly reporting energy consumption to upper-level governments, investing in energy conservation and pollution reduction infrastructure, and implementing environmental regulations (Zheng et al., 2013).

The environmental accountability system is also called the “target responsibility system (TRS)”, which contains four steps: disaggregating targets from central government to regional governments, signing target responsibility contracts, accounting and monitoring energy consumption, and assessing target performance (Qi, 2013; Zheng et al., 2013). The total energy conservation and pollution reduction targets are first disaggregated from the central government to regional governments and then further disaggregated to municipal governments (Zheng et al., 2013). There is normally a target responsibility contract signed by both the top officials and lower-level government officials which stipulates the specific obligations of each party (Zheng et al., 2013).

With environmental measurements incorporated into the evaluation system for political promotion, political leaders should be motivated to control pollution because it might affect their career prospects. In fact, Lan et al. (2014) found that SO\textsubscript{2} levels are significantly lower when the environmental accountability system is adopted. The system however has no effect on other types of pollutant, such as waste water and gas (Lan et al., 2014). Zheng et al. (2012) found that decreased pollution in water and air pollution and treatment for solid waste increase leaders\textsuperscript{7}

\textsuperscript{6} In China, the government generally consists of central government, regional government (or provincial government) and local government.
probability to be promoted (Zheng et al., 2013). This suggests the need to examine the effect of the environmental accountability system by using multiple measures of environmental outcomes as dependent variables.

**Data and Variables**

**Dependent variables:** I measure three types of environmental outcomes: water, air and X pollution. Further, I adopt two measures for water pollution: wastewater, industrial chemical and oxygen demand (COD). I adopt two measures for air pollution: SO$_2$ and waste gas. And finally I adopt one measure for solid waste.

Among these measurements, COD and SO$_2$ are the two measurements that the environmental accountability system uses to evaluate regional political leaders. To include measurements that are adopted by the accountability system and those that are not adopted by the system allows us to evaluate whether political leaders respond only to measurements that are included in their evaluation for promotion, or go beyond those indicated pollutants in their environmental performance. If the results suggest political leaders indeed are attentive to a variety of environmental issues, incorporating environmental measurements into the evaluations of political leaders is a powerful tool for dealing with China’s severe pollution problem. The government therefore should broaden the scope of environmental accountability systems to include more environmental indexes to the system.

All dependent variables are first constructed as per capita values to account for influences of regional differences such as economy size. I then take a natural log value of each variable to control the magnitude across pollution media. The pollution data is obtained from the China Statistical Yearbook on Environment, and the data is crosschecked and complemented with
China’s National Bureau of Statistics. Since the passage of the Regulation of the People's Republic of China on the Disclosure of Government Information (xinxi gongkai tiaoli) in 2007, the Chinese government made more information publicly available. Scholars for academic research have used data from the Chinese national statistical bureau and yearbooks more often since then (Kahn et al., 2013; Lan et al., 2014; Jing Wu et al., 2013). This paper follows data approached by recent empirical papers such as Lan et al. (2014) and Wu et al. (2013) to use data from more recent years, specifically 2004 to 2013, to increase the probability of data consistency.

First independent variable: Soft Budget Constraint

The first explanatory variable to explain China’s environmental outcome is “soft-budget constraint.” Ideal measurements for soft-budget constraint would be subsidies and tax concessions that local governments provide to SOEs (A. Kornai et al., 2003). Unfortunately, such information has not been made available in China. Instead, I adopt two indirect measurements to capture the relationship between regional governments and SOEs:

The first measurement I use is main tax paid by SOEs. As discussed in the literature review section, because a state-owned enterprises (SOE)’ main goal is to generate profit and ensure employment, SOEs in China receive considerable subsidies from the government (Lin, Cai, & Li, 1998; Qian, 1996) and have policy support to have better access to bank credit (Megginson, Ullah, & Wei, 2014). I hypothesize that in provinces where SOEs constitute a large portion of the tax base, environmental pollution problems will be substantially larger. There is a great variation among Chinese provinces with some land-locked energy intensive provinces heavily

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relying on SOEs, such as Shanxi, and some provinces that are close to the coast having expansive private sectors, such as Guangdong. Data is obtained from the China Statistical Yearbook of Finance, 2004 to 2013. The variables are modified to per capita measures and then are taken to natural log to ensure greater compatibility across provinces.

\[ H_{1a}: \text{the more taxes a province collects from SOEs, the higher pollution level the province will have.} \]

**Second independent variable: Fiscal Decentralization.**

Fiscal decentralization may also help explain provincial governments’ ability to provide “soft-budget constraint” conditions therefore increasing pollution level. There are two reasons why fiscal decentralization could be a proxy for soft-budget constraints. The first is provinces that have more financial resources are better able to provide financial assistance to SOEs located in their jurisdiction (i.e. larger possibility of forming soft-budget constraint). Financial decentralization may be endogenous to SOEs’ presence in provinces because provinces with a larger number of SOEs could generate more tax revenue, therefore retaining more revenue after sharing with the central government. I deal with this problem by adopting a fixed-effects model to capture some underlying characteristics of provinces.

Second, a more decentralized system may create more competition among provinces. According to US federalism literature, local governments possess more information than central governments (Dijkstra & Fredriksson, 2010; Millimet, 2013). Competing for economic resources, local governments would lower their regulatory standards, including their environmental regulations, to attract more businesses to their jurisdictions resulting in a phenomenon of “race to the bottom” (Revesz, 1992). As described in the literature section, after the tax reform, provincial governments have to heavily rely on value-added tax, business tax, and
enterprise profit tax (i.e. these three types of taxes constitute of 70% of regional governments’ revenue) (Lan et al., 2014). Such competition has been well-documented in empirical studies. For example, scholars have shown the decentralized financial system has motivated local governments to raise revenue through leasing land and attracting businesses to raise tax revenue (Su & Zhao, 2004; Tao, Liub, & Zou; X. Zhang, 2006). Relaxed environmental regulation could be another tool for local governments to attract businesses to their jurisdiction. This is also one type of soft-budget constraint. Fiscal decentralization is measured by the ratio of local government expenditure over central government expenditure (T. Zhang & Zou, 1998). Data is obtained from the Chinese Statistical Yearbook of Finance, 2004 to 2013.

\[ H_{1b} \text{ provinces with a higher ratio of local government expenditure over central government’s expenditure will have higher pollution levels.} \]

**Third independent variable: Political Leaders’ Promotions**

Facing the conflicting goals of economic growth and environmental protection, provincial leaders tend to focus on economic measurement that are “hard” targets in their evaluation process (Bo, 1996; Chen, Li, & Zhou, 2005; Li & Zhou, 2005). This literature, however, does not model the relationship between promotional outcome and environmental protection efforts. There is an implicit assumption in these studies that political leaders primarily focus on economic growth while overlooking environmental protection. Wu et al. (2013) is one of the few studies that models both economic measurements and environmental measurements in relationship to political promotion, but their study focuses on city-level leaders.

If empirical studies consistently show that economic growth is positively associated with political leaders’ promotion, we could reasonably argue that such economic expansion should be
associated with worsened environmental outcomes unless large scale and effective environmental control measures are taken. Empirical studies on China’s environmental law enforcement suggest this is rarely the case (E. C. Economy, 2011). Therefore, I hypothesize:

\[ H_2: \text{pollution levels will be positively associated with political promotion.} \]

Following this strand of literature, I collected provincial leaders’ biographic information from China Vitae (http://www.chinavitae.com/index.php), which collects CVs of China’s political leaders. Because the Party implements a double track system (described on p.14 literature review section), I collect information both on provincial governors and provincial party secretaries. Promotion data is coded in consistently with previous studies on China’s political system (Bo, 2002; Chen et al., 2005; Jiannan Wu & Ma, 2009): 1 means Succession, meaning a political leader remains in the same position; 2 means Transfer, meaning a leader is deployed to a similar ranked position; 3 means Promotion, meaning a leader is promoted to a higher ranked position or jurisdiction; 4 means Turnover, meaning a leader is dismissed due to misconduct; 5 means Retirement, meaning a leader is dismissed when reaching retirement age. When conducting analysis, I further aggregate the variable to a binary variable with 1 indicating promotion and 0 otherwise. Because political promotion normally takes place in January of each year, and leaders may be promoted because of last year’s performance, I also include a lagged term of promotion (Liu, Wu, & Ma, 2012). To be consistent with other variables, I collect information on political leaders from 2004 to 2013.

**Environmental Accounting System (EAS):** the phenomenon that provincial political leaders purely focus on economic growth may have changed since the adoption of environmental accountability systems in 2006. One study finds that SO\(_2\) levels are significantly lower when the
environmental accountability system is adopted; however, the system has no effect on other types of pollutants (Lan et al., 2014). Another study finds that decreased water and air pollution and treatment for solid waste increases a mayor’s probability of being promoted (Zheng et al., 2013). Following Lan et al (2014)’s approach, I include two policy variables. The first policy variable (Policy0607) represents the environmental accountability system is being introduced to law:1 if year is equal to 2006 or 2007; and 0 otherwise. I include another variable (Policy 0810), which represents the period when the system is implemented and strengthened (Lan et al., 2014): 1 means period of time after 2007 and 0 otherwise.

I hypothesize pollution levels of all pollutants have a negative relationship with the two policy variables, and the relationship is stronger with the latter policy. This is because when firms adopt pollution control equipment, it normally reduces emission levels of several pollutants at the same time. And when firms decrease levels of total water or gas waste, they reduce emission levels of multiple pollution media.

\[ H_3: \text{pollution level will be negatively associated with political promotion in 2006 and 2007.} \]

\[ H_3: \text{pollution level will be negatively associated with political promotion after 2008.} \]

**Pollution Fees:** a rich literature on environmental regulation has shown regulations such as monitoring and enforcement behavior has an impact on regulators’ environmental outcome (Dasgupta, Laplante, Mamingi, & Wang, 2001; Deily & Gray, 1991; Foulon, Lanoie, & Laplante, 2002; Magat & Viscusi, 1990; Evan J Ringquist, 1993b). I include environmental charges that Chinese governments levied to account for regulations. Data is obtained from China’s Ministry of Environmental Protection, 2004–2013. Another measurement scholars
normally use is the frequency of inspections. Inspections are normally taken by local government bureaucrats such that the data is not well-kept by the government. According to an interview with an inspector from the Beijing Environmental Protection Bureau, inspectors almost need to conduct inspections because of the large number of enterprises they oversee and also due to China’s severe pollution problem. And the situation is generally true across the country based on my field research. So even if inspection data is available, the variable of provincial inspections will not be a useful variable to analyze.

**Political Leader Attributes:** Lastly, I include political leaders’ attributes as control variables. Zheng et al. (2013) find that leaders with higher education devote more effort to protect the environment. I include political leaders’ education background in the model (Zheng et al., 2013). Data is obtained from China ViTae (Vitae: [http://www.chinavitae.com/index.php](http://www.chinavitae.com/index.php), 2004 to 2013. Another control variable is age. Kahn and Zhao (2013) argue that younger provincial governors would have greater career concerns because of their longer future career planning and their empirical study shows consistent results with other studies such as: Li and Zhou (2005) (Kahn et al., 2013; Li & Zhou, 2005). Data is coded as: 1 = high school degree; 2 = college degree; 3 = Master’s degree; 4 = PhD degree; 5 = overseas study experience. The following table presents summary statistics:
Table 1: Summary Statistics for Variables Adopted

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number of Observation</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (10000 tons)</td>
<td>310</td>
<td>6.62094</td>
<td>8.682508</td>
<td>0.1364</td>
<td>56.5305</td>
</tr>
<tr>
<td>COD (10000 tons)</td>
<td>309</td>
<td>31.9529</td>
<td>39.30332</td>
<td>0.07</td>
<td>198.25</td>
</tr>
<tr>
<td>Waste Water (10000 tons)</td>
<td>309</td>
<td>127.2427</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO2 (tons)</td>
<td>309</td>
<td>71.71053</td>
<td>71.2152</td>
<td>0.1</td>
<td>1065.87</td>
</tr>
<tr>
<td>Dust and Scoot (tons)</td>
<td>310</td>
<td>491.0104</td>
<td>5468.376</td>
<td>0.1</td>
<td>91327.79</td>
</tr>
<tr>
<td>Solid Waste (10000 tons)</td>
<td>310</td>
<td>81520.7</td>
<td>520517.1</td>
<td>5.4869</td>
<td>6194218</td>
</tr>
<tr>
<td>SOE Tax (100 million yuan)</td>
<td>310</td>
<td>195.9599</td>
<td>186.2163</td>
<td>0.31</td>
<td>866.32</td>
</tr>
<tr>
<td>Pollution Fee (10,000 yuan)</td>
<td>310</td>
<td>60532.96</td>
<td>81588.7</td>
<td>0.0</td>
<td>848971</td>
</tr>
<tr>
<td>Governor Promotion</td>
<td>310</td>
<td>2.719355</td>
<td>0.6934363</td>
<td>1.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Governor Education</td>
<td>310</td>
<td>2.690323</td>
<td>0.5809015</td>
<td>2.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Governor Age</td>
<td>310</td>
<td>58.54516</td>
<td>4.155111</td>
<td>47.0</td>
<td>71.0</td>
</tr>
<tr>
<td>Secretary Promotion</td>
<td>310</td>
<td>2.735484</td>
<td>0.6786377</td>
<td>1.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Secretary Education</td>
<td>310</td>
<td>2.816129</td>
<td>0.8486032</td>
<td>2.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Secretary Age</td>
<td>310</td>
<td>66.24839</td>
<td>110.5227</td>
<td>47.0</td>
<td>2004</td>
</tr>
</tbody>
</table>

Variables are used to estimate a fixed effects regression model:

\[ y_{it} = \alpha_{i} + \gamma + \beta_{it} + \epsilon_{it} \]

Where \( \alpha_{i} \) represents emission level of water, air, and solid waste pollution; \( \gamma \) represents two variables measuring soft-budget constraint: SOE tax and fiscal decentralization; \( \beta_{it} \) is a vector of dummy variables representing different periods of adopting EAS and strengthening EAS. \( \epsilon_{it} \) represents a vector of control variables such as political leaders’ education background and age.
Empirical Model Results

In this section, I discuss results from fixed effects models. In the first table, I present results from reduced form models, and in the second table, I present results from full function models with covariates. The reduced model generally follows Lan et al. (2014)’s approach that mainly explains China’s environmental outcome by fiscal decentralization and the environmental accountability system. I argue that China’s fiscal structure and the newly implemented environmental system alone cannot explain China’s environmental outcome. The variables adopted at Lan et al. (2014) only represent a reduced form. Two important independent variables: soft-budget constraint and political leaders’ general incentives for promotion are missing from their model. Once these two variables are added the squared is improved in every model, and the effect of fiscal decentralizing is decreased and, in some cases, is counteracted in new models.

