Real Effects of Shareholder Proposals: Innovation in the Context of Climate Change

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ABSTRACT

Extant literature struggles to identify definitive purpose for shareholder proposals, finding them to depend on their context. Progressively, climate change has gathered interest at annual meetings where shareholders present proposals related to the subject. The literature builds expectations for the role of obsolescence, regulation, and other forms of activism to motivate innovation with respect to climate-related proposals. Our results indicate that firms respond positively to these proposals by producing more climate patents and citations. The real effect that shareholder proposals have on innovation gains clarity in the context of climate change, contributing to the discussion of investor "voice."

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1 Introduction

"[We are] not opining on whether the world's climate is changing, at what pace it might be changing, or due to what causes. Nothing that [follows] should be construed as weighing in on those topics. Today's guidance will help [our understanding of shareholder proposals.]"

> *~ as adapted from SEC Chairman Shapiro's opening comments in SEC press release "SEC Issues Interpretive Guidance on Disclosure Related to Business or Legal Developments Regarding Climate Change," Jan. 27, 2010.*

"New technology adoption requires a 'flywheel' of falling costs spurring higher demand, making manufacturing economies of scale and innovation possible, driving costs even lower."

> *~ Ip, G. (November 4, 2021) Why Financing the Multi-Trillion-Dollar Transition to Net Zero Isn't That Hard: Funding for a carbon-free economy is infinite if there's a revenue stream, says Bank of America's Brian Moynihan. Wall Street Journal*

Financial theory has often questioned how shareholders express concern over their investment, how they "voice" their opinions. (Cuñat, Gine, & Guadalupe, 2015; Admati and Pfleiderer, 2009). We add to the discussion by exploring shareholder-initiated proposals which express concern over climate change and global warming. In this setting, the real effect of "voice" on owner-agent separation can be gauged from subsequent changes in corporate behavior when firms receive these proposals. We find that firm innovation policies are responsive to shareholder proposals: patent volume and value increases along with R&D expense. Overall, we discover that agents listen to owners who "voice" their climate concerns.

The early finance literature failed to detect instances of value relevance or impact on corporate behaviors that shareholder proposals might have (Karpoff et al. 1996; Black,1998; Bizjak and Marquette, 1998). More recent literature attaches meaning to proposals dependent not only on issue raised (Ertimur, Ferri and Stubbens, 2010) but also on the activist raising it (Bauer, Moers and Viehs, 2015). Thus, "voice" gains volume depending on what is said and who says it. However, "voice" does not necessarily have to be heard at an annual meeting. The

120-day window, from the time proposals are sent to management until the annual meeting, gives owner and agent plenty of time to work out their differences. In this process we witness strategic importance of proposals (Carleton, Nelson and Weisbach, 1998), beyond the non-binding right to be heard as an owner and beyond the ability to exclude improper subject matter as agent: Shareholder proposals apply low-cost, unenforceable, strategic pressure on management.

Gillan and Starks (2007) explain that shareholders can express their dissatisfaction in various ways, as "a continuum of possible responses" to corporate policies and performance. Shareholder proposals lie far from the expensive investments required for corporate control and much closer to the ease with which selling shares expresses dissatisfaction. While corporate control brings more certainty that change sought will be implemented, it comes with a high hurdle of investment. Selling shares may also apply disciplinary pressure, but the easy "Wall Street Walk" (Admati and Pfleiderer, 2009) leaves much to the imagination over what prompts the sale. As a slightly more expensive step, shareholder proposals make explicit statements which can either resonate with other shareholders and the market or fall on deaf ears during the feedback loop. For these reasons, what makes shareholder proposals so interesting is their ability to persuade, to find consensus and convince, to ferret out a middle ground among owners and between them and agents (and to do so with as little as a $2,000 investment in 500 words).

With reference to where proposals fit in a continuum of shareholder responses, finance literature has developed an understanding around subject matter that is proper for action, beyond the prescriptions of rule 14a-8 (The Code of Federal Regulation) which provide guidance on how voice gains volume. Recent literature places shareholder proposals into various contexts of who is saying what. These contexts can range from internal (governance) matters to external (environmental and social) ones, sponsored by gadflies[2] and hedge funds alike. Absent context, shareholder proposals can have little impact. For example, Karpoff et al. (1996) argue that proposals could potentially mitigate shareholder-manager agency conflict and pressure managers to adopt value-increasing corporate policies. However, these authors find no evidence that proposals matter for valuation or influence corporate policies. Renneboog and Szilagyi (2011), based on Karpoff et al's insights, contend that the "reputational pressure" on management is more effective than the implementation of proposals. Recent theory by Levit and Malenko (2011) also attempts to explain the influence of proposals on conflicting interests. Without a sufficiently aggravated conflict or cost, there is little for a proposal to ameliorate. To our best knowledge, finance literature has not found that shareholder proposals can have real effects on innovation. Our general conjecture is that the literature may lack proper subject matter, and that climate change provides a rich context, one that has been exasperated at annual meetings.

The subject of climate change has gathered attention progressively at annual meetings. From the first proxy appearance of "climate change" in 1994 through the end of 2019, by visually inspecting each DEF 14A from Edgar and SeekEdgar searches for instances of "climate change", we identify 719 distinct proposals sponsored by shareholders at 246 different firms, spread over 113 different industries at the 4-digit SIC level. We confirm these observations with

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[2] As Gillan and Starks (2007) explain, certain individuals sponsor or co-sponsor a significant number of shareholder proposals. These "gadflies" continue to be a concern: the benefit of providing shareholders a voice comes at the expense of firm resources dedicated to compiling information. The SEC is currently conducting a roundtable discussion to weigh these issues. "Statement Announcing SEC Staff Roundtable on the Proxy Process," Chairman Jay Clayton: July 30, 2018. According to Gibson Dunn, one gadfly "submitted or co-filed the most shareholder proposals during the 2018 proxy season—187 or 24% of all proposals." p. 4, "SHAREHOLDER PROPOSAL DEVELOPMENTS DURING THE 2018 PROXY SEASON," July 12, 2018.

data provided by Institutional Shareholder Services (ISS). "Climate change," as an observation, ranges from a single mention (often in conjunction with other sustainable issues) to heated debates between shareholders and management, repeating the phrase 55 times throughout the annual proxy. Additionally, some firms receive a single proposal over the 25-year period, while one firm collected 48 proposals during this time. Likewise, some entire industries experience only a single proposal, while SIC 2911 "Petroleum Refining" receive 104 such proposals to date.

We believe that "climate change" as a context appears to be rich: the sample is large enough to be statistically meaningful and lengthy enough to have withstood fleeting popularity. Among all proposals sponsored by shareholders, those related to climate change are among the most popular. According to the Proxy Monitor, in 2017 "there are 52 proposals with environmental concerns, the largest number by type of proposal, and "most of these involved greenhouse gas emissions, 'portfolio risk' from climate-change regulation, or more general sustainability concerns" (Copeland and O'Keefe, 2017). In 2017, environmental proposals represent twice as many as those related to either voting rules, special meetings/written consent, executive compensation or proxy access. As of the end of February 2018, there are 70 climate change proposals that have been submitted, according to ISS Analytics (Papadopoulus, 2018), which comes in second to Lobbying and Political Contributions at 74 proposals. Although "climate change" is a focused environmental concern, the topic is important among different types of current shareholder-initiated proposals.

Still, what reason might there be for suspecting real effects on corporate behavior? We review the list of titles for climate-related proposals, which reveals that shareholders are requesting firms specifically to innovate. Further inspection of the proposals and management's responses clarifies that technological advancement is often suggested as means for firms to adapt their practices to accommodate society's demand for reduce carbon emissions. Aside from the explicit calls for innovation stated in climate-related proposals, the finance literature suggests that innovation is a likely response to these proposals for several reasons. While the bulk of innovation literature addresses growth in aggregate or at the firm level, shareholders referencing climate issues stress moving forward sustainably, and not only for value-maximizing motives but also to avoid potentially expensive consequences. Such concern harkens back to at least three, theoretical underpinnings. The first is rooted in Schumpeter's (1942) notion of creative destruction and economic obsolescence. Another owes to Porter's (1995) hypothesis that effective regulation can lead to competitive advantage. The third reason draws parallels from other forms of shareholder activism which have been shown to impact innovation (David, Hitt and Gimeno, 2001; Aghion, Van Reenen and Zingales, 2013; Brav et al., 2018). For these reasons, we expect a positive relationship between shareholder proposals and innovation.

Our results show a significant correlation between proposals related to climate change and innovation proxied by patents and R&D. These associations hold through regression with established controls, along with time and industry invariant factors. A matching estimator considers size, year and industry to narrows differences and allow for a more favorable comparison between firms which receive a climate proposal and those that do not. Once matched, the same highly significant, positive coefficients hold. A placebo test differentiates climate proposals from all other proposals to suggest that the context of climate change drives results instead of attribution to the proposals process. In all, the evidence suggests that the proposal process engenders shareholder voice and that this voice has gained volume when expressing climate concerns.

Our contributions are three-fold to the literature. First, while some research does study both shareholder proposals and climate change, we are unaware of any such research which discovers real effects such as innovation, in the context of climate change. While climate change has been addressed extensively in the economics literature contemplating the social cost of carbon (Kokoski and Smith 1987; Nordhaus 1990; Morgenstern 1991; Sohngen and Mendelsohn 1998; Stern 2006, 2008; Pindyck 2007, 2012; Daniel, Litterman and Wagner, 2016) most of the discussion in finance, with respect to climate change, involves information aggregation and disclosure. The climate change literature would benefit from a better understanding of firm-level response to shareholders expressing concern over the matter.

Second, shareholder proposals assist our understanding of shareholder activism, and a more general notion of persuasion over coercion as built into the constructs of 14a-8. Shareholder proposals are an explicit form of activism, but these explicit statements cannot demand firm action; they are precatory. With respect to the proxy process and the market for corporate control, Manne (1965) is among the first to struggle with the purpose of proposals. Likewise, Pound (1988) at first finds inefficiencies that he later (1991) balances against shareholder rights. Karpoff et al (1996) continue the search only to find it without effect. Gillan and Starks (2007) are careful to differentiate between initial excitement and long-term improvement. Levit and Malenko (2011) theorize why activists can improve information aggregation when conflicts are exacerbated. Such conflict, Renneboog and Szilagyi (2011) explain, leads to shareholder proposals expressing "reputational pressure" on management. Our paper contributes real effects to the list of activist outcomes achieved by gaining shareholder consensus to pressure corporate decision making.

