

# **Spiraling downward: The real impacts of public short campaigns on product innovation\***

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## **Abstract**

Using a novel dataset of firm products, we examine whether public short campaigns (PSCs) have real impacts on target firms. We find target firms introduce fewer new products relative to matched control firms. The targets' research and development input, innovation productivity, and product quality also decline. PSCs affect product innovation via worsened stakeholder perceptions, because the innovation decline is especially prominent among targets vulnerable to the withdrawal of stakeholder support, and stakeholder relationships significantly weaken. Further analysis highlights how PSCs can aid in information discovery but have negative indirect consequences that cause a downward spiral in preexisting product conditions.

JEL classification: G30; G23; G14

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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. The U.S. Securities Exchange Commission (SEC) also does not require short sellers to disclose their individual short positions in specific securities, unlike the disclosure requirements for institutional investors' long positions. 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 debate on what roles these activist short sellers play in the financial market.<sup>2</sup> 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.<sup>3</sup> 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

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<sup>2</sup> The recent prominence of PSCs has also prompted the SEC to propose the new Rule 13f-2 in February 2022, which would require large institutions to disclose their short positions in individual securities and short sale transactions monthly (<https://www.sec.gov/news/press-release/2022-32>). 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.

<sup>3</sup> See <https://www.cnbc.com/2018/10/05/experts-including-warren-buffett--say-short-selling-can-be-beneficial-for-markets.html>.

funds publicly announced their short positions in Tesla’s stock, Tesla’s chief executive officer, Elon Musk, accused these activist short sellers of fabricating false rumors, calling them “value destroyers” who distract the company from long-term value creation.<sup>4</sup>

Are corporate managers’ allegations against activist short sellers true? Do PSCs have any real negative impacts on target firms as alleged by corporate managers? In this study, we seek to answer this question by examining whether PSCs affect key corporate innovation activities, using a novel dataset of new product and service announcements from Capital IQ’s Key Developments database.<sup>5</sup> Even after accounting for the possible superior stock picking abilities of activist short sellers (Kartapanis, 2019), we find that PSCs have strong negative long-term real impacts on their target firm’s new product introductions (NPIs) and that these negative impacts are partly due to the withdrawal of support from key stakeholders. Through focusing on PSC’s indirect impact on stakeholders, this paper highlights how feedback from financial markets to firm operations and cashflows may arise when key stakeholders of the firm, other than the managers, make decisions based on information revealed in the stock market (Goldstein, 2023; Subrahmanyam and Titman, 2001).

Successful product innovation is critical for long-term firm performance and survival (Argente et al., 2018; 2020). 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

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<sup>4</sup> For examples, see <https://www.cnn.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>.

<sup>5</sup> For brevity, we refer to both products and services simply as products henceforth.

process (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).<sup>6</sup> This influences stakeholders' perceptions of the target firm, making it difficult for target firms to raise external capital to fund innovation projects (Grullon et al., 2015). 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 disclosed short selling campaigns launched by prominent activist short sellers. To reduce the endogenous impacts of selection, we use a propensity score matching approach to match each target firm to a control firm within its own industry, using matching covariates that predict the likelihood of activism (Brav et al., 2018; Zhao, 2020).

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<sup>6</sup> 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.

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, after being targeted. The negative impact of PSCs lasts up to five years after the campaign announcement, indicating that the product market impact is not transitory. Furthermore, we 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).

A decline in NPIs is observed while controlling for aggregate short interest that include both public short selling and traditional non-disclosed short selling. Interestingly, we observe total short interest positively predicts the number of NPIs. Therefore, increased short selling generally leads to better innovation outcomes, which is consistent with the work of He and Tian (2016), who find that general short selling disciplines managerial myopia in investment decisions. The difference in results between traditional and public short selling suggests that the public nature of PSCs has incremental and distinct impacts from traditional short selling.

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). There is no way to check whether the post-campaign trend for targets and control firms would be similar if not for the launch of the PSC, but we can check whether the pre-campaign trends between the two groups of firms are similar. We find that target and matched firms have similar pre-campaign NPI trends. Furthermore, in a falsification test, we find that significant changes in target product outcomes only arise after the launch of the PSC, and not before. Finally, we exploit cross-sectional variations in campaign credibility and estimate triple-difference regression models. This test allows us to address econometric

concerns relating to whether our matching of target firms to control firms is well done, since we are now comparing across campaigns that are likely to have a stronger impact versus campaigns with a weaker impact. As expected, we find that negative product impacts are concentrated among campaigns where the short seller is more credible.

Next, we examine whether the reduction in product innovation is 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. The product market outcomes of these firms are most likely to suffer from worsened stakeholder perceptions of their future product offerings. 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 of poor product innovation. Customers whose faith in the target firm's product 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 departure of key employees, leading to worse product innovation. We find results consistent with these predictions, because the negative impacts are mostly observed among financially constrained targets, targets operating in competitive industries, and targets with high employee turnover.

Further supporting the stakeholder mechanism of negative real impact, target firms experience significant declines in capital raising and worsened relationships with major customers relative to control firms. Target managers also receive less voting support from shareholders on management-sponsored compensation proposals. Next, we also examine short campaigns' impacts on the product innovation of rival firms. Consistent with the stakeholder

channel, where the customers of target firms switch suppliers, we find that the rival firms of PSC targets benefit from greater product innovation in the five years after the short campaign.

We next examine whether alternative hypotheses can explain our results. The decline in NPIs cannot be explained by a reduction in overinvestment due to increased shareholder scrutiny, because we also find significant declines in product quality and innovation productivity. A curtailing of overinvestment would imply better innovation productivity and product quality instead. The results are also not due to target management making myopic cuts to innovation investments to boost short-term performance and the stock price as a defense mechanism against the PSC, because we do not find that the decline in NPIs is stronger among firms with more short-term-oriented investors where the price pressure is greater (Bushee, 1998).

Prior literature has found that activist short sellers have stock picking abilities and can detect corporate malfeasance (Kartapanis, 2019). So far, we have controlled for the selection of target firms based on observables. However, activist short sellers may be able to select targets based on private information that is unobservable to empiricists, allowing them to detect target firms that will experience long-term deterioration in product innovation before the rest of the market can. We carefully account for such a selection issue using Heckman's two-step selection model and a strong instrumental variable and continue to find a reduction in NPIs for target firms. Thus, while selection might partially drive the observed results in NPI declines, it cannot be the sole reason. Furthermore, a pure selection story cannot fully explain why the decline in NPIs is stronger among financially constrained firms, firms in competitive industries, and firms with less committed employees—firms that the stakeholder channel predicts would experience the greatest impact.

Critics of PSCs have often claimed that the allegations made by activist short sellers are unjustified and that, by spreading rumors about the firm, they harm the firm's long-term

economic health. We provide evidence that such claims by critics are not entirely true. Reductions in NPIs are concentrated among campaigns where the short seller alleges that the target has product-related issues, and this negative impact is especially strong among campaigns that are more credible. The targets of campaigns with other types of allegations do not experience declines in product innovation. Together with the previous sets of analyses, the results suggest that, although the decline in product innovation could have been partially due to activist short sellers being able to select firms with problematic product innovation, publicly announced allegations worsen a preexisting product situation through negatively impacting the target firm's stakeholder relationships. The withdrawal of key stakeholder support during the innovation process in reaction to the public announcement create a downward spiral for the target's product problems.

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 (2020) focus on comparing the impacts of short and long campaigns by hedge funds and find a decline in the investment levels of target firms. Wong and Zhao (2017) concentrate on how the feedback effect from PSCs affect manager's decisions. Different from Wong and Zhao (2017), we focus on the stock market's feedback effects on the reactions of other key stakeholders. Through doing so, we document that one important channel for the real impacts of activist short sellers is their influence on stakeholders' perceptions of the target firm. Furthermore, we examine product innovation outcomes, which allows us to directly test for the net economic impact of PSCs that goes beyond the level of investments and



to show that the reduction in innovation outcomes is associated with declines in innovation efficiency and product quality.

Several papers have examined how the ex ante threat of short selling impacts corporate real activities through disciplining managers (Chang et al., 2019; Fang et al., 2016; Grullon et al., 2015; Massa et al., 2015). In particular, He and Tian (2016) document how the threat of being shorted helps discipline managers, resulting in improved patenting quality and efficiencies. Our analysis underscores the difference between public short selling and traditional non-disclosed short selling and suggests that the public nature of short campaigns launched by activist short sellers has an incremental and distinct impact on firm activities via their broader influence, which goes beyond merely impacting financial market participants and target firm managers.

Our results are consistent with the active information role of the financial market in allocating firm investments (Goldstein et al., 2013). Prior empirical literature has examined the stock market's feedback effect on the firm's decisions through examination of how managers learn from stock prices (e.g., Chen et al., 2007; Luo, 2005). Extending the scope of the feedback effect, Subrahmanyam and Titman (2001) theorizes that feedback from financial market prices to cash flows may also affect the actions of nonfinancial stakeholders of the firm, such as customers and employees, resulting in cascades where small changes in stock prices can result in substantial changes in real asset values. We provide supportive empirical evidence of this by showing that the learning from financial markets is also extended to firms' nonfinancial stakeholders including customers and employees.

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 is proposing additional regulation requiring institutional investors to disclose more about their

individual short positions. The Australian Securities and Investments Commission has recently recommended a set of better practices for activist short sellers, such as fact checking with target firms before releasing any reports.<sup>7</sup> 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 taking a light hand when regulating these activist shareholders, since they help uncover negative information. Any negative real impacts on target firm product innovations are indirect and confined to firms that are already facing problems in the first place.

