Litigating Innovation: Evidence from Securities Class Action Lawsuits

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June 1, 2018

Abstract

Low-quality securities class action lawsuits disproportionally target firms with valuable innovation. We establish this fact using data on lawsuits against U.S. corporations between 1996 and 2011 and the private economic value of a firm's newly granted patents as a measure of valuable innovation. We find that securities class actions impose a substantial implicit "tax" on highly innovative firms. Regarding the channel, our findings suggest that changes in investment opportunities and corporate disclosure induced by the innovation make successful innovators attractive targets of low-quality litigation. Overall, our results provide new evidence consistent with the view that the current class action litigation system has adverse effects on the competitiveness of the U.S. economy.

Keywords: Innovation; Patents; Class Action Lawsuit; Shareholder Litigation; Corporate Governance; Law and Economics

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1. Introduction

Corporate innovation is a central determinant of optimal resource allocation and economic growth. A vast body of academic work, from Adam Smith's pin factory to Schumpeter's creative destruction, emphasizes the positive impact of corporate innovation on the economy. Consistent with this favorable view on innovation, fostering and promoting corporate innovation is a core policy objective in governments around the world.

If promoting innovative activity is a desirable societal goal, identifying potential obstacles to the creation and implementation of valuable new ideas is crucially important. This paper provides novel evidence suggesting that a central pillar of the U.S. litigation and corporate governance system, securities class action lawsuits, acts as an implicit "tax" on valuable innovation. Specifically, using data from the Stanford Securities Class Action Clearinghouse (SCAC) on class action lawsuits filed against public U.S. companies between 1996 and 2011, and using the private economic value of a firm's newly granted patents as a measure of valuable innovation, we show that valuable corporate innovation increases the likelihood of being the target of a low-quality class action lawsuit. Our findings suggest that low-quality class action litigation represents an undesirable byproduct of value-creating corporate innovation, which has important implications for our understanding of the potential real effects of the current litigation system.

The idea that lawyers can abuse the class action system by bringing meritless cases against innovative firms is firmly rooted in anecdotal evidence.[1] For example, Ed McCracken, at the time the CEO of Silicon Graphics Computers, wrote in a June 28, 1995 piece in the San Francisco Chronicle, titled "*The New Threat to High Tech Companies:*"[2]

> *This new breed of corporate raider* [he refers to plaintiff lawyers who bring frivolous class action lawsuits] *claims stock fraud when there is little or no evidence of wrongdoing– that is, deliberate false or misleading statements by the company about its potential– then ties a company up in litigation long enough to force a profitable settlement. It is a practice that costs people jobs and diverts millions from research and development [...] The high-tech firms of Silicon Valley and the Bay Area's bio-tech companies are the No. 1 target of these schemes [...]*

In an attempt to reduce such abuse of the class action litigation system, the U.S. Congress enacted the Private Securities Litigation Reform Act (PSLRA) of 1995. Senator Pete Domenici (one of the two Senators sponsoring the initial bill) explained in a U.S. Senate speech on August 10, 1995, why he thinks meritless class action litigation is a first-order problem:

[1] In the remainder of the paper we will use the terms "meritless lawsuit" and "low-quality lawsuit" interchangeably. In both cases, we are referring to lawsuits with little or no legal merit.

[2] We obtain this quote from Congressional Record Volume 141 (1995). We thank Lin, Liu, and Manso (2017) for drawing our attention to this Congressional Record.

These lawsuits divert resources from companies' research and development budgets to their legal departments. One of these lawsuits costs as much as developing and bringing to market a high-technology product line. Jobs that should have been created aren't created, and we lose out to our international competitors. The race to innovate becomes a race to the courthouse. [...] Some have called it a litigation tax.

The main contribution of our paper is threefold. First, most existing evidence supporting the view that meritless class actions target innovative firms is either anecdotal, or indirect. We provide direct large-scale evidence, including evidence from instrumental variables, showing that valuable innovation leads to a higher propensity to be subject to a low-quality class action lawsuit in the following year. Second, our results indicate that the views expressed in the above quotes are as relevant today as they were before the introduction of PSLRA. In particular, the "tax on valuable innovation" we document in our 1996-2011 sample period is directly related to the "litigation tax" invoked by Senator Domenici. Third, we document that meritless litigation leads to sizable economic losses for innovative firms.

Our findings have potentially important implications for understanding how securities class action litigation can affect the competitiveness of the U.S. economy. First, by draining resources, such as financial capital, reputational capital, and managerial time, from productive firms precisely when these companies are about to implement their new ideas, meritless class action lawsuits contribute to economy-wide misallocation of resources. Second, ex-post punishment of firms that generate valuable innovation, in the form a costly meritless lawsuit, distorts innovation incentives for all firms *ex ante*, which may lead to underprovision of innovation in the economy. Finally, a tax on valuable innovation may lead firms to refrain from listing on public stock markets and thus forego otherwise valuable growth opportunities – an argument in line with both anecdotal and prior academic evidence on class action lawsuits as an impediment to tapping public equity markets (e.g., Zingales (2006)).

Providing evidence that firms with valuable innovation get targeted with low-quality lawsuits is empirically challenging. A first challenge is to cleanly identify firms with valuable innovation output. A second challenge is to measure lawsuit merit, which is inherently unobservable. A third, and central, challenge is to minimize pertinent endogeneity concerns.

We measure the value of a firm's innovation output using an approach recently proposed by Kogan, Papanikolaou, Seru, and Stoffman (2017) (KPSS), who exploit stock-market reactions to new patent grants to determine the private economic value of innovations. Because we ultimately care about questions regarding the competitiveness of the U.S. economy, our aim is to identify a set of firms whose innovative activities are conducive to economic growth, i.e., firms whose activities should be incentivized rather than punished by the litigation system. The KPSS measure is ideal for this purpose because they show their measure of innovation value is a strong predictor of subsequent growth in employment, capital, output, profits, revenue-based total factor productivity, and overall economic growth. This feature sets the KPSS measure apart from other measures of innovation output, as well as from measures of innovation input. Our baseline measure of lawsuit merit is based on subsequent dismissal in the judicial process, which we argue is a conservative approach. We show that our main results are robust to a variety of measures of innovation output, and to a variety of proxies for lawsuit merit that have been proposed in the literature.

While we pay particular attention to identification issues in our main empirical analysis, the key findings are reflected already in the raw data. Figure 1 shows the annual likelihood of being targeted with a meritless class action lawsuit for two groups of firms: innovators with and without valuable innovation output, defined within 2-digit SIC industry years using the KPSS measure of innovation value measured over the previous calendar year. We use dismissal as a proxy for case merit. The results are striking: in every year in our sample period, successful innovators are several times more likely to be target of a meritless lawsuit than other firms in the same industry and year. We find that, on top of making a lawsuit more likely, valuable innovation is associated with greater losses to shareholders conditional on a meritless class action lawsuit being filed. While the average successful innovator loses about 3.0% of its market capitalization in the seven days around a meritless class action lawsuit filing, the average non-innovator loses only about 1.9%. Combined, these findings imply that more valuable innovation is associated with both, a greater probability of being subject to a meritless class action lawsuit, and a greater loss conditional on receiving such a lawsuit. The expected costs of meritless class actions are thus particularly high for the most innovative firms. To the best of our knowledge, our paper is the first to establish this fact.

We address potential endogeneity concerns using a range of different approaches. First, we estimate OLS regressions to show that the probability of a subsequent meritless class action lawsuit increases in current innovation value. In these regressions, we control for a rich set of variables which have been shown by Kim and Skinner (2012) to predict shareholder litigation, including firm size, sales growth, stock returns, volatility, skewness, and turnover. Second, while we do find a positive link between meritless lawsuits and valuable innovation, we do not find a statistically significant link for meritorious cases, which suggests that there is no mechanical relation between valuable innovation and class action lawsuits more broadly. Third, we can include firm fixed effects in our regressions, which rule out that time-invariant characteristics of the firm, such as firm culture, are driving the documented relationship. Fourth, we show that the results are robust to both ex post and ex ante proxies for lawsuit merit, as well as to alternative measures of innovation output. Finally, we estimate a dynamic version of our model, which shows that the timing of the effects supports a direct link between valuable innovation and subsequent meritless litigation.

The various controls and fixed effects minimize the scope for explanations in which the link between valuable innovation and shareholder litigation is due to omitted variables. But they leave open the possibility that variables that vary both across firms within industry-dates and coincide with changes in our innovation measure affect our results. In an additional test, we therefore exploit changes in state-level R&D tax credits (Wilson (2009)) and patent examiner leniency (Sampat and Williams (forthcoming)) as instruments for valuable innovation output. We continue to find that valuable innovation increases the probability of receiving a meritless lawsuit in the following year.

We estimate the incremental cost of valuable innovation, measured as the loss in shareholder value due to the increased risk of meritless class action litigation for a one-standard-deviation change in innovation value, to be around $1.1 million per year for the average firm in our sample.[3] To put this number into perspective, note that it represents 3.6% of the increase in profits due to the innovation over the next five years. Interpreted as a tax on profits, this number is economically significant. As an alternative way to gauge the economic significance of these estimates, we show below that the expected costs from meritless class action lawsuits after valuable innovation is almost twice as large as the unconditionally expected settlement amounts from class action lawsuits in our sample.

As a final step in our paper, we examine why innovators have an elevated risk of being targeted by meritless litigation. A common belief among both practitioners and academics is that innovation links with lawsuit propensity, because innovative firms have more volatile stock prices. For example, in the same article in the San Francisco Chronicle, Ed McCracken argues that *"The high-tech firms of Silicon Valley and the Bay Area's bio-tech companies are the No. 1 target of these schemes, because cutting-edge research and the risks inherent in development make their stock prices volatile."* The results in our paper cast doubt on this view. We do not find evidence that the increased litigation propensity for successful innovators could be driven by stock return volatility or skewness. We also fail to find evidence that firms with more valuable patent grants subsequently experience more negative earnings surprises.

If firms with valuable innovation output do not experience more lawsuit-triggering events, a natural explanation for our findings is that firms with valuable innovation output are more attractive firms to sue, conditional on experiencing a negative outcome. We argue this is plausible based on the very nature of valuable innovation. The KPSS innovation measure is high if the market, at the time of the patent grant, believes the innovation will add substantial value to the innovating firm. As shown by KPSS, and confirmed in our data, firms with valuable innovations make additional investments into capital and labor, and grow both output and profits. These

[3] As we argue in greater detail below, we believe our estimates are, if anything, conservative and likely to underestimate the true costs of meritless litigation following valuable innovation.

features plausibly increase the attractiveness of a firm as a litigation target (see Bebchuk (1988)). First, firms that invest into additional capital and labor, and are therefore busy growing their operations, have particularly high opportunity cost on managerial time and money. All else equal, these greater opportunity costs should increase for how much a firm is willing to settle even a meritless case, if doing so frees up time and prevents the firm from having to pay even more in legal fees and potential settlements in the future. Second, firms who are in the process of marketing new products are particularly vulnerable to bad publicity, which, again, makes successful innovators potentially attractive litigation targets.

We propose, test, and find evidence for an additional channel, based on how firms communicate valuable innovation. We show that successful innovators use more optimistic language in their annual reports and more forward-looking statements in the MD&A section of their annual reports, after valuable patents were granted. This is intuitive, given that valuable innovations are expected to generate substantial value during the years of the patents' protection, and given that managers will speak more, and more optimistically, about those innovations expected to add substantial value to the firm. Rogers, Buskirk, and Zechman (2011) provide direct evidence on a link between optimistic language and subsequent litigation, suggesting that optimistic statements are easier to attack. Combined, our results on the economic channel suggest that the problem of increased meritless class action litigation could be inextricably linked to the changes innovation induces in investment opportunities and corporate disclosures.

Our paper contributes to the literature on the economic consequences of the class action litigation system in the U.S. One strand of this literature focuses on the incidence, discovery, and cost of true frauds, i.e., meritorious class action lawsuits.[4] Because we focus on meritless class action lawsuits, our paper is different and complements the previous findings for meritorious lawsuits. A second strand of the literature focuses on meritless class actions and their impact on the economy. To the best of our knowledge, we contribute some of the cleanest evidence to suggest meritless lawsuits are an impediment to economic growth and therefore to the competitiveness of the U.S. economy. Other evidence includes Zingales (2006), who argues that the class action litigation system in the U.S. leads to a loss of competitiveness of U.S. public equity markets. Spiess and Tkac (1997) and Johnson, Kasznik, and Nelson (2000) show that market valuations of firms that are more likely to be target of meritless lawsuits increase around the introduction of the Private Securities Litigation Reform Act (PSLRA), which is consistent with meritless suits being costly to shareholders.[5] Rizzo (2017), while not distinguishing between meritless

[4]Papers in this literature include Karpoff, Lee, and Martin (2008), Gande and Lewis (2009), Wang, Winton, and Yu (2010), Dyck, Morse, and Zingales (2010), and Dyck, Morse, and Zingales (2014).

[5]Ali and Kallapur (2001) challenge some of the conclusions in these two studies. Whether or not PSLRA was successful in its stated aims remains a topic of scientific debate (e.g., Klock (2016), Choi (2007)). A summary of work on meritless litigation before the introduction of PSLRA in 1995 can be found in Choi, Pritchard, and Fisch (2005).

and meritorious litigation, finds that a higher likelihood of facing investor-friendly judges in a federal district court reduces shareholder value and suggests this is partly driven by a reduction in value-creating managerial risk-taking such as R&D investments.

While our paper focuses on shareholder class action lawsuits, our work is related to a set of studies which establish adverse effects of the litigation system on innovative firms in other settings. Lin, Liu, and Manso (2017) use a natural experiment to show that innovative activity increases when the threat of shareholder derivative lawsuits in state-courts decreases. Our study complements theirs in two key respects. First, we study federal class action lawsuits, while they study state-level derivative lawsuits. Second, by design, their study cannot provide direct evidence that valuable innovation leads to more meritless lawsuits. Cohen, Gurun, and Kominers (2016) provide evidence of "patent trolling," i.e., non-practicing entities targeting deep-pocketed innovators via frivolous patent infringement lawsuits, thereby reducing innovative activity at targeted firms. Mezzanotti (2017) documents that stronger patent enforcement can reduce the negative effects of patent litigation on corporate innovation. Combined, these studies and ours highlight the adverse effects of the litigation system on innovative activity across a broad spectrum of important, but distinct, subspaces of the litigation universe. Jointly, they provide empirical support for a concern raised by a number of CEOs in a survey conducted by McKinsey for the city of New York in 2007. These CEOs felt that "*the legal environment is detrimental to America's spirit of entrepreneurialism and innovation*" (McKinsey & Company (2007)).