I first followed Lan et al. (2014)’s approach to use industrial wastewater, gas, SO₂ and solid waste as dependent variables. I added one more dependent variable: COD that was not used in Hong at al. (2014)’s model but, nevertheless, is relevant to the research questions because COD has been incorporated into a new evaluation system used by the central government to evaluate regional political leaders. Though I collected data until 2013, I only run a model on the year frame from 2004 to 2010 to be consistent with Hong et al. (2014). I find only wastewater and gas are consistent with Hong et al. (2014)’s finding that higher levels of pollution are associated with

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8 Lan et al. (2014) include model reports based on hausman test (p. 16). When p value is less than 0.05 from hausman test, they report fixed effects model results and when p value is greater than 0.05, they report results from random effects model. I argue that fixed effects model fits my data better even when hausmen test indicates a random effect model. One reason is that there are underlying factors that vary across provinces but do not change over time. In the post reform period (after 2000), China’s provinces stay relatively the same in terms of size and economic structure. Another reason is that fixed effects model generates more consistent estimates (Kenward and Roger 1997).
a higher level of fiscal decentralization, i.e. in provinces where regional governments have a higher level of fiscal expenditure, the emission level of industrial wastewater and gas will be higher. I find the opposite effect on SO2 and solid waste. In provinces where regional governments have a higher level of fiscal expenditure, the emission level of SO2 and solid waste will actually be lower. For the newly added dependent variable, COD, I find a positive sign of the coefficient of fiscal decentralization, i.e. in provinces where regional governments have a higher level of fiscal expenditure, the emission level of COD will be higher. The reduced model results show that there is some evidence that fiscal decentralization is associated with a higher level of water pollution (wastewater and COD). However, fiscal decentralization is negatively associated with air and solid waste pollution, i.e. provinces that have a higher fiscal expenditure would have less air and solid waste pollution. I hypothesize it is because regional governments that have more fiscal resources have more resources to assist firms in technology transformation to reduce air pollution and solid waste. These governments would make air and solid waste pollution a priority to deal with because air pollution has been historically high and a great deal of media attention tends to center on China’s air pollution issues (Hsu, 2014; Times, 2012). Unlike attracting much media attention, solid waste treatment is generally treated under the radar that a large amount of solid waste in China is simply being burned. Burning solid waste decreases the amount of solid waste on paper but generates other serious environmental problems (Balkan, 2012). Because water pollution tends to attract less media attention, regional governments may be lenient with firms concerning water pollution to allow them expand production.
When adding the soft-budget constraint and political leaders’ independent variables, the effect of fiscal decentralization on air pollution is counteracted by political leaders. Provinces that have a higher ratio of expenditure compared to the national government’s expenditure still have lower level of SO\textsubscript{2} emissions; however, the magnitude is lower. The coefficient of lagged promotion of the provincial governor is positive meaning once a governor is promoted he may be relaxed and less rigorous in controlling SO\textsubscript{2}, a main measurement used in the reformed evaluation system. The SO\textsubscript{2} level will be higher after a governor is promoted counteracting the effort and investment went into decreasing SO\textsubscript{2} pollution. Water pollution (wastewater and COD) is
continually positively associated with fiscal decentralization. For wastewater, the magnitude of 
fiscal decentralization is smaller because of another variable: a governor’s promotion also 
contributes to a higher level of wastewater. Similar to SO₂, once a governor is promoted, he is no 
longer motivated to keep the wastewater level low, which results in a higher level of wastewater. 
Even though COD is still positively associated with fiscal decentralization, the magnitude is 
smaller. The effect is counteracted by the policy variable. Because COD was incorporated as a 
“hard target” by the EMAs, politicians started to reduce COD levels since the new policy was 
introduced. Both policy variables are negative and significant.

As discussed above, political leaders’ promotions are positively associated with both water 
pollution and air pollution and that after a provincial governor is promoted, the pollution level of 
wastewater will be 0.00002 % higher and the SO₂ will be 0.16 % higher. Governors’ educational 
backgrounds do not seem to be related to pollution levels. Party secretaries’ educational 
backgrounds are positively associated with wastewater and SO₂ but negatively associated with 
COD level. This finding is contradictory to previous research that argues that political leaders’ 
who received higher education or have abroad study experience tend to be more rigorous in 
solving environmental problems. However, this kind of argument may only apply to provincial 
governors but not party secretaries. The Communist Party tends to select administrators who 
have better educational background, but for party secretary, the Party’s choice tends to be based 
on a party member’s loyalty to the party and his or her political sense (zhengzhi juewu). Thus the 
Party secretary tends to be older and, in general, have lower education degrees. The party 
secretary’s age is positively associated with wastewater and gas, meaning provinces with older 
governors tend to have higher levels of wastewater and waste gas. These results are consistent
with Kahn and Zhao (2013)’s argument that younger provincial governors would more proactive in environmental regulations because of their longer future career planning.

<table>
<thead>
<tr>
<th></th>
<th>LPER Wastewater</th>
<th>LPER Gas</th>
<th>LPER SO2</th>
<th>LPER Solid Waste</th>
<th>LPER COD</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSOE Tax Per Capita</td>
<td>0.2528</td>
<td>0.9207***</td>
<td>0.2403</td>
<td>-0.0758</td>
<td>0.4051*</td>
</tr>
<tr>
<td></td>
<td>(0.4731)</td>
<td>(0.3817)</td>
<td>(0.1903)</td>
<td>(0.3602)</td>
<td>(0.2132)</td>
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<tr>
<td>Fiscal Decentralization</td>
<td>0.00004***</td>
<td>-0.00002***</td>
<td>-0.000001***</td>
<td>-0.000009</td>
<td>0.000237***</td>
</tr>
<tr>
<td></td>
<td>(0.00001)</td>
<td>(0.000008)</td>
<td>(0.000003)</td>
<td>(0.00001)</td>
<td>(0.000006)</td>
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<tr>
<td>Lagged Governor Promotion</td>
<td>0.00002***</td>
<td>-0.3419</td>
<td>0.1553***</td>
<td>-0.0931</td>
<td>0.1260</td>
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<tr>
<td></td>
<td>(0.1875)</td>
<td>(0.2730)</td>
<td>(0.0613)</td>
<td>(0.2085)</td>
<td>(0.0827)</td>
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<td>Lagged Secretary Promotion</td>
<td>0.0593</td>
<td>-0.0562</td>
<td>0.0807</td>
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<tr>
<td></td>
<td>(0.1303)</td>
<td>(0.0876)</td>
<td>(0.0549)</td>
<td>(0.1332)</td>
<td>(0.1586)</td>
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<td>Governor Education</td>
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<td>-0.0762</td>
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<td></td>
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<td>(0.1878)</td>
<td>(0.0679)</td>
<td>(0.1673)</td>
<td>(0.1093)</td>
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<td>Governor Age</td>
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<td>-0.025</td>
<td>0.0274</td>
<td>-0.0118</td>
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<td></td>
<td>(0.0207)</td>
<td>(0.0160)</td>
<td>(0.0167)</td>
<td>(0.0207)</td>
<td>(0.0117)</td>
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<tr>
<td>Secretary Education</td>
<td>0.2246*</td>
<td>0.0921</td>
<td>0.0508*</td>
<td>0.0030</td>
<td>-0.1651*</td>
</tr>
<tr>
<td></td>
<td>(0.1292)</td>
<td>(0.0780)</td>
<td>(0.0295)</td>
<td>(0.1741)</td>
<td>(0.0906)</td>
</tr>
<tr>
<td>Secretary Age</td>
<td>0.0004***</td>
<td>0.0001***</td>
<td>0.00001</td>
<td>0.00001</td>
<td>-0.00005</td>
</tr>
<tr>
<td></td>
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<td>(0.00005)</td>
<td>(0.00004)</td>
<td>(0.00008)</td>
<td>(0.00005)</td>
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<td>Policy0607</td>
<td>0.1020</td>
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<td>0.0033</td>
<td>-2.1891***</td>
<td>-0.4201***</td>
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<tr>
<td></td>
<td>(0.1418)</td>
<td>(0.0827)</td>
<td>(0.0658)</td>
<td>(0.4329)</td>
<td>(0.0618)</td>
</tr>
<tr>
<td>Policy0813</td>
<td>0.2115</td>
<td>0.1993</td>
<td>-0.1818*</td>
<td>-1.2789***</td>
<td>-1.1958***</td>
</tr>
<tr>
<td></td>
<td>(0.1771)</td>
<td>(0.1910)</td>
<td>(0.1009)</td>
<td>(0.2402)</td>
<td>(0.1037)</td>
</tr>
<tr>
<td>LPollution Fee Per Capita</td>
<td>-0.4205***</td>
<td>-0.3937***</td>
<td>0.0645</td>
<td>0.4227</td>
<td>-0.1034</td>
</tr>
<tr>
<td></td>
<td>(0.2200)</td>
<td>(0.1826)</td>
<td>(0.1181)</td>
<td>(0.3674)</td>
<td>(0.2201)</td>
</tr>
<tr>
<td>Percentage of Heavy Industry</td>
<td>0.0226***</td>
<td>-0.0084</td>
<td>-0.0012</td>
<td>0.0067</td>
<td>-0.0066</td>
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<tr>
<td></td>
<td>(0.0087)</td>
<td>(0.008)</td>
<td>(0.0032)</td>
<td>(0.0091)</td>
<td>(0.0074)</td>
</tr>
<tr>
<td>Ln GDP</td>
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<td>-1.6235***</td>
<td>-0.211</td>
<td>-1.8901***</td>
<td>0.695***</td>
</tr>
<tr>
<td></td>
<td>(0.2200)</td>
<td>(0.657)</td>
<td>(0.1243)</td>
<td>(0.7431)</td>
<td>(0.3801)</td>
</tr>
</tbody>
</table>

| R^2 | 0.07 | 0.21 | 0.5 | 0.4 | 0.7 |

Note: models have adopted robust standard errors and included in parentheses.
*p < 0.10, **p<0.05, ***p<0.01 two-tailed tests.
The measurement for soft-budget constraint is significant for industrial waste, gas, and COD. Provinces that have larger SOE tax revenue have higher levels of air pollution (gas) and water pollution (COD). One percentage higher of the ratio of local expenditure over central government is associated with 0.97% of more gas emission and 0.41% of COD emission. The results provide some evidence that soft-budget constraints could be positively associated with pollution levels. However, keep in mind that the SOE tax base is an indirect measurement for soft-budget constraints. In order to unravel how soft-budget constraints affect pollution levels, we need to continue to identify direct measurements, such as subsidies and tax breaks from local governments to SOEs.

Both policy variables are significant across different types of pollution. It seems that adopting the environmental accountability system has an effect not only on COD and SO₂ but also on other types of pollutants such as nitrogen, dust, soot, and solid waste. This finding is different from those in Lan et al. (2014), who finds that the environmental accountability system only has demonstrative effect on SO₂. Lan et al. (2014)’ model is suffered from model identification that did not consider soft budget constraint’s impact on pollution outcome. If political leaders indeed respond to the adoption of an environmental accountability system⁹, there may be reasons they also control other types of pollution. One is when firms adopt pollution control equipment. Such equipment normally reduces several pollutants at the same time. Similarly, when firms reduce the total amount of wastewater pollution, they reduce the emission of COD and nitrogen at the same time. Additionally, political leaders may view the adoption of an environmental accountability system as a way to improve their environmental performance, which can be reflected in their performance evaluation.