Third, the literature continues to seek forces which motivate innovation and make it more efficient. The current paper finds shareholder proposals to be a motivator of innovation. By combining Schumpeter's rationale on creative destruction with Porter's competitive advantage of effective regulation, firms can be expected to adapt to climate change by innovating.[3] The finance literature on innovation develops along a top-down approach, from growth in aggregate (Solow 1956; Swan 1956; Romer 1986; Aghion, Reenen and Zingales 2013) to firm-level (Nelson 1959; Aghion and Triole 1994a, 1994b), where our understanding is greatly enhanced by proxies for innovation (Schmookler 1966; Griliches 1984; Hall, Jaffe and Trajtenberg 2001). From here, motivators are explored (Manso 2011; Chen, Leung and Evans 2016). The current paper contributes shareholder proposals to this expanding list of motivators for innovation. With the above contributions and evidence, this paper furthers our understanding of shareholder proposals and how firms are responding to the challenges that climate change poses.

The rest of the paper unfolds as follows: Section 2 develops expectations from the literatures for a testable hypothesis. Section 3 explains the data, the sample and variable

[3] Beyond theory, firms are already beginning to echo this sentiment. During the January 25, 2019, Fourth Quarter and Full-Year 2018 NextEra Energy, Inc. and NextEra Energy Partners, LP Conference Call, Jim Robo, Chairman and Chief Executive Officer of NextEra Energy, states: "We continue to believe that [these continued technology improvements and cost declines] will be massively disruptive to the nation's generation fleet and create significant opportunities for renewables growth well into the next decade." (p. 6).

construction. Section 4 describes the methodologies and interprets the results, section 5 concludes.

2 Literature Review and Hypothesis Development

Real effects on corporate behaviors belie corporate finance. To this end, we investigate the role of shareholder proposals as the impetus for change in corporate policies on innovation. Shareholders explicitly propose innovation through renewable means or other clean technologies,[4] but also doing so appropriately.[5] Consequently, the connection between climate-related proposals and innovation is straight-forward. While these proposals might appear benign on the surface, there could very well be an underlying, implicit threat, as Lin, Liu and Manso (2017) examine in their study of the effect that universal demand laws on derivative suit have on innovation. Although these authors find support for their "pressure hypothesis," they make a compelling case that the threat of shareholder litigation can serve as a good form of discipline, instead of the misalignment that derivative suits are shown to impose on managerial incentives to innovate. Shareholders directly request innovation on annual proxy statements and managers directly respond to climate-related proposals on DEF 14A that they *are* innovating.[6]

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[4] Two examples from the 2016 proxy season highlight shareholder demands for innovation. Shareholders of Ameren Corp proposed "ITEM (4): SHAREHOLDER PROPOSAL RELATING TO A REPORT ON AGGRESSIVE RENEWABLE ENERGY ADOPTION." Shareholders in AES Corp sponsored "PROPOSAL 4: A REPORT ON COMPANY POLICIES AND TECHNOLOGICAL ADVANCES" targeting the firm's energy policies and emphasis on renewable sources.

[5] For example, Proposal 7 on Google's 2015 annual proxy suggests that management produce a cost-benefit analysis for the decision to go green. Specifically, "it would be useful for shareholders to know more about the costs of this choice." In 2014 a proposal to Kohls makes a compelling case that the benefits outweigh costs: "As a for-profit corporation, we encourage Company management to make decisions guided by free market capitalist ideals. This includes seeking reasonable returns on investments. Decision-making solely based upon climate change concerns might harm the Company's long-term interests and viability."

[6] The Board for Fluor Corporation has stated its opposition to repeated proposals from 2016 to 2018 requesting GHG reduction goals, by "Creating Technology to Reduce Greenhouse Gas Emissions," more specifically, by investing in NuScale Power, LLC along with Rolls-Royce.

In addition, the literature offers insight on why firms can be expected to innovate in response to climate-related proposal, irrespective of the explicit requests from shareholders. The literature offers at least three reasons to expect an increase in innovation from these shareholder proposals: obsolescence, regulation and other forms of shareholder activism.

First, shareholder calls for innovation when faced with climate change are rooted in economic notions of obsolescence, stranded assets[7] or the viability of assets to retain value, some rate of decay in excess of simple wear and tear. Obsolescence explains why, absent innovation, some firms may compete less effectively and why other firms may cease to exist altogether with societal shifts toward a low carbon future. Schumpeter's (1942) concept of creative destruction explains how some firms advance while other firms perish as a function of capitalism. In essence, many of the proposals that shareholders sponsor suggest that current firm practices are destroying value when they fail to adapt to a low carbon society.[8]

Regulation (or threat of it) serves as the second reason why shareholder proposals motivate innovation. In many of the proposals, shareholders are requesting more information on firm policies and practices related to climate change. The SEC defers to existing reporting standards as clarified in 2010.[9] The EPA has required mandatory reporting of GHG emissions

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[7] In 2016, Southern Company received a proposal calling for a, "REPORT QUANTIFYING POTENTIAL FINANCIAL LOSSES TO THE COMPANY ASSOCIATED WITH STRANDING OF COAL ASSETS."

[8] The climate-related proposals to Chevron reflect this shift in emphasis toward a direct assessment of financial risk, from one of simple emission disclosure. From 1999 to 2009, requests for a "Report on Greenhouse Gas Emissions" were recurrent. Beginning in 2010, Chevron saw "Stockholder Proposals Regarding Financial Risks from Climate Change."

[9] SEC Interpretive Release 33-9106 "Commission Guidance Regarding Disclosure Related to Climate Change" directly speaks to its position, namely, that existing disclosure requirements govern public companies, reiterating the requirements of "material information" in Regulations S-K and S-X: Business Description, Legal Proceedings, Risk Factors, Management's Discuss and Analysis, Foreign Private Issuers. In addition, the following existing topics might trigger disclosure requirements: Impact of legislation and regulation, International accords, Indirect consequences of regulation or business trends, and Physical impacts of climate change. While existing regulation has a materiality threshold to invoke required disclosure, the Interpretive Release points to the wealth of information

since 2010 in 40 CFR Part 98 for certain emitters (over 25,000 metric tons of CO_2e per year). In 2018, the Government Accounting Office (GAO) gathered investor sentiment for a general disclosure framework, only to conclude that "investors have not reached agreement" (p. 26). In lieu of formal regulation, shareholder proposals allow for internal politics. To understand how innovation might result from shareholder proposals, the economics of external regulation and internal regulation (private politics) acts as a microcosm of policy discussions. Stigler (1971) provides a theoretical framework for the role that the State plays when imposing regulation, one of prohibiting or compelling, helping or hurting. In the self-regulating politics that take place at annual meetings, shareholders make similar suggestions as to what is good for their investment in the firm.

The strategic management literature continues down this line of logic in which regulation does not necessarily conflict with firm fortunes. Porter and Van der Linde (1995) offer relief to the climate quandary and suggest that innovation can be triggered by regulation and result in competitive advantage. Even though Jaffe and Palmer (1997) do not find conclusive support for Porter's hypothesis (increased R&D, not patents), in general, the authors encourage future research to focus on particular regulation, industries and firms. Lanoie et al (2011) extend the work of Jaffe and Palmer (1997) which divides the Porter hypothesis into three forms: weak (regulation spurs innovation), narrow (flexible regulation spurs even more innovation) and strong (regulation enhances firm fortunes). Across seven OEDC countries (including the US), Lanoie et al. (2011) find strong support for the weak form of the Porter hypothesis, that environmental

available on public firms under voluntary disclosure (the Carbon Disclosure Project and Global Reporting Initiative) as well as the EPA's Climate Registry.

regulation does lead to innovation increases, but not for the narrow and strong forms. Ambec, Cohen, Elgie and Lanoie (2011) review the literature on the Porter Hypothesis since its inception and find mix evidence. On target to climate change regulation and directly to the finance literature, Krueger (2016) examines the UK's change in mandatory GHG reporting and provides a basis for expecting real effects, such as innovation, to result from regulatory pressure. This literature on the connection between regulation and innovation, along with the above discussion that shareholder proposals can serve a unique regulatory purpose, provides a reasonable basis to suspect that shareholder proposals pressure management to innovate.

The third reason why shareholder proposals are believed to spur innovation is attributable to the literature on other forms of shareholder activism. David, Hitt and Gimeno (2001) discover that the mere presence of institutional ownership is insufficient to exert influence on R&D investments; an institutional investor must become active to motivate innovation. Once active, institutions pressure management to make long-term investments. Although the authors do not find increases in R&D outputs, they do distinguish between proxy and non-proxy measures, discovering that shareholder proposals are more effective than non-proxy press coverage of institutional activism. Following hedge funds, Brav et al. (2018) discover that activism can not only increase innovation's efficiency (decreased R&D expenditures and increased patent counts and citations), but also reshape firm boundaries. Although hedge funds are a special case of activism, these authors consider shareholder proposals to be "hostile events" which result in similar efficiencies in innovation. The literature suggests that innovation increases due to the efforts of activists ranging from institutional investors to hedge funds.

Motivated by the reasons suggested by the literature (obsolescence, regulation, and activism), we have a reasonable basis to believe that firms respond to climate-related proposals by innovating, irrespective of the direct statements about innovation on the annual proxies by shareholders themselves. Consequently, we propose the following hypothesis:

H1: Firms that receive climate-related proposals innovate more than firms that do not receive these proposals.

3 Data and Variable Construction

3.1 Data Sources and Sample Overview

Fundamental accounting data and year-end stock price information is taken from Compustat. The data for shareholder proposals is from Institutional Shareholder Services (ISS) and the SEC's Edgar database, assisted by SeekEdgar's Cloud Technology developed by Raj Srivastava. Patent data is provided by Dimitris Papanikolaou, updated through 2020 based on the research of Kogan, Papanikolaou, Serum, and Stoffman (2017).