2. Securities Class Action Lawsuits in the U.S.

Private securities class action lawsuits are a central pillar of the U.S. litigation and corporate governance system. According to data from the Stanford Securities Class Action Clearinghouse (SCAC), about 5,000 class actions were filed between 1996 and 2017, and close to 40% of all companies listed on major U.S. stock exchanges have been targeted by a securities class action lawsuit at least once during that period. Figure 2 shows the annual number of securities class action lawsuits from 1996. Given that securities class action lawsuits are so prevalent, understanding their economic implications is important.

Securities class action lawsuits can be socially beneficial if they deter wrongdoing, curb managerial rent extraction, and compensate injured shareholders. However, class actions have a well-known dark side which stands against these benefits: lawyers have an incentive to bring meritless "low-quality" suits in the hope of securing a large settlement despite no actual managerial wrongdoing (e.g., Bebchuk (1988), Romano (1991), Bondi (2010)). Faced with the prospect of entering a long and resource-intensive legal dispute, and faced with the dangers of an imperfect judicial process, many firms are willing to settle cases even though the allegations are in fact untrue. Meritless cases are socially wasteful: they do not sanction any wrongdoing, they hurt corporate shareholders, they may distract managers from running their companies, and they are a burden on the judicial system. Using dismissed cases as a proxy for low quality cases, Figure 2 shows that low quality litigation may be an increasingly important problem. In 2011 (the last year with reasonably complete data on case outcomes in our sample), almost 60% of all cases are subsequently dismissed, which represents a substantial increase over the 35% dismissed cases filed in 1996.

While, all else equal, minimizing the amount of meritless class action litigation appears desirable, designing optimal policy to discourage meritless suits is difficult. An early illustration is the Private Securities Litigation Reform Act of 1995, which did not prevent a large number of low quality class actions being filed after its passage (see Figure 2). A more recent illustration is the Lawsuit Abuse Reduction Act (LARA) of 2017, which aims at curbing meritless litigation by holding plaintiff lawyers accountable for the cases they bring.[6]

LARA is highly controversial. Critics argue, for example, that introducing fines for lawyers, as proposed in LARA, would be an obstacle to filing meritorious claims, and create a new problem of costly follow-on litigation (see, e.g., Kaufman (2017)). A remarkable, and perhaps surprising, fact about the discussion surrounding LARA is that there seems to be substantial disagreement on a central object: just how costly are meritless class action lawsuits? For example, on one end of the spectrum, the U.S. Chamber of Commerce argues that: "*Every year, potentially billions of dollars are wasted on frivolous lawsuits, hurting job growth and slowing the economy*" (U.S. Chamber of Commerce (2017)). On the other end of the spectrum, the American Bar Association argues that the costs associated with meritless litigation are, at best, small, and that claims of high costs are mostly based on anecdotes rather than large-scale empirical research (American Bar Association (2017)).

The divergence of opinion on such a central issue underscores the need for systematic empirical evidence on the cost of meritless litigation, and, importantly, the channels which induce these costs.

3. Data

The core of our data are securities class action lawsuit filings obtained from the Stanford Securities Class Action Clearinghouse (SCAC) database. The SCAC covers essentially all securities class action lawsuits filed in a federal court in the United States since the adoption of the Private

[6] At the time of writing, this reform has passed the U.S. House of Representatives, and has moved on to the Senate Judiciary Committee.

Securities Litigation Reform Act (PSLRA) in 1996. The database provides filing dates for each lawsuit as well as all court filings associated with the class action. We exclude cases related to IPO underwriter allocation, analyst coverage, and mutual funds.

Class action lawsuits can be meritorious, i.e., based on actual wrongdoing, or meritless. Since actual wrongdoing is mostly unobservable for researchers, and since the judicial process is not perfect, we need to proxy for lawsuit merit. In our baseline, we define cases as meritless if they are ultimately dismissed (either voluntarily or by the federal court) and do not reach a settlement; they are meritorious otherwise. Effectively, this definition assumes that a case has no merit whenever a judge actually decides that it has no merit, or the plaintiff decides to drop the case. Using this definition, the summary statistics in Table 1 show that our observations are split roughly equally between meritorious and meritless cases. We consider alternative definitions of lawsuit merit below.

To identify firms that produce valuable innovation output, we build on recent work by Kogan, Papanikolaou, Seru, and Stoffman (2017) (KPSS), who develop a novel measure of technological innovation and document that it is an important driver of firm growth, creative destruction, and growth in aggregate productivity. Their measure of the value of a firm's innovative output is derived from stock-market reactions to new patent grants and captures the private economic value of innovations. We obtain the annual firm-level measure from Professor Noah Stoffman's website. As the measure is in dollars, we follow KPSS and scale it by lagged book assets. We call the resulting measure "innovation value."

The KPSS measure is close to ideal for our study for several reasons. First, the goal of our study is to examine if securities class action lawsuits are specifically targeting firms that produce valuable innovation, which has been shown to be vital for economic growth. KPSS show that the private economic value of patents, captured by their measure, is a particularly strong predictor for subsequent growth. Second, the KPSS measure of innovation output is based on patent grants, not filings of patent applications. Because the filing date for a patent precedes the patent grant date by, on average, 2.9 years, we can plausibly view the existence of innovation in year t as predetermined with respect to a lawsuit filing in year $t+1$, which helps our identification. Third, the measure is constructed assuming that the market forms an expectation about the economic value of an innovation before the patent grant date and that no new information is released by the grant decision itself. KPSS argue this is a reasonable assumption and present supporting evidence. This feature is very useful in our setting, because it mitigates the possibility that new information drives both, the measured return to an innovation, and the propensity to be subject to a lawsuit. We consider alternatives to the KPSS measure in our robustness tests.

The innovation value measure is available until 2010, which means that our combined litigation-innovation dataset spans the period from 1995 to 2011, with innovation measures from 1995 to

2010 and class action lawsuit filings from 1996 to 2011. A class action lawsuit in our sample is resolved (i.e., dismissed or settled) on average after 1,342 days. Since our sample ends in 2011, we expect to have an essentially complete sample of all filed class action lawsuits, including their resolution, throughout our sample period. Following KPSS, we replace innovation with zero if a firm is not granted any patent in a given year. We omit firms in industries that never patent in our sample, as well as financial firms (SIC codes 6000 to 6799) and utilities (SIC codes 4900 to 4949). We match our innovation-litigation data with financial information from Compustat, stock return information from CRSP, and institutional holdings data from Thomson Reuters 13-F filings.

Constructing our instrumental variables requires data on inventor locations and the identity of the USPTO examiner assigned to each patent application by the firms in our sample. We obtain this information from the Patent Examination Research Dataset ("PatEx"), which provides application-level data including the filing date, the name(s) and location of the inventor(s), the unique identifier and name of the assigned examiner, the group art unit of the examiner, and the class and subclass(es) to which the application was assigned. The data also contain information on the final decision made by the examiner as well as the date on which it was made.

Our final sample consists of 40,130 firm-year observations by 6,111 unique firms with non-missing data for our key control variables. Table 1 reports descriptive statistics. Unconditionally, there is a 1.0% chance that a meritless class action lawsuit is filed against a firm in our sample. Innovation value, i.e., the total economic value of patents granted to a firm scaled by lagged assets, has a mean of 2.4% and a standard deviation of 6.3%, which implies there is substantial variation in the value of innovative output across the firms in our sample.

4. Valuable Innovation and Shareholder Litigation

This section presents our main results. We will focus first on the effect of valuable innovation on the likelihood of being the target of a meritless class action lawsuit. We then estimate the costs of meritless litigation conditional on being targeted, as well as the combined "tax on valuable innovation."

4.1 Sorting

We begin with a simple sorting exercise. Figure 1 presents the probability of meritless class action lawsuit filings over our sample period for two groups of firms: high and low innovators. Low innovators are firms with a zero KPSS innovation value measure in the previous industry-year. We sort the remaining firms in the same industry-year into innovation terciles. High innovation firms are those in the top tercile. Industries are defined using 2-digit SIC-industry codes. Meritless lawsuits are defined as cases that get dismissed in the judicial process.

The results shown in Figure 1 are striking. In every year in our sample, the probability of being subject to a meritless lawsuit filing is substantially larger for successful innovators than for other firms in the same industry and year. On average, the probability of being targeted with a meritless lawsuit is almost four times as large for successful innovators.

These results are interesting for two reasons. First, they motivate our more elaborate tests in the next sections, which aim at establishing a causal link from valuable innovation to subsequent meritless litigation. Second, even in the absence of such a causal link, these results imply that meritless lawsuits fall disproportionately on successful innovators, who have been shown by KPSS to be important engines of economic growth.

4.2 Regressions

We next examine whether the pattern observed in Figure 1 holds up in a multivariate setting. Our baseline regression specification is:

$$y_{ij,t+1} = \lambda_{jt} + \beta \mathcal{I}_{it} + \gamma X_{i,t-1} + \epsilon_{ij,t+1}, \tag{1}$$

where $y_{ij,t+1}$ is an indicator variable equal to one if a class action lawsuit is filed in year $t+1$ against firm i in industry j, $\mathcal{I}_{it}$ refers to the KPSS innovation value measure, and λ_{jt} are 2-digit SIC-industry × year fixed effects. We include industry-year fixed effects because we want to rule out that the link between valuable innovation and subsequent litigation is driven by industry-specific business cycles, where more innovation in booms is followed by more litigation in busts for reasons that are unrelated to innovation.[7] $X_{i,t-1}$ is a vector of lagged control variables. Our set of baseline controls follows Kim and Skinner (2012), who empirically investigate the main predictors of shareholder litigation. Specifically, we control for Tobin's Q,[8] the log of assets, cash holdings, sales growth, institutional ownership, stock returns, volatility, skewness, and turnover. Standard errors are clustered at the firm level.

Table 2 presents our main results for three different dependent variables: an indicator for all lawsuits filed in $t+1$; an indicator for the subset of meritless lawsuits, defined as cases that are subsequently dismissed; and an indicator for the remaining subset of meritorious lawsuits. Columns (1) to (3) present results using only accounting-related control variables, whereas columns (4) to (6) add controls related to stock returns and trading volume. Since the main

[7]Lerner and Seru (2017) document substantial variation in patenting activity across industry-years, both across industries and over time.

[8]We find very similar results if we use the measure of Tobin's Q by Peters and Taylor (2017), which includes intangible capital.

results are the same for both sets of controls, we will mainly use columns (4) to (6) as a basis for our discussion.

Looking at columns (1) and (4), we find a strong positive link between valuable innovation and the filing of a class action lawsuit in the following year. From a shareholder value standpoint, more litigation is unambiguously bad, because any type of class action lawsuit is costly. From a societal standpoint, it matters whether the increase in litigation is driven by meritless or meritorious lawsuits. For instance, suppose (counterfactually) that most of the effect comes from meritorious lawsuits. Then valuable innovation can have a bright side: if more actual fraud is discovered, additional lawsuits may be a good thing from a societal standpoint even if individual shareholders lose money. By contrast, more meritless litigation is bad for both, shareholders and society.

To determine the source of the overall increase in lawsuit filings, we next estimate our regressions separately on the subsets of meritless and meritorious lawsuits, respectively. Table 2 shows that the effect is almost exclusively driven by an increase in the filing of meritless lawsuits against successful innovators. The coefficient on the innovation value variable is highly statistically significant for meritless litigation ($t = 3.52$), but not statistically different from zero for meritorious cases ($t = 0.67$). The point estimate in column (5) implies that a one standard-deviation shift in innovation value increases the probability of a meritless class action lawsuit filing in year $t + 1$ by 0.35 percentage points ($= 0.055 \times 0.063$), which is sizable relative to the unconditional probability of a meritless lawsuit filing of 1.0%. This is an important result because meritless litigation is socially wasteful. The results in Table 2 thus establish the existence of an implicit "tax on valuable innovation." We provide an estimate of the associated cost below.[9]

To get a better sense of the functional form that relates valuable innovation to shareholder litigation, Figure 3 presents nonparametric binned scatter plots. We compute averages of meritless class action filing probabilities for 50 innovation value bins, obtained after first residualizing both the class action filing and innovation variables on industry-year dummies and the same set of controls as in Table 2, column (5). Figure 3 shows that the probability of being target of a meritless lawsuit increases quite steadily in innovation value. In particular, the plot shows that the positive relation between valuable innovation and subsequent meritless litigation is not driven by outliers. The pattern is robust to altering the number of bins (results unreported for brevity). In contrast, the relationship between valuable innovation and meritorious litigation is almost flat.

[9]The results in Table 2 show that valuable innovation does not increase *observed* meritorious litigation. An interesting but separate question is whether valuable innovation increases the propensity to engage in actual fraud. We follow a standard approach in the literature on corporate fraud and estimate bivariate probit models (e.g., Wang (2013)) to separate fraud detection from fraud commission. We do not find any evidence to suggest valuable technological innovation would increase the propensity to commit fraud. We provide further details on these results in the Appendix.

Finally, we also consider the dynamics of the relationship between valuable innovation and meritless litigation risk. Specifically, we estimate the following distributed lags model:

$$y_{ij,t+1} = \lambda_{jt} + \sum_{\tau=-3}^{\tau=+3} \beta_\tau D(\mathcal{I}_{i,t+\tau}) + \epsilon_{ij,t+1}. \tag{2}$$

The dependent variable is an indicator for a meritless lawsuit filed against firm i in year $t+1$. $D(\mathcal{I}_{i\tau})$ are dummy variables equal to one for firm-years with high innovation value. High innovation value is defined, as in Figure 1, as firms in the top tercile of innovation value across all firms with non-zero innovation value within a given industry and year. The coefficients β_τ thus measure the difference in the probability of a meritless class action filing between high innovation firms and the remaining firms for different leads and lags of innovation value. The regression does not include any additional controls, because those controls would be endogenous.[10]

Figure 4 presents results. There is a large, statistically significant, difference ($t = 2.86$) between high innovation firms and other firms in the year after a valuable innovation. This reflects our baseline results which have shown that valuable innovation today leads to more meritless litigation next year. We see a slightly higher point estimate also in the year of the innovation, but that increase is not statistically significant. The concentration of the effect around the first year after the valuable innovation is very informative. In particular, the absence of a difference before the innovation year shows that we are unlikely capturing a fixed difference in the litigation propensity between high innovators and other firms. This dynamic pattern thus substantially increases the hurdle for potential alternative explanations. Any alternative that rests on a slow-moving variable being correlated with both innovation value and litigation propensity cannot explain our findings.

