Leviathan Inc. and Corporate Environmental Engagement

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Abstract

In a 2010 special report, *The Economist* called the resurgence of state-owned publicly-listed enterprises, "Leviathan Inc.", and criticized their poor governance and low efficiency. We show that state-owned enterprises engage more in environmental issues and are more responsive to salient environmental events and changes in government's political orientation. This relation is stronger among high-emission industries and firms with less overseas activities and with direct ownership held by domestic government rather than other blockholdings and sovereign wealth funds. The relation is more pronounced in economies lacking capital market development and energy security. Company valuations and operational performance do not suffer from such engagement. These results suggest that "Leviathan Inc." may be better positioned at dealing with environmental externalities.

Keywords: State ownership, environmental engagement, sustainability, ownership structure

JEL classification: G32, H11, H41, Q56

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Abstract

In a 2010 special report, *The Economist* called the resurgence of state-owned publicly-listed enterprises, "Leviathan Inc.", and criticized their poor governance and low efficiency. We show that state-owned enterprises engage more in environmental issues and are more responsive to salient environmental events and change in government's political orientation. The effect is more pronounced in energy firms located in emerging economies and countries with higher energy risks, and with direct ownership held by domestic government rather than sovereign wealth funds. Company valuations and operational performance do not suffer from such engagement. These results suggest that "Leviathan Inc." may be better positioned at dealing with environmental externalities.

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1. Introduction

With the rise of emerging market economies in the last two decades, the role of state capitalism has attracted new attention. In China, companies in which the state is a majority shareholder account for about two-thirds of the local stock market capitalization. Other emerging market governments such as Brazil or Russia also hold majority or significant minority stakes in publicly listed companies. These stakes can be directly held by central or local governments, as well as held indirectly through public pension funds or sovereign wealth funds. This pattern is contrary to that in many Western economies where large-scale privatizations in the 1980s and 1990s led to the decline in the role of the state in business. This trend has been reversed in the early 21st century, with some of the world's largest publicly listed firms now being state-owned enterprises (SOEs), especially those from emerging markets. In fact, when we compile data on state ownership, we find that 10 of the top 30 global public companies as ranked by Forbes magazine in 2010 were SOEs (Table 1).[1]

The Economist (2010, 2014) calls these resurging state-owned mega-enterprises "Leviathan Inc.", especially those in emerging economies, and warns about the dangers of such a state capitalism model.[2] This stems from a large literature on the economic inefficiency of state ownership, mostly based on the agency view (Megginson, Nash, and Randenborgh (1994), Shleifer (1998), Dewenter and Malatesta (2001), Megginson (2017)). This view argues that SOE managers have low-powered incentives and are poorly monitored by boards packed with politicians (Shleifer and Vishny (1998), La Porta and Lopez-de-Silanes (1999)). Rent-seeking by politicians running SOEs to advance their personal agenda can lead to corruption, poor resource allocation, reduced innovation and skewed wealth distribution (Shleifer (1998)). Yet other studies re-examining SOEs in emerging markets document positive effects of this "new state capitalism" in East Asia (Carney and Child (2013), Boubakri, Ghoul, Guedhami, and Megginson (2017)) and Brazil (Musacchio and Lazzarini (2014), Musacchio, Lazzarini, and Aguilera (2015)). This line of research suggests that SOEs are not necessarily poorly governed, and may help emerging markets deal with market failures and externalities in a more efficient way. We label this as the "social view".

While extant studies use profitability and stock market valuation to evaluate the efficiency implications of "Leviathan Inc.", these metrics may not represent the sole objective for a firm whose shareholders are prosocial and care about social welfare and externalities (Hart and Zingales (2017)). One crucial way that state ownership of businesses can be a positive factor in the public interest is to address environmental issues, an increasingly important topic and spanning several of the United Nations Sustainable Development Goals. An important goal is to tackle anthropogenic climate change (also referred to as "global warming"). While developed nations have historically been the largest contributors to global warming, the growth in new emissions is now concentrated in the recently

[1] This marked presence of state ownership among the world's biggest companies may be understated, given that the Forbes Global 2000 covers only publicly listed companies. For example, Saudi Aramco, the largest energy company in the world, which has been estimated to be the world's most valuable company, has been 100% owned by the Saudi Arabian government since 1980.

[2] "Leviathan" is something that is very large and powerful, or a sea monster in scriptural accounts. Leviathan is generally used to refer to the political state after its use in Thomas Hobbes' "Leviathan or The Matter, Forme and Power of a Common Wealth Ecclesiastical and Civil" (1651).

industrialized economies. In 2010, the countries emitting the most greenhouse gases (GHG) were China (22%), the U.S. (13%), the EU-28 (10%), India (5%), and Brazil (5%), according to the EU's EDGAR data (see Figure 1 for a more detailed visual illustration of CO_2 emission per country and region over time).[3] In September 2016, the Hangzhou G20 Summit focused on "green finance", and the U.S. and China ratified the 2015 Paris Agreement on climate change mitigation.[4] Besides reducing GHG emissions, achieving an efficient use of natural resources such as energy, water or materials and reducing environmental pollution are also increasingly important policy issues.

Governments can promote green technology by imposing carbon taxes and providing research subsidies (Laffont and Tirole (1993), Acemoglu, Akcigit, Hanley, and Kerr (2016)). For example, in the U.S., green industrial policies include laws such as the Clean Air Act, federal tax credits and state-level renewable portfolio standards. Rodrik (2014), however, concludes that these policies are "strong in theory, ambiguous in practice" (p.470). Alternatively, the state can intervene by holding ownership stakes in public corporations. State-owned firms can coordinate resources through government procurement and state funding (examples include oil or other natural resources funds and public pension funds) to support such green investment. In contrast, private firms in economies with less developed capital markets have difficulty in securing long-term financing. As companies from China and other emerging market countries make the transition from dirty to clean technology and reduce fossil fuel emissions to limit pollution and mitigate climate change, the role of state ownership could be important. UNEP (2016) estimates that in 2015, for the first time, the investment in renewable energies in emerging countries outweighed that in developed economies, with China contributing over a third of the world's total.[5]

In this paper, we conduct an international study of the impact of state ownership on a firm's engagement in environmental issues. We compile a new comprehensive dataset of the level of state ownership using several databases and combine it with measures of environmental, social, and governance (ESG) performance of publicly listed firms in 44 countries over the period from 2004 to 2014. There is considerable cross-country variation in state ownership in our sample. State ownership is more prevalent in emerging markets (25% of publicly listed companies) than in developed economies (4%). For example, SOEs represent more than 60% of the stock market in China, close to 40% in Russia and about 20% in Brazil. In comparison, government stakes are insignificant in the U.S. and in other major developed economies. SOEs are more prevalent in certain industries: telecommunications, utilities, and oil and gas. We focus primarily on how state ownership is related to corporate environmental sustainability (the "E" in ESG) as it measures how a firm addresses market failures and externalities generated via its operation to the

[3] Emission Database for Global Atmospheric Research (EDGAR) classifies CO_2, CH_4, N_2O, and F-gases as greenhouse gases (GHG). Under the United Nations Framework Convention for Climate Change (UNFCCC), countries submit their inventories of GHG emission data. The emission time series 1990-2012 per region/country is available in http://edgar.jrc.ec.europa.eu/overview.php?v=GHGts1990-2012&sort=des9. The country rankings based purely on CO_2 emissions for 2014 are similar: China (31%) US (22%), EU-28 (14%), India (12%), and Russia (10%). These data are available at: http://edgar.jrc.ec.europa.eu/overview.php?v=CO2ts1990-2014&sort=des9.

[4] The main aim of the Paris Agreement on climate change is to "[hold] the increase in the global average temperature to well below 2 °C above pre-industrial levels". The U.S. President Obama accepted it by executive order in September 2016. However, in June 2017, President Trump announced that the U.S. would stop participation in the Agreement.

[5] UNEP/Bloomberg New Energy Finance, "Global Trends in Renewable Energy Investment" (2016).

natural ecosystem.[6] In the baseline tests, we use Thomson Reuters' ASSET4 environmental scores, but we find consistent results using alternative environmental performance measures from two other widely-used datasets: MSCI ESG Intangible Value Assessment and Sustainalytics ESG Ratings.

Our main findings are that SOEs engage more in environmental issues, including emission mitigation, innovation in eco-efficient products or services, and reduction in the usage of natural resources, and produces less CO_2 emissions as measured by actual firm-level emission data. These baseline results document only an association between state ownership and environmental engagement. We thus conduct several tests on the social view of state-ownership in dealing with externalities. While state-control status is endogenous, it changes little for us to fully pin down causality given that our recent sample period is after most countries experienced waves of nationalizations and privatizations. However, we are able to conduct several identification tests. In the first set of tests, we exploit the fact that state-owned status is pre-determined in our sample period, typically the result of post-privatization in the previous decades and state ownership of publicly listed firms was maintained for reasons not dominated by environmental concerns that have received more attention lately. We find that firms that were historically state-owned still perform better in environmental issues, suggesting that state ownership promotes environmental engagement, rather than that governments picking "green companies" to keep and divesting polluting firms as a political expedient.

In our second set of tests, we explore the time variation in such engagement by SOEs around significant world shocks to the awareness of climate change and other environmental problems. First, we show that SOEs reacted more significantly to the passage of the Copenhagen Accord in December 2009 by subsequently reducing carbon dioxide (CO_2) emissions. As a second shock, we analyze the reaction of firms to the March 2011 Fukushima nuclear disaster that occurred in Japan, the most significant nuclear incident since the Chernobyl disaster. We find that SOEs, especially those in the utility industries, improved their environmental engagement subsequent to the nuclear disaster. Third, we explore the effect of people's attention to climate change by Google Search volume as in Choi, Gao, and Jiang (2018), and find that state-owned firms, especially those in high-polluting industries, cut more CO_2 emissions when there is much more attention to abnormal temperatures. Further placebo tests confirm that the aforementioned test results indeed take place in the relevant industries and around the time of these shocks.

In our third set of tests, we examine variation in the role of state ownership induced by the change of the government's political orientation in a country. We find that SOEs become more environmentally engaged following the government's political orientation changing toward more left leaning. Overall, the three sets of identification tests collectively are strong evidence that firms' state ownership affects environmental engagement by SOEs.

[6] We use the terms "environmental engagement" and "sustainability" interchangeably throughout.

There is also cross-sectional variation in the effect of state ownership on firms' environmental engagement based on governments' active role in ensuring energy safety or addressing negative externalities. We find that the relation is more pronounced for firms in countries facing greater energy risks and those in conflict with neighboring states which have stronger incentives to preserve and develop alternative sources of energy. Moreover, the relation is stronger among firms in countries with weaker environmental regulation and equity market development, consistent with the social view that the government provides a helping hand when the institutional environment is weak.

We then explore potential mechanisms of the above state ownership effect, which help us further differentiate the social view from the agency view. First, we find that the positive association between state ownership and environmental engagement is concentrated in pollution-intensive industries as measured by the U.S. Environmental Protection Agency's (EPA)' toxic release inventory (TRI) database. This is consistent with the argument that government stakes play a bigger role in areas where the challenges of pollution and emissions are more pressing. Second, we document a weaker environmental engagement of SOEs in firms with more foreign activities measured by foreign sales and assets, which is consistent with the social view. Third, we do not find a greater effect when the CEOs are politically connected (thus more incentivized to advance her political agenda), which does not support the agency view.

To better understand why government stakes are special, we test but fail to find a similar positive association between environmental engagement and other types of block-owners beyond the government. We interpret this as suggesting that what state block-ownership captures is not simply a mechanical effect of concentrated ownership, but it can be attributed to the state being the ultimate owner. We further document that the effect is stronger in the case of direct ownership stakes by domestic state entities. In contrast, we do not find an effect in the case of stakes held by foreign governments or by sovereign wealth funds (SWFs). This is consistent with the notion under the social view that SWFs are more concerned with financial returns, while domestic governments are more focused in addressing market failures, especially with regard to environmental issues.

We also show that SOEs' environmental engagement does not come at a cost to shareholder value in terms of future market-to-book ratio and profitability, which does not support the agency view. One possible explanation for state-owned firms' equal performance in market value and profitability despite their environmental engagement is that these companies may receive government subsidies, earn government procurements, or have more financial support from governments or state-owned banks. Lastly, we examine firms' engagement in social issues (S) and corporate governance (G), and compare the state ownership effects on E versus the S and G dimensions to shed light on where SOEs focus on. Interestingly, we document that SOEs also engage more in social issues, but do not have better or worse corporate governance practices. These results indicate that governments indeed play a different role from other blockholders, caring more about stakeholders and being more willing to invest in environmental issues.

Our work contributes to the literature on government involvement in public companies. The classical "agency view" of SOEs has been framed around the conflicting financial and social objectives that these companies face (e.g., Megginson and Netter (2001), Chen, Jiang, Ljungqvist, Lu, and Zhou (2017)). Central to this literature is the argument that state-owned firms usually have weaker corporate governance and poorer financial performance (e.g., Megginson, Nash, and van Randenborgh (1994), Dewenter and Malatesta (2001), Megginson and Netter (2001), Bortolotti and Faccio (2009)). The partial privatization waves in emerging markets in the last decades, however, might have heralded the rise of a new breed of publicly-listed SOEs. Recent studies document that "Leviathans" can achieve good financial performance (e.g., Inoue, Lazzarini, and Musacchio (2013), Cuervo-Cazurra, Inkpen, Musacchio, and Ramaswamy (2014), Musacchio, Lazzarini, and Aguilera (2015)). Boubakri, Ghoul, Guedhami, and Megginson (2017) provide evidence that government-owned firms exhibit higher market valuations than non-government-owned firms in East Asia, but the relation is non-linear. Karolyi and Liao (2017) document growing cross-border acquisition activities by SOEs, particularly those from emerging markets. Jia, Huang, and Zhang (2018) show that state-owned firms are able to produce better-quality patents in the presence of high-quality local governments. Others find that a large part of sovereign wealth funds' investments also come from emerging markets (Dewenter, Han, and Malatesta (2010); Kotter and Lel (2011); Bortolotti, Fotak, and Megginson (2015)). Given the rapid expansion of investment by emerging market SOEs and SWFs in the global arena, our findings have important policy implications.

This paper's findings are more in line with a "social view" that SOEs can be effective in addressing environmental externalities. Economic theory suggests that the private sector (the market) pursues profit maximization, while the public sector (the state) may correct market failures such as negative externalities that corporations generate to the environment (Benabou and Tirole (2010)). This dichotomy may play differently depending on the level of development of an economy. While companies in developed countries tend to exhibit better corporate governance practices and shareholder value maximization (Aggarwal, Erel, Stulz, and Williamson (2009)), these companies may not internalize environmental (and social) costs. For example, a company might improve shareholder value by outsourcing production to developing countries with laxer environmental regulations. In contrast, non-SOEs based in developing countries may not have incentives to pursue environmentally sustainable practices and instead maximize profits by using more polluting technologies. Our results highlight the role of state ownership being more effective in dealing with environmental issues than private ownership in industries and economies that are more sensitive to, and lack long-term capital to deal with, environmental issues. Importantly, we do not find support for the alternative view of state-ownership (the agency view) that SOEs are managed by incapable managers and are captured by politicians to fulfill their political agenda rather than maximizing social welfare (Shleifer and Vishny (1994), Sapienza (2004)).

We also contribute to the growing literature in finance examining how ownership structures affect corporate engagement in ESG issues. There has been a debate on the relation between ESG and shareholder value. Some

studies document a positive association (Godfrey, Merrill, and Hansen (2009), Servaes and Tamayo (2013), Hong and Liskovich (2015), Ferrell, Liang, and Renneboog (2016), Lins, Servaes, and Tamayo (2017)) while others find that ESG engagement is instead related to poor corporate governance (Masulis and Reza (2015), Cheng, Hong, and Shue (2016)). In the U.S., large institutional investors have been shown to react to local sustainability preferences (Gibson-Brandon and Kruger (2016)) and yield some power in terms of shareholder proposals and voting (Del Guercio and Tran (2012)) and private engagements (Dimson, Karakas, and Li (2015)). Internationally, the literature has focused on how shareholders affect the "G" dimension. For example, foreign institutional investors seem to export better corporate governance (Aggarwal, Erel, Ferreira, and Matos (2011)). In a recent study, Dyck, Lins, Roth, and Wagner (2018) examine and find that institutional investors from certain countries also promote higher E&S standards. Hopner, Oikonomou, Sautner, Starks, and Zhou (2016) examine how ESG shareholder engagement by a large institutional investor can reduce downside risk but this tends to be concentrated in the governance dimension. To our knowledge, the role of state ownership has not been examined despite its growing importance, particularly in emerging markets. Our contribution is to show that state ownership appears to be positively correlated with E (and to some extent with S, but not with G). We also find that shareholder value is not negatively affected by such engagement in non-shareholder maximization issues by SOEs.

2. Sample and Summary Statistics

In this section, we first describe how we compile the data and introduce key variables of interest: state ownership and corporate environmental engagement. We then provide details on the sample and control variables. Finally, we examine some summary statistics.

2.1. Data and Variables

2.1.1. State Ownership

The primary data on state ownership comes from Orbis, a Bureau van Dijk database which provides the types of ultimate owners historically for over 70,000 publicly listed companies around the world.[7] If there is an ownership pyramid, an "ultimate owner" is identified by following an uninterrupted path of control rights. A company is defined as state-owned if the ultimate owner is a public authority, a state, or a government entity with the percentage of voting rights exceeding 25% in every layer of the ownership pyramid. The main variable of interest in our study is ***State_own***, a dummy variable that equals one if the firm is state-owned, and zero otherwise. The ownership data from Orbis are updated over time and restored in historical DVDs, through which we extracted yearly information to construct our *State_own* measure.

[7] We do not include SOEs that are not publicly listed companies so the state presence is underestimated in our study. This data has previously been used to measure the frequency of SOEs in a smaller scope study by OECD (2013).

The most common example of a state-owned company occurs when a government of the country in which the company is headquartered has direct ownership that exceeds 25% of all outstanding shares. The largest stakes tend to be held directly by central or federal governments (e.g., the government of China or Brazil) and related entities (e.g., the China State-Owned Assets Supervision & Administration Commission), as well as by state-level governments (e.g., the municipality of Shanghai or the state of Sao Paulo) or through a development bank (e.g., BNDES in Brazil). The second case is that a company may be owned by a foreign government; an example is Indosat in Indonesia (originally controlled by the government of Indonesia, and then by the government of Singapore from 2003 through 2007, and owned by the Government of Qatar subsequently). Instances of foreign government control typically occur when a state-owned company or a sovereign wealth fund (e.g., GIC from Singapore or the Qatar Investment Authority) acquires a majority stake in a company overseas. Third, selling a stake to a foreign state-owned firm does not necessarily imply majority-ownership by a foreign state.[8] Finally, some firms were initially not state-owned but ultimately become nationalized.[9]

Orbis takes into account many of the special cases of state ownership, but we manually cross-check the data for possible mismeasurement of state-owned status.[10] To correct for such mismeasurements of state ownership, we consult three major databases—Orbis, FactSet/Lionshares, and Datastream—to cross-check the ownership information of companies in our sample. As long as a company is identified as having a government as the ultimate owner according to our criteria in any of the three databases, we consider the company as potentially state-owned. We then proceed to manually check a company's annual report and other public sources to determine whether its ultimate owner is a state entity. After these manual corrections, the number of firm-year observations for SOEs (*State_own* = 1) changes from 3,624 to 4,861. In Appendix 1, we provide some examples of these corrections for companies across developed economies and emerging economies.

In robustness tests, we use an alternative measure of state ownership that is continuous and based on government-held free-floating shares (***Government_held***), which we obtain from Datastream. This variable measures the percentage of floating shares held directly by governments via blockholdings greater than 5%. However, this variable has several shortcomings as it does not measure closely-held (non-floating) shares by governments, includes only the ownership in the first layer and does not trace up to higher levels in the case of ownership pyramids. Despite its limitations, we obtain consistent results using this alternative measure of state ownership.

2.1.2. Corporate Environmental (and Social and Governance) Engagement

[8] For example, EDP Energias de Portugal, a company that was majority-owned by Parpublica (owned by the government of Portugal), sold its shares in 2011, with China Three Gorges becoming the largest shareholder but holding less than 25%. Thus we consider EDP Energias de Portugal as state-owned before 2012, but no longer state-owned since 2012.

[9] A notable example is ABN AMRO, which was nationalized in 2010 by the Dutch government.

[10] A more unusual SOE case occurs when firms are owned by a group of governments, such as the Scandinavian airline company SAS, which is jointly owned by the governments of Sweden, Norway, and Finland, each holding less than 25% of the company's shares.

To evaluate corporate engagement in environmental issues (as well as in social and governance issues), we use data from Thomson Reuters' ASSET4 Environmental, Social, and Corporate Governance database (ASSET4), which has been used in previous ESG studies (e.g., Ferrell, Liang, and Renneboog (2016), Liang and Renneboog (2017), Dyck et al. (2018)). The ASSET4 sample covers more than 4,500 global publicly listed companies that are included in major equity indices. These indices include the S&P 500, Russell 1000, NASDAQ 100, MSCI Europe, FTSE 250, ASX 300, STOXX 600, the MSCI World Index, the MSCI Emerging Market index, among other major equity indices. The ASSET4 ratings consist of more than 750 ESG sub-dimensions (data points). Data are collected from multiple sources, including: a) company reports; b) company filings; c) company websites; d) NGO websites; e) CSR Reports; and f) reputable media outlets. Every data point goes through a multi-step verification process, including a series of data entry checks, automated quality rules and historical comparisons. These data points reflect more than 280 key performance indicators and are rated as both a normalized score (0 to 100, with 50 as the industry mean) and the actual computed value. The equally-weighted average is then normalized by ASSET4 so that each firm is given a score relative to the performance of all firms in the same industry around the world each year; in other words, the ratings are industry-benchmarked based on 136 unique industries defined by the Thomson Reuters Business Classification (TRBC). All ratings are provided on a yearly basis. For all companies, at least three years of history are available, and most companies are covered from 2005 onward. Thus the effective time-series of our sample are about ten years on average. Firms are rated on the basis of their ESG compliance (regulatory requirements) and their ESG engagement (voluntary initiatives). We primarily focus on the "E" ratings.