## **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 primary allegation that justifies the short position, for example, product-related issues, general overvaluation, accounting issues, and illegal activities. 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

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<sup>7</sup> See <https://asic.gov.au/regulatory-resources/markets/short-selling/activist-short-selling-campaigns-in-australia/>

(CRSP), financial data from Compustat, and short interest data from the SEC and removing campaigns on firms in regulated industries, we obtain a final sample of 341 campaigns announced by 79 unique activist short sellers targeting 241 unique firms over the period 2010-2017.<sup>8</sup> All stock returns and firm financial variables are winsorized at the first 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. 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 120 days into the future.

Panel B of Table 1 reports the time series distribution of short campaigns. Our statistics are consistent with the common belief and academic literature that PSCs have increased substantially over the recent years (e.g., Appel and Fos, 2020). The number of short campaigns increased from seven in 2010 to 91 in 2016.<sup>9</sup> The announcement returns are all significantly negative across the years.

Panel C of Table 1 reports the distribution of the PSCs across primary allegation types and the corresponding average CARs for each allegation type. Our classification of primary allegations is provided by ASR, and these classifications are thus mutually exclusive.<sup>10</sup> Appendix B provides anecdotal examples of each primary allegation type. Activist short sellers always claim the target firms' stocks are overvalued, but, for the majority of the 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-

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<sup>8</sup> Our sample selection criteria filter out events when anonymous bloggers publish comments on Seeking Alpha.

<sup>9</sup> Since the ASR data were downloaded in mid-2017, we do not have all the campaigns from 2017.

<sup>10</sup> We verified the primary allegation types for a randomly selected sample of 50 campaigns and find that almost all classifications are correct.

related allegations are the most prominent type, 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. Campaigns with product-related issues account for 38% of all campaigns. The second most common primary allegation is accounting issues and/or illegal activities, where the activist short sellers question the target companies' accounting practices and sometimes make accusations of financial fraud and illegal conduct by key personnel. For 21% of the campaigns, activist short sellers accuse the target companies of general overvaluation, with no specific allegation. Among the less common allegation types, investment and financing issues represent 7% and 6% of all campaigns, respectively.

We find that the stock market reacts strongly and negatively to almost all types of primary allegations. Announcement returns and longer-term returns are significantly negative for all the primary allegation types, except for financing issues, where the short- and long-term CARs are insignificant. The short-term stock market reactions are the strongest for claims related to firm investments and accounting/fraud issues. The negative CARs also persist over the longer term, indicating no reversal of initial negative reactions. Interestingly, stock market reactions to general overvaluation claims, although are one of the smallest in the short-term, engender the largest negative return in the long run. Valuation-driven short campaigns involve primarily opinions and interpretations of information rather than exposures of specific information, and this type of campaign can thus take longer to influence stock market valuations.

## *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' own website.<sup>11</sup> 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.<sup>12</sup> About 50% of the firms in the CRSP–Compustat merged database made at least one product announcement during 2002–2020. For each announcement, Capital IQ provides 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

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<sup>11</sup> 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).

<sup>12</sup> We downloaded the Capital IQ data in January 2021.

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.<sup>13</sup> 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

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<sup>13</sup> 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.

through a random sample of 500 announcements and find that 96% announcements 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 natural logarithm of one plus 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. 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-year period ending in year  $t - 2$ . This measure is similar to that used by Hirshleifer et al. (2013) to estimate patenting efficiency. We set *Number of NPIs* and *Innovation Productivity* to zero for 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 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 perform matching to partially mitigate the possibility that differences in firm product outcomes following short campaigns are due to differences in observable firm characteristics between short targets and other firms prior to the campaign. 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*.

As the next step, we match each PSC target, with replacement, to the nearest neighbor firm drawn from the same year and 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 most 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,



*Number of NPIs* and *R&D intensity* are not significantly different between the target and control firms prior to the PSC announcement. The pre-campaign trends in the outcome variables are also similar, since 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 interest, 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. 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. To ensure that our results are not driven by passive short selling that is undisclosed, we control for *Short interest* throughout our regression specifications.

### **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-year period 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.<sup>14</sup> We use the following DiD regression as our main model:

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

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  $j$ ;  $\alpha_i$  and  $\alpha_t$  denote firm and year fixed effects, respectively;<sup>15</sup>  $Target_{i,j,t}$  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;  $Post\ 5 - Year_{j,t}$  is an indicator variable equal to one for both target and control firm–years if they are within the five-year period 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 Cap*) and *Short Interest*. Our main variable of interest is the coefficient  $\beta_1$  of the interaction term between  $Target_{i,j,t}$  and  $Post\ 5 - Year_{j,t}$ , 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. The dependent variable in Panel A is the natural logarithm of one plus *Number of NPIs*. In Column (1), we find that the

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<sup>14</sup> 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.

<sup>15</sup> 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.

coefficient on the interaction term between *Target* and *Post 5-Year* is negative and statistically significant at the 1% level. Therefore, compared to their control firms, target firms announce 11.2% relatively fewer new products after being targeted. Interestingly, the coefficient on the standalone indicator variable *Post 5-Year* is positive, indicating that, compared to the pre-targeting period, control firms generally increase their product innovation. This is consistent with the overall trend in the full Compustat sample, where we see firms increasing their product introduction activities year on year.<sup>16</sup>

In Columns (2) and (3) of Table 3, we replace *Post 5-Year* with *Post 3-Year* and *Post 1-Year*, respectively, where *Post 3-Year* (*Post 1-Year*) is an indicator variable equal to one for the three years (one year) after the campaign announcement, and zero otherwise. We continue to find a positive and significant albeit weaker coefficient on the interaction between *Target* and the indicator variable *Post 3-Year*, but the interaction term involving the indicator variable *Post 1-Year* loses significance. The fact that we do not observe any significant impacts if we focus only on the one-year period after the campaign announcement suggests that the negative impact is not transitory. If the impact is temporary, with NPIs returning back to pre-campaign levels after the first year, we should observe a temporary decrease in NPIs only in the first year after the campaign announcement, and this temporary change should be picked up by the interaction between *Target* and *Post 1-Year*. However, we did not observe this.

To further examine whether the negative NPI impacts are long term or transitory and to pinpoint when they 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. In Columns (1) and (3) of Table 3, we find that that the negative impact on product outcomes occurs only starting two years after the campaign announcement. This is consistent with the time lag between

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<sup>16</sup> Year fixed effects can only pick up the general level of product activities in the sample, and not positive changes.

innovation effort and output as observed in launches of new products. Furthermore, the negative impacts continue up to five years after the campaign announcement, indicating that any negative impacts are non-transitory, consistent with the results in Panel A. In Columns (2) and (3), we include event year indicators for the years prior to the event and find no evidence of pre-treatment trends; there is no significant difference in the NPI activities in the two years immediately before the campaign announcement years between the target and control firms, consistent with the conclusion drawn from Table 2, Panel A, that the parallel trends assumption needed for the DiD estimation to be valid is upheld in our sample.

It is interesting to note that the coefficient on *Short interest* is mostly positive and significant in both panels of Table 3, indicating a positive impact of short selling on product outcomes. The variable *Short interest* aggregates both types of non-disclosed short selling activities and those of PSCs. This result on *Short interest* is consistent with that of He and Tian (2016), who find that increased short selling threats due to the passage of Regulation SHO resulted in improved patenting outcomes.<sup>17</sup> Together with the negative product impacts of PSCs we documented previously, our results highlight how public short selling and non-disclosed short selling could have differential impacts on the innovation activities of firms: non-disclosed short selling is beneficial for innovation, but public short selling is detrimental to firm innovative activities.

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

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<sup>17</sup> 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.

target firms' product quantity coming from new product launches and product updates. Third, we repeat our analysis in Table 3, Panel A, using the full Compustat sample without propensity score matching. We use the same model specifications as in Table 3A and control for all the matching covariates used in the matching approach. This analysis does not allow us to mitigate endogeneity concerns, as the matching approach does, but it helps us understand whether our results are externally valid for a broader set of firms. We continue to find significant declines in NPIs among target firms relative to non-target firms over the five-year period following short campaigns.

Overall, we show that PSC targets experience significant declines in the level of product innovation output relative to their control firms after being targeted by activist short sellers. This decline lasts for the long term and is not transitory.

### 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 more than that of the control firms after being targeted, since the coefficient on the interaction term between *Target* and *Post 5-Year* is negative and significant at the 1% level.

Next, we examine how the quality of products changes after short campaigns. The dependent variable in Column (2) of Table 4 is *New Product Announcement CAR(-10,10)*, and we use this variable to capture the stock market's perception of firm product quality. 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 evidence that

the product quality of the target firms weakens relative to that of their control firms following short selling campaigns. After being targeted, target firms' product announcements yield 1% lower abnormal returns compared to those of the control firms. The statistically weaker results for the stock market reactions to NPIs are consistent with the observation of Sood and Tellis (2009), that the stock market might have already anticipated the NPI through prior firm announcements about the new potential investment.

The dependent variable in Columns (3) to (5) 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. These results make sense, since it takes time for the inputs to be translated into outputs in the form of new products or product updates.

### *3.3. Cross-sectional impact of campaign credibility*

To further validate the results on declining product innovation that we documented, we examine cross-sectional variations in campaign credibility. We expect the negative impact to be stronger among campaigns launched by more credible and reputable short sellers. We estimate triple-difference regression models. These tests allow us to address econometric concerns relating to whether our matching of target to control firms is well done, since we are now comparing within the group of target firms across campaigns that are likely to have a stronger impact versus campaigns with a weaker impact.