The sample of climate-related shareholder proposals was gathered by conducting a search on SeekEdgar[10] using the term "climate change" and selecting DEF 14A as the form type. This search returned 1,752 shareholder proposals from the beginning of 1994 through the end of 2019. As we are interested in the ability of shareholder proposals to capture owner-agent tensions and, in turn, affect corporate behavior, each proposal was reviewed to ensure that "climate change" appears directly in a proposal sponsored by a shareholder or in management's response to a proposal. We identify 720 such proposals which are contained in 637 DEF 14As, as some firms

[10] Refer to https://www.seekedgar.co:8443/home.html for a complete description of the technology.

have several proposals in a given year. In addition, ISS has a brief description of the proposals that it collects, from which we are able to gain some reassurance about the sample of climate-related proposals. ISS indicates that there are 785 such proposals. Since Niagara Mohawk Power Corporation received the first shareholder proposal addressing climate change in 1994, 255 different firms have received similar proposals in 116 different industries.

3.1.1 Proposal Variable (of interest)

Our variable of interest represents the "pressure" from shareholder proposals related to climate change. In hopes of creating a proxy which captures the pressure that proposals exert on innovation, we take a running total of the number of proposals that a firm received from 1994 to 2019, reasoning that this pressure builds up over time and does not simply vanish when such proposals no longer appear at subsequent annual meetings. Proposals are averaged over three years, from year *t* to year *t-2*, to smooth the pressure and reflect its precatory nature. Running *t*, *t-2* is our main variable of interest, which is calculated as the natural log of one plus this backward average running total.[11] Thus, pressure either can build over several years through the feedback loop demonstrated in Figure 1, or it can release if shareholders no longer raise climate issues at subsequent annual meetings. Pressure, as proxied, neither materializes nor disappears immediately when there are gaps in the data. To accommodate the release of pressure, a zero is assigned in years when no climate proposals appear at an annual meeting. The pressure, then, can go to zero if there are no proposals for three years in a row. To distinguish between firms

[11] We also consider that firm innovation may not have a perfect memory of a pressure over the past 25 years of all proposals related to climate change. For robustness, we construct the same three-year, backward average but for only the last three years. The results that follow remain unchanged.

that have never received a proposal and firms whose shareholders have simply taken a break from proposing climate initiatives, the running total picks up where it last left off in the count, while logging the average smooths the firm-year observation.

Figure 2 depicts the pressure at Ford Motor Company, which received its first two climate proposals in 1998 and 1999, but then no proposal made it onto the ballot until 2003, after which there was at least one climate proposal (three in 2005) until 2008, one more in 2010 and another in 2017. To treat the 2017 observation as through Ford had never received any climate proposals would be as misleading and it would be to treat 2016 as through Ford were still feeling the same pressure that it did in 2008 (when the company had received multiple proposals for six years in a row). In all likelihood, during the 30 years that Bradley Gayton served on Ford's legal team (as corporate secretary, assistant and general counsel until 2020), he probably had not forgotten the mid-2000 wave of climate proposals when one resurfaced again in 2017. That year, the running total of Ford's climate proposal added one more to the 13 which had preceded it. However, the backward three-year average considers the two preceding years which saw no proposals, so that pressure, as proxied, builds back up quickly but not immediately. Since we are interested in the effect on subsequent innovation policies, such pressure captures shifts instead of shocks.

Of the 637 "climate change" proposals, the final sample contains 351 firm-year observations with sufficient accounting and innovation data. From 1994 to 2019, "climate change" has appeared in as many as 6 shareholder proposals in a single year (for Exxon) and has gather as many as 55 proposals over that time period (also for Exxon). Average firm-year support for these proposals ranges from 7% in 1999 to 33% in 2017, while support for individual proposals range from 1% to 67%.

3.1.2 Innovation Variables

To understand how corporate policies are influenced by proposals, our innovation variables include patenting activity as the resulting output of firm innovation, specifically related to climate change. The USPTO classification for climate change patents is Y02: "Climate change mitigation technologies related to energy generation, transmission or distribution." We rely on the data provided by Dimitris Papanikolaou, derived from Kogan et al. (2017) and updated through 2020. Six proxies for innovative output at the firm level are calculated from this data:

1) the number of Y02 patents filed per firm per year: *Y02 Count*.

2) the number of Y02 citations per firm per year: *Y02 Cites*.

3) the percent of a firm's patents that have the Y02 classification relative to all the same firm's patents in a given year: *Y02 Count Pct*.

4) the percent of a firm's citations on patents that have the Y02 classification relative to all the same firm's citations in a given year: *Y02 Cites Pct*.

5) the number of a firm's Y02 Patents that received citations in the top one percent of Y02 citations in a given year: *Top 1*.

6) the number of a firm's Y02 Patents that received citations in the top ten percent of Y02 citations in a given year: *Top 10*. A firm's annual Y02 patents relative to all its patents gives an

indication of the importance of climate change to a firm's innovation policies. Percent rankings of patents provide a well-documented relevance and importance. Patents that place in the top one percent for citations are often referred to as "blockbuster" patents. To ensure that the Y02 ranking is not a special case, we examine where these Y02 blockbusters would have placed in a general ranking of patents. The is only 0.6% of a ranking difference on average, meaning, these Y02 patents are blockbusters among all patent citations.

All six innovation variables are averaged forward, from *t* to *t+2*. To avoid truncation bias associated with patents and citations, we following prior literature and adjust the patent counts and citations accordingly (Hall, Jaffe, and Trajtenberg (2001)). For patent counts, we take each firm's total patents per year and dividing it by the average firm's total patents in the same year. For citations, we take each patent's citations for a given firm in a given year and divide it by that same's firm's average citations per patent, then take that figure and divide it by the average citations per patent from all patents that year. Although prior literature applies an additional scaling or "grossing up" of patents and citations by technology classification, this scalar would not be applicable to Y02 patents as these technologies are often only a component of patent. In fact, of the 1.9 million patents we examine from 1994 to 2019, only 8 *begin* with the Y02 classification, even though 105,737 patents contain the Y02 classification in the CPC coding scheme. For example, patent 5426677 appears to be primarily concerned with Physics, the G classification, (G21C1/09; G21C17/00; G21Y2002/202; G21Y2002/204; G21Y2004/304; Y02E30/40), but also has a Climate Mitigation (Y02) component. See Appendix C for the patenting activity over time. Disentangling truncation bias by year-technology for the Y02 classification is not feasible for this paper.

3.1.3 Control Variables

We follow Faleye et al. (2014) and Ferris et al. (2017) for control variables with a well-documented effect on innovation, in order to suggest the unique influence of shareholder proposals. The controls for the main regressions and subsequent analyses include Size, R&D, Tobin's Q, Firm Age, Revenue Growth, Stock Returns, Leverage and Cash Surplus. As will be shown and as has been discovered in prior literature, Size has a powerful impact on innovation. Large firms tend to innovate more (Atanassov, 2013), because they enjoy scope and scale efficiencies with fixed or sunk costs associated with research, development and the patenting process. We decide on the natural log of revenues as the proxy for size, to avoid any mechanical correlations which may result from other variables being scaled by assets. Research and development expense is scaled by assets at the beginning of the year.

We follow Baker et al. (2003) and Perfect and Wiles (1994) for our measurement of Tobin's Q: the difference between market value and book value of equity plus total assets all divided by total assets. Leverage is the ratio of long-term debt and its short-term portion to total assets. Cash Surplus is cash flow from operations less depreciation plus R&D scaled by assets (Ferris et al., 2017). In order to reduce the influence of small startups with protracted, negative measures of Cash Surplus, we require that a firm have a positive cash surplus over its entire life, but do not exclude from the sample those firms which have negative cash surplus in some years. This procedure follows Brown et al. (2009) to eliminate a small portion of outliers with a disproportionate influence.

4 Methodology and Results

The general methodology follows standard practice of building from an association between innovation and climate-proposals, to ordinary regressions that attempt to control for other explanations of the relationship, before employing more sophisticated techniques to suggest the unique role that climate-proposals play on innovation policies.

4.1 Descriptive Statistics, Correlations and Difference in Means

The descriptive statistics are presented in Table 1, Panel A. Similar to all prior studies of innovation, patent data are highly skewed, the median is much less than the mean. Our sample firms are larger in size and moderately profitable. On average, our sample firms possess important growth opportunities as implied by an average Q of 1.775, which is comparable to the average firm with a Q of 1.800. The pairwise correlations (Table 1, Panel B) show that a running total of proposals related to climate change have positive correlations with all of our innovation variables. The strongest correlation for Running, however, is with Size, reinforcing the relationship that literature has found between the two. The two-sample t-test in Panel C shows highly significant differences in the innovation polices between firms that have received climate-proposals and those firms that have not, along with Size, Age and Stock Returns.

4.2 Main Results

As shown in Tables 2, Panels A and B, a significant relationship between innovation and shareholder proposals exists, based on a full set of controls, and year and firm fixed effects. Receipt of at least one shareholder proposals in a year bears a strong, positive association with

Y02 patents counts and citations, along with the relative emphasis that climate-proposal firms place on climate mitigation innovations. Additionally, these proposal firms generate more Y02 patents that rank in in the top one and ten percent of all Y02 patents in a year. Using models 1 and 2 for each proxy of innovation, when *Running* increase by 10%, this partial effect increases Y02 patent count by 7,2% and patent citations proxy by 2.7%, which is statistically significant at the 1% level. These results are economically meaningful.

The skewness of innovation data, even for the proposal firms, combined with the skewness of the running total of proposals makes economic interpretations difficult to digest or generalize to a population, even though log transforming this data somewhat mitigates the skewness. Consequently, our primary aim for the remainder of this paper is to establish a robust relation between innovation policies as influenced by shareholder proposals related to climate change. Principally, is there sufficient variation to examine which identifies anything unique about these climate-related proposals? To answer this question, we turn to the econometric tools developed by the literature to address endogeneity concerns.

4.3 Endogeneity Concerns

As with any corporate finance endeavor, identifying causation is always a challenge. Claiming this for shareholder proposals is particularly troublesome, especially when the proxy variable that attempts to capture the effect accumulates over time in a running total. Yet, by construction, spirit of Code of Federal Regulation, and annual monitoring by the Division of Corporate Finance, shareholder proposals *cannot* legally force the hand of management, even when proposals come to a vote and gather 100% support at annual meetings. Still, as financial economists of firm-level policies, we can't help but try to identify something that approaches causation or at least be curious about the heterogeneity of climate proposals having a unique effect on innovation decisions.