One may raise the concern that the ASSET4 sample is biased toward certain countries such as the U.S. As in other cross-country studies, the sample is constructed by tracking major equity indices that cover the largest companies around the world. A manual check of the data confirms that most multinational corporations in the Forbes Global 2000 list are in our sample. There is a sample bias towards larger firms but these firms are likely to have greater societal and environmental impacts. In robustness checks, we also use data from alternative ranking services (MSCI ESG Intangible Value Assessment and the Sustainalytics ESG Ratings databases).

In the main analysis, we focus on a company's overall environmental score (*ENVSCORE*), and three sub-aggregate level scores: Emission Reduction (*ENER*), Product Innovation (*ENPI*) and Resource Reduction (*ENRR*). *ENER* measures a company's commitment and effectiveness in reducing air emissions, waste, water discharges and spills, or its impact on biodiversity. *ENPI* measures a company's research and development of eco-efficient products or services. *ENRR* measures a company's ability to reduce the use of materials, energy, or water, and to find more eco-efficient solutions by improving supply chain management. In addition, we introduce a variable measuring firm-level CO_2 and CO_2 equivalent emissions (for other greenhouse gases) in tonnes (variable name "ENERDP023" in the ASSET4 database), scaled by total assets and then taken logarithm to be normalized (*Ln(CO2/Assets)*) following Masulis and Reza (2015). This is arguably a more concrete measure of a firm's environmental impact compared to normalized ratings. On the other hand, it only focuses on greenhouse gas emissions and does not reflect

other environmental dimensions such as water pollution and natural resource exhaustion. Another advantage of tests using CO_2 emissions is that it is less subject to manipulation.[11] Appendix 2 provides detailed definitions of these variables.

In supplemental tests, we also investigate companies' engagement in social issues and corporate governance issues by analyzing data on non-environmental ESG dimensions from ASSET4. The social pillar score (*SOCSCORE*) measures a company's ability to generate trust and loyalty in its workforce, customers, and society, through its adoption of best management practices. The corporate governance pillar score (*CGVSCORE*) measures a company's systems and processes, which ensure that its board members and executives act in the best interests of its long-term shareholders. These two variables are also defined in Appendix 2.

2.1.3. Control Variables

We control for common firm-level covariates included in most corporate finance research, such as total assets, leverage, market-to-book ratios (MTB) and return on assets (ROA), with data obtained from Datastream and Compustat Global. Definitions of these variables are also provided in Appendix 2. Following Dyck et al. (2018), who find that a firm's ESG engagement can be driven by its institutional investors (especially foreign ones), we also control for a company's institutional ownership (including both domestic and foreign institutional holdings). Data on institutional ownership are collected from Factset/LionShares. Moreover, given the cross-country nature of our data, we control for country-level GDP per capita obtained from the World Bank. Finally, we control for country fixed effects and industry-year fixed effects, where industry is defined by the Thomson Reuters Business Classification (136 industries in total) so as to be consistent with how ESG ratings are industry-benchmarked.

2.2. Summary Statistics

Table 1 shows that state-owned enterprises feature prominently in the Forbes Global 2000 list of top public companies as ranked by Forbes magazine in 2010.[12] These 10 SOEs, highlighted in bold, include four companies from China (ICBC, PetroChina, China Construction Bank, and Bank of China), two from France (GDF Suez and EDF Group) and one each from Russia (Gazprom), Brazil (Petrobras), the U.K. (Lloyds), and Italy (ENI). SOEs play an important role in both developed and emerging economies. While these SOEs score relatively well in terms of environmental performance (*ENVSCORE*, and its sub-scores) and social performance (*SOCSCORE*), a majority of SOEs are poorly governed according to the corporate governance pillar score (*CGVSCORE*).

[11] To address the concern that state-owned companies could get preferential treatment from regulators or be able to fudge environmental indicators or avoid costly compliance measures (e.g., Fisman and Wang, 2015), we performed robustness tests controlling for corruption indices from Transparency International and World Bank. The (untabulated) results show no relation between environmental indicators and measures of corruption. The variable, however, is only available for about 43% of our sample firms.

[12] We choose 2010 to report these figures for data comparability with the figures quoted in *The Economist* (2010). The year 2010 is also in the middle of our sample period.

In Panel A of Table 2 we show the distribution of firm-year observations (and number of unique firms) across countries for the sample used in our regressions. Leading the list are firms in developed markets (the U.S., Japan, the U.K., Australia, and Canada), but the sample has a reasonable coverage of firms in emerging economies, in particular the BRICS countries (Brazil, Russia, India, China, and South Africa). Overall, we have a sample of 28,218 firm-year observations (3,850 unique firms) for which data are available in 2004-2014 for all dependent and independent variables in the baseline regressions. Table IA.1 in the Internet Appendix provides the numbers of observations per year we use in our baseline regression analysis.[13]

Table 2 shows that the average level of state ownership (*State_own*) of our sample of publicly listed companies is 6.5%. The country with the highest proportion of state-owned companies in our sample is China but the average levels of state ownership are also high for other emerging economies. Figure 2 provides the average percentage of state-owned firms in each country during the 2004-2014 sample period. There is considerable cross-country variation: SOEs represent 65% of the market in China, 39% in Russia, 20% in Brazil, and 12% in France, but have a trivial presence in some other countries such as the U.S. Table 2 also provides the average of environmental pillar scores (*ENVSCORE*) in each country. The average environmental pillar score is 51.6, which is expected as all ESG scores are standardized and industry-adjusted by Thomson Reuters to get a mean score of 50. Except for China (26.0), the average environmental pillar scores of the BRICS countries are around the standardized mean: Brazil (53.0), India (55.1), Russia (44.5), and South Africa (52.7).[14]

As a first look at the relation between state ownership and environmental engagement, we plot the average *ENVSCORE* for SOEs (firms with at least 25% of control rights owned by the government) and non-SOEs in each country in Figure 3. We observe a general pattern that SOEs' *ENVSCORE* is higher than non-SOEs' in most countries. For a formal test, in Panel A of Table 2 we conduct a t-test for the equality of the environmental pillar scores *ENVSCORE* between SOEs and non-SOEs. The average *ENVSCORE* for state-owned firms is 57.7 compared to 51.2 for non-SOEs and the difference is statistically significant (p-value = 0.00). When we look at each individual country, we find SOEs' environmental pillar scores are higher than that of non-SOEs in 32 of 44 countries (the difference is statistically significant in 25 countries at the 10% level).[15] These findings provide preliminary evidence on the link between a firm's state ownership and environmental engagement. We find similar country-level results for the sub-categories of emission reduction (*ENER*), environmental product innovation (*ENPI*), and environmental

[13] We drop 2002 and 2003 from the main analysis to avoid biasing our baseline results by insufficient coverage. However, in untabulated results, we obtain consistent results if we include 2002 and 2003 in the sample.

[14] In untabulated results, the results on the relation between state ownership and environmental engagement remain consistent when we remove the five BRICS countries from the regression sample.

[15] Figure IA.1 in the Internet Appendix presents the time-series evolution of *ENVSCORE* in companies based in the five geographic regions. We observe that North American firms are ranked the lowest while European firms are highly ranked. Some fluctuations are observed for firms in the other three regions. Figures IA.2 and IA.3 show similar time-series evolution for *SOCSCORE* and *GOVSCORE*. Figure IA.4 shows the evolution of the proportion of state-owned firms (both equal-weighted and value-weighted) in five geographic regions over the sample period. In both panels, we see an increase in SOEs in emerging economies such as Asia Pacific and Latin America. At the same time, there is a decline of SOEs in Africa and Middle East in our sample. State ownership in Europe remains at relatively modest levels throughout the period, and it is virtually absent in North America.

resource reduction category (*ENRR*) scores. We also report the results of a t-test for the equality of these sub-scores between SOEs and non-SOEs in Table IA.2 in the Internet Appendix. SOEs receive significantly higher scores than non-SOEs do in most countries across all three sub-categories.[16]

In Panel B of Table 2 we show the summary statistics of firms classified based on the 10 industries in the broad Industry Classification Benchmark (ICBIN) taxonomy.[17] State ownership is greater in Telecommunications (31.9%), Utilities (26.1%) and Oil & Gas (12.6%). Comparing the environmental pillar scores, SOEs have higher *ENVSCORE* in seven of ten industries. Notably, the three industries in which the non-SOEs' *ENVSCORE* is higher than the SOEs' (Industrials, Consumer Goods, and Health Care) are those with fairly low state ownership (5.3%, 2.0%, and 1.0%). In industries with a stronger government presence, we find SOEs are more active in terms of environmental issues. We report sub-category scores (*ENER*, *ENPI*, and *ENRR*), *SOCSCORE*, and *CGVSCORE*, and t-test results for the equality between SOEs and non-SOEs in Table IA.3 in the Internet Appendix.

We also find that the patterns of univariate analysis documented above are persistent across time. In Table IA.4 we document that SOEs are associated with significantly higher *ENVSCORE* and *SOCSCORE* for almost every sample year from 2004 through 2014. In addition, SOEs are associated with a significantly lower *CGVSCORE* in every sample year.

Results of these univariate tests should be interpreted with caution because we have not controlled for several country- and firm-level factors. Panel A of Table 3 presents summary statistics of the key variables in the multivariate regressions we implement later in our study. Panel B of Table 3 reports Pearson correlation coefficients for all variables in the baseline regressions. We find that state ownership is positively and significantly correlated with all environmental engagement proxies. In addition, multicollinearity is unlikely to be a concern given the correlations between *State_own* and control variables.

3. Empirical Results on State Ownership and Environmental Engagement

We now test the relation between state ownership and corporate engagement in environmental issues using multivariate regressions. We first present results from the baseline regression and then consider further tests based on salient environmental events and government changes. Lastly, we explore several potential mechanisms that might account for such an association.

[16] There is also a large cross-country variation in the average social pillar score. The SOEs' average score (*SOCSCORE*) is 62.0, significantly higher than other firms' average score of 51.4. In Table IA.2 of the Internet Appendix, we test whether SOEs have higher *SOCSCORE* than non-SOEs and find statistically significant difference in 24 countries (at the 10% significance level). Interestingly, we find the opposite correlation between state ownership and corporate governance: The SOEs' average score (*CGVSCORE*) is 41.6, significantly lower than other firms' average score of 54.0, consistent with the literature that SOEs suffer from governance problems.

[17] The ICBIN 10-industry classification is coarser than the TRBC (136 industries) used by ASSET4 in their proprietary scoring method. Therefore, while the global average *ENVSCORE* is close to 50, it does not have to be for each ICBIN group.

3.1. Baseline Regression

Our baseline regression is specified as follows:[18]

$$ENV_{i,k,j,t} = \beta_0 + \beta_1 State\_own_{i,k,j,t-1} + \beta_2 Inst_{own}{}_{i,k,j,t-1} + \beta_3 Ln(Assets_{i,k,j,t-1}) + \beta_4 Leverage_{i,k,j,t-1}$$

$$+ \beta_5 MTB_{i,k,j,t-1} + \beta_6 ROA_{i,k,j,t-1} + \beta_7 Ln(GDP_{j,t}) + \Sigma\, \boldsymbol{\rho} * I(Country_j) + \sum \boldsymbol{\delta} * I(Ind\_Year_{k,t}) + \varepsilon_{i,k,j,t}, \quad (1)$$

where $ENV_{i,k,j,t}$ denotes the firm-level environmental engagement (*ENVSCORE* and sub-scores *ENER*, *ENPI*, and *ENRR*, as well as a measure of firm-level CO_2 emission scaled by total assets, $Ln(CO_2/Assets)$) of firm *i* in industry *k* and headquartered in country *j* in year *t*. The primary explanatory variable, $State\_own_{i,k,j,t-1}$, is an indicator variable that equals one if firm *i* is state-owned in year *t-1* and zero otherwise. Other control variables include the percentage of institutional ownership ($Inst\_own_{i,k,j,t-1}$), firm size ($Ln(Assets_{i,k,j,t-1})$), leverage ($Leverage_{i,k,j,t-1}$), market-to-book ratio ($MTB_{i,k,j,t-1}$), return on assets ($ROA_{i,k,j,t-1}$), and GDP per capita in logarithm ($Ln(GDP_{j,t})$). All the control variables are winsorized at the 5th and 95th percentiles. $I(Country_j)$ and $I(Ind\_Year_{k,t})$ stand for country and industry-year fixed effects based on TRBC industries. Controlling for industry-year fixed effects is crucial as this addresses the Gormley and Masta (2014) critique to using the industry-demeaned dependent variable (e.g., ASSET4 industry-adjusted ESG scores). We estimate Equation (1) using an ordinary least squares (OLS) model on a panel of all firm-year observations with non-missing values in all dependent and independent variables over 2004-2014.[19] Standard errors are clustered at the firm level to correct for firm-specific autocorrelation in estimation errors.

Panel A of Table 4 reports the estimation results for Equation (1). We first estimate the equation using only state ownership (*State_own*) as the explanatory variable as well as country and industry-year fixed effects (Column (1)). The point estimate of state ownership at 8.927 is statistically significant at the 1% level. Given that the dependent variable is standardized on a scale of 0-100, the coefficient can be directly interpreted as percentage. That is, state-owned firms on average receive an environmental score that is about 9% higher than non-state-owned firms. In Column (2), when we include all other control variables in the estimation, the coefficient of *State_own* is reduced to 4.688, but remains statistically significant at the 1% level. This means SOEs' improved environmental performance makes them rank 5 percentiles higher relative to their industry peers from around the world.

We also investigate which aspects of environmental engagement are related to state ownership by replacing the dependent variable *ENVSCORE* with its component (i.e., sub-categorical) scores *ENER* (Columns (3)-(4)), *ENPI* (Columns (5)-(6)) and *ENRR* (Columns (7)-(8)). The results suggest that a firm's state-control status is strongly

[18] Our regression sample for firm-level environmental engagement (CO_2 emission) includes 28,218 (12,289) firm-year observations.
[19] The dependent variables (*ENVSCORE*, *ENER*, *ENPI*, and *ENRR*) are bounded between 0 and 100. In a robustness check, we regress the logarithmic value of environmental engagement proxies as well as use a fractional response model to account for the issue of limited dependent variable, and obtain consistent results.

correlated with higher scores across these different dimensions. In addition, we find that state-owned firms on average have lower CO_2 emissions-to-assets ratio (Columns (9)-(10)) to more specifically examine climate change issues. Due to limited data availability on CO_2 emissions, this reduces our sample size by more than half, but the results are consistent with that when we use *ENVSCORE* and its subscores.

The results in Panel A of Table 4 also show that environmental engagement scores are higher in firms with greater institutional ownership, bigger size, higher market-to-book ratios, lower leverage ratio, and are more profitable (higher ROA). These findings are consistent with the prior literature on the presence of institutional investors promoting socially responsible corporate behavior (see Dyck et al. (2018)) and the "doing well by doing good" argument that more profitable companies care more about sustainability (see Hong, Kubik, and Sheinkman (2012); Flammer (2015)).

State ownership is endogenous but it is worth noting that state-control status of a public companies is generally quite stable during our sample period (although the state's political leaning and objectives may change over time), since it is likely a legacy of post-privatization ownership structures. State-owned firms were formed before our sample period for reasons typically unrelated to environmental concerns, which tends to be a more recent phenomenon. Therefore, we utilize the long-lag information of our sample by regressing *ENVSCORE* on long-lagged *State_own* and report the results in Panel B of Table 4. We took four different approaches to lag the *State_own* variable: (1) using the predetermined *State_own* levels as of 2004 (the start of our sample period); (2) taking a 5-year lag (*L5.State_own*) for the sub-sample period after 2009 (if there are fewer than 5 years, the observation is omitted); (3) taking a 5-year lag (*L5.State_own*) for the full sample period (if there are fewer than 5 years, the observation is omitted); and (4) averaging each firm's *ENVSCORE* scores over the period 2009-2014 and the value of *State_own* over the period of 2004-2009, and running a single cross-sectional regression of the averaged *ENVSCORE* score on the averaged *State_own*. Overall, our results support that a firm's history of being state-owned is significantly and positively associated with higher *ENVSCORE*. Therefore, our results are more in line with the idea that state ownership promotes more environmental engagement, rather than that governments as owners pick "green companies" to keep and divesting polluting firms as a political expedient.

3.2. Evidence from Salient Environmental Events

We explore time variation in the salience of environmental sustainability issues and investigate whether the state-controlled firms react differently to these events. For this purpose, we estimate the following regression to examine if there is a significant change in the relation between state ownership and environmental engagement after the event:

$$ENV_{i,k,j,t} = \alpha_0 + \beta_0 State\_own_{i,k,j,t-1} \times Post_t + \beta_1 State\_own_{i,k,j,t-1} + \beta_2 Inst\_own_{i,k,j,t-1}$$

$$+ \beta_3 Ln(Assets_{i,k,j,t-1}) + \beta_4 Leverage_{i,k,j,t-1} + \beta_5 MTB_{i,k,j,t-1} + \beta_6 ROA_{i,k,j,t-1} + \beta_7 Ln(GDP_{j,t})$$

$$+\Sigma\, \boldsymbol{\rho} * I(Country_j) + \Sigma\, \boldsymbol{\delta} * I(Ind\_Year_{k,t}) + \varepsilon_{i,k,j,t}, \quad (2)$$

where *ENV* denotes related environmental engagement measures, and $Post_t$ is an indicator variable that equals one if year *t* is after the event and zero otherwise. The interaction term *State_own* × *Post* is used to test whether state-owned firms reacted more strongly to the event in comparison with non-state-owned firms.

We first focus on the passage of the Copenhagen Accord which raised awareness of the severity of climate change and other environmental problems around the globe. The Accord was the major achievement of the United Nations Climate Change Conference held in Copenhagen in December 2009. It was drafted by a coalition of the BASIC countries (Brazil, South Africa, India and China) given the growth of emissions in these countries and the U.S., and was intended to succeed to the 1992 Kyoto Protocol, which was scheduled to end in 2012. While the Accord was not legally binding, this actually provides a good ground for testing firms' *voluntary* engagement in environmental issues. We argue that the collective effort in the passage of the Copenhagen Accord increased state-owned firms' pressure to reduce GHG emissions, because SOEs should be more responsive to heightened attention brought by a government accord.[20] The interaction term *State_own* × *Post* is used to test whether state-owned firms reacted more strongly to the event and reduced GHG emissions after 2009. We thus use $Ln(CO_2/Assets)$ as the dependent variable in Equation (2), and let *Post* be one for 2010-2014 (*Post_2009*). We expect the coefficient estimate of the interaction term, β_0, to be significantly negative. The results are reported in Column (1) in Panel A of Table 5. We find that the estimation of β_0 is negative with marginal statistical significance, suggesting that state-owned firms produce lower GHG after the Copenhagen Accord. Moreover, the coefficient on *State_own* is also significantly negative, consistent with Table 4. The results suggest that, after the passage of the Copenhagen Accord, state-owned firms increased their efforts toward addressing environmental issues by about 20% more than non-state-owned firms' efforts.

Second, we explore the reactions by SOEs worldwide to another global environmental event, namely the Fukushima nuclear disaster which occurred in Japan on March 11, 2011 and was the most significant nuclear incident since the 1986 Chernobyl disaster. [21] It also led to widespread international reactions—for example, triggered by this incident, Germany accelerated plans to close its nuclear power reactors and decided to phase the rest out by 2022. Since this event deals with environmental issues unrelated to global warming, we estimate Equation (2) by using *ENVSCORE* as the dependent variable and letting *Post* be one for 2012-2014 (*Post_2011*). We expect the coefficient estimate on the interaction term, β_0, to be significantly positive because SOEs should be under more pressure from governments and the public. As shown in Column (2) in Panel A of Table 5, we find a

[20] Although there may be confounding event around this time such as the Deepwater Horizon oil spill which happened in April 2010, we argue that it actually reinforced the global awareness of human-caused environmental issues and should work in the same direction to strengthen our results.

[21] It was an energy accident at the Fukushima Daichi Nuclear Power Plant initiated by the tsunami following the Tohoku earthquake. The insufficient cooling due to the tsunami led to three nuclear meltdowns, hydrogen-air explosions, and the release of radioactive material, resulting in a massive evacuation of over 170,000 people in Japan.

positive and significant coefficient of the interaction term, indicating that SOEs increased their efforts toward addressing environmental issues by about 2.3% more than non-state-owned firms after the Fukushima incidence. In addition, as the Fukushima incidence affected mostly the utilities industry, we run a similar test as in Equation (2) but introduce a triple interaction term *State_own* × *Post_2011* × *Utilities*. In Column (3), we find that the coefficient on the triple interaction is positive and significant, suggesting that the effect is stronger for utility companies which were most sensitive to nuclear risk.

Third, we explore the effect of how different countries react to abnormally high local temperatures by examining attention to climate change based on the the data from Choi, Gao, and Jiang (2018). The term "abnormally warm" refers to cases in which a city's temperature is significantly higher than the historical average temperature at the same point of the year. This is done by decomposing local monthly temperature of country *j* in month *m* into 3 components, which account for predictable, seasonal, and abnormal patterns (i.e., $Temperature_{j,m} = Aver\_Temp_{j,m} + Mon\_Temp_{j,m} + Ab\_Temp_{j,m}$). We extract the $Ab\_Temp_{j,m}$ part because this is arguably unpredictable. We then aggregate the previous year's 12-month $Ab\_Temp_{j,m}$ of the capital city or the city of major stock exchanges (e.g., Frankfurt and New York City) of the country in which our focal firm is located, and create a dummy of *High Abnormal Temperature* equalling 1 if country *j*'s aggregated annual abnormal temperature is above the sample median, and 0 otherwise in year *t*. In Columns (4)-(5) of Panel A of Table 5, we again use $Ln(CO_2/Assets)$ as the dependent variable as it is directly related to abnormal temperature, and focus on the coefficient on a triple interaction term *State_own* × *High abnormal temperature* × *Emission industry*, together with industry-year fixed effects to take into account the fact that certain industries have both strong state presence and concerns regarding GHG emissions. *Emission industry* is defined in two ways: In Column (4), it is defined as a dummy variable which equals one if the firm belongs to the Oil & Gas industry or the Utilities industry in the broad ICBIN classification and zero otherwise. In Column (5), it is defined as a continuous variable of industry emission intensity. For industry emission intensity, we use the U.S. Environmental Protection Agency's (EPA) toxic release inventory (TRI) database to measure the magnitude of hazardous substances (Currie, Davis, Greenstone, and Walker, 2015).[22] We then calculate the median weight of total hazardous substances produced by all factories in each SIC 2-digit code in the TRI database, and use this value as a proxy of industry emission intensity. In Columns (4)-(5) of Panel A of Table 5, we find a significant and negative coefficient of the interaction term *State_own* × *High abnormal temperature* × *Emission industry* in both Column (4) (where *Emission industry* is a dummy variable representing Oil & Gas and Utilities industries) and Column (5) (where *Emission industry* is a continuous variable representing industry emission intensity). This result indicates that SOEs reduce their CO_2 emissions more than non-SOEs following unexpectedly high abnormal temperatures, particularly in high-emission industries, which supports the proactive role of government ownership in addressing the climate change challenge.

