Does Corporate Environmental Responsibility Create Value?: Evidence from Court Rulings*

Taehyun Kim†
Chung-Ang University
taekim@cau.ac.kr

Yongjun Kim‡
University of Seoul
jkim@uos.ac.kr

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Abstract

We the impact of corporate environmental responsibility (ER) actions on firm value, using two 5-to-4 Supreme Court rulings. We adopt an event studies approach and demonstrate that firms experience a positive market reaction when they are expected to increase their ER activities. We observe that the market reactions to these actions are greater for firms that are under greater pressure from the Court decisions. Furthermore, we find that these return patterns are most pronounced among firms located in regions with high levels of social trust, where stakeholders appreciate ER the most. Firms that were required to reduce toxic chemical emissions show positive earnings surprises, higher revenue and profitability, and greater capital inflow from institutional investors with longer investment horizons. In sum, we present empirical evidence that the market views ER a necessary aspect of adapting to the increasing demands for sustainability in today's financial markets.

JEL classification: G11; G14; G32; G38; M14

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†Address: 84 Heukseok-ro, Heukseok-dong, Dongjak-gu, Seoul, 06974, Republic of Korea, Phone: 82-2-820-5627

‡Address: University of Seoul, 163 Seoulsiripdae-ro, Dongdaemun-gu, Seoul, Republic of Korea, 02504, Phone: 82–6490–2264

1 Introduction

In response to strong demands and pressure for environmental accountability and responsibility from investors and market participants, corporations are investing significant resources in environmental responsibility (ER) actions. Effective transition strategies can reduce risks related to climate change, stranded assets, and regulatory liabilities. Corporate ER actions can enhance brand equity, sales, human capital retention, and competitive positioning (see eg., Currie et al. (2014); Flammer (2015a); Flammer (2015b); Albuquerque, Koskinen, and Zhang (2019)). However, managing environmental impacts requires substantial resources from firms.

Governments also play a crucial role in the environmental, social, and governance (ESG) landscape. A fundamental question in this context is whether the costs or benefits of environmental sustainability outweigh the other, which shifts the focus to tallying the net cost of serving environmental responsibility. Understanding this will help inform policy implications of stricter environmental regulations. This study evaluates whether and how shareholders benefit financially from firms' engagement in pollution abatement.

We analyze two opposing Supreme Court rulings that reshaped regulatory limits of environmental regulations in the U.S. to isolate the causal effects of ER actions on firm value. As these narrowly-decided rulings create plausibly exogenous and unexpected shocks to a firm's pollution abatement practices, the market's reaction to these rulings offers a useful setting for examining this causal relationship. We employ event study methodology to analyze announcement returns following the two rulings, finding that improvements in ER create shareholder value. When the Court expands environmental laws' scope, firms with inadequate ER investments before the ruling have stronger incentives to "go green" after the ruling, resulting in higher value compared to already greener firms.

We employ an event studies methodology to examine announcement returns following two 5-to-4 Supreme Court rulings. We find that improvements in ER create shareholder value. When the Court widens the scope of environmental laws, firms lacking adequate ER investments before the ruling gets to have stronger going green incentives after the ruling. These firms gain more value compared to firms that are already greener. Furthermore, our CAR analysis reveals that the CAR pattern persists over a 20-day window and does not revert.

Conversely, we find that "brown" firms experience a decline in value when no longer required to strengthen pollution abatement. Specifically, when a Court's ruling restricts and narrows the regulatory capacity of an existing regulation, brown firms are negatively impacted. This is

because the market perceives that firms lacking adequate ER investments prior to the ruling will no longer have an incentive to improve their environmental performance. Overall, our results suggest that the impact of Court rulings on firm value depends on whether they strengthen or weaken firms' incentives to adopt greener production processes. When the Court ruling strengthens the incentive, they gain value. But, when the ruling weakens the incentive, they lose value. Our results are consistent with Karpoff, John R. Lott, and Wehrly (2005) highlighting the critical role of legal and regulatory penalties in impacting firm value. Our findings also align with the predictions of a model that suggests positive surprises in ESG demands cause green stocks to outperform, and green firms carry higher realized returns (Pastor, Stambaugh, and Taylor (2021)).

Evidence from field surveys suggests that participants' strong social preferences are the main driver of investors' preference toward green firms and socially responsible investing (SRI) (Bauer, Ruof, and Smeets (2021)). To test this channel of social preference of investors are at work in our context, we examine whether and how the level of social trusts are associated with the value responses associated with court rulings.

We also find that announcement returns of green vs. brown firms following the two Court rulings are more pronounced among firms headquartered in regions with high social trust level. Investors in such regions penalize environmental irresponsibility more severely, suggesting that local stakeholders and investors with higher social trust levels pay more attention to firms' contributions to environmental protection.

We subsequently explore the long-term consequences of improved pollution abatement. Our analysis indicates that firms more actively engaged in pollution abatement experience higher Tobin's Q, cash flow, revenue, and gross profitability (Novy-Marx (2013)). Moreover, these firms also exhibit positive earnings surprises. Shares in cleaner firms are more likely to be held by investors with longer horizons. By providing empirical evidence suggesting the channels through which ER actions contribute to increased firm value, we contribute to the ongoing debate on the value of ESG initiatives.

Despite considerable attention being paid to ESG activities and investor demand for SRI, there is no clear evidence as to whether ESG creates shareholder value. Some investors consider ESG movements as politically motivated rather than effective investment risk management. Some studies find that ESG activities are value-destroying and driven by managerial entrenchment (Di Giuli and Kostovetsky (2014); Krüger (2015); Cheng, Hong, and Shue (2016); Masulis and Reza (2015)). Servaes and Tamayo (2013) found that the positive relationship between ESG

and Tobin's Q disappears once firm-level fixed differences are controlled for. Riedl and Smeets (2017) find that investors in socially responsible mutual funds earn a significantly lower rate of returns and pay higher management fees. On the other hand, Lins, Servaes, and Tamayo (2017) argue that CSR is a way to build the social capital of a firm, enabling it to weather the loss of overall market trust.