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⁹ As discussed in Lan et al. (2014), political leaders may fabricate statistics in order to have good scores for the environmental accountability system. However, they argue, if these numbers are changed, it at least reflects that political leaders respond to environmental accountability system in some way and the central government’s evaluation system. This suggests the current evaluation system has some utility in changing Chinese political leaders’ behavior, albeit in not the way it was intended.
accountability system as a signal for increased emphasis on environmental protection in their career evaluations. Therefore, they may take proactive actions to deal with future reform in the evaluation system.

Conclusion and Discussion

I analyzed two types of institutional constraints China faces that could prevent provincial governments from conducting effective environmental protections. Through panel analysis, I find that provinces that have a large tax base from SOEs tend to have higher levels of water and air pollution. Fiscal decentralization is negatively associated with air and water pollution, and provinces that have more financial resources are associated with lower levels of water and emissions. I explain this result by pointing out that air pollution is usually a high stake issue, and China still uses simple incineration methods to treat solid waste which makes reducing solid waste easier for regional governments. But for water pollution that has not received much attention as air pollution, fiscal decentralization is positively associated with water pollution (wastewater and COD). This result offers partial evidence that fiscal decentralization could be associated with higher levels of pollution.

I find that once a provincial governor is elected, the pollution level of water and air is higher. He or she may be relaxed after being promoted and become less rigorous in controlling pollution levels. This effect, in some cases, counteracts efforts the government put into pollution control previously. The secretary’s educational background is positively associated with pollution levels. But I argue this result cannot be used to refute the argument that political leaders with higher degrees will be more rigorous in environmental control because party sectaries are normally selected and promoted according to their loyalty and political sense (zhengzhi juewu) rather than
educational background. The party secretary’s age is also positively associated with pollution levels. I argue that younger leaders will be more proactive to take more aggressive actions towards improving the environment because they have longer careers and they foresee the central government will implement more environmental policies in the future that could be related to their careers.

I find that pollution levels of air, water, and solid wastes are generally lower after the environmental accountability system is adopted. This shows political leaders respond to EAMs and adjust their behavior accordingly. Contrary to earlier studies (Lan et al., 2014; Zheng et al., 2013), I find that political leaders’ educational backgrounds are not correlated with pollution outcomes. Also contrary to Zheng et al. (2013) and Lan et al. (2014)’s results, Party secretaries’ age is negatively associated with water and air pollutions, such that in provinces where older secretaries are older pollution level is lower.

I am appropriately cautious about making generalized claims from this research which shows evidence that some of the institutions analyzed in China have an impact on their environmental outcomes. In order to further prove that soft-budget constraints have a decisive impact on China’s environmental outcome, more direct measurements such as local governments’ subsidies and tax breaks to SOEs should be collected and analyzed. A qualitative study to picture the dynamic between local governments and SOEs would also be helpful for us to understand more of the mechanisms that are involved in creating and maintaining soft-budget constraints at the local level.
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Tao, R., F. Y. M. Liub, et al. "“Race to the Bottom” Competition by Negotiated Land Leasing."


Chapter II: Can Supply Chain Management Improve Firms’ Environmental Performance?

Introduction

Almost all consumer goods we see today are produced by multiple firms. In order to make sure the final products sold to consumers meet environmental regulatory requirements, parent companies\(^\text{10}\) need to make sure components provided by suppliers are also in compliance with environmental regulations (Seuring & Müller, 2008). Facing an increasingly complicated domestic regulatory environment, some firms also view more stringent regulations as opportunities to improve efficiency (Hansmann K W, 2001; Hutchison, 1998; Porter & Van der Linde, 1995b). Firms do not only take reactive measures to cope with regulations by conducting whole supply chain environmental management, but also actively look for innovative ways to control environmental damages through a whole supply as a way to increase competitiveness.

While there is an extensive literature on the drivers and motivations for conducting green supply chain management (GSCM) in general (Green, Morton, & New, 1996; Hall, 2000; Hunt, 1990; Kemp & Soete, 1992; Lamming & Hampson, 1996; Williams H. Medhurst, 1993), only a few empirical studies have evaluated whether such practices have an impact on firms’ environmental performance. This sparse literature also tends to overly focus on cases in Asia and Eastern Europe. Even though an emphasis on these regions may reflect the reality that most manufacturing has shifted to Asia and Eastern Europe, this type of research should be equally important in the United States. As Fiorino, D. and M. Bhan (2013) correctly point out, supply chain management resembles governmental regulations in many ways, and understanding the

\(^{10}\) Scholars identify companies that serve final products differently, with some define these companies as “focal companies” and others call them parent companies or simply buyers. These companies named differently however have similar characteristics, which normally are the closest to consumers and have power to govern the supply chain and require suppliers to make behavioral change (Seuring and Muller 2008).
mechanism of supply chain management opens up opportunities for public and private collaborations (Fiorino & Bhan, 2013), especially when green supply chain provides opportunities to reduce the cost for public regulations. According to Vandeberg (2005), private firms conduct significant amounts of monitoring and enforcement to make sure their partners are in compliance with their environmental requirements (Vandenbergh, 2005). The total annual expenditure of private firms spent just on Phase I environmental assessments exceeds $500 million a year compared to $400 million spent by the EPA’s enforcement office (Vandenbergh, 2005). With more available public data in the United States, supply chain management scholars have more opportunities to conduct systematic studies on understanding the mechanism of supply chain management and evaluating the effectiveness of such practices.

The current field of green supply chain management mostly relies on surveys, interviews, and case studies. The purpose of this paper is to evaluate whether supply chain management has an impact on firms’ environmental outcomes through systematic quantitative study. In particular, I ask several questions in this paper and aim to answer these questions using empirical evidence from power generating and consumer electronics sectors in the United States. Specifically, I ask the following questions:

1. Is there a correlation between parent firms’ and supplier firms’ environmental performance? Specifically, do firms that have better (or worse) environmental performance tend to conduct businesses with firms that also have good (or poor) environmental performance?

2. Do parent companies’ supply chain management efforts improve their suppliers’ environmental performance?
3. Does conducting supply chain management improve companies’ own environmental performance?

**Literature Review**

Supply chain normally refers to a process that consists of a product’s life cycle from raw material production to manufacturing different components and, finally, the assembled product to be delivered to final consumers. This process normally involves multiple firms linked through a supply chain that interacts with each other through contracts, enforcement of contracts, information sharing, and other activities (Ayers, 2006). Figure 1 shows a schematic depiction of the supply chain provided (Cox, Sanderson, & Watson, 2001)

![Figure 1: A typical manufacturing (product) supply chain](image)

Environmental impacts could be generated through the entire lifetime of the supply chain from raw material extraction to production and transportation to the final customers. Green supply chain management (GSCM) aims to integrate social and environmental goals into firms’ general economic goals through inter-firm collaborations (Ageron et al., 2012). There are many variations with regard to the concepts of dealing with environmental issues during different stages of supply chains. For example, Cruz (2009), Young and Kiekliwicz-Yong (2001) use the term sustainable network management, which tends to incorporate all types of social responsibility measures into supply chains including issues such as labor standards, ethical standards, and environmental issues (Cruz, 2009; Young & Kielkiewicz-Young, 2001). Some
scholars, such as Wu, Dunn, and Forman use green supply chain and sustainable supply chain interchangeably, but such cases are rare and authors tend to focus on all aspects of social responsibility measures (John Wu, Dunn, & Forman, 2012). In my study, I focus on only environmental aspects of supply chain management. Lippman (2009) and Sharfman et al. (2009) adopt the concept of supply chain environmental management, which has a very similar meaning and implication as the terminology used by scholars such as Svensson (2001) and Sarkis (1995, 2006, 2010) who have focused on summarizing and theorizing in the field to give a more consistent definition to be more widely used by scholars.

Firms often see this green supply chain management desirable because sometimes customers and other stakeholders do not distinguish between a company and its suppliers (Sarkis, 2006). According to Bacallan (2000), ”although they may have nothing to do at all with the problem, companies are often held accountable for the labor practices and the environmental liabilities of their suppliers.” Therefore, companies have the incentive to green the whole supply chain to avoid potential environmental problems that might arise with their suppliers that may threaten their own environmental performance and public image (Sarkis, 2006).

*Can supply chain management improve firms’ environmental performance?*

A small set of empirical studies has found that supply chain management has a positive impact on firms’ environmental performance. Frosch (2008) finds a positive effect of green supply chain management (GSCM) on firms’ environmental performance (Frosch, 2008). Through explanatory case studies on Toyota and adoption of ISO 140001, Simpson et al. (2005) find that consumers’ demand on environmentally-friendly products has a positive impact on suppliers’ environmental performance (Simpson & Power, 2005). Through an extensive survey study in
southeast Asia, Rao (2002) shows that firms start with their own environmental initiatives and then help their suppliers to become greener (Rao, 2002). The extra effort made by parent companies does not only improve the environmental performance of the suppliers but also further enhances their own environmental performance (Rao, 2002). A later study by Rao and Holt (2005) shows that having suppliers adopt an environmental management system (EMS) and greening their operations has led to a significant reduction of waste and air pollution by suppliers and increased compliance with environmental regulations (Rao & Holt, 2005). However, these studies are limited to Asia.

Drawing evidence from 118 firms in China, Christmann and Taylor (2001) find firms that supply to multinational corporations in China or supply to developed countries have better environmental compliance than other firms (Christmann & Taylor, 2001). Through a case study in the United Kingdom, Green et al. (1998) conclude that supply chain management has a positive effect on environmental outcomes, but it is not clear whether collaboration between firms is the most effective approach to stimulate better environmental outcomes (Green, Morton, & New, 1998). Utilizing an OECD survey that targeted 3,746 U.S. manufacturing facilities worldwide, Darnall et al. (2008) found that facilities that have adopted EMS are more likely to impose indirect control mechanisms on suppliers that are, in turn, more likely to improve their suppliers’ environmental performance.

Surprisingly, the majority of supply chain management studies focus on Eastern Europe and Asia. Only a few studies are conducted in the United States. Through a national survey with the chemistry industry in the United States, Theyel (2006) found that firms that thrive to meet customers’ standards are more likely to set such standards for their suppliers, and such collaboration make firms successful in waste reduction (Theyel, 2001). Drawing evidence from
three automobile assembly plants in the United States, Geffen and Rothenberg (2000) show that through actively involving first tier suppliers in environmental innovation, the first two plants have significantly improved efficiency and reduced waste for both suppliers and the plants. The third plant that failed to involve its suppliers in environmental control has had a difficult time integrating new materials into its production process and has experienced a dramatically increased pollution level of 40% yearly (C. A. Geffen & Rothenberg, 2000).

The majority of studies in GSCM focuses on Eastern Europe and Asia largely because of the shift of a bulk of global manufacturing to these regions (Anbumozhi & Kanda, 2005; Baresel-Bofinger, Ketikidis, Koh, & Cullen, 2006; Rao, 2002). Given the fact that the public and private costs of traditional environmental protection are significant - these costs were in the tens of millions of dollars in recent years (Clark, 2005) - policy makers are interested in alternative approaches such as business-led voluntary programs, information disclosure, and laboring to unleash the market power to deal with environmental problems in a more efficient way (Clark, 2005). Supply chain management has the potential to be substitutive or complementary to public regulations as “co-regulator” (Fiorino & Bhan, 2013; D. O'Rourke, 2003). More empirical studies in GSCM are needed in the United States context for efficiency improving purposes. Given that data availability in the United States is much higher than most developing counties, such studies should be more comprehensive.

In addition, the field of GSCM is overwhelmingly dominated by case studies, surveys, and interviews, which normally deal with small sample sizes that limit the generalizability of these studies. In this project, I attempt to use publicly available data to support a large-n quantitative study to identify broader patterns and increase the generalizability of GSCM studies.
Sample, Data and Measurements

In this study, I focus on two sectors in the United States: the power generation sector (utilities) and consumer electronics sector. The reason for selecting these two sectors is that they contrast with each other in terms of levels of responsiveness to market changes such that the consumer electronics sector is relatively more responsive to the market. The purpose is to identify general patterns of how supply chain management impacts environmental performance on these two distinct sectors. In both sectors, I select companies that are publicly listed because their financial data and some organizational data are publicly available. Konar and Cohen (1998) found that firms “with the largest negative abnormal stock price returns upon the first initial announcement of TRI were the firms that reduced emissions the most.” Through CSIMarket, an independent digital financial media company’s analysis, I am able to pair parent companies with their first tier suppliers.

Accordingly, this study contains two samples. One sample is from the electronics sector that consists of 209 parent companies and paired with 2,759 supplier companies. The second sample is from the power-generating sector that consists of 211 parent companies and paired with 9,382 supplier companies. Both samples then are matched with KLD database firms’ supply chain management and performance data. The environmental performance data for utility sector is from EPA’s TRI database. Because the utility sector is a focus of governmental environmental regulations, the TRI data is relatively complete for the utility sector. On the contrary, a large portion of TRI data for electronics is missing. I complement environmental performance data for

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11 **CSIMarket** is an independent digital financial media company that provides stock market analysis, industry research and news on business and economy to worldwide customers. http://csimarket.com/help/About_us.php

12 **KLD Research & Analytics**, Inc. (KLD) is the leading authority on social research for institutional investors. To meet the needs of social investors, KLD provides research, benchmarks, compliance, and consulting services analogous to those provided by financial research service firms.” Data obtained from Wharton Research Data Services (WRDS).
the electronics sector with KLD survey data. Both sectors contain data from 1998 to 2010.