In sum, we conclude from the results in this section that valuable technological innovation is strongly related to subsequent meritless shareholder litigation, and that this link is neither induced by a rich set of observable variables, nor by unobserved factors at the industry-year level, nor by stable differences between innovative and non-innovative firms.

4.3 Alternative Proxies for Lawsuit Merit

We believe case dismissal is the best proxy for lawsuit merit in our setting. A potential concern with using the dismissal proxy, however, is that dismissal is only observed some time after a lawsuit is filed. To show this does not influence our results, this section provides results from

[10] While we believe the above specification is the most appropriate one, we have estimated the regression also with the set of controls controls $X_{i,t-1}$ from our main regression, effectively disregarding the issue of endogenous controls. We have also estimated a specification with firm fixed effects added to equation (2). Both alternatives deliver qualitatively similar results to the specification in Equation (2).

alternative proxies for case merit based on *ex ante* measures such as case attributes, plaintiff attributes, and plaintiff lawyer attributes. We consider four alternative measures in total. A particular advantage of these measures is that they are public information when the case is filed.

We start by exploiting the fact that material financial misstatements are a strong indicator of lawsuit merit (e.g., Choi, Pritchard, and Fisch (2005), Karpoff, Koester, Lee, and Martin (2017)). Our first proxy for class action merit is therefore an indicator for whether the defendant firm was subject to an accounting-related SEC investigation in the filing year or in the two calendar years prior to the filing. We obtain information on SEC enforcement actions from the Accounting and Auditing Enforcement Releases (AAER) database. The second proxy separates lawsuits that allege a U.S. GAAP violation from other, less tangible, allegations (e.g., omissions), using the classification provided by the SCAC.

We next exploit the identity of the lead plaintiff. We posit that plaintiffs with a better reputation would be less likely to file a frivolous lawsuit, because such suits effectively involve fabricated allegations not based on managerial wrongdoing, which has the potential to seriously harm the reputation of a plaintiff. Relative to individual investors, institutional investors are likely to worry more about their reputation. Consistent with this notion, prior work has shown that institutions are more likely to pursue meritorious cases in general (e.g., Choi, Pritchard, and Fisch (2005), Park (2013)). We identify institutional investors by manually screening lead plaintiff names. Thus, our third proxy for lawsuit merit is whether an institution is the lead plaintiff.

Our final proxy uses market shares of plaintiff lawyers as a measure of law firm reputation (see de Fontenay (2016)). We assume that highly reputable law firms are less likely to file frivolous lawsuits because their reputation capital at stake is higher. We compute lawyer market share as the fraction of all securities class action lawsuits filed by a given law firm in the previous calendar year that did not get dismissed. We then average individual lawyer market shares across all plaintiff lawyers to get a case-specific lawyer market share measure. We then split cases into high and low lawyer market share at the median within a given calendar year. An alternative interpretation of the institutional investor and law firm based proxies – consistent with our argument – would be that institutional investors and law firms with higher market share are more sophisticated than retail investors and smaller law firms, and that more sophisticated parties are more likely to bring meritorious suits.

Table 3 presents results. Specification (1) uses as dependent variable an indicator equal to one for all class action filings with a concurrent SEC enforcement action. Specification (2) uses as dependent variable an indicator based on all class actions without an SEC enforcement action. Hence, we split the sample of all class actions in one subsample that is more likely comprised of meritorious suits, and one subsample that is more likely comprised of meritless suits. Comparing specifications (1) and (2) reveals that there is no significant relation between valuable innovation and lawsuit filings for cases in which the SEC has a concurrent enforcement action, which is intuitive, because the SEC only investigates potentially serious cases of financial misstatements. By contrast, the remaining cases, which are more likely meritless, show a strong positive link between valuable innovation and class action filings. Using SEC enforcement actions as an alternative proxy for lawsuit merit therefore yields qualitatively identical results to our baseline definition which uses dismissed cases.

The remaining columns in Table 3 present analogous results for the other three proxies. We find that valuable innovation is strongly linked to class action filings if the allegation does not involve a U.S. GAAP violation, if the lead plaintiff is not an institutional investor, and if the plaintiff lawyers have a smaller market share. By contrast, if allegations relate to U.S. GAAP violations, which are tangible and hard to fabricate, or if the lead plaintiff is sophisticated or has likely more reputational capital at stake, valuable innovation does not link with subsequent litigation.

Overall, the results in Table 3 are remarkably consistent across the four alternative measures. They are also strongly consistent with our interpretation of the baseline results in Table 2: valuable innovation leads to more meritless litigation. The findings show our previous results were not specific to defining meritless lawsuits as lawsuits that are dismissed. Instead, our main results show up robustly across a range of proxies measurable at the time of lawsuit filing.

4.4 Robustness

To establish that our main result presented in Table 2, specification (5), is robust to alternative specifications, we perform a series of robustness tests, all presented in Table 4. In Panel A, we show that our results are robust to defining meritless lawsuits as lawsuits that are either dismissed or settled for less than $3 million (e.g., Dyck, Morse, and Zingales (2010)).[11]

In Panel B, we consider alternative measures of innovation output. The first two lines show our results are similar if we define an indicator variable for firms in the top tercile of innovation value within their industry and year, or if we scale innovation value by the firm's lagged market capitalization as opposed to by lagged book assets. Next, we use the total number of patents granted to the firm as an alternative measure of innovation output and find a similar effect. We then use citation-weighted patent counts, obtained from Professor Noah Stoffman's website, as well as the number of patents which rank in the top decile of patents granted in

[11]Note that the focus of papers like Dyck, Morse, and Zingales (2010), or Wang and Winton (2016), is different from ours. Their goal is to use a conservative measure of true fraud, which is why they exclude cases with low settlements in their definition of meritorious cases. Our goal, by contrast, is to use a conservative measure of meritless lawsuits, which is why we exclude low settlement amounts in our definition of meritless lawsuits.

the same technology class and year.[12] Overall, we find that our result is robust to alternative measures of innovation output, although the economic magnitude is somewhat lower than for KPSS measure.[13]

Panel C adds additional controls. First, we include contemporaneous controls for sales growth, stock return, volatility, skewness, and turnover. These variables are not included in our baseline because they are likely endogenous controls: returns, volatility, and skewness may be higher because of valuable innovation. While excluding these variables is econometrically warranted, the results in Panel C show that our main results obtain strongly and independently from these controls. Next, we want to rule out that times of valuable innovations coincide with high spending on innovation inputs, and that the latter drives the link with litigation. We therefore control for R&D expenses, defined as R&D expenses reported in Compustat divided by total lagged assets. We can also control for the average level of R&D investment during the years (-8,-3) relative to the year where innovation value is measured, in order to control for the possibility that innovative firms may have spent significantly more on R&D in the past.[14] Our results are hardly affected by controls for R&D, which shows our results are induced by valuable innovation output as opposed to high innovation input.

Another possibility we address in Panel C is that the link between valuable innovation and litigation is induced by managerial overconfidence. To that end, we control for a stock-option based proxy for managerial overconfidence proposed by Malmendier and Tate (2005) and find virtually unchanged results. We then use firm fixed effects in order to tackle the potential concern that better-run firms are both, more likely to generate valuable innovations, and less likely to be sued for securities fraud. Consistent with such unobserved heterogeneity biasing our OLS estimates downward, Panel C shows that adding firm fixed effects increases the point estimate. Finally, by including district court $\times$ year fixed effects, we can ensure that our results are not driven by innovative firms being located in districts with more business-friendly courts.

In Panel D, we examine alternative sample restrictions. First, in order to ensure our results are not driven by unobserved differences between patenting and non-patenting firms, we estimate our regressions using only firm-years with non-zero innovation. Second, in order to rule out that

[12]We use citation and technology class information from the Patent Examination Research Dataset ("PatEx") to derive this measure.

[13]The ex-post citation measures may be subject to a mechanical downward-bias in our setting because citations accrue only after a patent was granted. If subsequent citations are lower for firms which get into legal trouble (most obviously if the litigation discourages the firm itself or its peers from investing in follow-up inventions), regressing lawsuits on ex-post citations will induce a downward bias. Relatedly, Abrams, Akcigit, and Grennan (2013) document that the relationship between citations and economic value follows an inverted U-shape, with fewer citations at the high end of economic value than in the middle. Hence, as also noted by KPSS, the economic value of a patent is correlated with, but different from, the scientific value of a patent.

[14]Since patents are on average filed three years prior to the grant year, we choose to measure R&D input during the five years ending in year $t = -3$. Our results are not sensitive to the precise window over which R&D input is measured.

the tech bubble around the year 2000 drives our result, we exclude the years 2000 and 2001 from our estimation. In both cases, we find essentially unchanged results.

We conclude that our main result is robust to a battery of robustness checks.

4.5 Instrumental Variable Regressions

Our main regressions and robustness tests above control for a rich set of observable and unobservable variables which, in our view, substantially raise the bar for alternative explanations.

There are two remaining potential concerns. First, unobserved *time-variant* factors on the firm level, which are (i) not captured by our control variables and (ii) correlated with both innovation and subsequent litigation, may induce an omitted variable bias. Second, non-random measurement error in our innovation measure may covary with unobserved factors that drive shareholder litigation. We feel it is nontrivial to think of plausible stories along these lines, since any confounding variation would need to match the dynamic pattern we observed in Figure 4, i.e., the sharp increase in litigation risk in the year following the innovation. Nevertheless, to be conservative, this section aims at further alleviating such concerns by exploiting plausibly exogenous variation in innovation value in an instrumental variable (IV) setting.

The first instrument for valuable innovation we use is tax-induced changes in the user cost of R&D capital, a strategy motivated by previous studies in the literature (e.g., Matray and Hombert (2017), Bloom, Schankerman, and Van Reenen (2013)). The underlying idea is that R&D tax credits motivate investment in R&D, and that more investment in R&D will increase the total value of innovation output in the following years. The instrument exploits the fact that different firms within the same industry and year face different changes in state-level R&D tax credits depending on the geographical distribution of their R&D activity. State-level tax credits can be considerably more generous than federal tax credits and are therefore a relevant concern for firms when deciding about R&D investments.

To construct the instrument, we use estimates of the user cost of R&D capital provided by Wilson (2009) and match them to the geographical distribution of the firm's R&D activity. To estimate the geographical distribution of R&D activity, we follow Bloom, Schankerman, and Van Reenen (2013) and use the 3-year moving average share of the firm's inventors located in each state, using the PatEx database to retrieve inventor locations. We then compute the weighted average change in the R&D user cost over the years -3 and -4 relative to the innovation year, in order to capture changes in the tax incentives prevailing around the time of patent filing (which on average occurs three years prior to the grant).

To be a valid instrument, changes in the user cost of R&D must satisfy the relevance and exclusion conditions. The relevance condition requires that the instrument is related to our variable of innovation value, $\mathcal{I}_{it}$, in the first-stage regression. Since the purpose of R&D tax credits is to promote innovation, and since the evidence in Wilson (2009) and the related literature finds R&D tax credit are successful in that regard, the instrument satisfies the relevance condition. The exclusion restriction requires that the instrument affects the dependent variable only via its effect on the independent variable to be instrumented. The existing literature above suggests that R&D tax credits satisfy this condition due to a large degree of randomness regarding the introduction and level of R&D tax credits on the state level (see, for example, Bloom, Schankerman, and Van Reenen (2013)).[15]

The second instrument we use exploits the patent grant process at the USPTO and is based on the leniency of the USPTO patent examiners assigned to outstanding patent applications of the firm (see Sampat and Williams (forthcoming)). New patent applications at the USPTO are categorized based on the type of technology, and directed to a specialized group of examiners called Art Unit. Within an Art Unit, a supervisor then allocates new patent applications to examiners. Sampat and Williams (forthcoming) argue that the overall leniency of the assigned patent examiner is a valid instrument for the ultimate grant outcome. First, regarding the relevance criterion, patent examiners have a substantial amount of discretion when handling patent applications, and hence, likely have significant influence on the grant decision. Second, regarding the exclusion restriction, interviews with current and former USPTO examiners have indicated that the assignment process of examiners to new patent applications is effectively random within a given art unit and filing year (Lemley and Sampat (2012)). Sampat and Williams (forthcoming) provide evidence supporting this conditional random assignment assumption by showing that patent applications assigned to "lenient" and "strict" examiners do not differ on observable characteristics at the time of patent application. Further strengthening the random assignment argument, we find that average examiner leniency is uncorrelated with predicted innovation value, where innovation value is predicted as a function of the firm-level control variables in Table 2 (see Appendix).

We construct our measure of average patent examiner leniency as follows. For each patent application, we compute examiner leniency, following Sampat and Williams (forthcoming), as the average approval rate using all other applications evaluated by the same examiner. We then regress this measure on Art Unit $\times$ year fixed effects in order to capture only variation within the same Art Unit and application year, and average the residuals across all outstanding patent applications for a given firm at the end of each calendar year. We add the number of pending

[15]One may worry about state-level economic conditions being correlated with changes in R&D tax credits. If local economic conditions are also correlated with shareholders' propensity to file a meritless lawsuit, this may bias our inference. Alleviating these concerns, Bloom, Schankerman, and Van Reenen (2013) search for evidence of a correlation of changes in tax credits with state-level economic conditions, but do not find such evidence. In addition, since we will have two instruments, we can estimate a specification using both instruments simultaneously and use the Hansen J-test to test the exclusion restriction. We do not reject the null hypothesis that our two instruments are valid.

applications as an additional control variable.

Table 5 presents the results of our two-stage least squares estimates. Panel A shows the first-stage regression. Consistent with the existing literature, we find a strong negative relationship between the user cost of R&D capital and valuable innovation, and a positive relationship between examiner leniency and valuable innovation.[16] Panel B presents results from the second stage. For both instruments, we find that instrumented innovation value continues to be a strong predictor of meritless class action lawsuits. Adding the control variables from Table 2, specification (5), hardly affects the point estimates, supporting the assumption that our instruments are exogenous.