Our study adds to the body of research studying the value of ESG actions and environmental regulations. By examining the market value of ER and exploiting Court rulings as a setting, we provide insights into the likely causal relationship between ER actions and firm value. We recognize the challenges in studying the value implications of corporate ER or ESG due to potential positive associations between CSR adoptions and other organizational changes that can boost firm value. One advantage of our setting, which uses Court rulings, is that they are less likely to be driven by firm characteristics. The event study setup also offers advantages in this regard because it is unlikely that firms adopt other major changes in organizational processes during short event windows. Second, a significant difficulty involved in the literature is that it is unclear how we should quantify ESG activities. Our focus on the granular data of corporate pollution abatement to construct a quantitative proxy of corporate ER tactic is useful, as pollution emissions are regulated by strict and uniform reporting rules. Third, our analysis highlights that ER demands of market participants play an important role. Relatedly, Chowdhry, Davies, and Waters (2018) and Dyck et al. (2018) show that ESG-conscious investor ownership incentivizes profit-driven firms to pursue ESG goals, and these investors are more likely to invest in firms with potentially higher ESG value. Krueger, Sautner, and Starks (2020) provide evidence based on novel survey data suggesting a significant fraction of institutional investors incorporate firms' ESG aspects and climate actions into their portfolio formation, with stronger demand among investors with longer horizons (Starks, Venkat, and Zhu (2017)).

A majority of investors are reported to derive utility from directing capital to cleaner, environmentally responsible firms (Hartzmark and Sussman (2019);Bauer, Ruof, and Smeets (2021)). In the presence of investors and governments who emphasize good ER performance, less-polluting firms enjoy an increased capital supply in financial markets and/or government credit support. This credit supply channel can be a source of value for firms with strong CER activities. Supporting this hypothesis, we find that greener firms attract more institutional investors with longer horizons ("dedicated investors," classified in Bushee (2001)). Our results suggest that environmentally conscious investors and corporations do not need to trade wealth for non-monetary benefits.

The remainder of this paper is organized as follows. Section 2 presents the details of the data used in our analysis. Section 3 describes the empirical design of the event study analysis. Section 4 presents the primary empirical results. Section 5 provides the results and suggests channels of influence that explain the main results. Section 6 concludes.

2 Data and summary statistics

In this section, we describe the data sources and construction of the main variables.

2.1 Pollution abatement

As a federal government agency established in 1970, the EPA's mission is to protect human health and the environment. The EPA has the authority and responsibility to maintain and enforce a variety of environmental laws, and it works closely with U.S. states and local governments. The Office of Enforcement and Compliance Assurance (OECA) of the EPA oversees the enforcement of national environmental laws through civil and criminal enforcement. The OECA works with EPA's regional offices and state governments. The violation of environmental regulations or laws triggers civil or criminal trials and penalties. The legal standards for distinguishing between criminal and civil enforcement depends on whether a responsible party committed a "knowing violation" of the law[1]. "Knowing violations" include intentional decisions to dispose of or dump pollutants into a river without permits and failing to install required air pollution control devices. By contrast, a civil violation may be caused by an accident or mistake.

Pollution emissions data are available from the Toxics Release Inventory (TRI) program administered by the EPA during from 1990 to 2015.[2] The TRI program oversees all production facilities in a TRI-reportable industry and sector within the U.S. as long as the facility manufactures or processes TRI-listed chemicals. Any facility in the U.S. within a TRI-reportable industry sector must submit a TRI report containing detailed information about its waste management practices, as long as the facility operates with 10 or more employees and manufactures

[1] `https://www.epa.gov/enforcement/basic-information-enforcement`

[2] A significant drawback of TRI data that is downloadable from the EPA website is survivorship bias. When a TRI facility ceases operations, the toxic emissions data from previous years for that facility vanishes as well. After discussing with EPA staff, we acquired TRI data *devoid of* survivorship bias from the individual overseeing the data program at the EPA. It is an unbalanced panel of facilities that have been under the TRI's monitoring.

or processes TRI-listed chemicals in amounts greater than the quantity threshold posted by the EPA. The TRI report includes information on the final release of toxics through the air, water, or landfills.

Considering the profound public health impact of toxic chemical emissions, TRI reporting rules and processes are strictly monitored by the EPA. The EPA conducts an extensive quality analysis of the data reported to the TRI and provides analytical support for enforcement efforts led by the OECA. The EPA first identifies TRI forms containing potential errors and then contacts the facilities that have submitted them. If errors are confirmed, the facilities submit the corrected reports. The EPA also uses the Office of the Inspector General, which conducts audits to prevent and detect fraud and abuse in the TRI program.[3]

In our empirical exercises, we focus on the total quantity of toxic releases, which is the amount of toxic chemicals disposed of directly into the environment. We consider toxic releases regulated under the Clean Air Act (CAA), given its wide-ranging influence and capacity to regulate daily emissions of pollutants in the U.S..

The EPA outlines waste management guidelines in the "Waste Management Hierarchy." Source reduction is the preferred method of waste management, because it is best prevented or reduced at the source. By replacing toxic inputs with cleaner raw materials, source reduction eliminates of toxic byproducts from the beginning of the production process. Firms are expected to fully engage in recycling, energy recovery, and treatment to reduce toxic byproducts.[4] After such intermediate processes are carried out, firms will have to release toxic chemicals for direct disposals via landfills, water discharge, and air releases. Although direct disposal is the least expensive waste management method, it is environmentally harmful. The EPA calls for direct disposal as a last resort.

2.2 Trust

To measure the level of social trust among residents across the U.S. we use data from the General Social Survey (GSS) from 1990 to 2015 (Lins, Servaes, and Tamayo (2017); Kapons et al. (2022)). The survey is administered by a non-partisan and objective research organization

[3]Section 325(c) authorizes civil and administrative penalties for noncompliance with TRI reporting requirements. Section 1101 of Title 18 of the U.S. Code makes it a criminal offense to falsify information given to the U.S. Government (including maintaining intentionally false inspection records).

[4]Recycling consists of activities through which discarded toxic chemical in waste is put for reuse. Energy recovery is the process of generating energy from the combustion of toxic chemicals. Treatment involves alteration and destruction of toxic chemical properties of hazardous materials.

at the University of Chicago, known as the NORC, with principal funding from the National Science Foundation. The survey was conducted annually from 1990 to 1994 and biannually since 1996.