Compared to previous research that largely relies on case studies and surveys on subjective matters this study uses publicly scrutinized data and contributes to the field by providing a more reliable data source and larger sample size.

Considering the complication of supply chain networks, readers may question how representative the dyadic relationship presented in this work is given that I was able to identify only the first tier suppliers. However, the field of GSCM is still very new (Seuring & Müller, 2008; Srivastava, 2007), and there is a lack of analytical framework and tools to systematically study complicated supply chains. Yet, studying dyadic relationship between parent companies and the first tier suppliers serves as an important first step to conceptualize the supply chain relationship (Anderson & Gerbing, 1988; Choi & Hartley, 1996; De Toni, 1999). In addition, first tier suppliers normally take on large responsibilities for product design and quality and work more closely with parent companies than the second and third tiered suppliers (Flynn & Belzowski, 1996; C. A. Geffen & Rothenberg, 2000). Therefore, the first tier suppliers’ interactions with the parent company will be more frequent and the relationship will be closer. Interesting patterns may be easier to be identified from the dyadic relationship and then could be applied to other tiers of suppliers in future research. Below is the summary statistics for both sectors:
<table>
<thead>
<tr>
<th>Utility</th>
<th>Observations</th>
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<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
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<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
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Table 2: Summary Statistics for Electronics Sector

<table>
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<th>Electronics</th>
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<td>2759</td>
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</table>

**Dependent variables:** for the power-generating sector, I include four dependent variables: onsite TRI and hazard releases, and offsite TRI and hazard releases. The data is from the EPA’s TRI database.\(^\text{13}\) The reason to include both measurements is because “hazard” is a broader definition.

\(^{13}\) http://www2.epa.gov/toxics-release-inventory-tri-program
than “toxics.”"\textsuperscript{14} While toxics are more closely monitored by the EPA, there are other hazards being generated from the production process. Including both measurements allows us to examine whether a parent company’s supply chain management has an impact on only high risk toxics or has an impact on general emission of all hazards. The time frame for TRI data is from 2000 to 2013 that could be matched to the KLD dataset. “The Pollution Prevention ACT of 1990 required plants that exceed the TRI reporting threshold to report their off-site transfers to recyclers beginning in 1991 (Gamper-Rabindran, 2006).” “The off-site transfers to recyclers comprise recycling for the recovery of solvents, the recovery of metals, other recovery, and for acid regeneration (Gamper-Rabindran, 2006).” “The Office of Technology Assessment highlights the failure of several offsite disposal, treatment, or recycling facilities to properly treat, recycle, and dispose waste, and their severe contamination of areas close to residential areas and aquifers (Gamper-Rabindran, 2006).”

Because of a large portion of missing data issues, I include a different dependent variable from KLD database: environmental strength as a proxy for environmental performance.

Environmental strength of suppliers is measured by total number of environmental programs adopted by suppliers from product design, pollution prevention, recycling, clean energy technology, and management systems to programs to reduce environmental impacts of operations. The time frame is also from 2000 to 2013.

**Independent variables:** the main independent variable is a parent company’s supply chain management performance. Empirical studies in Europe, Asia, and some sectors in the United States, Asia, and so on have focused on green practices in health care institutions, school districts, the construction industry, and restaurant chains.

\textsuperscript{14} According to the Environmental Protection Agency (EPA), if a waste does not appear on a special Listed Wastes group is labeled as ‘hazardous’ when it meets one (or more) of four waste characteristics. These characteristics are ignitability, corrosively, reactivity, and toxicity.
States suggest parent companies’ supply chain management has a positive impact on suppliers’ environmental performance, I expect the coefficient for parent company’s supply chain management to be negative, i.e., better supply chain management conducted by parent companies will lead to a reduced level of pollution by suppliers. Data is from the KLD database with a time frame from 2000 to 2013; 1 means strong supply chain management performance that parent firms take effective management measures to regulate their suppliers and 0 means weak parent companies have specific management measures with regard to suppliers.

I include an additional independent variable that measures suppliers’ supply chain management strength. Because the suppliers included in my study are first tier suppliers, they also govern a significant number of second and third tier suppliers. The rationale is that firms that conduct better supply chain management may, in general, have more concern about environmental issues and, therefore, show better environmental performance (Rao, 2002). I expect the sign of this variable to be negative as well. Data is also from the KLD database with a time frame from 2000 to 2013.

**Control variables**

**Environmental regulations:** in most cases consumer goods are produced by different firms that makes complying with environmental regulations not only an internal issue for the firm that serves the final product but also concerns the suppliers to provide components that are also in compliance with regulations (Tzavara & Héritier, 2012). With the pressure to make sure the final products are in compliance with quality and environmental regulations, parent companies have incentives to monitor and inspect or take other means to pressure their suppliers to comply with relevant regulations (Tzavara & Héritier, 2012). Parent companies that are subject to
stringent regulations will have stronger incentives and exert stronger pressure to monitor and inspect their suppliers (Hérîtier, Mueller-Debus, & Thauer, 2009). Through game-theoretical modeling, Tzavara and Heritier (2012) found that the “strictness” of regulations provides more incentives for parent companies to monitor their suppliers (Tzavara & Hérîtier, 2012). In this study, I do not have a direct measurement for the strictness of regulations. Instead, the KLD database provides information about firms’ compliance records. Using the same logic, I argue that parent firms that have good compliance records are more aware of environmental regulation issues and, therefore, are more likely to pressure their suppliers to comply whereas parent companies that are not in compliance are less incentivized or have fewer resources to keep their suppliers in compliance. I expect the sign of this variable to be negative - firms with parent companies having good environmental compliance records and will have better environmental performance.

**Firms’ size:** because larger firms may use more resources and generate more pollution in general, I include supplier companies’ revenues to control for the size of the companies.

**Estimation Strategies**

I answer the questions raised in two steps. I first conduct a series of correlation analysis to identify several relationships: 1) whether there is correlation between parent companies and supplier companies’ environmental performance; 2) whether there is a correlation between parent company’s supply chain management and suppliers’ environmental performance; and 3) whether there is a correlation between suppliers’ own supply chain management and their environmental performance. Then I conduct panel regression analysis controlling for factors that could impact firms’ environmental performance. In particular, I estimate a series of fixed-effects
models at the firm level with reduced functional form and full-functional form models all
reported in the next section (Hausman, 1978; Heckman & Hotz, 1989). \(^{15}\)

\[
Y_{it} = a + \sum \beta X_{kit} + \sum \Sigma C_{k} Z_{kit} + \sum \Sigma \delta_{i} W_{kit} + \Sigma \gamma_{i} v_{i} + \epsilon_{it}
\]

Where \(Y_{it}\) is the emission level of suppliers companies, \(X_{kit}\) represents parent companies’
supply chain management, \(Z_{kit}\) represents parent companies’ emission level, \(W_{kit}\) represents
supplier companies’ supply chain management, and \(v_{i}\) represents firm level fixed effects term
accounting for time-invariant firm factors that affect firms’ emission level such as size of the
firm.

**Empirical Results**

**Correlation results**

I first report the correlation results. Table 3 reports the correlation between parent companies and
supplier companies’ environmental performance. Among four different indicators of
environmental performance, only onsite hazard release shows significant correlation between
parent companies and their suppliers, and this relationship is positive.

\(^{15}\) Fixed effects models produce consistent coefficients but not efficient while random effects models are efficient
but less consistent (See Huasman 1978; Heckman and Hotz 1989). I chose fixed effects models because the
consistency is more important for policy implications.
Table 3 Correlation of Environmental Performance - Utilities

<table>
<thead>
<tr>
<th>Utilities</th>
<th>Parent Company</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Onsite TRI Release</td>
<td>Onsite Hazard Release</td>
<td>Offsite TRI Release</td>
<td>Offsite Hazard Release</td>
</tr>
<tr>
<td>Supplier Company</td>
<td>Onsite TRI Release</td>
<td>0.0301</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Onsite Hazard Release</td>
<td></td>
<td>0.0813**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Offsite TRI Release</td>
<td></td>
<td></td>
<td>-0.0202</td>
</tr>
<tr>
<td></td>
<td>Offsite Hazard Release</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.10, **p<0.05, ***p<0.01 two-tailed tests.

Table 4 presents a correlation between parent companies’ supply chain management with the suppliers’ environmental performance and the supplier companies’ own supply chain management with their own environmental performance. The results show that better supply chain performance conducted by parent companies is negatively associated with supplier companies’ onsite TRI release and a higher supply chain labor strength is associated with suppliers’ less onsite hazard release. However, this relationship is reversed in another measurement - offsite TRI release. Better supply chain management conducted by parent companies is associated with more offsite TRI release. This may be because when parent companies monitor or inspect supplier companies, it is easier for them to observe onsite TRI and hazard releases. The reduced TRI release from suppliers may be released from sites that are relatively further away from them.

Interestingly, good supply chain performance of suppliers are positively associated with onsite releases but negatively associated with offsite releases. This may be because those supplier
companies now act as parent companies for their own suppliers. They do not need to hide their pollution by moving it from onsite to offsite. In addition, suppliers’ own higher labor standard is associated with less onsite hazard releases.

Table 4 Correlation between Supply Chain Management and Environmental Performance – Utilities

<table>
<thead>
<tr>
<th>Utilities</th>
<th>Parent Company</th>
<th>Supplier Company</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supply Chain</td>
<td>Supply Chain Labor Standard</td>
</tr>
<tr>
<td>Supplier Company</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onsite TRI Release</td>
<td>-0.0357*</td>
<td>0.0102</td>
</tr>
<tr>
<td>Onsite Hazard Release</td>
<td>-0.0159</td>
<td>-0.0344*</td>
</tr>
<tr>
<td>Offsite TRI Release</td>
<td>0.1248***</td>
<td>0.0098</td>
</tr>
<tr>
<td>Offsite Hazard Release</td>
<td>0.0068</td>
<td>0.0113</td>
</tr>
</tbody>
</table>

*p < 0.10, **p<0.05. ***p<0.01 two-tailed tests.

The last table shows correlation results for the electronics sector. The results show that parent companies’ environmental strength is positively associated with supplier companies. When a parent company’s environmental strength is stronger, so is his or her suppliers. Parent companies’ supply chain performance is negatively associated with supplier companies, which is contrary to my prediction. Suppliers’ own supply chain performance is negatively associated with their environmental strength while suppliers’ own supply chain labor standards are positively associated with suppliers’ environmental strength.
Panel analysis results

Table 6 presents estimates for restricted models on four dependent variables. In these models, I include only the main independent variable – lagged parent firm’s supply chain management and the dependent variable. These models consistently show that better supply chain management conducted by a parent company is not associated with a supplier’s level of onsite or offsite TRI and hazard release. In the reduced models, the supplier’s revenue captures the main effects of the environmental outcome that firms with large revenue will have more resources to conduct more environmental control and keep the emission levels low.
Table 6 Restricted Models – Utilities

<table>
<thead>
<tr>
<th></th>
<th>Onsite TRI Release</th>
<th>Onsite Hazard Release</th>
<th>Offsite TRI Release</th>
<th>Offsite Hazard Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent Company Supply Chain Performance</td>
<td>0.1921</td>
<td>0.3002</td>
<td>-0.0946</td>
<td>0.0206</td>
</tr>
<tr>
<td></td>
<td>0.1786</td>
<td>0.2038</td>
<td>0.1245</td>
<td>0.2305</td>
</tr>
<tr>
<td>Supplier Company Revenue</td>
<td>0.022</td>
<td>-1.1516</td>
<td>-0.4536</td>
<td>-0.8851</td>
</tr>
<tr>
<td></td>
<td>0.0375</td>
<td>0.0299</td>
<td>0.0376</td>
<td>0.0400</td>
</tr>
<tr>
<td>Constant</td>
<td>7.4123</td>
<td>26.3508</td>
<td>0.3245</td>
<td>28.1011</td>
</tr>
<tr>
<td></td>
<td>0.3848</td>
<td>0.2079</td>
<td>0.3245</td>
<td>0.285</td>
</tr>
<tr>
<td>R²</td>
<td>0.001</td>
<td>0.9</td>
<td>0.4</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Note: models have adopted robust standard errors and included in parentheses. *p < 0.10, **p<0.05, ***p<0.01 two-tailed tests.

Table 7 shows estimates from full models with all covariates. Consistent with the reduced models, supply chain management conducted by the parent company has little or no effect on suppliers’ environmental performance. Among four dependent variables, lagged parent company’s supply chain management is only associated with suppliers’ onsite hazard release and the sign is positive – meaning better supply chain management conducted by the parent company is actually associated with higher levels of onsite hazard release. It is the total number of environmental programs adopted by the parent company that is negatively associated with suppliers’ environmental outcomes. The results show that the adoption of more environmental programs by a parent firm is associated with lower levels of onsite TRI, offsite TRI, and offsite hazard release. This suggests that a greener management process may be less important and that environmental control programs that target particular issues could have an impact on suppliers’ environmental performance. This result also offers some evidence that programs adopted by a
parent company would have an impact on suppliers’ environmental performance. In order to understand what kind of programs adopted by parent companies and how they impact suppliers, we would need more qualitative data.

