The real impacts of public short campaigns: Evidence from stakeholders*

Claire Liu
University of Sydney Business School
University of Sydney
Email: claire.liu@sydney.edu.au

Angie Low
Nanyang Business School,
Nanyang Technological University
Email: AACLow@ntu.edu.sg

Talis Putnins
UTS Business School
University of Technology Sydney
Email: talis.putnins@uts.edu.au

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Abstract

Using a novel dataset of firm product introductions, we examine whether public short campaigns (PSCs) have real impacts on targets. Targets introduce fewer new products and experience declines in innovation productivity and product quality relative to matched firms following PSCs. This decline in product innovation is partly attributed to the withdrawal of support from key stakeholders, resulting in reduced access to external capital, decreased employee commitment, and weakened customer relationships. Our results suggest that the public nature of PSCs has distinctive impacts on target firms compared to traditional short selling, primarily through their impact on the firm's stakeholders.

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1. Introduction

Due to fears of legal risk and regulatory scrutiny, short sellers have traditionally kept their positions private and avoided publicizing their short positions and investment theses. In recent years, however, a new breed of short sellers has emerged who launch high-profile public short campaigns (PSCs) to talk down a target firm's stock and present evidence of specific allegations, such as accounting irregularities and product deficiencies, or they may simply allege that a target's stock is overvalued. By publicly announcing their pessimistic opinions of target firms, these activist short sellers hope to influence other market participants' views of the target stock and cause long investors to sell the stock. The subsequent stock price decline allows activist short sellers to profit from the short positions that they built before their announcement.

The prominence of these PSCs came to the forefront in the GameStop short squeeze at the beginning of 2021 and created debates on what roles these activist short sellers play in the financial market.[1] Proponents such as Warren Buffet have signaled their support for activist short sellers, arguing that they perform an important role by aiding price discovery through uncovering negative information and exposing corporate malpractice.[2] However, critics and, in particular, the management targeted by PSCs have accused these activist short sellers of market manipulation, spreading falsehoods, and causing target companies long-term economic damage (Walker and Forbes, 2013). For example, when several high-profile activist hedge funds publicly announced their short positions in Tesla's stock, Tesla's chief executive officer,

[1] Despite the Financial Industry Regulatory Authority (FINRA) publicly discloses the aggregate short interest in US-listed stocks, however this information was collected from dealers/brokers and a particular short seller's short interest in these stocks was not reported to the regulator. The recent prominence of PSCs has also prompted the SEC to adopt the new Rule 13f-2 in October 2023, which would require large institutions with gross short positions that exceed certain thresholds to disclose their short positions in individual securities and short sale transactions monthly (https://www.sec.gov/news/press-release/2023-221) to the SEC. Before Rule 13f-2, activist short sellers could announce their short investment theses without disclosing their exact short position (if any) in the target company to the regulator.

[2] See https://www.cnbc.com/2018/10/05/experts-including-warren-buffett--say-short-selling-can-be-beneficial-for-markets.html.

Elon Musk, accused these activist short sellers of fabricating false rumors, calling them "value destroyers" who distract the company from long-term value creation.[3]

Do PSCs have any real negative impacts on target firms as alleged by corporate managers? In this study, we show that the public nature of PSCs not only influences stock market participants' views but also adversely affects the perception of key stakeholders towards target firms. Using a novel dataset of new product and service announcements from Capital IQ's Key Developments database,[4] we find that PSCs have strong negative long-term real impacts on their target firm's new product introductions (NPIs), even after accounting for the possible superior stock-picking abilities of activist short sellers (Kartapanis, 2019). These negative impacts are partly due to the withdrawal of support from key stakeholders important in the product innovation process. Through focusing on PSC's impact on stakeholders, this paper highlights how financial markets affect firms' real activities when key financial and non-financial stakeholders of the firm, other than the managers, make decisions based on information revealed in the stock market (Goldstein, 2023; Subrahmanyam and Titman, 2001).

Product innovation is an ideal context to examine the consequences of stakeholder support. Successful product innovation is critical for long-term firm performance and survival (Argente et al., 2018). Unlike patenting and research and development (R&D) activities, which may not ultimately lead to new products, the introduction of a new product is an important milestone in the innovation process that has direct implications for sales (Chu et al., 2021). During the long and complex development process involved in bringing a new product to the market, firms need the support of their key stakeholders. Investors must be willing to supply capital for the new risky investment (Atanassov, 2016). The cooperation of employees and their investment in terms of firm-specific human capital is integral to the innovation process

[3] For examples, see https://www.cnbc.com/2017/11/15/elon-musk-said-tesla-short-sellers-are-jerks-who-want-us-to-die.html and https://www.tesla.com/Blog/taking-Tesla-private.
[4] For brevity, we refer to both products and services simply as products henceforth.

(Acharya et al., 2014). Finally, firms must work with key customers to understand their needs and garner support for the final product (Gruner and Homburg, 2000; Lukas and Ferrell, 2000).

PSCs generate bad publicity for the firm and damage the reputation of the firm and its management (Brendel and Ryans, 2021).[5] When being targeted in a PSC by Hindenburg Research, Carl Icahn, the chairman of Icahn Enterprises, said that the campaigns "… distort companies' images, damage their reputations…".[6] PSCs may thus influence stakeholders' perceptions of the target firm, making it difficult for target firms to raise external capital to fund innovation projects (Grullon et al., 2015).[7] Employee commitment and customers' faith in the target firm can also be negatively affected, resulting in lowered innovation productivity and shrinking demand for the target firm's products. These negative stakeholder impacts will, in turn, reduce the target firms' ability to innovate and introduce new products after the announcement of PSCs, thereby creating a negative cascading effect that worsens the product situation for target firms (Subrahmanyam and Titman, 2001).

We collect a comprehensive sample of firm-initiated product-related press releases and use textual analysis to categorize the press releases into news relating to new product launches and major product updates versus other minor product-related news. We primarily measure product innovation outcomes using the number of NPIs, defined as new product launches and major product updates announced by the firms. Our sample of PSCs consists of publicly

[5] It is often difficult to prove in court that a target's stock was illegally manipulated by the activist short seller, since prosecutors would need to prove that the activist willfully aimed to artificially drive down the stock price, which is not easy because the activist can claim to have made an inaccurate judgment. The high hurdle to prove short campaigns are illegal thus creates room for manipulative short selling campaigns (sometimes called "distort and short" campaigns), which are aimed at artificially driving down stock prices for the benefit of the short seller. Such distort and short campaigns are mostly pseudonymous short attack campaigns published on investing discussion platforms such as Seeking Alpha (SeekingAlpha.com), where the author of the short thesis adopts a pseudonymous identity (Mitts, 2020). In this study, we focus on PSCs launched by prominent activist short sellers, to which corporate managers and key stakeholders are more likely to pay attention.

[6] Source: https://www.prnewswire.com/news-releases/icahn-enterprises-responds-to-self-serving-short-seller-report-301821068.html

[7] PSCs are short selling events with extreme negative publicity for target firms and differ from other types of negative disclosures, such as analysts' sell recommendations or credit rating downgrades. Unlike other disclosure events where the disclosed information is generally accurate, activist short selling is a much more controversial disclosure event where activist short sellers are often accused of purely manipulating stock prices for their own benefits.

disclosed short selling campaigns launched by prominent activist short sellers. To reduce the endogenous impacts of selection on observables, we use a propensity score matching approach to match each target firm to a control firm within its industry, using matching covariates that predict the likelihood of activism (Brav et al., 2018; Zhao, 2020).

Using a difference-in-differences (DiD) approach, we find that, relative to their matched control firms, PSCs' target firms introduce 11.2% fewer new products per year, on average, over the five years after being targeted. Consistent with the parallel trend assumption, target and matched firms have similar pre-campaign NPI trends, with significant changes in target product outcomes only arising after the launch of the PSC, and not before. Using alternative measures of product innovation, we also find a long-term decrease in innovation productivity as measured by the number of NPIs per dollar of R&D capital (Hirshleifer et al., 2013). Market reactions to new product announcements for target firms are also lower post-campaign announcement relative to their matched counterparts, evidence that product quality deteriorates after being the target of a PSC (Cohn et al., 2020; Mukherjee et al., 2017). R&D inputs of target firms also decline in the short-term relative to control firms.

Next, we provide evidence confirming that the reduction in product innovation is at least partly due to key stakeholders withdrawing their support from target firms. The stakeholder channel predicts that the negative impacts on NPIs should be stronger among targets that are financially constrained, targets operating in competitive industries, and targets with less committed employees -- firms that are most vulnerable to the withdrawal of shareholder support. Financially constrained firms can face difficulties raising capital to fund additional innovation projects if capital providers are negatively influenced by the activist short seller's accusation. Important customers whose faith in the target firm is weakened by the short seller's allegation can switch suppliers, especially in competitive industries where alternative suppliers are readily available. Finally, firms with less committed employees can experience

lower employee morale and the departure of key employees, leading to worse product innovation. We find results consistent with our predictions.

Further supporting the stakeholder mechanism of negative real impact, target firms experience worsened relationships with capital providers, employees, and important customers relative to control firms. Target managers raise less equity capital and receive less voting support from shareholders on management-sponsored compensation proposals. Moreover, target firms experience a higher likelihood of customers terminating trade relationships and weaker sales growth to their major customers. Lastly, using employee rating data from Glassdoor.com, target firms' employee sentiment significantly worsens relative to control firms following PSCs.

Prior literature has found that activist short sellers have stock-picking abilities (Kartapanis, 2019). We have controlled for the selection of target firms based on observables by using matched sample analysis throughout. We further address the selection issue in several ways. First, activist short sellers have every incentive to disclose problems in targets that justify their short selling attack to influence other market participants' views. A selection story would thus imply stronger product effects among campaigns where activist short sellers predict product problems. However, we find similar degrees of product innovation decline across all types of campaigns regardless of whether the activist short sellers alleged product problems in targets or not. Second, NPI declines are also present among the subset of campaigns where the activist short sellers are likely to have made a mistake. If selection based on fundamentals is driving our results, we should not observe negative impacts of PSCs among campaigns where activist short sellers are inaccurate in their predictions. Finally, we carefully account for selection using Heckman's two-step selection model and a strong instrumental variable. We continue to find a reduction in NPIs for target firms. We also check that the results are not

driven by alternative hypotheses such as a reduction in overinvestment or management making myopic cuts in innovation investments to boost short-term performance.

Throughout our analysis, we control for aggregate short interest in the target firm's stock which includes short positions of both public short selling and traditional non-disclosed short selling. Unfortunately, existing data does not allow us to differentiate between the two types of short positions. We show that while activist short selling is associated with NPI declines, aggregate short interest positively predicts the number of NPIs. The latter result is consistent with He and Tian (2023) who find that non-disclosed short selling has disciplinary effects on managers. Further reinforcing the idea that stakeholder responses play a key role in differentiating activist and non-disclosed short selling, aggregate short interest has no predictive powers for the stakeholder relationships of the target firm.

This study contributes to several strands of literature. First, we add to the emerging literature that examines the financial and real impacts of activist short sellers, which have been very much the focus of policymakers and the financial press since the GameStop short squeeze. Ljungqvist and Qian (2016) and Paugam et al. (2021), for example, examine the financial market implications of public short selling. Zhao (2020) examines target characteristics, while Lamont (2012) and Brendel and Ryans (2021) document how targets respond to activist short sellers' allegations. Appel and Fos (2022) focus on comparing the impacts of short and long campaigns by hedge funds. Wong and Zhao (2017) concentrate on how PSCs affect target managers' decisions. Different from Wong and Zhao (2017), we focus on the stock market's impact on the reactions of other key stakeholders and document that one important channel for the real impacts of activist short sellers is their influence on stakeholders' perceptions of the target firm.

Existing research, such as Chang et al. (2019), Fang et al. (2016), He and Tian (2023), and Massa et al. (2015), has generally found beneficial impact of short selling threats on firm

activities due to their disciplinary effects. Our analysis extends these studies on short selling by highlighting how the public nature of short campaigns has an incremental and distinct negative impact on firm activities, primarily due to their broader influence on firm stakeholders. Unlike traditional non-disclosed short selling where the impact primarily affects financial market participants and disciplines firm managers, our results indicate that the influence of public short selling is broader and that stakeholders' responses play a key role.

Our results are also related to the stream of literature that examines the active informational role of the financial market in allocating firm investments (Goldstein et al., 2013). Prior empirical literature has examined the stock market's effect on the firm's decisions through an examination of how managers learn from stock prices (e.g., Chen et al., 2007; Luo, 2005). This real effect of the stock market may itself provide the impetus for activist short sellers to engage in PSCs even if they are uninformed (Goldstein and Guembel, 2008). We provide evidence to support this as we find declines in product innovation even when activist short sellers are not accurate in their allegations. Our results further show that one channel through which these activist short sellers impact firm fundamentals is through their impact on key stakeholders, providing support to the theoretical model in Subrahmanyam and Titman (2001).

Finally, our paper also has policy implications for public short selling regulations. Countries around the world are increasingly looking into the roles of these activist shorts and considering whether there should be additional regulation. For example, the U.S. SEC has recently adopted additional regulation requiring institutional investors to disclose more about their individual short positions with the regulator to increase scrutiny of activist short selling.[8] The Australian Securities and Investments Commission has recently recommended a set of

[8] See https://www.reuters.com/markets/us/us-sec-finalize-rules-increasing-transparency-short-selling-market-2023-10-13/

better practices for activist short sellers, such as fact-checking with target firms before releasing any reports.[9] These additional disclosures and regulations are likely to add to the cost and reduce the benefits of launching a public short selling campaign (Jank et al., 2021). Our paper highlights the importance of increased scrutiny when regulating these activist shareholders. While activist short sellers may aid in price discovery, the negative publicity generated by their campaigns may go beyond just affecting market participants' views and have real consequences for target firms through their impact on key stakeholders' perceptions.