We identify a firm's local stakeholders as residents of the region in which the firm is headquartered. We gauge the trust level of local stakeholders in each region by considering the respondents' answers to the question, "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" The multiple choices include "Most people can be trusted," "Can't be too careful," "Depends," "Don't know," or "Refused." We take the fraction of local respondents whose answers are "Most people can be trusted" as an index of local stakeholders' trust level in a given year.

2.3 Lobbying expenditure

Under the Lobbying Disclosure Act of 1995, lobbying firms must disclose their income and organizations with in-house lobbyists must disclose all compensation paid to the hired lobbyists. The data are available from 1998.

2.4 Financial statements

We obtain firm-level accounting information from the annual tape of Standard & Poor's Compustat and stock market information from the Center for Research in Security Prices (CRSP). We link the EPA TRI parent company information with the Compustat/CRSP databases using a name-matching algorithm. We obtain historical company names and addresses from the CRSP, as well as 10-K, 10-Q, and 8-K filings using the SEC Analytical Package provided by the Wharton Research Data Service. Data on institutional ownership reported in the 13F filings are from Thomson Reuters.

2.5 Construction of variables and summary statistics

Our final sample includes 1,551 U.S. public firms using data from 1990 to 2015. Table 1 presents the summary statistics for the firm-level observations of our sample. Our main focus variable is $\Delta Toxic$, which captures annual innovations in corporate ESG actions and commitment to sustainable growth. $\Delta Toxic$ is defined as annual changes in total amounts of toxic chemical releases discharged as direct disposal from all facilities owned by a firm scaled by

sales to account for the overall production level. We label $\Delta Toxic$ as *CER Gap* capturing the intensity of ER demands imposed on a firm. Appendix A provides details on the construction of the variables used in the analysis.

3 Experimental design

In this section, we elaborate our identification strategy to explore the causal relationship between CER actions and firm value. Exploiting two legislative events, we employ event studies analysis to evaluate regulatory changes with reference to stock market data (Schwert 1977, 1981).

3.1 Legislative events

We use two Supreme Court rulings that largely re-defined the scope of the EPA's regulatory authority. These rulings were 5-to-4 decisions and our results show that the rulings contain significant unexpected information.[5]

We believe that Supreme Court rulings provide an ideal quasi-experimental setting for our study for several reasons (Larcker, Ormazabal, and Taylor (2011); Cohen and Wang (2013)). First, we are able to identify event dates precisely. Legislative events, especially those pertaining to Supreme Court rulings, have more salient announcement dates than regulatory events. Environmental rules tend to go through multiple rounds of an extensive process in which feedback from various sets of interests groups and citizens is heard before the law is finalized. These intermediate processes attenuate the surprise information contained in the announcement of the enactment of a final rule. Second, a Court ruling lays out expected changes in regulations and proposed changes are both material and "binding," which implies substantial treatment effect.

Third, two Court ruling events affect the expected intensity of pollution abatement in opposite directions. When the Court rules in favor of the EPA's regulatory authority and, in effect, extends the scope of environmental laws, we can infer the value of adopting cleaner production processes by observing stock market reactions around Court rulings. Similarly, when the Supreme Court rules in favor of restricting the breadth or intensity of regulations, we infer

[5]If the market had partially anticipated the Court rulings before the announcements, our results would underestimate the value of the cleaner production practices.

a value change resulting from the expected adoption of lax environmental regulations and the resulting rollback in pollution abatement.

Finally, our empirical setting is advantageous because our pollution emissions data guide us in identifying a set of firms that are affected to a larger extent by a ruling than another set of firms that are affected to a lesser extent. We exploit cross-sectional variations in the degree of expected changes in pollution abatement driven by the same Court rulings. We expect the effects of Court rulings to be more pronounced for firms with the widest discrepancy between existing pollution abatement and the new standard declared by the Court.

3.2 The April 2, 2007 Supreme Court ruling

In Massachusetts v. EPA, the Supreme Court found that the EPA has the authority to regulate greenhouse gas and carbon dioxide emissions as pollutants under the CAA (Sugar (2007)).[6] This was a 5-to-4 decision. The case set the stage for greenhouse gas regulations and was a major win for environmentalists. Before the ruling, the U.S. had not regulated greenhouse gas emissions, as the EPA held that greenhouse gas emissions lay beyond their statutory authority under the CAA. Justice John Paul Stevens delivered the opinion for the Court, observing that "greenhouse gases fit well within the CAA's capacious definition of air pollutants." It was a landmark decision and is widely considered one of the "most important environmental decisions in years."[7]

3.3 The June 29, 2015 Supreme Court ruling

In Michigan v. EPA, the Supreme Court found that the EPA "unreasonably" interpreted the CAA when it declined to consider compliance costs to the industry in determining the regulatory threshold for toxic chemical emissions. The Court ruled that the EPA violated the CAA when it refused to consider such costs. This was a 5-to-4 decision. Although the EPA argued that the health benefits of the rule outweigh the costs to industry, the ruling ordered the EPA to scale back its regulations.[8]

[6]CAA section 302(g), in relevant part, defines an air pollutant as an "air pollution agent or combination of such agents, including any physical, chemical, biological, radioactive substance or matter that is emitted into or otherwise enters the ambient air."

[7]https://www.nytimes.com/2007/04/03/washington/03scotus.html

[8]The EPA argued that "the public gets 9 dollars of health benefits for every 1 dollar the industry spends."

3.4 Methodology

We adopt an event study framework to examine the abnormal returns surrounding the Court rulings to measure the net value creation driven by the expected change in equilibrium pollution abatement practices. We consider the abnormal returns ($AbRet$) earned over the event window above and beyond the expected returns predicted by the CAPM and the Fama-French three-factor models. To compute abnormal returns, we first use daily returns for 36 months prior to the month before the event to obtain a firm's expected returns based on the CAPM and Fama-French three-factor models (Dimson (1979)). We then obtain the abnormal returns for each stock by subtracting the expected returns from the realized returns during the event window. Specifically, we estimate the following model:

$$AbRet_i = \alpha + \beta * CER\ Gap_i + Ctrls_i + FE + \epsilon_i. \tag{1}$$

where $CER\ Gap$ is the annual change in a firm's log level of emissions of CAA-regulated toxic pollutants and captures the extent to which firms invest in corporate environmental responsibility. $Ctrls$ is a vector of control variables including the logarithm of total assets ($log(Assets)$), market leverage ratio ($Leverage$), tangibility ($Tangibility$), and Tobin's Q ($Tobin's\ Q$). FE indicates the industry fixed effects based on the Fama-French 48-industry classfication.