To substantiate our main findings, we first, we employ a matching estimator in Table 3. The sample of treated firms are matched to firms based on similar characteristics. Following Krueger (2016), firms are matched based on size, industry and year. We employ the Coarsened Exact Matching (CEM) estimator to approach endogeneity, as introduced by Blackwell, Iacus, King and Porro (2009) and employed by Balsmeirer, Flemming and Manso (2017) to enhance causal inference of board independence on innovation. Blackwell et al. (2009) discuss how the CEM estimator prunes the observations "so that the remaining data have better balance between the treated and the control groups." Once matched, we follow the suggestions of Rubin (2001) to ensure (1) that the means are less than half a standard deviation apart, (2) the ratio of variance is close to one and (3) the variance ratio of residuals is within a relevant range.[12] Table 3 shows highly significant, positive relationships of Running with all innovation proxies. Compared to the main regressions, the coefficient retains significance at the 1% level or better for five of the six models. The economic significance of the estimators declines slightly for the first four models, but gains importance for patents in the Top 1 and 10 percent, after the sample is diminished considerably by pruning it of less comparable firms.

To further our quest to obtain uniqueness of the proposal effect, a two-stage least squares analysis is performed using the Pope as an instrumental variable. We utilize a Nexis-Uni search

[12] In results, not tabulated for brevity, we show that matching estimator, based on size, industry, and year, is effective and results in a balanced sample.

to find the number of times that the Pope and climate change are discussed in business wires and press releases in the US by US publications. The natural log of the number of such articles serves as my instrumental variable. Although the Pope is an influential person and religious groups actively sponsor shareholder proposals, no known proposals are directly sponsored by the Pope. News articles on the Pope and climate change, therefore, cannot have the same direct link to innovation that shareholder proposals can have.

The intuition for the instrument is straight-forward: Pope might compel shareholders to sponsor proposals, yet the Pope is not a sponsoring shareholder himself. The first climate-related proposals were sponsored in 1994 by the Benedictine Sisters of San Antonio, Texas, Immaculate Heart Missions of Arlington, Virginia, and The Sisters of St. Dominic of Caldwell, New Jersey: all Catholic sponsors. Further, the Institutional Shareholder Services (ISS) aggregates shareholder sponsors by type. Religious groups are active sponsors with 22 percent of all climate-related shareholder proposals (second only to SRI funds with 23 percent of climate proposals). Given these dynamics, it is reasonable to assume that the Pope addressing climate change exerts an influence on proposals without directly influencing firm decisions to innovate.

Table 4A formally tests the first stage relationship between Running and Pope, which is highly significant and the F-test is greater than the critical value of 10. As mentioned, the Pope intuitively satisfies the exclusion restriction. When the Pope instruments for Running, there is only a significant, positive relationship in models 2 and 4: Y02 Counts and Y02 Cites. The test of endogeneity, however, is satisfied only for Y02 Cites. This econometric technique suggests that there is something unique about climate proposals that exerts a positive influence on climate innovations. One weakness of using the Pope as an instrument is that all firm-year observations are the same for the Pope. To compensate for this weakness, we also include employ another instrument.

Table 4B contains a two-stage least squares regression that employs *Peer Effects* as an instrument. *Peer Effects* are the average of firms by state of incorporation that received climate proposals presented each year at annual meetings, where the focal firm is excluded from the average. We follow previous literature (Grennan, 2019; Leary and Roberts, 2014; Kaustia and Rantala, 2015; Seo, 2021) which also examines the effect that the behavior of peers can have on firm policies.We choose the state of incorporation as a peer group because the motivation to innovate emanates primarily at the state level. For example, while the differences in innovation policies between Chevron and Exxon may not be that vast, the differences in pressure to mitigate climate change between California and Texas are stark. Although shareholders (and the proposals on climate change they sponsor) have a wide geographic dispersion, the state of incorporation provides the legal framework to weigh enforcement of shareholder rights. In other words, shareholder voice finds acoustics that vary by state.

Column 1 of Table 4B formally tests the relevance condition of the *Peer Effects* instrument: a highly significant, positive correlation with the variable of interest, *Running*, and an F-statistic well in excess of the critical value of 10, indicating the instrument is not weak (Stock and Yogo, 2005; Wooldridge, 2010). In the second stage regressions, the instrumented *Running* variable has a significant, positive relationship with four of the six innovation proxies (highly significant at the 1% level for Y02 patent counts (model 2) and Y02 patents as a percent of all patents (model 4)). Although the exclusion condition cannot be formally tested in Endogeneity tests suggest that Running as instrumented is not significantly correlated with the error term in the second stage. Intuitively, we believe that the exclusion restriction is satisfied by excluding the focal firm from the group average. These results suggest that when the peer effects of climate proposals by state instrument for the proposals that a particular firm receives, there is a significant increase in climate innovation: patent counts, citations, relative to other patents and patents that are in the top 10 percent. We design a placebo in Table 5A to test whether the peer selection of state of incorporation may be driving prior results. By assigning firms to states at random, following Grennan (2019), we find that the random grouping has no explanatory power, suggesting that the peer effect of firms in the same state of incorporation is an appropriate instrument that affects firm innovation policies through the *Running* variable of interest.

While the hand-collected sample may add to the originality in the evaluation of shareholder proposals, it also opens the possibility for error that the data has not been vetted by a professional data-manger. To address this possibility, we rerun our main regressions on innovation using the relevant "Item Code" from ISS. In addition, we also compare firms that have received climate-related proposals to all the other shareholder proposals that firms have received, as a placebo test. Afterall, proposal-receiving firms may be more innovative, and there may be nothing special about firms that receive climate-related proposals. That a firm receives any proposal, climate or otherwise, may be driving the results. We present the results of this analysis in Table 5B. The coefficients for climate-related proposals in all models are multiple times larger than for non-climate-related proposals, with significance at the 1% level or better. Thus, the results are robust along both dimensions: an alternative data source (ISS) and by comparison to a placebo.

Next, we check robustness of our main result by limiting the sample to firms that have ever received a proposal related to climate change during our sample period: a climate-proposal-only sample. We depict the result of this analysis in Table 6, which provides supportive evidence of our main conjecture. For these firms, receipt of a climate proposal has a positive influence on subsequent climate innovation, even if this positive influence is marginal for highly cited patents.

Finally, we look at yet another way to approach shareholder pressure and use the percent of the votes at the annual meetings in favor of a climate-related proposal (that ISS collects) as the main regressor. Similar to the increasing number of proposals that a firm receives in a year, the vote outcome in support of these proposals also has gained traction over time, culminating in 2017, the first year that several climate proposals exceeded majority support. Table 7 reports the OLS regression results for innovation on matched basis, on *Vote For*: the average percentage of the vote in support of a climate proposal at an annual meeting. The evidence suggests that this alternative measure of proposal "pressure" has a positive association with Y02 patents.

4.4 The Effect of Board Independence

Board independence is believed to be particularly important to the shareholder proposals. The Staff Legal Bulletins (SLBs) place emphasis on the role of the board when a firm petitions the SEC to exclude a shareholder proposal. While the SEC does not take a position on board composition or structure, the literature has found that independent boards provide stronger governance. Management seeks to exclude a significant portion of proposals: 40% on average and the SEC grants permission most (72%) of the time, according to Soltes et al (2017). However, SLB 14E in 2009 is believed to have expanded the "proper subject" matter for proposals that are "so significant" to broad economic policy. In 2017, SLB 14I reinforced the board's role as liaison between owners and agents, so long as well-reasoned and well-informed analyses guide the board's move to exclude a proposal. Again in 2018, the division of Corporate Finance issued another SLB 14J, which references climate change and the micromanagement of setting specific GHG goals.[13] The discussions in these SLBs on the board's role provide crucial insights on enforcement of Rule 14a-8, the governing law. The literature suggests that board independence has an impact on such intentions to represent shareholders.

The literature has addressed board independence in a variety of contexts. Bhagat and Black (2001) are among the first to study the long-term impact of board independence on firm performance. They employ the fraction of directors that are independent, but find no evidence that independence improves profitability in the long run. By examining the local supply of independent directors, Knyazeva, Knyazeva and Masulis (2013) unravel some endogeneity concerns to discover a positive relationship between board independence, firm value and performance. In addition, the market has responded positively to board independence (Rosenstein and Wyatt, 1990) and executive compensation can be better monitored by independent boards (Ryan and Wiggins, 2004). If climate-related proposals have economic merit, independent boards are in a good position to objectively weigh the consequences in favor of firm interests. In the presence of heightened and relaxed forms of governance, the literature suggests that internal monitors should have a noticeable, moderating impact on innovation spurred by shareholder proposals.

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[13] According to the Harvard Law School Forum, 2019 Proxy Season Preview, "climate-related proposals were disproportionately affected" (p. 2) by SLB's 14I and 14J. (Westcott, posted April 15, 2019)

We test the role of Board Independence in Table 8. We first add the percent of independent directors on board for each firm-year as a control variable Panel. Next, we split the sample, based on board independence, and rerun our main tests for each subsample. We find that board independence matters for corporate innovations: proposals related to climate change are more impactful on firm innovation policies when firms have *less* independent boards. This finding is not surprising. Our interpretation of it is that climate-proposals are more important when boards are less independent. Climate-proposals can substitute for board independence to enhance climate technologies.

4.5 Shareholder Proposals, Innovation and Firm Performance

To determine the overall impact on firm performance of changes to firm behaviors that proposals have, we consider equity returns. To assist comparability by "pruning" the control sample for size, year and industry, we again employ the CEM estimator. We take the fitted estimates of the innovation model (with controls and time and industry indicators) and use them in the following regression:

$$Stock\ Performance_{t+1,t+3} = \alpha_t + \boldsymbol{\beta_1} \widehat{Innovation}_t + \sum Stock\ Controls_t + year_t + industry_i + \varepsilon_t$$

Where the measures of stock performance include buy-and-hold returns for three-year periods on unadjusted stock returns and risk adjusted returns, using Jensen's alpha and the Carhart four-factor alpha. Stock returns are compounded monthly beginning t+1 and ending t+3 for a three-year buy-and-hold return. To adjust for risk, the monthly factors on Ken French's website are employed to determine Jensen's alpha and the Carhart four-factor alpha. The control variables for stock returns follow Bhandari and Javakhadze (2017). Size is the market value of all assets. Market-to-Book is the ratio of the market value of equity to the book value of equity. Leverage is the same as above: the ratio of long-term debt and its short-term portion to total assets. Momentum is the prior 24 months of compounded stock returns. Indicator variables are added to the regressions for industry at the four-digit SIC level and for year.