2. Data and Empirical Methodology

2.1. PSC data and sample construction

We start with a sample of publicly announced short selling campaigns obtained from Activist Shorts Research (ASR) that covers PSCs by prominent traders from 2010 to 2017. We stop in 2017 to allow us time to study the long-term impacts of the campaigns. The ASR dataset provides detailed information on each PSC in which the activist short seller voluntarily disclosed taking a short position. For each campaign, the dataset reports the initial announcement date, information on the target firm, and the activist short seller. Private communications from ASR state their analysts use their industry knowledge to track a list of prominent activist short sellers and their PSCs. We list the top ten most active activist short sellers in our sample in Panel A of Appendix B.

Among all the events covered by ASR, 608 campaigns involve target firms headquartered in the United States (U.S.) and listed on major U.S. stock exchanges. After requiring target firms' stock return information from the Center for Research in Security Prices (CRSP), financial data and short interest data from Compustat, and removing campaigns on firms in regulated industries, we end up with 341 campaigns announced by 79 unique activist

[9] See https://asic.gov.au/regulatory-resources/markets/short-selling/activist-short-selling-campaigns-in-australia/

short sellers targeting 241 unique firms over the period 2010-2017.[10] All stock returns and firm financial variables are winsorized at the 1st and 99th percentiles.

Table 1 summarizes the characteristics of the 341 PSCs in our initial sample. Panel A provides statistics on the market reactions to campaign announcements while Panel B reports the time series distribution of short campaigns.[11] The market generally responds strongly to short campaign announcements. The mean cumulative abnormal returns (CARs) over the event window (day 0, day +1) is -3.00%, where day 0 is the day of the activist short seller's campaign announcement. This underperformance also persists over longer windows, up to at least 252 trading days into the future.

Panel C of Table 1 reports the distribution of the PSCs across allegation types and the corresponding average CARs for each allegation type. We manually go through source documents and news articles to identify the allegations of the activist short seller leveled against each target. Each PSC can have multiple allegations. Appendix B provides anecdotal examples of each allegation type. Activist short sellers always claim the target firms' stocks are overvalued, but, for almost all campaigns in our sample, the claims are accompanied by specific allegations of product issues, accounting problems, investment- and financing-related issues that explain the overvaluation. Product-related allegations are the most common at 59% of all campaigns, where the activist short sellers criticize the target firms' products, claiming, for example, that their products are ineffective, unattractive, or at a competitive disadvantage or the firms are operating in declining industries. The second most common allegation is business or management issues where the activist short seller accuses management of being incompetent or having poor investments or business strategy. We find that the stock market reacts strongly and negatively to all types of allegations. The short-term stock market reactions

[10] Our sample selection criteria filter out events when anonymous bloggers publish comments on Seeking Alpha.
[11] Since the ASR data were downloaded in mid-2017, we do not have all the campaigns from 2017.

are the strongest for claims related to legal or fraud issues and weakest for allegations relating to business or management issues, which is understandably more subjective.

2.2. Product announcement data

Firm products are the final innovation output that directly generates cash flows and thus represent an important determinant of firm value (Chu et al., 2021). Our main analysis of firm product activities uses product announcement press releases from the Capital IQ Key Developments database, which starts in 2002. Product-related announcements are defined as corporate announcements pertaining to the development, introduction, change, improvement, or discontinuation of a company's product or services. We follow Edmans et al. (2018) and exclude news released by external media and keep only firms' voluntary press releases via a newswire (e.g., Business Wire) or the firms' website.[12] The database consolidates different sources of particular news into a single record and thus has an advantage in identifying unique news releases over those of standard news sources, such as Factiva and LexisNexis (Edmans et al., 2018).

After merging the product announcement information from Capital IQ with that of Compustat and CRSP using the Central Index Key and company names, our initial sample includes 175,456 product announcements by 7,429 unique U.S. public firms over 2002–2020.[13] About 50% of the firms in the CRSP–Compustat merged database made at least one product announcement during the 2002–2020 period. For each announcement, Capital IQ provides

[12] Although such product announcements are voluntary, firms generally have an incentive to release new information about their product developments. First, product launches and updates are generally good news, and managers have incentives to disclose this good news to inform capital market participants of the product innovation implications on firm value (Cao et al., 2018; Chen et al. 2002). Second, voluntary disclosures of product developments help companies market their products and secure market share (Fosfuri and Giarratana, 2009).

[13] We downloaded the Capital IQ data in January 2021.

information on the firm, the initial announcement date, a title (i.e., "headline"), and a more detailed summary (i.e., "situation").

We use textual analysis to classify all product announcements into four categories based on a list of comprehensive keywords for each category: 1) new product launches, 2) product updates, 3) progress toward new products, and 4) others. The detailed keyword list to classify product announcement categories is provided in Appendix C. This keyword list is an expanded list based on the initial keywords used by Cao et al. (2018), and the definition of the four categories is similar to that of Yang et al. (2018), who classify the product announcements by hand. New product launches are defined as introductions or a major new version of products, services, or software (e.g., iPhone 12). Product updates are announcements about a firm's improvements or updates of its existing products, such as a new model of an existing product, with new features or a software update (e.g., from v. 14.1 to v. 14.2). Thus, product updates are less substantial than product launches; however, since it is not easy to differentiate between these two categories, for most of our tests we examine the aggregate of these two types of announcements. Progress toward new products is defined as material progress toward developing or manufacturing new products, such as regulatory approvals and presentations of trial results. Lastly, we classify announcements that are not in these three categories as others, and these can include announcements about product previews, new store openings, and so forth.

We classify each news item based on keyword counts of the text in the product announcement headline. An announcement is classified into a category if its headline has the highest frequency of keywords for that category. This allows us to classify 91.6% of all product announcements in the initial sample. For the remaining announcements, with no keyword identified or the same keyword count in multiple categories from the announcement headlines, we use the keyword count of the detailed product announcement summary for classification.

This allows us to classify another 8.4% of the announcements. Among the remaining unclassified announcements, we drop announcements that are related to either product recalls and development failures or non-product-related releases and classify the remainder by manually reading through the press release.[14] Among the 174,995 valid product announcements left, 56.4% are new product launches, 25.6% are product developments, 12.5% are product updates, and 5.4% are classified under the others category. We manually read through a random sample of 500 announcements and find that 96% are classified correctly using this methodology.

2.3. Product activity measures

We construct several measures of product-related activities along three dimensions: quantity, efficiency, and quality. We measure a firm's product quantity using the number of NPIs (*Number of NPIs*), which aggregates the number of new product launches and product updates by a firm during the fiscal year. We set the *Number of NPIs* to zero for the firm–years without product announcements.

Next, we construct an efficiency measure to measure a firm's ability to generate new products from its innovation inputs. The variable *Innovation Productivity* is calculated as a firm's number of NPIs during year *t* divided by its accumulated R&D capital, *R&D Capital,* over the five years ending in year *t* - 2. This measure is similar to that used by Hirshleifer et al. (2013) to estimate patenting efficiency. Like *Number of NPIs*, *Innovation Productivity* is set to zero for the firm–years without product announcements.

Finally, we use the stock market's reaction to a firm's NPI announcement to proxy for product quality (Cohn et al., 2020; Mukherjee et al., 2017). We estimate the CAR over the

[14] Product recalls and development failures usually contain the following keywords and their variations: *recalls*, *postpone*, *recollect*, *call back*, and *fail* and *license/test*. We ensured that our classification of new product launches and developments do not contain news related to recalls or development failures.

event window (day -10, day +10) surrounding the announcement to an NPI. We use a wider event window to capture the possibility of Capital IQ's inaccurate reporting of the initial product announcement date. In calculating product announcement CARs, we estimate the expected returns using the standard market model over the estimation window (day -250, day -50). This market value approach allows us to capture the forward-looking product value from the market expectations of the future cash flows associated with the new products. Finally, we follow the literature and use R&D intensity as innovation input.

2.4. Construction of the matched sample

PSC target firms are not randomly selected and share certain characteristics (Zhao, 2020). Therefore, we use propensity score matching to form a matched sample of counterfactual firms that share observable characteristics similar to those of the PSC target firms. We estimate propensity scores using matching covariates that significantly predict a firm's probability of being targeted by activist short sellers, including the natural logarithm of *Total Assets*, *Firm Risk*, *Tobin's Q*, *ROA*, *Sales Growth, Annualized Stock Return, Amihud Illiquidity*, and pre-campaign changes in *ROA* and *Tobin's Q.* We follow Brav et al. (2018) and Zhao (2020) when selecting the matching covariates. The matching covariates are measured as of year t - 1, while the pre-campaign changes are measured between years t - 3 and t - 1, where year t is the fiscal year of the short campaign announcement. All variables are defined in Appendix A. The propensity score matching is carried out on the sample of firms in the Compustat–CRSP merged database with non-missing matching covariates. All the matching covariates significantly predict the likelihood of being targeted. Small, risky, liquid firms with a high *Tobin's Q*, sales growth and operating and stock performances are more likely to be targeted. Targets also tend to be firms with a declining trend in *ROA* and *Tobin's Q*.

In the second step, we match each PSC target, with replacement, to the nearest neighbor firm drawn from the same year and the same two-digit Standard Industrial Classification (SIC) code as the target firm observation. We also require the target firm and the control firm to come from two-digit SIC codes with at least one product announcement of any type in the fiscal year immediately before the short campaign event. This yields 274 short campaigns in our final matched sample. This final matched sample of target firms and control firms will be the basis of our analysis.

Table 2 reports the summary statistics for pre-campaign product outcomes and the firm characteristics of the target firms and control firms in our final matched sample. In Panel A, the *Number of NPIs* and *R&D intensity* are not significantly different between the target and control firms in the year before the PSC announcement, even though we do not match on these two variables. The key identifying assumption for a DiD setup is the parallel trends assumption, which requires any trends in the outcome variables to be similar between the treatment and control firms (Roberts and Whited, 2013). We find that the average annual change in the outcome variables over the five years before the campaign is similar between the two groups of firms, suggesting that the parallel trends assumption is upheld. Panel B also shows that the target and control firms exhibit similar matching covariate firm characteristics prior to the campaign announcement, indicating that the matching is well done.

It is natural for target firms to have high short interests, even before the event, because the activist short seller's strategy is to sell the stock short before making the announcement, which causes the stock price to fall, allowing the short seller to profit from the decline. Therefore, we do not match on short interest since it is an outcome of the short campaign. But we control for short interest in our regressions. We measure *Short Interest* as a firm's number of shares held short divided by the total number of shares outstanding. Thus, this variable captures the aggregated total short positions of both public and non-public short sellers, where

the latter's short positions are not publicly announced. As expected, target firms have significantly higher average proportions of shares held in short positions than their control firms immediately before the PSC announcement.

3. Main Empirical Results

3.1. NPIs surrounding short campaigns

Our main analysis examines how target firms' product-related activities change relative to those of their control firms after being targeted by PSCs. Therefore, the multivariate analysis consists of the firm-years of the target and control firms in the final matched sample over the 11 years beginning five years before the short campaign and ending five years afterward, that is, from year t - 5 to year t + 5, where year t is the fiscal year of the campaign announcement.[15] We use the following DiD regression as our main model:

$$Y_{i,j,t} = \alpha_i + \alpha_t + \beta_1 * Target_{i,j,i} * Post\,5 - Year_{j,t} + \beta_2 * Post\,5 - Year_{j,t} + \gamma * Control_{i,t} + \varepsilon_{j,i,t} \quad (1)$$

where $Y_{i,j,t}$ is one of our product-related variables described in Section 2.3 and is measured for firm i in year t of short campaign j. The target and its matched control firm share the same campaign j; α_i and α_t denote firm and year fixed effects, respectively;[16] $Target_{i,j,t}$ is an indicator variable equal to one if firm i is the target of short campaign j, and zero if the firm is the corresponding control firm from the matching procedure; $Post\ 5\text{-}Year_{j,t}$ is an indicator variable equal to one for both target and control firm–years if they are within the five years after the announcement of short campaign j, and zero otherwise; and $Control_{i,t}$ denotes the vector of control variables, which includes the natural logarithm of firm market capitalization (*Market*

[15] Since our sample ends in fiscal year 2019 due to requiring complete financial and product announcement data, any campaigns in the last few years would not have the full five years of post-event data. In particular, the last campaign announced in calendar year 2017, which corresponds to fiscal year 2016 or 2017, have only up to three full fiscal years of product announcement data after the event. Therefore, we also start the multivariate analysis sample in fiscal year 2007, three years before the first campaign in 2010.

[16] A minority of the targets appear multiple times in our sample, so we use the same firm fixed effects across the different campaigns in which the same target firm appears. The results are similar if we use campaign–firm fixed effects instead.

Cap) and *Short Interest*. Our main variable of interest is the coefficient β_1 of the interaction term between $Target_{i,j,t}$ and $Post\ 5\text{-}Year_{j,t}$, which gives the percentage differential between the target and control firms in the change in NPIs after being targeted by short campaigns.

Standard errors are clustered at the firm level throughout. The results are also consistent when we double-cluster by firm–year instead. We do not control for those firm characteristics that are used as matching covariates in the propensity score matching, since they are already accounted for through the matching procedure. Controlling for them in the DiD regressions does not affect the results.