[22] The TRI database was established in response to the 1986 Emergency Planning and Community Right-to-Know Act (EPCRA), which requires firms to report their factories' locations as well as their storage, use, and releases of hazardous substances.

We also conduct placebo tests for each of the three salient environmental shocks. In Panel B of Table 5, we run the baseline regression for Equation (1) year by year with *Ln(CO_2/Assets)* as the dependent variable and find that the significance of the coefficient on *State_own* only shows up after 2010 but not before, coinciding with the enactment of the Copenhagen Accord. In Panel C, we test the coefficient of triple interaction term in each of the other nine ICBIN industries (i.e., excluding the Utilities industry) following the Fukushima incidence, and find that none of them is positive and significant. This indicates that the effects we identify in Columns (2) and (3) in Panel A are unique to the Utilities industry. In Panel D, we regress *Ln(CO_2/Assets)* on *State_own* × *High abnormal temperature* within each of the ten ICBIN industries, and only find negative and significant coefficients for the subsamples of Industrials (Column (6)) and Utilities (Column (10)), both of which are high-emission industries.

Overall, the results in Table 5 suggest that state-owned firms are more responsive to the pressure to act on global warming and other environmental concerns which supplement our cross-sectional evidence in Table 4. The results are stronger for the Copenhagen and Fukushima events than for the abnormally high temperature setting, which seem reasonable as the government may be more responsive to international accords and disasters, but not so responsive to sudden temperature change. These results are not sufficient to fully establish causality, but they are more in line with the social view of state-ownership in dealing with externalities.

3.3. Evidence from Changes in Governments' Policy Orientation

While the change in state control status itself is infrequent in our sample period, we examine variation induced by the change of the government's political orientation in a country. Specifically, if a country's ruling party is more left-leaning, its government may pursue a stronger role in controlling economic life (Mullainathan and Shleifer (2005)). In the context of corporate environmental engagement, Di Giuli and Kostovetsky (2014) find that the political leaning of the government in different US states can shape firm-level ESG policies, and firms in more left-leaning states (i.e., the Democratic-firms) tend to invest significantly more in ESG (including environmental) issues. We use international data on ruling governments' political orientation from the World Bank's Database of Political Institutions (DPI) which varies across countries and years. Therefore, we create two year-related dummies: *Government leaning right* is a dummy that represents the year in which (or two years after) the government (or the largest government party) changed from the left-orientation to center- or right-orientation in the political spectrum with regard to economic policy. *Government leaning left* is a dummy representing the year in which (or two years after) the government changed from center- or right-orientation to the left orientation. We then interact these two dummies with the *State_own* dummy and test the interaction effects on *ENVSCORE* in the next year because government changes may occur closer to year-end. We thus estimate the following model:

$$ENV_{i,k,j,t} = \alpha_0 + \beta_0 State\_own_{i,k,j,t-1} \times Government\ leaning_{j,t} + \beta_1 State\_own_{i,k,j,t-1} + \beta_2 Government\ leaning_{j,t} + \beta_3 Inst\_own_{i,k,j,t-1}$$

$$+\beta_4 Ln(Assets_{i,k,j,t-1}) + \beta_5 Leverage_{i,k,j,t-1} + \beta_6 MTB_{i,k,j,t-1} + \beta_7 ROA_{i,k,j,t-1} + \beta_8 Ln(GDP_{j,t})$$

$$+\Sigma\, \boldsymbol{\rho} * I(Country_j) + \Sigma\, \boldsymbol{\delta} * I(Ind\_Year_{k,t}) + \varepsilon_{i,k,j,t}, \quad (3)$$

where *Government leaning*$_{j,t}$ denotes *Government leaning right*$_{j,t}$ in Columns (1) and (3) and *Government leaning left*$_{j,t}$ in Columns (2) and (4). In Column (1), *Government leaning right*$_{j,t}$ is an indicator variable that equals one if the government changed from the left-orientation to center- or right-orientation in year *t* ("Immediate year"). In Column (2), *Government leaning left*$_{j,t}$ is an indicator variable that equals one if the government changed from center- or right-orientation to the left orientation in year *t*. In Columns (3) and (4), the immediate year dummy (i.e., year *t*) is replaced by an indicator of two years (i.e., from year *t* to year *t*+2) after the government leaning ("Post 2 years") right and left, respectively. The interaction term *State_own* × *Government leaning* is used to test whether state-owned firms reacted more strongly to the event in comparison with non-state-owned firms. Equation (3) is essentially a difference-in-differences analysis, except that instead of interacting with a "post-event" dummy covering all years after an event, we only focus on the year or two years right after government political orientation change to capture the different immediate reactions of SOEs and private firms, which is expected to be greater than later adjustments in subsequent years.

The results are reported in Table 6. The coefficients on *State_own* × *Government leaning right* in Columns (1) and (3) are insignificant, indicating that when the government leans toward right, the role of state ownership does not change much. This can be explained by the increasing awareness of environmental issues around the world and even a right-wing government is unlikely to dramatically cut policies and spending on environment after gaining power. In contrast, the positive and significant coefficients on *State_own* × *Government leaning left* in Columns (2) and (4) suggest that when the government leans toward left, the positive effect of state ownership on firm environmental engagement becomes stronger, consistent with our previous results. The economic effects (6.690 and 5.527) are even bigger than that in the baseline results (4.688). Redefining *Government leaning right (left)* as government changed from center- or left-orientation to the right-orientation (from the right-orientation to center- or left-orientation) yields very similar results. Our analysis based on governments' changes on political orientation provides further evidence on the effect of state ownership on corporate environmental engagement.

3.4. Heterogeneity and Channels

3.4.1. Cross-country variations

We next explore the heterogeneity across countries in the correlation between state ownership and environmental engagement. The social view predicts that the role of Leviathan Inc. in addressing externalities is particularly important in economies that are more sensitive to environmental issues.

We report these country-split results in Table 7. First, if a country is highly energy dependent, the state may have a stronger incentive to engage in activities and technologies that improve its energy efficiency. We test whether the state-ownership effect is stronger in these countries with higher country-level energy security risk indexes obtained from the U.S. Chamber of Commerce's Institute for 21st Century Energy. As shown in Columns (1) and (2), the coefficient of *State_own* is positive and statistically significant only in the subsample of countries of *High energy dependence* (i.e., the energy security risk index value is above the sample median). This potentially implies that concerns on a country's natural resources may indeed be a motivation for the state to pressure companies to be more energy efficient.

Second, if a country is in conflict with its neighboring countries for energy resources, its government may have stronger incentives to improve energy efficiency to counter potential instability in energy supply. We test this conjecture by examining the coefficient on *State_own* dummy in subsamples based on the country-level neighboring country conflicts index obtained from the Global Conflict Risk Index (GCRI) of the European Commission's Joint Research Center. We particularly focus on the "fuel export" dimension (the only dimension related to energy risk) of this index, defined as the proportion of a country's GDP that is export of fossil fuels. The variable is log transformed, imputed and rescaled. Columns (3) and (4) show that the positive effect of state ownership on environmental engagement only presents in the subsample of *High neighboring countries conflict* (i.e., neighboring country conflicts index is above the sample median). This suggests that neighboring conflicts may be another reason for the governments to push for more efficient usage of resources by the firms it owns.

Third, the social view story is about addressing weaknesses in environmental regulation and internalizing non-priced externalities. This predicts that in countries with strong environmental regulation one would expect SOEs to have limited impact and in countries with weak regulation the impact would be stronger. Therefore, we use the Carrot & Sticks dataset to construct an index of positive environmental regulatory changes as used in Schiller (2018).[23] In Columns (5) and (6), we find indeed that the effect of state ownership mainly presents in countries with *low* environmental regulation (i.e., the value of the environmental regulatory change index is zero). This finding is also against the agency view: when a country is of lower environmental regulation, we would expect that the environmental issues are not of priority in state-appointed CEOs' agenda.

Fourth, we partition our sample into high and low long-term capital countries based on the median of country-level stock market capitalization to GDP ratios from the World Bank database. Countries of higher ratios are expected to be more developed in financial markets as well as institutional environments. We find that the positive effect only shows up in the subsample of less developed countries (Column (8)) instead of the high long-term capital countries (Column (7)). This result suggests that private firms in markets with less developed capital markets find

[23] See "Environmental regulations" in https://www.carrotsandsticks.net/regulations/.

it harder to secure long-term financing for environmental projects, and as a result, the states step in through ownership to provide more long-term capital for such engagement.

3.4.2. Industry- and firm-level channels

Besides heterogeneity across countries, we next investigate several industry- and firm-level channels underlying the link between a firm's state ownership and its environmental engagement measured by *ENVSCORE*. First, if state ownership works in the public interest to deal with environmental externalities, we expect the effect to be more pronounced in industries that are more sensitive to pollution and other environmental concerns, such as the oil and gas industry in which even major environmental disasters happen frequently. In Column (1) of Table 8, we test this conjecture by interacting the *State_own* dummy with a continuous variable *Industry emission intensity*, which is defined as the median weight of total hazardous substances produced by all factories in each SIC 2-digit code in the TRI database. The coefficient estimate of the interaction term *State_own* × *Industry emission intensity* is statistically significant at the 1% level, suggesting a stronger relation between state ownership and environmental engagement in emission-intensive firms. This finding again highlights SOEs' role in dealing with externalities in industries that are more sensitive to environmental concerns.

Second, if a firm has more foreign operations, the role of the domestic government in influencing its environmental practices may be attenuated. Therefore, we test whether the effect of state ownership on environmental engagement is weaker for firms that have a higher fraction of revenues coming from abroad by interacting the *State_own* dummy with a dummy *High foreign sales* that equals one if the firm's foreign sales to total sales ratio is above the sample median and zero otherwise. This is a proxy for the geographical coverage of the impact of the firm's sales. As shown in Column (2) of Table 8, the coefficient on the interaction term *State_own* × *High foreign sales* is negative and statistically significant, suggesting that the state-ownership effect is indeed weaker in firms with more overseas revenues. In Column (3), we measure international firm operations using balance sheet instead of revenues by using *High foreign assets* which is a dummy that equals one if the firm's foreign assets to total assets ratio is above the sample median and zero otherwise, and we find a similar result for the interaction term *State_own* × *High foreign assets*. These findings further support the interpretation that the government's intervention is more limited if the environmental externalities do not occur within the country's borders.

Finally, we consider whether SOEs with politically-connected CEOs are more environmentally engaged. According to the agency view, a CEO with political connection may benefit privately from engaging in environmental issues as part of her career advancement. That is, the agency view predicts a stronger effect among CEOs with political backgrounds. Alternatively, it could also be that politically connected CEOs may pollute more because this may potentially increase economic output and facilitate their connected politicians' promotion (Jia, 2018). To test this channel, we interact the *State_own* dummy with *Political connection of CEO*, which is a dummy

that equals one if the CEO is politically connected by manually collecting information from BoardEx and other online news sources such as Bloomberg Businessweek.[24] Column (4) of Table 8 shows that the coefficient on the interaction term *State_own* × *Political connection of CEO* is insignificant and the coefficient on *State_own* remains significantly positive. These findings suggest that our baseline findings cannot be simply attributed to the career objectives of politically appointed CEOs, and do not support the agency view.

Overall, the results in Tables 7 and 8 reveal some interesting cross-sectional variations on the role of state ownership in a firm's environmental engagement, and are more in line with the "social view". Such a role is stronger in countries with greater energy dependence and risk, weaker environmental regulation and lack of long-term financing, as well as in more emission-intensive and locally operated firms. On the other hand, the agency view is not supported as we do not find the effect of state ownership to be more pronounced among politically connected CEOs.

3.5. Are Government Stakes Special?

We conduct further tests to explore what is special about government ownership by employing an alternative proxy of state ownership, comparing the effect of the state's blockholdings to other types of blockholders, and exploring further the different types of government stakes.

We first consider an alternative proxy of state ownership and replace the binary variable *State_own* (where the ultimate owner is the central government, a state or a public authority) with the continuous variable *Government_held*. Data for this variable come from Datastream and identify the percentage of free-floating shares held by the government, if those blockholdings exceed 5%. In Column (1) in Panel A of Table 9, we rerun the baseline regression as specified in Equation (1) using this alternative measure of state ownership. Results continue to suggest that firms with greater government blockholdings score more highly in environmental engagement.

Second, we ask whether the effects we document above are unique to government ownership, or instead may be just related to the presence of any blockholder. To address this concern, we use data from Datastream on the percentage of total shares held by different types of strategic blockholders. These include block holdings of 5% or more by foreign investors (*Foreign holdings*), other industrial companies (*Cross holdings*), pension funds (*Pension fund held*), investment companies (*Investment co. held*), employees (*Employee held*), other investors (*Other holdings*), and total holdings by all these blockholders (*Strategic holdings*). In our baseline tests, we already control for ownership by institutional investors (*Inst_own*) which are frequent blockholders in firms (both domestic and foreign). Data from Factset/Lionshares also allow us to identify the percentage of all outstanding shares owned by

[24] Following Faccio (2006), we define "Political connection of CEO" as that the CEO worked in the government, political party committee or military, or is/was a member of the parliament or congress. Faccio, Masulis, and McConnell (2006), Chaney, Faccio, and Parsley (2011) and Megginson (2017) find that politically connected firms underperform. The survey paper by Megginson (2017) concludes that political connections tend to enhance valuations of connected companies, but these private benefits are usually associated with significant costs for the overall economy and financial system.

domestic institutional investors (*Domestic inst. held*) and by foreign institutional investors (*Foreign inst. held*) (see Aggarwal et al. (2011) and Dyck et al. (2018)). We use these data to supplement our results from Datastream free-float blockholding data. Although the Factset/Lionshares and Datastream universes are different, we are only able to include firms that have ASSET4 ratings which are mostly covered by both databases. Hence, the samples are comparable across different columns.

Panel A of Table 9 presents the regression results for using each of the above blockholder variables as the main explanatory variable.[25] We find that almost all other types of blockholdings are either uncorrelated (foreign holdings, cross holdings, other holdings, domestic institutional holdings, and foreign institutional ownership) or negatively correlated with environmental engagement (pension fund holdings, investment company holdings, employee holdings, and strategic holdings). The findings reported in Panel A of Table 9 suggest that the link between state ownership and environmental engagement is special compared to other types of blockholdings.

Third, we explore the role of different types of government stakes. Does the effect of government stakes occur because a domestic (not foreign) government owns a company? Does it matter whether a company is held directly by the state or held through an investment vehicle of sovereign wealth fund (SWF, such as the Norges Bank of Norway or Temasek of Singapore)? Answering these questions can further shed light on the mechanisms through which government ownership functions to promote corporate environmental engagement. According to the social view, the effect should mainly take place through direct ownership stakes by a domestic government that cares more about public goods within its own borders (local environmental protection), rather than investment by SWF in foreign businesses which may focus more on financial returns. We test this by distinguishing between domestic and foreign state ownership, and between direct government stakes and investment by SWF.

The results are reported in Panel B of Table 9. In Column (1), we run the baseline regression on a subsample of firms that have an ultimate owner in a foreign country. We do not find any statistical significance of the coefficient on *State_own*. In Column (2), we run the same regression in a subsample of firms that have domestic ultimate owner, and find a positive and significant coefficient on *State_own* with the economic magnitude similar to that in the baseline result in Table 4. In Column (3), we interact the *State_own* dummy with a dummy variable *Foreign_state*, which takes a value of 1 if the company has ownership stakes held by any foreign government or foreign SWF, and 0 otherwise. The coefficient of the interaction term *State_own* × *Foreign_state* is negative and marginally significant, which reinforces our earlier argument based on the social view that domestic governments care more about environmental issues or are under greater pressure from the local population. Finally, we test the difference between direct state ownership and ownership through investment by sovereign wealth funds. In Column (4) we include *State_own* and a dummy variable indicating whether the company is invested by a sovereign wealth fund

[25] Again, to save space, we present results for only ENVSCORE as the dependent variable. Results are similar using other sub-dimensional environmental scores as dependent variables, and are available upon request.

(*SWF*) in the same regression,[26] and find that the effect comes mostly from *State_own* rather than *SWF*, suggesting that it is direct government ownership that matters for corporate environmental engagement. This is consistent with the notion that SWFs are mainly concerned with financial returns, while domestic governments trying to address environmental externalities and market failures.

3.6. Alternative Measures of Environmental Engagement

Prior literature has expressed some concern with the reliability of a single ESG dataset and it is recommended to cross-validate the results with alternative ESG data providers (Chatterji, Durand, Levine, and Touboul (2016)). For this purpose, we replace the dependent variable (the ASSET4 Environmental Pillar Score) with two alternative measures of firm-level environmental engagement from two most widely-used alternative data sources: MSCI ESG Intangible Value Assessment ("MSCI") and Sustainalytics ESG Ratings ("Sustainalytics"). We take the environment-related ratings from each database: the *Environmental Pillar Score* from MSCI (ranging between 0 and 10) and the *Environmental Score* from Sustainalytics (ranging between 0 and 100). Both ratings measure how well companies proactively manage the environmental issues that are most material to their business and provide an assessment on companies' ability to mitigate risks and capitalize on opportunities.[27] Similar to ASSET4, these two alternative ratings are also industry-adjusted, that is, companies are rated on their environmental engagement (both voluntary initiatives and mandatory compliance) relative to their industry peers on a global scale. Firm coverage is comprised mostly of the constituents of major global equity indices. The MSCI database covers 1,625 companies for 2016 and each company is given only one score on a scale of 0 to 10, based on its environmental performance. The Sustainalytics database covers 8,060 companies over the years 2010-2017, and each company is scored on a scale of 0 to 100.

Since the MSCI database we had access to was limited to only one year (2016), we conduct cross-sectional ordinary least squared (OLS) estimations and regress each firm's *Environmental Pillar Score* in 2016 on *State_own* and other variables measured in 2015. We control for industry and country fixed effects. There are a total of 1,385 unique firms in the cross-sectional regression. As shown in Column (1) of Table 10, the coefficient on *State_own* is positive and statistically significant. The economic magnitude is also comparable to our baseline results using the ASSET4 scores (*ENVSCORE*): on average, state-owned firms score 5% higher than non-state-owned firms, as the coefficient of *State_own* is 0.511 (on a scale of 0 to 10) for *MSCI Environmental Pillar Score*.

Column (2) of Table 10 presents the results when we estimate Equation (1) using the *Environmental Score* from Sustainalytics as the dependent variable on a sample of 14,447 firm-year observations (3,230 unique firms after merging with other datasets). We again find a significantly positive coefficient on *State_own* (1.459), which

[26] We obtain SWF holding data from Factset and consider a company as being invested by a SWF (either domestic or foreign) if its Security Holder Type is classified as "Institutions – Sovereign Wealth Manager" by Factset.

[27] For the MSCI database, we refer to the description of Liang and Renneboog (2017). For the Sustainalytics database, the assessment of a company's environmental engagement is structured into four dimensions: (1) Preparedness; (2) Disclosure; (3) Quantitative Performance; (4) Qualitative Performance.

suggests that state-owned firms score 1.5% higher than non-state-owned firms (as *Environmental Score* is on a scale of 0 to 100). Given that these two alternative measures are compiled by different data providers, these results suggest that the correlation between corporate environmental engagement and state ownership is not likely driven by the peculiarity of the ASSET4 data.

4. State Ownership and Shareholder Value, Social Engagement, and Corporate Governance

An important question is whether the state-ownership effects we document are unique to environmental issues or could state-owned firms be superior in dealing with other non-environmental externalities and at what cost this could come in terms of shareholder value. Some authors find that state-owned firms perform better in social issues such as employment and community engagement (Liang and Renneboog, 2017). In contrast, Shleifer and Vishny (1998) argue that, due to incentive problems, state-owned firms may engage in rent-seeking activities at the cost of society at large. Others find that state-owned firms usually have weaker corporate governance and consequently poorer financial performance (e.g., Megginson, Nash, and Van Randenborgh (1994), Dewenter and Malatesta (2001), Megginson and Netter (2001), Bortolotti and Faccio (2009)). Musacchio, Lazzarini, and Aguilera (2015) argue that the new form of state ownership ("Leviathan Inc.") has mixed implications for governance and firm performance. We examine these issues in this section.

In Table 11, we start by investigating the shareholder value implications of such environmental engagement by state-owned firms. For this purpose, we regress the market-to-book ratio (*MTB*) and ROA in year *t* on the interaction between state ownership (*State_own*) and the aggregate environment engagement score (*ENVSCORE*) in year *t-1*. We exclude financial firms given the peculiarity of their capital structure (Claessens, Djankov, Fan, and Lang (2002)), and report the results for *MTB* and *ROA* in Column (1) and Column (2), respectively. The control variables are similar to those tested before, except that we do not include *MTB* (*ROA*) when future *MTB* (*ROA*) is the dependent variable. Several interesting observations emerge. First, the coefficient on *State_own* is statistically insignificant, suggesting that SOEs do not have higher (or lower) shareholder value. Second, *ENVSCORE* is positively and significantly correlated with *MTB*, consistent with the "doing well by doing good" hypothesis (see Hong, Kubik, and Sheinkman (2012), Flammer (2015)) and the empirical evidence that corporate environmental engagement is related to better firm performance and higher value (Dowell, Hart, and Yeung (2000)). Third, the coefficient of the interaction term *State_own* × *ENVSCORE* is insignificant, suggesting that environmental engagement by state-owned firms is not associated with lower shareholder value. In Columns (3)-(4) we run similar tests but use long-term *MTB* and *ROA* (by taking their moving-average from year *t* to year *t+4*) as the dependent variables to capture the long-run effect of environmental engagement by SOEs. We obtain statistically and quantitatively similar results. The same pattern is found when we run the regression on each of the ICBIN industries in untabulated results. Overall, these findings do not support the agency view of state ownership as state-owned firms' environmental engagement does not appear to damage their shareholders' value. In unreported results, we

conduct similar analyses on other various measures of shareholder returns, including returns on equity (ROE), dividends per share (DPS), dividend yields, and sales growth, and find none of the coefficients on the interaction term *State_own* × *ENVSCORE* is negative.