The IV point estimates imply a larger effect of valuable innovation on meritless litigation risk than the OLS estimates. A one-standard-deviation increase in valuable innovation leads to a 2.1 (=0.330×0.063) and 4.5 (=0.718×0.063) percentage point increase in the likelihood of a meritless lawsuit being filed against the firm, respectively. There could be several potential explanations for this difference in economic magnitudes. First, measurement error in our innovation value variable will lead to an attenuation of the OLS coefficient, but not of the IV coefficient. Our measure of innovation value, being based on stock market reactions, is almost certainly subject to measurement error. In particular, if the stock market is able to anticipate the grant of particularly valuable patents, the KPSS measure will be downward biased. Second, the decision to file a lawsuit may be influenced by unobservable firm characteristics that are also correlated with innovation value. For example, if better-run firms are both, more likely to produce valuable patents and less likely to be subject to securities class action lawsuits, our OLS coefficients will be biased downwards.

However, we would like to point out that our OLS and IV coefficients are not statistically different from each other. Hence, it is possible that the difference in coefficient estimates is merely a result of estimation error. Our main conclusion from the IV regression is thus that it confirms our main OLS result: valuable innovation has an economically sizable effect on a firm's likelihood to be the target of a meritless securities class action lawsuit.

4.6 Quantifying the "Tax on Valuable Innovation"

The results in the previous sections show that valuable innovation leads to more meritless class action lawsuits. Hence, a disproportionate share of the cost associated with securities class action lawsuits falls on precisely those firms whose innovative ideas are most conducive to economic growth. But how costly is meritless litigation against successful innovators? The purpose of this section is to get a sense of the economic magnitude of the "tax on valuable innovation" we document in this paper.

[16] The F-statistics suggest these are reasonably strong instruments.

4.6.1 Shareholder Losses Around Filing Dates

We start with an event study around the filings of meritless and meritorious class action lawsuits without conditioning on innovation. We use an event window from three trading days before the filing date to up to ten trading days after the filing, and compute abnormal returns relative to a Fama-French and Carhart model estimated over days $t = -300$ to $t = -50$. To be conservative, we only study filing events where the first trading day after the end of the class action period does not fall inside the event window (-3,+10). This ensures that the large stock drops which usually mark the end of a class period, and which are often driven by negative information the market receives about a firm, are not affecting our estimates. This, in turn, should give us a cleaner estimate of the impact of the lawsuit itself. In case of multiple lawsuits filed against the same company which later get consolidated, we only retain the filing of the first lawsuit.

Figure 5 presents results separately for meritless and meritorious cases, respectively. The filing of a meritless class action lawsuit is associated with a significant drop of about 2.2% in market value for the targeted firm in the (-3,+3) window around the filing date, with no further change afterwards. Turning to meritorious lawsuits, we find, as expected, even bigger effects. Over the seven days around the filing, the market value of affected stocks drop by 3.1%, with cumulative losses approaching 5.0% by day ten. While samples and methodologies differ, the magnitudes of these drops is in the same ballpark as those reported in earlier studies on stock market reactions in response to class action filings; in particular, finding substantial shareholder value costs for meritless lawusits is also consistent with earlier work (e.g., U.S. Chamber Institute for Legal Reform (2017), Klock (2016), Choi and Pritchard (2016), Gande and Lewis (2009), Griffin, Grundfest, and Perino (2004), Pritchard and Ferris (2001)).[17]

There are reasons to believe the above effects understate the true cost of meritless class actions to shareholders. In particular, Gande and Lewis (2009) argue and show that lawsuits are partially anticipated by the market and that focusing on filing dates thus understates the magnitude of shareholder losses. In addition, Karpoff, Koester, Lee, and Martin (2017) show that the filing date is only one event, albeit an important one, in a string of events that occur when a company gets into legal trouble. By design, we are not capturing any additional value lost in these additional events.

One way to try and capture some of this additional value loss is to expand the event window. If we use an event period of 61 days around the announcement, from day $t = -30$ to day $t = 30$ around the filing date, we find that the losses are substantially larger than those shown in Figure

[17] Our approach above may underestimate the difference between meritless and meritorious cases if anticipation effects are greater for truly fraudulent behavior. Consistent with the latter possibility, we find, in unreported results, much larger declines in market value around the class action period end date for meritorious than for meritless cases. This has no bearing on our central point: being target of a meritless class action lawsuit is very costly in terms of shareholder value.

5 (results unreported for brevity). Interestingly, we observe a large and steady decline in stock prices for meritless suits until day two after the filing day, but no further decline thereafter. This suggests the lawsuit is not simply a byproduct of period with bad news; it is more consistent with the market anticipating a costly lawsuit filing because, in that scenario, we should see little return movement after the filing event. The cumulative abnormal return over the (-30,+30) window is around -18% for meritless lawsuits, consistent with the argument in Gande and Lewis (2009) that focusing on filing dates may understate the value loss. However, a drawback of the long window approach is that it is more likely to capture also the negative fundamental information which triggers the filing of the case, as well as other confounding, but unrelated, pieces of information. To be conservative, we will therefore focus on our estimates based on the tighter (-3,+3) window around the filing date where the end of the class action period is excluded.

In Figure 6, we plot the cumulative abnormal returns around the filing of a meritless lawsuit separately for innovative and non-innovative firms. High-innovation firms are defined as firms which rank in the top tercile of firms within the same industry and year, respectively, based on their KPSS innovation measure in the calendar year prior to the filing. No-innovation firms are those with zero patents in the previous calendar year. Consistent with the idea that litigation is costlier for firms with attractive growth opportunities, we see a larger drop for high-innovation firms. Over days (-3,+3), the drop in market value is 3.0% for innovative firms and thus about 1.1 percentage points higher than for non-innovative firms.

Table 6 confirms the result that abnormal stock returns around lawsuit filings are lower for innovative firms in an OLS regression with the same set of control variables and fixed effects as in Table 2, specification (5). If anything, the difference gets larger once we control for potentially confounding variables. The point estimates in specification (2) suggest that a one-standard-deviation increase in innovation value leads to a 1.9 (= 0.302×0.063) percentage points lower abnormal stock return.

If firms with valuable innovations were smaller than their peers, higher percentage losses would not necessarily translate into higher dollar losses. But since successful innovators are much larger, the corresponding dollar losses in the 7 days around a meritless lawsuit filing are $148 million for the average successful innovator, but only $12 million for the average non-successful innovator. A substantial fraction of the total costs of meritless litigation therefore falls on successful innovators.

A potential concern about the above estimates could be that stock prices revert as the market learns about lawsuit merit. We therefore first examine abnormal returns around the dismissal date, which on average occurs more than two years after the filing date. We find average abnormal returns of 0.1% around the average lawsuit dismissal. We cannot reject that these returns are zero ($t = 0.25$). As shown in Table 6, columns (3) and (4), we also do not find a significant difference in the stock price reaction between innovative and non-innovative firms. There is thus no evidence for meaningful reversals around the dismissal date.

4.6.2 Potential Sources of Shareholder Value Losses around Lawsuit Filings

The above results establish that the losses to shareholders around the filing of a meritless lawsuit are economically substantial. For the average size firm in our sample, the 2.2% announcement return translates to $108M. What are the exact sources behind these losses, and what is their relative contribution? While fully answering this question is beyond the scope of our study, and left for future research, we consider three potential sources in this section.

A first source of value reduction are direct legal costs associated with the lawsuit. Unfortunately, large-scale data on defense counsel costs are scarce. Survey evidence suggests a median range for direct legal costs for outside lawyers working on class action lawsuits of around $1M for more routine cases, and up to $30M for very complex cases (Carleton Fields (2016), p.17). We conclude that direct legal costs are non trivial and may explain a considerable fraction of the shareholder value loss associated with class action filings for smaller firms. But, for larger firms, direct legal costs are unlikely to explain the bulk of the shareholder value loss associated with class action filings.

A second potential source are expected settlement costs. Empirically, almost all firms who lose the motion to dismiss settle. As an upper bound estimate of the expected cost, if the market had no information regarding the lawsuit outcome, the average expected settlement amount (=$31M) multiplied with the probability that the lawsuit is not dismissed (=59%) could explain a shareholder value loss of up to $18M, which represents about 17% of the market value of the average firm (=$108M). By contrast, the better the market is able to discern cases which get dismissed from other cases, the closer expected settlement costs are to zero for cases which ultimately end up being dismissed. The fact that we do not observe a significant positive abnormal announcement return around the lawsuit dismissal argues against expected settlement costs being a major driver of shareholder losses.

Finally, shareholder value losses may reflect reputation costs induced by shareholder lawsuits. A widely held view is that, for cases of actual wrongdoing, reputation costs are of central importance. For example, Karpoff, Lee, and Martin (2008) estimate that reputation costs alone make up on average two thirds of the decline in shareholder value associated with financial misconduct. Consistent with this idea, survey evidence based on 385 U.S. firms documents that reputation concerns and potential business implications rank high among the most important risk factors firms cite in connection with class action lawsuits (see e.g., Carleton Fields (2018), pp.23).

In our setting, reputation costs may be high even for allegations which turn out to be meritless and are not sanctioned in court, for at least two reasons. First, customers, suppliers, providers of capital, and employees may not know with great certainty whether a case is meritless or meritorious at the filing of the case. This can lead to reduced demand for a firm's products, worsened terms of trade, higher cost of capital, worsened access to trade credit, and lower employee morale, which may all inflict long-term value loss for affected firms, even if the allegation is later found to be meritless. Second, being accused of wrongdoing, even if there is no merit to the claims in court, may impart a stigma on firms, leading to similar adverse reputation effects. For example, Deng, Willis, and Xu (2014) document that even after a securities class action lawsuit is dismissed, lenders do not reset most loan terms to pre-suit levels, reflecting a permanent reputational loss for the targeted firm. Our evidence above is consistent with the view that, just like for meritorious suits, reputation costs are a key driver of the observed value loss for meritless class action lawsuits.

4.6.3 Ex-Ante Costs of Meritless Litigation: A Back-Of-The-Envelope Calculation

To get a sense of the economic magnitude of the implicit tax on valuable innovation, consider the following back-of-the-envelope calculation. The increase in expected litigation costs for a change in innovation value has two components. First, valuable innovation increases the likelihood of a meritless lawsuit. Second, it increases the expected value loss conditional on being litigated. The combined effect of a one-standard-deviation increase in valuable innovation on the expected dollar cost of litigation is therefore given by:

$$\Delta E(cost_{litigation}) = \overline{Size}(\Delta_p(\overline{CAR} + \Delta_{CAR}) + \overline{p}\Delta_{CAR}), \tag{3}$$

where $\overline{Size}$ refers to the average market capitalization of the firms in our sample, Δ_p refers to the change in the probability of being litigated induced by a one-standard-deviation increase in innovation value, $\overline{CAR}$ is the average cumulative abnormal stock return around a meritless lawsuit filing, Δ_{CAR} is the expected increase in the cumulative abnormal stock return induced by a one-standard-deviation increase in innovation value, and $\overline{p}$ refers to the average probability of being target of a meritless lawsuit. $\overline{Size}$, $\overline{CAR}$, and $\overline{p}$ are given by \$3.2 billion, 2.2%, and 1.0%, respectively. Above we have estimated the increase in the cumulative abnormal returns due to a one-standard-deviation increase in innovation value to be 1.9 percentage points, and the increase in the likelihood of being target of a meritless lawsuit in the following year to be 0.35 percentage points. The tax on a one-standard-deviation increase in innovation value that stems from increased meritless litigation risk is therefore equal to \$1.08 million for the average firm-year. In other words, if all firms in our sample had increased their innovation output by one standard deviation, the aggregate implicit tax over the full sample period would have amounted to \$43 billion.

To put these numbers into perspective, consider the effect of a one-standard-deviation increase in innovation value on future firm profits. Using the same regression specification as KPSS, we estimate that a one-standard-deviation increase in innovation increases profits by 3.9% (=0.614×0.063) over the the next five years (see Table 8, Panel B).[18] Applying this growth rate to the average firm profit in our sample, we estimate that a one-standard-deviation increase in innovation raises firm profits on average by $29.8 million over the following five years. The tax on valuable innovation due to meritless litigation therefore represents ca. 3.6% and hence an economically sizable fraction of the increase in profits in the first years. An alternative point of reference are expected settlement payments for class action lawsuits. For the average firm-year, the average settlement amount paid for securities class action lawsuits is equal to $0.60 million (=$24.3 billion aggregate settlement amounts divided by 40,130 firm-years). Hence, a one-standard-deviation increase in innovation leads to an increase in expected meritless litigation costs that is almost twice as high as what the average firm can expect to pay in the form of settlement amounts. Obviously, these numbers are coarse and need to be taken with a grain of salt. They nevertheless indicate that the "tax on valuable innovation" is economically sizable.

5. Potential Channels

In this section we examine potential channels to explain why successful innovators are more often subject to meritless lawsuits. We consider two broad possibilities. First, we test whether valuable innovation is associated with a greater likelihood of subsequent negative events that trigger lawsuit filings, e.g., a large stock price drop, or a missed earnings forecast. If lawyers were mechanically filing a lawsuit upon observing a negative event, we would then see more lawsuits for successful innovators. The second possibility we consider is that valuable innovation makes firms more attractive litigation targets, conditional on experiencing a negative event.

5.1 Valuable Innovation and Lawsuit-Triggering Events

To assess whether successful innovators are more likely to experience negative events such as large stock price drops or unexpectedly poor accounting performance, we analyze the effect of valuable innovation on daily stock return volatility, skewness, and large negative earnings surprises.

Table 7 presents the results. In specification (1), we regress next-period stock return volatility on innovation value and volatility today, as well as the same controls as in Table 2, specification (5). Stock volatility is measured as the standard deviation of daily stock returns. Specification (2) repeats the same regression using the skewness of daily stock returns as the dependent variable.

[18] KPSS estimate profits to increase by 4.6% for their sample period, which spans the years between 1950 and 2010.

In specification (3), to capture the likelihood of experiencing an extreme negative return shock, we define an indicator equal to one if a given firm's first percentile of daily stock returns in a year is in the bottom 5% across all firms in that year. Specification (4) uses the same definition as in specification (3), but replaces the first return percentile by the firm's lowest quarterly earnings surprise in a given calendar year. Due to the strong persistence in daily stock return volatility and skewness, we estimate dynamic specifications in Table 7.

Across all four measures, we find no indication that valuable innovation output is associated with a statistically or economically greater likelihood of experiencing lawsuit-triggering events in the next period. If anything, valuable innovation is associated with *lower*, not higher, stock return volatility. This is consistent with patent grants reducing uncertainty about the firm's innovation output rather than exacerbating uncertainty. Our earlier results from Table 3 are also informative: since we do not observe an increase in lawsuits that allege GAAP violations following valuable innovation, those results are inconsistent with the explanation that successful innovators are more likely to have accounting restatements.