### Table 7 Full Models – Utilities

<table>
<thead>
<tr>
<th></th>
<th>Onsite TRI Release</th>
<th>Onsite Hazard Release</th>
<th>Offsite TRI Release</th>
<th>Offsite Hazard Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent Company Supply Chain Performance</td>
<td>0.0705</td>
<td>0.4232*</td>
<td>-0.0105</td>
<td>0.30003</td>
</tr>
<tr>
<td></td>
<td>(0.1354)</td>
<td>(0.2257)</td>
<td>(0.1377)</td>
<td>0.3192</td>
</tr>
<tr>
<td>Parent Company Supply Chain Labor Standard</td>
<td>-0.986</td>
<td>-3.2441***</td>
<td>0.7414</td>
<td>2.5996*</td>
</tr>
<tr>
<td></td>
<td>(0.9286)</td>
<td>(1.4791)</td>
<td>(0.9996)</td>
<td>(1.4586)</td>
</tr>
<tr>
<td>Parent Company Environmental Programs</td>
<td>-0.4531***</td>
<td>-0.3901</td>
<td>-0.6879***</td>
<td>-0.807***</td>
</tr>
<tr>
<td></td>
<td>(0.1693)</td>
<td>(0.3013)</td>
<td>(0.2456)</td>
<td>(0.3577)</td>
</tr>
<tr>
<td>Parent Company Compliance</td>
<td>1.1205*</td>
<td>-0.1706</td>
<td>-0.6167</td>
<td>-0.8983</td>
</tr>
<tr>
<td></td>
<td>(0.5901)</td>
<td>(0.7495)</td>
<td>(0.7388)</td>
<td>(0.9891)</td>
</tr>
<tr>
<td>Supplier Company Compliance</td>
<td>0.7492</td>
<td>1.4237*</td>
<td>1.1583*</td>
<td>0.0167</td>
</tr>
<tr>
<td></td>
<td>(0.6019)</td>
<td>(0.7949)</td>
<td>(0.465)</td>
<td>(1.0262)</td>
</tr>
<tr>
<td>Ln Supply Company Revenue</td>
<td>-0.0167</td>
<td>-0.398*</td>
<td>0.0341</td>
<td>-0.0527</td>
</tr>
<tr>
<td></td>
<td>(0.1545)</td>
<td>(0.2333)</td>
<td>(0.2255)</td>
<td>(0.2626)</td>
</tr>
<tr>
<td>Ln Gross State Product (GSP)</td>
<td>-2.9358***</td>
<td>-0.7703</td>
<td>1.7643</td>
<td>3.1787</td>
</tr>
<tr>
<td></td>
<td>(0.6049)</td>
<td>(2.1055)</td>
<td>(1.7958)</td>
<td>(3.5277)</td>
</tr>
<tr>
<td>Percentage of Manufacturing Employment</td>
<td>-0.0256</td>
<td>-0.0537</td>
<td>0.0054</td>
<td>-0.0085</td>
</tr>
<tr>
<td></td>
<td>(0.0154)</td>
<td>(0.0326)</td>
<td>(0.0205)</td>
<td>(0.0395)</td>
</tr>
<tr>
<td>Constant</td>
<td>47.3084</td>
<td>37.2543</td>
<td>-14.0736</td>
<td>-24.5058</td>
</tr>
<tr>
<td></td>
<td>(8.3639)</td>
<td>(26.2901)</td>
<td>(23.8573)</td>
<td>(45.5855)</td>
</tr>
<tr>
<td>R²</td>
<td>0.02</td>
<td>0.1</td>
<td>0.04</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Note: robust standard errors are clustered around state level and included in parentheses. *p < 0.10, **p<0.05. *** p<0.01 two-tailed tests.
Finally, Table 8 shows the estimate results for the electronics sector. The first four columns show results from reduced models and the last column shows the results from the full model. These models consistently show that parent companies’ supply chain management is negatively associated with suppliers’ environmental strength and that better supply chain management from the parent company led to weaker environmental performance appears to be counter-intuitive. But one thing to note is that the environmental strength of suppliers is measured by the total number of environmental programs adopted by suppliers including product design, pollution prevention, recycling, clean energy technology, management systems, and programs to reduce the environmental impact of operations. It may be the case that the suppliers who have a parent company that actively monitors and inspects their environmental performance will rely on their parent company’s management measures and, therefore, will not have incentives to conduct environmental control programs on their own.

One thing to notice is that the total number of environmental programs adopted by the parent company is positively associated with suppliers’ environmental programs and the coefficients are highly significant. While a parent company’s supply chain management does not seem to lead to more environmental programs adopted, the parent company’s adopted environmental programs may lead suppliers to adopt similar programs as their parent company.
### Table 8 Fixed Effects (random trend) Models – Electronics

<table>
<thead>
<tr>
<th>Model</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent Company Supply Chain Performance</td>
<td>-0.2431***</td>
<td>0.0087</td>
<td>-0.3054****</td>
<td>-0.6953***</td>
<td>-0.6818***</td>
</tr>
<tr>
<td></td>
<td>(0.1239)</td>
<td>(0.0665)</td>
<td>(0.0928)</td>
<td>(0.2005)</td>
<td>(0.1973)</td>
</tr>
<tr>
<td>Parent Company Supply Chain Labor Standard</td>
<td></td>
<td></td>
<td>0.0048***</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.0513)</td>
<td>(0.0508)</td>
<td></td>
</tr>
<tr>
<td>Supplier Company Revenue</td>
<td>0.4200***</td>
<td>0.4019***</td>
<td>-0.0648****</td>
<td>-0.0544***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0863)</td>
<td>(0.0869)</td>
<td>(0.0205)</td>
<td>(0.0216)</td>
<td></td>
</tr>
<tr>
<td>Parent Company Environmental Programs</td>
<td></td>
<td></td>
<td>0.1153***</td>
<td>0.1184***</td>
<td>0.1180***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.0334)</td>
<td>(0.0378)</td>
<td>(0.0377)</td>
</tr>
<tr>
<td>Parent Company Compliance</td>
<td></td>
<td></td>
<td>0.6581</td>
<td>-0.3946</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.1162)</td>
<td>(0.2712)</td>
<td></td>
</tr>
<tr>
<td>Supplier Company Compliance</td>
<td></td>
<td></td>
<td></td>
<td>1.0611***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.2976)</td>
</tr>
<tr>
<td>Constant</td>
<td>1.2461***</td>
<td>-2.0077***</td>
<td>-1.6295***</td>
<td>2.0769**</td>
<td>2.002***</td>
</tr>
<tr>
<td></td>
<td>(0.2896)</td>
<td>(0.7030)</td>
<td>(0.7010)</td>
<td>(0.3159)</td>
<td>(0.2949)</td>
</tr>
</tbody>
</table>

\[ R^2 \]

0.2 0.3 0.3 0.14 0.12

Note: time variable is included by not reported. Models have adopted robust standard errors and included in parentheses.

*p < 0.10, **p < 0.05, ***p < 0.01 two-tailed tests.
Conclusion and Discussion

The correlation analysis results show that in the power generating sector, parent companies’ supply chain management has a positive impact on their suppliers’ onsite TRI and hazard releases. This effort, however, does not have any impact on suppliers’ offsite TRI or hazard releases. Through regression analysis, I find the effect of supply chain management on suppliers’ environmental performance becomes insignificant. Rather, it is the parent company’s adoption of environmental programs that is negatively associated with a supplier’s emission level of TRI and hazard release. This result from the utility sector is corresponded in the electronics sector. While better supply chain management conducted by a parent company is negatively associated with suppliers’ adoption of environmental programs, the parent company’s adoption of environmental programs is positively associated with suppliers’ adoption of programs. I argue that suppliers tend to copy and follow what their parent companies do and adopt similar programs. While it is difficult to translate management procedures to specific programs, copying programs that were adopted by the parent company is easier. In both sectors, the compliance variable is significant and consistently shows that parent companies that have better environmental compliance records tend to have suppliers with better environmental performance or more environmental control programs.

But there are limitations to the samples. There are only two sectors in my samples, which may affect the generalizable power of my study. However, if some general pattern exists in the two extreme cases selected, this may suggest that such a pattern could be universal in other sectors too. Nevertheless, these samples serve a diagnostic function for future research. Choosing only listed companies may also affect the generalizable power of the study. However, identifying suppliers is difficult either because firms could argue this is private information and do not share
this information or, in other cases, firms simply lack the ability to track all suppliers and suppliers’ environmental performances. This is why there have not been many systematic large-n studies in the green supply chain management field. The next step is to find creative ways to measure environmental performance across sectors to increase generalizability and provide more nuanced policy recommendations. Future research needs to find creative ways to measure environmental performance across sectors to increase generalizability and provide more nuanced policy recommendations.
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Chapter III: How do Activists Motivate Multinational Corporations to Adopt Higher Levels of Green Supply Chain Management?

Introduction

A field focusing on green supply chain management (GSCM) has emerged in the era of globalization. Indeed, many products we see today are not produced by one single manufacturer in a single country. For example, Apple Ipod parts are manufactured by ten different companies from five different countries and finally assembled in China (Linden, Kraemer, & Dedrick, 2007). The globalization process requires companies not only to consider their own environmental practices domestically, but also to require their suppliers in other countries to provide products that comply with their domestic environmental laws and regulations. Upstream firms, concerned with regulatory and stakeholder demands, monitor and enforce environmental requirements through second-order agreements (Vandenergh, 2005), which may complement or even substitute government regulations (Fiorino & Bhan, 2013). Having an effective private governance regime sounds like good news for regulators who face increasingly high regulatory costs.\(^\text{16}\) However, the factors that motivate firms to act like “regulators” are inconsistent and unsystematic.

Empirical studies have demonstrated pressure from internal and external stakeholders that have influenced firms’ decisions in adopting GSCM (Carter, 2000; Carter & Jennings, 2002a, 2002b, 2004). However, there are several gaps in the literature. First, even though empirical studies have given sufficient attention to internal stakeholders, the research has overwhelmingly focused on

\(^{16}\) Clark (2005) estimates the public and private cost under command and control regime is worth tens of billions dollars. EPA estimates transition from command and control approach to incentive based approach could save up to $ 45 billion. [http://yosemite1.epa.gov/ee/epa/eed.nsf/webpages/USExperienceWithEconomicIncentives.html](http://yosemite1.epa.gov/ee/epa/eed.nsf/webpages/USExperienceWithEconomicIncentives.html)
top management persons. This research has demonstrated that support from top management level and environmental managers along with entrepreneurship are the keys for successful adoption and implementation of GSCM practices (C. K. Hahn, Watts, & Kim, 1990; Lippmann, 1999; Trowbridge, 2001; Walton, Handfield, & Melnyk, 1998). However, how other individual or institutional shareholders exert their pressure in particular with regard to GSCM practices has not been systematically studied. According to shareholder primacy’s theory, the corporations’ main legal purpose is to maximize the utility and long term values of individual shareholders (Baron, 2001; Ehrich, 2005; Fisch, 2004; Springer, 1999). Empirical literature on shareholder resolutions mainly focuses on shareholder resolutions’ impact on firms’ operation and stock value (S. L. Gillan, Kensinger, & Martin, 2000; S. Gillan & Starks, 2007; Johnson, Porter, & Shackell-Dowell, 1997; Karpoff, 2001).

Empirical studies have also demonstrated that environmental NGOs have been successful in pressuring firms to adopt and review their supply chain practices (Beamon, 1999, 2005; Hall, 2000). However, the view of NGO pressures has been isolated. Scholars using game theory have found that pressure from NGOs on firms will be stronger when stakeholders are worried about environmental impacts (Lyon & Maxwell, 2008). This however has not been incorporated into empirical studies. It may be the case that firms are more likely to make behavioral change when attacked by multiple stakeholders rather than by one group alone. In this paper, I aim to incorporate both internal and external pressures exerted by activists from both shareholder resolutions and public campaigns.

Regulatory pressure has been universally confirmed by empirical studies as one of the critical drivers to adopt GSCM (Carter & Dresner, 2001; Green et al., 1996; Min & Galle, 2001; Walton et al., 1998), especially in developing countries such as China (Zhu & Sarkis, 2006; Zhu et al.,
2007). But these scholars mainly evaluate regulatory pressures based on firms’ perceptions.
There has not been explicit modeling of regulatory threat in statistical analysis using actual
measures of law or regulations targeting firms. In this paper, I make such an attempt to model
future regulatory threat and implementation of regulations in addition to firms’ own willingness
to support environmental regulations.

Finally, the majority of empirical work in the field relies on methods of surveys, interviews, and
case studies. Despite recent advances in methodology (Seuring & Müller, 2008; Walker et al.,
2008; Zhu & Sarkis, 2006), the field lacks consistent, objective, and quantifiable measurements
for GSCM that makes causal inference through econometric modeling difficult. This makes
studying the outcome of activists’ pressure difficult. In this paper, I aim to develop objective and
quantifiable GSCM measures that could be used for econometric modeling and for comparison
across firms.

**Literature Review**

Supply chain normally refers to a process that consists of a product’s life cycle from raw material
production to manufacturing different components and, finally, assembled product to be
delivered to final consumers. This process normally involves multiple firms linked through
supply chains that interact with each other through contract signing and enforcement,
information sharing and other activities (Ayers, 2006). Figure 1 shows a schematic depiction of
the supply chain (Cox et al., 2001).