Table 3 reports the results of the model we describe above. In Panel A, the dependent variable is the natural logarithm of one plus the *Number of NPIs* in Columns (1) and (2) and we use OLS specification. To address concerns that our variable of interest is a count variable (Cohn et al., 2022), in Columns (3) and (4), we use Poisson specification with the dependent variable *Number of NPIs*, without taking the logarithmic transformation. [17]

In Column (1), we find that the coefficient on the interaction term between *Target* and *Post 5-Year* is negative and statistically significant at the 1% level. Compared to their control firms, target firms announce 11.2% relatively fewer new products after being targeted. The positive and significant coefficient on the standalone indicator variable *Post 5-Year* is consistent with the overall trend in the full Compustat sample, where we see firms increasing their product introduction activities year on year. Similar results are observed in Column (3) where we use the Poisson specification: target firms experience a 19.4% decline in production introductions relative to their matched firms.

In Columns (2) and (4) of Table 3 Panel A, we vary the number of years surrounding the event and replace *Post 5-Year* with *Post 3-Year*, where *Post 3-Year* is an indicator variable

[17] We use the Stata command PPMLHDFE to run the Poisson model and it automatically drops firms with zero NPI throughout the sample period, reducing the number of observations to 3,240 and 2,217 in the estimation samples of Columns (3) and (4) respectively in Table 3A. To avoid confusion and to be consistent with the OLS estimation, we report the original number of firm-year observations before dropping for all the Poisson models.

equal to one for the three years after the campaign announcement, and zero otherwise. In this case, we restrict the sample to the seven years beginning three years before the short campaign and ending three years afterward. We continue to find a negative and significant coefficient on the interaction between *Target* and the indicator variable *Post 3-Year*.

To further examine whether the parallel trend assumption holds and to pinpoint exactly when the negative impacts on NPIs occur, in Panel B of Table 3, we construct event year indicator variables. The indicator variable *Event Year +n* (*-n*) is equal to one for the target and control firm–year *n* years after (before) the campaign announcement year, and zero otherwise. We find the coefficients on the interaction terms between *Target* and the event year indicator variables are consistently negative and much bigger in absolute magnitude in the years after the campaign announcement, compared to before the campaign. The negative impact on product outcomes becomes significant starting two years after the campaign announcement and continues up to five years afterward (Column (1)). The results are consistent with the time lag between innovation effort and output as observed in the launches of new products.

The coefficients on the interaction terms involving event year indicators for the years before the event are not significant. This is consistent with the conclusion drawn from Table 2, Panel A that there is no significant difference in the product activities in the years before the campaign announcement between the target and control firms. Thus, the parallel trends assumption needed for the DiD estimation to be valid is upheld in our sample.

Additionally, it is interesting to note that the coefficient on *Short Interest* is mostly positive and significant in Table 3, indicating a positive correlation between aggregated firm-level short interest and product outcomes. This positive coefficient contrasts with the negative product impacts of PSCs we documented previously. We explore and discuss this distinction in more detail later in Section 5.

We undertake several sensitivity analyses to check the robustness of our main results. First, we aggregate all four categories of product announcements and continue to find a greater significant decline in target firms' product announcements relative to control firms after PSCs. Second, we also separately examine the number of announcements relating to new product launches, product updates, and product development progress and find the strongest decline in target firms' product quantity coming from new product launches and product updates. Third, we run the analysis using the full Compustat sample without propensity score matching and find that targeted firms experience significant declines in NPIs relative to non-targeted Compustat firms in the five years after being targeted.

3.2. Firm-level innovation productivity, quality, and innovation inputs

We next turn to examine how innovation productivity, product quality, and innovation inputs change following PSCs in Table 4. The dependent variable in Column (1) is *Innovation Productivity*, a firm's *Number of NPIs* scaled by *R&D Capital*. We obtain a smaller sample than in Table 3 due to the requirement of positive *R&D Capital* firm–years for *Innovation Productivity* to have valid values. We find that the innovation productivity of the target firms decreases significantly more than that of the control firms after being targeted.

Next, we examine how the quality of products changes after short campaigns. The dependent variable in Column (2) is *New Product Announcement CAR(-10,10)*. The analysis is carried out at the product announcement level and is limited to the subsample of campaigns where both the target and control firms have at least one product announcement during the five-year periods before and also after the short campaign. We find that after being targeted, target firms' product announcements yield 1% lower abnormal returns compared to those of the control firms, indicating that target firms have worse product quality after PSCs.

The dependent variable in Columns (3) and (4) of Table 4 is *R&D Intensity,* which is a proxy for a firm's innovation input. We examine both longer and shorter periods, because, if

activist short sellers impact the innovation process, the impacts on innovation inputs should be felt more immediately than those on innovation outcomes. We find evidence that target firms decrease their innovation input in the shorter term, over the three years after the campaign announcement.

Overall, using various alternative specifications, we find that target firms experience a decline in product innovation quantity and quality after being targeted by activist short sellers. The target firms also face declines in innovation input and productivity. Next, we examine the mechanism through which activist short sellers cause the decline in product innovation.

4. Do PSCs Hurt Target Product Innovation via the Stakeholder Channel?

How do PSCs affect product innovation? Stakeholder support is integral to the innovation process, and the publicity generated through the short campaigns hurts the target's reputation and is likely to affect the views of the target firm's key stakeholders and thus their support.[18] Stakeholders, unlike managers who generally have more information, may learn new information from the public allegations. In addition, stakeholders may just be unwilling to be associated with firms that are perceived to be in trouble. We consider three types of key stakeholders in our analysis: capital providers (i.e., shareholders and debtholders), customers, and employees.

First, PSCs can negatively affect capital providers' perceptions of a firm's future prospects, leading financiers to increase the required compensation for providing capital or simply refuse to provide the requested capital to the target firm (Wong and Zhao, 2017). Target firms, especially those who are financially constrained, may thus be unable to raise the

[18] When Icahn Enterprises (IEP) was targeted by Hindenburg Research in a PSC in May 2023, Carl Icahn, chairman of IEP, called Hindenburg Research "Blitzkrieg Research" and said that it was the "modus operandi is to launch disinformation campaigns to distort companies' images, damage their reputations and bleed the hard-earned savings of individual investors." Source: https://www.prnewswire.com/news-releases/icahn-enterprises-responds-to-self-serving-short-seller-report-301821068.html

necessary funds to finance their new product developments. The documented reduction in R&D expenditure is consistent with this conjecture. Firms that are unable to raise capital would have to reduce their innovation investment, leading to less product output and the reduced investment would also negatively impact their product quality.

Second, PSCs can negatively affect customers' perceptions of target firms' products, which can lead to shrinking customer demand for the target firms' products to the extent that there exist substitutes. This can, in turn, lead firms to invest less in product innovation. Furthermore, customers who intend to switch suppliers can be less forthcoming in their market feedback to the target firm, affecting the firm's ability to bring quality products to the market (Gruner and Homburg, 2000; Lukas and Ferrell, 2000). Finally, employees are an essential part of product innovation (Acharya et al., 2014), and short campaigns can significantly weaken a firm's employee commitment, leading to reduced morale among the workforce and the departure of key employees, which can hurt the innovation process.

We provide evidence of the stakeholder channel through two sets of tests. Our first set of tests focuses on the cross-sectional impact of PSCs. We hypothesize that the negative product impact should be especially prominent among firms most vulnerable to declining stakeholder support. The second set of tests directly examine whether stakeholder relationships are negatively affected, using different proxies for the quality and strength of the relationships. If PSCs curtail target firms' capital-raising activities, leading them to reduce innovation investments, we expect stronger negative product impacts of PSCs among financially constrained firms, and capital raised by the firm would be reduced after the announcement of the short campaign. Similarly, if customer perceptions of target firms suffer because of short campaigns, we expect target firms from competitive industries to suffer more, since the customers in such markets have greater ability to switch to competitor supplier firms. Target firms' relationships with their major customers should also weaken. Finally, if employee

retention becomes a problem after a firm is targeted, we should observe worsening employee sentiments after targeting and the negative impact on product outcomes should be stronger among firms experiencing high employee turnover where employee relations are weaker.

4.1. Evidence supporting the stakeholder channel through the cross-sectional examination of firm types

In Table 5, Column (1), we examine whether financially constrained firms are more affected by short attacks. We measure the level of financial constraint faced by target firms and control firms using the indicator variable *Financially Constrained*, which is equal to one if the firm's Hadlock–Pierce (2010) financial constraint index is greater than the top quartile value in the full sample, and zero otherwise. We find that the reduction in product output after being targeted is concentrated among firms that are financially constrained since the coefficient on the triple interaction term of *Target*, *Post 5-Year*, and *Financially Constrained* is negative and significant. This result is consistent with our conjecture that short campaigns affect capital providers' perceptions of the firm's future prospects, thus negatively affecting target firms' abilities to raise necessary funds to finance their new product developments.

In Column (2) of Table 5, we examine the cross-sectional effects of industry competitiveness. We proxy for a firm's product market competition using *High Competition*, which is an indicator variable equal to one if the firm is in an industry with Herfindahl–Hirschman Index lower than the bottom quartile value in the full sample, and zero otherwise. To better capture product market positions and competition within the industry, we use the Hoberg–Phillips (2010, 2016) textual industry classification to classify the firms. We find results consistent with our expectations. The negative product impact of PSCs is mostly concentrated among firms in highly competitive industries where customers have a greater ability to switch supplier firms.

In Column (3) of Table 5, we examine whether the decline in product quantity is stronger among target firms with weaker employee commitment as proxied by employee turnover. Similar to Babenko and Sen (2014) and Phua, Tham, and Wei (2018), we define *Employee Turnover* as the natural logarithm of a firm's ratio of non-executive employee stock option cancellations to its total number of stock options outstanding plus one. The decline in product output is significantly stronger among target firms with greater employee turnover, consistent with our expectations.

In untabulated results, we also find that the negative impact of PSCs on innovation productivity and product quality is concentrated among firms that are financially constrained, face high product competition, or have low employee commitment.

4.2. Evidence supporting the stakeholder channel through direct examination of stakeholder relationships

4.2.1. Relationship with financial stakeholders

Table 6 examines the impact of short campaigns on target firms' relationship with capital providers. In Panel A, we examine whether short campaigns make it harder for a target firm to raise funds from equity holders and debtholders. In Column (1), the dependent variable, *Total Issuance*, is the sum of a firm's net equity issuance and net debt issuance during the year as a percentage of its beginning-of-year total assets.[19] We follow Baker and Wurgler (2002) and Dong et al. (2012) to calculate net equity and debt issuances using Compustat annual financials.

We find that the total net funds raised from both equity and debt financing significantly decline for target firms relative to control firms over the five years following PSCs. In Columns

[19] Because firms can repay debt or repurchase shares, *Total Issuance* can be a negative number. Our results are similar if we use Ln(1 + *Total Issuance*) as the dependent variable, where *Total Issuance* is measured as a ratio and not a percentage.

(2) and (3) where we separately examine *Net Equity Issuance* and *Net Debt Issuance,* respectively, we observe that the decline in total issuance is primarily driven by declines in equity issuance, highlighting the importance of PSCs in influencing equity holders' perceptions of the valuation of target firms.

The decline in capital raised could be driven by a decrease in demand for capital by target firms. Therefore, in Panel B of Table 6, we directly examine shareholder support for target management by using shareholder voting results from ISS Voting Analytics. We focus on management proposals relating to compensation, which is more uniform across firms and reflects shareholder dissatisfaction with management.[20] Shareholder votes on compensation-related proposals should serve as an overall confidence vote of approval/disapproval of management.

The sample contains all compensation-related proposals sponsored by the management of target and control firms, from five years before the short campaign to five years afterward. The dependent variable in both columns of Panel B is the natural logarithm of one plus *Pct "No" votes*, which is the number of disapproval votes received for a proposal divided by the total number of votes cast. We also control for whether Institutional Shareholder Services recommends supporting the proposal (*ISS For*) in all model specifications, following Liu et al. (2020).

In Column (1), we observe a significant positive coefficient on *Target*Post 5-Year*, indicating that the shareholders of target firms are significantly less supportive of management-sponsored compensation proposals relative to the shareholders of control firms following short campaigns. This increase in shareholder disapproval is not driven by the proxy advisor's

[20] Since 2010, public companies in the United States are required to have shareholder votes on executive compensation proposals either every one, two or three years. Generally speaking, the majority of management proposals are related to the election of directors, which can be affected by individual director characteristics. Other management proposals, such as those involving ratifying auditors, are seldom contested, and some proposals, such as those involving increasing authorized share capital or the amendments of certain bylaws, are unique to only a subset of firms.

reluctance to endorse management after a short campaign because in Column 2 we find that the increase in negative votes are mainly among proposals that receive positive ISS recommendations.

4.2.2. Relationship with major customers and employees

We next turn to PSCs' impact on target firms' major customer relationships in Panel A of Table 7. In Column (1), we examine the likelihood of terminating relationships with major customers. We obtain information about the target and control firms' customers from the Factset Revere database which provides information about a firm's network of customers obtained from various sources, including annual filings, press releases, investor presentations, etc. We track each unique supplier-customer pair from five years before the announcement of the PSC to five years after. The dependent variable in Column (1), *Customer Relationship Termination*, is an indicator variable that equals one if a firm's important customer relationship is no longer reported by the target/control firm (supplier) in the next year and equals zero otherwise. To ensure we are capturing significant relationships and also minimize possibility of data recording errors, we restrict to those customer relationships in the database that last for at least four years (the median duration of relationships in the full sample). We use OLS regression with supplier–customer pair and year fixed effects. We also control for supplier firm *Sales Growth* and the relationship length between the customer and supplier (*Relationship Length*) measured at the end of each fiscal year. The variable of interest is again *Target*Post 5-Year*. Consistent with worsening relationships with their significant customers, we find that target firms are 5 percentage points more likely to experience a termination of the relationship with their customers compared to their matched control firms. This economic significance is considerable given that the unconditional probability of termination in our sample is 11%.