In Table 5, the dependent variable is the natural logarithm of one plus *Number of NPIs*. The main variables of interests are the triple interactions of *Target*, *Post 5-Year*, and various cross-sectional measures of campaign credibility. In Column (1), we use the number of PSCs undertaken by the activist short seller over the past three years as a proxy for short seller

reputation. To allow for the three years to measure short seller reputation, we limit our sample to campaigns since 2012 in Column (1). We find that the target firms of campaigns initiated by more reputable activist short sellers experience a stronger decline in firm product quantity relative to those targeted by less reputable short sellers. In Column (2), we find that the drop in NPI is stronger for the target firms of campaigns initiated by activist short sellers who disclose detailed information of their allegations by publishing a report that explains the rationale behind the campaign. Such campaigns supported by reports are more credible.

PSC announcements are often accompanied by large negative market reactions. Campaigns that are more credible should be associated with larger price drops. In Column (3) of Table 5, we use an indicator variable to measure stock market reactions to short campaigns and keep only events where the target firms are targeted by short campaigns for the first time during our sample period.<sup>18</sup> The indicator variable *Low CAR(0, +5)* indicates whether the CAR over the event window (0, +5) is in the lowest quartile of the sample. The results in Column (3) suggest that the negative impact on firm product outcomes is concentrated among campaigns with stronger and more negative stock market reactions.

#### **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 is likely to affect the views of key stakeholders of the target firm and their support of the target firm. 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 to

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<sup>18</sup> The interaction term *Target\*Campaign Credibility* is thus omitted due to multicollinearity.

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 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 about 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 are intending 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.

The stakeholder channel hypothesis is also consistent with the active information role of the financial market in allocating firm investments (Goldstein et al., 2013; Goldstein and Guembel, 2008; Subrahmanyam and Titman, 2001; Morck et al., 1990), and we focus on how the negative information revealed by activist short sellers affects various stakeholders' support of the firm and thus subsequently firm activities in the process. All three groups of stakeholders are likely to be affected simultaneously when a firm is targeted by a PSC. Therefore, under the stakeholder channel, worsening stakeholder relationships would lead target firms to invest less in innovation, which, in turn, results in the lower product quantity, quality, and innovation productivity we observed so far.



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 suffer. Finally, if employee retention becomes a problem after a firm is targeted, we should observe higher rates of employee turnover after targeting and the negative impact on product outcomes should be stronger among firms experiencing high employee turnover.

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

In Table 6, Column (1), we examine whether financially constrained firms are more strongly 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 firm future prospects, thus negatively affecting target firms' abilities to raise the necessary funds to finance their new product developments.

In Column (2) of Table 6, 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 a 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 greater ability to switch supplier firms.

In Column (3) of Table 6, 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 (Compustat's *optca*) to its total number of stock options outstanding (Compustat's *optosey*) plus one. Consistent with our expectations, we find that the decline in product output is significantly stronger among target firms with greater employee turnover.

In untabulated results, we examine *Innovation Productivity* and product quality as proxied by the market reaction to new product announcements (*New Product Announcement CAR(-10,+10)*) as alternative dependent variables. Consistent with Table 6, we continue to 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 examining stakeholder relationships

In Table 7, we examine whether public campaigns negatively affect target firms' important stakeholder relationships. Evidence of worsening stakeholder relationships that are important to the product innovation process will provide further support for the stakeholder channel. First, we examine whether short campaigns make it harder for a target firm to raise funds from equity holders and debtholders. In Column (1) of Panel A, the dependent variable is the natural logarithm of total equity and debt net issuance plus 100.<sup>19</sup> We follow Baker and Wurgler (2002) and Dong et al. (2012) to calculate equity and debt issuances using Compustat annual financials. The main variable of interest is the interaction between *Target* and *Post 5-Year*, which gives the impact of PSCs on target firms relative to control firms. The coefficients on the other control variables are omitted for brevity.

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-year period following PSCs. Further, in an untabulated analysis, we find that this decline in total issuance is strongest two to three years following short campaigns, suggesting the decline is concentrated over the near term. We also separately examine equity and debt net issuances and find 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.

We next turn to PSCs' impact on target firms' major customer relationships in Column (2) of Table 7. 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). We obtain information about firms' major customers from the Compustat Segment files. Public U.S. firms are required

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<sup>19</sup> We add 100 because we are measuring net issuance as a percentage of assets. Because firms can repay debt or repurchase shares, the net issuance numbers can be negative, and, thus, we add 100 before taking the logarithm. Our results are similar if we use *Total Issuance* without the logarithmic transformation or if we use  $\text{Ln}(1 + \textit{Total Issuance})$  as the dependent variable, where *Total Issuance* is measured as a ratio and not a percentage.

by the SEC to disclose sales 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 sample target and control firms.

The dependent variable in Column (2) of Panel A of Table 7 is the natural logarithm of one plus *Principal Customer Sales Growth*, where *Principal Customer Sales Growth* is the current sales to a particular large customer divided by lagged sales to the same customer by the supplier, expressed in percentage points. We use supplier–customer pair and year fixed effects and control for supplier firm *Sales Growth* and other customer–supplier relationship characteristics, including *Sales Dependence* and *Relationship Length*. 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 short campaign announcement. 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 Column (3) of Panel A of Table 7, we examine whether employee relationships worsen after being targeted. Our proxy of employee relationship is the natural logarithm of one plus *Employee Turnover*, where *Employee Turnover* is defined using option cancellations, as in Table 6. Higher employee turnover will indicate worsening employee relationships. We do not find that short campaigns lead to higher employee turnover at target firms relative to control firms over the five-year period following short campaigns.

In Panel B of Table 7, we use shareholder voting results to examine whether shareholders' perceptions of target firms' management change after short campaigns. If shareholders view the target's management more negatively after the PSC, we should see decreasing support from shareholders for proposals sponsored by management as they

withdraw their support. We focus on management proposals relating to compensation, which is more uniform across firms and reflects shareholder dissatisfaction with management. 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. Given that shareholders typically do not get to vote on internal decisions made by firm management, their votes on compensation-related proposals serve as an overall confidence vote of approval/disapproval of management.

The sample in Panel B of Table 7 contains all compensation-related proposals sponsored by the management of target and control firms, from five years prior to the short campaign to five years afterward. The dependent variable in all 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 the average number of disapproval votes received for all management-sponsored proposals during the annual shareholder meeting (*Average Pct “No”*), and whether Institutional Shareholder Services recommends supporting the proposal (*ISS For*) in all model specifications, following Liu et al. (2020).

In Columns (1) to (3) of Panel B of Table 7, we find strong evidence 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. Interestingly, this effect is only significant for *Target\*Post 1-Year* in Column (1) and for *Target\*Post 3-Year* in Column (2), suggesting that shareholders’ disapproval of target firms’ management is concentrated in the near term of one to three years after campaign announcements. In Columns (4) to (6), we examine whether the decreased shareholder voting

support of the target firm observed above is driven by the shareholders' own perceptions of management, independent of the proxy advisor's recommendations. The main variable of interests in these three columns are the triple interactions of *Target*, *ISS For*, and the *Post* indicator in each column. We find that the coefficients on all triple interactions in Columns (4) to (6) are positive and significant. Thus, the effect of shareholders' increased numbers of disapproval votes toward target firms' proposals are driven by those proposals that received positive ISS recommendations, suggesting shareholders' own perceptions of target firms' management has become more negative, despite the proxy advisor being positive about the proposal.

Overall, we find support for the real negative impact of short campaigns through observing more difficulties for target firms in raising external capital, their weakened relationships with significant customers, and weaker shareholder voting support of target firms' management-sponsored compensation proposals. Importantly, these negative impacts of stakeholders start to show up in the near term, which, in turn, serve as a channel for the deterioration in product innovation over the long term.

## **5. Additional Tests**

### *5.1. Testing alternative hypotheses*

We argue that the decline in product output after PSCs is due to weakening stakeholder relationships, which negatively affect the innovation process. In this section, we test for the possibilities of alternative explanations. In particular, we check whether the results are driven by the curbing of overinvestments in target firms due to heightened shareholder scrutiny or increased short-term pressures faced by target management. We also check whether our results are due simply to the superior stock picking abilities of activist short sellers.

### *5.1.1. Curbing of overinvestment*

PSCs can indirectly discipline the agency problem of overinvestments. One of the main allegations of activist short sellers is that their target stocks are overvalued. 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. Managers can also learn from the short campaign and reduce their investments (Chen et al., 2007). Wasteful product development activities are thus curtailed, resulting in fewer NPIs going forward. This could explain our results in Table 3. However, under this curbing of the overinvestment channel, we should expect the reduction in wasteful investments to improve innovation productivity and product quality. Yet, as observed in Table 4, after the PSC, innovation productivity and product quality decline instead. Therefore, the decline in NPIs is unlikely to be due to the curbing of overinvestments.

### *5.1.2. 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 try and meet earnings targets and shore up their defenses against the attack. Any signs of financial weakness on the target's part can cause a further decline in the target's stock price. 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). Therefore, under this alternative hypothesis, target firms facing pressure from their short-term-oriented shareholders should be most affected by the increased pressure to cut spending in R&D at the expense of long-term product output to counter the short campaign.

We test the short-term pressure hypothesis by examining whether the negative product outcome impacts are stronger among target firms with more short-term-oriented investors. In untabulated results, we measure the degree of short-term pressure faced by the target firm using the investor turnover variable of Gaspar et al. (2005), and the percentage of institutional investors who are transient (Bushee, 1998). We find no evidence supportive of the short-term pressure hypothesis, since target firms under short-term pressures from their investors do not exhibit worse declines in product outcomes compared to targets firms with long-term investors.