![figure 1: a typical manufacturing (product) supply chain](image-url)
Environmental impacts could be generated through the entire lifetime of the supply chain from raw material extraction to production and transportation to the final customers. Green supply chain management (GSCM) aims to integrate social and environmental goals into firms’ general economic goals through inter-firm collaborations (Ageron et al., 2012). There are many variations with regard to the concepts of dealing with environmental issues during different stages of supply chain or taking supply chain as a whole. For example, Cruz (2009), Young and Kiekliewicz-Yong (2001) use the term sustainable network management, which tends to incorporate all types of social responsibility measures into supply chain including issues such as labor standard, ethical standards, and environmental issues (Cruz, 2009; Young & Kielkiewicz-Young, 2001). Some scholars, such as Wu, Dunn, and Forman, use green supply chain and sustainable supply chain interchangeably, but such cases are rare and authors tend to focus on all aspects of social responsibility measures (John Wu et al., 2012). In my study, I focus on only the environmental aspect of supply chain management. Lippman (2009) and Sharfman et al. (2009) adopt the concept supply chain environmental management, which has very similar meaning and implication as scholars such as Svensson (2001) and Sarkis (1995, 2006, 2010) who have focused on summarizing the theorizing of the field and give a more consistent definition that is more widely used by scholars.

Measuring Green Supply Chain Management

Green supply chain management involves more than one firm, and, depending on the characteristics of products, GSCM involves different strategies. Programs could be adopted to reduce packaging waste, recycling, jointly design eco-friendly products, and reduce
transportation waste. There are currently two approaches to measure green supply chain management. The first approach is to focus on one aspect of GSCM. Examples of this approach include green design (see Zhang et al. 1997; Johnson 1998; and Azzone and Noci (1996); logistic networks (see Fleischmann et al., 2000, 2001 and Jayaraman et al., 2003); and recycling or reuse of products and materials (see Thierry et al. 1995, Ayres et al. 1997 and Ferre 1997, 2001). It is not obvious however how these GSCM practices should be measured and compared across firms that may have adopted diverse GSCM activities. Even among firms that adopt similar green supply chain management, there has been few systematic standards or criteria developed to assess these individual programs.

Another approach to measure GSCM is simply counting the number of programs adopted by firms (B. Zhang et al., 2008; Zhu et al., 2007). These authors first define green supply chain management as a set of programs such as green purchasing, cooperating with customers’ environmental requirements, investment recovery, and eco-design, and then they ask survey respondents to choose which programs have been adopted. This measurement is also difficult to be use for systematic statistical studies because these green supply chain programs cannot always be added. Some companies adopted three programs that were easy to implement but may have less effect on changing their suppliers’ behavior. On the contrary, companies that adopt one program may be especially effective at changing the behaviors of their suppliers. Simply counting the number of programs adopted also poses challenging for statistical inference that makes it difficult to trace causal links between what drivers motivate adoption of which programs or which program could improve performance.

In order to address this problem of inconsistent measurements, I propose two measures. The first measurement is drawing inspiration from business literature that uses adoption of codes or
standards (Doshi, Dowell, & Toffel, 2013; Epstein & Roy, 2005). Following the approach of adoption of codes and standards, I include the first measurement—whether a firm has adopted an additional supplier’s code of conduct in addition to its own code of conduct. For the second measurement, whether a firm discloses its supplier list publicly, I follow the literature on information disclosure that suggests stakeholders are interested in transparency of firms as a way to monitor the social responsibility of their actions (Cho, Freedman, & Patten, 2012; Lyon & Shimshack, 2012; Reid & Toffel, 2009). I argue that these two measurements are more systematic institutional changes that could be used to compare the level of firms’ regulation of their suppliers across firms and sectors. Rather than adopting ad hoc programs, these measures affect all suppliers along the supply chain. The following is an example from Apple’s supplier code of conduct.

“Air Emissions Management Supplier shall identify, manage, reduce, and responsibly control air emissions emanating from its operations that pose a hazard to the environments. Suppliers shall conduct routine monitoring of the performance of its air emission control system.”

In addition, these measurements are more in line with the private politics literature that will be discussed below. When activists initiate a campaign towards a firm, they seek to change firms’ practices, norms, and beliefs that could be institutionalized (Reid & Toffel, 2009). Motivated by certain moral principles, activists rarely purpose ad hoc changes of firms (Baron & Diermeier, 2007; Den Hond & De Bakker, 2007; Maxwell, 2010). The purpose of this paper is to evaluate whether activists strategies are successful in achieving their goals; therefore, adopting the two

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17 The electronic industry association requires all electronic firms to adopt a code of conduct, which is more general. It is voluntary for firms to adopt an additional suppliers code of conduct to have higher standards for their suppliers.
measurements mentioned above is appropriate for this study.

**Stakeholders’ pressure on firms and private politics**

A stakeholder is “any group or individual who can affect or is affected by the achievement of an organization’s objective” (Freeman & McVea, 2001). Scholars categorize stakeholders as direct and indirect, primary and secondary, or based on multiple dimensions of legitimacy, urgency, and power (Clarkson, 1995; Mitchell, Agle, & Wood, 1997). Some scholars recognize that corporations often need a “license to operate” in the corporations that are in a nested environment of different shareholders need to obtain “regulatory, economic, and social license” to survive and succeed (Neil Gunningham, 2003). A legitimate business is the one that acts in a way that is “desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions (Suchman, 1995).” Adopting GSCM may be a result of pressure from a variety of stakeholders such as government, customers, shareholders, etc.

However, some stakeholders are rather passive but others are more active in participating and shaping corporation’s governance. For example, consumers normally respond to firms’ product or services through their purchasing behavior but rarely directly participate in firms’ governance. In order to organize consumers to be involved in pressuring firms’ behavior change, Non-governmental organizations (NGOs) are required to organize such collective actions and media’s moral mobilizations. NGOs on the other hand normally have a clear agenda as what need to be changed. For example, investors who associated with the United Nations Principles for Responsible Investment initiative have lobbied heavily on firms to join the UN Global Compact (Den Hond & De Bakker, 2007). This study focuses on stakeholder activists who have a clear agenda and interest in changing firms’ governance.
Activists could be individuals or organizations. Individuals’ could purchase firms’ minority share of a company and file shareholder resolutions to influence firms’ decision making. From 1942 to the 1970s, shareholder activism was mostly conducted by individual investors (S. Gillan & Starks, 2007). Motivated by shared idea, concerns or ideology, individuals could also from activists groups either in the form of loosely organized networks (Diani & McAdam, 2003) or highly organized and professional organization (Den Hond & De Bakker, 2007). In the environmental field, many professional organizations formed that conduct organized lobbying or public campaigns against firms or industries. Since the 1980s, there has been a rise of institutional stakeholders taking on activism, first led by pension funds and labor union and then followed by an increasing role of NGOs (S. Gillan & Starks, 2007).

Activists could achieve their goals through non-market strategies, also known as private politics (Baron & Diermeier, 2007). These strategies often do not rely on law or government. Some common non-market strategies include shareholder resolutions, consumer boycott, protest and public campaign (Baron, 2003; Baron & Diermeier, 2007). Through these strategies, activists seek institutional change of firms that they require targeted firms significantly alter or even replace current institutions (Den Hond & De Bakker, 2007). According to O’Rourke (2003, p. 234), “the best possible outcome from a shareholder engagement campaign is that the company agrees to substantially changes in practice (A. O'Rourke, 2003).” And these changes do not only require effort from one single firms but often activists push for changes in a broader level that involves firms’ suppliers, resource and product consumer and other organizations that offer similar products or services (DiMaggio & Powell, 2000).

Public campaigns are the main strategies adopted by NGOs to pressure private firms (Baron, 2003; Baron & Diermeier, 2007). Through public campaigns, NGOs could publicly damage a
firm’s reputation and then encourage the firm to believe that it is in its interests to alter its behavior or change current institutions to regain its public reputation or legitimacy (Den Hond & De Bakker, 2007). For example, in its campaign to eliminate hazardous chemicals from electronic products, Greenpeace ranks electronic firms each year and issues a report publically shaming firms that do not respond to their campaign.18 Firms are then incentivized to respond to Greenpeace’s campaign and improve their governance, such as publicizing their suppliers’ list to show they no longer purchase hazardous substances from suppliers that use them.

Another major channel through which activists could pressure firms on their governance issues is through shareholder resolutions. However, unlike literature on NGOs, literature on the effectiveness of shareholder resolutions is relatively inconclusive. According to Gillan and Starks (2007), among 790 proposals received by the American Society of Corporate, 439 were eventually voted on (S. Gillan & Starks, 2007). Drawing on evidence from companies listed in the S&P 500 Index, Reid and Toffel found that shareholder resolutions facilitate firms’ consent to climate change mitigation (Reid & Toffel, 2009). Focusing on eighteen firms that are targeted by CalPERS, Cruchely et al. (1998) find that targeted firms have made significant changes in their activities (Crutchley, Hudson, & Jensen, 1998). A case study on Sears finds that suggestive activism has a positive influence on the firm’s value and that management restructuring happened more quickly than it would have without shareholder pressure (S. L. Gillan et al., 2000). Other studies find that shareholder resolutions have no impact or an uncertain impact on firms’ operations, performance (Johnson et al., 1997; Karpoff, 2001), or stock market value (Del Guercio & Hawkins, 1999; Karpoff, 2001).

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Though both strategies—public campaign and shareholder resolutions—tend to be utilized often by activists, they are normally studied separately and the view on NGOs is rather static (Maxwell, 2010). Empirical literature however tends to focus on one or another (for NGOs see Beamon, 1999, 2000; Hall, 2000; and for shareholder resolution see Clark, Salo and Hebb (2008); Lounsbury, Ventresco and Hirsch (2003). In reality, firms do not only receive just one type of pressure. Often they are pressured at the same time or sequentially by public campaigns and shareholder resolutions. Studies that focus on only one stakeholder or another systematically miss the bigger picture. My study bridges this gap by incorporating both NGOs’ public campaigns and activists’ shareholder resolutions into a single model.

**Measurements and Data**

**Green supply chain management:** I use data collected on 565 of the largest electronics-producing firms in the United States from 2007 to 2012. The list of companies is obtained through KLD database¹⁹, and I select companies that provide electronic products and services by industry SIC codes. I then search each company’s publicly accessible website for their suppliers code of conduct and suppliers’ information and record in which year such information is made available.

**NGOs’ campaign against electronic companies:** Following the literature that environmental NGOs have become one of the biggest drivers towards greener supply chains (Hall, 2000), I expect firms that have been pressured by environmental NGOs will adopt higher levels of GSCM. I select an international environmental NGO, Greenpeace, and a U.S. domestic NGO,

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¹⁹ **KLD Research & Analytics**, Inc. (KLD) is the leading authority on social research for institutional investors. To meet the needs of social investors, KLD provides research, benchmarks, compliance, and consulting services analogous to those provided by financial research service firms.” Data obtained from Wharton Research Data Services (WRDS).
Electronics Take Back Coalition (ETBC), as my focus for two reasons: first, since I select the electronic sector as the focus of my study, Greenpeace and ETBC are environmental NGOs that have specifically targeted firms in the electronic sectors. Second, from news reports, Greenpeace has been successful in pressuring several large firms to eliminate hazardous chemicals from their products by regulating their own suppliers. And ETBC has been successful in pressuring electronic firms to adopt codes of conduct. I collect data on Greenpeace and ETBC’s campaign on electronic companies since 2006 from Greenpeace and ETBC’s website and reports. The data has been aggregated into year level data to match other variables.

**Shareholders’ environmental desire:** scholars have found some evidence of shareholders’ role in firms’ environmental management and performance (Green et al., 1996). Harford (1997) shows that large publicly traded firms might be more willing to comply with environmental standards (Heyes, 1998). Gray and Deily (1996) found that plants owned by less diversified firms (i.e. a smaller number of stakeholders) were less likely to be in compliance (Gray & Deily, 1996). Reid and Toffel (2009) found that companies are more likely to disclose their environmental information if they are targeted by shareholder resolutions on a related issue. Shareholders’ environmental desires, however, have rarely been modeled in GSCM studies. Following Reid and Toffel (2009), I obtain shareholders’ resolution data from the KLD Research & Analytics database. The resolution variable is coded as a binary variable. If a company receives a resolution that is related to environmental and social responsibility issues in a particular year, it is coded as 1 and otherwise 0.

**Interaction of NGO and shareholder attack:** in order to capture the dynamics between internal and external processes, I create interaction terms between NGO campaigns and shareholder resolutions. I first create an interaction term that shows interaction between current year NGO
campaigns with previous year shareholder resolutions to analyze whether companies that receive shareholder resolution demands on environmental issues in the previous year are more likely to change supply chain management behavior if they are pressured by NGO campaigns in the following year. I then create another interaction term to indicate that a firm is pressured by a NGO campaign in the previous year followed by shareholder resolution on environmental matters in the following year.