We consider two alternative event windows. We first construct an event window from one day prior to the date of the ruling to three days after it. We then consider an event window from one day prior to the date of the ruling to five days after the ruling. We include one day prior to the actual event date to examine event returns and allow the market to acquire information prior to the actual events. We also follow the custom that the period of interest often encompasses multiple days (MacKinlay (1997)).

4 Results

We examine the extent to which CAR differs across firms with heterogeneous pollution abatement levels.

4.1 Market reactions and CER gap

We examine the cross-sectional variations in market reactions depending on the implied changes in the greenness of the manufacturing process caused by a Court decision, using Equation 1. We measure a firm's investment in CER by *CER Gap*, which is based on the quantity of toxic emissions each year. Because the 2007 Supreme Court ruling transforms the scope of the CAA, we use the *CER Gap*, which is based on the quantity of toxics regulated under the CAA, as a measure to gauge a firm's existing commitment to sustainability. For its part, the 2015 Supreme Court ruling also changed the intensity of the EPA's enforcement of the CAA. Therefore, we use the *CER Gap* computed based on the amounts of toxic chemicals regulated under the CAA. It is useful to have a precise quantity measure of degrees of sustainability, as this allows us to identify a "treatment" group of firms that needed to change their ESG actions to a greater extent than the "control" group of firms did following an identical Court ruling.

Firms with a higher level of *CER Gap* exhibit weaker CER performance. The coefficient of interest is β. Our hypothesis is that the more polluting a firm is, the larger is the implied benefit of implementing changes in the production process caused by the Court ruling. Thus, we expect β to be positive because the ruling causes firms with a higher level of *CER Gap* to take measure to reduce their pollution abatements to a greater extent than non-polluters. We find empirical support for this prediction.

Following the April 2, 2007 ruling, we observe significant movements in the stock prices of firms reporting to the EPA's TRI program. On average, these firms gained a raw return of 1.6% over the four-day event window. We examine whether market reactions to the Court ruling vary according to a firm's existing pollution abatement intensity. These results are consistent with the prediction of an equilibrium model, as demonstrated by Pastor, Stambaugh, and Taylor (2021), who predict that green stocks outperform when positive ESG shocks occur.

We estimate Equation (1) and report the results for cross-sectional variations in announcement returns in Panels A and B of Table 2. We present the results for the four-day event window in Panel A and the six-day event window in Panel B. Stock price reactions are approximately 17% higher for a standard deviation increase in *CER Gap* for an average firm in the TRI sample. Coefficient captures within-industry variations. These results are robust when alternative event windows are considered.

Next, we examine abnormal returns following the June 29, 2015 ruling. On average, firms conducting TRI reporting lose of 2.2% over the four-day event window. We then examine the

cross-sectional variations in stock price reactions by estimating Equation (1). The coefficient of interest is β in model 1. We expect β to be negative because the ruling would require firms with a higher level of *CER Gap* firms to improve their pollution abatement to a greater extent than firms with better performance in pollution abatement. Firms with a higher level of *CER Gap* have not made sufficient investment in cleaner procedures than peer firms with a lower level of *CER Gap*; weaker regulations allowed by the ruling may cause firms with a higher level of *CER Gap* to continue to neglect their investment in clean production practices.

Consistent with this prediction, high *CER Gap* firms fared worse in the stock market than other firms. The results are reported in Panels A and B of Table 3. We find that a standard deviation increase in *CER Gap* delivers 16% lower returns during the event window for an average firm in the TRI sample during the four-day event window. Coefficients captures within-industry variations. As shown in Panel B of Table 3, we find consistent results when we examine cumulative abnormal returns over a six-day window.

Furthermore, we examine the CAR dynamics over a 20-day window to ensure the short-run CAR results do not disappear immediately. In Figure 1 and Figure 2, we present the difference in CAR between firms with high *CER Gap* and low *CER Gap*. Our analysis reveals that the CAR pattern persists over a 20-day window and does not revert.

We find that firms gain value when they are expected to go green. These results suggest that the value consequences of ER are related to the expected regulatory liabilities and compliance costs, including clean-up and recovery costs after accidents. The value of firms with environmental concerns is likely lower than that of firms conducting CER. Firms falling short of their CER investments may need to incur significant compliance and litigation costs when unanticipated environmental disasters occur (Esty and Winston (2006); Darnall, Henriques, and Sadorsky (2010)). Even in the absence of environmental accidents, investors may discount firms with environmental concerns because of the anticipated compliance costs associated with future regulation.

Therefore, firms that do not fully invest in ER are discounted from the market before the arrival of stricter regulations. When the Supreme Court ruling arrives, the regulatory shock is realized. Firms that have previously underinvested in CER are expected to increase their CER to comply with new trends in regulations. With this expected increase in environmental sustainability investments, the prices of these firms increase. The results are consistent with those reported by Tang and Zhang (2018). By studying a sample of green bond issues in 28 countries, the authors show that green bond issuers experience positive stock returns following

news announcements of green bond issues.

4.2 Social trust

We investigate differential stock price reactions to the Court rulings based on social trust. We estimate Equation (1) separately for firms located in regions with high social trust and those located in regions with low social trust. Trust and cooperative norms represent social capital. We hypothesize that firms located in regions with high levels of social trust will experience more intense stock price reactions around the Court rulings. Firms investing in CER actions decide to avoid free-riding and choose to internalize the negative externalities imposed on society. People characterized by higher social trust are likely to have stronger preferences for corporate ESG and CER actions, and such investors tend to be more keen on and appreciative of changes in CER actions (Choi, Gao, and Jiang (2020)). Therefore, we expect firms facing local investors to be more sensitive to the Court rulings.