### *5.1.3. Informed stock picking versus negative real causal impacts*

Some of our results are potentially consistent with an alternative hypothesis where the observed patterns are due to activist short sellers' informed stock picking. Activist short sellers could have selected targets based on private information that is unobservable to empiricists and which allows them to detect target firms that will experience long-term deterioration in product innovation before the rest of the market can. Although our matching approach is only able to address selection issues on observables, we have additionally provided evidence that PSCs impact the innovation process through weakening stakeholder relationships. Furthermore, such selection on observables alone cannot explain why financially constrained firms, firms in competitive industries, and firms with weak employee commitment are likely to suffer more.

Nevertheless, to further examine whether the results are due solely to selection, we follow Brav et al. (2010) and use Heckman's (1979) two-step selection model to account for activist short sellers' non-random selection of target firms. The idea behind Heckman's selection model is that the selection issue is a form of omitted variable bias 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. We argue that the likelihood of being targeted should increase with the proportion of tax-sensitive institutional investors. Tax-sensitive investors have more incentives to exploit situations to capitalize on capital losses and combine it 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 affects firms' innovation outcomes, and the exclusion requirement of the instrument variable is thus also likely to hold.<sup>20</sup> When constructing *TSI Own*, we follow the 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 8 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

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<sup>20</sup> 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.

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 ordinary least squares (OLS) regression using the natural logarithm of one plus *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, to account for the fact that the target firms are not randomly selected. In both steps, we control for all the matching covariates used in the propensity score matching and the control variables used in Table 3. 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. This additional control is important to account for yearly industry-level innovation output, since we do not use the control firms in the second step. Because we do not use the control firms in the second step, we control for the matching covariates too in both steps. The second step further controls for firm fixed effects. 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.

The coefficient on the instrumental variable *TSI Own* is positive and significant at the 1% level in Column (1) of Table 8, which confirms its relevance, as discussed above. Additionally, in Column (2), the coefficient on the inverse Mills ratio is far from significant, with a *t*-statistics of 0.35, suggesting little evidence of selection bias affecting the results in the second step. Importantly, the coefficient on *Post 5-Year* remains negative and statistically significant, indicating significant deterioration of product innovation, even after correcting for selection.

We do not aim to eliminate the possibility that activist short sellers’ superior selection of target firms is partially causing some of 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. This conclusion is further supported by our main empirical setup, where we use a matching approach to account for concerns regarding selection based on observables, and our additional results on the stakeholder channel.

### *5.2. Worsening versus unjustified negative real impacts*

Although PSCs have real causal impacts, there are two possibilities for these impacts. First, PSCs could indiscriminately damage the reputation of the target company and, in turn, have an unjustified negative impact on target product outcomes. Such unjustified negative impacts can occur when an activist short seller of the campaign accuses the target firm of non-product-related issues (e.g., overvaluation) that cause stakeholders to view the target firm negatively in general and to withdraw their support. This withdrawal of support then causes the “innocent” target firm to suffer from poor product outcomes afterward. Thus, the poor product outcome is an indirect consequence of the short campaign.

Alternatively, activist short sellers could have identified a target firm’s product-related issues and their public allegations of product problems worsen the situation, affecting the confidence of the target firm’s stakeholders and leading to a downward spiral of the product situation, which might not have been so bad absent the actions of the activist short sellers. Such an alternative explanation is still consistent with our conclusion in Section 5.1.3 that PSCs have real negative impacts on firm product innovation in the sense that they exacerbate a preexisting product issue. In this latter case, the negative impacts represent a more moderate and fairer type of negative impact, while the former unjustified negative impact is less fair to the target firm. We investigate this issue by examining whether the negative firm product outcomes are broadly based across all types of allegations or only concentrated among allegations involving product issues.

In Table 9, we focus only on firms that are targeted only once, such that there is only one primary allegation type, to ensure we capture cleaner impacts of allegation types. This

approach yields 161 events involving 161 unique target firms. The results are generally similar if we examine all the campaigns. We find that the negative effect on target firm product introductions is concentrated and only statistically significant among PSCs with product-related allegations. The coefficient on the triple interaction term between *Target*, *Post 5-Year*, and an indicator for product-related allegations is negative and significant at the 5% level. In contrast, although the coefficient on the triple interaction term involving accounting/fraud allegations is negative, it is not significant, and its magnitude is close to ten times smaller. Furthermore, the coefficients on the interaction terms involving the other types of allegations (general overvaluation and investment and financing issues) are positive and mostly insignificant. These results support the conjecture that PSCs have worsening rather than unjustified negative impacts on all target firms.

One can potentially argue that the product allegations by activist short sellers might have little ground and that, by baselessly accusing the target firms of product issues, the activist shorts are creating unjustified negative impacts on the target firms. However, in untabulated results, we find that the decline in product outcomes for product issue PSCs are concentrated among campaigns initiated by more credible activist short sellers, who are less likely to make false accusations.

Overall, the fact that the negative product outcome is concentrated among specific campaigns with product-related allegations and, especially, more credible product-related allegations suggests that the negative real impact of PSCs is unlikely to be driven by unjustified claims or the manipulation of stock prices, as some critics claim. This explanation is consistent with the informative trading role of activist short sellers (Appel and Fos, 2022; Ljungqvist and Qian, 2016). However, because of the publicity surrounding the campaigns, stakeholder confidence in the target is negatively affected, causing a downward spiral of a product situation that might not have been so bad absent the activist shorts.

### 5.3. Spillover effects on targets' rival firms

Previously, we found that PSCs weaken target firms' relationships with their major customers. In Table 10, we show the results of additional analysis to examine whether the rivals of target firms benefit from the targets' deteriorating relationships with their customers. The sample consists of the firm-years of rival firms, starting five years before the year of the announcement of the short campaign and ending five years afterward. Rival firms are defined as those firms in the same four-digit SIC code industry as the target firm in the year immediately before the campaign announcement. The dependent variable is the natural logarithm of one plus *Number of NPIs* of the rival firms. The key independent variable is *Post 5-Year*, which indicates the five years after the announcement of a PSC targeting a firm in the industry.

In Column (1) of Table 10, we find moderate evidence that rival firms' NPIs increase for up to five years following short campaigns. The coefficient on *Post 5-Year* is positive and its corresponding *t*-statistic (1.63) is marginally significant at 11%. In Columns (2) to (5), we test if the PSC's impact on rival firms is stronger among campaigns alleging product, accounting, overvaluation, and other issues, respectively. Our main variable of interest is the interaction term between *Post 5-Year* and the indicator variable for each allegation type. Interestingly, in Column (2), we find strong evidence that rival firms' number of NPIs significantly improves following campaigns with product-related allegations for the target firms. This result supports the customer stakeholder channel results in Tables 5 and 6 and suggests that negative customer perceptions about target firms are particularly strong when activist short sellers specifically criticize their products, which in turn benefits their rival firms.

In contrast, in Columns (3) to (5) of Table 10, we find that rival firms experience significant declines in the number of NPIs after the campaign announcement when the PSC targets accounting, valuation, and other issues (financing or investment). Unlike product

allegations aimed at target firms, activist short sellers' campaigns on accounting, valuation, and other issues do not seem to benefit rival firms. This result is consistent with findings of negative spillover effects on rival firms after financial misrepresentation scandals (e.g., Goldman et al., 2012), where the information in the accusation of one firm affects that used to value rival firms.

Taken together, we find additional support for the stakeholder channel in Table 10, particularly among campaigns involving product allegations. Rival firms experience significantly greater numbers of NPIs following short campaigns and benefit from target firms' customers' negative perceptions when activist short sellers make allegations that the target firms' products are ineffective and unattractive.

## **6. 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 NPIs, we find that target firms introduce 11.2% fewer new products each year relative to their matched control firms after being targeted. The negative declines last for up to five years afterward, suggesting that the real impact is not transitory. These negative real impacts persist even after accounting for the possibility that activist short sellers could have superior abilities in selecting target firms with problematic product issues compared to the rest of the market, indicating that the product innovation decline is at least a partial reflection of the real causal impacts of these PSCs.

Additional tests show that the R&D input, innovation productivity, and product quality of target firms also drop after the launch of a short campaign. We control for aggregate short

interest throughout our analysis and find that public short selling has distinct effects on product innovation compared to traditional non-disclosed short selling, because, in the regressions, total short interest positively impacts product innovation, unlike PSCs.

Product innovation requires the strong support of key stakeholders at every step of the complex process. Further analysis shows that the decline in product innovation is partly due to the negative publicity surrounding target firms that adversely affects stakeholders' perceptions of the target firm's future product offerings, resulting in these key stakeholders withdrawing their support from the target firm. We find that the negative impacts of PSCs are most prominent among financially constrained firms and firms with weaker commitments from customers and employees. The product outcomes of these firms are most susceptible to the negative perceptions of capital providers, customers, and employees. Additional results show that target firms reduce the capital they raise and have worse relationships with their customers after being targeted. Shareholder support for key management proposals in annual meetings also declines. The rival firms of targets benefit through increased product output.

Finally, we find that the decline in product innovation is concentrated among short campaigns alleging that the targets have product issues in the first place. These results, together with the previous results on stakeholder relationships and significant real impacts even after accounting for selection issues, suggest that, while the deterioration in product outcomes is partly due to activist short sellers influencing key stakeholders' perceptions of the target firms' future prospects, activist short sellers also play an informational role in discovering information about target firms. Unfortunately, due to the public nature of the short campaigns, an indirect consequence is the withdrawal of support by key stakeholders of the target firm due to the negative publicity surrounding the target firm. This withdrawal creates a downward spiral in an existing product problem that might not have been so bad absent the publicity surrounding the short campaign.