In Column (2), we use the growth of sales to a major customer to proxy for the strength of the customer relationship, following Cen et al. (2017) and Liu et al. (2021). As Revere

customer sales information is not well-populated, we obtain information about firms' dollar sales amount to major customers from the Compustat Segment files.[21] The dependent variable is *Principal Customer Sales Growth*, where *Principal Customer Sales Growth* is the natural logarithm of one plus the current year's total sales to a particular large customer as reported by the supplier firm divided by last year's total sales to this same large customer. We use the same model specification as Column (1) and additionally control for *Sales Dependence*, which is well populated in the Compustat Segment data. We find that a target firm's growth in sales to a particular significant customer is significantly lower than a control firm's growth in sales to its significant customer following the PSC. This result is consistent with our conjecture that the PSC target's customer relationships weaken and its principal customers switch to other competitor suppliers after the short campaign.

In Panel B of Table 7, we examine whether employee perceptions of their employer firm worsen after being targeted. We scrap Glassdoor.com for employee reviews of their employing firm. Glassdoor.com is one of the largest employer review websites in the US and covers a broad spectrum of US firms (Green et al., 2019). Prior literature has shown that Glassdoor reviews are useful in measuring employee perceptions of their employer after major events that might affect firm reputation such as news of tax avoidance (Lee et al., 2021) and accounting fraud (Zhou and Makridis, 2021). Worsening employee perception of their employers and the top management might lead to low employee morale and increased turnover, which would negatively affect the innovation process.

On Glassdoor, employees rate their companies on various aspects, career opportunities, senior management, work-life balance, and compensation, among other things, from a scale of

[21] Public U.S. firms covered by the Segment files are required by the SEC to disclose sales amounts to major customers, that is, those who typically account for at least 10% of a firm's total sales. To identify unique supplier–customer pairs, we require the customers to be public U.S. firms. Our sample consists of 1,398 relationship–year observations for our target and control firms in Column (2). Our sample in Column (1) from the Revere Database is much larger since it contains data sources beyond regulatory filings, relationships with non-public customers, and smaller customer relationships that account for less than 10% total sales of the supplier firms.

1 to 5. Employees also give an overall rating for the company. Our sample in Table 7 Panel B consists of all employee ratings from five years before the PSC announcement to five years after. In Column (1) where the dependent variable is *Overall Rating,* we find that employee perception of the target firms declines more over the five years after the short campaign compared with the employee ratings of the control firms. This result is due to employees' worsening perception of the career opportunities available to them (Column (2)) and also decreased satisfaction with top management (Column (4)). There is also evidence that employees are less satisfied with their work-life balance.[22] Interestingly, the impact of PSCs on employee commitment is opposite to that of general short selling activities which is shown to improve employee relations (Brockman et al., 2020).

Overall, the results in Tables 6 and 7 confirm that after the PSC, target firms face declines in shareholder support, experience weaker customer relationships with more frequent terminations of relationships, and have more dissatisfied employees.

5. Addressing Selection Concerns and Alternative Hypotheses

5.1 Informed stock picking versus negative real causal impacts

We argue that PSCs have a causal impact on target firms' product innovation through their negative impact on stakeholders' perceptions of the target firm. However, activist short sellers could have selected targets based on private information that is unobservable to empiricists which allows them to detect target firms that will experience long-term deterioration in product innovation before the rest of the market can. Our matching approach addresses selection issues on observables, and we have additionally provided evidence that PSCs impact the innovation process through weakening stakeholder relationships. To further

[22] Due to large numbers of missing values, we did not examine employee ratings on the remaining 2 categories of culture and diversity, equity and inclusion.

address selection concerns, we undertake a series of various tests. First, informed stock-picking should predict that the results will be stronger among campaigns where activists are likely to be most accurate about the product problems of the target; we use subsample analysis to examine this. Second, we use a Heckman selection model with a strong instrument to account for the selection issue.

5.1.1 Subsample analysis - evidence from allegation types

As discussed in Section 2.1, activist short sellers make different types of allegations to convince other market participants to join in the selling of the target stock to drive the stock price down, including product-related issues, management & investment issues, and accounting problems. Given this goal, activist short sellers would have every incentive to explicitly allege a certain issue if indeed there are grounds for selecting targets based on this particular issue. In particular, if the worsening product innovation is *purely* due to activist short sellers ex-ante predicting future product issues, we would expect that the decline in production innovation be stronger among PSCs where the activist short sellers *accurately* allege concerns that the target firms have product issues than campaigns where they do not make any product-related allegation.

In Table 8, we split our sample of PSCs based on the allegation type of campaigns. PSCs can have multiple allegations and if there are allegations of product issues, we classify these PSCs in Column (1). In Column (2), there are 111 out of 274 PSCs where the activist short seller accuses the target of issues other than product-related problems. Contrary to a pure selection hypothesis, we find significant product deterioration regardless of whether the target is accused of having product issues or not. Additionally, the economic significance of the negative impact of PSCs on product innovation is similar across the two types of campaigns.

Next, some other allegations may not be directly related to product issues but they may be implicitly associated with poor future innovation performance. Therefore, we expand our

definition of selection issues and include PSCs where there are allegations of mismanagement or poor investments. PSCs may not directly select targets based on their product issues but select them based on management and poor investments, which can indirectly lead to poor future product innovation performance. Column (3) contains PSCs where the activist short seller accuses the target of product issues and/or mismanagement/poor investments issues while Column (4) contains all other PSCs (49 out of 274 campaigns) where no such allegations are leveled at the target. We continue to find that both sets of PSCs suffer declines in product innovation after the campaign, with slightly bigger economic significance observed for campaigns without product, mismanagement, and poor investment issues.

Finally, we divide the subsample of campaigns with product allegations into those where there are only product allegations and no other allegations (Column (5)) and campaigns where there are multiple allegations, product issues being one of them (Column (6)). Despite that our analysis in Panel A of Table 8 does not allow us to directly rule out the selection story, we find a series of results that are inconsistent with the notion that the product innovation decline of target firms is purely due to activist short sellers' prediction of product issues.

5.1.2 Subsample analysis – Evidence from market reactions

PSC announcements are often accompanied by large negative market reactions. Campaigns that are more credible and more informative should be associated with large price drops. However, there are about a third of campaigns where the campaign announcements are accompanied with negligible or non-negative stock market reactions. Compared to campaigns where there are large negative price reactions, campaigns with non-negative price reactions are campaigns where the stock market perceives as less accurate, i.e., activist short sellers may have made a mistake. We therefore test whether the negative impacts on product innovation are mainly among campaigns with more accurate selection, that is, campaigns with negative announcement CARs. In Columns (1) and (2) of Table 8 Panel B, we divide the sample of

campaigns into those with negative and non-negative announcement *CAR (0,+5)*, respectively, where Day 0 is the day of the PSC announcement. We find equally strong negative impacts of PSCs across both subsamples.

The market may not always get it right at the beginning and thus, we extend the analysis to examine the long-term market reaction over (0,+252) days in Columns (3) and (4). More information about the target is likely to be revealed over the longer term. Although most of the campaigns have negative long-term returns, 39% of our campaigns experience non-negative CARs over the one year after the PSC announcement. Again, we find equally strong results across the two subsamples of campaigns. These results also highlight that the decline in innovation performance is not merely a result of the stock price decline that often accompanies PSCs as we find similar results even when there are no negative stock reactions to the PSC announcement (Grullon et al., 2015).[23]

Finally, if selection is driving the results, we should see a greater decline in target firms where activist short sellers have better access to information to evaluate the target. In untabulated results, we segment our sample of target firms based on several proxies of information asymmetry, such as analyst coverage, analyst dispersion, and bid-ask spread. However, we find equally strong declines in product performance regardless of whether the firm is informationally transparent or opaque.

5.1.3 Heckman selection

Finally, we follow Brav et al. (2010) and directly control for activist short sellers' non-random selection of target firms using Heckman's (1979) two-step selection model. The idea behind Heckman's selection model is that the selection issue is a form of omitted variable bias

[23] Even among the campaigns with non-negative CARs and insignificant stock market reactions, target firms' shareholders can become more reserved about their support for the targets' fund-raising efforts and are also less trusting of target management. The results here together with the previously documented results of worsening relationships with shareholders suggest that even if the markets are not convinced by the activist short sellers. Additionally, customers and employees may withdraw support due to reputation damage alone or the worry that short sellers will continue to attempt bring down target firms.

that can be estimated using an instrumental variable approach whereby, in the first step, the instrumental variable is used to predict the likelihood of being a target. From this first step, we derive the inverse Mills ratio, which is the selection hazard of being a target. In the second step, we include the inverse Mills ratio as an additional explanatory variable to account for any omitted variables that could affect the selection of the target firm.

In the first step, we use our instrumental variable *TSI Own*, which is the equity ownership of the firm by tax-sensitive institutional investors, expressed as the ratio of the firm's total shares outstanding at the end of the fiscal year. Activist short sellers typically profit from price declines by convincing existing target shareholders to sell (Ljungqvist and Qian, 2016). We argue that the likelihood of a firm being targeted should increase with the proportion of tax-sensitive institutional investors since tax-sensitive investors are more likely to sell target stocks following PSC campaign announcements. Tax-sensitive investors have more incentives to exploit situations to capitalize on capital losses and combine them with capital gains to minimize their tax bills (Dammon et al., 2001). PSC target stocks are typically overvalued and have high stock returns before PSC announcements. Compared to investors who are less affected by taxes, tax-sensitive investors would have added incentives to sell their shares of the target firm to realize any capital loss or minimize any capital gains they might have accumulated, further generating a downward spiral in the target firm's stock price from which activist short sellers can profit. Therefore, the relevance condition of the instrument should be satisfied. Additionally, we are unaware of any systematic study that finds tax-sensitive investor ownership directly affects firms' innovation outcomes, and the exclusion requirement of the instrument variable is thus also likely to hold.[24] When constructing *TSI Own*, we follow the

[24] Dimmock et al. (2018) show that mutual funds with huge unrealized capital gains on certain stocks are more likely to exert a monitoring effort on the particular stock because they cannot easily unwind their position without incurring high capital gains taxes. Although the paper shows this capital gains lock-in effect is stronger among funds with tax-sensitive ultimate clienteles, it is unclear how the tax sensitivity of investors itself will affect the monitoring efforts of mutual funds; that is, absent the capital gains lock-in effect, the tax sensitivity of investors is unlikely to have any first-order impact on the governance choices of mutual funds.

methodology of Blouin et al. (2017), which classifies all institutional investors as either tax-sensitive or not, based on their portfolio characteristics and trading behavior.

Table 9 presents the results from Heckman's two-step procedure. In the first step, we estimate a probit model with the dependent variable *Target,* an indicator variable equal to one if a firm is the target of a short campaign, and zero if the firm is the corresponding control firm from the matching procedure as described in Table 2. The first-step estimation is conducted on the sample of both target and control firm–years used in Table 3. In the second step, we estimate an OLS regression using the natural logarithm of one plus the *Number of NPIs* as the dependent variable on the subsample of target firm–years only. We control for the inverse Mills ratio estimated from the first step. Because we do not use the control firms in the second step, we control for the matching covariates in both steps. We also include the control variables used in Table 3 in both steps. We additionally control for *Industry NPI,* which is the number of NPIs of all the firms in a two-digit SIC code industry during the year. Controlling for *Industry NPI* is important to account for yearly industry-level innovation output since we do not use the control firms in the second step.[25] To ensure that our instrument, *TSI Own*, is not capturing the impacts of institutional ownership on innovation (Aghion et al., 2013), we additionally control for *Inst Own*, which is the total 13F institutional ownership during the year. We use the two-step procedure to estimate the two stages of the selection model, and standard errors are bootstrapped with 200 applications over the two steps simultaneously.

In Column (1), the coefficient on the instrumental variable *TSI Own* is positive and significant at the 1% level, which confirms its relevance. Additionally, there is little evidence of selection bias affecting the results because the coefficient on the inverse Mills ratio is insignificant in Step 2. Importantly, even after correcting for selection in Step 2, the coefficient

[25] We do not control for firm fixed effects because the dependent variable in the first step, *Target*, is time-invariant for each firm. In untabulated results, we control for firm fixed effects in the second step only and continue to find similar results.

on *Post 5-Year* remains negative and statistically significant, indicating significant deterioration of product innovation after firms are being targeted by activist short sellers.

Taken together, our battery of tests in Sections 5.1.1-5.1.3 suggests that the documented decline in product innovation cannot be solely driven by the accurate selection by activist short sellers of firms with deteriorating fundamentals. Furthermore, a selection story alone cannot explain the simultaneous deterioration in product innovation and stakeholder relationships. In untabulated tests, we further examine the possibility that activist short sellers may be selecting targets with less committed stakeholders. We do not find this to be the case as we do not find the cross-sectional variables in Table 5 (financial constraints, competitive industry, and employee turnover) to have any significant predictive power when predicting the likelihood of being a PSC target.