The impact on stock performance is depicted in Table 8. All proxies of fitted innovation are related to significantly enhance stock performance on both a raw and risk adjusted basis, suggested that corporate innovations induced by shareholder climate-related proposals is value-creating for the firm.

5 Conclusion

In this article, we investigate whether shareholder climate-related proposals influence corporate innovations, specifically, technologies to mitigate climate change. As a low-cost form of activism, the literature on the effectiveness of shareholder proposals suggests that the context matters. We propose that climate change provides an excellent context for examining the real effect of shareholder-initiated proposals.

The issue of climate change is a progressively dominant environmental topic at annual shareholder meetings. We contemplate that firm innovations could be a response to climate-related proposals. In these proposals, shareholders themselves are directly requesting that firms invest more heavily in new technologies that result is less carbon being emitted. Besides the straight-forward requests by shareholders, prior literature demonstrates how obsolescence, regulation, and other forms of activism set precedent for the importance of climate change-related proposals on corporate innovations.

Normally, assets depreciate at predictable rates through common use. But shifting economic forces can erode such predictability much faster than useful lives. Innovation allows firms to adapt to the economic landscapes being shifted by climate change. Many of the shareholder proposals on climate change refer to economic depreciation at an alarming rate and argue that current practices could destroy value if a firm fails to adopt to a low carbon society. If the threat of obsolescence outweighs agency cost, shareholder proposals may be a catalyst of innovation. Innovations also could be triggered by internal regulation represented by shareholder proposals (private politics). Finally, prior literature on other forms of shareholder activism suggests that innovation increases due to the efforts of activists, ranging from institutional investors to hedge funds.

We conduct our empirical analyses using a large sample of firms for the period 1994 to 2019 and discover a positive association between shareholder climate-related proposals and corporate innovations. Our results are robust to matching estimator, an instrumental variable, a quasi-natural experiment, placebo analysis, alternative sample/sub-sample construction, and different proxies of our variable of interest in "proposal pressure." We further show that the documented effect is moderated by board independence. Finally, changes in corporate innovations, attributable to shareholder climate-related proposals, are value-relevant for the firm. Overall, shareholder proposals related to climate change have real effects on firm innovation policies. Given these results, the feedback loop enabled by proposals appears to serve its purpose: shareholder have a voice sufficient to have real effects on firm-level innovation.

Appendix A: Description of Variables and Sources

VARIABLES	DESCRIPTION	SOURCE
Innovation		
Y02 Counts	Forward average, from t+1 to t+3, of the natural log of one plus the number of patents with the Y02 classification for each firm by the date the patent is filed, adjusted for truncation bias.	https://github.com/KPSS2017/Technological-Innovation-Resource-Allocation-and-Growth-Extended-Data
Y02 Cites	Forward average, from t+1 to t+3, of the natural log of one plus the number of patent citation with the Y02 classification for each firm by the date the patent is filed, adjusted for truncation bias.	https://github.com/KPSS2017/Technological-Innovation-Resource-Allocation-and-Growth-Extended-Data
Y02 Count Pct	The percent of a firm's Y02 patents in a given year relative to all of that firm's patents filed in the same year.	Cohen et al. (2020)
Y02 Count Pct	The percent of a firm's Y02 patent citations in a given year relative to all of that firm's patent citations filed in the same year.	Cohen et al. (2020)
Y02 Top 1	The natural log of one plus the number of Y02 patents whose citations were in the top 1 percent of all Y02 patents in a given year.	Balsmeier et a. (2017)
Y02 Top 10	The natural log of one plus the number of Y02 patents whose citations were in the top 10 percent of all Y02 patents in a given year.	Balsmeier et a. (2017)
Climate-Related Proposals		
Running	Backward average, from t to t-2, of the natural log of one plus a running total of the number of climate-related proposals that a firm receives over entire sample period.	SEC's Edgar website and SeekEdgar cloud technology
Controls		
Size	Natural log of one plus total revenues	Compustat
R&D/Assets	Research and development expense divided by beginning assets	Compustat
Tobin's Q	Calculated as the Market Value of Equity minus the Book Value of Equity plus Book Value of Assets divided by Book Value of Assets.	Perfect and Wiles, (1994); Baker, Wurgler and Stein (2003)
Firm Age	Natural log of one plus the number of years that a firm is listed in Compustat	Compustat
Revenue	Measured as the change in revenues from the	Compustat

Growth	end of each year	
Stock Return	Measured as the annual change in the adjusted stock price.	Compustat
Leverage	Calculated as total Liabilities divided by total Assets.	Compustat
Cash Surplus	Calculated as the net cash from operations minus depreciation plus research and development scaled by total assets.	Compustat

Appendix B: Patents from 1994 to 2020

Year	All Patents	Climate Patents	Percent
2020	1,319	21	1.6%
2019	21,055	451	2.1%
2018	51,078	1,244	2.4%
2017	75,240	2,555	3.4%
2016	83,972	4,065	4.8%
2015	88,177	5,464	6.2%
2014	87,810	5,827	6.6%
2013	91,202	6,408	7.0%
2012	91,264	6,861	7.5%
2011	80,001	6,170	7.7%
2010	73,899	5,578	7.5%
2009	72,247	5,000	6.9%
2008	81,801	5,447	6.7%
2007	82,364	5,096	6.2%
2006	81,501	4,724	5.8%
2005	83,529	4,537	5.4%
2004	83,997	4,447	5.3%
2003	86,756	4,543	5.2%
2002	87,461	4,632	5.3%
2001	85,509	4,332	5.1%
2000	78,342	3,623	4.6%
1999	70,193	3,025	4.3%
1998	62,612	2,494	4.0%
1997	63,312	2,648	4.2%
1996	51,934	2,273	4.4%
1995	51,841	2,342	4.5%
1994	41,726	1,930	4.6%
Total	1,910,142	105,737	5.5%

Figure 1: Number of Climate Change Proposals over Time

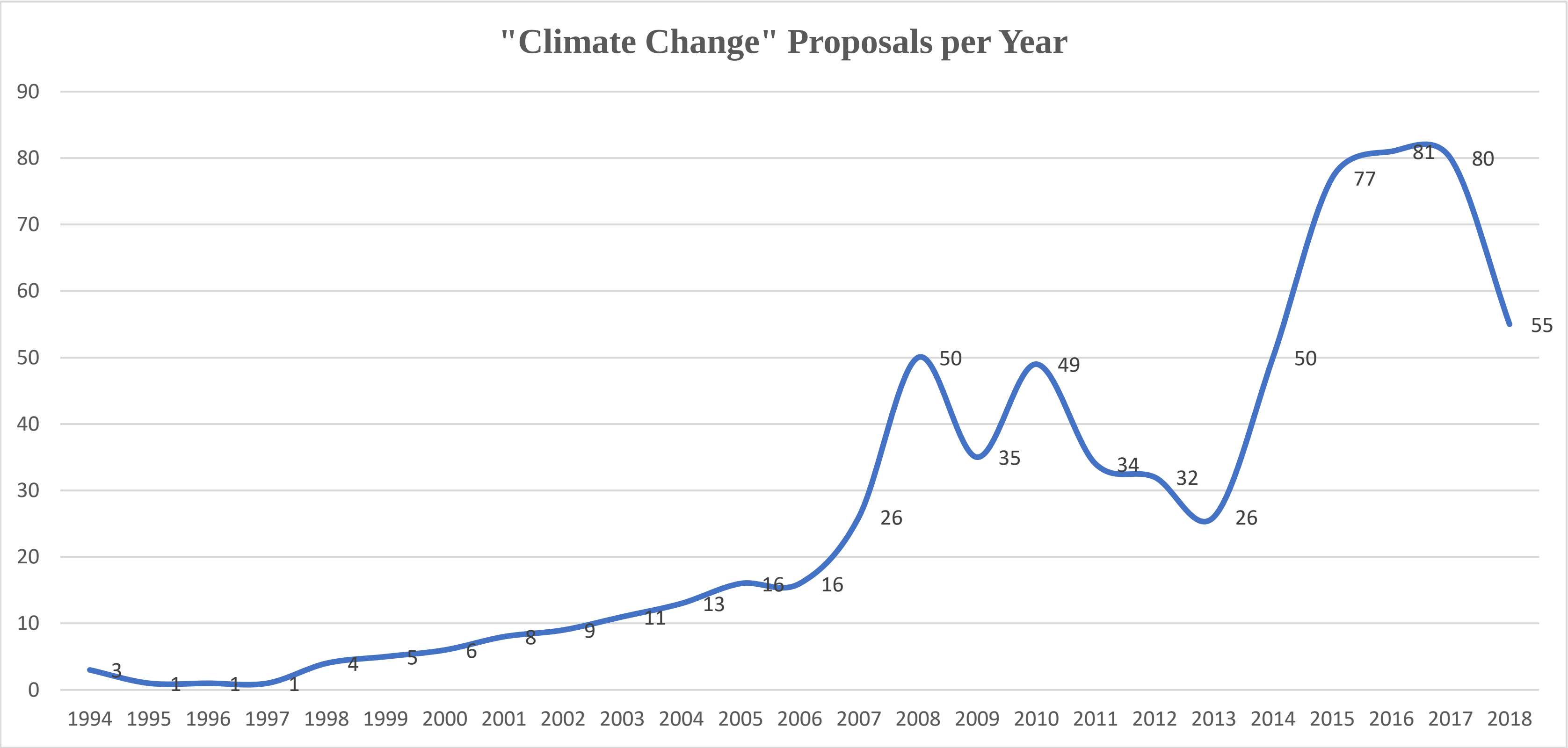
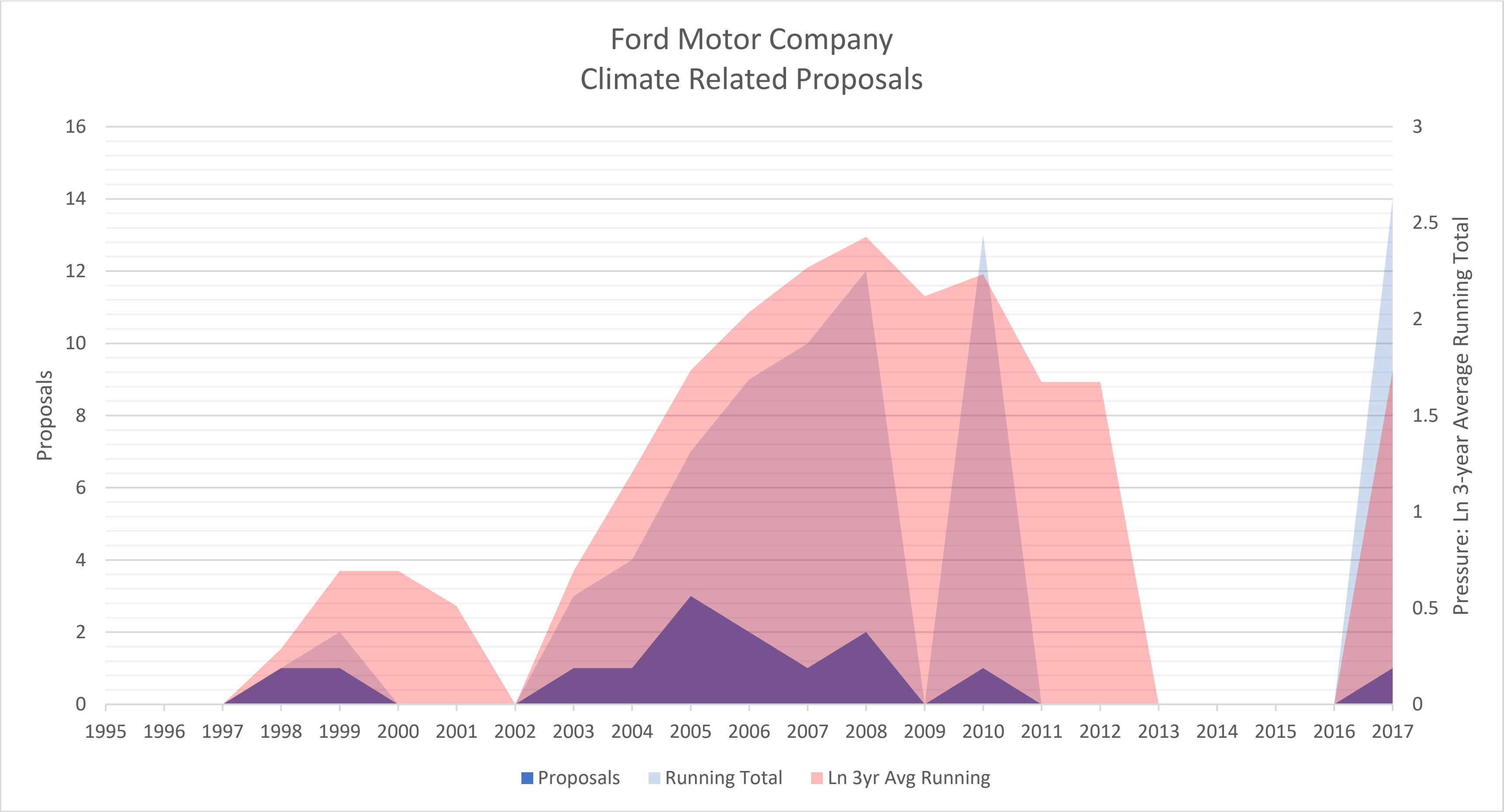