The results are presented in Tables 4 and 5. When the Court delivers rulings requiring changes in corporate environmental policies, investors who value ESG actions to a greater extent tend to respond more strongly. Consistent with this hypothesis, we find that stock market reactions to the two Court rulings are stronger in firms located where local residents have high levels of social trust. In other words, firms located in regions with stronger community concerns may face stronger pressure to be environmentally responsible (Dyck et al. (2018)). In return, stakeholders can compensate these firms by showing stronger consumer loyalty or providing capital at a lower cost to environmentally responsible firms. These results imply that the utility functions of agents link ER and asset prices (Baker et al. (2018); Baldauf, Garlappi, and Yannelis (2020)).

4.3 Lobbying

One might be concerned that the effects of Supreme Court rulings are captured by the lobbying efforts of interest groups, which would imply that any regulatory changes directed by a Court ruling should benefit firms with stronger lobbying influence at the expense of firms lacking such lobbying influence. To address this alternative story, we construct an indicator variable, *Lobbying Firm*, which takes the value of 1 if a company incurs positive lobbying expenditure or hires lobbyists in the year prior to the ruling and 0 otherwise. The results are

reported in Panels A and B of Tables 6 and 7. We include the lobbying indicator in regression model 1 as a control variable and find that the main effects are not subsumed by the lobbying indicator. Announcement returns are higher for firms expected to show a larger change in the greenness of their production processes, and the differential value effects are not driven by firms' lobbying efforts.

Overall, we find empirical support for our predictions regarding the value of engaging in cleaner production practices. Our results show that the stock market largely recognizes the social costs of the negative externalities associated with the environmental costs of modern production.

5 Channels and mechanisms

5.1 Future firm performance

To investigate the potential channels for the value of CER, we examine whether polluting behavior affects firm value and operating performance. If our proposed pollution abatement measure captures value-enhancing investments in firm sustainability, we should observe an increase in the firms' subsequent performance. To test this hypothesis, we examine the yearly changes in cash flow and gross profitability as measures of changes in operating performance.

As an additional channel through which greener firms create value, we consider changes in institutional ownership using 13F filing data from Thomson Reuters. The rationale behind this strategy is to investigate whether cleaner firms attract institutional investors, who are relatively long-term investors, resulting in the return outperformance documented in the previous section. To achieve this, we implement the following panel regression:

$$\Delta Y_{i,t+1} = \beta * \Delta CER\ Gap_{i,t} + Ctrls_{i,t} + FEs + \epsilon_{i,t+1}. \tag{2}$$

For the control variables, we add the logarithms of total assets, leverage, tangibility, and Tobin's Q. In all specifications, we include industry (based on the Fama-French 48-industry classification) and year-fixed effects. Standard errors are clustered at the industry level.

Table 8 presents the results of the panel regression. Columns (1) and (2) present the changes in operating profits as a consequence of toxic releases. We find significant and negative coefficients for *CER Gap*, indicating that polluting firms tend to exhibit poorer operating

performance. A similar finding is found for gross profitability, and the results are reported in Columns (3) and (4). We find that greener firms perform better by delivering higher gross profitability the following year. A one-standard-deviation increase in *CER Gap* predicts a decrease in gross profitability of -0.37% (column (3)). To further examine the mechanism behind the outperformance of greener firms, we decompose gross profits into revenue and cost and evaluate the relative importance of cost reduction and revenue enhancement. The estimated results, reported in Columns (5) to (8), suggest that an increase in revenue drives an overall change in gross profitability.

Finally, we present results showing that institutional investors reduce their holdings in firms with deteriorating CER investments. Columns (1) and (2) of Table 9 show that, on average, institutional investors reduce their holdings in toxic firms after an increase in the amount of toxic material releases, as represented by the negative coefficient estimate on *CER Gap* although it is not statistically significant. We then separate institutional holdings into two groups based on Bushee's (2001) classification: long-term (i.e., "dedicated" institutions) and short-term (i.e., "transient" institutions) investors. We present the results in columns (3) to (6) of Table 9. Greener firms tend to attract more capital from institutional investors who prioritize long-term value creation. The results pertaining to changes in the average percentage of ownership held by institutional investors, shown in column (1), seem to be driven mainly by changes in holdings by institutional investors with relatively longer investment horizons rather than investors with shorter investment horizons. These results are consistent with the findings of Nofsinger, Sulaeman, and Varma (2019) that institutional investors underweight firms with environmental and social concerns.

6 Conclusion

Our study finds that firm-level ER actions have important implications for managers and investors. Using highly granular data on pollution emissions from production facilities, we present empirical evidence consistent with the market viewing ER as leading to higher firm value. Our results suggest that socially conscious managers and investors need not trade shareholder value for ER.

We first examine the market reactions around two Supreme Court rulings that change the trajectory of average pollution abatement in the U.S. When a firm's incentives to serve

ER become stronger because of an unexpected Court ruling, those firms gain value upon the announcement of the ruling. When a firm's incentives to go green become weaker due to the Court ruling, those firms lose value. These results indicate that ER enhances firm value. This value can be driven by changes in the expected regulatory liabilities and product market performances such as sales and profitability. This value can also be created by the capital flows held by investors with ESG preferences. When a significant fraction of investors and government-backed programs provide capital to firms with stronger ER, ER actions can reduce the firms' cost of capital. The two channels of value gains are not mutually exclusive.

Announcement returns around the Court rulings are greater for firms located in regions where residents exhibit higher levels of social trust. These results imply that stakeholder preferences play a key role in linking the CER to subsequent returns. Our paper finds that firm-level CER actions have important implications for managers and investors.

Furthermore, we examine whether pollution abatement is associated with financial performance and valuation in the long run. We find that firm-level toxic releases are negatively correlated with Tobin's Q, cash-flow profitability, gross profitability, and long-term investments among institutional investors in the following year. Moreover, firm-level sustainability is positively related to positive earnings surprises.

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Figure 1: CAR Dynamics - 2007 Ruling

This figure indicates that the CAR persists over the 20-day window following the ruling. It highlights the differences in CAR dynamics based on firms' pre-ruling corporate ER. We calculate the CAR starting from one day prior to the ruling. The x-axis represents the number of days after the Supreme Court ruling. We obtain the differences in CAR by subtracting the CAR of firms in the low *CER Gap* group from that of firms in the high *CER Gap* group. The firms are divided into two groups based on the magnitude of $\Delta Toxic$, which is *CER Gap*. Firms fall in high *CER Gap* group when the level of $\Delta Toxic$ is above the median value of $\Delta Toxic$ in 2006. Firms fall in low *CER Gap* group when the level of $\Delta Toxic$ is below the median value of $\Delta Toxic$ in 2006. The CAR pattern is similar when we adjust for expected returns based on factor models.