With our tests, we do not aim to eliminate the possibility that activist short sellers' superior selection of target firms is partially the reason for the observed worsening product market outcomes. Our goal in this section is more modest: the results in this section show that PSCs have real causal impacts on target innovation outputs, even after we have carefully accounted for selection issues empirically.

5.2. Testing alternative hypotheses

5.2.1. Curbing of overinvestment

PSCs can indirectly discipline the agency problem. One of the main allegations of activist short sellers is that their target stocks are overvalued, possibly due to overinvestment. This overvaluation can lead to overinvestment to the extent that it artificially lowers the target firm's cost of capital (Gilchrist et al., 2005). The activist short seller's spotlight on the target firm is likely to increase the monitoring by the target firm's shareholders. Wasteful product development activities are thus curtailed, resulting in fewer NPIs going forward to improve

innovation productivity and product quality. This hypothesis could only explain our results in Table 3, but is inconsistent with our results in Table 4 that innovation productivity and product quality decline after PSCs instead. Therefore, the decline in NPIs is unlikely to be due to the curbing of overinvestments and we find the negative real impact of PSCs outweighs their the disciplinary role on target firms.

5.2.2. Increased short-term pressures

PSCs can aggravate the short-term pressures on target firms, forcing them to cut investments in discretionary expenses, such as R&D, to meet earnings targets and shore up their defenses against the attack. In particular, some target firms might face greater pressures from their short-term-oriented shareholders, while other target firms might have more long-term-oriented shareholders who monitor the firm and are less likely to be swayed by the allegations and quarterly earnings performance (Bushee, 1998). Under this alternative hypothesis, we should see stronger results among target firms facing pressure from their short-term-oriented shareholders. However, we find no evidence supportive of the short-term pressure hypothesis using proxies from Bushee (1998) and Gaspar et al. (2005) to classify institutional investors into long-term oriented and short-term-oriented.

6. Additional Tests – Distinct Role of Activist Short Selling

Existing literature generally finds that short selling activities and short selling threats discipline corporate managers and improve various corporate outcomes, such as leading to lower earnings management (Fang et al., 2016; Massa et al., 2014), better acquisition outcomes (Chang et al., 2019), and improved patent innovation outcome (He and Tian, 2023).[26] We consider the impact of general short selling activities by controlling for the aggregated short

[26] Regulation SHO increased short selling activities in general (Grullon et al., 2015). This increase in short selling is likely to be due to undisclosed short selling, and not PSCs. In untabulated results, we also examined the impact of public short campaigns on patenting outcomes, using data from Kogan et al. (2017). Consistent with the product outcome results we observe in Table 3, we find that PSCs negatively impact patenting efficiency and value.

interests at the firm-level, *Short Interest*, in all model specifications. We find that the coefficient on *Short Interest* is positive and mostly significant in predicting product innovation, consistent with the existing literature of a generally beneficial impact of short selling on firm innovation. This contrasts with the negative product innovation impact of activist short sellers we have documented thus far. In this section, we focus on the unique impacts of activist short sellers vis-à-vis traditional short selling.

6.1. Alternative samples and specifications

We further examine whether the differential impacts of activist short sellers and general short selling activities can be generalized to a broader sample in Table 10 Panel A. Therefore, we repeat our analysis in Table 3, Panel A, using the full Compustat sample without propensity score matching. We continue to find that *Short Interest* is positively related to new product introductions in Column (1). In Column (2), we add *Target * Post 5-Year* and find significant declines in NPIs among target firms after the launch of short campaigns, which contrasts the positive coefficient on *Short Interest*.

Prior literature has shown that most of PSCs are preceded by a big increase in short interest (Akbas et al., 2017). Therefore, in Columns (3) and (4), instead of the level of short interest, we control for the change in the level of short interest. We find even stronger results that an increase in short interest is associated with an increase in NPIs.

In Panel B of Table 10, we examine the marginal role of activist short selling over and beyond general short selling by asking a more modest question: Would the innovation outcomes of PSC target firms differ from that of a matched firm with similar levels of short interest but without being publicly called out? We match each of the target firms to another firm without a PSC in the same industry and same year using the level of short interest as a matching covariate. In Columns (1) and (2), we find that compared to their matched firms with

similar levels of short interest, target firms experience a significant decline in NPIs. In Columns (3) and (4), we match on the change in short interest levels instead and find similar results. These results confirm what we have seen in the larger non-matched sample that there are marginal and distinctive impacts of activist short selling after controlling for the level of and changes in overall short positions.

6.2. Role of stakeholders

We further find that whilst *Short Interest* generally has a positive impact on product innovation, it does not have any significant adverse impact on stakeholder relationships in Tables 6 and 7, unlike PSCs. This is consistent with the unique impact of PSCs arising mainly through the impact on stakeholders. Furthermore, in untabulated tests, we find that the declines in product innovation and weakening of external stakeholder relationships occur mainly among the subsample of campaigns where there is a report. External stakeholders may learn new information (regardless of whether they are accurate or not) from the reports put out by activist short sellers, leading them to change their views of the target firm. No such additional information is made available in the case of non-disclosed short selling.

7. Conclusion

Activist short sellers publicly reveal their short theses in PSCs to induce shareholders to sell, and they profit when the target firm's stock price drops. The financial implications of these short campaigns on target firm stock prices have been well studied; however, less is understood whether they have any real long-lasting impacts on target firms. Using a novel dataset of new production introductions (NPIs), we find that target firms introduce 11.2% fewer new products relative to their matched control firms in the five years after being targeted. R&D input, innovation productivity, and product quality of target firms also deteriorate after the

launch of a short campaign. These negative impacts persist even after accounting for the possibility that activist short sellers could have superior abilities in selecting target firms with product issues: we continue to find product innovation declines in subsamples of targets where activist short sellers are unlikely to be selecting target firms based on their fundamentals and after accounting for selection using a two-stage Heckman selection model.

Product innovation requires the strong support of key stakeholders at every step of the complex process. The public nature of the short campaigns negatively affects key stakeholders' views and perceptions towards the target, which leads them to withdraw their support for the innovation process in target firms. Consistent with the stakeholder channel, we find that the negative impacts of PSCs are most prominent among financially constrained firms and firms with weaker commitments from customers and employees. We also uncover evidence of deteriorating stakeholder relationships. Target firms raise less equity capital and their shareholder support for key management proposals in annual meetings significantly declines. Target firms also have weaker relationships with their major customers after being targeted, with more frequent relationship termination. Lastly, employee sentiment toward target firms significantly worsens compared to control firms following short campaigns.

We control for aggregate short interest throughout our analysis and find that activist short selling has distinct effects on product innovation compared to general short selling activities. General short selling positively predicts product innovation, unlike PSCs which worsen product innovation. Further reinforcing the idea that the distinct impact of PSCs vis-à-vis general short selling arises from the impact on stakeholders, we find that general short selling has no significant impact on stakeholder relationships. Thus, our paper highlights the incremental and distinctive impacts of activist short selling compared to general short selling activities through the former's impact on stakeholders.

Overall, this paper suggests that regulators need to consider the distinctive impact of public short campaigns that are different from traditional short selling in regulating short selling activities.

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Appendix A. Variable Definitions

Variable	Definition
Main explanatory and dependent variables	
Number of NPIs	A firm's total number of press releases about its new product/service launches and updates during the fiscal year. Source: Capital IQ
R&D Intensity	A firm's R&D expense during the fiscal year divided by its lagged total assets. Missing values are set to zero. Source: Compustat
Innovation Productivity	A firm's number of press releases about its new product/service launches and updates during the fiscal year *t* scaled by its accumulated R&D capital over the five years ending in year *t*-2. Source: Capital IQ and Compustat
New Product Announcement CAR(-10,+10)	The cumulative abnormal return (CAR) starting 10 days before a firm's press release about new product/service launches and updates to 10 days after. CARs are calculated using the standard one-factor market model. The expected return is estimated over the period (-250, -50) using the CRSP value-weighted market return. Source: Capital IQ and CRSP
Target	An indicator variable equal to one if a firm is the target of the public short campaign and zero if the firm is the corresponding control firm from the matching procedure. Source: Activist Shorts Research
Post 5-Year	An indicator variable equal to one for both target and control firm-years if they are within the five years following a public short campaign announcement, and zero otherwise. Source: Activist Shorts Research
Post 3-Year	An indicator variable equal to one for both target and control firm-years if they are within the three years following a public short campaign announcement, and zero otherwise. Source: Activist Shorts Research
Event Year +/-n	An indicator variable equal to one for both target and control firm-years if the year is *n* years after/before the campaign announcement. Source: Activist Shorts Research
Other variables	
Annualized Stock Return	A firm's annualized stock return from daily returns during the fiscal year. Source: CRSP
Customer Relationship Termination	An indicator variable equal to one if a firm's customer relationship is no longer reported by the supplier firm in the next year, and equals zero otherwise. Source: Factset Revere
Delta Q	A firm's change in Tobin's Q between year *t*-3 and year *t*-1, where year *t* is the fiscal year of the campaign announcement. Source: Compustat
Delta ROA	A firm's change in ROA between year *t*-3 and year *t*-1, where year *t* is the fiscal year of the campaign announcement. Source: Compustat
Delta Short Interest	A firm's change in short interest between year *t*-1 and year *t*, where year *t* is the current fiscal year. Source: Compustat
Employee Satisfaction Rating	A variable from one to five indicating employee satisfaction with the firm, with five being the most satisfied. Source: Glassdoor.com
Employee Turnover	A firm's percentage of stock option cancellations (Compustat: optca) to the total number of non-executive employee stock options outstanding as of the beginning of the year (Compustat: optosey). Source: Compustat
Firm Risk	The natural logarithm of a firm's variance of daily returns over the fiscal year. Source: CRSP
Financially Constrained	An indicator variable equal to one if a firm's Hadlock and Pierce (2010) financial constraint index is in the top quartile in the full sample, and zero otherwise. Source: Compustat
High Competition	An indicator variable equal to one if a firm is in a Hoberg and Phillips textual industry with the Herfindahl–Hirschman Index (HHI) lower than the bottom quartile value in the full sample, and zero otherwise. Source: Compustat and Hoberg–Phillips (2010, 2016)
Illiquidity	A firm's average daily Amihud Illiquidity during the fiscal year. Source: CRSP

Industry NPI	The total number of new product/service launches and updates of all firms in a two-digit SIC industry during the year.
Inst Own	Percentage of shares outstanding held by institutions. Source: 13F filings
ISS For	An indicator variable equal to one if the proxy advisor ISS recommends shareholders vote "Yes" in support of the proposal, and zero otherwise. Source: ISS Voting Analytics
Market Cap	The market value of a firm measured using common shares outstanding times the share price at the end of the fiscal year. Source: Compustat
Net Debt Issuance	A firm's change in total assets less sum of the change in book equity and change in deferred taxes scaled by lagged assets. Source: Compustat
Net Equity Issuance	A firm's sum of change in book equity and change in deferred taxes less change in retained earnings scaled by lagged assets. Source: Compustat
Pct "No" Votes	The number of "Against" votes received for a management proposal divided by the total number of votes cast in percentage terms. Source: Source: ISS Voting Analytics
Principal Customer Sales Growth	The sales growth to a particular large customer as reported by the supplier firm, which is defined as the natural logarithm of one plus the current year's total sales to a particular large customer as reported by the supplier firm divided by last year's total sales to this same large customer. Source: Compustat Segment
R&D Capital	The five-year accumulated R&D expenses assuming an annual depreciation rate of 20% ending in year t-2: $R\&D_{i,t-2} + 0.8*R\&D_{i,t-3} + 0.6*R\&D_{i,t-4} + 0.4*R\&D_{i,t-5} + 0.2*R\&D_{i,t-6}$, where $R\&D_{i,t-2}$ denotes firm *i*'s R&D expenses in the fiscal year ending in year t-2, and so on. Source: Compustat
Relationship Length	The relationship duration between a firm and its principal customer.
ROA	Operating income before depreciation scaled by lagged total assets. Source: Compustat
Sale Dependence	The fraction of a supplier firm's sale to a large customer divided by the supplier firm's total sales during the year. Source: Compustat Segment
Sales Growth	The natural logarithm of a firm's sales divided by its lagged sales. Source: Compustat
Short Interest	A firm's number of shares held short divided by its total number of shares outstanding at the end of the fiscal year-end. Source: Compustat.
Tobin's Q	A firm's total assets minus book value of equity plus market value of equity divided by total assets. Source: Compustat
Total Assets	A firm's total assets at the end of the fiscal year. Source: Compustat
Total Issuance	The sum of a firm's *Net Equity Issuance* and *Net Debt Issuance*. Source: Compustat
TSI Own	A firm's total percentage ownership by tax-sensitive institutional investors at the end of the fiscal year constructed following the definition in Blouin et al. (2017). Source: Brian Bushee's personal webpage and 13F Filings

Appendix B. Names of Activist Short Sellers and Examples of Short Campaigns by Allegation Types

Panel A lists the top 10 activist short sellers by the number of campaigns in our sample. Panel B provides examples of public short campaigns by allegation types and relevant web sources used to verify them. We have underlined keywords and phrases that are relevant in verifying campaign allegations.