Figure 2: Proposal Pressure at Ford



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Tables

Table 1: Summary Statistics and Correlations

Panel A of this table reports summary statistics for the main dependent and independent variables and controls. Panel B shows the correlations among variables and their significance for all non-missing, paired observations. Panel C provides a t-test of the difference in means between populations which either have received climate-related proposals (Treated) or have not received such proposals (Control). The difference in means and variance are assumed to be equal. All variables are defined in Appendix A.

	N	Mean	Median	Std. Dev.	min	max	p25	p75	skewness	kurtosis
Y02 Count $_{t+1, t+3}$	13822	0.247	0.000	1.536	0.000	31.576	0.000	0.019	12.025	180.523
Y02 Cites $_{t+1, t+3}$	13822	0.280	0.000	1.793	0.000	65.795	0.000	0.000	13.833	284.703
Y02 Count pct $_{t+1, t+3}$	13822	0.025	0.000	0.079	0.000	1.000	0.000	0.002	5.244	38.046
Y02 Cites pct $_{t+1, t+3}$	13822	0.023	0.000	0.080	0.000	1.000	0.000	0.000	5.257	37.835
Y02 Top 1 pct $_{t+1, t+3}$	13822	0.022	0.000	0.130	0.000	1.897	0.000	0.000	7.931	77.395
Y02 Top 10 pct $_{t+1, t+3}$	13822	0.108	0.000	0.399	0.000	4.031	0.000	0.000	5.021	31.862
Running $_{t, t-2}$	**13822**	**0.033**	**0.000**	**0.201**	**0.000**	**3.646**	**0.000**	**0.000**	**9.048**	**105.416**
Size $_{t, t-2}$	13822	8.198	8.078	1.312	1.770	13.085	7.359	8.989	0.223	3.686
R&D/Assets $_{t, t-2}$	13822	0.018	0.000	0.040	0.000	0.439	0.000	0.018	3.460	18.700
Tobin's Q $_{t, t-2}$	13822	1.800	1.466	1.064	0.577	16.241	1.181	2.021	3.765	27.580
Age $_{t, t-2}$	13822	2.374	2.395	0.443	1.596	3.135	2.074	2.771	-0.121	1.957
Sales Growth $_{t, t-2}$	13822	0.269	0.062	14.846	-0.473	1234.442	0.006	0.134	83.084	6905.571
Stock Return $_{t, t-2}$	13822	0.044	0.063	0.267	-3.237	3.032	-0.053	0.168	-0.909	21.208
Leverage $_{t, t-2}$	13822	0.622	0.615	0.208	0.000	2.655	0.494	0.736	0.862	7.675
Cash Surplus $_{t, t-2}$	13822	0.074	0.061	0.072	-0.522	0.593	0.030	0.104	1.187	7.135

Panel B: Pairwise Correlations

Variables	Count	Cites	Count Pct	Cites Pct	Top 1	Top10	Running	Size	R&D	Q	Age	Sales Growth	Stock Return	Leverage	Cash
Y02 Count	1.000														
Y02 Cites	0.825*	1.000													
Y02 Count pct	0.253*	0.213*	1.000												
Y02 Cites pct	0.268*	0.264*	0.859*	1.000											
Y02 Top 1	0.606*	0.752*	0.170*	0.244*	1.000										
Y02 Top 10	0.774*	0.777*	0.329*	0.420*	0.766*	1.000									
Running	0.298*	0.251*	0.166*	0.154*	0.186*	0.239*	1.000								
Size	0.278*	0.263*	0.141*	0.139*	0.229*	0.311*	0.246*	1.000							
R&D/Assets	0.147*	0.147*	0.069*	0.084*	0.217*	0.294*	-0.025*	0.013	1.000						
Tobin's Q	0.048*	0.062*	-0.037*	-0.028*	0.110*	0.131*	-0.018	0.110*	0.455*	1.000					
Age	0.058*	0.048*	0.043*	0.002	0.037*	0.045*	0.139*	0.356*	-0.046*	-0.093*	1.000				
Sales Growth	-0.002	-0.002	-0.004	-0.003	-0.002	-0.003	-0.003	-0.021	-0.005	0.009	-0.021	1.000			
Stock Return	-0.001	0.008	-0.011	-0.012	0.024*	0.016	-0.023*	0.027*	0.042*	0.193*	0.044*	0.013	1.000		
Leverage	0.016	-0.005	-0.002	-0.009	-0.071*	-0.070*	0.011	0.043*	-0.268*	-0.228*	0.130*	-0.001	-0.108*	1.000	
Cash Surplus	0.101*	0.112*	0.016	0.031*	0.175*	0.218*	0.005	0.138*	0.652*	0.672*	-0.004	-0.011	0.171*	-0.408*	1.000

**** p<0.01, ** p<0.05, * p<0.1*

Panel C: Two-sample t test with equal variances

Variable	Control N	Treated N	Control Mean	Treated Mean	dif	St_Err	t_value	p_value
Y02 count $_{t+1, t+3}$	13471	351	.205	1.875	-1.669	.082	-20.4	0
Y02 cites $_{t+1, t+3}$	13471	351	.233	2.088	-1.856	.096	-19.4	0
Y02 count pct $_{t+1, t+3}$	13471	351	.024	.072	-.048	.004	-11.35	0
Y02 cites pct $_{t+1, t+3}$	13471	351	.022	.069	-.047	.005	-10.95	0
Y02 Top 1 pct $_{t+1, t+3}$	13471	351	.019	.128	-.108	.007	-15.6	0
Y02 Top 10 pct $_{t+1, t+3}$	13471	351	.099	.487	-.389	.022	-18.25	0
Size $_{t, t-2}$	13471	351	8.156	9.806	-1.65	.07	-23.7	0
R&D/Assets $_{t, t-2}$	13471	351	.018	.015	.004	.002	1.75	.082
Tobin's Q $_{t, t-2}$	13471	351	1.8	1.775	.025	.058	.45	.661
Age $_{t, t-2}$	13471	351	2.366	2.687	-.321	.024	-13.5	0
Sales Growth $_{t, t-2}$	13471	351	.275	.046	.228	.802	.3	.776
Stock Return $_{t, t-2}$	13471	351	.045	.013	.033	.015	2.25	.024
Leverage $_{t, t-2}$	13471	351	.622	.624	-.002	.011	-.2	.857
Cash Surplus $_{t, t-2}$	13471	351	.074	.081	-.007	.004	-1.75	.08