These results should be interpreted with caution regarding whether environmental engagement by SOEs comes at a cost to other shareholders. We do not refute the possibility that environmental engagement such as emission reduction can be costly to shareholders, but such costs may be offset by the benefits from such engagement, such as avoidance of future penalties, better reputation and greater support by other stakeholders (e.g., Hong and Liskovich, 2015). In addition, SOEs may have more access to preferential government procurement contracts and other public benefits such as soft budget constraints or cheaper credits, which can lower SOEs' cost of financing. This is indeed what Borisova, Fotak, Holland and Megginson (2015) have argued and found: government ownership in publicly traded firms can carry an implicit debt guarantee reducing the chance of default. As a result, it is associated with a substantially lower cost of debt (bank credit spread) in times of economic recession or firm distress (e.g., 18 basis points in the recent financial crisis). Overall, Table 11 suggests that a greater engagement in environmental issues of state-owned companies has insignificant *net effect* on shareholder value, at least as reflected in market valuation and profitability, but may have strong welfare implications for society at large as suggested by the social view. In fact, government itself as an important controlling shareholder may represent the interests of broader group of stakeholders and maximize their welfares, which is not necessarily reflected in market value (Hart and Zingales, 2017).

We then examine how SOEs fare in terms of social and corporate governance issues. We address this question using the aggregate social ("S") and corporate governance ("G") pillar scores of the ESG ratings from the ASSET4 database. The first score measures a company's overall engagement in social issues (*SOCSCORE*), or how firms care about customers, suppliers, employees, community, and human rights. The second score measures corporate governance quality (*CGVSCORE*) with regard to board functions and structure, compensation policy for executives, integrated vision and strategy, and shareholder rights. In Figures IA.2 and IA.3 of the Internet Appendix we show the time series of the average social and corporate governance pillar scores. While we find that European firms are ranked highest in terms of social scores, North American firms (mainly US firms) rank highest in terms of corporate governance, consistent with the extant literature.

The evidence in Table 12 indicates that state-owned firms also engage more in social issues, as is evident by the significantly positive coefficients on *State_own* in Columns (1)-(2), but they do not have differential corporate governance performance, as the coefficient on *State_own* is insignificant in Columns (3)-(4). These results further confirm that state-owned firms may engage more in terms of non-financial issues and dealing with externalities, but they are no better (and no worse) in corporate governance. This echoes our results in Table 11 that state ownership does not increase or decrease shareholder value. Overall, our evidence suggests that state-control is related to greater welfare of stakeholders at large, without necessarily sacrificing shareholder interests.

5. Conclusion

The role of the state in organizing economic life has been long debated. A major trend characterizing the beginning of the 21st century is the resurgence of state-owned enterprises ("Leviathan Inc."), especially in emerging market economies. This period has also witnessed increased attention paid to global warming, pollution and other sustainability issues. Governments can address environmental sustainability not just through taxation, subsidies, and regulations, but also directly via SOEs. It is commonly thought, however, that governments can be captured by rent-seeking politicians and that ultimately SOEs cannot be managed effectively.

Our paper examines the role of state ownership of publicly listed companies in dealing with environmental issues around the world over the last decade. We find that SOEs tend to be more engaged in environmental issues, and such a pattern is not present for other block-owners from the private sector. The effect comes mainly from domestic ownership stakes by the government in local firms, rather than from holdings by foreign governments or sovereign wealth funds. We document that the role of SOEs in environmental engagement is more pronounced for pollution-intensive industries, firms with more local operations, and firms located in countries lacking energy resources, in conflict with neighboring countries, with low environmental regulation and with weak capital market development. Further supporting our results is the finding that SOEs reacted more strongly than non-state-owned firms to the 2009 Copenhagen Accord, the 2011 Fukushima nuclear disaster and attention to high temperatures. We also provide difference-in-differences analysis around changes in the government's political orientation in a country changing toward more left leaning. Interestingly, SOEs are also more engaged with social issues, but these companies do not have better or worse corporate governance performance.

We believe these findings have important policy implications. As economies worldwide embraced pro-market reforms in the last quarter of the 20th century, many prototypical SOEs were transformed. Partial privatization may have resulted in changes, but it did not spell the end of state ownership of companies. Our findings show that modern SOEs have emerged to be more effective than their private counterparts in dealing with environmental externalities.

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Appendix 1. Examples of Corrections of ORBIS's State-Owned Status Data

Region	Ownership type	Company	Original data in ORBIS	Correction
Asia Pacific	Domestic state owned	Zijin Mining, China	2002-2014 non-state-owned	Majority owned (>25%) by Minxi Xinghang State-Owned Assets Investment Co. Ltd., which is a private company controlled by the Chinese government. http://www.hkexnews.hk/listedco/listconews/SEHK/2013/0425/LTN201304251235.pdf
	Domestic state owned	Weicai Power, China	No information	State-owned until 2007. Since 2008 the total state ownership fell below 25%. http://www.hkexnews.hk/listedco/listconews/SEHK/2008/0430/LTN20080430625.pdf
	Domestic state owned	Tsigntao Brewery, China	No information	Always state-owned. The controlling shareholder is Tsingtao Brewery Group Company Limited, which is wholly owned subsidiary of SASACQ (青岛国资委). http://www.hkexnews.hk/listedco/listconews/SEHK/2009/0429/LTN200904291779.pdf http://www.hkexnews.hk/listedco/listconews/SEHK/2014/0423/LTN20140423394.pdf, and also from Wind
	Domestic state owned	Woori Bank, South Korea	No information	Always state-owned. The Korean Deposit Insurance Company controls the majority stock of its parent firm Woori Finance Holding. https://spot.wooribank.com/pot/Dream?withyou=ENENG0662; http://blogs.wsj.com/moneybeat/2014/07/09/south-koreas-woori-privatization-still-faces-biggest-hurdle-suitors-for-woori-bank/
	Foreign state owned	S-Oil Corporation, South Korea	2002-2010 non-state-owned; 2011-2014 state-owned	Always state-owned but by the Saudi Arabian government. Its largest shareholder has always been Aramco Overseas Company which is state-owned by Saudi Arabian state. http://www.bloomberg.com/news/articles/2014-01-10/saudi-aramco-to-buy-2-billion-stake-in-s-oil-official-says
	Owned by sovereign wealth fund	Singapore Post, Singapore	2002-2007 & 2014- non-state-owned; 2008-2013 state-owned	State-owned before 2014 by Temasek. In 2014, Temasek's ultimately shares owned drops to less than 25%. Hence, by our standard, we classify it as non state-owned in 2014. http://www.singpost.com/download/ar201415.pdf
	Owned by sovereign wealth fund	Singapore Telecom, Singapore	2002-2007 & 2010 non-state-owned; 2008-2009 & 2011-2014 state-owned	Always state-owned. Temasek owns over 50% nearly all the time. http://info.singtel.com/about-us/investor-relations/annual-reports?dispatcher=302
	Owned by sovereign wealth fund	Singapore Airlines, Singapore	2002-2007 non-state-owned; 2008-2014 state-owned	Always state-owned. Temasek owns over 50% all the time. https://www.singaporeair.com/en_UK/us/about-us/information-for-investors/annual-report/
		IRPC, Thailand	2002-2009 & 2013-2014 state-owned; 2010-2012 non-state-owned	Always state-owned. The controlling shareholder is PTT Plc which is controlled by Thailand Ministry of Finance. http://irpc.listedcompany.com/ar.html
	Owned by sovereign wealth fund	SIAM Cement, Thailand	2002-2012 state-owned; 2013-2014 non-state-owned	Always state-owned. The controlling shareholder has always been Crown Property Bureau, which can be seen as Thailand sovereign fund. http://scc.listedcompany.com/misc/ar/20150223-scc-ar-2014-en.pdf; http://www.scg.co.th/en/04investor_governance/07_annual_report_sustainability_report.html

Appendix 1. (continued)

Region	Ownership type	Company	Original data in ORBIS	Correction
Latin America	Domestic state owned	Companhia Energetica de Sao Paulo (CESP), Brazil	No information	Always state-owned. The State of São Paulo is the controlling shareholder. http://quicktake.morningstar.com/stocknet/secdocuments.aspx?symbol=cesdy
	Domestic state owned	VALE, Brazil	2002-2014 non-state-owned (preferred shares)	Always state-owned. ORBIS only records its ordinary shares, whereas ASSET4 sample only records its preferred shares.
	Domestic state owned	Cielo S.A., Brazil	2002-2011 non-state-owned; 2012-2014 state-owned	State-owned since 2010, as the state-owned company Banco do Brasil increased its stake from 23.5% to 28.6% and retain such position afterwards. http://extapps.mz-ir.com/cielo/rao2009/eng/ra/07.htm
	Foreign state owned	Aguas Andinas, Chile	2008-2010 & 2012: state-owned; other years non-state-owned	State-owned since 2008. Aguas Andinas is fully owned by Inversiones Aguas, whose controlling shareholder 'Sociedad General de Aguas de Barcelona (SGAB)' was acquired by Suez and Caixabank in 2008, and 35% of Suez is controlled by the French government.
Europe	Domestic state owned	CEZ, Czech	2002-2005 state-owned; 2006-2014 non-state-owned	Always state owned. Before 2006, the controlling shareholder is national property fund, which is also state-owned. https://www.cez.cz/en/investors/financial-reports/annual-reports.html
	Domestic state owned	Verbund, Austria	2002-2005 non-state-owned; 2006-2014 state-owned	Always state owned. Over 50% of shares have been owned by Republic of Austria even before 2006. https://www.zonebourse.com/VERBUND-AG-6491294/pdf/32124/VERBUND%20AG_Rapport-annuel.pdf
	Foreign state owned	EDP Renovaveis, Spain	Only identified as state-owned in 2012	State-owned until 2011. Its parent company is Energias de Portugal which is controlled by Parpública (state-owned by Portugal) before until 2011. From 2012, China Three Gorges becomes the largest shareholder of EDP, but holding less than 25% shares. http://www.edp.pt/en/Investidores/publicacoes/relatorioecontas/Pages/RelatorioeContas.aspx
	Domestic state owned	France Telecom (ORANGE), France	2002-2008 state-owned; 2008-2014 non-state-owned	Always state-owned. After 2009 until 2014, the French government still control over 25% of ORANGE. However, now part of the stake is owned indirectly through FSI (state-owned).
	Domestic state owned	OJSC Rostelecom, Russia	Only identified as state-owned in 2006 and 2014	Always state-owned. The Russian government maintain over 50% of its shareholding mainly through Svyazinvest, also a state-owned enterprise. http://www.rostelecom.ru/en/ir/results_and_presentations/ar/
	Foreign state owned	VIMPELCOM, Russia	Always non-state-owned	Always state-owned but by Norwegian state. Telenor (controlled by Norway government) has always maintain an over 25% stake in the company since 2002. https://www.telenor.com/media/in-focus/vimpelcom-ltd/historical-background/
	Domestic state owned	OC Rosneft, Russia	2002-2008 non-state-owned; 2009-2014 state-owned	Always state-owned. The controlling shareholder has always been ROSNEFTEGAZ, which is state-owned. https://www.rosneft.com/Investors/Reports_and_presentations/Annual_reports/

Appendix 2. List of Variables and Data Sources

Variable	Description
ENVSCORE	The environmental pillar (ENVSCORE) measures a company's impact on living and non-living natural systems, including the air, land, and water, as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and capitalize on environmental opportunities in order to generate long-term shareholder value. The environmental pillar is an equally weighted score of the sub-dimensional scores: Emission Reduction, Product Innovation, and Resource Reduction. Source: Thomson Reuters ASSET4 database.
ENER	Emission Reduction, measures a company's management commitment to and effectiveness in reducing environmental emission in production and operational processes. It reflects a company's capacity to reduce air emissions (greenhouse gases, F-gases, ozone-depleting substances, NOx, Sox, etc.), waste, hazardous waste, water discharges, and spills, or its impacts on biodiversity, and to partner with environmental organizations to reduce the environmental impact of the company in the local or broader community. Source: Thomson Reuters ASSET4 database.
ENPI	Product Innovation measures a company's management commitment to and effectiveness in supporting the research and development of eco-efficient products or services. It reflects a company's capacity to reduce environmental costs and burdens for its customers, and thereby create new market opportunities through new environmental technologies and processes or eco-designed, dematerialized products with extended durability. Source: Thomson Reuters ASSET4 database.
ENRR	Resource Reduction measures a company's management commitment to and effectiveness in achieving an efficient use of natural resources in the production process. It reflects a company's capacity to reduce the use of materials, energy, or water, and to find more eco-efficient solutions by improving supply chain management. Source: Thomson Reuters ASSET4 database.
SOCSCORE	The social pillar measures a company's capacity to generate trust and loyalty its workforce, customers, and society, through (SOCSCORE) its use of best management practices. It is a reflection of the company's reputation and the health of its license to operate, which are key factors in determining its ability to generate long-term shareholder value. The social pillar is an equally weighted score of the sub-dimensional scores: Customer/ Product Responsibility, Society/ Human Rights, Workforce/ Diversity and Opportunity, Workforce/ Employment Quality, Workforce/ Health & Safety, Workforce/ Training & Development. Source: Thomson Reuters ASSET4 database.
CGVSCORE	The corporate governance pillar (CGVSCORE) measures a company's systems and processes, which ensure that its board members and executives act in the best interests of its long-term shareholders. It reflects a company's capacity, through its use of best management practices, to direct and control its rights and responsibilities through the creation of incentives, as well as checks and balances in order to generate long-term shareholder value. The corporate governance pillar is an equally weighted score of the sub-dimensional scores: Board of Directors/ Board Functions, Board of Directors/ Board Structure, Board of Directors/ Compensation Policy, Integration/ Vision and Strategy, Shareholder/ Shareholder Rights. Source: Thomson Reuters ASSET4 database.
CO_2/Assets	CO_2 and CO_2 equivalents emission in tonnes scaled by total assets and then taken logarithm. Source: Thomson Reuters ASSET4 (ENERDP023).
MSCI Environmental Pillar Score	The Environmental Pillar Score includes the following issues: carbon emissions, product carbon footprint, energy efficiency, insuring climate change risk, water stress, biodiversity and land use, raw material sourcing, financing environmental impact, toxic emissions and waste, packaging material and waste, electronic waste, opportunities in clean tech, opportunities in green building, opportunities in renewable energy, etc. The data is then converted to a relative score, by allocating the company with the best performance within its industry sector in a given category a 10, the top score, giving the company with the worst performance a 0, the lowest, and scoring the remainder pro-rata between 10 and 0. Source: MSCI Intangible Value Assessment.

Sustainalytics Environmental Score	The Sustainalytics Environmental Score addresses a broad range of macro-level environmental issues and trends that have a significant, and in some cases material, impact on industries and companies, creating both risks and opportunities for investors. The score is based on a company's environmental engagement based on four dimensions: (1) Preparedness, which refers to assessments of company management systems and policies designed to manage material environmental risks; (2) Disclosure, which refers to assessments of whether company reporting meets international best practice standards and is transparent with respect to most material ESG issues; (3) Quantitative Performance, which refers to assessments of company ESG performance based on quantitative metrics such as carbon intensity; (4) Qualitative Performance – assessments of company ESG performance based on the analysis of controversial incidents that the company may be involved in. Underlying each industry group template is a customized weight matrix designed to further highlight the key environmental issues faced by each sector, and companies are also assessed for their level of involvement in major controversies and the associated business risks they face from such involvement. The ratings are given on a scale of 0-100 using the "best-of-sector" methodology to compare companies within a given sector to industry best practices. Source: Sustainalytics ESG Ratings.
State_own	A dummy variable that equals one if the ultimate owner is the state, the government, or a public authority, and zero otherwise. Ultimate owner is defined as the shareholder holding the percentage of direct voting rights, identified by following the path of uninterrupted control rights (at 25%) throughout the ownership pyramid. Source: Orbis.
Foreign_state	A dummy variable that equals one if the company has ownership stakes held foreign government or foreign SWF, and zero otherwise. Source: Orbis.
SWF	A dummy variable that equals one if the company has shares owned by a sovereign wealth fund (SWF), and zero otherwise. Source: Factset.
Inst_own	Holdings (end-of-year) by all institutions as a fraction of market capitalization. Source: FactSet/LionShares.
Market-to-book (MTB)	Calculated as the ratio of the market value of total equity to the book value of total equity, winsorized at the 5% level. Source: Datastream.
Return on assets (ROA)	Calculated as the ratio of net income to the book value of total assets of the company. Source: Datastream and Compustat.
Ln(Assets)	The logarithm of the company's total assets. Source: Datastream and Compustat.
Leverage	The ratio of total liabilities to total assets of the company, winsorized at 5% level. Source: Datastream and Compustat.
GDP (per capita)	GDP (per capita) is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. In the regression analysis, we take the logarithm of GDP per capita and denote it as *Ln(GDP)* for simplicity. Source: World Bank database.
Government held	The percentage of total shares in issue of holdings of 5% or more held by a government or government institution. Source: Datastream.
Foreign holdings	The percentage of total shares in holdings of 5% or more held by an institution domiciled in a country other than that of the issuer. Note: Before March 1st, 2005, this datatype was calculated as a separate strategic component. Since that date NOSHFR has represented the foreign held holdings of 5% or more included in the total strategic holdings datatype NOSHST. Source: Datastream.
Cross holdings	The percentage of total shares in holdings of 5% or more held by one company in another. Source: Datastream.
Pension fund held	The percentage of total shares in holdings of 5% or more held by pension funds or endowment funds. Source: Datastream.
Investment co. held	The percentage of total shares in holdings of 5% or more held as long term strategic holdings by investment banks or institutions seeking a long term return. Note that holdings by Hedge Funds are not included. Source: Datastream.

Employee held	The percentage of total shares in holdings of 5% or more held by employees, or by those with a substantial position in a company that provides significant voting power at an annual general meeting, (typically family members). Source: Datastream.
Other holdings	The percentage of total shares in holdings of 5% or more held strategically, and outside one of the above categories. Source: Datastream.
Strategic holdings	The percentage of total shares in holdings of 5% or more held strategically and not available to ordinary investors. Note that holdings of 5% or more held by hedge fund owners or investment advisor/hedge fund owners are regarded as very active, and not counted as strategic. Source: Datastream.
Domestic inst. held	Holdings (end-of-year) by institutions located in the same country where the stock is listed as a fraction of market capitalization. Source: FactSet/LionShares.
Foreign inst. held	Holdings (end-of-year) by institutions located in a different country from the country where the stock is listed as a fraction of market capitalization. Source: FactSet/LionShares.
Foreign sales	The percentage of foreign sales over total net sales revenue of the company. Source: Datastream/Worldscope.
Foreign assets	The percentage of foreign assets over total assets in the balance sheet of the company. Source: Datastream/Worldscope.
Energy dependence (Energy security risk)	Scores for the country-level energy security risk are reported in relation to an average reference index measuring risks for OECD member countries. The OECD average risk index is calibrated to a 1980 base year figure of 1,000. It includes: (1) Global fuels, which measures the reliability and diversity of global reserves and supplies of oil, natural gas, and coal; (2) Fuel imports, which measure the exposure of national economies to unreliable and concentrated supplies of oil and natural gas, and coal; (3) Energy expenditures, which measures the magnitude of energy costs to national economies and the exposure of consumers to price shocks; (4) Price and market volatility, which measures the susceptibility of national economies to large swings in energy prices; (5) Energy use intensity, which measures energy use in relation to population and economic output; (6) Energy power sector, which measures indirectly the reliability of electricity generating capacity; (7) Transportation sector, which measures efficiency of energy use in the transport sector per unit of GDP and population; (8) Environmental, which measures the exposure of national economies to national and international greenhouse gas emission reduction mandates. Lower emissions of carbon dioxide from energy indicate a less of risk to energy security. Source: International Index of Energy Security Risk of the US Chamber of Commerce's Institute for 21st Century Energy (www.energyxxi.org).
Neighboring country conflicts (fuel export)	The neighboring country conflicts index is an index of the statistical risk of violent conflict in the next 1-4 years and is exclusively based on quantitative indicators from open sources. With the assumption that structural conditions in a country are linked to the occurrence of violent conflict, the GCRI collects 25 variables in 5 dimensions (social, economic, security, political, geographic/environmental) and uses statistical regression models to calculate the probability and intensity of violent conflict. We particularly focus on the "fuel export" dimension (the only dimension related to energy risk) of this index, defined as the proportion of a country's GDP that is export of fossil fuels. The variable is log transformed, imputed and rescaled, with no further limits imposed. Source: Global Conflict Risk Index (GCRI) of the European Commission's Joint Research Center (http://conflictrisk.jrc.ec.europa.eu/)
Environmental regulation	Dummy variable indicating whether in a particular year the country changed its regulation toward enhancing environmental protection and reporting. Source: Carrot & Sticks dataset (https://www.carrotsandsticks.net/regulations/).
MktCap/GDP	Stock Market Capitalization / GDP. Source: World Bank
Political orientation (Government leaning)	Political orientation of the Executive Branch, which measures party orientation with respect to economic policy, coded based on the description of the party in the sources, 1=Right; 3=Left; 2=Center. Right: Parties that are defined as conservative, Christian democratic, or right-wing. Left: Parties that are defined as communist, socialist, social democratic, or left-wing. Center: Parties that are defined as centrist or when party position can best be described as centrist (e.g., party advocates strengthening private enterprise in a social-liberal context). *Not* described as centrist if competing factions "average out" to a centrist position (e.g., a party of "right-wing Muslims and Beijing-oriented Marxists"). 0: All cases that do not fit into category (i.e., party platform does not focus on economic issues, or there are competing wings), or no information. Source: Database of Political Institutions (DPI) from World Bank

Industry emission intensity	The median weight of total hazardous substances produced by all factories in each SIC 2-digit code in the TRI database. Source: U.S. Environmental Protection Agency's (EPA) toxic release inventory (TRI) database.
Political connection of CEO	Political connection of CEO is a dummy variable that equals one if the CEO of the company worked in the government, political party committee, or military, or is/was a member of the Congress, and zero otherwise. Source: BoardEx and online search (e.g., Bloomberg Businessweek).