Panel A. List of top 10 activist short sellers

Short Seller Name	Frequency	Percentage (%)
The Street Sweeper	43	15.69
Citron Research	20	7.30
Spruce Point Capital Management	17	6.20
Kynikos Associates (Jim Chanos)	14	5.11
Richard Pearson	12	4.38
Lakewood Capital Management	10	3.65
Long-Short Value	10	3.65
Alpha Exposure	7	2.55
GeoInvesting (FG Alpha Management)	7	2.55
Greenlight Capital Inc	7	2.55

Panel B. Examples of short campaigns by allegation types

Panel B1. Product-related issues: ineffective or unprofitable products or services

Example 1. Jim Chanos announcing shorting Caterpillar at Delivering Alpha Conference: https://www.marketfolly.com/2013/07/jim-chanos-short-caterpillar-cat.html

"Chanos says Caterpillar is a great company, but they're essentially levered to the wrong products at the wrong time (the worst part of a cycle)."

Example 2. Druckenmiller shorting IBM in bet cloud computing to win: https://www.bloomberg.com/news/articles/2013-11-23/druckenmiller-bets-against-ibm-as-cloud-technology-wins

"Duquesne's Chairman Druckenmiller confirmed he is shorting International Business Machines Corp. (NYSE: IBM) in bet cloud computing to replace it… "IBM is old technology being replaced by cloud technology."

Panel B2. Business or Management Issues: poor investments, business strategy, or incompetent management

Example 1. Muddy Waters vs. American Tower: "In the report, Muddy Waters valued American Tower shares at $44.57, saying… American Tower 'has engaged in a value destroying investment binge overseas… .' "

Example 2. Citron Research vs. Chemed Corp: Chemed "needs to systemically reform its corporate management and billing practices… ."

Panel B3. Accounting or Disclosure Issues: inaccurate accounting or misleading disclosures

Example 1. Ebix plunges after report claims financial statements are inaccurate: https://seekingalpha.com/article/1210281-the-truth-about-robin-rainas-ebix-part-i

"Shares of Ebix (EBIX), which provides software products for the insurance industry, are falling sharply after a contributor to the financial site Seeking Alpha alleged the company's financial statements are "unreliable, inaccurate, and incomplete." The contributor, Gotham City Research, disclosed a short position in the stock in conjunction with the cautious report."

Example 2. Lowe's shrugs off negative Seeking Alpha article: https://seekingalpha.com/article/1513142-illegal-products-could-spell-big-trouble-at-lumber-liquidators

"Shares of Lowe's Companies, Inc. (NYSE: LOW) traded as low as $67.60 Friday morning, only to rebound and move higher as investors shrugged off a report by Xuhua Zhou on Seeking Alpha that accused the company of being guilty of formaldehyde noncompliance in sourcing laminate flooring from China... Zhou is short Lowe's shares."

Panel B4. Financing issues: issues related to firms' leverage and insufficient cash flow

Example 1. Spruce Point vs. CECO Environmental: https://www.sprucepointcap.com/ceco-environmental-corp/

"Based on our forensic financial analysis, insider behavior, and anticipated changes in the regulatory environment driving its business, we believe CECO is at high risk of a covenant breach in 2017."

Example 2. Geo Investing vs.: "CDZI has an insolvent balance sheet and has posted a loss the last 42 quarters straight."

Panel B5. Legal or fraud issues: significant legal/compliance risk or fraud

Example 1. Viceroy Research vs. MiMedx: "Viceroy Research uncovers substantial previously unreported data evidencing an incestuous hiring policy from a kickback & bribery company scheme, a possible SEC enforcement investigation, and indications of channel stuffing."

Panel B6. No specific issue: the short seller simply claims that the target stock is overpriced and does not have any specific allegation

Example 1. Jim Chanos recommends shorting Sotheby's: https://www.businessinsider.com.au/chanos-recommends-shorting-sothebys-2014-4?r=US&IR=T

"Jim Chanos shows Sotheby's stock price tracks speculative bubbles."

Appendix C. Keyword List for Classification of Firm Product Announcements and Examples

This appendix lists the keywords, combinations of keywords, and phrases used to classify product announcements into four categories. Our initial keyword list used for product announcement classification is based on Cao et al. (2018). We then manually go through 1,000 randomly selected product announcements to expand the key word list for each product announcement category. After constructing the expanded keyword list, we identify and include these keywords' variations using Stanford's CoreNLP package.

We list the keywords in *italics* below and provide an example for each product announcement category, where the keywords identified are underlined.

1) New product launches: *announce, launch, introduce, unveil, release, deliver, ship, offer, debut, bring, give, enable, uncover, reveal, new service, first* & *appear, available* & *now/immediately*, and their variants.
   Example: "Apple Inc. launches iPad."

2) Product updates: *updates, enhance, revise, upgrade, expand, add, streamline, support, strengthen, improve, new feature/version, next generation, extend*, and their variants.
   Example: "Apple updates iMac Line."

3) Progress toward new products: *progress, phase, trial, evaluate, assess, study, research, experiment, approval, clearance, milestone, certify, permit, license, develop, publish, patent, finding, result, evidence, data,* their variants, and all possible combinations of words from lists 1 and 2 below [27]:
   List 1: *accept, approve, begin, start, initiate, commence, undertake, prepare, complete, finish, achieve, receive, accomplish, finalize, conclude, close, stop, apply, register, explore, search, seek, inspect, success, report, update, discover, pass, satisfy, comply,* and *analyze*.
   List 2: *operate, manufacture, produce, making, process, construct, drug, drill, mine, mining, treatment, assemble, assembly, validate, licensing, draft, trademark, intellectual property, exploration, plan, regulation, standard, requirement, and submission.*
   For example, we capture the phrase "*commences manufacturing*" if an announcement contains both the word "*commence*" from list 1 and "*manufacturing*" (a variation of "manufacture") from list 2.

   Example: "Varian Medical Systems Inc. has received 510(k) clearance from the U.S. Food and Drug Administration (FDA) to market a new version of its VariSeed(TM) treatment."

4) Others (product preview or new stores/distribution channel): *preview, demonstrate, sneak peek, showcase, exhibit, show, arrive, come, available in, distributor, enter/expand & market, available* & language (e.g., Spanish), *available* & country/state/county names, and number + countries (e.g., 2 countries).[28]
   Example: "Apple Inc. announces availability of iPhone 6 and iPhone 6 Plus in China."

[27] We exclude some variations of the keywords from this category if their variations are used to describe nouns with different meanings. For instance, some words ending 'er' or 'or' that have different meanings compared to their verb forms: *receiver, processor, analyzer,* and *operator*.
[28] The list of languages and geographic locations' names is from the Stanford CoreNLP package.

Table 1. Summary Statistics of Public Short Campaigns

This table summarizes characteristics of our initial sample of 341 public short campaigns targeting U.S. companies over the period 2010-2017. Panel A reports summary statistics for stock market reactions to public short campaign announcements over various event windows. Cumulative abnormal returns (*CARs*) are calculated using the one-factor market model where the expected return is estimated over days (-250, -50) using the CRSP value-weighted market return, where day 0 is the day of the campaign announcement. Panel B reports the distribution of public short campaigns by year, and the mean and median *CAR(0,+5)* surrounding the campaign announcements. Panel C reports the distribution of campaigns by allegation types and each allegation type's mean CAR over various event windows. These allegations are not mutually exclusive and allegation classifications are explained in more details in Appendix B.

Panel A. Stock market reactions to public short campaign announcements

Variable	N	Mean	25th Pctl	Median	75th Pctl	STD
CAR(0,+1)	341	-3.00%	-6.23%	-2.57%	0.43%	5.45%
CAR(0,+5)	341	-4.03%	-9.42%	-3.42%	0.58%	7.79%
CAR(0,+20)	341	-6.55%	-12.93%	-5.05%	2.66%	14.64%
CAR(0,+120)	341	-17.60%	-36.41%	-10.84%	8.46%	43.24%
CAR(0,+252)	341	-31.04%	-65.36%	-19.21%	18.34%	79.88%

Panel B. Stock market reactions to public short campaign announcements by calendar year

Calendar Year	N	% of Total Campaigns	CAR(0,+5)	
			Mean	Median
2010	7	2%	-5.01%	-4.01%
2011	13	4%	-5.83%	-7.85%
2012	17	5%	-6.79%	-6.85%
2013	41	12%	-3.66%	-1.88%
2014	45	13%	-5.50%	-5.05%
2015	68	20%	-2.33%	-2.43%
2016	91	27%	-3.54%	-2.95%
2017	59	17%	-4.56%	-4.47%

Panel C. Stock market reactions to public short campaign announcements by allegation types

Allegation Type	N	% of Total Campaigns	CAR (0,+5)	CAR (0+20)	CAR (0,+120)
			Mean	Mean	Mean
Product-related issues	163	59%	-4.01%	-6.70%	-17.73%
Business or management issues	140	51%	-3.51%	-6.43%	-15.54%
Accounting or disclosure issues	99	36%	-5.18%	-7.62%	-15.14%
Financing issues	52	19%	-5.69%	-7.07%	-19.23%
Legal or fraud issues	33	12%	-6.16%	-6.88%	-18.86%
No specific issue	14	5%	-4.04%	-5.15%	-10.87%

Table 2. Firm Characteristics of Public Short Campaign Targets and Control Firms in the Matched Sample

This table reports the summary statistics for firm characteristics of the final matched sample at the event level before the year of the public short campaign (PSC). For each PSC target, the corresponding control firm is in the same two-digit SIC industry and year that has the closest propensity score. The propensity score is estimated from a probit regression predicting the likelihood of being a PSC target using the natural logarithm of *Total Assets*, *Firm Risk*, *Tobin's Q*, *ROA*, *Sales Growth, Annualized Stock Return, Illiquidity*, the changes in *ROA (Delta ROA)* and *Tobin's Q (Delta Q)*. The matching covariates are measured as of year *t*-1 while the changes in *ROA* and *Tobin's Q* are measured between year *t*-3 and year *t*-1, where year *t* is the fiscal year of the campaign announcement. In both panels, we report means, medians, and differences in means (between target and control firms) of innovation outcomes and firm characteristics measured in year *t*-1. Panel A also reports the average annual change in innovation outcomes of target and control firms over year *t*-5 to year *t*-1. ***, **, and * indicate the statistical significance of the difference in means at the 1%, 5%, and 10% levels respectively. All variables are defined in Appendix A.

Panel A. Product innovation characteristics of target and control firms

Variables	Target (N=274)		Non-Target (N=274)		Difference in Means
	Mean	Median	Mean	Median	
Number of NPIs	1.82	0.00	1.84	0.00	-0.02
Average Annual Change Over (-5,-1)	0.30	0.25	0.31	0.15	-0.01
R&D Intensity	0.11	0.03	0.08	0.02	0.03
Average Annual Change Over (-5,-1)	0.03	0.00	0.03	0.01	0.00

Panel B. Other firm characteristics of target and control firms

Variables	Target (N=274)		Non-Target (N=274)		Difference in Means
	Mean	Median	Mean	Median	
Total Assets ($ mil)	5220.25	487.3	3627.45	842.3	1592.81
Market Cap ($ mil)	5264.29	1006.18	4899.19	1327.91	365.1
Firm Risk	7.9	7.88	7.79	7.69	0.11
Tobin's Q	3.28	2.24	3.06	2.16	0.22
ROA	0.08	0.13	0.11	0.14	-0.03
Sales Growth	0.78	0.75	0.75	0.74	0.03
Annualized Stock Return (%)	0.25	0.20	0.22	0.13	0.03
Illiquidity	0.13	0.00	0.14	0.00	-0.01
Delta ROA	0.01	0.01	-0.02	0.00	0.03
Delta Q	-0.16	0.01	0.04	0.16	-0.21
Short Interest	0.06	0.03	0.04	0.02	0.02***

Table 3. Public Short Campaigns and New Product Introductions

This table reports difference-in-differences regression results from our main model using firm-years of public short campaign (PSC) target and control firms in the final matched sample. The matching procedure is described in Table 2. *Number of NPIs* is the number of new product/service launches or updates by a firm during the fiscal year. We use OLS specification when the dependent variable is the natural logarithm of one plus the *Number of NPIs* and Poisson specification when the dependent variable is the *Number of NPIs*. *Target* is an indicator variable equal to one if the firm is the target of a PSC and zero if the firm is the control firm. In Panel A, the *Post 5-Year* (*Post 3-Year*) indicator variable is equal to one for both target and control firm-years if they are within the five- (three-) year period after the announcement of the PSC, and zero otherwise. In the odd-numbered (even-numbered) columns of Panel A, we include firm-years of the target and control firm starting five (three) years before the year of the PSC announcement and ending five (three) years afterward, including the fiscal year of the campaign announcement. In Panel B, we construct PSC event year indicators over the [-3, +5] years surrounding the campaign announcement year. *Event Year +n* (*-n*) is an indicator equal to one for both target and control firm-years if the year is *n* years after (before) the campaign announcement. We include firm-years of the target and control firm starting five years before the year of the short campaign announcement and ending five years afterward, including the fiscal year of the campaign announcement. We use firm and year fixed effects in all models, and standard errors are clustered by firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. All variables are defined in Appendix A.