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## Appendix A. Variable Definitions

Variable	Definition
<i>Main explanatory and dependent variables</i>	
Number of NPIs	A firm's total number of press releases about its new product launches and product updates during the fiscal year.
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.
Innovation Productivity	A firm's number of press releases about its new product launches or product updates during the fiscal year $t$ scaled by its accumulated R&D capital over the five-year period ending in year $t-2$ .
New Product Announcement CAR(-10,+10)	The cumulative abnormal return starting 10 days before a firm's press release about new product launches or product updates to 10 days after. Cumulative abnormal returns (CAR) 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.
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.
Post 5-Year	An indicator variable equal to one for both target and control firm-years if they are within the five-year period following a public short campaign announcement, and zero otherwise.
Post 3-Year	An indicator variable equal to one for both target and control firm-years if they are within the three-year period following a public short campaign announcement, and zero otherwise.
Post 1-Year	An indicator variable equal to one for both target and control firm-years if they are within the one-year period following a public short campaign announcement, and zero otherwise.
<i>Other explanatory variables</i>	
Annualized Stock Return	A firm's annualized stock return from daily returns during the fiscal year.
Delta Q	A target or control 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.
Delta ROA	A target or control firm's change in ROA between year $t-3$ and year $t-1$ , where year $t$ is the fiscal year of the campaign announcement.
Employee Turnover	A target or control firm-year'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).
Firm Risk	The natural logarithm of a firm's variance of daily returns over the fiscal year.
Financially Constrained	An indicator variable equal to one if a target or control firm-year's Hadlock and Pierce (2010) financial constraint index is in the top quartile in the full sample, and zero otherwise.
High Competition	An indicator variable equal to one if one if a target or control firm-year is in a Hoberg and Phillips textual industry with a Herfindahl-Hirschman Index (HHI) lower than the bottom quartile value in the full sample, and zero otherwise.
Illiquidity	A firm's average daily Amihud Illiquidity during the fiscal year.
Industry NPI	The total number of new product launches and updates of all firms in a two-digit SIC industry during the year.
Low CAR(0, +5)	An indicator variable equal to one if the CAR(0, +5) surrounding a public short campaign announcement is in the bottom quartile value in the full sample, and zero otherwise.
Market Cap	The market value of a firm using common shares outstanding (CSHO) times the share price at the end of the fiscal year.

Number of Short Campaigns	The number of public short campaigns announced by an activist short seller over the past three calendar years for an event.
Pct “No” Votes	The number of “Against” votes received for an agenda item divided by the total number of votes cast in percentage terms.
Principal Customer Sales Growth	The sale growth to a particular large customer as reported by the supplier firm in percentage terms.
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 fiscal year ending in year t-2, and so on.
Relationship Length	The relationship duration between a firm and its principal customer.
ROA	Operating income before depreciation scaled by lagged total assets.
Sale Dependence	The fraction of a supplier firm's sale to the large customer divided by the supplier firm's total sales during the year.
Sales Growth	The natural logarithm of a firm's sales divided by lagged sales.
Short interest	A firm's number of shares held short divided by its total number of shares outstanding immediately before the fiscal year end.
Short Report Available	An indicator variable equal to one for a campaign if the activist short seller also published a short report that provides detailed rationales for the short selling, and zero otherwise
Tobin's Q	$(\text{Total Assets} - \text{Book Value of Equity} + \text{Market Value of Equity}) / \text{Lagged Total Assets}$
Total Assets	A firm's total assets at the end of the fiscal year.
Total Issuance	The sum of a firm's <i>Equity Issuance</i> and <i>Debt Issuance</i> as a percentage of its total assets during the year. <i>Equity Issuance</i> is calculated as [change in book equity (item CEQ) + change in deferred taxes (item TXDB) - change in retained earnings (item RE)] scaled by lagged assets. <i>Debt Issuance</i> is calculated as [change in total assets (item AT) - change in book equity (item CEQ) - change in deferred taxes (item TXDB)] scaled by lagged assets.

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## 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

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. Accounting issues and illegal activities

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 B3. General overvaluation

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”.

#### Panel B4. Investment issues

Example 1. Muddy Waters bets against American Tower in first US move: <https://www.wsj.com/articles/BL-MBB-4721>

“In the report, Muddy Waters valued American Tower shares at \$44.57, saying... American Tower ‘has engaged in a value destroying investment binge overseas,’ the report said.”

#### Panel B5. Financing issues

Example 1. Spruce Point is short 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.”

## 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 key word 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 <sup>21</sup>:

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)*.<sup>22</sup>

Example: "Apple Inc. announces availability of iPhone 6 and iPhone 6 Plus in China."

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<sup>21</sup> 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*.

<sup>22</sup> 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 the 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 primary allegation types and each allegation type's mean *CAR* over various event windows. These primary allegations are mutually exclusive.

*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(-20,+20)	341	-5.48%	-16.60%	-6.71%	7.89%	21.60%
CAR(0,+120)	341	-17.60%	-36.41%	-10.84%	8.46%	43.24%

*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 primary allegation types*

Primary Allegation	N	% of Total Campaigns	CAR (0,+5)	CAR (-20,+20)	CAR (0,+120)
			Mean	Mean	Mean
Product-related issues	131	38%	-4.02%	-4.21%	-13.86%
Accounting issues and illegal activities	97	28%	-4.47%	-8.57%	-18.55%
General overvaluation	70	21%	-3.60%	-3.73%	-27.05%
Investment Issues	24	7%	-5.69%	-7.07%	-19.23%
Financing Issues	19	6%	-1.26%	-2.92%	-1.74%



**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 prior to the year of short campaigns. For each public short campaign 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 public short campaign 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 difference 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 statistical significance of 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 targets 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 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. 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 and zero if the firm is the control firm. In Panel A, the *Post 5-Year* (*Post 3-Year*, *Post 1-Year*) indicator variable is equal to one for both target and control firm-years if they are within the five- (three-, one-) year period after the announcement of the public short campaign, and zero otherwise. In Panel B, we construct public short campaign event year indicators over the [-2, +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. The coefficients on the standalone *Event Year* and *Post 5-Year* indicators in Panel B 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.

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

Dep Var:	Ln(1+Number of NPIs)		
	(1)	(2)	(3)
Target * Post 5-Year	-0.112*** (-2.87)		
Target * Post 3-Year		-0.094** (-2.48)	
Target * Post 1-Year			-0.036 (-0.82)
Post 5-Year	0.066** (1.97)		
Post 3-Year		0.071** (2.44)	
Post 1-Year			0.013 (0.38)
Ln(Market Cap)	0.026 (1.35)	0.026 (1.34)	0.026 (1.32)
Ln(Short interest)	3.796* (1.72)	3.729* (1.69)	3.441 (1.56)
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	4,341	4,341	4,341
Adjusted R-Square	0.729	0.729	0.729

*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)		
	(1)	(2)	(3)
Target * Event Year +5	-0.165* (-1.69)		-0.167* (-1.66)
Target * Event Year +4	-0.125 (-1.55)		-0.126 (-1.59)
Target * Event Year +3	-0.149** (-2.50)		-0.144** (-2.41)
Target * Event Year +2	-0.124** (-2.32)		-0.125** (-2.35)
Target * Event Year +1	-0.068 (-1.45)		-0.075 (-1.56)
Target * Post 5-Year		-0.127*** (-3.00)	
Target * Event Year -1		-0.053 (-1.23)	-0.050 (-1.19)
Target * Event Year -2		-0.028 (-0.73)	-0.026 (-0.69)
Ln(Market Cap)	0.025 (1.29)	0.026 (1.35)	0.022 (1.24)
Ln(Short interest)	3.394 (1.53)	3.691* (1.67)	3.155 (1.45)
Standalone Event Year/Post 5-Year Indicators	Y	Y	Y
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	4,341	4,341	4,341
Adjusted R-Square	0.730	0.730	0.732

**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 targets 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 short campaign announcement and five years afterward, including the fiscal year of the campaign announcement. In Column (1), the dependent variable is *Innovation Productivity*, *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 public short campaign targets and the control firms starting five years prior to the year of the short campaign announcement and ending five years afterward. To maintain 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 Column (3), the dependent variable is *R&D Intensity*, which is a firm's R&D expenditure during the fiscal year divided by beginning of the year total assets. In all three columns, *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)	(5)
Target * Post 5-Year	-0.032*** (-2.68)	-0.010* (-1.86)	-0.012 (-1.52)		
Target * Post 3-Year				-0.014* (-1.93)	
Target * Post 1-Year					-0.009 (-1.44)
Ln(Market Cap)	0.016* (1.74)	-0.007 (-1.51)	-0.007 (-1.51)	-0.007 (-1.53)	-0.007 (-1.52)
Ln(Short interest)	0.620 (0.84)	1.189** (2.57)	1.189** (2.57)	1.182** (2.52)	1.180** (2.57)
Standalone Post Event Indicators	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
N	2,725	4,782	4,341	4,341	4,341
Adjusted R-Square	0.484	0.051	0.051	0.051	0.051