A lawsuit filing could mechanically lead to higher volatility. Hence, the tests in Table 7 are biased towards finding an increase in volatility. The fact that we nevertheless find, if anything, the opposite reinforces our conclusion that the positive link between valuable innovation output and subsequent litigation is not driven by greater uncertainty due to valuable innovation. While previous anecdotal evidence (see for example the McCracken quote in the introduction), and previous academic studies have argued that innovation may increase litigation risk because it induces greater stock return volatility (e.g., Lin, Liu, and Manso (2017)), our results in this section suggest that a different economic channel is needed to understand the link between valuable innovation and meritless litigation.

5.2 Successful Innovators as Attractive Litigation Targets

An alternative possibility, which we explore in this section, is that successful innovators are more attractive litigation targets. We consider two possible channels through which valuable innovation could increase the attractiveness as a target: changes in opportunity costs, and changes in corporate disclosure.

5.2.1 Valuable Innovation and Firm Growth

One reason why successful innovators are attractive litigation targets could be that managers of firms with valuable innovation output have particularly high opportunity costs on their time and resources, because technological innovation allows the firm to grow substantially, which requires substantial managerial effort and investments. Another reason could be that firms which are trying to market new products may be more adversely affected by the bad publicity that a class action lawsuit entails. Thus, plaintiff lawyers may believe it is easier to extract large settlements from successful innovators who are facing higher expected litigation costs.[19]

Since the opportunity cost of managerial time and company resources is unobservable, opportunity cost is inherently hard to test as a potential channel. However, we can provide at least indirect evidence by showing that managers of firms with valuable innovations are busy expanding their business. We use regression specifications from KPSS, in which future growth in the dependent variable over horizons from one to five years is regressed on the value of innovation output today. Following KPSS, we include the current level of the dependent variable, the log of firm capital, the log of employment, and stock return volatility as controls; additionally, we include the control variables from Table 2, specification (5), as well as industry-year fixed effects. Table 8 presents results. Each coefficient in each panel represents a separate regression and we omit results on the control variables for brevity. Consistent with the findings by KPSS, valuable innovation leads to substantial growth in capital and employment (see Table 8, Panels A and B), which is consistent with an increase in opportunity costs. Panels C and D show an increase in firm output and profits following a valuable patent grant, which is consistent with successfully marketing new products. If firms that market new products are particularly vulnerable to bad publicity, this may explain why successful innovators are attractive targets of meritless lawsuits.

We conclude from Table 8 that the changes in corporate investment and output, induced by valuable innovation, support the hypothesis that valuable innovation makes a firm an attractive litigation target. With due caution we note that the coefficient sizes, and how they vary with different horizons, are informative. Across all panels, the incremental growth rate is biggest in the initial year after the patent grant. This may explain why innovative firms are most vulnerable to litigation in the first year after the patent grant.

5.2.2 Valuable Innovation and Changes in Corporate Disclosure

A second channel we consider is that the information disclosed by successful innovators to investors makes it easier for lawyers to craft a meritless complaint. In particular, if managers of firms that obtain valuable patents use more optimistic and forward-looking language in their communication with investors – which seems plausible given the very nature of valuable innovation – then they could automatically be more vulnerable to being wrong ex post. Consistent with this idea, Rogers, Buskirk, and Zechman (2011) document that more optimistic disclosure tone is associated with greater litigation risk.

We examine this channel by assessing whether valuable innovation output coincides with an increase in optimistic and forward-looking disclosure. In Table 9, specification (1), we regress the

[19]See Bebchuk (1988) for a model where expected litigation costs for the defendant increase the probability of frivolous lawsuits.

change in the share of positive words in a firm's 10-K, which we use as a proxy for optimism, on innovation value. To capture positive words, we use the positive financial word dictionary (Fin-Pos) provided on Professor Bill McDonald's Word Lists Page. The results show that optimism indeed increases during high innovation years, in line with the idea that communicating about valuable innovation implies using more optimistic language.

In specification (2), we examine the use of forward-looking language. The dependent variable we use is the change in the forward-looking intensity of the firm's Management Discussion & Analysis (MD&A) section in the annual report, defined by Muslu, Radhakrishnan, Subramanyam, and Lim (2015) as the number of forward-looking sentences divided by the total number of sentences in the MD&A.[20] Using this measure, we find that the amount of forward-looking statements increases significantly with innovation value. We thus conclude that how firms communicate valuable innovation is a potential channel through which valuable innovation induces more meritless litigation.

Combined, our results on the economic channel suggest that the problem of increased meritless class action litigation is inextricably linked to the changes innovation induces in corporate outcomes and corporate disclosures. An increased propensity to be litigated therefore appears to be a fundamental feature associated with valuable innovative activity.

6. Discussion

Our findings have potentially important implications for understanding how securities class action litigation can affect the competitiveness of the U.S. economy. We discuss some of these implications below.

First, Kogan, Papanikolaou, Seru, and Stoffman (2017) show, using the same measure as we use in our study, that valuable innovation output is an important driver of economic growth, and that obtaining a valuable patent is followed by substantial investments in capital and labor. By draining resources, such as financial capital, reputational capital, and managerial time, from innovative firms precisely when these companies want to expand, meritless class action lawsuits may contribute to economy-wide misallocation of resources.

Second, a standard prediction from optimal contracting models, such as Holmström (1979), Lazear and Rosen (1981), and Holmström (1982), is that optimal incentive provision requires higher rewards for better performance. Our finding that those firms who produce the most valuable new ideas are punished via meritless class action lawsuits runs counter to that general

[20] We obtain the forward-looking intensity measure from the data appendix of Muslu, Radhakrishnan, Subramanyam, and Lim (2015) published on the *Management Science* webpage.

prescription. Hence, ex-post punishment of firms that generate valuable innovation, in the form a costly meritless lawsuit, may distort innovation incentives for all firms *ex ante*, which may lead to underprovision of innovation in the economy.

We note that, from a managerial perspective, the tax on valuable innovation we identify may be particularly relevant. In case a lawsuit is successful, the manager may lose her job, face legal consequences, and may suffer reputational penalties in the labor market. Managers thus have a particularly great incentive to avoid getting sued in the first place, which, in turn, may lead them to make decisions which are suboptimal from a shareholder value standpoint.

Third, due to the importance of knowledge spillovers (see e.g., Bloom, Schankerman, and Van Reenen (2013)), meritless lawsuits, and the disincentives for innovation they entail, may not only affect the growth of innovating firms themselves, but also that of their peers.

Fourth, litigation against innovative firms may create disincentives for these firms to list on public stock markets and thus forego otherwise valuable growth opportunities – an argument in line with both anecdotal and prior academic evidence on class action lawsuits as an impediment to tapping public equity markets (e.g., Zingales (2006)). For example, Robert G. Gilbertson wrote in a July 13, 1995 piece in the Hartfort Currant, titled *Yes: Bill Would Protect Growing Companies:*

> *I am chief executive officer of CMX Systems, a small high-tech company in Wallingford that manufactures precision measuring devices for the disk drive and semiconductor industry. By any objective measure, CMX has been ripe for expansion for some time. We grew more than 2,000 percent in the four years from 1990 through 1993, and our sales exceeded $8.6 million in 1993. To continue this extraordinary growth, CMX needed to sell stock to the public in early 1994 to finance a $4 million research-and-development plan. However, we were deterred from this option after watching other small companies get whiplashed by frivolous securities lawsuits.*

Our findings may thus also contribute to our understanding of the well-documented decreasing trend in the number of publicly listed firms in the U.S. (see, for example, Doidge, Karolyi, and Stulz (2017)).

Fifth, as the economy becomes more technology-intensive, the results in this paper suggest that the "tax on valuable innovation" we identify in this paper may become even more relevant in the future.[21] In addition, an increased shift towards technology-driven innovation may also deepen the problem that having to deal with meritless class action lawsuits adversely affects the resources judges and courts can expend on dealing with cases of actual wrongdoing.

[21] For example, Kogan, Papanikolaou, Seru, and Stoffman (2017) construct an innovation index which is showing a strong upward trend post World War 2.

7. Conclusion

Meritless shareholder litigation disproportionally targets firms with valuable technological innovation. We establish this fact using data on shareholder class action lawsuits for U.S. corporations between 1996 and 2011, using a measure of innovative output based on the private economic value of a firm's newly granted patents by Kogan, Papanikolaou, Seru, and Stoffman (2017). The link between valuable innovation and meritless litigation is robust to a rich set of observable and unobservable controls, alternative definitions of lawsuit merit, as well as instrumental variables. Our findings thus suggest that the U.S. securities class action system imposes a substantial implicit "tax" on innovative firms in the form of meritless shareholder litigation.

Our results have implications for two broad debates. First, we provide the first systematic evidence that valuable innovation triggers meritless class action litigation. Our core result is that meritless class action lawsuits constitute an economically meaningful tax on innovation output, which has direct implications for the potential real effects of the current class action system. Most immediately, it implies a misallocation of resources by draining money and time from a set of firms which need them the most in order to implement their innovative ideas. In addition, ex-post punishment in the form of meritless litigation may affect firms' decisions to innovate and/or publicly list *ex ante*. Overall, the evidence in this paper supports the view that the current securities class action system in the U.S. is an impediment to economic growth and competitiveness. Estimating the magnitude of these distortions could be a fruitful area for future research.

Our study focuses on innovation due to its documented importance for economic growth and advantages for our identification strategy. However, in light of our results on the economic mechanism, it is plausible that a more general systematic link exists between valuable growth opportunities and meritless litigation. Specifically, we have documented that firms with valuable innovations may be more attractive litigation targets because they (i) face high opportunity costs, and (ii) more heavily use forward-looking and optimistic language in their disclosures. Since any positive shock to future cash flows, e.g., in the form of new positive NPV projects, is likely to change a firm's characteristics along these dimensions, the U.S. litigation system may systematically punish firms with the most attractive growth opportunities. If the tax on valuable innovation we identify is merely a subset of a broader "tax on valuable growth opportunities," the economic costs of meritless class actions are potentially much larger than we estimate them to be. We leave exploring the link between meritless litigation and growth opportunities more broadly to future research.

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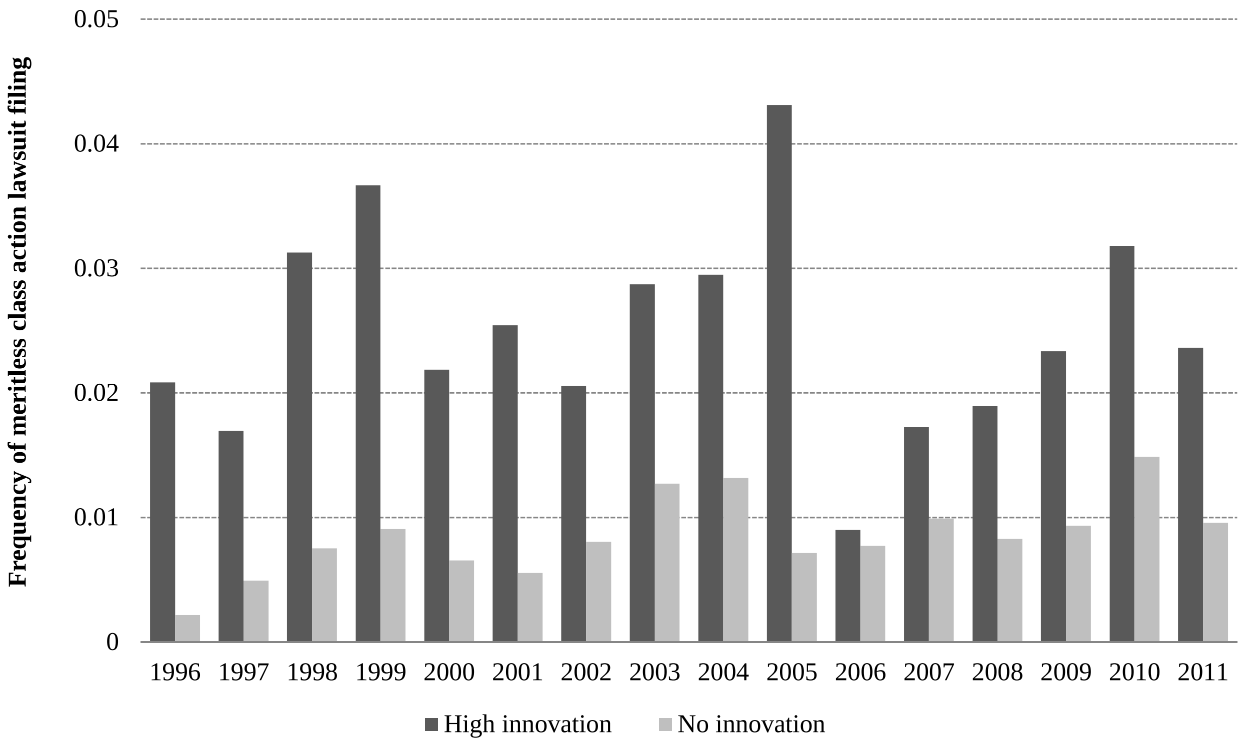


Figure 1: Meritless securities class action filings by innovation group over time. The figure presents the frequency of meritless class action lawsuit filings over time for two groups of firms: high and low innovators. We sort all firms with positive innovation value in the previous calendar year into terciles within the same SIC 2-digit industry and year. High innovation are firms which rank in the top tercile. Low innovation firms are those with zero innovation in the previous calendar year. Innovation value is measured as the economic value of patents granted to the firm, as provided by Kogan, Papanikolaou, Seru, and Stoffman (2017). Meritless lawsuits are identified as lawsuits that are eventually dismissed.