Panel C: Two-sample t test with equal variances

Table 2: Shareholder Climate-Related Proposals and Corporate Innovations

This table shows the results of ordinary least square regressions with Innovation as the dependent variable based on the patent data by date filed with the US Patent Office containing the Y02 (climate change) technology classification, each defined in Appendix A. *Running* is the natural log of one plus a three-year, backward average of an accumulated total of the climate-related shareholder proposals that a firm has received from 1994 to 2019. The control variables are also averaged over three years and include: Size, R&D, Tobin's Q, Age, Revenue Growth, Stock Returns, Leverage and Cash Surplus, as defined Appendix A. *t-statistic*, based on robust standard errors, adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1) Y02 Counts t+1, t+3	(2) Y02 Cites t+1, t+3	(3) Y02 Counts pct t+1, t+3	(4) Y02 Cites pct t+1, t+3	(5) Y02 Top 1 pct t+1, t+3	(6) Y02 Top 10 pct t+1, t+3
Running $_{t, t-2}$	.723***	.694***	.015***	.011***	.019***	.053***
	(18.276)	(10.379)	(4.546)	(3.298)	(3.604)	(4.623)
Size $_{t, t-2}$	.037*	.145***	.01***	.012***	.008***	.021***
	(1.952)	(4.515)	(6.497)	(7.431)	(3.191)	(3.811)
R&D/Assets $_{t, t-2}$	.525	1.468	-.032	-.022	-.144**	.533***
	(.993)	(1.642)	(-.745)	(-.494)	(-2.034)	(3.501)
Tobin's Q $_{t, t-2}$	-.007	-.02	.001	0	-.002	-.001
	(-.636)	(-1.137)	(1.493)	(-.268)	(-1.31)	(-.44)
Age $_{t, t-2}$	.213***	.113	.012*	.022***	.016	.13***
	(2.663)	(.835)	(1.782)	(3.199)	(1.469)	(5.663)
Sales Growth $_{t, t-2}$	0	0	0	0	0	0
	(.257)	(.342)	(.508)	(.537)	(.236)	(.212)
Stock Return $_{t, t-2}$	.003	.069*	.002	.003	.007**	.015**
	(.124)	(1.652)	(1.072)	(1.639)	(2.21)	(2.108)
Leverage $_{t, t-2}$	.16***	.147	0	.006	-.001	-.032*
	(2.685)	(1.462)	(-.091)	(1.163)	(-.093)	(-1.874)
Cash Surplus $_{t, t-2}$	-.082	-.153	-.025	-.02	-.01	-.1*
	(-.438)	(-.481)	(-1.617)	(-1.214)	(-.384)	(-1.84)
_cons	-.46***	-1.112***	-.076***	-.099***	-.062***	-.224***
	(-2.681)	(-3.834)	(-5.432)	(-6.745)	(-2.72)	(-4.532)
Observations	13822	13822	13822	13822	13822	13822
R-squared	.853	.693	.629	.601	.632	.82
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

t-values are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 3: Matching Estimator

This table employs ordinary least square regression weighted by the Coarsened Exact Matching (CEM) estimator developed by Blackwell, Iacus, King and Porro (2009), which "temporarily coarsen each variable into substantively meaningful groups, exact match on these coarsened data, and then retain only the original (uncoarsened) values of the matched data." The proposal sample is matched on Size, Year and Industry, with the sample of firms without shareholder proposals. The dependent variables of Innovation are based on the patents by date filed with the US Patent Office containing the Y02 (climate change) technology classification, each defined in Appendix A. *Running* is the natural log of one plus a three-year average of an accumulated total of the climate-related shareholder proposals that a firm has received from 1994 to 2019. The control variables include: Size, R&D, Tobin's Q, Age, Revenue Growth, Stock Returns, Leverage and Cash Surplus, as defined in Appendix A. *t-statistic*, based on robust standard errors, adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1) Y02 Counts t+1, t+3	(2) Y02 Cites t+1, t+3	(3) Y02 Counts pct t+1, t+3	(4) Y02 Cites pct t+1, t+3	(5) Y02 Top 1 pct t+1, t+3	(6) Y02 Top 10 pct t+1, t+3
Running $_{t, t-2}$	.502***	.561***	.013***	.012**	.039***	.065***
	(10.214)	(6.837)	(2.664)	(2.288)	(5.273)	(3.94)
Observations	5629	5629	5629	5629	5629	5629
R-squared	.899	.743	.699	.645	.666	.803
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Table 4A: 2SLS Instrumental Variable

This table employs a two stage least square regression, with the number of Business Wires or Press Releases in the US by a US publisher contained the "Pope" and "climate change" in a Nexis-Uni search instrumenting for the variable of interest, the *Running* total of shareholder proposals concerned with climate change. The dependent variables in the second stage are based on the patents by date filed with the US Patent Office containing the Y02 (climate change) technology classification, each defined in Appendix A. *Running* is the natural log of one plus a three-year average of an accumulated total of the climate-related shareholder proposals that a firm has received from 1994 to 2019. The control variables include: Size, R&D, Tobin's Q, Age, Revenue Growth, Stock Returns, Leverage and Cash Surplus, as defined in Appendix A. *t-statistic*, based on robust standard errors, adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Stage1	Stage2	Stage2	Stage2	Stage2	Stage2	Stage2
	Running	Y02 Counts	Y02 Cites	Y02 Counts pct	Y02 Cites pct	Y02 Top 1	Y02 Top 10
VARIABLES	t, t-2	t+1, t+3	t+1, t+3	t+1, t+3	t+1, t+3	t+1, t+3	t+1, t+3
PopeUS $_{t,\,t-2}$	0.007***						
	(4.08)						
Running $_{t,\,t-2}$		3.777**	6.189***	0.012	-0.174	0.229	-1.046*
		(2.27)	(2.70)	(0.12)	(-1.52)	(1.36)	(-1.93)
Constant	-0.416***						
	(-13.68)						
Observations	10,788	10,788	10,788	10,788	10,788	10,788	10,788
R-squared	0.310	0.064	-0.129	0.034	-0.294	0.053	-0.331
F-Test (SW)	16.63						
p-value	0.00						
Endogeneity Test		2.046	5.332	0.192	5.033	0.820	10.298
p-value		0.1526	0.0209	0.6611	0.0249	0.3652	0.0013
Industry Dummy		Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy		No	No	No	No	No	No
Other Controls		Yes	Yes	Yes	Yes	Yes	Yes

Table 4B: 2SLS Instrumental Variable

This table employs a two stage least square regression, with *Peer Effects* (the state of incorporate average *Running* excluding the focal firm from the average) instrumenting for the variable of interest, the *Running* total of a firm's shareholder proposals concerned with climate change. The first stage is shown in column 1. Columns 2-7 represent the second, instrumented stage regressions. The dependent variables in the second stage are based on the patents by date filed with the US Patent Office containing the Y02 (climate change) technology classification, each defined in Appendix A. *Running* is the natural log of one plus a three-year average of an accumulated total of the climate-related shareholder proposals that a firm has received from 1994 to 2019. The *Firm Control* variables include: Size, R&D, Tobin's Q, Age, Revenue Growth, Stock Returns, Leverage and Cash Surplus, as defined in Appendix A. The *Peer Control* variables include the same control variables but averaged similar to the Peer Effects. *t-statistic*, based on robust standard errors, adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1) First Stage	(2) Y02 Counts t+1, t+3	(3) Y02 Cites t+1, t+3	(4) Y02 Counts pct t+1, t+3	(5) Y02 Cites pct t+1, t+3	(6) Y02 Top 1 pct t+1, t+3	(7) Y02 Top 10 pct t+1, t+3
Peer Effect $_{t, t-2}$	.299***						
	(6.173)						
Ln Running $_{t, t-2}$		2.947***	4.112**	.161***	.014	-.018	.46*
		(2.723)	(2.269)	(2.768)	(.246)	(-.169)	(1.799)
_cons	.244***						
	(2.869)						
Observations	13547	13547	13547	13547	13547	13547	13547
R-squared	.554	-.214	-.197	-.16	.008	.001	-.093
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peer Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test (SW)	23.07						
p-value	0.0000						
Endogeneity Test		5.915	4.459	8.857	0.006	0.134	3.205
p-value		0.0150	0.0347	0.0029	0.9372	0.7142	0.0734

t-values are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 5A: Placebo Test: Random State Assignment

This table employs the same specification as in Table 4B, except that firms are randomly assigned to states: a two-stage least square regression, with *Random Peer Effects* (a random state of incorporate average of *Running* excluding the focal firm from the average) instrumenting for the variable of interest, the *Running* total of a firm's shareholder proposals concerned with climate change. The first stage is shown in column 1. Columns 2-7 represent the second, instrumented stage regressions. The dependent variables in the second stage are based on the patents by date filed with the US Patent Office containing the Y02 (climate change) technology classification, each defined in Appendix A. *Running* is the natural log of one plus a three-year average of an accumulated total of the climate-related shareholder proposals that a firm has received from 1994 to 2019. The *Firm Control* variables include: Size, R&D, Tobin's Q, Age, Revenue Growth, Stock Returns, Leverage and Cash Surplus, as defined in Appendix A. The *Peer Control* variables include the same control variables but averaged similar to the Peer Effects. *t-statistic*, based on robust standard errors, adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1) First Stage	(2) Y02 Counts $_{t+1, t+3}$	(3) Y02 Cites $_{t+1, t+3}$	(4) Y02 Counts pct $_{t+1, t+3}$	(5) Y02 Cites pct $_{t+1, t+3}$	(6) Y02 Top 1 pct $_{t+1, t+3}$	(7) Y02 Top 10 pct $_{t+1, t+3}$
Random Peer Effect $_{t, t-2}$	.019						
	(.744)						
Running $_{t, t-2}$		-.44	5.614	-.13	.063	-.001	.589
		(-.056)	(.457)	(-.245)	(.137)	(-.001)	(.317)
_cons	.132**						
	(1.964)						
Observations	13624	13624	13624	13624	13624	13624	13624
R-squared	.551	-.04	-.427	-.158	-.011	.003	-.173
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peer Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-Test (SW)	0.41						
p-value	0.5214						
Endogeneity Test		0.028	0.263	0.105	0.015	0.001	0.109
p-value		0.8679	0.6083	0.7458	0.9040	0.9780	0.7407