**Table 5. Cross-Sectional Effects of Campaign Credibility**

This table reports regression results on the number of new product introductions using firm-years of public short campaign targets 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 short campaign announcement and five years afterward, including the fiscal year of the campaign announcement. The main variables of interests are the triple interaction terms of *Target*, *Post 5-Year* and a variable that measures campaign credibility. The dependent variable 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* indicator variable is equal to one for both target and control firm-years if they are within the five-year period after the announcement of the public short campaign, and zero otherwise. The campaign credibility variable is constructed at the campaign level, which takes the same value for both the target and control firm of a campaign. In Column (1), *Number of Short Campaigns* counts the number of all public short campaigns announced by the activist short seller over the three years prior to the event at the focal firm. Our sample in Column (1) is restricted to campaigns announced after 2012 (three years after the first event in our sample). In Column (2), *Short Report Available* is an indicator variable equal to one if the activist short seller of an event also published a short report that provides detailed rationales for short selling, and zero otherwise. In Column (3), *Low CAR(0, +5)* is an indicator variable equal to one if the *CAR(0, +5)* surrounding the campaign announcement is below the bottom quartile value of that in the full sample, and zero otherwise. The sample in Columns (3) only contains 225 campaigns with unique target firms, and only the first short campaign if they are targeted for multiple times during the sample period, thus the interaction term *Target \* Campaign Credibility* dropped out due to multicollinearity. 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)		
	<i>Number of Short Campaigns</i>	<i>Short Report Available</i>	<i>Low CAR(0, +5)</i>
	(1)	(2)	(3)
Campaign Credibility Var =			
Target * Post 5-Year * Campaign Credibility Var	-0.065** (-2.18)	-0.146* (-1.90)	-0.160* (-1.71)
Target * Post 5-Year	0.022 (0.30)	-0.016 (-0.25)	-0.078 (-1.57)
Target * Campaign Credibility Var	0.011 (0.90)	0.064* (1.74)	
Post 5-Year * Campaign Credibility Var	0.030 (1.36)	0.058 (1.17)	0.080 (1.23)
Campaign Credibility Var	-0.006 (-0.80)	-0.024 (-1.11)	-0.056 (-1.10)
Post 5-Year	-0.028 (-0.48)	-0.004 (-0.08)	0.048 (1.21)
Ln(Market Cap)	0.030 (1.44)	0.028 (1.43)	0.039* (1.93)
Ln(Short interest)	4.168* (1.78)	4.228* (1.84)	0.753 (0.33)
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	3,616	3,828	3,102
Adjusted R Square	0.747	0.738	0.734

**Table 6. 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 using firm-years of campaign targets 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 prior to 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-year period 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 a 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= Firm Characteristics Var =	Ln(1+Number of NPIs)		
	<i>Financially Constrained</i>	<i>High Competition</i>	<i>Ln(Employee Turnover+1)</i>
	(1)	(2)	(3)
Target * Post 5-Year * Firm Characteristics Var	-0.175* (-1.73)	-0.203* (-1.76)	-0.024*** (-2.70)
Target * Post 5-Year	-0.019 (-0.42)	-0.025 (-0.44)	-0.549 (-0.29)
Target * Firm Characteristics Var	0.231*** (2.76)	0.104 (0.96)	0.327 (1.57)
Post 5-Year * Firm Characteristics Var	0.131 (1.60)	0.149** (2.19)	0.059 (0.27)
Post 5-Year	0.012 (0.33)	-0.001 (-0.04)	-0.205 (-0.20)
Firm Characteristics Var	-0.128** (-2.28)	-0.036 (-0.57)	-0.020 (-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-Square	0.753	0.734	0.711

**Table 7. Impact of Public Short Campaigns on Stakeholder Relationships**

This table reports regression results examining the impact of public short campaigns on target firms' stakeholder relationships relative to their control firms. In Panel A, the sample consists of target firms and their 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 prior to the year of the short campaign announcement and five years afterward, including the fiscal year of the campaign announcement. The dependent variable in Column (1) is the natural logarithm of 100 plus *Total Issuance*, where *Total Issuance* 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. Since there are negative percentage values as we measure net issuance activities, we add 100 to *Total Issuance* before taking logarithm transformation. The dependent variable in Column (2) is the natural logarithm of one plus *Principal Customer Sales Growth*, which is defined as the sales growth to a particular large customer *j* as reported by the target/control firm (supplier firm) in percentage terms. A firm's principal customers are customers that account for a large proportion of the firm's total annual sales (usually 10% or more) reported in the Compustat Segment files. The analysis is done at the supplier firm-principal customer level. We additionally control for the target/control firm's *Sales Growth*, and other customer-supplier relationship characteristics including *Sales Dependence*, and *Relationship Length*. The dependent variable in Column (3) is the natural logarithm of one plus *Employee Turnover*, where *Employee Turnover* is the target/control firm's stock option cancellations during the year as a percentage of the number of non-executive employee stock options outstanding at the beginning of the year. 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 prior to the year of the campaign announcements and five years afterward. The analysis is done at the proposal level. The dependent variable 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 to vote "Yes" in support of the proposal, and zero otherwise. *Average Pct "No" Votes* is the average *Pct "No" Votes* of all agenda items put to a vote at the firm's annual shareholder meeting. In both panels, *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 campaign for both the target and control firm. The coefficients on the other control variables used in our main model in Table 3 Panel A are omitted for brevity. Other than Column (2) of Panel A which controls for supplier-customer pair fixed effects and year fixed effects, all other 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, customer sales, and employee turnover*

Dep Var:	Ln(Total Issuance+100)	Ln(Principal Customer Sales Growth+1)	Ln(Employee Turnover +1)
	(1)	(2)	(3)
Target * Post 5-Year	-0.049*** (-2.72)	-0.084* (-1.75)	-0.003 (-0.33)
Post 5-Year	0.024 (1.50)	0.042 (0.78)	0.008 (1.08)
Other T3A Controls	Y	Y	Y
Supplier - Customer Relationship Characteristics	N	Y	N
Firm FE	Y	N	Y
Supplier-Customer Pair FE	N	Y	N
Year FE	Y	Y	Y
Observations	4,050	1,398	3,905
Adjusted R-squared	0.397	0.357	0.367

Panel B. Shareholder support for management proposals

Dep Var:	Ln (Pct "No" Votes +1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Target * Post 1-Year	0.105** (2.03)			-0.067 (-0.79)		
Target * Post 3-Year		0.108** (2.19)			-0.080 (-1.10)	
Target * Post 5-Year			0.079 (1.38)			-0.108 (-1.36)
Target * Post 1-Year * ISS For				0.202* (1.90)		
Target * Post 3-Year * ISS For					0.217** (2.39)	
Target * Post 5-Year * ISS For						0.218** (2.26)
Target * ISS For				0.110 (1.63)	0.070 (0.98)	0.045 (0.62)
Post 1-Year * ISS For				-0.160* (-1.91)		
Post 3-Year * ISS For					-0.202*** (-2.86)	
Post 5-Year * ISS For						-0.173** (-2.35)
Post 1-Year	-0.100** (-2.54)			0.039 (0.59)		
Post 3-Year		-0.061* (-1.65)			0.116** (2.09)	
Post 5-Year			-0.018 (-0.37)			0.134** (2.00)
ISS For	-1.408*** (-36.36)	-1.407*** (-36.28)	-1.408*** (-36.39)	-1.470*** (-28.50)	-1.429*** (-26.30)	-1.420*** (-26.02)
Ln(Average Pct "No")	0.467*** (16.59)	0.466*** (16.58)	0.466*** (16.55)	0.464*** (16.51)	0.463*** (16.50)	0.463*** (16.48)
Other T3A Controls	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
N	5,220	5,220	5,220	5,220	5,220	5,220
Adjusted R-Square	0.618	0.618	0.617	0.618	0.618	0.618



**Table 8. 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 targets 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 prior to 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 public short campaign target firm and zero if firm  $i$  is the control firm.  $X_{i,t-1}$  is the set of control variables measured in the year before the campaign announcement.  $\ln(TSI\ Own_{i,t-1} + 1)$  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:

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

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)	0.178*** (6.54)	
Post 5-Year		-0.041* (-1.78)
Inverse Mills Ratio		0.157 (0.35)
Ln(Market Cap)	0.086** (2.22)	0.014 (0.33)
Ln(Short interest)	54.219*** (13.28)	10.762 (0.82)
Ln(Total Assets)	-0.024 (-0.68)	-0.009 (-0.21)
Firm Risk	0.168*** (5.09)	0.010 (0.19)
MTB	-0.008 (-0.55)	-0.010 (-0.87)
ROA	-0.323*** (-3.21)	0.158 (1.43)
Sales Growth	-0.182 (-1.34)	-0.038 (-0.52)
Annualized Stock Return	0.097* (1.79)	-0.018 (-0.49)
Illiquidity	-0.048 (-0.85)	-0.015 (-0.32)
Delta Q	0.003 (0.28)	0.008 (1.59)
Delta ROA	0.293** (2.50)	-0.065 (-0.78)
Ln(1+Industry NPI)	0.023** (2.15)	0.140*** (5.57)
Firm FE	N	Y
N	4,114	2,192
Pseudo/Adjusted R Square	0.246	0.738

**Table 9. Public Short Campaign Allegation Types and New Product Introductions**

This table reports regression results examining the cross-sectional effects of allegation types using firm-years of public short campaign targets and control firms in the final matched sample. The matching procedure is described in Table 2. To isolate the effects of different allegation types, the sample in this table only includes events where the target firm has only been targeted by activist short sellers once. We include firm-years belonging to 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. The dependent variable 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-year period after the announcement of the public short campaign event, and zero otherwise. *Product Issues*, *Accounting Issues*, *Valuation Issues*, and *Other Issues* are indicator variables equal to one if the primary campaign allegation is related to product issues, accounting issues/illegal activities, general overvaluation, and investment/financing issues respectively, and zero otherwise. The control firm takes the allegation types of the target firm it is matched to. 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)			
	<i>Product Issues</i>	<i>Accounting Issues or Illegal Activities</i>	<i>General Overvaluation</i>	<i>Investment or Financing Issues</i>
Allegation Type=	(1)	(2)	(3)	(4)
Target * Post 5-Year * Allegation Type	-0.194** (-1.97)	-0.018 (-0.20)	0.153 (1.36)	0.322* (1.81)
Target * Post 5-Year	-0.018 (-0.32)	-0.098* (-1.70)	-0.133** (-2.47)	-0.127*** (-2.62)
Post 5-Year * Allegation Type	0.110* (1.67)	-0.051 (-0.94)	-0.081 (-1.07)	-0.111 (-0.87)
Allegation Type	-0.034 (-1.20)	0.006 (0.30)	0.043* (1.70)	0.032 (0.75)
Post 5-Year	0.005 (0.10)	0.067 (1.48)	0.070* (1.75)	0.059 (1.52)
Other T3A Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
N	2,673	2,673	2,673	2,673
Adjusted R-Square	0.727	0.726	0.727	0.727