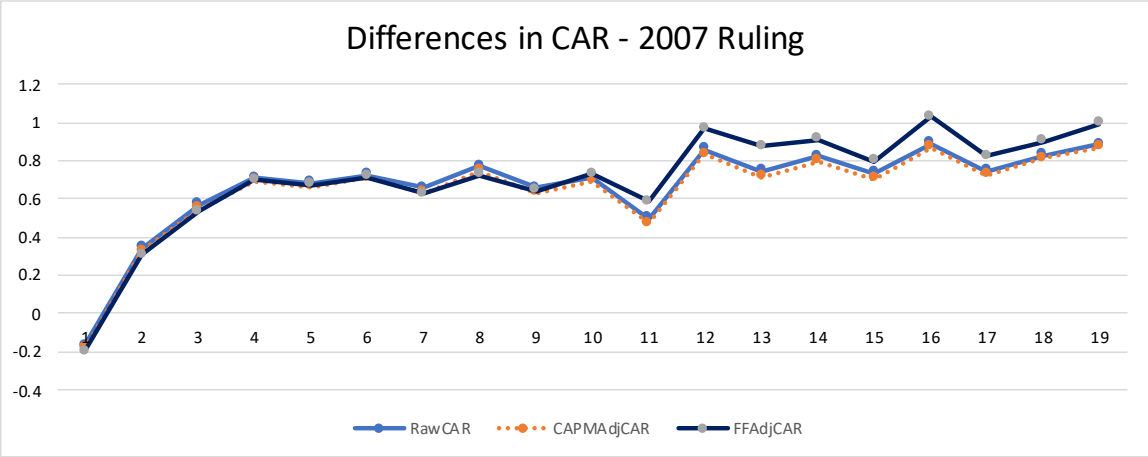

Figure 2: CAR Dynamics - 2015 Ruling

This figure indicates that the CAR persists over the 20-day window following the ruling. It highlights the differences in CAR dynamics based on firms' pre-ruling corporate ER. We calculate the CAR starting from one day prior to the ruling. The x-axis represents the number of days after the Supreme Court ruling. We obtain the differences in CAR by subtracting the CAR of firms in the low *CER Gap* group from that of firms in the high *CER Gap* group. The firms are divided into two groups based on the magnitude of $\Delta Toxic$, which is *CER Gap*. Firms fall in high $\Delta Toxic$ group when the level of $\Delta Toxic$ is above the median value of $\Delta Toxic$ in 2014. Firms fall in low $\Delta Toxic$ group when the level of $\Delta Toxic$ is below the median value of $\Delta Toxic$ in 2014. The CAR pattern is similar when we adjust for expected returns based on factor models.

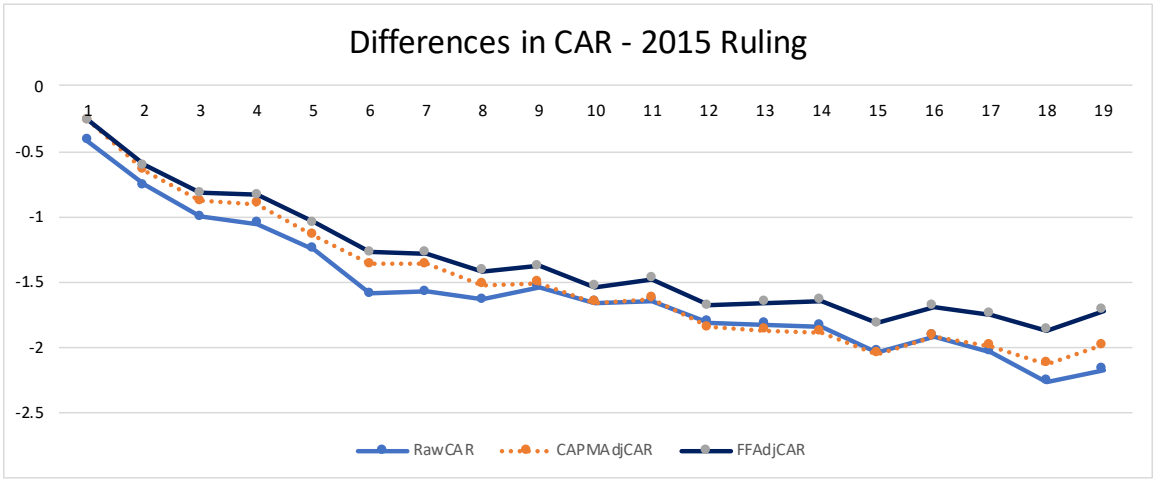

Table 1: Summary Statistics

This Table reports the summary statistics of sample. The sample includes firms with both EPA and financial data available from 1990 through 2015. All variables are defined in the Appendix A and are winsorized at 1% in both tails of the distribution.

	N	Mean	Median	SD	P25	P75
CER Gap	16896	-0.072	0.000	0.734	-0.229	0.097
log(Assets)	16896	6.926	6.860	1.880	5.591	8.196
Tobin's Q	16881	1.614	1.362	0.842	1.078	1.851
Leverage	16860	0.267	0.221	0.217	0.093	0.396
Tangibility	16896	0.351	0.306	0.201	0.199	0.462
Cashflow	16869	0.150	0.143	0.096	0.096	0.199
Capex/AT	16786	0.061	0.047	0.050	0.028	0.076

Table 2: Announcement Returns Following the 2007 Supreme Court Decision

This Table reports the results regarding stock price reactions around the April 2, 2007 Supreme Court Ruling. *CER Gap* is an indicator variable that takes the value of one when a firm's $\Delta Toxic$ in 2006 is above the median value for the sample of firms reporting to the EPA in 2006 and zero otherwise. $\Delta Toxic$ represents the annual change in a firm's log level of emissions of CAA-regulated toxic pollutants, which captures a firm's investment in ER prior to the ruling. Control variables include the log of total assets, the market leverage ratio, tangibility, and Tobin's Q. Standard errors are clustered at the Fama-French 48 Industry level. Parentheses enclose t-statistics. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Panel A: Cross-sectional Variations in CAR(-1,3)