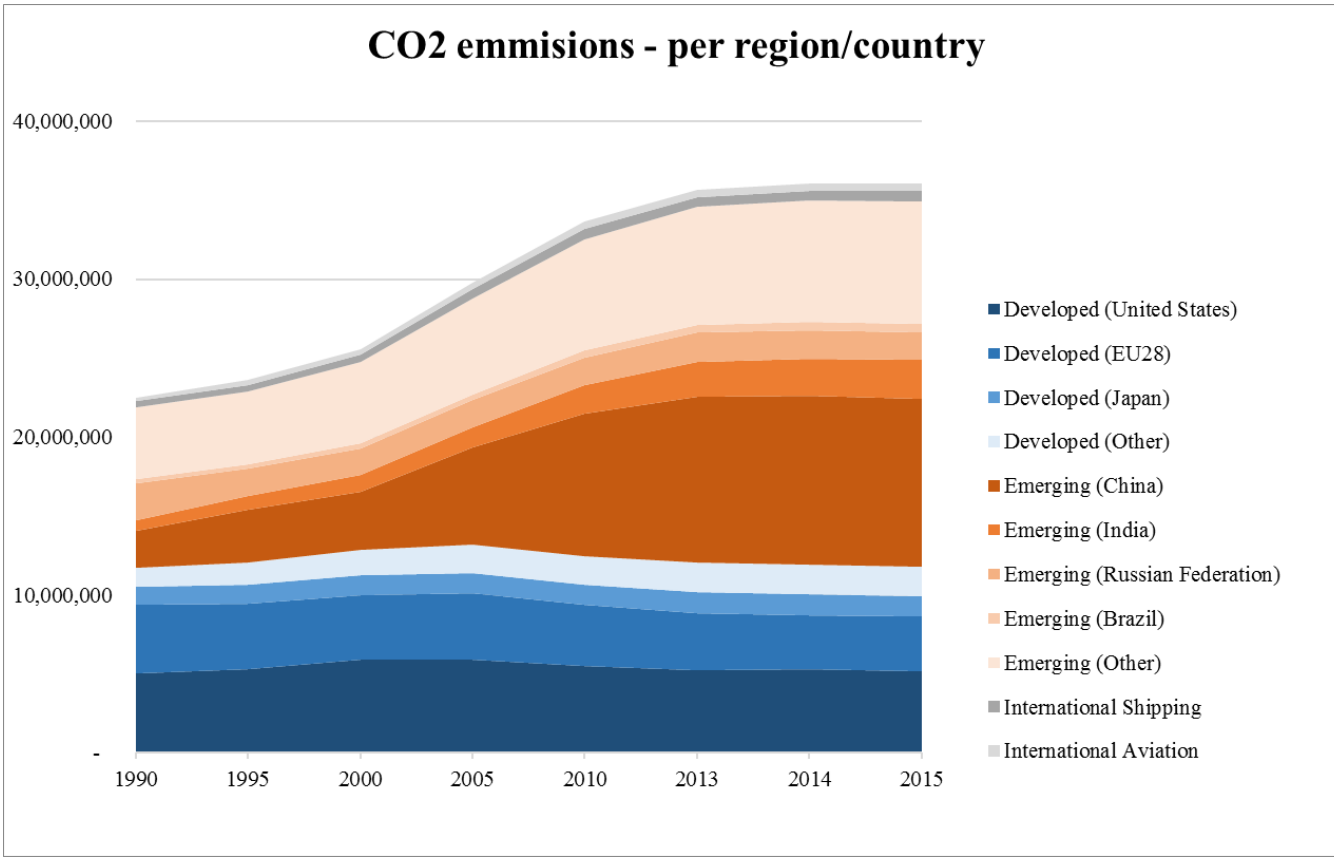

Figure 1. Total CO_2 Emissions Over Time, per Region/Country

This figure presents the 1990-2015 time series of country-specific CO_2 emission totals of fossil fuel use and industrial processes. Source: Emission Database for Global Atmospheric Research (EDGAR) 4.3.2, European Commission, Joint Research Centre (JRC)/PBL Netherlands Environmental Assessment Agency.

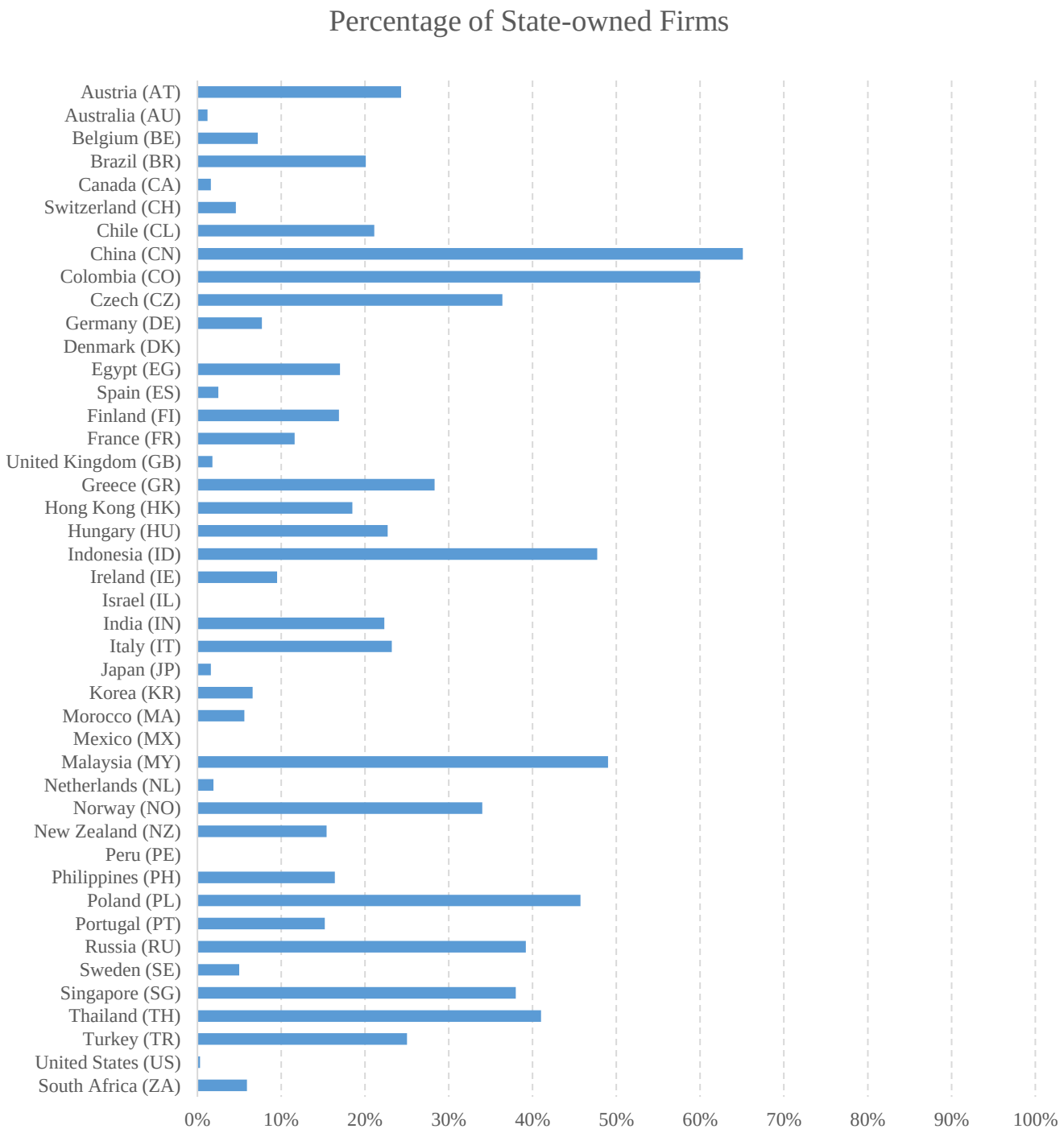

Figure 2. Average State Ownership of Publicly-listed Firms, per Country

This figure presents the proportion of state-owned firms among all firms in our sample in each country. Countries are sorted based on the pooled average of *State_own* in the sample period from 2004 to 2014. We require the firm-year to have non-missing values in the following variables (used in our regression analyses) to be included in the sample: ENVSCORE, State_own, institutional ownership, total assets, leverage, market-to-book ratio, ROA, and GDP per capita.

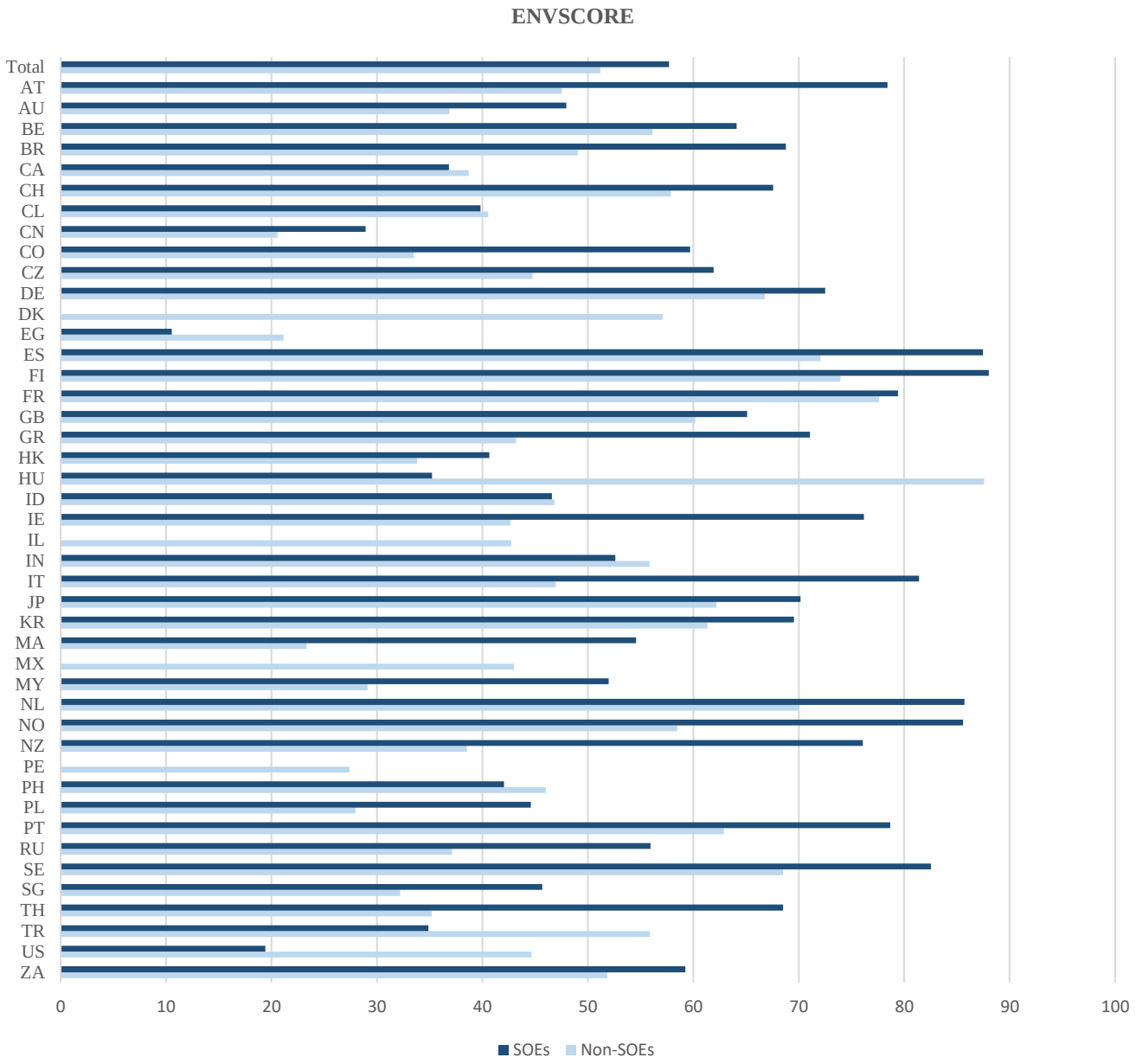

Figure 3. Average Environmental Scores (ENVSCORE) of SOEs and Non-SOEs, per Country

This figure presents the average environmental scores (ENVSCORE) of SOEs and non-SOEs in each country in our sample. For all firm-year observations in the SOE group or the non-SOE group in each country in the sample period from 2004 to 2014 in the sample period from 2004 to 2014, we calculate their pooled average in ENVSCORE. There is no bar for countries without SOE.

Table 1. Forbes Top-Ranked Global Companies, 2010

This table presents the average values of state ownership (*State_own*), the environmental pillar scores (*ENVSCORE* and sub-categories scores: emission reduction *ENER*, product innovation *ENPI*, resource reduction *ENRR*), social pillar scores (*SOCSCORE*), and corporate governance pillar scores (*CGVSCORE*) of the top publicly listed companies in the Forbes Global 2000 list for 2010. The top 10 state-owned enterprises are highlighted in boldface. Country abbreviations are described in Figure 2.

Forbes Rank 2010	Country	*State_own*	*ENVSCORE*				*SOCSCORE*	*CGVSCORE*
				ENER	*ENPI*	*ENRR*		
1. JPMorgan Chase	US	0	92.50	76.57	97.25	87.06	66.48	72.70
2. General Electric	US	0	95.06	94.53	97.69	95.05	90.78	94.49
3. Bank of America	US	0	77.54	48.28	86.94	80.64	67.41	82.06
4. ExxonMobil	US	0	94.19	92.48	94.75	93.17	91.67	86.78
5. ICBC	**CN**	1	**87.86**	**72.09**	**95.19**	**85.65**	**78.27**	**78.98**
6. Banco Santander	ES	0	93.21	92.03	87.77	93.30	95.23	89.16
7. Wells Fargo	US	0	91.92	93.11	88.13	84.08	59.39	82.47
8. HSBC Holdings	GB	0	93.40	93.63	87.41	93.41	86.73	84.91
9. Royal Dutch Shell	GB	0	89.69	79.54	89.40	92.34	78.23	87.56
10. BP	GB	0	89.86	89.45	75.50	89.25	87.12	83.28
11. BNP Paribas	FR	0	93.04	87.99	97.34	90.84	94.07	90.89
12. PetroChina	**CN**	1	**57.50**	**64.25**	**15.44**	**75.30**	**81.13**	**19.74**
13. AT&T	US	0	92.71	93.39	88.22	88.37	79.26	91.63
14. Wal-Mart Stores	US	0	86.55	69.81	71.89	88.95	75.46	94.06
15. Berkshire Hathaway	US	0	9.36	9.39	14.92	8.92	3.75	63.05
16. Gazprom	**RU**	1	**81.95**	**91.28**	**53.11**	**79.10**	**76.46**	**6.99**
17. China Construction Bank	**CN**	1	**53.33**	**34.44**	**87.36**	**35.94**	**81.45**	**28.92**
18. Petrobras	**BR**	1	**91.67**	**90.93**	**84.42**	**88.34**	**93.80**	**34.01**
19. Total	FR	0	89.70	77.73	87.75	83.24	83.63	65.24
20. Chevron	US	0	90.42	86.96	87.89	82.06	63.51	77.78
21. Barclays	GB	0	94.11	90.95	94.89	92.44	93.23	86.60
22. Bank of China	**CN**	1	**79.61**	**37.93**	**95.50**	**88.15**	**82.44**	**49.77**
23. Allianz	DE	0	93.50	93.66	88.13	93.40	93.40	78.88
24. GDF Suez	**FR**	1	**90.06**	**92.34**	**88.28**	**78.89**	**95.71**	**76.96**
25. E ON	DE	0	91.60	94.91	85.84	84.94	96.59	29.78
26. Goldman Sachs	US	0	92.12	78.15	87.37	93.51	53.77	74.37
27. EDF Group	**FR**	1	**92.86**	**84.90**	**97.53**	**88.77**	**96.13**	**33.16**
28. AXA Group	FR	0	93.39	85.18	95.44	93.31	94.37	82.90
29. Lloyds	**GB**	1	**90.01**	**92.48**	**69.86**	**92.90**	**93.20**	**73.90**
30. Procter & Gamble	US	0	94.69	92.76	97.41	93.50	92.54	81.51
31. ENI	**IT**	1	**89.02**	**83.41**	**81.75**	**84.79**	**96.11**	**59.61**

Table 2. Univariate Tests of State Ownership and Environmental Performance

This table shows the averages of state ownership dummy (*State_own*), environmental pillar score (*ENVSCORE*, and sub-scores: emission reduction *ENER*, product innovation *ENPI* and resource reduction *ENRR*), social pillar score (*SOCSCORE*), and corporate governance pillar score (*CGVSCORE*). *, **, *** denote statistical significance at the 1%, 5%, and 10% level, respectively. Country abbreviations are described in Figure 2.

Panel A: Univariate Tests by Country

Country	Unique firm no.	Obs	*State_own*	*ENVSCORE*					*ENER*	*ENPI*	*ENRR*	*SOCSCORE*	*CGVSCORE*
				All	*State_own* =1	*State_own* =0	*p-value* (1 - 0)						
Total	3,850	28,218	0.065	51.60	57.69	51.18	0.00	***	51.53	49.27	51.80	52.07	53.18
AT	16	153	0.243	55.23	78.42	47.54	0.00	***	52.92	54.95	52.23	56.11	33.17
AU	344	1,825	0.012	36.98	47.95	36.87	0.07	*	40.27	34.60	39.32	39.47	63.46
BE	27	237	0.072	56.50	64.10	56.13	0.34		56.53	50.74	56.67	52.96	50.56
BR	81	388	0.201	53.05	68.79	49.04	0.00	***	52.11	46.66	55.79	63.17	26.97
CA	255	1,576	0.016	38.79	36.81	38.69	0.72		41.84	36.08	40.20	39.74	73.70
CH	64	479	0.046	58.36	67.57	57.89	0.15		57.17	54.70	58.35	56.61	47.17
CL	20	115	0.211	40.19	39.81	40.54	0.91		39.43	39.81	43.05	44.91	9.26
CN	44	218	0.651	26.01	28.92	20.58	0.00	***	24.39	38.47	23.13	25.40	24.59
CO	7	26	0.600	48.77	59.70	33.50	0.02	**	54.64	38.17	50.86	71.34	28.21
CZ	3	22	0.364	51.00	61.92	44.76	0.00	***	46.32	51.33	51.43	70.32	18.27
DE	84	715	0.077	67.27	72.51	66.78	0.07	*	64.67	65.00	66.27	68.27	34.55
DK	24	227	0.000	57.10		57.10			54.92	54.79	58.09	54.07	38.02
EG	11	55	0.170	19.55	10.55	21.15	0.00		21.37	25.05	20.67	27.24	8.64
ES	50	400	0.025	72.20	87.47	72.06	0.00	***	71.97	60.82	73.25	78.04	49.72
FI	27	244	0.169	76.11	88.02	73.94	0.00	***	69.22	78.39	71.03	70.35	60.87
FR	96	885	0.116	77.75	79.41	77.62	0.47		75.48	70.70	77.43	78.83	55.09
GB	327	2,779	0.018	60.24	65.09	60.18	0.25		62.89	48.35	63.02	63.21	74.04
GR	19	183	0.283	50.87	71.06	43.18	0.00	***	54.31	37.51	55.84	51.10	17.70
HK	140	918	0.185	34.74	40.65	33.81	0.00	***	33.16	36.87	37.12	36.03	36.50
HU	4	22	0.227	75.69	35.23	87.58	0.00		76.63	70.86	71.43	78.51	41.16
ID	31	139	0.477	46.41	46.58	46.82	0.96		51.94	37.26	48.70	62.82	26.03
IE	12	105	0.095	45.85	76.17	42.66	0.00	***	48.75	42.82	44.45	38.16	63.39
IL	14	82	0.000	42.73		42.73			37.24	40.99	49.35	45.73	37.17
IN	73	353	0.223	55.11	52.61	55.82	0.41		54.38	49.21	59.18	58.87	29.05
IT	47	424	0.232	55.13	81.41	46.96	0.00	***	54.07	52.97	56.35	64.14	44.09
JP	412	3,916	0.016	62.29	70.17	62.18	0.03	**	61.97	63.14	57.34	47.28	11.94
KR	108	559	0.066	61.95	69.53	61.34	0.07	*	61.37	64.28	56.18	56.89	13.84
MA	3	19	0.056	27.30	54.56	23.33	-		25.57	27.54	33.38	54.64	5.45
MX	24	115	0.000	43.00		43.00			45.33	34.56	47.50	45.06	13.16
MY	44	207	0.490	40.12	51.97	29.13	0.00	***	44.71	37.32	40.53	49.12	46.94
NL	31	269	0.019	70.32	85.72	70.03	0.00	***	67.91	63.69	71.03	76.86	64.42
NO	15	150	0.340	64.40	85.57	58.49	0.00	***	62.19	65.59	58.24	67.94	63.39
NZ	9	65	0.154	44.31	76.07	38.54	0.00	***	43.31	45.98	41.67	41.47	62.47
PE	1	7	0.000	27.40		27.40			41.28	18.82	33.43	31.99	51.66
PH	14	63	0.164	44.86	42.04	46.01	0.68		42.42	43.30	48.75	45.31	28.78
PL	26	128	0.457	35.39	44.60	27.94	0.00	***	38.78	34.78	34.85	42.30	23.24
PT	11	95	0.152	65.79	78.67	62.90	0.02	**	67.95	53.27	65.80	75.48	56.17
RU	33	178	0.392	44.46	55.95	37.12	0.00	***	47.90	33.39	50.61	53.23	28.39
SE	45	427	0.050	69.26	82.53	68.52	0.00	***	66.81	67.06	65.77	65.35	55.63
SG	49	414	0.380	36.98	45.66	32.19	0.00	***	37.82	35.14	40.67	40.79	43.78
TH	29	135	0.410	49.00	68.51	35.19	0.00	***	47.78	47.04	50.38	59.52	45.52
TR	24	135	0.250	51.04	34.88	55.89	0.00		51.49	51.33	49.65	55.79	22.47
US	1,032	8,328	0.003	44.58	19.42	44.66	0.00		43.18	45.28	45.18	47.93	74.20
ZA	120	438	0.059	52.71	59.25	51.84	0.11		54.70	39.73	59.98	70.97	60.58

Table 2. (continued)

Panel B: Univariate Tests by Major Industry								
Industry	Obs.	*State_own*	*ENVSCORE*				*SOCSCORE*	*CGVSCORE*
			All	*State own*=1	*State own*=0	p-value (1 - 0)		
Basic Materials	2,923	0.057	55.85	59.84	55.68	0.10	53.55	54.77
Consumer Goods	3,300	0.020	61.62	47.15	61.99	0.00	57.78	46.64
Consumer Services	3,928	0.024	41.17	52.56	40.91	0.00	46.41	53.50
Financials	4,920	0.068	42.63	46.76	42.37	0.02	45.21	49.69
Health Care	1,593	0.010	44.20	20.76	44.49	0.00	50.97	55.78
Industrials	5,519	0.053	59.24	53.55	59.57	0.00	55.46	52.34
Oil & Gas	1,987	0.126	45.75	65.45	42.87	0.00	48.81	63.59
Technology	1,905	0.022	52.29	63.00	52.07	0.04	51.82	58.82
Telecommunications	757	0.319	55.60	63.58	52.07	0.00	62.70	51.90
Utilities	1,372	0.261	63.88	64.68	63.80	0.59	62.91	55.16
No ICBIN classification	14	0.000	33.11		33.11		37.43	61.57
Total	28,218	0.066	51.60	57.69	51.18	0.00	52.07	53.18

Table 3. Summary Statistics

Panel A presents summary statistics for variables in the sample period 2004-2014 for our main specification. The main variables of interest include state ownership dummy (State_own), environmental pillar score (*ENVSCORE*, and sub-scores: emission reduction *ENER*, product innovation *ENPI* and resource reduction *ENRR*), firm-level CO_2 emission (Ln (CO_2/Assets)), social pillar score (*SOCSCORE*), and corporate governance pillar score (*CGVSCORE*). Variable definitions and data sources are described in Appendix 2. All control variables are winsorized at the 5th and 95th percentiles. Summary statistics in Panel A include mean, standard deviation (S.D.), minimum (Min), first quartile (0.25), median, third percentile (0.75), and maximum (Max). Panel B presents Pearson pairwise correlation coefficients for variables in the main specification and other key variables representing state ownership.