**Regulation:** Arguably, GSCM emerged as a response to more stringent and complex regulations (Sarkis, 2006). Many scholars have confirmed coping with regulatory requirements and preventing future regulations as a common driver for GSCM (Green et al., 1996; Haufler, 2003; Zhu & Sarkis, 2006). Empirical studies in GSCM have largely replied to surveying firms’ perceptions about regulatory pressure rather than measuring the actual pressure imposed on firms. In this paper, I follow Reid and Toffel’s (2009) method of measuring a future regulatory threat. I select regulations on hazardous substance (RoHS) that directly regulate the electronic sector’s use of hazardous substances as my regulatory variable. I create two variables to capture future regulatory threats and current regulatory pressure. If a company is located in a state that has introduced RoHS relevant law\(^\text{20}\), it receives a score of 1, but otherwise, a company receives a 0 to measure future regulatory threat. So far, twenty-five states have signed and implemented producer responsibility laws in dealing with controlling hazardous substances and recycling e-waste.

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\(^{20}\) RoHS is broadly defined here. Theses laws and regulations include control of utilization, import and export of certain hazardous materials and recycle electronic products to control the harm of hazardous substance.
**Figure 1: States that have passed producer responsibility law**

![Map showing states that have passed producer responsibility laws](Image from http://www.electronicstakeback.com)

**EMS and GSCM:** Research has shown that firms that have previously adopted some level of environmental management systems (EMS) are more likely to adopt ISO 14001 system (Morrow & Rondinelli, 2002). This may be because the pre-existing EMS has provided managerial infrastructures that would be required by ISO 14001 standards that makes it easier and less costly for these firms to adopt ISO 14001 (Kolln & Prakash, 2002). This logic may apply to the relationship between EMS and GSCM. Firms’ EMS may have already contained elements to deal with suppliers’ environmental management; therefore, it may be easier and less costly for firms with a higher level of EMS to adopt higher levels of GSCM. I include a variable EMS that measures the level of EMS adopted by firms. This data is also from KLD database.

**Coordination costs:** The level of conducting GSCM is also related to the cost of the companies (Simpson & Power, 2005). Operating in more countries may pose a greater transaction cost for firms to obtain information about their suppliers and communicate with them. I include a
variable, “countries that a firm operates within,” to measure the transaction cost. I expect that firms that have more intense global operations (i.e., operating in more countries) will adopt a higher level of supply chain management.

**Companies’ support for environmental regulations:** Scholars argue that greener firms are more likely to support more environmental regulations because they have invested so much in green technology and management lobbying for more stringent environmental regulations that it would raise costs for their competitors (Muñoz-García & Akundjanov, 2014; Porter & Van der Linde, 1995a). From this reasoning, I expect firms that are supporting environmental regulations are more likely to adopt a higher level of GSCM to maintain their competitive edge. I include a variable from the KLD database that measures companies’ support for environmental regulations. This variable is a binary variable; a company supporting environmental regulation in a particular year receives a score of 1; otherwise it receives a 0.

**Company size:** Many studies found that firm size is associated with firms’ environmental performance and compliance behavior. Larger firms are more likely to comply with environmental regulations (Brehm & Hamilton, 1996; Gray & Deily, 1996). I include a logged term of assets to control for firm size. I expect that bigger firms will be more likely to adopt higher levels of GSCM.

**Environmental strength:** I include a total number of environmental strength obtained from the KLD database to conduct a robustness test. I expect internal and external stakeholders’ pressure that results in a higher level of GSCM may also induce a higher-level of environmental strength. However, the result may also be reversed; firms may respond to NGO and shareholders’ attacks by improving environmental strength of their own (i.e. improving pollution and waste control)
rather than conducting more intensive improvements throughout the whole supply chain.

**Competitors:** Lastly, firms adopting a new code or making more information available simply may because their competitors have done so. In order to keep a competitive edge, firms will adjust their behavior according to their competitors behavior (Christmann, 2004). Corporate environmental managers often monitor the disclosed information of their competitors to determine the leaders and followers and where their own company ranks (Cohen, 2001). Activists against one or several firms may also incur a “domino” effect whereby competing firms try to avoid similar campaigns that might otherwise be directed at them (Baron & Diermeier, 2007).

**Model Specification**

I first utilize a cross-sectional probit model with interaction terms between a NGO campaign and a shareholder resolution on two dependent variables: adoption of supplier code of conduct and revealing suppliers’ list:

\[
P (Y=1|X) = f ( X_{NGO} + X_{share} + X_{NGO, t} X_{share, t-1} + X_{share, t-1} + X_{NGO, t-1} + X_{reg} + X_{control}) (1)
\]

This set of models shows basic patterns of whether firms’ GSCM is associated with relevant factors. The dependent variable adoption of a supplier’s code of conduct has more yearly variation. I then run a set of fixed effects models, restricted models without controls, and the full model, which includes all control variables. In these models, I also incorporate interaction terms: (1) a company first pressured by shareholder resolution and then pressured by NGO campaigns in the next year; and (2) a company first pressured by NGO campaigns and then pressured by shareholder resolutions. The reason to use a logit model is to avoid an incidental parameter bias problem (Greene 2002).
Logit \( Y=1 | X_{it} \) = \( f (X_{NGO_{it}} + X_{share_{it}} X_{NGO_{it}} + X_{share_{it-1}} + X_{NGO_{it-1}} + X_{reg_{it}} X_{control_{it}}) \) (2)

**Empirical Results**

Table 1 shows results from the cross sectional models. It shows that whereas a NGO campaign has no impact on firms’ adoption of a supplier code of conduct, it is positively associated with firms’ revealing of their suppliers list. Shareholder resolutions have a positive impact on both firms’ willingness to reveal their suppliers’ list and adopt a supplier code of conduct.

The interaction terms are also significant in both models. In the first model, the second interaction term is significant, but the sign is contrary to what I expected. The coefficient is negative, which means that firms that are first pressured by shareholder resolution and then NGO campaigns are less likely to adopt a code of conduct. This may be because firms would adopt a supplier code of conduct right away once they were pressured by shareholder resolutions. When once again pressured by NGOs, they no longer have “adopting a code of conduct” at their disposal to respond to NGO campaigns. In the model with revealing a suppliers list as the dependent variable, both interaction terms are significant. However, these effects are smaller than NGO campaigns alone.

The results also show that regulatory threat, measured by introducing new laws on recycling e-waste has a positive impact on both adopting a supplier code of conduct and revealing a suppliers list. The result shows that just their home state plans to introduce e-waste laws that will induce firms to be more likely to adopt supplier codes of conduct and reveal their supplier list. The actual implementation of e-waste law however has a negative impact on firms’ incentive to reveal their suppliers’ list. This may because introducing laws has created enough incentive for
firms to reveal their suppliers. By the time the law is being implemented, firms that are incentivized by law have already revealed their suppliers list, and so they no longer have to reveal a suppliers list at their disposal to cope with the law. The results also show that firms care about their competitors’ strategies. If firms see their competitors adopting a supplier code of conduct or revealing a suppliers list, they are more likely to do so too.
Table 1: Probit Model Estimates

<table>
<thead>
<tr>
<th></th>
<th>Supplier Code of Conduct (0 or 1)</th>
<th>Marginal Effect</th>
<th>Revealing Suppliers List (0 or 1)</th>
<th>Marginal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGO Campaign</td>
<td>1.3889 (1.0604)</td>
<td>0.3280</td>
<td>12.5175*** (1.7258)</td>
<td>1.171</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.0664* (0.3282)</td>
<td>0.0160</td>
<td>0.8410* (0.4548)</td>
<td>0.079</td>
</tr>
<tr>
<td>First pressured by NGO then</td>
<td>-1.0618 (1.1708)</td>
<td>-0.2510</td>
<td>8.7243*** (0.7056)</td>
<td>0.816</td>
</tr>
<tr>
<td>NGO Shareholder then NGO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First pressured by NGO then</td>
<td>-1.8056* (1.1608)</td>
<td>-0.4270</td>
<td>7.7532*** (1.1229)</td>
<td>0.725</td>
</tr>
<tr>
<td>NGO Shareholder then NGO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduced into Law</td>
<td>0.8708* (0.5107)</td>
<td>0.0940</td>
<td>14.3001*** (0.7211)</td>
<td>1.338</td>
</tr>
<tr>
<td>Law Implementation</td>
<td>-0.4319 (0.4962)</td>
<td>-0.1020</td>
<td>-14.4915*** (0.7578)</td>
<td>-1.356</td>
</tr>
<tr>
<td>EMS</td>
<td>-0.0569 (0.2539)</td>
<td>-0.0130</td>
<td>-0.3225 (0.3813)</td>
<td>-0.030</td>
</tr>
<tr>
<td>Number of Countries Operating</td>
<td>0.0022 (0.0038)</td>
<td>0.0010</td>
<td>-0.0104 (0.0067)</td>
<td>-0.001</td>
</tr>
<tr>
<td>LogAssets</td>
<td>0.3992*** (0.1303)</td>
<td>0.0940</td>
<td>0.4676* (0.2714)</td>
<td>0.044</td>
</tr>
<tr>
<td>Supply Chain Labor Standard</td>
<td>-0.2036 (0.2181)</td>
<td>-0.0480</td>
<td>-0.0622 (0.3539)</td>
<td>-0.006</td>
</tr>
<tr>
<td>Competitors' action</td>
<td>0.1309*** (0.0534)</td>
<td>0.0310</td>
<td>3.5026*** (0.3762)</td>
<td>0.328</td>
</tr>
<tr>
<td>Supporting Environmental</td>
<td>-0.7145 (0.8899)</td>
<td>-0.1690</td>
<td>0.3353 (0.8072)</td>
<td>0.031</td>
</tr>
<tr>
<td>Regulations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-3.6309*** (1.4744)</td>
<td></td>
<td>-36.1822*** (1.8634)</td>
<td></td>
</tr>
</tbody>
</table>

Wald chi2: 30.48 (p < 0.01)
Pseudo R2: 0.26
Number of Obs: 564

Note: models have adopted robust standard errors and included in parentheses.
*p < 0.10, **p<0.05. ***p<0.01 two-tailed tests.
Table 2 reports fixed effect model results. By running models excluding variables that are likely to be endogenous to the dependent variables, such as EMS and firms supporting environmental regulations, the estimation results stay consistent. The fixed effects models consistently show that both NGO campaigns and shareholder resolutions have a positive impact on a firm’s decision to adopt supplier codes of conduct. But the effect of NGO pressure is larger. Once including a firm’s willingness to support more environmental regulations, regulatory variables are not significant anymore. The coefficient is however negative, which suggests that firms that are supportive of more environmental regulations are less likely to adopt supplier codes of conduct. The fact that firms, which express support for regulations, are less likely to adopt a supplier code of conduct may be because firms use their expression to support environmental regulations to divert shareholders’ attention so that they could do less. In addition, I find the number of countries in which firms have operations is a better predictor of the adoption of a supplier code of conduct than purely firm size. This is not surprising; with suppliers located in more jurisdictions that have different levels of environmental regulations, adopting a uniform highest standard may help firms significantly reduce transaction costs, such as individuals negotiating contract terms with suppliers.
<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGO Campaign</td>
<td>1.1473</td>
<td>1.7576*</td>
<td>1.8392*</td>
<td>1.7624*</td>
<td>1.1463</td>
<td>2.9214**</td>
</tr>
<tr>
<td></td>
<td>(0.7097)</td>
<td>(.9401)</td>
<td>(0.9459)</td>
<td>(1.0456)</td>
<td>(1.0576)</td>
<td>(1.3110)</td>
</tr>
<tr>
<td>Shareholder Resolutions</td>
<td>0.7463**</td>
<td>0.7597**</td>
<td>0.7739**</td>
<td>0.7346*</td>
<td>1.0180**</td>
<td>.9614*</td>
</tr>
<tr>
<td></td>
<td>(.3166)</td>
<td>(0.3523)</td>
<td>(0.3528)</td>
<td>(0.4189)</td>
<td>(0.4564)</td>
<td>(.5540)</td>
</tr>
<tr>
<td>NGO Share</td>
<td>-0.4694</td>
<td>-0.5266</td>
<td>-16.1612</td>
<td>-17.0227</td>
<td>-6.049</td>
<td></td>
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<tr>
<td></td>
<td>(1.532)</td>
<td>(1.5279)</td>
<td>(1924.392)</td>
<td>(3180.53)</td>
<td>(1.9239)</td>
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<td>Signed into Law</td>
<td>-1.9098</td>
<td>-1.8902</td>
<td>-1.8783*</td>
<td>-14.3415</td>
<td>-16.1653</td>
<td>-2.4312</td>
</tr>
<tr>
<td></td>
<td>(1.0487)</td>
<td>(1.0674)</td>
<td>(1.0691)</td>
<td>(1421.997)</td>
<td>(2424.68)</td>
<td>(1.7815)</td>
</tr>
<tr>
<td>Law Implementation</td>
<td>-.2898*</td>
<td>-.3816*</td>
<td>-.3741</td>
<td>-.4393</td>
<td>-.6440</td>
<td>.5767</td>
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<tr>
<td></td>
<td>(.5551)</td>
<td>(0.5703)</td>
<td>(0.5701)</td>
<td>(0.6140)</td>
<td>(0.6710)</td>
<td>(.7927)</td>
</tr>
<tr>
<td>Competitor</td>
<td>0.09115</td>
<td>0.0970</td>
<td>-.04991</td>
<td>-.0637</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0636)</td>
<td>(0.0739)</td>
<td>(0.0874)</td>
<td>(0.1027)</td>
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</tr>
<tr>
<td>Supply Chain Labor Standard</td>
<td>0.3672*</td>
<td>0.3213</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(0.1997)</td>
<td>(0.2181)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Number of Countries Operating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0252***</td>
<td>0.0183***</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td>(0.0058)</td>
<td>(0.0064)</td>
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<tr>
<td>Supporting Environmental</td>
<td></td>
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<td></td>
<td></td>
<td>-2.7414***</td>
<td></td>
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<tr>
<td>Regulations</td>
<td></td>
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<td></td>
<td></td>
<td>(0.9033)</td>
<td></td>
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<tr>
<td>Log likelihood</td>
<td>-168.9929</td>
<td>-143.5932</td>
<td>-142.5957</td>
<td>-94.7189</td>
<td>-82.6637</td>
<td>-58.8814</td>
</tr>
<tr>
<td>LR chi2</td>
<td>13.70</td>
<td>14.14</td>
<td>16.13</td>
<td>16.54</td>
<td>40.65</td>
<td>38.33</td>
</tr>
<tr>
<td>Prob &gt; chi2</td>
<td>0.008</td>
<td>0.0282</td>
<td>0.0239</td>
<td>0.0352</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Note: standard errors are clustered around states and included in parentheses.
*p < 0.10, **p<0.05, ***p<0.01 two-tailed tests.
Conclusion and Discussion