Panel A. Public short campaigns and the number of new product introductions

Dep Var:	**Ln(1+Number of NPIs)**		**Number of NPIs**	
	OLS		*Poisson*	
	(1)	(2)	(3)	(4)
Target * Post 5-Year	-0.112***		-0.216***	
	(-2.87)		(-2.83)	
Target * Post 3-Year		-0.094**		-0.172**
		(-2.49)		(-2.34)
Post 5-Year	0.066**		0.122*	
	(1.97)		(1.78)	
Post 3-Year		0.037		0.063
		(1.09)		(0.95)
Ln(Market Cap)	0.026	0.015	0.055	0.036
	(1.35)	(0.73)	(1.41)	(0.87)
Ln(1+Short Interest)	3.796*	4.763*	8.114*	10.681**
	(1.72)	(1.84)	(1.93)	(2.08)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
N	4,341	3,089	4,341	3,089
Adjusted/Pseudo R-Squared	0.729	0.753	0.192	0.220

Panel B. Time trend in the number of new product introductions of target and control firms surrounding campaign announcement years

Dep Var:	**Ln(1+Number of NPIs)**	**Number of NPIs**
	OLS	*Poisson*
	(1)	(2)
Target * Event Year -3	0.018	0.025
	(0.44)	(0.36)
Target * Event Year -2	-0.023	-0.037
	(-0.56)	(-0.49)
Target * Event Year -1	-0.048	-0.089
	(-1.09)	(-1.18)
Target * Event Year +1	-0.077	-0.153
	(-1.55)	(-1.61)
Target * Event Year +2	-0.134**	-0.276***
	(-2.40)	(-2.63)
Target * Event Year +3	-0.159**	-0.290**
	(-2.57)	(-2.21)
Target * Event Year +4	-0.135	-0.219
	(-1.64)	(-0.99)
Target * Event Year +5	-0.175*	-0.340
	(-1.77)	(-1.19)
Ln(Market Cap)	0.025	0.047
	(1.30)	(1.19)
Ln(1+Short Interest)	3.212	7.479*
	(1.45)	(1.80)
Standalone Event Year Indicators	Y	Y
Firm FE	Y	Y
Year FE	Y	Y
N	4,341	4,341
Adjusted R-Squared	0.730	0.716

Table 4. Alternative Innovation Outcomes – Public Short Campaigns and Firm Innovation Productivity, Product Quality, and R&D Intensity

This table reports regression results on alternative innovation measures using firm-years of public short campaign (PSC) target and control firms in the matched sample. The matching procedure is described in Table 2. We include firm-years of the target and control starting five years prior to the year of the PSC announcement and five years afterward, including the fiscal year of the campaign announcement in all columns except Column (4) where we include only +/-3 years surrounding the announcement. In Column (1), the dependent variable is *Innovation Productivity* which is *Number of NPIs* scaled by *R&D Capital*. *Number of NPIs* is the number of new product/service launches or updates by a firm during the fiscal year *t*. *R&D Capital* is the five-year cumulative R&D expenditures assuming an annual depreciation rate of 20% ending in year *t*-2. The sample in Column (1) is restricted to firm-years with positive *R&D Capital*. In Column (2), the dependent variable is *New Product Announcement CAR(-10, +10)*, which is the cumulative abnormal return (CAR) starting 10 days before the announcement of the new product/service launch or update to 10 days after. The CARs are calculated using the one-factor market model where the expected return is estimated over days (-250, -50) using the CRSP value-weighted market return and day 0 is the day of the product announcement. Our sample in Column (2) is at the product announcement level and contains the product announcements by the PSC targets and the control firms starting five years before the year of the short campaign announcement and ending five years afterward. To maintain the covariate balance, we require the target firm and corresponding control firm to both have at least one product announcement pre- and post-campaign announcement. In Columns (3) and (4), the dependent variable is *R&D Intensity*, which is a firm's R&D expenditure during the fiscal year divided by beginning-of-year total assets. *Target* is an indicator variable equal to one if the firm is the target of a public short campaign and zero if the firm is the control firm. *Post n-Year* is an indicator variable for the *n* years after the announcement of the campaign for both the target and control firms. The coefficients on the standalone *Post n-Year* indicators are omitted for brevity. We use firm and year fixed effects in all models, and standard errors are clustered by firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. All variables are defined in Appendix A.

Dep Var:	**Innovation Productivity**	**New Product Announcement CAR (-10, +10)**	**R&D Intensity**	
	(1)	(2)	(3)	(4)
Target * Post 5-Year	-0.032***	-0.010*	-0.012	
	(-2.68)	(-1.86)	(-1.52)	
Target * Post 3-Year				-0.013**
				(-2.45)
Ln(Market Cap)	0.016*	-0.007	-0.001	-0.000
	(1.74)	(-1.51)	(-0.17)	(-0.05)
Ln(1+Short Interest)	0.620	1.189**	0.145	-0.382
	(0.84)	(2.57)	(0.24)	(-1.13)
Standalone Post Event Indicators	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
N	2,725	4,782	4,341	3,089
Adjusted R-Squared	0.484	0.051	0.808	0.853

Table 5. Cross-Sectional Variations in Product Outcome Impacts of Public Short Campaigns

This table examines the cross-sectional variations in the product outcome impacts of public short campaigns (PSCs) using firm-years of campaign target and control firms in the final matched sample. The matching procedure is described in Table 2. We include firm-years of the target and control starting five years before the year of the short campaign announcement and five years afterward, including the fiscal year of the campaign announcement. The dependent variable in all columns is the natural logarithm of one plus the *Number of NPIs*. *Number of NPIs* is the number of new product/service launches or updates by a firm during the fiscal year. *Target* is an indicator variable equal to one if the firm is the target of a public short campaign and zero if the firm is the control firm. *Post 5-Year* is an indicator variable equal to one for both target and control firm-years if they are within the five years after the announcement of the public short campaign, and zero otherwise. Across all columns, we interact *Target* and *Post 5-Year* with different target firm characteristics. In Column (1), the cross-sectional firm characteristic is *Financially Constrained*, an indicator variable equal to one if the target/control firm's Hadlock and Pierce (2010) financial constraint index is greater than the top quartile value in the full sample, and zero otherwise. In Column (2), the cross-sectional firm characteristic is *High Competition*, an indicator variable equal to one if the target/control firm is in an industry with the Herfindahl–Hirschman Index (HHI) lower than the bottom quartile value in the full sample, and zero otherwise. Industry classifications are based on the textual analysis of the text in the business descriptions found in annual 10-Ks (Hoberg and Phillips, 2016). In Column (3), the cross-sectional firm characteristic is the natural logarithm of one plus *Employee Turnover*, where *Employee Turnover* is the target/control firm's stock option cancellations during the year (Compustat variable: *optca*) as a percentage of the number of non-executive employee stock options outstanding at the beginning of the year (Compustat variable: *optosey*). *Financially Constrained*, *High Competition* and *Employee Turnover* take values lagged by one year. The coefficients on the other control variables used in our main model in Table 3 Panel A are omitted for brevity. We use firm and year fixed effects in all models, and standard errors are clustered by firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. All variables are defined in Appendix A.

Dep Var=	**Ln(1+Number of NPIs)**		
Firm Characteristics Var =	*Financially Constrained*	*High Competition*	*Ln(Employee Turnover+1)*
	(1)	(2)	(3)
Target * Post 5-Year * Firm Characteristics Var	-0.175*	-0.203*	-0.024***
	(-1.73)	(-1.76)	(-2.70)
Target * Post 5-Year	-0.019	-0.025	-0.549
	(-0.42)	(-0.44)	(-0.29)
Target * Firm Characteristics Var	0.231***	0.104	0.327
	(2.76)	(0.96)	(1.57)
Post 5-Year * Firm Characteristics Var	0.131	0.149**	0.059
	(1.60)	(2.19)	(0.27)
Post 5-Year	0.012	-0.001	-0.205
	(0.33)	(-0.04)	(-0.20)
Firm Characteristics Var	-0.128**	-0.036	-0.020
	(-2.28)	(-0.57)	(-0.11)
Other T3A Controls	Y	Y	Y
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	3,673	4,377	3,943
Adjusted R-Squared	0.753	0.734	0.711

Table 6. Impact of Public Short Campaigns on Financial Stakeholders

This table reports regression results examining the impact of public short campaigns (PSCs) on target firms' financial stakeholder relationships relative to their control firms. In Panel A, the sample consists of target and control firms in the final matched sample. The matching procedure is described in Table 2. We include firm-years belonging to the target and control firm starting five years before the year of the PSC announcement and five years afterward, including the fiscal year of the campaign announcement. The dependent variable in Column (1) of Panel A is *Total Issuance*, which is the sum of a firm's *Net Equity Issuance* and *Net Debt Issuance* as a percentage of its beginning-of-year total assets during the year. The dependent variable in Column (2) of Panel A is *Net Equity Issuance*, which is calculated as the sum of the change in book equity and change in deferred taxes less change in retained earnings scaled by lagged assets. The dependent variable in Column (3) of Panel A is *Net Debt Issuance*, which is calculated as the change in total assets less the sum of the change in book equity and change in deferred taxes scaled by lagged assets. In Panel B, the sample includes all management-sponsored compensation-related proposals of both target and control firms in the matched sample, starting five years before the year of the campaign announcements and five years afterward. The analysis is done at the proposal level. The dependent variable in all columns of Panel B is the natural logarithm of one plus *Pct "No" Votes*, which is the number of "Against" votes received for an agenda item divided by the total number of votes cast in percentage terms. *ISS For* is an indicator variable equal to one if the proxy advisor ISS recommends shareholders vote "Yes" in support of the proposal, and zero otherwise. In both panels, *Target* is an indicator variable equal to one if the firm is the target of a PSC and zero if the firm is the control firm *Post 5-Year* is an indicator variable equal to one for both target and control firm-years if they are within the five years after the announcement of the PSC, and zero otherwise. All models include firm and year fixed effects. Standard errors are clustered by firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. All variables are defined in Appendix A.

Panel A: External financing

Dep Var:	**Total Issuance**	**Net Equity Issuance**	**Net Debt Issuance**
	(1)	(2)	(3)
Target * Post 5-Year	-9.079***	-5.431***	-1.458
	(-3.01)	(-2.78)	(-1.09)
Post 5-Year	5.037*	5.207***	-0.852
	(1.89)	(3.14)	(-0.67)
Ln(Market Cap)	10.453***	6.321***	3.201***
	(6.06)	(4.92)	(4.93)
Ln(1+Short Interest)	546.480**	201.270	94.301
	(2.26)	(1.43)	(0.84)
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	4,050	4,050	4,050
Adjusted R-squared	0.397	0.483	0.126

Panel B. Shareholder support for management proposals

Dep Var:	**Ln (Pct "No" Votes +1)**	
	(1)	(2)
Target * Post 5-Year	0.092**	-0.137*
	(2.21)	(-1.74)
Target * Post 5-Year * ISS For		0.218**
		(2.26)
Target * ISS For		0.045
		(0.62)
Post 5-Year * ISS For		-0.173**
		(-2.35)
Post 5-Year	-0.019	0.134**
	(-0.43)	(2.00)
ISS For	-1.629***	-1.692***
	(-54.28)	(-26.31)
Ln(Market Cap)	-0.076***	-0.034
	(-3.99)	(-1.36)
Ln(1+Short Interest)	1.771	3.112
	(0.75)	(1.13)
Firm FE	Y	Y
Year FE	Y	Y
N	5,220	5,220
Adjusted R-Squared	0.559	0.561

Table 7. Impact of Public Short Campaigns on Non-Financial Stakeholders

This table reports OLS regression results examining the impact of public short campaigns (PSCs) on target firms' non-financial stakeholder relationships relative to their control firms. In Panel A, the sample consists of major customer relationships of target and control firms in the final matched sample. We include relationship-years belonging to the target and control firm starting five years before the year of the PSC announcement and five years afterward, including the fiscal year of the campaign announcement. The dependent variable in Column (1) of Panel A is *Customer Relationship Termination*, which is an indicator variable that equals one if a firm's customer relationship is no longer reported by the target/control firm (supplier firm) in the next year and equals zero otherwise. We restrict our sample to important customer relationships, i.e., relationships that last for four years (median duration of the full sample) or longer in the Factset Revere Supply Chain database. The dependent variable in Column (2) of Panel A is *Principal Customer Sales Growth*, which is defined as the natural logarithm of one plus the current year's total sales to a particular large customer *j* as reported by the target/control firm (supplier firm) divided by last year's total sales to this same large customer. A firm's principal customers are customers that account for a large proportion of the firm's total annual sales (10% or more) reported in the Compustat Segment files. We additionally control for the target/control firm's *Sales Growth* and customer-supplier relationship characteristics; we control for *Relationship Length* in both columns and *Sales Dependence* in column (2) of Panel A. In Panel B, the sample contains employee review ratings from Glassdoor.com of target and control firms in our main matched sample. The ratings range from one to five with five being the best. In Column (1) of Panel B, *Overall Rating* is the overall rating from an employee's review on Glassdoor.com. In Columns (2) to (5), we use employee ratings on several sub-categories as the dependent variables. In both panels, *Target* is an indicator variable equal to one if the firm is the target of a PSC and zero if the firm is the control firm. *Post 5-Year* is an indicator variable equal to one for both target and control firm-years if they are within the five years after the announcement of the PSC, and zero otherwise. All specifications in Panel A control for supplier-customer pair fixed effects and year fixed effects, and all Panel B models include firm and year fixed effects. Standard errors are clustered by firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. All variables are defined in Appendix A.