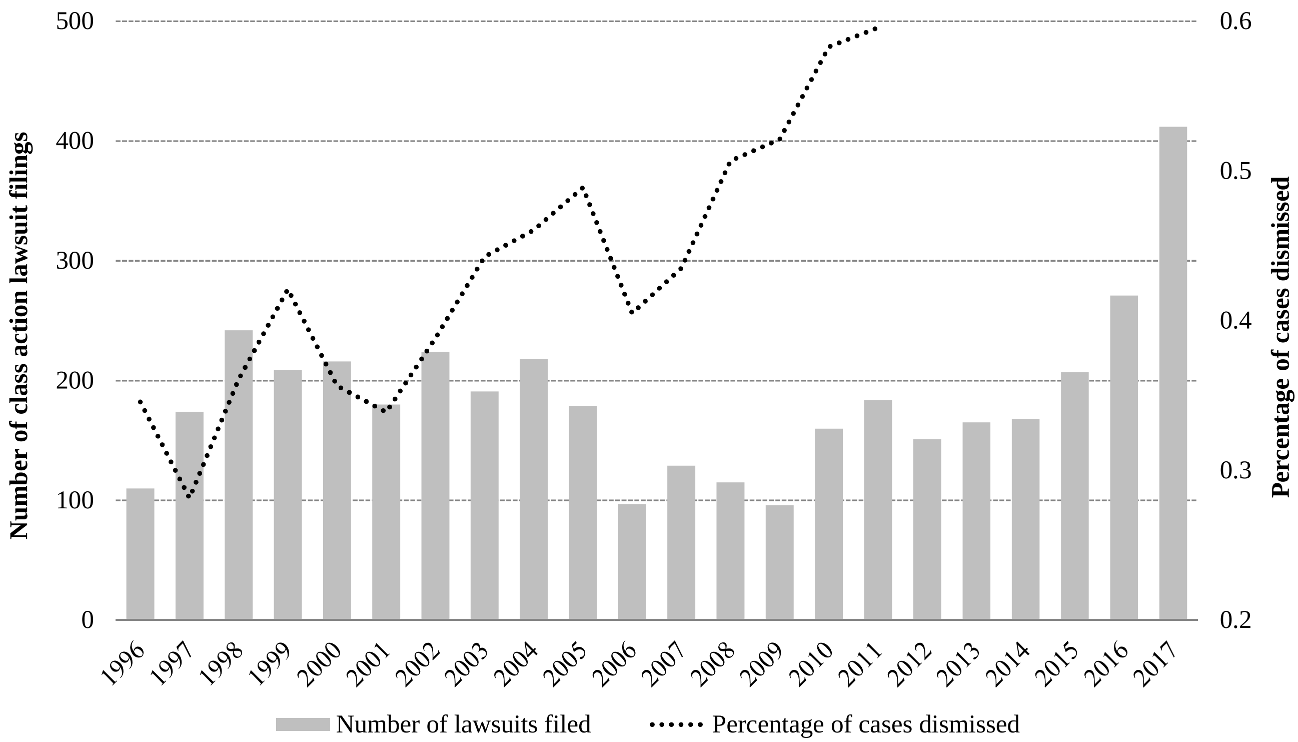
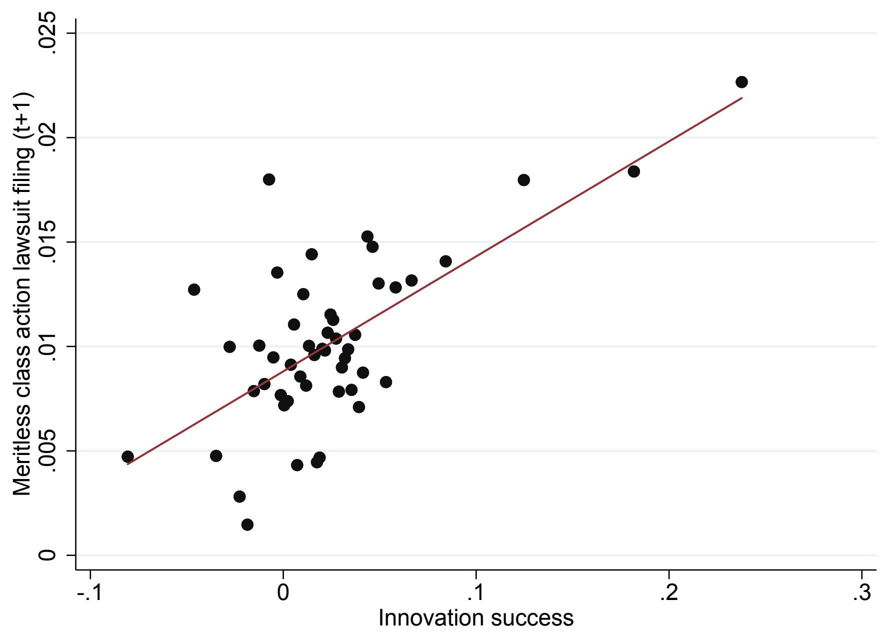


Figure 2: Class action filings and dismissed cases over time.
The figure presents the total number of securities class action lawsuit filed in a given calendar year, and the fraction of these cases which are subsequently dismissed. Securities class action lawsuits are retrieved from the Stanford Securities Class Action Clearinghouse database. We exclude cases related to IPO underwriter allocation, analyst coverage, and mutual funds.



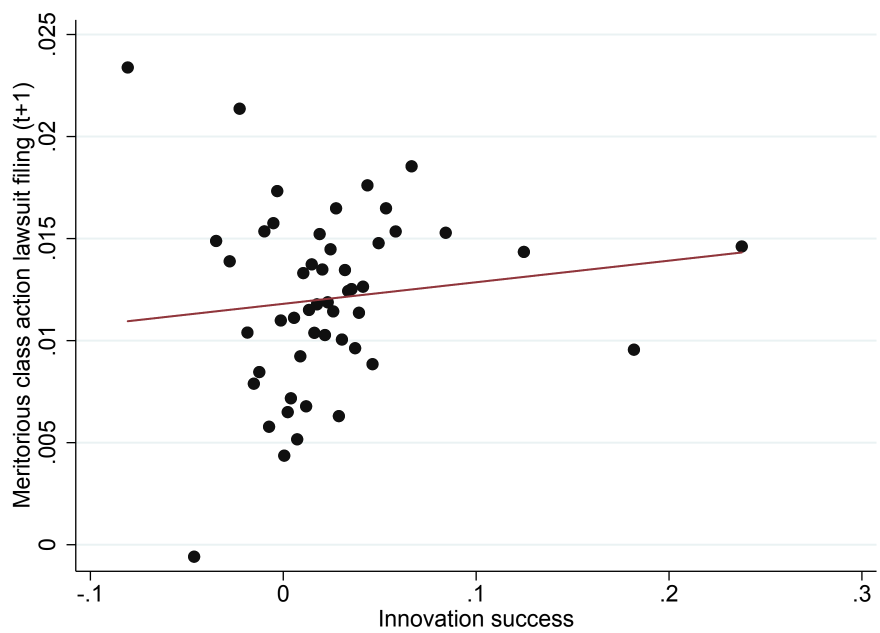


Figure 3: Valuable innovation and next-period class action lawsuit filing.
The figure presents nonparametric binned scatter plots of the relationship between the probability of a class action lawsuit filing in the following year and valuable innovation. We sort firms' innovation value into 50 equal-sized bins and plot the average frequency of observing a meritless (upper graph) and meritorious (lower graph) class action lawsuit filing in the following calendar year against the average innovation value measure within each bin. The lawsuit and innovation variables are first residualized on industry × year dummies and the set of control variables presented in Table 2, specifications (5) and (6). The best-fit line is estimated with an OLS regression using the underlying micro data. Innovation value is measured as the economic value of patents granted to the firm, as provided by Kogan, Papanikolaou, Seru, and Stoffman (2017). Meritless lawsuits are identified as lawsuits that are eventually dismissed; all other lawsuits are classified as meritorious.

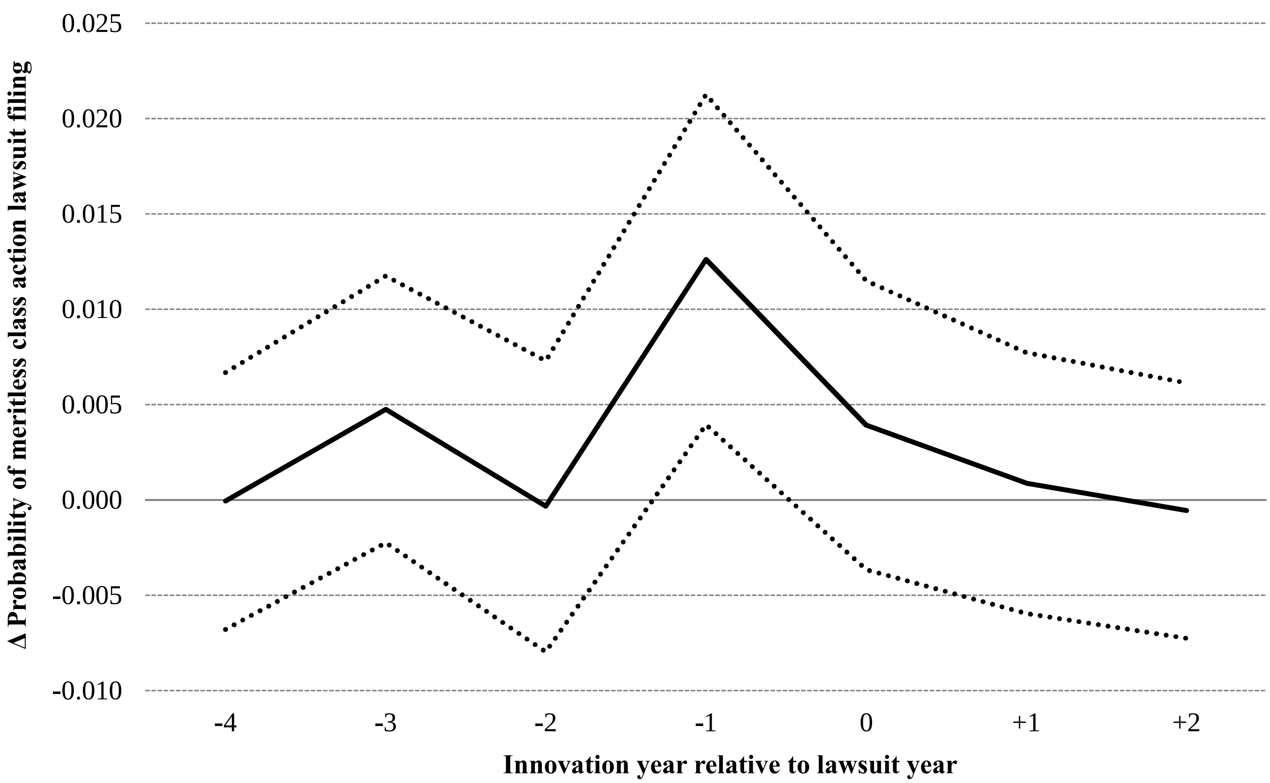


Figure 4: Dynamic effects of valuable innovation on meritless litigation risk.
The figure plots the coefficients (and 95% confidence intervals) from a dynamic analysis of the effect of valuable innovation on meritless litigation risk, based on Equation (2). High innovation firms are those which rank in the top tercile of all firms with positive innovation in the same industry and year, based on their measure of innovation value. Innovation value is measured as the economic value of patents granted to the firm, as provided by Kogan, Papanikolaou, Seru, and Stoffman (2017). Meritless lawsuits are identified as lawsuits that are eventually dismissed.

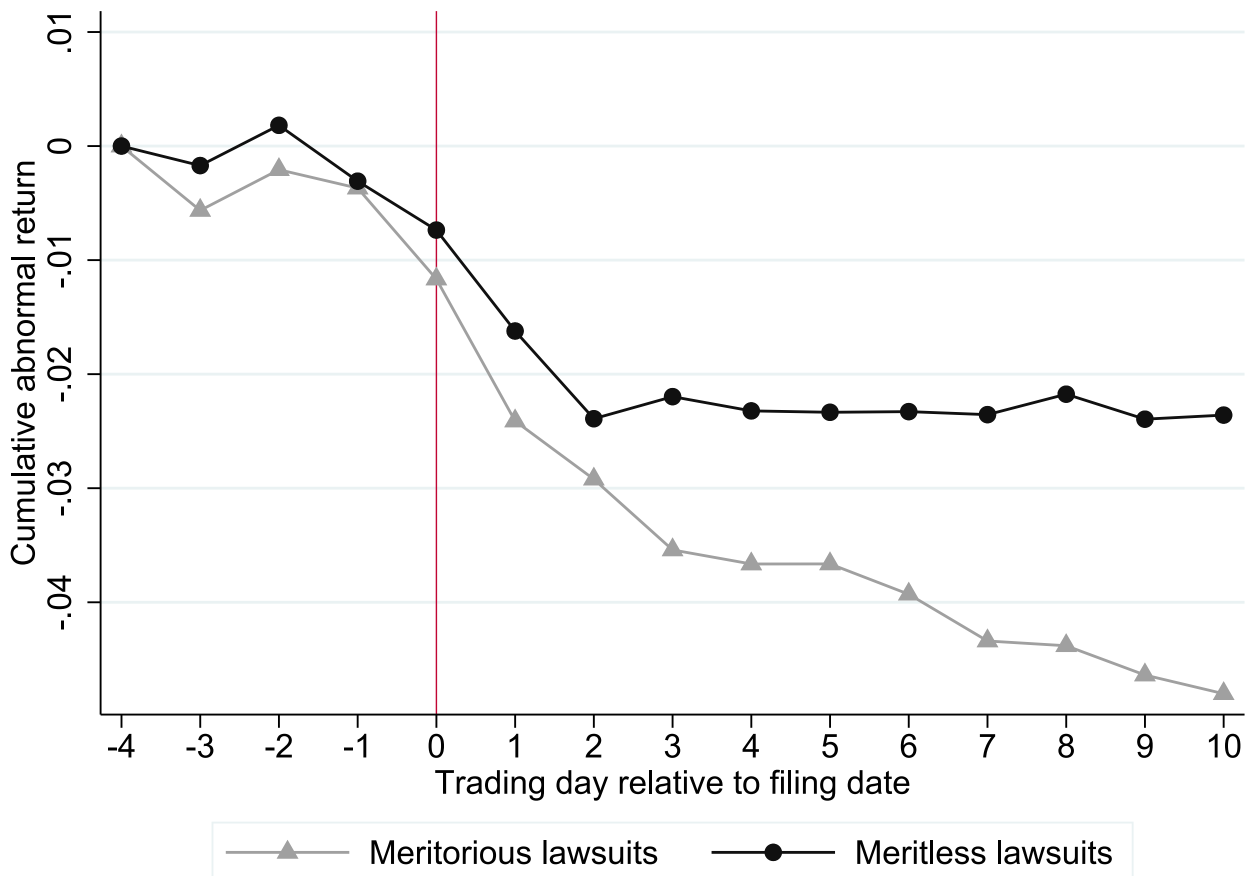


Figure 5: Cumulative abnormal returns around class action lawsuit filings.
The figure shows the cumulative abnormal returns over event days (-3,+10) around the filing of a meritless versus meritorious lawsuit. Meritless lawsuits are identified as lawsuits that are eventually dismissed; all other lawsuits are classified as meritorious. Abnormal returns are estimated based on the Fama-French-Carhart 4-factor model estimated over days $t = -300$ to $t = -50$. We exclude filing events where the first trading day after the end of the class action period falls into the event window.