Panel A. Summary Statistics of All Variables

Variable	Obs	Mean	Std. Dev.	Min	0.25	Median	0.75	Max
ENVSCORE	28,218	51.60	32.00	8.48	17.89	51.665	85.29	97.5
ENER	28,218	51.53	32.03	7.29	18.38	50.57	85.51	98.04
ENPI	28,218	49.27	31.27	8.35	19.27	36.34	82.69	99.68
ENRR	28,218	51.80	32.02	6.31	18.18	54.93	84.54	97.69
SOCSCORE	28,218	52.07	30.59	3.43	22.38	52.84	82.35	98.88
CGVSCORE	28,210	53.18	30.15	1.09	23.73	61.06	79.65	97.55
Ln(CO_2/Assets)	13,052	-3.355	2.246	-8.398	-4.574	-3.190	-1.645	0.137
State_own	28,218	0.065	0.247	0	0	0	0	1
Inst_own	28,218	0.394	0.308	0.019	0.136	0.282	0.678	0.961
Ln(Assets)	28,218	15.57	1.53	11.81	14.55	15.49	16.63	18.31
Leverage	28,218	23.40	16.80	0	9.32	22.125	34.77	59.54
MTB	28,218	2.483	1.828	0.54	1.2	1.89	3.11	7.6
ROA	28,218	6.154	6.247	-7.55	2.09	5.425	9.56	20.39
Ln(GDP)	28,218	10.510	0.592	8.05	10.50	10.70	10.82	10.96
SWF	28,218	0.012	0.110	0	0	0	0	1
High abnormal temperature	7,655	0.479	0.500	0	0	0	1	1
Govt. leaning left (Immediate)	25,122	0.038	0.192	0	0	0	0	1
Govt. leaning right (Immediate)	25,122	0.028	0.165	0	0	0	0	1
Govt. leaning left (post 2 years)	25,122	0.147	0.354	0	0	0	0	1
Govt. leaning right (post 2 years)	25,122	0.092	0.289	0	0	0	0	1
Energy dependence	25,641	1020.656	216.569	657	924	962	1057	2749
High energy dependence	25,641	0.559	0.496	0	1	1	1	1
Neighbor country conflicts	24,203	0.973	1.057	0	0.27	0.65	1.12	7.09
Environmental regulation	28,218	0.576	0.674	0	0	0	1	3
Mktcap/GDP	25,631	134.55	178.05	10.36	71.07	100.79	132.98	1254.47
High Mktcap/GDP	25,631	0.445	0.497	0	0	0	1	1
Industry emission intensity	12,658	155,852	1,406,543	0	169.545	8,555	41,727.5	2.24×10^7
Foreign sales	11,838	4.100%	5.459%	0	0.36%	1.88%	5.11%	19.61%
High foreign sales	11,834	0.512	0.500	0	0	1	1	1
Foreign assets	22,275	20.94%	24.69%	0	0	10.25%	35.4%	79.05%
High foreign assets	22,275	0.526	0.499	0	0	1	1	1
Political connection of CEO	12,869	0.205	0.404	0	0	0	0	1
MSCI Env. Pillar Score	1,385	5.575	2.174	0	4.1	5.5	7	10
Sustainalytics Env. Score	14,447	52.916	13.008	23	42.25	51.367	62	100

Table 3. (continued)

Panel B: Pairwise Correlation Coefficients of Key Variables

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1)	State_own	1															
(2)	Government_held	0.554	1														
(3)	SWF	0.154	0.178	1													
(4)	ENVSCORE	0.049	0.073	0.023	1												
(5)	ENER	0.062	0.085	0.019	0.925	1											
(6)	ENPI	0.017	0.039	0.030	0.825	0.638	1										
(7)	ENRR	0.048	0.067	0.016	0.922	0.838	0.626	1									
(8)	SOCSCORE	0.085	0.109	0.021	0.781	0.756	0.568	0.772	1								
(9)	CGVSCORE	-0.103	-0.045	0.002	0.170	0.177	0.068	0.204	0.295	1							
(10)	Ln(CO_2/Assets)	0.049	0.040	0.008	0.039	0.121	-0.007	-0.025	0.023	-0.004	1						
(11)	Inst_own	-0.198	-0.139	-0.054	-0.094	-0.116	-0.062	-0.077	-0.025	0.560	0.011	1					
(12)	Ln(Assets)	0.125	0.110	0.042	0.399	0.381	0.326	0.374	0.398	0.031	-0.234	0.030	1				
(13)	Leverage	0.039	0.025	0.022	0.102	0.112	0.065	0.088	0.074	0.007	0.145	-0.030	0.190	1			
(14)	MTB	-0.054	-0.036	-0.024	-0.080	-0.090	-0.079	-0.046	0.002	0.136	0.011	0.177	-0.260	-0.047	1		
(15)	ROA	0.002	0.010	-0.009	-0.030	-0.032	-0.051	-0.002	0.040	0.078	0.132	0.104	-0.225	-0.150	0.457	1	
(16)	Ln(GDP)	-0.277	-0.163	-0.030	0.014	0.004	0.042	-0.005	-0.051	0.331	-0.064	0.353	-0.045	-0.026	-0.009	-0.090	1

Table 4. Main Regressions

This table reports the results from regressing measures of firm-level environmental engagement on a state ownership dummy (*State_own*) and other control variables as well as industry-year fixed effects and country fixed effects. In Panel A, the firm-level environmental engagement is measured by the environmental pillar score (*ENVSCORE*, and its sub-scores, *ENER*, *ENPI*, and *ENRR*) from ASSET4 and the logarithm of CO_2 emission in tonnes at the company level (scaled by total assets). For CO_2 emission tests, we require each firm to have CO_2 emission data for at least three years. Control variables include the ratio of institutional ownership (*Inst_own*), total assets in logarithm (*Ln(Assets)*), leverage ratio (*Leverage*), market-to-book ratio (*MTB*), return on assets (*ROA*), and GDP per capita in logarithm (*Ln(GDP)*). All control variables are winsorized at the 5th and 95th percentiles. In Panel A, *State_own* and other control variables (except *Ln(GDP)*) are lagged by one year. The sample period is 2004-2014. In Panel B, we utilized the long-lag information of our sample by regressing *ENVSCORE* on long-lagged *State_own*. We took four different approaches: (1) using the predetermined *State_own* levels as of 2004 (*State_own_2004*); (2) taking a 5-year lag (*L5.State_own*) for the sub-sample period after 2009 (if there are fewer than 5 years, the observation is omitted); (3) taking a 5-year lag (*L5.State_own*) for the full sample period (if there are fewer than 5 years, the observation is omitted); and (4) averaging each firm's *ENVSCORE* scores over the period 2009-2014 and the value of *State_own* over the period of 2004-2009 (*State_own_pre-2009*), and running a single cross-sectional regression of the averaged *ENVSCORE* score on the averaged *State_own*. Detailed definitions of all variables are in Appendix 2. Robust standard errors are clustered at the firm-level and reported in parentheses. ***, **, and * denote p<0.01, p<0.05, and p<0.1, respectively.

Panel A. Baseline specifications

Dependent variable =	*ENVSCORE*		*ENER*		*ENPI*		*ENRR*		*Ln(CO_2/Assets)*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
State_own	8.927***	4.688***	8.167***	3.967***	6.062***	2.858**	9.109***	5.016***	-0.365***	-0.349***
	(1.651)	(1.393)	(1.652)	(1.421)	(1.551)	(1.381)	(1.672)	(1.454)	(0.132)	(0.134)
Institution_own		7.182***		7.702***		1.043		9.744***		-0.00911
		(2.373)		(2.445)		(2.289)		(2.453)		(0.209)
Ln(assets)		12.70***		12.62***		9.187***		12.55***		0.00950
		(0.300)		(0.303)		(0.296)		(0.307)		(0.0258)
Leverage		-0.077***		-0.061***		-0.074***		-0.075***		0.0067***
		(0.0234)		(0.0234)		(0.0222)		(0.0244)		(0.00208)
MTB		1.439***		1.212***		1.282***		1.405***		-0.0150
		(0.184)		(0.186)		(0.176)		(0.195)		(0.0158)
ROA		0.137***		0.161***		0.0263		0.175***		0.00879*
		(0.0472)		(0.0474)		(0.0469)		(0.0493)		(0.00456)
Ln(GDP)		-0.136		-1.394		0.126		1.104		-1.010***
		(2.070)		(2.144)		(2.131)		(2.344)		(0.163)
Observations	28,218	28,218	28,218	28,218	28,218	28,218	28,218	28,218	12,289	12,289
R-squared	0.336	0.509	0.317	0.488	0.372	0.465	0.264	0.434	0.795	0.797
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 4. (continued)

Panel B. Long lags of state ownership				
Dependent variable = ENVSCORE	(1)	(2)	(3)	(4)
State_own_2004	5.314***			
	(1.582)			
L5.State_own		5.188***	5.181***	
		(1.541)	(1.493)	
State_own_pre-2009				4.703***
				(1.601)
Observations	19,099	19,101	23,412	3,855
R-squared	0.516	0.516	0.513	0.553
Sample	Post-2009	Post-2009	Full	Collapsed
Control variables	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	No
Industry FE	No	No	No	Yes
Country FE	Yes	Yes	Yes	Yes

Table 5. Salient Environmental Shocks

This table examines SOEs' environmental engagement around events or unexpected shocks that raise social awareness of environmental issues: Copenhagen Accord of 2009, Fukushima nuclear accident of 2011 and high abnormal temperatures following Choi et al (2018). The specifications include the same control variables as Table 4 but we omit the coefficients of the control variables for brevity. All control variables are winsorized at the 5th and 95th percentiles, and are in year t-1 (except for Ln(GDP) that is in year t). Panel A reports the baseline results around the three environment-related events or shocks, with Column (1) for Copenhagen Accord and the dependent variable being *Ln(CO_2/Assets)*, Columns (2)-(3) for the Fukushima incidence and the dependent variable being *ENVSCORE*, Columns (4)-(5) for abnormally high temperatures and the dependent variable being *Ln(CO_2/Assets)*. *Emission industry* is defined as (a) a dummy that equals 1 if a firm's ICBIN industry classification is either Oil & Gas or Utilities (i.e., energy industries) in Column (4), and (b) a continuous variable measuring industry emission intensity based on the median weight of total hazardous substances produced by all factories in each SIC 2-digit code in the U.S. Environmental Protection Agency's (EPA) toxic release inventory (TRI) database in Column (5). Placebo tests are conducted for years preceding and after the Copenhagen Accord (Panel B), industries not affected by Fukushima (Panel C) and industries (broadly defined based on ICBIN classifications) that are less sensitive to emissions (Panel D). Detailed definitions of all variables are in Appendix 2. Robust standard errors are clustered at the firm-level and reported in parentheses. ***, **, and * denote p<0.01, p<0.05, and p<0.1, respectively.

Panel A. Evidence from Three Shocks

	Copenhagen	Fukushima		Abnormal temperature	
	(1)	(2)	(3)	(4)	(5)
Dependent variable =	*Ln(CO_2/Assets)*	*ENVSCORE*	*ENVSCORE*	*Ln(CO_2/Assets)*	*Ln(CO_2/Assets)*
State_own	-0.215***	3.775**	4.026**	-0.650***	-0.625***
	(0.0821)	(1.510)	(1.793)	(0.190)	(0.227)
State_own × Post_2009	-0.197*				
	(0.107)				
State_own × Post_2011		2.267*	0.898		
		(1.299)	(1.599)		
State_own × Utilities			-0.854		
			(3.038)		
State_own × Post_2011 x Utilities			4.738*		
			(2.714)		
Emission industry				1.133**	0.176***
				(0.468)	(0.0336)
High abnormal temperature				-0.0180	-0.0137
				(0.0309)	(0.0644)
State_own × Emission industry				0.209	0.234
				(0.352)	(1.299)
State_own × High abnormal temperature				0.205	0.260
				(0.144)	(0.185)
Emission industry × High abnormal temperature				0.210	0.635
				(0.166)	(0.876)
State_own × Emission industry × High abnormal temperature				-0.643**	-1.853*
				(0.276)	(0.974)
Observations	12,289	28,218	28,218	7,655	4,256
R-squared	0.797	0.510	0.510	0.796	0.690
Control variables	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes

Table 5. (continued)

Panel B. Placebo Test for the Copenhagen Event (by Year)

Dependent variable = Ln(CO_2/Assets)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Year	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
State_own	0.191	0.175	-0.0506	-0.148	-0.204	-0.190	-0.326*	-0.407**	-0.376**	-0.436***	-0.489***
	(0.289)	(0.236)	(0.254)	(0.204)	(0.186)	(0.162)	(0.168)	(0.166)	(0.158)	(0.164)	(0.189)
Observations	252	472	607	836	997	1,277	1,496	1,623	1,722	1,625	1,496
R-squared	0.883	0.860	0.859	0.828	0.832	0.820	0.760	0.764	0.761	0.762	0.753
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel C. Placebo Test for the Fukushima Event (by Industry)

Dependent variable = ENVSCORE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Industry	*Basic Materials*	*Consumer Goods*	*Consumer Services*	*Financials*	*Health Care*	*Industrials*	*Technology*	*Telecomm*	*Oil & Gas*
State_own	3.518**	3.892**	3.216**	3.947**	3.814**	4.696***	3.930**	2.866*	2.967*
	(1.616)	(1.547)	(1.512)	(1.645)	(1.516)	(1.618)	(1.554)	(1.563)	(1.615)
State_own × Post_2011	2.226	2.654**	2.223*	3.403**	2.436*	1.703	2.167	2.230*	1.725
	(1.364)	(1.329)	(1.343)	(1.417)	(1.306)	(1.416)	(1.326)	(1.346)	(1.419)
State_own × Industry	1.535	-3.349	9.340	-0.994	0.0433	-6.167*	-2.545	5.464	6.440*
	(3.623)	(5.035)	(8.644)	(3.783)	(12.51)	(3.509)	(3.748)	(4.828)	(3.544)
State_own × Post_2011 x Industry	1.043	-7.713	2.011	-5.071	-19.38*	3.979	1.501	4.816	4.913
	(4.437)	(5.289)	(4.401)	(3.411)	(10.95)	(3.420)	(5.101)	(4.577)	(3.273)
Observations	28,218	28,218	28,218	28,218	28,218	28,218	28,218	28,218	28,218
R-squared	0.510	0.510	0.510	0.510	0.510	0.510	0.510	0.510	0.510
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5. (continued - 2)

Panel D. Placebo Test for Abnormally High Temperature (by Industry)										
Dependent variable = Ln(CO_2/Assets)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Industry	*Basic Materials*	*Consumer Goods*	*Consumer Services*	*Financials*	*Health Care*	*Industrials*	*Oil & Gas*	*Technology*	*Telecomm*	*Utilities*
State_own	-0.0318	-0.0748	0.628*	-0.699	0.476	0.419*	1.045*	0.225	-0.238	0.455
	(0.826)	(0.394)	(0.362)	(0.460)	(0.522)	(0.241)	(0.544)	(0.416)	(0.175)	(0.544)
High abnormal temperature	-0.148*	0.102**	0.00712	0.0288	0.258**	-0.0591	-0.0125	-0.0237	0.113	0.387
	(0.0833)	(0.0477)	(0.0683)	(0.0610)	(0.127)	(0.0520)	(0.132)	(0.0895)	(0.104)	(0.254)
State_own x High abnormal temperature	-0.488	0.421	-0.404	0.139	.	-0.333*	0.108	0.102	0.164	-0.789**
	(0.894)	(0.427)	(0.531)	(0.222)	.	(0.171)	(0.298)	(0.263)	(0.273)	(0.303)
Observations	796	899	767	1,188	363	1,399	405	435	169	378
R-squared	0.541	0.620	0.622	0.655	0.630	0.677	0.636	0.554	0.721	0.454
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6. Changes in Government Political Orientation

This table reports the results from regressing environmental pillar score (*ENVSCORE*) on a state ownership dummy (*State_own*), a time dummy indicating the year in or two years after which there was a change of government leaning towards right or left, and their interactions, other control variables, country fixed effects, and industry-year fixed effects. *Government leaning right* is an indicator variable that equals one if the government changed from the left orientation to center- or right-orientation, and zero otherwise. *Government leaning left* is an indicator variable that equals one if the government changed from center- or right-orientation to the left orientation, and zero otherwise. Columns (1)-(2) report the results for the immediate year (year *t*) of government leaning change, and Columns (3)-(4) report the results for a period of two years post-change (from year *t* to year *t+2*). The specifications include the same control variables as Table 4 but we omit the coefficients of the control variables for brevity. All control variables are winsorized at the 5th and 95th percentiles, and are in year *t-1* (except for *Ln(GDP)* that is in year *t*). Detailed definitions of all variables are in Appendix 2. Robust standard errors are clustered at the firm-level and reported in parentheses. ***, **, and * denote p<0.01, p<0.05, and p<0.1, respectively.

Dependent variable = ENVSCORE	(1)	(2)	(3)	(4)
State_own	4.895***	4.650***	4.821***	4.215**
	(1.706)	(1.677)	(1.756)	(1.662)
Government leaning right	-0.267		-1.049	
	(0.679)		(0.643)	
Government leaning left		0.797		0.933*
		(0.691)		(0.504)
State_own × Government leaning right	-0.368		0.458	
	(2.780)		(2.752)	
State_own × Government leaning left		6.690**		5.527**
		(2.687)		(2.483)
Observations	20,789	20,789	20,789	20,789
R-squared	0.529	0.530	0.530	0.530
Control variables	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Sample	Immediate year	Immediate year	Post 2 years	Post 2 years

Table 7. Cross-Country Variation

This table reports the results from regressing environmental pillar score (*ENVSCORE*) on state ownership dummy (*State_own*), other control variables, country fixed effects, and industry-year fixed effects for the sub-sample of country-splits based on above ("High") or below ("Low") the sample median. Columns (1)-(2) show the results of country split by *Energy Security Risk (*country-level index on energy security risk as assessed by the U.S. Chamber of Commerce). Columns (3)-(4) show the results of country split by *Neighboring Country Conflict (fuel export)* (country-level index measuring a country's tensions with its neighboring countries with regard to fuel export, as assessed by Global Conflict Risk Index). Columns (5)-(6) show the results of country split by *Environmental Regulation* (dummy variable indicating whether country had a positive environmental regulatory change based on Carrot & Sticks dataset). Columns (7)-(8) show the results of country split by *Market Cap/GDP* ratio as a proxy for the level of capital market development. The specifications include the same control variables as Table 4 but we omit the coefficients of the control variables for brevity. All control variables are winsorized at the 5th and 95th percentiles. *State_own* and other control variables (except *Ln(GDP)*) are lagged by one year. The sample period is 2004-2014. Detailed definitions of all variables are in Appendix 2. Robust standard errors are clustered at the firm-level and reported in parentheses. ***, **, and * denote p<0.01, p<0.05, and p<0.1, respectively.

Dependent variable = ENVSCORE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State_own	5.466***	1.763	6.089***	3.394	2.000	4.676***	3.896	4.200**
	(1.661)	(2.856)	(2.043)	(2.102)	(2.348)	(1.643)	(2.577)	(1.701)
Observations	13,946	10,015	11,542	12,469	13,151	14,859	11,291	14,107
R-squared	0.538	0.535	0.531	0.554	0.552	0.520	0.489	0.555
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	High energy dependence	Low energy dependence	High neighboring country conflicts (fuel export)	Low neighboring country conflicts (fuel export)	High environment regulation	Low environment regulation	High MktCap/GDP	Low MktCap/GDP

Table 8. Channels for the State Ownership Effect

This table reports the results from regressing environmental pillar score (*ENVSCORE*) on lagged state ownership dummy (*State_own*) interacting with firm-level variables exploring the channels ("Channel variables"), and their constitutive terms, as well as other control variables, country fixed effects, and industry-year fixed effects. Chanel variables include the following: (1) *Industry emission intensity* is a firm-level continuous variable defined as the median weight of total hazardous substances produced by all factories in each SIC 2-digit code in the U.S. Environmental Protection Agency's (EPA) toxic release inventory (TRI) database; (2) *Foreign sales* is the percentage of foreign sales over total net sales revenue of the company, and *High foreign sales* is a dummy variable indicating whether its value is greater than the sample median; (3) *Foreign assets* is the percentage of foreign assets over total assets in the balance sheet of the company, and and *High foreign asset* is a dummy variable indicating whether its value is above the sample median; (4) *Political connection of CEO* is a dummy that equals one if the CEOs are politically connected and zero otherwise. The specifications include the same control variables as Table 4 but we omit the coefficients of the control variables for brevity. All control variables are winsorized at the 5th and 95th percentiles. *State_own* and other control variables (except *Ln(GDP)*) are lagged by one year. The sample period is 2004-2014. Detailed definitions of all variables are in Appendix 2. Robust standard errors are clustered at the firm-level and reported in parentheses. ***, **, and * denote p<0.01, p<0.05, and p<0.1, respectively.