	(1) RawRet(-1.3)	(2) CAPM-Adj(-1.3)	(3) FF-Adj(-1.3)
CER Gap	0.339***	0.343**	0.351***
	(2.97)	(2.65)	(2.85)
Observations	601	601	601
R^2	0.1676	0.1611	0.1628
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes

Panel B: Cross-sectional Variations in CAR(-1,5)

	(1) RawRet(-1.5)	(2) CAPM-Adj(-1.5)	(3) FF-Adj(-1.5)
CER Gap	0.480***	0.487***	0.498***
	(3.08)	(2.86)	(3.06)
Observations	601	601	601
R^2	0.1481	0.1454	0.1473
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes

Table 3: Announcement Returns around the 2015 Supreme Court Ruling

This Table reports the results for stock price reactions around the June 29, 2015 Supreme Court Ruling. *CER Gap* is an indicator variable that takes the value of one when a firm's $\Delta Toxic$ in 2014 is above the median value for the sample of firms reporting to the EPA in 2014 and zero otherwise. $\Delta Toxic$ represents the annual change in a firm's log level of emissions of CAA-regulated toxic pollutants, which captures a firm's investment in corporate ER prior to the ruling. Control variables include the log of total assets, the market leverage ratio, tangibility, and Tobin's Q. Standard errors are clustered at the Fama-French 48 Industry level. Parentheses enclose t-statistics. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Panel A: Cross-sectional Variations in CAR(-1,3)

	(1)	(2)	(3)
	RawRet(-1.3)	CAPM-Adj(-1.3)	FF-Adj(-1.3)
CER Gap	-0.559**	-0.533**	-0.501**
	(-2.71)	(-2.65)	(-2.52)
Observations	486	486	486
R^2	0.3592	0.3376	0.3000
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes

Panel B: Cross-sectional Variations in CAR(-1,5)

	(1)	(2)	(3)
	RawRet(-1.5)	CAPM-Adj(-1.5)	FF-Adj(-1.5)
CER Gap	-0.586**	-0.564**	-0.525**
	(-2.56)	(-2.57)	(-2.63)
Observations	486	486	486
R^2	0.4809	0.4673	0.3955
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes

Table 4: Trust and Announcement Returns around the 2007 Supreme Court Ruling

This Table reports the results for stock price reactions around the April 2, 2007 Supreme Court ruling. *CER Gap* is an indicator variable that takes the value of one when a firm's $\Delta Toxic$ in 2006 is above the median value for the sample of firms reporting to the EPA in 2006 and zero otherwise. $\Delta Toxic$ represents the annual change in a firm's log level of emissions of CAA-regulated toxic pollutants, which captures a firm's investment in ER prior to the ruling. Control variables include the log of total assets, the market leverage ratio, tangibility, and Tobin's Q. Standard errors are clustered at the Fama-French 48 Industry level. Parentheses enclose t-statistics. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Panel A: Announcement Returns in High Trust Regions

	(1)	(2)	(3)
	RawRet(-1.3)	CAPM-Adj(-1.3)	FF-Adj(-1.3)
CER Gap	0.391***	0.405***	0.440***
	(2.82)	(2.93)	(3.18)
Observations	389	389	389
R^2	0.2170	0.2077	0.2067
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes
Control	Yes	Yes	Yes

Panel B: Announcement Returns in Low Trust Regions

	(1)	(2)	(3)
	RawRet(-1.3)	CAPM-Adj(-1.3)	FF-Adj(-1.3)
CER Gap	0.252	0.217	0.201
	(1.12)	(0.85)	(0.83)
Observations	211	211	211
R^2	0.3131	0.3089	0.3153
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes
Control	Yes	Yes	Yes

Table 5: Trust and Announcement Returns around the 2015 Supreme Court Ruling

This Table reports the results for stock price reactions around the June 29, 2015 Supreme Court ruling. *CER Gap* is an indicator variable that takes the value of one when a firm's $\Delta Toxic$ in 2014 is above the median value for the sample of firms reporting to the EPA in 2014 and zero otherwise. $\Delta Toxic$ represents the annual change in a firm's log level of emissions of CAA-regulated toxic pollutants, which captures a firm's investment in corporate ER prior to the ruling. Control variables include the log of total assets, the market leverage ratio, tangibility, and Tobin's Q. Standard errors are clustered at the Fama-French 48 Industry level. Parentheses enclose t-statistics. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Panel A: Announcement Returns in High Trust Regions

	(1) RawRet(-1.3)	(2) CAPM-Adj(-1.3)	(3) FF-Adj(-1.3)
CER Gap	-0.677**	-0.647**	-0.618**
	(-2.60)	(-2.59)	(-2.55)
Observations	350	350	350
R^2	0.2565	0.2276	0.1904
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes
Control	Yes	Yes	Yes

Panel B: Announcement Returns in Low Trust Regions

	(1) RawRet(-1.3)	(2) CAPM-Adj(-1.3)	(3) FF-Adj(-1.3)
CER Gap	-0.168	-0.137	-0.062
	(-0.26)	(-0.22)	(-0.09)
Observations	136	136	136
R^2	0.6147	0.5930	0.5456
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes
Control	Yes	Yes	Yes

Table 6: Does Lobbying Explain the Announcement Returns Following the 2007 Supreme Court Decision?