The empirical results show that both NGO public campaigns and shareholder resolutions are positively associated with the adoption of a supplier code of conduct. But the effect of a NGO is larger than shareholder resolution. In pressuring firms to disclose their suppliers list, a NGO public campaign has a much larger effect than shareholder resolution. The interaction terms show that firms are more likely to make institutional changes when they are pressured from both internal and external sources. However, the effect of the interaction term is smaller than just a NGO public campaign. Firms that are first pressured by shareholder resolution and then NGO campaigns are less likely to adopt supplier codes of conduct. This is counterintuitive, but it may be the case that firms taking shareholder resolutions seriously would adopt supplier codes of conduct right away once they are pressured by a shareholder solution leaving them no tools to respond to NGO campaigns later. However, due to the limitation of the data, the results discussed above suggest some possibilities, and I do not attempt to draw casual inference from the models.

Regulations matter for firms’ behaviors as well. It is the introduction of new laws rather than the actual implementation that is more effective in pressuring firms to adopt supplier codes of conduct and reveal their suppliers list. The regulatory threat effect on adoption of supplier codes of conduct, however, disappears in the fixed effects models, which show firms’ willingness to support more environmental regulations is negatively associated with firms’ adoption of a code of conduct. I suspect this is because firms’ expression of support for more environmental regulations gives them space to divert shareholders’ attention.
Lastly, I find the number of countries that firms operate in is a better predictor for the adoption of codes of conduct than firm size. Firms are more likely to adopt supplier codes of conduct if they operate in more countries. This makes sense in that firms which operate in multiple jurisdictions need to deal with different levels of environmental regulations, and having a uniformed code that satisfies the highest standard may significantly reduce the transaction cost of negotiating environmental requirements in each individual contract. This result is consistent with Christmann’s (2004) finding that multinationals that depend on their subsidiaries globally tend to have higher standardized operational standards (Christmann, 2004).

This paper fills an important gap in empirical literature that typically analyzes each mechanism of activism alone. Incorporating both public campaign and shareholder resolution in one model, I compared which mechanism has a larger effect on firms’ institutional change. This paper also contributes to the field of green supply chain management by offering two measurements of institutional change with regard to supplier management. Though limited in variation, these measurements could be used for comparison across firms and industries. In order to provide more variations, I plan to contribute to identify measurements that could be used for GSCM studies. Some examples could be 1) whether screening and selection processes of suppliers contain environmental requirement; 2) whether parent companies require a third party conduct suppliers’ environmental performance and compliance auditing, and 3) whether firms conduct suppliers’ environmental performance and compliance auditing on their own. With these measurements, the field could advance to theorize and generate more systematic large-n studies.
Bibliography


Conclusion

Through three independent empirical essays, I analyze political and market institutions’ roles in determining environmental outcome in the regional and firm level. In my first essay, I have shown that political institutions in China, because of structural constraint, are not sufficient to produce satisfying environmental outcomes. Provinces in which local governments rely on state-owned enterprises (SOEs) tend to have higher levels of pollution, and political leaders, once promoted, tend to relax their effort in combating pollution. The year after a provincial governor is promoted, the pollution level tends to be higher. In the second and third chapter, I turn to one type of market institution: green supply chain management in the hope to identify an effective market institution that could replace or complement political institutions to solve environmental issues. Drawing on evidence from the United States’ utility and electronic sector, I find that a parent company’s supply chain management is not associated with a supplier’s environmental performance. It is really environmental programs adopted by a parent company that is associated with either a supplier’s lower level of TRI and hazard release or higher level of adoption of environmental programs. Though no direct evidence of supply chain management is identified in my study, these results show important association of suppliers’ adoption of environmental programs and environmental performance with a parent company’s adoption of environmental programs. The initial diagnosis of relationship between a parent company and a supplier company presents the potential for the use and study of supply chains to advance environmental policies. To identify what environmental programs and how these programs adopted by a parent company impact suppliers calls on more data and a qualitative research design.

My first chapter starts with regional level data and shows how different political institutions interact in China’s thirty-one provinces. In my future research, I plan to collect industry and firm
level data to study how political institutions interact with private institutions at the firm level. With more available governance and financial data on the firm level from the United States, I am able to analyze the effectiveness of a market institution in determining firms’ environmental performance. My analysis shows that suppliers tend to have better environmental performance if their parent company adopts more environmental programs. One interesting question emerges about whether such a mechanism is also true in a Chinese context whose utility sector is concentrated with state-owned enterprise. In my first chapter, I already described SOEs that generally face soft budget constraint have primarily goal to produce certain level output for regional government and do not have an incentive to reduce pollution. With a particular SOE feature, there is a question about whether a mechanism identified in a democratic free market context could hold water in an authoritarian regime that is in transition to a free market economy. Nevertheless, the analysis conducted in the U.S. utility sector could be beneficial for China’s SOE reform that aims to transfer SOEs to market players.

Unlike the utility sector, the Chinese electronics sector has more small and medium sized private firms and these firms have been well integrated into the global network. In the second chapter, I show that in the United States, suppliers tend to rely on their parent company’s management rather than design their own management programs. With a highly globalized electronics sector, this finding may be more relevant to Chinese policy makers. The Chinese government’s policy to create national champions and compete in the global market may work well in the electronics sector, in which suppliers tend to follow their parent company’s steps. My third chapter shows that governmental strategy may not be the only way to encourage parent firms to adopt better supply management. Activists could also pressure parent companies to adopt higher-level supply
chain management through an external mechanism, public campaign, and an internal process, shareholder resolution.

This dissertation contributes to several literatures. The first chapter contributes to the literature on China’s environmental policy by conducting systematic quantitative studies. Though quantitative studies start to emerge on China with more recent available data, published quantitative evaluation of China’s environmental regulations are still quite rare. Within few quantitative works on China’s environmental policies, the impact of fiscal decentralization and political promotion on policy outcomes is normally analyzed separately. In chapter I, I incorporate both measurements in my model and analyze how they collectively determine policy outcomes. While much attention of scholarly work and policy analysts was drawn on China’s political institutions, I show in my analysis that scholars and policy analysts should not be too optimistic of the promises that the Chinese government makes because of the embedded institutional constraints: soft budget constraint and the Party-controlled evaluation system for political leaders. Alternative approaches, such as market-based instrument and voluntary approach should also be considered while the political institutions are being reformed. In my second and third chapter, I identify one type of market mechanism that Chinese scholars and policy makers could utilize to strengthen its effort to combat severe environmental problems in China.

This dissertation’s contribution, however, is not limited to the Chinese context and has more implications for U.S. policy makers as well. In large part, private firms enforce laws and regulations through second-order agreements with their business partners - environmental provisions either embedded in a larger package agreement such as acquisition agreements or those which constitute a standalone agreements (Vandenberg, 2005). According to Vandenberg
private firms conduct significant amounts of monitoring and enforcement to make sure their partners are in compliance with their environmental requirements (Vandenergh, 2005). The total annual expenditure of private firms spent on Phase I environmental assessments alone exceeds $500 million a year compared to $400 million spent by the EPA’s enforcement office (Vandenergh, 2005). This is also echoed in a recent work by Fiorino and Bhan (2013), who demonstrate supply chain relationship could act as an important source of pressure resembling government regulation to change firms’ environmental behavior through in-depth interviews in the U.S. electronics sector (Fiorino & Bhan, 2013).

However, this does not mean private enforcement or supply chain management could replace government regulation because the second-order agreements sometimes lack accountability and transparency (Vandenergh, 2005). Supply chain management is rather ad hoc and increases uncertainty more than public regulation because of the great variation among firms (Fiorino & Bhan, 2013). Yet my findings, together with these previous studies, suggest that private governance presents opportunities for public-private collaborations to achieve better environmental outcomes in a more efficient way. For example, Vandenberg (2005) suggests that the government could require stringent disclosure on private agreements and the information they generated to increase transparency and accountability (Vandenergh, 2005). However, no specific policy prescription could be made until we have a systematic understanding of private agreements bounding private firms and the mechanisms of private governance through supply chains.

Governmental intervention may not be the only factor that could facilitate firms’ voluntary monitoring and enforcement behavior. In the last empirical chapter, drawing evidence from 565 large electronic firms headquartered in the United States, I show that activists could effectively
pressure multinational corporations to adopt institutional changes such as adopting supplier
codes of conduct or disclose their supplier list. They could achieve such a goal through either
public campaign or file a shareholder resolution. Non-governmental organizations may play an
important role in this domain in encouraging more rigorous and transparent private governance.

In the green supply chain management field, my second chapter adds to the literature by
conducting an empirical study on U.S. cases. With manufacturing shifted to Asia and Eastern
Europe in the past two decades, it is not surprising that the majority of empirical work is focused
on cases in Asia and Eastern Europe. But such research should be equally important in the
United States, where policy makers are actively searching for more efficient policy tools. The
United States where more data is available, should offer more opportunities to systematically
study supply chain mechanisms that could further contribute to theory building.

The current state of green supply chain management relies on methods of surveys, interviews and
case studies that lack consistent, objective, and quantifiable measurements for GSCM that makes
causal inference through econometric modeling difficult. In the last empirical chapter, I identify
consistent measurements for firms’ institutional change that can be extended to other sectors and
markets in which the voluntary approach of addressing environmental externalities is considered.

Last but not least, my research has great relevance to climate change issues and policy making.
As China overtook the United States and became the largest CO$_2$ emitter, given the size of
China’s economy and fast pace of its industrialization, China’s environmental issues are
increasingly becoming global. Identifying the political constraints that China is facing is
important for China’s political reform, and because it is also critical for designing effective
political institutions to manage China’s environmental issues. Having the world’s largest manufacturing sector, Chinese firms are increasingly being integrated into the global system. Making sure effective political institutions in China regulate these firms has an implication for global environmental policies. Identifying mechanisms that parent firms could adopt to influence their suppliers offers opportunities for multinational firms to help their Chinese partners improve environmental performance. Initiatives taken by firms are essentially critical for global climate change policies because production processes are important sources of pollution and greenhouse emissions. Private governance that could change firms’ behaviors, therefore, has an important implication for climate change adaptation policies.

*Future Work*

The challenge of research work on China is data accessibility. In order to answer important questions that have been raised in this dissertation, I will continue to look for valid data sources for my research. One of the foremost pertaining to this dissertation is measurements for soft budget constraint, which requires more accurate measurements of local governments’ subsidies, tax breaks, and other special policies towards SOEs. Disentangling the relationship between local governments and SOEs may require field research with qualitative analysis. I also plan to closely monitor the new development of China’s environmental policy, such as the pilot cap-and-trade program with regard to CO$_2$

In the green supply chain field, scholars need to continue to develop consistent and more precise measurements for green supply chain management. These measurements may include but are not limited to 1) the date of adopting a suppliers’ code of conduct; 2) whether a firm reveals a suppliers list in a given year; 3) whether a parent company requires the screening and selection
process of suppliers containing environmental requirements; 4) whether a parent company requires a third party to conduct suppliers’ environmental performance and compliance auditing; and 5) whether a parent firm conducts suppliers’ environmental performance and compliance auditing on its own. This requires working with a large number of firms to obtain detailed information.

Lastly, more sectors should be examined to increase generalizability. I intend to extend my research to other sectors and in another country context, such as China. I believe the process of accumulating empirical studies will also help push theorizing in the field.
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EDUCATION

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  - **Research Project**: “International Collaboration on Higher Education”
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Beijing Technology and Business University
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  - **Research Project**: “British Culture and Business English”

FIELDS OF INTERESTS

Environmental policies, corporate environmental practices, government and business relations, environmental justice, international relations, China’s political economy and spatial statistics

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Research Center for Chinese Politics and Business, IUB, IN September 2012 – October 2013

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Collected data on industry concentration in China, Japan, Korea, Germany and the United States and conducted data analysis.

Helped with Professor Kennedy’s book editing.
Research Center for Chinese Politics and Business, IUB, IN  
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Collected China’s trade, economic and political data and conducted data analysis.  
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