Dependent variable = ENVSCORE	(1)	(2)	(3)	(4)
State_own	5.725***	4.893**	6.625***	3.496*
	(1.405)	(2.137)	(1.679)	(2.070)
State_own × Industry emission intensity	0.706***			
	(0.272)			
High foreign sales		6.312***		
		(1.442)		
State_own × High foreign sales		-10.36***		
		(3.417)		
High foreign assets			5.016***	
			(0.692)	
State_own × High foreign assets			-4.410**	
			(2.212)	
Political connection of CEO				2.499**
				(1.139)
State_own × Political connection of CEO				-6.020
				(3.790)
Observations	28,084	11,702	28,218	12,807
R-squared	0.474	0.567	0.514	0.551
Control variables	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes

Table 9. State Versus Other Types of Block-ownership

This table reports the results from regressing environmental pillar score (*ENVSCORE*) on the variables for other ownership types, other control variables, country fixed effects, and industry-year fixed effects. In Panel A, the state ownership (*Government_held*) measures the percentage of free-float shares held by the government if they are above the 5% threshold. Proxies for other types of block-ownership (i.e., above 5% ownership holdings) include the ratios of floating shares owned by foreign investors (*Foreign holdings*), by other corporations (*Cross holdings*), by pension funds (*Pension fund held*), by investment companies (*Investment co held*), by employees (*Employee held*), by other investors (*Other holdings*), by strategic investors (*Strategic holdings*), and the ratios of shares owned by domestic institutional investors (*Domestic inst. held*) and by foreign institutional investors (*Foreign inst. held*). In Panel B, *Foreign_state* is a dummy variable that equals one if the company has ownership stakes held by any foreign government or foreign SWF, and zero otherwise. *SWF* is a dummy variable that equals one if the firm has at least one sovereign wealth fund investor (defined by Factset/LionShares) and zero otherwise. The specifications include the same control variables as Table 4 but we omit the coefficients of the control variables for brevity. The sample period is 2004-2014. Detailed definitions of all variables are in Appendix 2. Robust standard errors are clustered at the firm-level and reported in parentheses. ***, **, and * denote p<0.01, p<0.05, and p<0.1, respectively.

Panel A. Government versus Other Types of Block-owners

Dependent variable = ENVSCORE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Government held	0.103***									
	(0.0360)									
Foreign holdings		-2.750								
		(2.384)								
Cross holdings			-0.00974							
			(0.0199)							
Pension fund held				-0.216***						
				(0.0763)						
Investment co. held					-0.046**					
					(0.0224)					
Employee held						-0.200***				
						(0.0265)				
Other holdings							-0.0204			
							(0.0430)			
Strategic holdings								-0.0830***		
								(0.0155)		
Domestic inst. own									-3.412	
									(3.002)	
Foreign inst. own										2.496
										(3.013)
Observations	28,001	28,001	28,062	28,062	28,062	28,062	28,062	28,062	28,218	28,218
R-squared	0.510	0.509	0.509	0.509	0.509	0.513	0.509	0.511	0.509	0.509
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 9. (continued)

Panel B. Different Forms of State Ownership				
Dependent variable = ENVSCORE	(1)	(2)	(3)	(4)
State_own	1.675	7.830***	23.32***	4.540***
	(3.912)	(1.690)	(7.716)	(1.364)
State_own x Foreign_state			-18.75**	
			(7.685)	
SWF				3.930
				(3.041)
Observations	1,470	9,680	28,040	28,040
R-squared	0.619	0.553	0.510	0.510
Control variables	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Sample	Foreign own	Domestic own	All	All

Table 10. Alternative Measures of Environmental Engagement

This table reports the results based on the environmental scores using two alternative sources—the Environmental Pillar Score from MSCI and the Environmental Score from Sustainalytics. Since we only have the 2016 data in the *MSCI Environmental Pillar Score*, we conduct cross-sectional OLS regression and regress the environmental score on a state ownership dummy (*State_own*), control variables, industry fixed effects, and country fixed effects. For *Sustainalytics Environmental Score*, we conduct pooled OLS regression as Equation (1) and regress the environmental score on a state ownership dummy (*State_own*), control variables, industry-year fixed effects, and country fixed effects. In Column (1), we do not include *Ln(GDP)* as it perfectly correlates with country fixed effects. Detailed definitions of all variables are in Appendix 2. In Column (2), we use robust standard errors are clustered at the firm-level. ***, **, and * denote p<0.01, p<0.05, and p<0.1, respectively. All control variables are winsorized at the 5th and 95th percentiles.

Dependent variable =	(1) *MSCI Environmental Pillar Score*	(2) *Sustainalytics Environmental Score*
State_own	0.511**	1.459**
	(0.257)	(0.698)
Inst_own	-0.203	0.776
	(0.320)	(1.102)
Ln(Assets)	0.562***	3.739***
	(0.0501)	(0.159)
Leverage	0.0939	-0.0250**
	(0.0691)	(0.0114)
MTB	0.163	0.470***
	(0.291)	(0.0975)
ROA	0.0262**	-0.00283
	(0.0131)	(0.0247)
Ln(GDP)		2.063**
		(0.843)
Observations	1,385	14,447
Number of firms	1,385	3,230
R-squared	0.547	0.433
Industry-year FE	No	Yes
Industry FE	Yes	No
Country FE	Yes	Yes
Model	Cross-section OLS	Pooled OLS

Table 11. Shareholder Value and Firm Performance

This table reports the results from regressing market-to-book ratio (*MTB*) and ROA, either 1-year forward or 5-year forward, and winsorized at the 5th and 95th percentiles, on state ownership dummy (*State_own*), environmental pillar score (*ENVSCORE*), their interaction term, other control variables, country fixed effects, and industry-year fixed effects. Control variables include Institutional ownership, Ln(assets), Leverage, MTB (except for the regressions with MTB as the dependent variable), ROA (except for the regressions with ROA as the dependent variable), Ln(GDP), and are defined in Appendix 2. All control variables are winsorized at the 5th and 95th percentiles. *State_own* and other control variables (except *Ln(GDP)*) are lagged by one year. The sample period is 2004-2014. Following the literature, financial firms are excluded in all regressions. Robust standard errors are clustered at the firm-level and reported in parentheses. ***, **, and * denote p<0.01, p<0.05, and p<0.1, respectively.

Dependent variable =	(1) *1-year forward MTB*	(2) *1-year forward ROA*	(3) *5-year forward MTB*	(4) *5-year forward ROA*
State_own	-0.103	0.242	0.149	0.717
	(0.172)	(0.317)	(0.150)	(0.758)
ENVSCORE	0.006***	0.008***	0.004***	0.010***
	(0.0009)	(0.0014)	(0.0007)	(0.0022)
State_own × ENVSCORE	-0.0015	-0.004	-0.003	-0.009
	(0.0023)	(0.0042)	(0.002)	(0.009)
Observations	21,012	20,960	10,344	9,771
R-squared	0.414	0.585	0.633	0.580
Control variables	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes

Table 12. Other ESG Pillars: Social and Corporate Governance Performance

This table reports the results from regressing social pillar score (*SOCSCORE*) and corporate governance pillar score (*CGVSCORE*) on state ownership dummy (*State_own*), other control variables, country fixed effects, and industry-year fixed effects. Control variables include total assets in logarithm (*Ln(Assets)*), leverage ratio (*Leverage*), market-to-book ratio (*MTB*), return on assets (*ROA*), and GDP per capita in logarithm (*Ln(GDP)*). All control variables are winsorized at the 5th and 95th percentiles. *State_own* and other control variables (except *Ln(GDP)*) are lagged by one year. Detailed definitions of all variables are in Appendix 2. Robust standard errors are clustered at the firm-level and reported in parentheses. The sample period is 2004-2014. ***, **, and * denote p<0.01, p<0.05, and p<0.1, respectively.

	(1)	(2)	(3)	(4)
Dependent variable =	*SOCSCORE*	*SOCSCORE*	*CGVSCORE*	*CGVSCORE*
State_own	9.392***	5.326***	2.007	1.001
	(1.740)	(1.475)	(1.216)	(1.137)
Inst_own		11.95***		25.57***
		(2.387)		(1.897)
Ln(Assets)		12.72***		5.097***
		(0.298)		(0.204)
Leverage		-0.0963***		-0.00721
		(0.0234)		(0.0158)
MTB		1.558***		0.418***
		(0.184)		(0.134)
ROA		0.239***		0.0179
		(0.0479)		(0.0350)
Ln(GDP)		1.211		2.932*
		(2.175)		(1.747)
Observations	28,218	28,218	28,210	28,210
R-squared	0.268	0.460	0.665	0.710
Industry-year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes

Internet Appendix for

Leviathan Inc. and Corporate Environmental Engagement

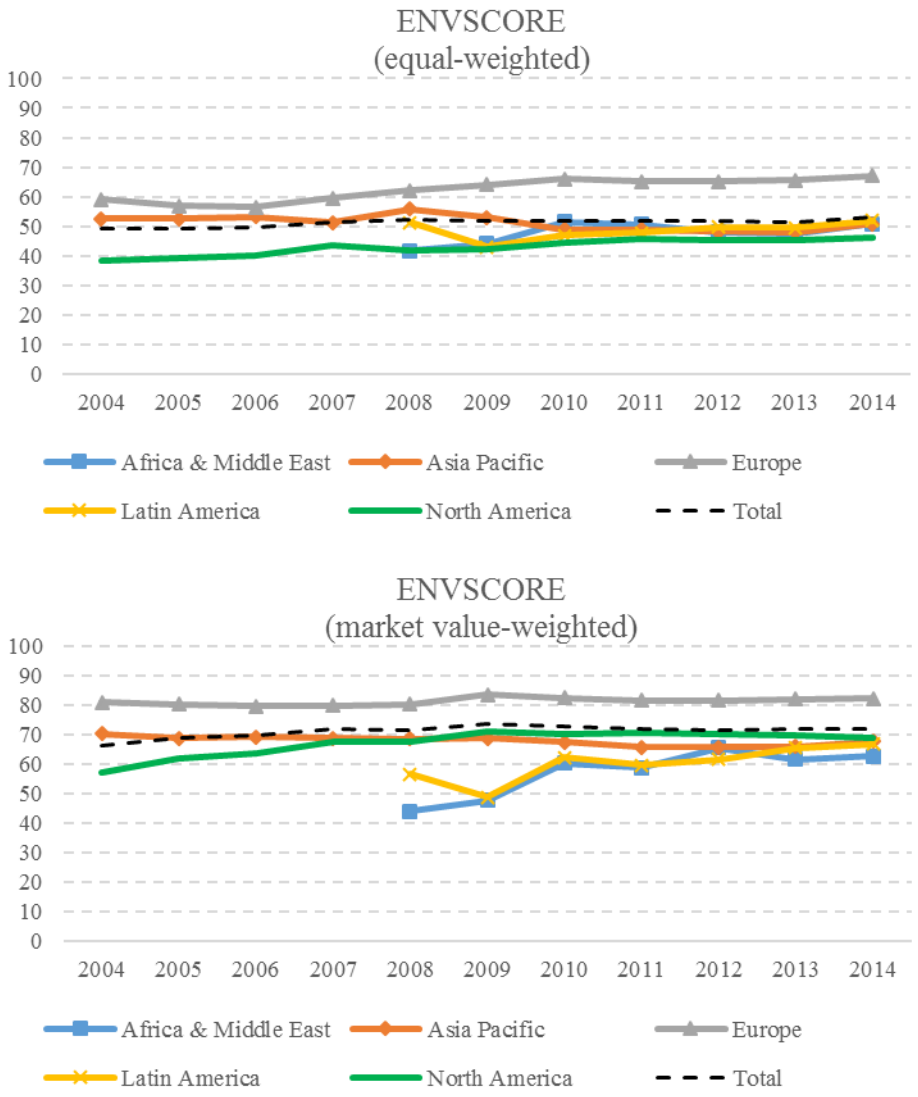

Figure IA.1 Average Environmental Engagement of Publicly-listed Firms, per Geographic Region and Year

This figure presents the time series patterns of the average of the ASSET4 environmental pillar scores (*ENVSCORE*) of public firms in the five geographical regions. The sample period is from 2004 to 2014. Panel A presents equal-weighted averages, calculated with the pooled average score of public firms in a region in each year. Panel B shows value-weighted scores, in which we calculate the average scores of public firms in a region in each year, weighted by the lagged market capitalization.

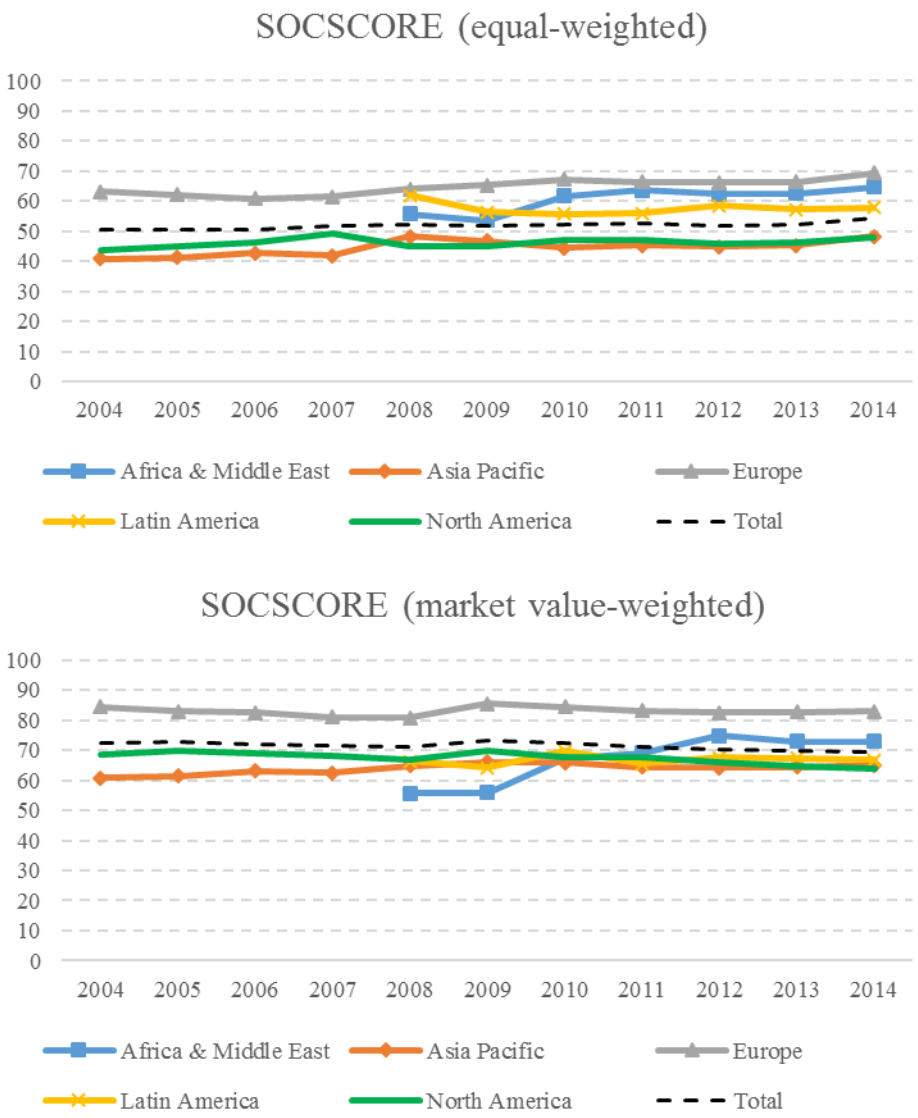

Figure IA.2 Average Social Scores of Publicly-listed Firms, per Geographic Regions and Years
This figure presents the time series patterns of the average of social pillar scores (*SOCSCORE*) of public firms in the five geographical regions. The sample period is from 2004 to 2014. Panel A presents equal-weighted averages, calculated with the simple average score of public firms in a region in each year. Panel B shows value-weighted scores, in which we calculate the average scores of public firms in a region in each year, weighted by the lagged market capitalization.

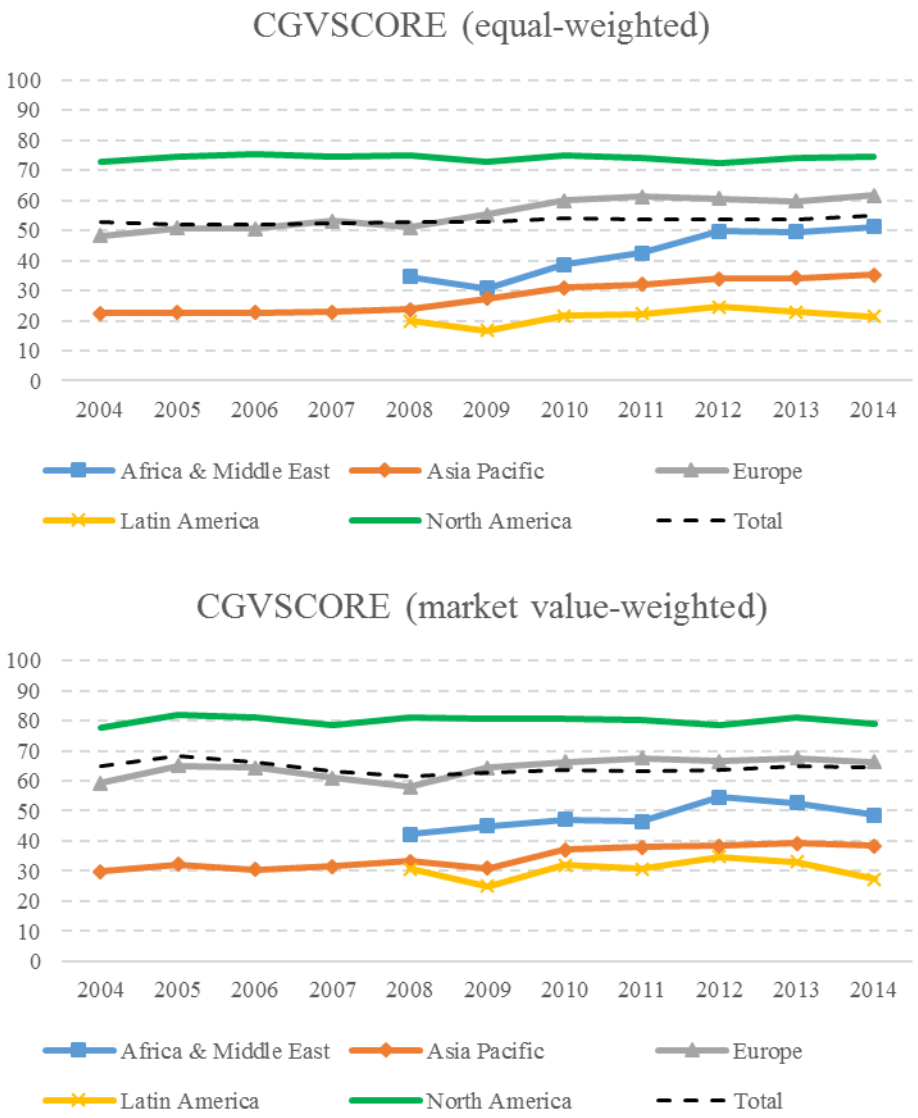

Figure IA.3 Average Corporate Governance Scores of Publicly-listed Firms, per Geographic Regions and Years

This figure presents the time series patterns of the average of corporate governance pillar scores (*CGVSCORE*) of public firms in the five geographical regions. The sample period is from 2004 to 2014. Panel A presents equal-weighted averages, calculated with the simple average score of public firms in a region in each year. Panel B shows value-weighted scores, in which we calculate the average scores of public firms in a region in each year, weighted by the lagged market capitalization.

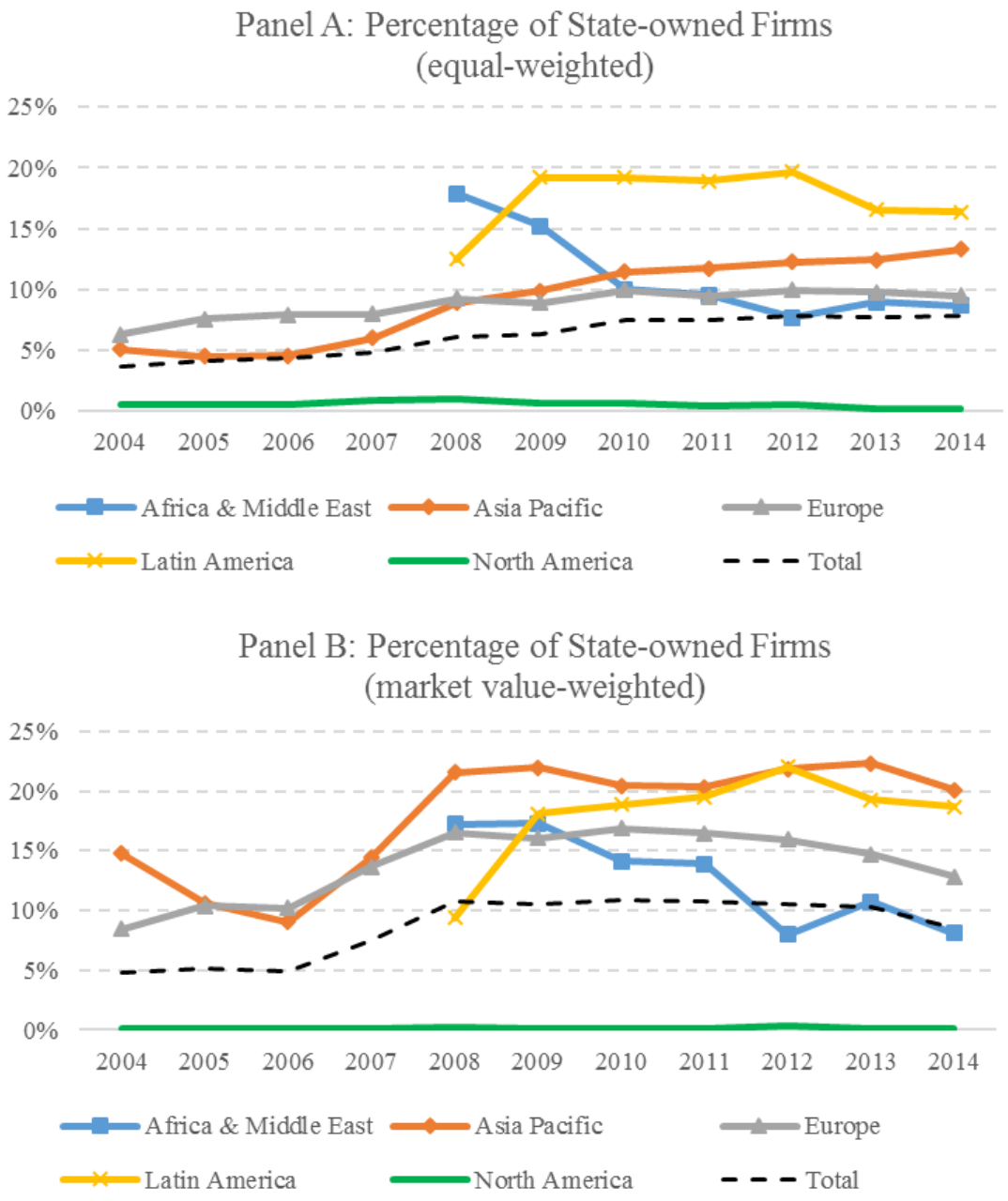

Figure IA. 4. Average State Ownership of Publicly-listed Firms, per Geographic Region and Year

This figure presents the time series patterns of the proportion of state-owned public firms in the five different regions. The sample period is from 2004 to 2014. Panel A presents equal-weighted averages, in which we calculate the ratio of the number of state-owned firms among all public firms in a region in each year in our sample. Panel B shows value-weighted averages, in which we calculate the average ratios of state-owned firms among all public firms in a region in each year in our sample, weighted by the lagged market capitalization.