This Table reports the results regarding stock price reactions around the April 2, 2007 Supreme Court Ruling. *CER Gap* is an indicator variable that takes the value of one when a firm's $\Delta Toxic$ in 2006 is above the median value for the sample of firms reporting to the EPA in 2006 and zero otherwise. $\Delta Toxic$ represents the annual change in a firm's log level of emissions of CAA-regulated toxic pollutants, which captures a firm's investment in ER prior to the ruling. Control variables include the log of total assets, the market leverage ratio, tangibility, and Tobin's Q. Standard errors are clustered at the Fama-French 48 Industry level. Parentheses enclose t-statistics. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Panel A: Cross-sectional Variations in CAR(-1,3)

	(1) RawRet(-1.3)	(2) CAPM-Adj(-1.3)	(3) FF-Adj(-1.3)
CER Gap	0.337***	0.339**	0.347***
	(2.91)	(2.58)	(2.79)
Lobbying	0.103	0.186	0.183
	(0.29)	(0.54)	(0.53)
Observations	601	601	601
R^2	0.1677	0.1616	0.1633
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes

Panel B: Cross-sectional Variations in CAR(-1,5)

	(1) RawRet(-1.5)	(2) CAPM-Adj(-1.5)	(3) FF-Adj(-1.5)
CER Gap	0.471***	0.476***	0.487***
	(3.03)	(2.75)	(2.97)
Lobbying	0.399	0.494	0.473
	(1.01)	(1.29)	(1.21)
Observations	601	601	601
R^2	0.1499	0.1481	0.1497
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes

Table 7: Does Lobbying Explain the Announcement Returns around the 2015 Supreme Court Ruling

This Table reports the results for stock price reactions around the June 29, 2015 Supreme Court Ruling. *CER Gap* is an indicator variable that takes the value of one when a firm's $\Delta Toxic$ in 2014 is above the median value for the sample of firms reporting to the EPA in 2014 and zero otherwise. $\Delta Toxic$ represents the annual change in a firm's log level of emissions of CAA-regulated toxic pollutants, which captures a firm's investment in corporate ER prior to the ruling. Control variables include the log of total assets, the market leverage ratio, tangibility, and Tobin's Q. Standard errors are clustered at the Fama-French 48 Industry level. Parentheses enclose t-statistics. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Panel A: Cross-sectional Variations in CAR(-1,3)

	(1)	(2)	(3)
	RawRet(-1.3)	CAPM-Adj(-1.3)	FF-Adj(-1.3)
CER Gap	-0.572***	-0.546**	-0.517**
	(-2.73)	(-2.66)	(-2.56)
Lobbying	-0.545	-0.542	-0.668
	(-1.30)	(-1.30)	(-1.56)
Observations	486	486	486
R^2	0.3621	0.3407	0.3050
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes

Panel B: Cross-sectional Variations in CAR(-1,5)

	(1)	(2)	(3)
	RawRet(-1.5)	CAPM-Adj(-1.5)	FF-Adj(-1.5)
CER Gap	-0.598**	-0.576**	-0.543***
	(-2.62)	(-2.63)	(-2.73)
Lobbying	-0.534	-0.531	-0.752*
	(-1.34)	(-1.36)	(-1.80)
Observations	486	486	486
R^2	0.4825	0.4689	0.3994
FF48 Ind FE	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes

Table 8: Financial Performance

This Table reports relationships between the CER measure, *CER Gap*, in year t and various performance measures in year $t+1$. The outcome variables are cash flow, gross profitability, revenue, and costs. Control variables include the log of total assets, the market-leverage ratio, tangibility, and Tobin's Q. Standard errors are clustered at the Fama-French 48-industry level. Parentheses enclose t-statistics. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)
	CF		GP	
CER Gap	-0.002***	-0.001**	-0.005***	-0.003***
	(-3.41)	(-2.37)	(-5.35)	(-3.81)
Observations	15062	15038	15088	15064
R^2	0.045	0.066	0.045	0.085
Controls	No	Yes	No	Yes
FF48 Ind and Year FE	Yes	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes	Yes
	(1)	(2)	(3)	(4)
	Rev		Costs	
CER Gap	-0.011***	-0.006**	-0.007**	-0.003
	(-3.41)	(-2.08)	(-2.59)	(-1.42)
Observations	15088	15064	15088	15064
R^2	0.056	0.104	0.053	0.095
Controls	No	Yes	No	Yes
FF48 Ind and Year FE	Yes	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes	Yes

Table 9: Institutional Investor Ownership

This Table reports relationships between CER measure, *CER Gap*, in year t and institutional ownership in year $t+1$. The outcome variables are proportion of ownership held by institutional investors (Institutional), institutional investors with longer investment horizons (Dedicated), and institutional investors with shorter investment horizons (Transient). Control variables include the log of total assets, the market-leverage ratio, tangibility, and Tobin's Q. Standard errors are clustered at the Fama-French 48-industry level. Parentheses enclose t-statistics. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Institutional		Dedicated		Transient	
CER Gap	-0.001	-0.001	-0.002**	-0.002**	-0.001	-0.001
	(-1.06)	(-1.18)	(-2.15)	(-2.26)	(-1.37)	(-1.12)
Observations	15024	15005	10203	10197	14459	14440
R^2	0.045	0.046	0.236	0.234	0.253	0.256
Controls	No	Yes	No	Yes	No	Yes
FF48 Ind and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
FF48 Ind Cluster	Yes	Yes	Yes	Yes	Yes	Yes

Appendix A: Variable construction

CER Gap is the difference between the log amount of total toxic releases in year t and t-1
$log(Assets)$ is the logarithm of total assets (at).
$Tobin's\ Q$ is defined as the market-to-book ratio, where the numerator equals the market value of equity ($prcc_f * csho$) plus the book assets (at) minus the sum of the book value of common equity (ceq) and deferred taxes and investment credit ($txditc$), and the denominator is the book value of assets (at).
$Leverage$ is the ratio of total outstanding debt ($dlcq + dlttq$) to the beginning-of-the-year book value of assets (at).
$Tangibility$ is the ratio of property, plant and equipment ($ppent$) to the beginning-of-the-year book value of assets (at).
CF, cash flow, is defined as income before depreciation and amortization ($oibdp$), scaled by the beginning-of-the-year book value of assets (at).
$Size$ is log of market capitalization ($csho * prcc_f$).
$Capex/AT$ is the ratio of capital expenditure ($capex$) to the beginning-of-the-year book value of assets (at).
GP, gross profitability, is revenue ($revt$) minus the cost of goods sold ($cogs$), scaled by the beginning-of-the-year book value of assets (at).
Rev is revenue ($revt$) scaled by the beginning-of-the-year book value of assets (at).
$Costs$ is the cost of goods sold ($cogs$) scaled by the beginning-of-the-year book value of assets (at).
$Institutional$ refers to the proportion of institutional holdings reported in 13-F filings.
$Dedicated$ is the proportion of dedicated holders according to Bushee (2001) reported on 13-F filings.
$Transient$ is the proportion of transient holders according to Bushee (2001) reported on 13-F filings.