**Table 10. Impact of Public Short Campaigns on Rival Firm Product Innovation**

This table reports regression results on the spillover effects of public short campaigns on target firms' rivals. The sample includes firm-years of target firms' rival firms starting five years prior to the year of the short campaign announcement and five years afterward, including the fiscal year of the campaign announcement. Rival firms are firms in the same four-digit SIC industry as the target firm. 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 during the fiscal year. *Post 5-Year* is an indicator variable equal to one for rival firm-years if they are within the five-year period after the announcement of the public short campaign event, and zero otherwise. In Columns 2 to 5, we examine the interaction with campaign allegation types where *Target Product Issues*, *Target Accounting Issues*, *Target Valuation Issues*, and *Target Other Issues* are indicator variables equal to one if the primary campaign allegation of the corresponding target firm is related to product issues, accounting issues/illegal activities, general overvaluation, and investment/financing issues respectively, and zero otherwise. Control variables in all models include those used in the main models in Table 3 Panel A (*Ln(Market Cap)* and *Ln(Short interest)*) and the matching covariates used in constructing the matched sample (*Ln(Total Assets)*, *Firm Risk*, *Tobin's Q*, *ROA*, *Sales Growth*, *Annualized Stock Return*, *Illiquidity*, and *Delta ROA* and *Delta Q*). All models include rival firm fixed effects 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.

Dep Var=	Ln(1+Number of NPIs)				
	(1)	(2)	(3)	(4)	(5)
Post 5-Year	0.007 (1.63)	-0.006 (-0.99)	0.011** (2.34)	0.011** (2.47)	0.010** (2.03)
Post 5-Year * Target Product Issues		0.032*** (3.59)			
Post 5-Year * Target Accounting Issues			-0.016** (-1.98)		
Post 5-Year * Target Valuation Issues				-0.024*** (-3.05)	
Post 5-Year * Target Other Issues					-0.023** (-2.40)
Target Product Issues		-0.013*** (-3.18)			
Target Accounting Issues			0.006* (1.66)		
Target Valuation Issues				0.010*** (2.65)	
Target Other Issues					0.016*** (3.12)
Other T3A Controls	Y	Y	Y	Y	Y
Matching Covariate Control Variables	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
N	175,400	175,400	175,400	175,400	175,400
Adjusted R-Square	0.703	0.703	0.703	0.703	0.703

This internet appendix includes additional results to the paper “**Spiraling downwards: The real impacts of public short campaigns on product innovation**”.

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**Table A1. Robustness Tests Using Alternative Dependent Variables and Samples**

This table reports OLS regression results from tests that replicate our main results in Panel A of Tables 3 using alternative dependent variables and using the full Compustat sample without the use of propensity score matching. The samples in Panels A and B are based on the matched sample of target firms and control firms described in Table 2. In Panel A, *Number of All Announcements* is a firm's total number of all types of product/service-related press releases during the fiscal year. *Number of Product Updates*, *Number of New Product Launches*, and *Number of Product Development Progress* counts a firm's number of press releases about product/service updates, new product/service launches, and progress toward new products/services, respectively. In Panel B, we examine patenting outcomes. Our patent data is from Kogan et al. (2017). *Number of Patents Granted* is a firm's total number of patents granted during the fiscal year. *Patent Efficiency* is a firm's patent counts during the fiscal year scaled by its R&D capital accumulated over the five-year period ending in year  $t-2$ . *Total Patent Value* is a firm's total sum of Kogan et al. (2017) patent value estimated from stock market reactions to patent grants in millions of dollars during the fiscal year. Panel C replicates our main results uses the full Compustat sample over the 2007-2019 period without the use of propensity score matching. The dependent variable is the natural logarithm of one plus the *Number of NPIs*. *Number of NPIs* is the number of new product/service launches or updates during the fiscal year. We also control for matching covariates used in constructing the matched sample ( $\ln(\text{Total Assets})$ , *Firm Risk*, *Tobin's Q*, *ROA*, *Sales Growth*, *Annualized Stock Return*, *Illiquidity*, and *Delta ROA* and *Delta Q*). For all three panels, *Target* is an indicator variable equal to one if the firm is a target of activist short selling and zero otherwise. *Post n-Year* is an indicator variable that equals to one for both target and control firm-years if they are within the  $n$ -year period after the announcement of a public short campaign, and zero otherwise. Appendix A of the main paper provides detailed variable descriptions. Standard errors are clustered by firm in all regressions. \*\*\*, \*\*, and \* indicates statistical significance of 1%, 5%, and 10% respectively.

*Panel A. Public short campaigns and alternative firm product output measures*

Dep Var:	Ln(1+Number of All Announcements)	Ln(1+Number of Product Updates)	Ln(1+Number of New Product Launches)	Ln(1+Number of Product Development Progress)
	(1)	(2)	(3)	(4)
Target * Post 5-Year	-0.096** (-2.02)	-0.046*** (-2.69)	-0.092** (-2.36)	-0.010 (-0.28)
Post5-Year	0.080** (2.17)	0.042** (2.45)	0.056* (1.70)	0.056** (2.04)
Ln(Market Cap)	0.040* (1.88)	0.008 (1.07)	0.023 (1.24)	0.027** (2.10)
Ln(Short Interest)	7.099** (2.53)	1.132 (1.09)	3.416 (1.58)	5.018** (2.42)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
N	4,341	4,341	4,341	4,341
Adjusted R Square	0.766	0.586	0.701	0.774

*Panel B. Public short campaigns and firm patenting outcomes*

Dep Var=	Ln(1+Number of Patents Granted)	Patent Efficiency	Ln(1+ Total Patent Value)
	(1)	(2)	(3)
Target * Post 5-Year	0.052 (0.68)	-0.040* (-1.70)	-0.203 (-1.56)
Post 5-Year	-0.037 (-0.69)	0.022 (1.42)	0.038 (0.43)
Ln(Market Cap)	0.055* (1.83)	0.015 (1.54)	0.171*** (3.01)
Ln(Short Interest)	-4.810 (-1.05)	-2.263 (-1.49)	3.713 (0.62)
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	4209	2717	4209
Adjusted R Square	0.912	0.556	0.907

*Panel C. Effect of public short campaigns using the full sample without matching*

Dep Var:	Ln(1+Number of NPIs)		
	(1)	(2)	(3)
Target * Post 5-Year	-0.046** (-2.10)		
Target * Post 3-Year		-0.034 (-1.54)	
Target * Post 1-Year			-0.023 (-0.92)
Ln(Market Cap)	0.012* (1.77)	0.012* (1.79)	0.013* (1.82)
Ln(Short Interest)	0.070 (0.79)	0.069 (0.79)	0.066 (0.75)
Matching Covariate Control Variables	Y	Y	Y
Standalone Post-Event Indicator Variables	Y	Y	Y
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	31,337	31,337	31,337
Adjusted R-Square	0.721	0.721	0.721

**Table A2. Robustness Checks for Cross-Sectional Variations in Product Outcome Impacts of Public Short Campaigns using Alternative Dependant Variables**

This table reports OLS regression results from tests that replicate our results in Table 6 using alternative dependent variables. We use the same model specification and sample as Table 6 but the dependent variables in Panels A and B are *Innovation Productivity* and *New Product Announcement CAR(-10, +10)* respectively. In Panel A, *Innovation Productivity* is the *Number of NPIs* of a firm scaled by its *R&D Capital*. *Number of NPIs* is the number of new product/service launches or updates 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 Panel A is restricted to firm-years with positive *R&D Capital*. In Panel B, *New Product Announcement CAR(-10, +10)* is the cumulative abnormal return (CAR) starting 10 days before the announcement of the new product/service launch or update to 10 days after. Day 0 is the day of the product announcement. 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. Our sample in Panel B is at the product announcement level and contains the product announcements by the public short campaign targets and the control firms starting five years prior to the year of the short campaign announcement and ending five years afterwards. To maintain 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 all columns of both panels, *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* indicator variable is equal to one for both target and control firm-years if they are within the five-year period 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) of both panels, 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) of both panels, the cross-sectional firm characteristic is *High Competition*, an indicator variable equal to one if the target/control firm is in an industry with a 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) of both panels, 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.