Panel A. Major customer relationships

Dep Var:	**Customer Relationship Termination**	**Principal Customer Sales Growth**
	(1)	(2)
Target * Post 5-Year	0.050***	-0.084*
	(2.88)	(-1.75)
Post 5-Year	-0.120***	0.042
	(-9.29)	(0.78)
Ln(Market Cap)	0.010	-0.039
	(1.58)	(-0.96)
Ln(1+Short Interest)	-0.238	-5.386
	(-0.33)	(-1.44)
Supplier - Customer Relationship Controls	Y	Y
Supplier-Customer Pair FE	Y	Y
Year FE	Y	Y
N	17,906	1,398
Adjusted R-Squared	0.15	0.357

Panel B. Employee sentiments

Dep Var:	**Employee Satisfaction Rating**				
	Overall Rating	*Career Opportunities*	*Compensation & Benefits*	*Senior Leadership*	*Work-life Balance*
	(1)	(2)	(3)	(4)	(5)
Target * Post 5-Year	-0.080**	-0.076**	-0.030	-0.082*	-0.150**
	(-1.97)	(-2.10)	(-1.08)	(-1.80)	(-2.23)
Post 5-Year	0.024	0.026	0.019	0.020	0.074**
	(0.74)	(0.96)	(0.99)	(0.56)	(2.06)
Ln(Market Cap)	0.080***	0.112***	0.090***	0.099***	0.018
	(3.60)	(5.12)	(4.71)	(3.26)	(0.70)
Ln(1+Short Interest)	-3.755	-2.203	-2.289	-4.432	-5.930*
	(-1.32)	(-0.67)	(-1.02)	(-1.11)	(-1.88)
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
N	443,042	392,992	392,588	381,351	392,956
Adjusted R-Squared	0.073	0.070	0.140	0.050	0.066

Table 8. Subsample Analysis of Allegation Types and Stock Market Reactions

This table reports regression results from subsample analysis based on allegation types and stock market reactions to the public short campaign (PSC) announcement. The sample consists of firm-years of PSC target and control firms in the final matched sample. The matching procedure is described in Table 2. We include firm-years belonging to the target and control firm starting five years before the year of the short campaign announcement and five years afterward, including the fiscal year of the campaign announcement. The dependent variable in both panels is the natural logarithm of one plus the *Number of NPIs*. *Number of NPIs* is the number of new product/service launches or updates by a firm during the fiscal year. *Target* is an indicator variable equal to one if the firm is the target of a PSC and zero if the firm is the control firm. *Post 5-Year* is an indicator variable equal to one for both target and control firm-years if they are within the five years after the announcement of the PSC event, and zero otherwise. In Panel A, we split the full sample using campaign allegations. The control firm takes the allegation types of the target firm it is matched to. In Columns (1) and (2), we split the sample of short campaigns into those with and without product allegations, respectively. In Columns (3) and (4), we split the sample of short campaigns into those with product or business allegations and campaigns without either type of allegation, respectively. In Columns (5) and (6), we split the sample of short campaigns with product allegations into those that have only product-related allegations (*Product is the Only Issue*) and those with both product and other non-product allegations (*Product and Other issues*). In Panel B, we split the full sample of campaigns into those with credible allegations and non-credible allegations proxied by stock market reaction to campaign announcements based on CAR over (0, +5) or (0, +252). The control firm takes the market reactions of the target firm it is matched to. Odd-numbered columns in Panel B contain the subsamples that are perceived to be more credible and have negative CAR over (0, +5) and (0, +252) respectively. Even-numbered columns contain the subsamples that are perceived to be less credible and have positive CAR over (0, +5) and (0, +252) respectively. We use firm and year fixed effects in all models, and standard errors are clustered by firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. All variables are defined in Appendix A.

Panel A. Subsample analysis of product-related allegations vs. non-product-related allegations

Dep Var=	**Ln(1+Number of NPIs)**					
	Product Issues	*Non-product issues*	*Product or Business Issues*	*Non-Product & Non-Business Issues*	*Product is the Only Issue*	*Product and Other issues*
	(1)	(2)	(3)	(4)	(5)	(6)
Target * Post 5-Year	-0.117**	-0.103*	-0.105**	-0.143*	-0.108	-0.119**
	(-2.33)	(-1.74)	(-2.40)	(-1.77)	(-1.21)	(-2.07)
Post 5-Year	0.103**	0.008	0.075*	0.029	0.024	0.132**
	(2.32)	(0.16)	(1.95)	(0.44)	(0.30)	(2.56)
Ln(Market Cap)	0.028	0.021	0.032	0.001	0.013	0.035
	(1.13)	(0.71)	(1.40)	(0.02)	(0.37)	(1.10)
Ln(1+Short Interest)	3.419	4.373	3.527	5.433	4.070	3.050
	(1.12)	(1.56)	(1.43)	(1.31)	(0.95)	(0.90)
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
N	2,594	1,746	3,547	794	820	1,774
Adjusted R Squared	0.718	0.742	0.724	0.748	0.699	0.724

Panel B. Subsample analysis using stock market reactions

Dep Var=	**Ln(1+Number of NPIs)**			
	CAR(0,+5)<0	*CAR(0,+5)>0*	*CAR(0,+252)<0*	*CAR(0,+252)>0*
	(1)	(2)	(3)	(4)
Target * Post 5-Year	-0.107**	-0.122*	-0.113**	-0.113**
	(-2.36)	(-1.70)	(-2.23)	(-1.98)
Post 5-Year	0.078**	0.037	0.065	0.069
	(2.03)	(0.56)	(1.45)	(1.38)
Ln(Market Cap)	0.039*	-0.017	0.021	0.036
	(1.77)	(-0.49)	(0.87)	(1.23)
Ln(1+Short Interest)	4.151*	2.426	4.309	2.645
	(1.67)	(0.59)	(1.59)	(0.86)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
N	3,160	1,180	2,680	1,661
Adjusted R Squared	0.735	0.709	0.725	0.731

Table 9. Target Firm Product Outcomes with Heckman's Correction for Selection

This table reports results from the two-step Heckman (1979) selection model using firm-years of public short campaign (PSC) target and control firms in the final matched sample. The matching procedure is described in Table 2. We follow Brav et al. (2010) and use Heckman (1979)'s two-step procedure to address selection issues. The first step is estimated using all target and control firm-years, and the second step is only estimated within target firm-years. We include firm-years starting five years before the year of the short campaign announcement and five years afterward, including the year of the campaign announcement. We start by estimating the below probit regression on the sample of target/control firm-years:

$$Target_{i,t} = \beta X_{i,t-1} + \gamma Ln(TSI\ Own_{i,t-1} + 1) + \varepsilon_{i,t}, (1)$$

The dependent variable in the first step is $Target_{i,t}$, which is an indicator variable equal to one if firm *i* is the PSC target firm and zero if firm *i* is the control firm. $X_{i,t-1}$ is the set of control variables. $Ln(TSI\ Own_{i,t-1} + 1)$ is the instrumental variable, where $TSI\ Own_{i,t-1}$ is a firm's total percentage ownership by tax-sensitive institutional investors at the end of the fiscal year constructed following the definition in Blouin et al. (2017), and it takes the value of the year just before the year of campaign announcement. $\varepsilon_{i,t}$ is the error term. In the second step, we estimate the following OLS regression using target firm-years only:

$$Ln(1 + Number\ of\ NPIs)_{i,t} = \alpha_i + \lambda\, X_{i,t-1} + \eta Post\ 5 - Year_{i,t} + \delta IMR_{i,t} + \omega_{i,t}, (2)$$

The variable $IMR_{i,t}$ is the inverse mills ratio and is the hazard function estimated from the first step. $\omega_{i,t}$ is the error term in the second step. Standard errors in both steps are bootstrapped simultaneously with 200 replications. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. All variables are defined in Appendix A.

Dep Var:	**Target**	**Ln(1+Number of NPIs)**
	First step	*Second step*
	(1)	(2)
Ln(1+TSI Own)	0.155***	
	(5.58)	
Post 5-Year	0.129***	-0.079**
	(2.89)	(-2.08)
Inverse Mills Ratio		-0.279
		(-1.33)
Ln(Market Cap)	0.118***	0.094***
	(8.03)	(5.01)
Ln(1+Short Interest)	68.867***	-5.953
	(15.77)	(-0.70)
Annualized Stock Return	0.110**	-0.088**
	(2.30)	(-2.42)
Tobin's Q	-0.021**	-0.015**
	(-1.98)	(-2.05)
ROA	-0.146	0.132**
	(-1.51)	(2.25)
Delta Q	0.014	0.013*
	(1.45)	(1.83)
Delta ROA	0.312***	-0.091
	(3.11)	(-1.29)
Sales Growth	-0.128	-0.267***
	(-0.91)	(-3.53)
Firm Risk	0.122***	0.019
	(3.68)	(0.67)
Illiquidity	-0.127**	0.020
	(-2.41)	(0.52)
Inst Own	-0.011***	0.001
	(-10.65)	(0.81)
Ln(1+Industry NPI)	0.037***	0.139***
	(3.48)	(14.29)
N	3,980	2,055
Pseudo R-Squared	0.011	0.142

Table 10. Public Short Campaigns vs. Aggregated Short Interests: Results using Alternative Samples
This table reports OLS regression results from alternative samples. The dependent variable in both panels is the natural logarithm of one plus the *Number of NPIs*. *Number of NPIs* is the number of new product/service launches or updates by a firm during the fiscal year. *Target* is an indicator variable equal to one if the firm is the target of a public short campaign (PSC) and zero if the firm is the control firm. *Post 5-Year* is an indicator variable equal to one for target firm-years if they are within the five-year period after the announcement of the PSC, and zero otherwise. Panel A reports the regression results using the full sample of US non-regulated firms in the CRSP-Compustat Merged Database without matching from 2007 to 2019. In Columns (1) and (2) of Panel A, the variables of interests are the natural logarithm of one plus *Short Interest* and the interaction term *Target*Post 5-Year*. In Columns (3) and (4) of Panel A, the variable of interests are the interaction term *Target*Post 5-Year* and the natural logarithm of one plus *Delta Short Interest*, which captures the annual change in a firm's aggregated short interest. Panel B reports regression results using alternative matched samples, where target firms are matched to control firms using aggregate short interests or changes in short interests. We construct a matched sample similar to the matching procedure described in Table 2, but estimate the propensity score from a probit regression predicting the likelihood of being a PSC target using the natural logarithm of one plus short interests in Columns (1) and (2) and using the annual change in a firm's aggregated short interest at the end of fiscal year in Columns (3) and (4). For each PSC target, the corresponding control firm is in the same two-digit SIC industry and year that has the closest propensity score. We include firm-years of the target and control firm starting five years prior to the year of the short campaign announcement and five years afterward, including the fiscal year of the campaign announcement. For both panels, we use firm and year fixed effects in all models, and standard errors are clustered by firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively. All variables are defined in Appendix A.

Panel A. Impact of aggregated short interests vs. public short campaigns in the full Compustat sample

Dep Var=	**Ln(1+Number of NPIs)**			
	(1)	(2)	(3)	(4)
Ln (1+Short Interest)	0.174*	0.180*		
	(1.88)	(1.95)		
Ln (1+Delta Short Interest)			0.253***	0.193***
			(3.77)	(3.01)
Target * Post 5-Year		-0.039*		-0.037*
		(-1.74)		(-1.65)
Ln(Market Cap)	-0.014*	-0.014*	-0.023***	-0.018**
	(-1.72)	(-1.77)	(-2.96)	(-2.24)
Annualized Stock Return	0.006	0.006	0.006	0.008
	(1.01)	(0.99)	(0.92)	(1.25)
Tobin's Q	-0.001	-0.000	-0.001	0.001
	(-0.12)	(-0.09)	(-0.25)	(0.13)
ROA	-0.032	-0.032	0.018	0.013
	(-0.96)	(-0.96)	(0.63)	(0.44)
Delta Q	0.025	0.025	0.025	0.038**
	(1.18)	(1.17)	(1.46)	(2.03)
Delta ROA	-0.003	-0.003	-0.031	-0.031
	(-1.05)	(-1.04)	(-1.63)	(-1.42)
Sales Growth	0.030*	0.030*	-0.002	-0.003
	(1.70)	(1.67)	(-0.53)	(-1.27)
Firm Risk	-0.019***	-0.019***	-0.017**	-0.018***
	(-2.86)	(-2.86)	(-2.57)	(-2.73)
Illiquidity	-0.010**	-0.010**	-0.013***	-0.012***
	(-2.32)	(-2.34)	(-3.20)	(-2.82)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
N	30,487	30,487	27,669	27,669
Adjusted R-Squared	0.663	0.663	0.652	0.653

Panel B. Alternative matched samples matched on short interest and change in short interest

Dep Var=	**Ln(1+Number of NPIs)**			
	Matched on *Short Interest*		Matched on *Delta Short Interest*	
	(1)	(2)	(3)	(4)
Target * Post 5-Year	-0.049*	-0.058*	-0.080*	-0.084*
	(-1.71)	(-1.66)	(-1.76)	(-1.86)
Post 5-Year	0.041*	0.048*	0.039	0.037
	(1.66)	(1.67)	(1.05)	(1.00)
Ln(Market Cap)		0.052*		-0.012
		(1.71)		(-0.58)
Annualized Stock Return		-0.006		-0.023
		(-0.29)		(-1.05)
Tobin's Q		0.005		-0.004
		(0.63)		(-0.37)
ROA		0.032		0.093
		(0.43)		(0.95)
Delta Q		-0.033		-0.050
		(-0.71)		(-1.03)
Delta ROA		-0.002		-0.019
		(-0.42)		(-0.27)
Sales Growth		-0.024		-0.002
		(-0.54)		(-0.20)
Firm Risk		-0.019		0.013
		(-1.19)		(0.56)
Illiquidity		0.008		-0.004
		(0.39)		(-0.20)
Ln(1+Short Interest)				0.303
				(1.16)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
N	4,504	4,504	4,082	4,082
Adjusted R-Squared	0.671	0.678	0.691	0.692