Table 5B: Placebo Test: Non-Climate Proposals

This table contains regressions on innovation, using a placebo by comparing climate proposals to all other proposals. The dependent variables are based on the patents by date filed with the US Patent Office containing the Y02 (climate change) technology classification, each defined in Appendix A. *ISS CC* is the natural log of one plus an accumulated total of climate-related shareholder proposals that a firm has received from 1994 to 2019, according to ISS Item Code. *ISS Non-CC* is the natural log of one plus an accumulated total of *all other* shareholder proposals that a firm has received from 1994 to 2019, according to ISS. The control variables include: Size, R&D, Tobin's Q, Age, Revenue Growth, Stock Returns, Leverage and Cash Surplus, as defined in Appendix A. *t-statistic*, based on robust standard errors, adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1) Count	(2) Count	(3) Cites	(4) Cites	(5) Pct_Count	(6) Pct_Count	(7) Pct_Cites	(8) Pct_Cites	(9) Top_1	(10) Top_1	(11) Top_10	(12) Top_10
ISS CC	.477***		.893***		.019***		.015***		.022***		.048***	
	(12.957)		(14.507)		(6.503)		(4.876)		(4.428)		(4.54)	
ISS NonCC		.054***		.187***		.003***		.004***		.01***		.012***
		(4.021)		(8.28)		(2.696)		(3.908)		(5.614)		(3.219)
_cons	-.507***	-.487***	-1.205***	-1.215***	-.078***	-.078***	-.101***	-.102***	-.065***	-.068***	-.229***	-.231***
	(-2.936)	(-2.797)	(-4.17)	(-4.181)	(-5.58)	(-5.538)	(-6.856)	(-6.911)	(-2.817)	(-2.967)	(-4.629)	(-4.663)
N	13822	13822	13822	13822	13822	13822	13822	13822	13822	13822	13822	13822
R-squared	.851	.85	.696	.692	.63	.629	.601	.601	.632	.632	.82	.82
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

t-values are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 6: Alternative Sample

The following table OLS regressions are *only* for firms that have *ever* received a proposal related to climate change. The dependent variables are based on the patents by date filed with the US Patent Office containing the Y02 (climate change) technology classification, each defined in Appendix A. *Running* is the natural log of one plus a three-year average of an accumulated total of the climate-related shareholder proposals that a firm has received from 1994 to 2019. The control variables include: Size, R&D, Tobin's Q, Age, Revenue Growth, Stock Returns, Leverage and Cash Surplus, as defined in Appendix A. *t-statistic*, based on robust standard errors, adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1) Y02 Counts $_{t+1, t+3}$	(2) Y02 Cites $_{t+1, t+3}$	(3) Y02 Counts pct $_{t+1, t+3}$	(4) Y02 Cites pct $_{t+1, t+3}$	(5) Y02 Top 1 pct $_{t+1, t+3}$	(6) Y02 Top 10 pct $_{t+1, t+3}$
Running $_{t, t-2}$	.638***	.542***	.014***	.014***	.013	.036*
	(7.076)	(3.41)	(2.916)	(3.096)	(1.247)	(1.868)
Size $_{t, t-2}$	-.135*	.266*	.008*	.01**	.009	.024
	(-1.685)	(1.887)	(1.9)	(2.383)	(.959)	(1.392)
R&D/Assets $_{t, t-2}$	8.412***	10.15**	-.049	-.013	.102	1.313**
	(3.378)	(2.309)	(-.382)	(-.102)	(.358)	(2.479)
Tobin's Q $_{t, t-2}$	-.019	-.068	.002	-.001	-.01**	-.01
	(-.517)	(-1.045)	(1.293)	(-.641)	(-2.322)	(-1.243)
Age $_{t, t-2}$	.694	-.232	-.008	.035	.022	.277***
	(1.403)	(-.266)	(-.313)	(1.369)	(.395)	(2.636)
Sales Growth $_{t, t-2}$	-.023	-.085	.002	.002	-.003	.004
	(-.285)	(-.587)	(.38)	(.38)	(-.322)	(.216)
Stock Return $_{t, t-2}$	-.003	.114	-.013*	-.006	.029*	.031
	(-.024)	(.477)	(-1.865)	(-.918)	(1.859)	(1.075)
Leverage $_{t, t-2}$	1.459***	1.734***	-.01	.011	.106***	.086
	(4.616)	(3.108)	(-.61)	(.691)	(2.955)	(1.283)
Cash Surplus $_{t, t-2}$	-3.95***	-1.937	-.025	.025	.066	-.45**
	(-4.196)	(-1.166)	(-.514)	(.515)	(.619)	(-2.25)
_cons	.04	-2.247	-.024	-.107**	-.12	-.436**
	(.044)	(-1.395)	(-.501)	(-2.275)	(-1.158)	(-2.246)
Observations	2579	2579	2579	2579	2579	2579
R-squared	.858	.678	.559	.52	.65	.854
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes

t-values are in parentheses

**** p<.01, ** p<.05, * p<.1*

Table 7: Alternative Measure of the Main Variable of Interest

This table contains regressions on innovation against an alternative proxy for shareholder pressure. The dependent variables are based on the patents by date filed with the US Patent Office containing the Y02 (climate change) technology classification, each defined in Appendix A. *Vote For* is the average percent support for a climate-related proposal that the proposals receive at annual meetings from 1994 to 2019, according to ISS Item Code. The control variables include: Size, R&D, Tobin's Q, Age, Revenue Growth, Stock Returns, Leverage and Cash Surplus, as defined in Appendix A. *t-statistic*, based on robust standard errors, adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1) Y02 Counts t+1, t+3	(2) Y02 Cites t+1, t+3	(3) Y02 Counts pct t+1, t+3	(4) Y02 Cites pct t+1, t+3	(5) Y02 Top 1 pct t+1, t+3	(6) Y02 Top 10 pct t+1, t+3
Vote For $_{t, t-2}$	.145***	.295***	-.001	-.001	.008***	.03***
	(6.803)	(8.29)	(-.578)	(-.323)	(2.689)	(4.939)
Size $_{t, t-2}$	.051***	.157***	.01***	.012***	.008***	.022***
	(2.633)	(4.883)	(6.689)	(7.573)	(3.324)	(3.972)
R&D/Assets $_{t, t-2}$	.439	1.337	-.033	-.023	-.147**	.521***
	(.82)	(1.494)	(-.757)	(-.504)	(-2.081)	(3.421)
Tobin's Q $_{t, t-2}$	-.007	-.021	.001	0	-.002	-.001
	(-.667)	(-1.177)	(1.493)	(-.267)	(-1.323)	(-.464)
Age $_{t, t-2}$	.141*	.06	.01	.02***	.014	.127***
	(1.747)	(.448)	(1.496)	(2.996)	(1.331)	(5.533)
Sales Growth $_{t, t-2}$	0	0	0	0	0	0
	(.302)	(.369)	(.519)	(.546)	(.246)	(.225)
Stock Return $_{t, t-2}$	-.005	.07*	.002	.003	.007**	.015**
	(-.213)	(1.665)	(.877)	(1.502)	(2.205)	(2.174)
Leverage $_{t, t-2}$	.157***	.159	-.001	.006	0	-.03*
	(2.613)	(1.583)	(-.177)	(1.102)	(-.057)	(-1.777)
Cash Surplus $_{t, t-2}$	-.142	-.185	-.027*	-.021	-.011	-.101*
	(-.748)	(-.58)	(-1.737)	(-1.3)	(-.423)	(-1.862)
_cons	-.473***	-1.142***	-.076***	-.099***	-.063***	-.227***
	(-2.722)	(-3.933)	(-5.412)	(-6.732)	(-2.753)	(-4.597)
Observations	13822	13822	13822	13822	13822	13822
R-squared	.85	.692	.629	.601	.632	.82
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes

t-values are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 8: The Role of Board Independence

This table contains ordinary least square regressions that consider *Board Independence*, defined as "no significant connection with the firm" by Institutional Shareholder Services. In Panel A, *Board Independence* is used as a control variable. In Panel B, the sample is split between *Less* and *More Board Independence. Running* is the natural log of one plus a three-year average of an accumulated total of the climate-related shareholder proposals that a firm has received from 1994 to 2019. Control variables include: Size, R&D, Tobin's Q, Age, Revenue Growth, Stock Returns, Leverage and Cash Surplus, as defined above in the Description of Variables. *t-statistic*, based on robust standard errors, adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Percent of Board Independence as control

	(1) Y02 Counts $_{t+1, t+3}$	(2) Y02 Cites $_{t+1, t+3}$	(3) Y02 Counts pct $_{t+1, t+3}$	(4) Y02 Cites pct $_{t+1, t+3}$	(5) Y02 Top 1 pct $_{t+1, t+3}$	(6) Y02 Top 10 pct $_{t+1, t+3}$
Running t, t-2	.632***	1.098***	-.002	.001	.056***	.075***
	(11.214)	(8.431)	(-.478)	(.171)	(5.568)	(3.843)
Percent Indep	.006	-.45	-.037***	-.027**	-.017	-.015
	(.035)	(-1.254)	(-3.125)	(-1.967)	(-.623)	(-.271)
_cons	-2.058***	-2.021**	-.13***	-.227***	.046	-.4***
	(-4.865)	(-2.067)	(-4.059)	(-6.029)	(.608)	(-2.728)
Observations	5747	5747	5747	5747	5747	5747
R-squared	.917	.705	.785	.687	.631	.824
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

t-values are in parentheses
**** p<.01, ** p<.05, * p<.1*

Panel B: Sample split between Less and More independent boards

	(1) Less Count	(2) More Count	(3) Less Cites	(4) More Cites	(5) Less Pct_Count	(6) More Pct_Count	(7) Less Pct_Cites	(8) More Pct_Cites	(9) Less Top_1	(10) More Top_1	(11) Less Top_10	(12) More Top_10
Running $_{t,\ t\text{-}2}$	.876***	.432***	2.016***	.279	.013**	-.012**	-.004	.009	.15***	-.029**	.209***	-.034
	(10.16)	(5.97)	(16.147)	(1.187)	(2.003)	(-2.074)	(-.521)	(1.311)	(9.14)	(-2.356)	(7.91)	(-1.163)
_cons	-1.117*	-2.388***	-2.232**	-.83	-.189***	-.081*	-.246***	-.196***	-.038	.29***	-.387**	-.018
	(-1.825)	(-3.836)	(-2.517)	(-.411)	(-4.268)	(-1.688)	(-4.845)	(-3.25)	(-.329)	(2.753)	(-2.066)	(-.074)
Observations	3014	2733	3014	2733	3014	2733	3014	2733	3014	2733	3014	2733
R-squared	.937	.913	.872	.626	.838	.801	.78	.66	.646	.709	.874	.819
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

t-values are in parentheses

**** p<.01, ** p<.05, * p<.1*