*Panel A. Cross-Sectional Variations in Innovation Productivity Outcomes*

Dep Var=	Innovation Productivity		
	<i>Financially Constrained</i>	<i>High Competition</i>	<i>Ln(Employee Turnover+1)</i>
Firm Characteristics Var =	(1)	(2)	(3)
Target * Post 5-Year * Firm Characteristics Var	-0.076* (-1.84)	-0.090* (-1.82)	-0.008* (-1.91)
Target * Post 5-Year	-0.009 (-0.76)	0.006 (0.41)	0.006 (0.35)
Target * Firm Characteristics Var	-0.000 (-0.01)	0.008 (0.19)	0.070 (1.11)
Post 5-Year * Firm Characteristics Var	0.028 (0.82)	0.096** (2.20)	-0.001 (-0.01)
Post 5-Year	0.018** (2.33)	-0.021 (-1.41)	0.019 (0.08)
Firm Characteristics Var	0.027 (1.36)	0.025 (0.75)	0.037 (0.69)
Other T3A Controls	Y	Y	Y
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	2,529	2,730	2,822
Adjusted R-Square	0.559	0.495	0.500

*Panel B. Cross-Sectional Variations in Product Quality Outcomes*

Dep Var=	New Product Announcement CAR(-10,+10)		
	<i>Financially Constrained</i>	<i>High Competition</i>	<i>Ln(Employee Turnover+1)</i>
Firm Characteristics Var =	(1)	(2)	(3)
Target * Post 5-Year * Firm Characteristics Var	-0.013* (-1.66)	-0.014 (-1.14)	-0.103* (-1.77)
Target * Post 5-Year	-0.062* (-1.86)	-0.002 (-0.38)	-0.005 (-0.79)
Target * Firm Characteristics Var	0.006 (1.00)	0.021** (2.33)	0.038 (0.79)
Post 5-Year * Firm Characteristics Var	0.001 (0.03)	0.015* (1.67)	-0.047 (-1.43)
Post 5-Year	0.025 (0.98)	-0.011 (-1.52)	0.015 (0.56)
Firm Characteristics Var	-0.036* (-1.90)	-0.001 (-0.23)	0.004 (0.61)
Other T3A Controls	Y	Y	Y
Additional Controls	Y	Y	Y
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	4,248	4,361	4,313
Adjusted R-Square	0.051	0.049	0.047



**Table A3. Additional Results for the Impact of Public Short Campaigns on External Financing Outcomes**

This table reports OLS regression results from tests that replicate our results in Column (1) Panel A of Table 7 using alternative explanatory and dependent variables. The dependent variable in Column (1) is the natural logarithm of 100 plus *Total Issuance*, where *Total Issuance* 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. Since there are negative percentage values as we measure net issuance activities, we add 100 to *Total Issuance* before taking logarithmic transformation. The dependent variable in Columns (2) and (3) is *Net Equity Issuance*, which is calculated as [change in book equity (item CEQ) + change in deferred taxes (item TXDB) - change in retained earnings (item RE)] scaled by lagged assets. The dependent variable in Columns 4 and 5 is *Net Debt Issuance*, which is calculated as [change in total assets (item AT) - change in book equity (item CEQ) - change in deferred taxes (item TXDB)] scaled by lagged 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 5-Year* indicator variable is equal to one for both target and control firm-years if they are within the five-year period after the announcement of the public short campaign, and zero otherwise. We also construct public short campaign event year indicators over the five years after the campaign announcement year. *Event Year +n* is an indicator equal to one for both target and control firm-years if the year is *n* years after the campaign announcement. The coefficients on the standalone *Event Year* and *Post 5-Year* indicators are omitted for brevity. 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.

Dep Var:	Ln(Total Issuance+100)	Ln(Net Equity Issuance+100)		Ln(Net Debt Issuance+100)	
	(1)	(2)	(3)	(4)	(5)
Target * Post 5-Year		-0.033*** (-2.65)		-0.009 (-0.83)	
Target * Event Year +5	-0.056 (-1.15)		-0.054* (-1.79)		0.000 (0.00)
Target * Event Year +4	-0.013 (-0.33)		-0.026 (-0.98)		0.020 (0.73)
Target * Event Year +3	-0.068** (-2.19)		-0.047** (-2.32)		-0.021 (-1.04)
Target * Event Year +2	-0.057** (-2.25)		-0.034** (-2.01)		-0.017 (-1.03)
Target * Event Year +1	-0.045* (-1.96)		-0.024* (-1.65)		-0.009 (-0.58)
Ln(Market Cap)	0.068*** (6.80)	0.043*** (5.29)	0.043*** (5.30)	0.028*** (5.04)	0.029*** (5.06)
Ln(Short Interests)	3.404** (2.37)	1.430 (1.54)	1.460 (1.56)	0.868 (0.96)	0.974 (1.08)
Standalone Event Year/Post Indicators	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Observations	4,050	4,050	4,050	4,050	4,050
Adjusted R-squared	0.396	0.517	0.516	0.125	0.125

**Table A4. Cross-Sectional Variations in Product Outcome Impacts of Public Short Campaigns using Alternative Firm Characteristics**

This table reports OLS regression results from tests that replicate our results in Table 6 using alternative cross-sectional firm characteristic variables. We use the same model specification and sample as Table 6 but the cross-sectional firm characteristic variables in Columns (1) and (2) are *High Investor Turnover* and *High Transient Own*, respectively. *High Investor Turnover* is an indicator variable equal to one if a target/control firm's institutional investor turnover variable constructed following Gaspar et al. (2005) is greater than the top quartile value in the full sample, and zero otherwise. *High Transient Own* is an indicator variable equal to one if a target/control firm's percentage ownership by transient institutional investors based on classifications from Bushee (1998) is greater than the top quartile value in the full sample, and zero otherwise. Both *High Investor Turnover* and *High Transient Own* take values lagged by one 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-year period after the announcement of the public short campaign, and zero otherwise. The coefficients on the other control variables used in our main model in Table 3 Panel A are omitted for brevity. 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.

Dep Var= Firm Characteristics Var =	Ln(1+Number of NPIs)	
	<i>High Investor Turnover</i>	<i>High Transient Own</i>
	(1)	(2)
Target * Post 5-Year * Firm Characteristics Var	-0.129 (-1.10)	-0.029 (-0.33)
Target * Post 5-Year	-0.091** (-2.02)	-0.108** (-2.34)
Target * Firm Characteristics Var	0.056 (0.93)	-0.048 (-0.78)
Post 5-Year * Firm Characteristics Var	0.014 (0.16)	0.056 (0.99)
Post 5-Year	0.065* (1.86)	0.055 (1.45)
Firm Characteristics Var	-0.053 (-1.24)	0.014 (0.35)
Other T3A Controls	Y	Y
Firm FE	Y	Y
Year FE	Y	Y
N	4,016	4,014
Adjusted R-Square	0.739	0.739

**Table A5. Public Short Campaign Product-Related Allegations and Campaign Credibility**

This table reports regression results on the cross-sectional effects of product-related allegations using subsamples of targets and corresponding control firm-years split based on campaign credibility. To isolate the effects of allegation types, the sample in this table only includes only campaigns where the target firm has been targeted by activist short sellers once. In Columns (1) and (2), we split the sample of public short campaigns using activist short sellers' credibility measured using *Number of Short Campaigns*, which counts the number of all public short campaigns announced by the activist short seller over the three years prior to the event at the focal firm. Column (1) [(2)] contains the subsample of campaigns where the activist short seller's number of short campaign is greater than or equal to [less than] the median number of short campaigns in the full sample. In Columns (3) and (4), we split the full sample based on *Short Report Available*, which is an indicator variable equal to one if the activist short seller of an event also published a short report that provides detailed rationales for short selling, and zero otherwise. In Columns (5) and (6), we split the full sample based on *Low CAR(0, +5)*, which is an indicator variable equal to one if the CAR(0, +5) surrounding the campaign announcement is below the bottom quartile value of that in the full sample, and zero otherwise. *Product Issues* is an indicator variable equals to one if the campaign allegation is product-related. We use firm and year fixed effects in all models, and standard errors are clustered by firm. The sample in this table only includes only campaigns where the target firm has been targeted by activist short sellers once, thus the interaction term *Target \* Product Issues* dropped out due to multicollinearity. \*\*\*, \*\*, 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)					
			Subsamples based on			
	<i>&gt;= Median Number of Short Campaigns</i>	<i>&lt;Median Number of Short Campaigns</i>	<i>Short Report Available=1</i>	<i>Short Report Available=0</i>	<i>Low CAR(0, +5) =1</i>	<i>Low CAR(0, +5) =0</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Target * Post 5-Year * Product Issues	-0.269** (-2.03)	-0.105 (-0.76)	-0.143 (-1.48)	-0.079 (-0.60)	-0.416** (-2.23)	-0.126 (-1.14)
Target * Post 5-Year	-0.016 (-0.20)	-0.020 (-0.26)	-0.092* (-1.70)	-0.012 (-0.13)	-0.121 (-0.96)	0.010 (0.16)
Post 5-Year * Product Issues	0.092 (1.05)	0.136 (1.45)	0.020 (0.30)	0.085 (1.06)	0.353*** (3.28)	0.042 (0.55)
Product Issues	-0.027 (-0.70)		-0.001 (-0.06)	-0.023 (-0.81)	-0.057 (-0.89)	0.002 (0.07)
Post 5-Year	0.010 (0.16)	-0.019 (-0.27)	0.088* (1.84)	-0.042 (-0.59)	0.065 (0.67)	-0.015 (-0.27)
Other T3A Controls	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
N	1,495	1,178	1,865	808	625	2048
Adjusted R-Square	0.750	0.697	0.720	0.739	0.554	0.749

**Table A6. Robustness Checks for Main Results Using Double Clustered Standard Errors**

This table reports OLS regression results from tests that replicate our main results in Panel A of Tables 3 using the same model specifications, but standard errors are double clustered by firm and year. We use firm and year fixed effects in all models, and standard errors are clustered by firm. The dependent variable is the natural logarithm of one plus the *Number of NPIs*. *Number of NPIs* is the number of new product/service launches or updates 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 n-Year* indicator variable is equal to one for both target and control firm-years if they are within the *n*-year period after the announcement of the public short campaign, and zero otherwise. \*\*\*, \*\*, 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)		
	(1)	(2)	(3)
Target * Post 5-Year	-0.112*** (-3.29)		
Target * Post 3-Year		-0.094** (-2.53)	
Target * Post 1-Year			-0.036 (-1.27)
Post 5-Year	0.066* (1.99)		
Post 3-Year		0.071** (2.77)	
Post 1-Year			0.013 (0.47)
Ln(Market Cap)	0.026 (1.36)	0.026 (1.33)	0.026 (1.31)
Ln(Short Interests)	3.796 (1.30)	3.729 (1.30)	3.441 (1.20)
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	4,341	4,341	4,341
Adjusted R-Square	0.730	0.729	0.729