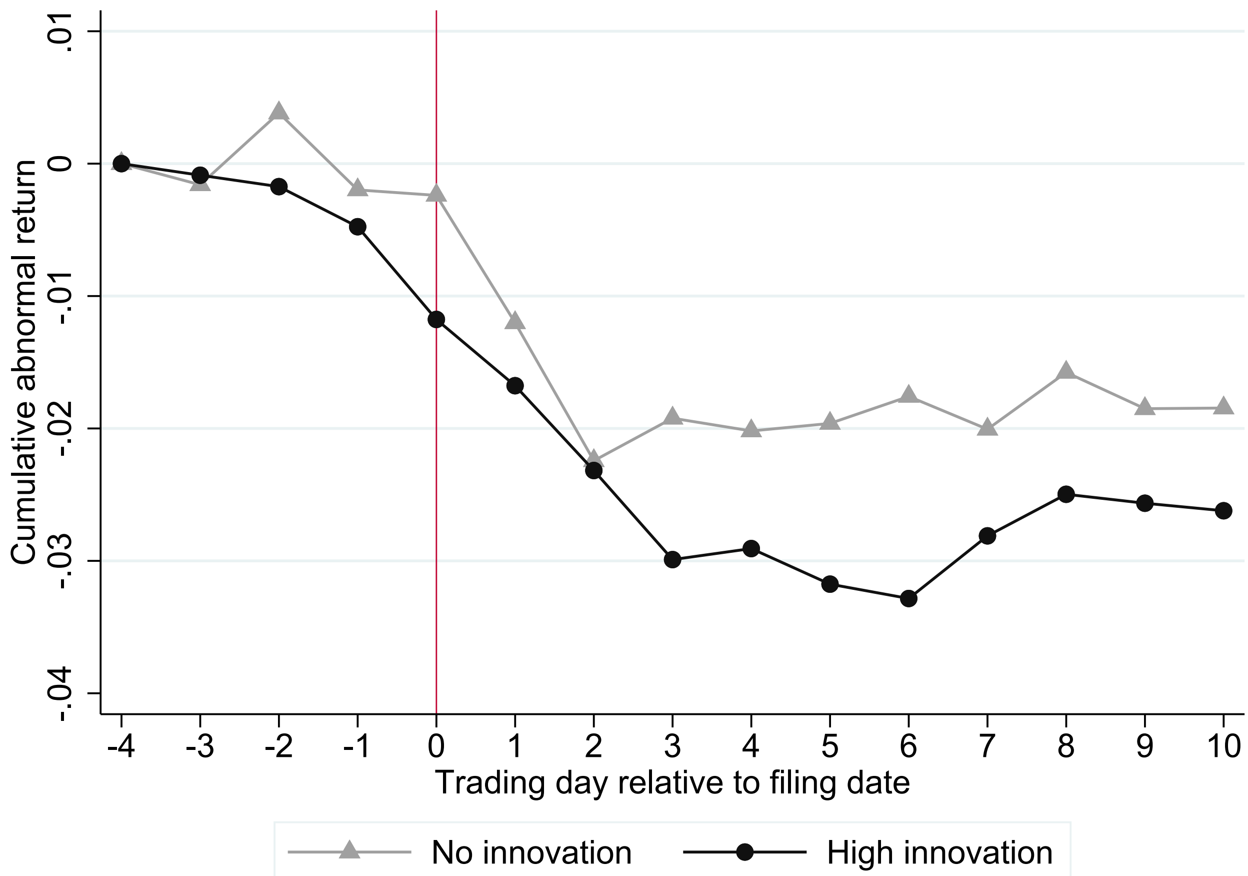


Figure 6: Cumulative abnormal returns around meritless class action lawsuit filings by innovation group.

The figure shows the cumulative abnormal returns over event days (-3,+10) around the filing of a meritless class action lawsuit, separately for high and low innovators. High innovation are firms which rank in the top tercile of all firms in the same industry and year, based on their measure of valuable innovation in the previous calendar year. No innovation firms are those with zero innovation in the previous calendar year. Innovation value is measured as the economic value of patents granted to the firm, as provided by Kogan, Papanikolaou, Seru, and Stoffman (2017). Meritless lawsuits are identified as lawsuits that are eventually dismissed. Abnormal returns are estimated based on the Fama-French-Carhart 4-factor model estimated over days $t = -300$ to $t = -50$. We exclude filing events where the end of the class action period falls into the event window.

Table 1: Summary Statistics

This table presents summary statistics for key variables. Securities class action lawsuits are retrieved from the Stanford Securities Class Action Clearinghouse database from 1996 to 2011. Meritless lawsuits are identified as lawsuits that are eventually dismissed; all other lawsuits are classified as meritorious. Innovation value is measured as the economic value of patents granted to the firm, as provided by Kogan, Papanikolaou, Seru, and Stoffman (2017), scaled by lagged book assets.

	N	Mean	Std. Dev.	0.25	Median	0.75
Dependent Variables						
Class action lawsuit filing$_{t+1}$	40,130	0.022	0.147	0.000	0.000	0.000
Meritless class action lawsuit filing$_{t+1}$	40,130	0.010	0.100	0.000	0.000	0.000
Meritorious class action lawsuit filing$_{t+1}$	40,130	0.012	0.109	0.000	0.000	0.000
Key Independent Variables						
Innovation value$_t$	40,130	0.024	0.063	0.000	0.000	0.009
Control variables						
Tobin's Q$_{t-1}$	40,130	2.037	1.655	1.100	1.497	2.279
Log assets$_{t-1}$	40,130	5.487	2.041	3.981	5.355	6.817
Cash$_{t-1}$	40,130	0.355	0.222	0.181	0.310	0.499
Sales growth$_{t-1}$	40,130	0.171	0.516	-0.024	0.087	0.238
Sales growth$_{t-2}$	40,130	0.223	0.583	-0.002	0.105	0.272
IO$_{t-1}$	40,130	0.346	0.326	0.000	0.289	0.645
Stock return$_{t-1}$	40,130	0.192	0.645	-0.161	0.153	0.479
Stock return$_{t-2}$	40,130	0.155	0.631	-0.187	0.122	0.441
Return skewness$_{t-1}$	40,130	0.488	1.110	0.015	0.400	0.864
Return skewness$_{t-2}$	40,130	0.456	1.074	0.013	0.381	0.818
Return volatility$_{t-1}$	40,130	0.638	0.355	0.382	0.556	0.798
Return volatility$_{t-2}$	40,130	0.629	0.350	0.376	0.551	0.790
Turnover$_{t-1}$	40,130	17.619	18.452	5.620	11.640	22.913
Turnover$_{t-2}$	40,130	16.890	17.938	5.421	11.010	21.753

Table 2: Valuable Innovation and Class Action Lawsuit Filings

This table regresses indicators for next-period class action lawsuit filings on the value of this period's innovation output. Meritless lawsuits are identified as lawsuits that are eventually dismissed; all other lawsuits are classified as meritorious. Innovation value is measured as the economic value of patents granted to the firm, as provided by Kogan, Papanikolaou, Seru, and Stoffman (2017), scaled by lagged book assets. t-statistics, reported in parentheses, are based on standard errors that allow for clustering at the firm level.

	Class action lawsuit filing$_{t+1}$					
	All	Meritless	Meritorious	All	Meritless	Meritorious
	(1)	(2)	(3)	(4)	(5)	(6)
Innovation value$_t$	0.078	0.061	0.016	0.066	0.055	0.010
	(3.53)	(3.91)	(1.08)	(2.95)	(3.52)	(0.67)
Tobin's Q$_{t-1}$	0.005	0.002	0.003	0.003	0.001	0.002
	(6.45)	(4.15)	(4.91)	(4.32)	(2.57)	(3.46)
Log assets$_{t-1}$	0.008	0.004	0.005	0.008	0.004	0.004
	(13.80)	(8.83)	(10.17)	(10.71)	(7.31)	(7.52)
Cash$_{t-1}$	0.015	0.007	0.007	0.009	0.005	0.004
	(3.20)	(2.29)	(2.20)	(1.91)	(1.50)	(1.20)
Sales growth$_{t-1}$	0.008	0.003	0.005	0.006	0.002	0.004
	(4.63)	(2.75)	(3.59)	(3.48)	(1.77)	(2.93)
Sales growth$_{t-2}$	0.006	0.003	0.003	0.004	0.002	0.002
	(3.70)	(2.34)	(2.86)	(2.83)	(1.82)	(2.17)
IO$_{t-1}$	-0.014	-0.004	-0.009	-0.017	-0.005	-0.012
	(-4.16)	(-1.79)	(-3.89)	(-5.02)	(-2.18)	(-4.63)
Stock return$_{t-1}$				0.006	0.002	0.004
				(3.58)	(1.85)	(3.26)
Stock return$_{t-2}$				0.004	0.002	0.002
				(2.32)	(1.68)	(1.64)
Return skewness$_{t-1}$				-0.001	-0.001	-0.001
				(-1.65)	(-1.51)	(-0.89)
Return skewness$_{t-2}$				0.000	0.001	0.000
				(-0.25)	(1.17)	(-1.05)
Return volatility$_{t-1}$				0.006	0.002	0.004
				(1.77)	(0.92)	(1.60)
Return volatility$_{t-2}$				-0.006	0.000	-0.007
				(-1.60)	(-0.12)	(-2.29)
Turnover$_{t-1}$				0.031	0.025	0.006
				(3.58)	(3.92)	(1.02)
Turnover$_{t-2}$				0.014	-0.005	0.020
				(1.70)	(-1.00)	(2.96)
Industry × year f.e.	Yes	Yes	Yes	Yes	Yes	Yes
N	40,116	40,116	40,116	40,116	40,116	40,116
R^2	0.040	0.033	0.026	0.043	0.035	0.027

Table 3: Alternative Proxies for Lawsuit Merit

This table regresses indicators for next-period class action lawsuit filings on valuable innovation output. In specification (1) ((2)), the dependent variable is equal to one if a lawsuit is filed that (does not) coincide or was (not) preceded by an SEC investigation of an accounting restatement by the firm, respectively. In specification (3) ((4)), the dependent variable is equal to one if a lawsuit is filed that alleges (does not allege) a U.S. GAAP violation, respectively. In specification (5) ((6)), the dependent variable is equal to one if a lawsuit is filed that (does not) involve an institutional investor as lead plaintiff, respectively. In specification (7) ((8)), the dependent variable is equal to one if a lawsuit is filed by law firms with a small (large) market share, respectively. Market shares of plaintiff law firms are computed based on the share of the total number of non-dismissed securities class actions filed in the previous calendar year. In case of multiple law firms per filing, we compute the average market share. A class action lawsuit is classified as being filed by a small (large) law firm if the average market share is below (above) the median in a given year. Innovation value is measured as the economic value of patents granted to the firm, as provided by Kogan, Papanikolaou, Seru, and Stoffman (2017), scaled by lagged book assets. Control variables are the same as in Table 2, specification (5). t-statistics, reported in parentheses, are based on standard errors that allow for clustering at the firm level.

	Class action lawsuit filing$_{t+1}$							
	SEC action		GAAP violation		Institution		Plaintiff law firm	
	No	Yes	No	Yes	No	Yes	Small	Large
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Innovation value$_t$	0.060	0.006	0.056	0.009	0.059	0.007	0.052	0.013
	(2.95)	(0.64)	(3.00)	(0.72)	(2.79)	(0.95)	(3.03)	(0.93)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year f.e.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	40,116	40,116	40,116	40,116	40,116	40,116	40,116	40,116
R^2	0.040	0.018	0.037	0.027	0.040	0.029	0.033	0.029

Table 4: Robustness

This table presents robustness tests. The baseline regression refers to specification (5) from Table 2. For brevity we only report coefficients of interest and suppress control variables. Economic effects are calculated as the reported coefficient multiplied by the standard deviation of the key independent variable, divided by the mean of the dependent variable. In Panel A, the dependent variable is equal to one if a lawsuit is filed that is either dismissed or settles for less than $3 million. In Panel B, we test alternative definitions of innovation output. High innovation dummy is an indicator equal to one if the firm ranks in the top tercile of firms within a given industry and year, using the Kogan, Papanikolaou, Seru, and Stoffman (2017) measure, conditional on firms with positive innovation value. Next, we scale the continuous innovation measure by lagged market capitalization as opposed to by lagged book assets. We also replace the innovation value measure by the logarithm of one plus the total number of patents granted, citation-weighted patent counts, and the number of patents granted which rank in the top decile of patents in the same technology class and year by ex-post citations. In Panel C, we add additional controls. R&D expenditures are scaled by lagged assets and replaced by zero if R&D expenditures are missing. CEO overconfidence is measured as in Malmendier and Tate (2005). In Panel D, we impose different sample restrictions. First, we restrict the sample to firms with at least one patent in a given calendar year. Then we estimate the regression after excluding calendar years 2000 and 2001.

	Coeff	*t*-statistic	Econ. Effect	*N*
Baseline	0.055	(3.52)	34.7%	40,116
Panel A: Alternative Measure of Meritless Lawsuit				
Dismissal or settlement <$3m	0.053	(3.13)	23.9%	40,116
Panel B: Alternative Measures of Innovation Output				
High innovation dummy	0.010	(3.50)	27.4%	40,116
Scaled by market cap	0.090	(3.39)	27.0%	40,116
Number of patents	0.002	(2.15)	16.8%	40,116
Citation-weighted patent counts	0.001	(2.08)	16.9%	40,116
Patents in top 10% of citations	0.007	(2.10)	16.4%	40,116
Panel C: Additional Controls				
Contemporaneous sales growth and stock return variables	0.048	(3.03)	30.1%	39,910
R&D	0.055	(3.48)	35.0%	40,093
R&D (-3,-8)	0.055	(3.39)	34.8%	38,230
CEO overconfidence	0.057	(2.31)	35.9%	13,613
Firm fixed effects	0.062	(2.22)	38.9%	39,199
District × year fixed effects	0.059	(3.64)	37.2%	39,919
Panel D: Sample Restrictions				
Non-zero innovation	0.040	(3.09)	44.8%	12,986
Exclude 2000-2001	0.063	(3.33)	39.5%	34,223

Table 5: Instrumental Variable Regressions

This table shows results from instrumental variable regressions. Panel A reports the first-stage results and Panel B the second stage. We use two instrumental variables. The first instrument is the change in the firm's user cost of R&D capital, measured during years (-4,-3) prior to the innovation year. We obtain state-level user cost of R&D capital from Wilson (2009), and use the location of the firm's inventors to estimate the geographical distribution of R&D activity over the previous three calendar years. The second instrument is the average leniency of the USPTO patent examiners assigned to the outstanding patent applications of the firm at the end of the year prior to valuable innovation. We compute examiner leniency for each application as the average approval rate for all other applications processed by the same examiner over her career (excluding the application itself), after residualizing on art unit by application-year fixed effects. Control variables are the same as in Table 2, specification (5). In columns (3) and (4), we also control for the log of the number of outstanding patent applications. Both instrumental variables and sorted into deciles within industry and year. t-statistics, reported in parentheses, are based on standard errors that allow for clustering at the firm level.