Table IA.1. Sample Data Distribution Across Years

This table presents the number of firm-year observations with available data on state ownership dummy (*State_own*), environmental pillar score (*ENVSCORE* and sub-scores: emission reduction *ENER*, product innovation *ENPI*, resource reduction *ENRR*) across the sample years (2002-2014). In the rightmost column, we list the number of observations used in regression of Equation (1).

Year	State_own	*ENVSCORE*	*ENER*	*ENPI*	*ENRR*	Observations used in regressions
2004	4,592	1,819	1,827	1,827	1,827	1,346
2005	4,592	2,235	2,244	2,244	2,244	1,706
2006	4,567	2,248	2,257	2,257	2,257	1,752
2007	4,557	2,425	2,436	2,436	2,436	1,950
2008	4,546	2,918	2,929	2,929	2,929	2,361
2009	4,536	3,347	3,360	3,360	3,360	2,730
2010	4,523	3,958	3,978	3,978	3,978	3,135
2011	4,496	4,048	4,070	4,070	4,070	3,230
2012	4,472	4,128	4,150	4,150	4,150	3,361
2013	4,410	4,225	4,246	4,246	4,246	3,428
2014	4,278	4,130	4,131	4,131	4,131	3,219
Total	58,748	37,402	37,561	37,561	37,561	28,218

Table IA.2. Comparisons by Countries

In this table, we present the averages of state ownership dummy (*State_own*), environmental pillar score (*ENVSCORE* and sub-scores: emission reduction *ENER*, product innovation *ENPI*, resource reduction *ENRR*), social pillar score (*SOCSCORE*), and corporate governance pillar score (*CGVSCORE*). We also conduct t-tests for the difference in averages across state-owned and non-state-owned firms and report the p-value based on unequal variance. In Morocco (MA), we only have one observation in *State_won* =1 and the p-value cannot be calculated.

Country	*ENER* All	*ENER State_own* =1	*ENER State_own* =0	p-value (1 - 0)	*ENPI* All	*ENPI State_own* =1	*ENPI State_own* =0	p-value (1 - 0)	*ENRR* All	*ENRR State_own* =1	*ENRR State_own* =0	p-value (1 - 0)
Total	51.52	59.19	50.99	0.00	49.27	51.37	49.12	0.00	51.80	57.61	51.39	0.00
AT	52.92	80.90	43.79	0.00	54.95	67.03	50.82	0.00	52.23	74.65	44.84	0.00
AU	40.27	51.70	40.13	0.04	34.60	33.59	34.65	0.87	39.32	60.32	39.08	0.00
BE	56.53	61.02	56.39	0.61	50.74	61.85	50.04	0.09	56.67	64.84	56.25	0.32
BR	52.11	65.42	48.62	0.00	46.66	56.61	44.18	0.00	55.79	71.56	51.83	0.00
CA	41.84	48.37	41.61	0.23	36.08	28.49	36.16	0.06	40.20	37.29	40.05	0.61
CH	57.17	69.85	56.55	0.02	54.70	65.89	54.09	0.07	58.35	62.62	58.15	0.55
CL	39.43	42.18	38.93	0.61	39.81	42.56	39.30	0.61	43.05	37.62	44.63	0.27
CN	24.39	28.61	16.49	0.00	38.47	37.28	40.69	0.37	23.13	27.40	15.14	0.00
CO	54.64	64.40	43.08	0.08	38.17	46.24	28.07	0.05	50.86	60.28	34.02	0.02
CZ	46.32	86.10	23.59	0.00	51.33	33.56	61.49	0.00	51.43	53.90	50.02	0.54
DE	64.67	71.48	64.08	0.04	65.00	59.65	65.42	0.14	66.27	74.39	65.50	0.01
DK	54.92		54.76		54.79		54.62		58.09		57.94	
EG	21.37	11.33	23.11	0.00	25.05	18.63	26.66	0.00	20.67	10.07	22.22	0.00
ES	71.97	86.56	71.80	0.01	60.82	85.49	60.38	0.00	73.25	78.94	73.38	0.11
FI	69.22	88.12	65.66	0.00	78.39	84.05	77.30	0.05	71.03	77.77	69.92	0.02
FR	75.48	79.08	75.06	0.10	70.70	71.98	70.67	0.68	77.43	77.61	77.45	0.95
GB	62.89	70.45	62.76	0.07	48.35	48.67	48.40	0.95	63.02	69.64	62.90	0.11
GR	54.31	76.72	45.67	0.00	37.51	45.95	34.30	0.02	55.84	77.88	47.50	0.00
HK	33.16	38.03	32.51	0.02	36.87	42.71	35.59	0.00	37.12	42.75	36.38	0.01
HU	76.63	51.58	84.00	0.00	70.86	28.00	83.46	0.00	71.43	34.58	82.27	0.00
ID	51.94	53.08	51.80	0.79	37.26	37.58	36.66	0.84	48.70	46.25	51.62	0.26
IE	48.75	77.78	45.69	0.00	42.82	73.16	39.62	0.00	44.45	62.94	42.50	0.01
IL	37.24		36.66		40.99		40.92		49.35		48.95	
IN	54.38	55.70	54.09	0.70	49.21	42.24	51.18	0.01	59.18	55.29	60.28	0.20
IT	54.07	81.50	45.55	0.00	52.97	73.52	46.50	0.00	56.35	77.78	49.71	0.00
JP	61.97	72.24	61.83	0.00	63.14	66.64	63.09	0.32	57.34	65.52	57.22	0.05
KR	61.37	73.17	60.43	0.01	64.28	65.89	64.20	0.71	56.18	58.99	55.90	0.52
MA	25.57	61.80	23.06	-	27.54	19.15	24.40	-	33.38	75.92	29.03	-
MX	45.33		44.92		34.56		34.69		47.50		47.13	
MY	44.71	54.10	35.94	0.00	37.32	48.88	26.60	0.00	40.53	50.09	31.63	0.00
NL	67.91	68.86	67.89	0.92	63.69	85.12	63.28	0.00	71.03	85.43	70.76	0.01
NO	62.19	82.11	51.93	0.00	65.59	82.94	56.65	0.00	58.24	78.55	47.78	0.00
NZ	43.31	71.02	38.27	0.00	45.98	84.61	38.96	0.00	41.67	60.42	38.26	0.00
PE	41.28		41.28		18.82		18.82		33.43		33.43	
PH	42.42	48.10	41.42	0.57	43.30	30.37	46.54	0.03	48.75	46.97	49.78	0.68
PL	38.78	50.98	28.92	0.00	34.78	34.52	34.90	0.91	34.85	46.91	25.09	0.00
PT	67.95	84.03	64.20	0.01	53.27	59.68	52.50	0.26	65.80	79.06	62.63	0.01
RU	47.90	57.01	42.13	0.00	33.39	41.50	28.17	0.00	50.61	62.61	42.92	0.00
SE	66.81	83.88	65.89	0.00	67.06	68.01	66.89	0.84	65.77	79.00	65.03	0.00
SG	37.82	46.77	32.87	0.00	35.14	37.99	33.60	0.11	40.67	51.22	34.88	0.00
TH	47.78	72.93	30.53	0.00	47.04	61.13	36.62	0.00	50.38	61.34	42.60	0.00
TR	51.49	37.08	55.55	0.00	51.33	41.18	54.22	0.03	49.65	29.56	56.31	0.00
US	43.18	24.79	43.24	0.00	45.28	21.92	45.37	0.00	45.18	21.37	45.25	0.00
ZA	54.70	56.69	54.23	0.66	39.73	41.20	39.15	0.68	59.98	72.73	58.88	0.00

Table IA.2. (continued)

Country	*SOCSCORE* All	*SOCSCORE* *State_own*=1	SOCSCORE *State_own*=0	p-value (1 - 0)	*CGVSCORE* All	*CGVSCORE* *State_own*=1	*CGVSCORE* *State_own*=0	p-value (1 - 0)
Total	52.07	62.00	51.40	0.00	53.18	41.62	53.98	0.00
AT	56.11	87.38	46.04	0.00	33.17	48.26	28.23	0.00
AU	39.47	52.69	39.41	0.04	63.46	71.81	63.48	0.10
BE	52.96	67.52	52.04	0.09	50.56	52.84	50.49	0.59
BR	63.17	86.21	57.30	0.00	26.97	28.04	26.77	0.56
CA	39.74	29.23	39.83	0.02	73.70	76.54	73.67	0.30
CH	56.61	56.39	56.62	0.97	47.17	39.11	47.69	0.11
CL	44.91	44.76	45.29	0.95	9.26	9.33	9.31	0.99
CN	25.40	30.71	15.48	0.00	24.59	26.33	21.33	0.05
CO	71.34	77.48	62.04	0.24	28.21	32.82	22.20	0.23
CZ	70.32	75.72	67.23	0.02	18.27	24.79	14.55	0.00
DE	68.27	68.12	68.23	0.98	34.55	30.80	34.85	0.12
DK	54.07		53.88		38.02		37.85	
EG	27.24	12.45	29.99	0.00	8.64	2.30	9.77	0.00
ES	78.04	94.15	77.90	0.00	49.72	55.75	49.62	0.20
FI	70.35	85.47	67.44	0.00	60.87	63.32	60.51	0.32
FR	78.83	81.69	78.50	0.15	55.09	51.90	55.54	0.15
GB	63.21	68.31	63.14	0.20	74.04	65.24	74.21	0.00
GR	51.10	69.16	44.34	0.00	17.70	23.74	15.44	0.00
HK	36.03	38.87	35.86	0.22	36.50	42.08	35.13	0.00
HU	78.51	34.34	91.50	0.00	41.16	34.47	43.12	0.11
ID	62.82	71.48	56.43	0.00	26.03	35.39	18.78	0.00
IE	38.16	54.21	36.47	0.01	63.39	68.51	62.85	0.24
IL	45.73		45.08		37.17		36.88	
IN	58.87	61.23	58.26	0.39	29.05	14.91	32.94	0.00
IT	64.14	86.13	57.35	0.00	44.09	53.81	41.15	0.00
JP	47.28	57.70	47.13	0.02	11.94	13.77	11.92	0.29
KR	56.89	71.71	55.70	0.00	13.84	10.51	14.09	0.00
MA	54.64	87.75	50.62	-	5.45	14.80	4.82	-
MX	45.06		44.64		13.16		13.16	
MY	49.12	64.32	34.62	0.00	46.94	58.28	35.29	0.00
NL	76.86	90.48	76.60	0.00	64.42	74.15	64.24	0.00
NO	67.94	89.97	56.60	0.00	63.39	71.78	59.07	0.00
NZ	41.47	46.59	40.54	0.00	62.47	66.47	61.74	0.31
PE	31.99		31.99	0.54	51.66		51.66	
PH	45.31	57.02	43.73	0.15	28.78	27.42	29.15	0.76
PL	42.30	55.41	31.83	0.00	23.24	27.09	20.18	0.02
PT	75.48	88.50	72.67	0.00	56.17	46.00	58.15	0.15
RU	53.23	62.04	47.30	0.00	28.39	27.70	29.07	0.65
SE	65.35	85.60	64.10	0.00	55.63	64.16	55.20	0.03
SG	40.79	52.71	34.38	0.00	43.78	53.16	38.97	0.00
TH	59.52	73.69	49.45	0.00	45.52	48.99	42.73	0.11
TR	55.79	38.17	61.65	0.00	22.47	19.94	23.09	0.29
US	47.93	23.52	48.01	0.00	74.20	71.84	74.22	0.29
ZA	70.97	72.29	70.73	0.77	60.58	63.94	59.95	0.29

Table IA.3. Comparisons by Industries

This table presents the averages of state ownership dummy (State_own), environmental pillar score (*ENVSCORE* and sub-scores: emission reduction *ENER*, product innovation *ENPI*, resource reduction *ENRR*), social pillar score (*SOCSCORE*), and corporate governance pillar score (*CGVSCORE*) in ten different industries based on the ICBIN classification: Basic Materials, Consumer Goods, Consumer Services, Financials, Health Care, Industrials, Oil & Gas, Technology, Telecommunications, and Utilities. We also conduct t-tests for the difference in averages across state-owned and non-state-owned firms and report the p-value based on unequal variance.

Industry	Obs	*State_own*	*ENVSCORE* All	*ENVSCORE* *State_own* =1	*ENVSCORE* *State_own* =0	p-value (1 - 0)	*ENER* All	*ENER* *State_own* =1	*ENER* *State_own* =0	p-value (1 - 0)
Basic Materials	2,923	0.057	55.85	59.84	55.68	0.10	58.61	62.94	58.40	0.06
Consumer Goods	3,300	0.020	61.62	47.15	61.99	0.00	60.11	48.85	60.43	0.00
Consumer Services	3,928	0.024	41.17	52.56	40.91	0.00	41.16	58.37	40.74	0.00
Financials	4,920	0.068	42.63	46.76	42.37	0.02	40.84	40.57	40.91	0.85
Health Care	1,593	0.010	44.20	20.76	44.49	0.00	44.67	27.83	44.88	0.04
Industrials	5,519	0.053	59.24	53.55	59.57	0.00	57.45	56.19	57.53	0.47
Oil & Gas	1,987	0.126	45.75	65.45	42.87	0.00	51.66	69.77	48.99	0.00
Technology	1,905	0.022	52.29	63.00	52.07	0.04	48.60	61.04	48.34	0.01
Telecommunications	757	0.319	55.60	63.58	52.07	0.00	54.86	62.94	51.22	0.00
Utilities	1,372	0.261	63.88	64.68	63.80	0.59	70.20	69.57	70.64	0.50
No ICBIN	14	0.000	33.11		33.11		24.06		24.06	

Industry	*ENPI* All	*ENPI* *State_own* =1	*ENPI* *State_own* =0	p-value (1 - 0)	*ENRR* All	*ENRR* *State_own* =1	*ENRR* *State_own* =0	p-value (1 - 0)
Basic Materials	49.74	51.01	49.78	0.63	55.50	59.51	55.31	0.08
Consumer Goods	59.42	41.96	59.83	0.00	60.89	48.94	61.19	0.00
Consumer Services	36.90	36.17	36.97	0.77	46.15	57.66	45.87	0.00
Financials	42.53	51.13	41.93	0.00	44.63	47.05	44.48	0.17
Health Care	39.94	23.61	40.17	0.02	47.92	21.12	48.20	0.00
Industrials	59.66	47.75	60.35	0.00	56.31	54.24	56.43	0.23
Oil & Gas	41.12	53.94	39.24	0.00	44.09	63.99	41.18	0.00
Technology	56.03	63.88	55.88	0.12	51.17	64.41	50.89	0.01
Telecommunications	51.73	56.89	49.46	0.00	56.86	65.09	53.17	0.00
Utilities	53.50	54.90	53.14	0.31	59.78	61.71	59.28	0.14
No ICBIN	49.11		49.11		30.23		30.23	

Industry	*SOCSCORE* All	*SOCSCORE* *State_own* =1	*SOCSCORE* *State_own* =0	p-value (1 - 0)	*CGVSCORE* All	*CGVSCORE* *State_own* =1	*CGVSCORE* *State_own* =0	p-value (1 - 0)
Basic Materials	53.55	63.75	52.95	0.00	54.77	53.80	54.90	0.66
Consumer Goods	57.78	44.97	58.08	0.00	46.64	38.20	46.90	0.03
Consumer Services	46.41	54.08	46.22	0.01	53.50	43.93	53.76	0.00
Financials	45.21	54.15	44.63	0.00	49.69	37.90	50.62	0.00
Health Care	50.97	26.25	51.27	0.00	55.78	29.47	56.12	0.00
Industrials	55.46	54.76	55.51	0.66	52.34	40.92	53.00	0.00
Oil & Gas	48.81	68.29	45.98	0.00	63.59	40.68	66.89	0.00
Technology	51.82	60.40	51.61	0.07	58.82	48.78	59.13	0.03
Telecommunications	62.70	70.39	59.19	0.00	51.90	48.62	53.63	0.03
Utilities	62.91	71.37	60.13	0.00	55.16	35.86	62.04	0.00
No ICBIN	37.43		37.43		61.57		61.57	

Table IA.4. Comparisons by Sample Years

This table presents the averages of state ownership dummy (*State_own*), environmental pillar score (*ENVSCORE* and sub-scores: emission reduction *ENER*, product innovation *ENPI*, resource reduction *ENRR*), social pillar score (*SOCSCORE*), and corporate governance pillar score (*CGVSCORE*) in each year from 2004 to 2014. We also conduct t-tests for the difference in averages across state-owned and non-state-owned firms and report the p-value based on unequal variance.

Year	Obs	*State_own*	*ENVSCORE* All	*ENVSCORE* *State_own*=1	*ENVSCORE* *State_own*=0	p-value (1 - 0)	*ENER* All	*ENER* *State_own*=1	*ENER* *State_own*=0	p-value (1 - 0)
2004	1,346	0.036	49.36	61.74	48.90	0.01	48.96	60.21	48.54	0.01
2005	1,706	0.040	49.86	60.39	49.42	0.00	49.48	59.70	49.05	0.01
2006	1,752	0.042	50.29	58.83	49.97	0.02	50.01	57.65	49.73	0.03
2007	1,950	0.048	51.70	60.41	51.26	0.01	51.46	61.41	50.94	0.00
2008	2,361	0.060	51.97	58.42	51.58	0.01	51.71	60.75	51.15	0.00
2009	2,730	0.064	51.72	55.25	51.49	0.14	51.64	57.92	51.23	0.01
2010	3,135	0.075	51.91	55.87	51.54	0.05	51.82	57.51	51.32	0.00
2011	3,230	0.075	52.01	56.61	51.66	0.02	52.00	58.41	51.51	0.00
2012	3,361	0.079	51.61	56.76	51.13	0.01	51.68	58.49	51.05	0.00
2013	3,428	0.078	51.53	58.30	51.12	0.00	51.72	59.53	51.20	0.00
2014	3,219	0.079	53.14	58.46	52.90	0.01	53.18	59.70	52.82	0.00

Year	*ENPI* All	*ENPI* *State_own*=1	*ENPI* *State_own*=0	p-value (1 - 0)	*ENRR* All	*ENRR* *State_own*=1	*ENRR* *State_own*=0	p-value (1 - 0)
2004	46.71	55.72	46.37	0.02	48.88	61.28	48.42	0.01
2005	47.09	47.44	47.08	0.92	49.45	64.27	48.83	0.00
2006	47.58	47.49	47.66	0.96	50.16	61.93	49.64	0.00
2007	49.59	54.49	49.36	0.13	51.65	59.49	51.26	0.02
2008	50.20	53.67	50.01	0.19	52.11	56.68	51.82	0.08
2009	49.84	49.66	49.85	0.94	51.72	55.12	51.51	0.15
2010	49.57	50.81	49.43	0.52	52.15	54.78	51.89	0.18
2011	49.61	50.81	49.52	0.54	52.37	56.61	52.05	0.03
2012	49.31	50.65	49.19	0.47	52.24	57.09	51.78	0.01
2013	49.19	52.67	49.07	0.08	52.01	58.09	51.64	0.00
2014	50.46	52.19	50.54	0.43	53.51	58.22	53.26	0.02

Year	*SOCSCORE* All	*SOCSCORE* *State_own*=1	*SOCSCORE* *State_own*=0	p-value (1 - 0)	*CGVSCORE* All	*CGVSCORE* *State_own*=1	*CGVSCORE* *State_own*=0	p-value (1 - 0)
2004	50.05	61.82	49.61	0.01	51.76	40.92	52.16	0.01
2005	50.19	63.61	49.63	0.00	51.11	43.94	51.42	0.05
2006	50.92	63.04	50.36	0.00	51.64	42.40	52.05	0.01
2007	51.79	62.16	51.24	0.00	52.09	44.15	52.48	0.01
2008	52.35	61.42	51.77	0.00	52.71	38.11	53.66	0.00
2009	51.80	60.41	51.23	0.00	52.76	36.72	53.89	0.00
2010	52.22	60.51	51.51	0.00	53.81	38.62	55.00	0.00
2011	52.44	62.12	51.69	0.00	53.69	40.49	54.84	0.00
2012	51.96	61.49	51.11	0.00	53.65	45.06	54.47	0.00
2013	52.11	62.79	51.36	0.00	53.75	42.51	54.91	0.00
2014	54.26	63.64	53.67	0.00	54.84	45.00	55.86	0.00