Panel A: First stage

	Innovation value$_t$			
	(1)	(2)	(3)	(4)
Δ R&D user cost$_{(t-4,t-3)}$	-0.004	-0.002		
	(-10.29)	(-6.70)		
Examiner leniency$_{t-1}$			0.001	0.001
			(2.73)	(3.44)
Controls	No	Yes	No	Yes
Industry × year f.e.	Yes	Yes	Yes	Yes
N	13,875	13,875	13,875	13,875
F-test statistic	105.82	44.88	7.43	11.86

Panel B: Second stage

	Meritless class action lawsuit filing$_{t+1}$			
	(1)	(2)	(3)	(4)
Innovation value$_t$	0.281	0.330	0.748	0.718
	(2.86)	(1.72)	(1.63)	(1.74)
Controls	No	Yes	No	Yes
Industry × year f.e.	Yes	Yes	Yes	Yes
N	13,875	13,875	13,875	13,875

Table 6: Valuable Innovation and Cumulative Abnormal Returns Around Class Action Lawsuit Filing and Dismissal

This table regresses cumulative abnormal returns around the filing and dismissal of meritless class action lawsuits on valuable innovation. Cumulative abnormal returns are measured over event days (-3,+3), where abnormal returns are estimated based on the Fama-French-Carhart 4-factor model estimated over days $t = -300$ to $t = -50$. Meritless lawsuits are identified as lawsuits that eventually get dismissed. Control variables are the same as in Table 2, specification (5). t-statistics, reported in parentheses, are based on standard errors that allow for clustering at the firm level.

	Cumulative abnormal return (-3,+3)			
	Filing		Dismissal	
	(1)	(2)	(3)	(4)
Innovation value$_t$	-0.140	-0.302	-0.016	0.036
	(-1.86)	(-2.48)	(-0.27)	(0.43)
Controls	No	Yes	No	Yes
Industry × year f.e.	Yes	Yes	Yes	Yes
N	309	211	349	244
R^2	0.338	0.479	0.276	0.370

Table 7: Valuable Innovation and Lawsuit-Triggering Events

This table regresses next-period stock return volatility, return skewness, an indicator for extreme low returns, and an indicator for extreme negative earnings surprises, on innovation value. Stock return volatility and return skewness are computed based on daily stock returns for any given firm-year. Extreme negative return is an indicator equal to one if the first percentile of daily stock returns of a firm is in the bottom 5% across all firms in the same calendar year. Negative earnings surprise is an indicator equal to one if the firm's most negative quarterly earnings surprise is in the bottom 5% across all firms in the same calendar year. Earnings surprises are computed as the difference between the announced quarterly EPS and the consensus forecast from IBES, scaled by the stock price at the end of the previous calendar quarter. Control variables are the same as in Table 2, as well as one lag of the dependent variable. t-statistics, reported in parentheses, are based on standard errors that allow for clustering at the firm level.

	Stock return volatility$_{t+1}$	Return skewness$_{t+1}$	Extreme negative return$_{t+1}$	Negative earnings surprise$_{t+1}$
	(1)	(2)	(3)	(4)
Innovation value$_t$	-0.041	-0.071	-0.016	-0.005
	(-2.09)	(-0.63)	(-0.93)	(-0.23)
Controls	Yes	Yes	Yes	Yes
Industry × year f.e.	Yes	Yes	Yes	Yes
N	37,808	37,808	37,473	19,166
R^2	0.670	0.123	0.150	0.104

Table 8: Valuable Innovation and Firm Growth

This table regresses measures of firm growth on valuable innovation output. Innovation value is measured as the economic value of patents granted to the firm, as provided by Kogan, Papanikolaou, Seru, and Stoffman (2017), scaled by book assets. We estimate the following equation:

$$log(X_{i,t+\tau}) - log(X_{it}) = \lambda_{jt} + \beta_\tau \mathcal{I}_{it} + \gamma_\tau Z_{it} + \eta_{i,t+\tau}, \tag{4}$$

where τ varies between one and five years, λ_{jt} and 2-digit-SIC industry $\times$ year fixed effects, and Z_{it} is a vector of control variables that includes $log(X_{it})$, the same variables as the controls in Table 2, specification (5), as well as log values of firm capital, employment, and stock return volatility. As dependent variables, we use capital stock, number of employees, the nominal value of output, and profits, all defined as in Kogan, Papanikolaou, Seru, and Stoffman (2017). t-statistics, reported in parentheses, are based on standard errors that allow for clustering at the firm level.

		Horizon		
1	2	3	4	5
Panel A: Capital				
0.143	0.268	0.336	0.414	0.503
(4.07)	(4.21)	(3.57)	(3.39)	(3.38)
Panel B: Labor				
0.096	0.179	0.212	0.208	0.193
(2.76)	(2.97)	(2.40)	(1.81)	(1.38)
Panel C: Output				
0.132	0.083	0.109	0.074	0.105
(2.27)	(0.89)	(0.89)	(0.48)	(0.58)
Panel D: Profits				
0.368	0.449	0.572	0.591	0.614
(7.24)	(5.20)	(4.91)	(4.09)	(3.53)

Table 9: Valuable Innovation and Corporate Disclosure

This table regresses changes in disclosure tone on valuable innovation output. In column (1), the dependent variable is the annual change in the average Loughran-McDonald positive word proportion in 10-K filings. In column (2), the dependent variable is the change in the forward-looking intensity of the firm's MD&A disclosure provided by Muslu, Radhakrishnan, Subramanyam, and Lim (2015). Control variables are the same as in Table 2, specification (5), as well as one lag of the dependent variable. *t*-statistics, reported in parentheses, are based on standard errors that allow for clustering at the firm level.

	Δ Positive word proportion$_t$	Δ Forward-looking intensity$_t$
	(1)	(2)
Innovation value$_t$	0.001	0.018
	(4.33)	(3.61)
Controls	Yes	Yes
Industry × year f.e.	Yes	Yes
N	28,126	21,538
R^2	0.183	0.407

APPENDIX

Table A.1: Predicted Innovation Value and Patent Examiner Leniency

The table reports results from regressing predicted innovation value on patent examiner leniency. In columns (1) and (2), we predict innovation value as a function of the control variables in Table 2, specifications (2) and (5), respectively. Innovation value is measured as the economic value of patents granted to the firm, as provided by Kogan, Papanikolaou, Seru, and Stoffman (2017). We control for the number of pending applications in both specifications. *t*-statistics, reported in parentheses, are based on standard errors that allow for clustering at the firm level.

	Predicted innovation value$_t$	
	(1)	(2)
Examiner leniency$_{t-1}$	0.000	0.000
	(-0.82)	(-0.79)
Industry × year f.e.	Yes	Yes
N	22,304	20,724
R^2	0.24	0.26

A Do Successful Innovators Commit More Fraud?

In this section, we would like to zoom in on meritorious lawsuits and investigate whether valuable innovation output may link positively to the propensity to commit fraud. This question is relevant, even though valuable innovation showed no significant link to meritorious lawsuits in our baseline test in Table 2. The reason is that lawsuits can only be brought for true frauds if they are detected, which implies that more fraud can be committed even if we do not see an increase in meritorious lawsuits. In our setting, a lower detection probability, perhaps because innovative firms are more opaque for outsiders, may offset a greater propensity to commit fraud among successful innovators. Separating fraud commission from fraud detection is the aim of this section.

Separating fraud commission from fraud detection is a long-standing challenge for studies of corporate fraud. We follow the standard approach in the literature to deal with the problem of partial observability and estimate a Poirier (1980) bivariate probit model. At the heart of this model is the idea that fraud commission and fraud detection can be separated if a researcher is willing to commit to a specific way of modelling the two as separate, but related equations. Our exposition in this section largely follows Wang, Winton, and Yu (2010). Specifically, we denote F^*_{it} as the latent variable determining firm i's decision to commit fraud in year t and L^*_{it} as the latent variable that governs the subsequent detection of a possible fraud, respectively:

$$F^*_{it} = \beta'_F X_{F,it} + \eta_{it} \tag{5}$$

$$L^*_{it} = \beta'_L X_{L,it} + \epsilon_{it}, \tag{6}$$

where $X_{F,it}$ and $X_{L,it}$ are vectors of observable variables determining fraud commission and detection, respectively. A key assumption of Poirier (1980)'s model is that η_{it} and ϵ_{it} are distributed bivariate standard normal; their correlation is denoted by ρ. Fraud is committed ($F_{it} = 1$) if $F^*_{it} > 0$, and it is detected ($L_{it} = 1$) if $L^*_{it} > 0$. The realizations of F_{it} and L_{it} are not directly observed; instead, we observe the product $Z_{it} = F_{it}L_{it}$.[22] Let Φ denote the bivariate standard normal cumulative distribution function. Then the model for the observable variable Z_{it} is given by:

$$P(Z_{it} = 1) = \Phi(\beta'_F X_{F,it}, \beta'_L X_{L,it}, \rho) \tag{7}$$

$$P(Z_{it} = 0) = 1 - \Phi(\beta'_F X_{F,it}, \beta'_L X_{L,it}, \rho) \tag{8}$$

[22] The dependent variable is thus an indicator equal to one if the firms starts to engage in fraud in a given calendar year, and zero otherwise. We use the start of the class action period as opposed to the year of the lawsuit filing to identify fraud starts.

and the log-likelihood of the model by

$$\mathcal{L}(\beta_F, \beta_L, \rho) = \sum log(P(Z_{it} = 1)) + \sum log(P(Z_{it} = 0)). \tag{9}$$

The above model is fully identified and can be estimated using the maximum-likelihood method under two conditions. First, $X_{F,it}$ and $X_{L,it}$ must not contain exactly the same variables. That is, the researcher needs to identify variables which affect only fraud detection but not fraud commission, or vice versa. Second, the explanatory variables need to exhibit sufficient variation.

We implement the model as follows. First, we follow Dyck, Morse, and Zingales (2014) and use option grants as well as the percentage of incentive pay as instruments in the fraud commission equation. We include a standard set of observable control variables proposed by the existing fraud literature. Specifically, we control for firm characteristics (Tobin's Q, the log of total book assets, cash holdings (defined as cash over lagged assets), leverage, return on assets), proxies for monitoring intensity by outsiders (institutional ownership, ownership concentration, analyst coverage), and executive compensation (executive stock holdings over total pay, and the log of the value of exercisable stock options held by the CEO).[23]

Because the second requirement for bivariate probits – explanatory variables need to exhibit sufficient variation – effectively makes it impossible to include industry × year fixed effects, we include year fixed effects and control for industry-level heterogeneity as in Dyck, Morse, and Zingales (2014)) by adding indicators for Qui-Tam industries and regulated industries as additional controls. Columns (1) and (2) in Table A.2 present results which indicate that valuable innovation does not significantly affect a firm's propensity to commit fraud (column (1)) or, to be litigated conditional on committing fraud (column (2)).

In the next two specifications, we add variables that exclusively affect fraud detection. Following Wang, Winton, and Yu (2010), we use abnormal stock return, abnormal stock volatility, and abnormal turnover in the detection equation. All three variables are measured over the two calendar years *after* the year of fraud commission. We compute abnormal versions of returns, volatility and turnover by absorbing industry × year effects. Columns (3) and (4) show that, if anything, valuable innovation decreases fraud commission and increases fraud detection.

[23]Previous work has documented that managers who have more stock options are more likely to manipulate accounting numbers, which may indicate a generally greater willingness of managers with high-powered incentives to engage in fraud and be sued (e.g., Burns and Kedia (2006), Bergstresser and Philippon (2006)). Because measures of executive pay are available only for a subset of firms, and because restricting our sample to only firms with available pay data would severely reduce the number of cases we can analyze, we include dummy variables indicating missing executive pay variables, and thus, effectively, estimate an average effect for these firms.

Table A.2: Bivariate Probit Model

This table presents results from a bivariate probit model with partial observability. The dependent variable is a dummy variable equal to one if the firm starts to commit fraud in the next calendar year, and zero otherwise. Frauds are identified as class action lawsuits that do not get dismissed and do not settle for less than $3m. The estimation of fraud propensity is indicated by $F = 1$, and the estimation of lawsuit filing (or "detection") likelihood is indicated by $L = 1$. Incentive pay refers to the average of the ratio of restricted stock grants divided by total compensation across executives for a firm-year. Log option value is measured as the log of the sum of the in-the-money exercisable options for all executives. Abnormal stock returns, volatility, and turnover are estimated after averaging the raw measures over the two calendar years following the year where fraud commission is measured, and regressing them on industry-year fixed effects. Volatility is measured as the standard deviation of daily stock returns. Control variables are Tobin's Q, the log of total assets, cash holdings, leverage, ROA, past stock return, institutional ownership, log of number of analysts following, as well as year dummies and indicators for Qui Tam and regulated industries, defined as in Dyck, Morse, and Zingales (2014). *t*-statistics, reported in parentheses, are based on standard errors that allow for clustering at the firm level.

	F=1	L=1	F=1	L=1
	(1)	(2)	(3)	(4)
Innovation value$_t$	0.274	-0.440	-1.385	4.185
	(0.47)	(-0.91)	(-2.51)	(1.73)
Incentive pay	0.055		0.078	
	(2.46)		(2.37)	
Log option value	0.195		0.686	
	(0.66)		(1.68)	
Competitor lawsuits				
Abnormal stock return				-13.556
				(-5.01)
Abnormal stock volatility				0.419
				(1.56)
Abnormal turnover				0.041
				(3.36)
Incentive pay missing	0.456	-0.153	0.666	-0.193
	(0.38)	(-0.47)	(1.90)	(-0.67)
Log option value missing	0.148	0.269	0.776	0.152
	(0.42)	(0.95)	(1.49)	(0.54)
Controls	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes
N	38,229	38,229	30,213	30,213