Public Listing, Managerial Short-termism, and Product Inventions

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Abstract

We construct a novel and comprehensive dataset of trademarks owned by big privately held and publicly listed firms in the U.S. over three decades to examine whether and how public listing status affects product inventions. We find that while publicly listed firms register more product inventions compared with their big privately held counterparts, their product inventions are less likely to survive long. We attribute these patterns to the short-termism of public firms' managers, which is supported by a test based on short-term institutional investors. Using an unexpected court ruling in the Ninth Circuit Court that enhanced managerial short-termism for public firms as an identification test, we find that the relation between the public listing status and product inventions strengthens after this ruling, which supports a causal interpretation of our results.

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1. Introduction

Product inventions play an important role in determining firms' short-term profitability and long-term sustainability in the consumer-oriented economy. To survive and thrive in fiercely competitive markets, firms need product inventions to maintain their positions, to penetrate new markets, and to address changes in customer preferences and market conditions (Porter, 1996; Johnson, Christensen, and Kagermann, 2008; Millot, 2009). Once product inventions succeed, they develop into firms' long-term capital and create competitive advantage (Dierickx and Cool, 1989; Hall, 1992). However, the success of product inventions hinges on persistent investments and consistent marketing efforts to gain customer trust. Conventional wisdom suggests that access to public equity markets can ease firms' financial constraints and provide them with long-term capital, which enhances persistent investments and growth (e.g., King and Levine, 1993a, 1993b; Rajan and Zingales, 1998; Nanda and Rhodes-Kropf, 2013). Public listing may thus serve as a catalyst for product inventions.

However, anecdotal evidence seems to suggest that privately held firms ("private firms" hereafter) have some advantages with respect to product inventions. For example, Elon Musk, who has expressed his intention to bring Tesla private, said "*Being public also subjects us to the quarterly earnings cycle that puts enormous pressure on Tesla to make decisions that may be right for a given quarter, but not necessarily right for the long-term*" in his blog post.[1] As another prominent example, Michael Dell, the CEO of Dell Computer, wrote to all Dell employees on his going private decision: "*Today, we announced a definitive agreement for me and global technology investment firm Silver Lake to acquire Dell and take it private… I believe that we are better served with partners who will provide long-term support to help Dell innovate and accelerate the company's transformation strategy*."[2] Collectively, these arguments motivate us to examine whether and how public listing status influences firms' product inventions.

There are several important differences between publicly listed firms ("public firms" hereafter) and private firms that can potentially impact their success in terms of product inventions.

[1] https://www.cnbc.com/2018/08/08/elon-musk-wants-to-take-tesla-private--heres-what-it-means.html
[2] See the full press release "Dell Enters Into Agreement to Be Acquired By Michael Dell and Silver Lake" at: http://www.dell.com/Learn/us/en/uscorp1/secure/2013-02-04-michael-dell-silverlake-acquisition?c=us&l=en&s=corp.

First, it is well-documented that public firms' managers are subject to short-term pressure from equity market investors and takeover threats. Thus, risk-averse managers with career concerns tend to make myopic decisions in order to deliver acceptable short-term performance rather than long-term value (Stein, 1988; Lerner, Sørensen, and Stromberg, 2011). Second, it takes a substantial portion of managers' time and energy to satisfy various requirements of public listings, such as mandatory disclosure and frequent auditing (Aggarwal and Hsu, 2014). As a result, public firms' managers cannot focus on important, long-term investments that require significant attention, such as product inventions. Third, shares of public firms are tradable on stock markets, which allows managers to easily liquidate their stock shares and may elevate their opportunistic tendencies (Ferreira, Manso, and Silva, 2014), such as focusing on short-term goals while sacrificing long-term prospects. These arguments lead us to hypothesize that the public listing status leads firms and managers to become more short-term-oriented in terms of product inventions.

To examine how public firms differ from private firms in product inventions, we measure public and private firms' product inventions using the comprehensive trademark database from the United States Patent and Trademark Office (USPTO) that is recently available to the public.[3] U.S. trademark data have been used to measure firm-level product inventions in the past (e.g., Gao and Hitt, 2012; Block, De Vries, Schumann, and Sandner, 2014), but only on a small scale due to data availability. It is worth noting that trademark data enable us to examine both the birth and *death* of product inventions, different from other datasets of product announcements and surveys that only capture the birth of product inventions. Trademark owners must renew their trademarks periodically; otherwise, these trademarks will be cancelled. Thus, we can use the active status of a trademark to infer whether it survives market competition and thus succeeds in the long run (Sandner and Block, 2011; Gao and Hitt, 2012; Bei, 2019; Nasirov, 2020). Our study thus fills a gap in the literature by constructing a comprehensive and unique database of both private and public firms' trademark activities to study their long-term success in product inventions.

We match the trademark assignee names in the USPTO Trademark Case File Dataset to company names in the S&P Capital IQ database to compile a comprehensive trademark dataset of

[3] Although trademarks have been used to measure firms' activities in product inventions in Europe and Australia (Mendonca, Pereira, and Godinho, 2004; Schautschick and Greenhalgh, 2016; Flikkema, Castaldi, De Man, and Seip, 2015, 2019; Crown, Faggian, and Corcoran, 2020), there was no comprehensive, organized trademark data in the U.S. until Graham, Hancock, Marco, and Myers (2013).

both big private firms[4] and public firms over the period 1984–2014 and develop measures to capture firms' product inventions in terms of quantity and survival (renewal) likelihood. Using this novel dataset consisting of 4,492 unique public firms and 15,210 unique private firms, we show that public firms tend to launch more products compared to their private counterparts. Specifically, public firms on average launch 47% more new trademarks. However, the renewal ratio of public firms' new trademarks is 13% lower than that of private firms. These findings suggest that while public firms are more aggressive in launching product inventions, their product inventions are much less likely to survive and succeed in the long run, which confirms the consequences of short-termism associated with public listing.

To examine the mechanism underlying these main results, we analyze how the investment horizons of institutional investors can explain firms' product inventions. We find that public firms with a higher proportion of shares held by short-term institutional investors launch more products with a lower renewal ratio.

To ensure that our main results are not driven by omitted variables or unobserved public listing choices, but rather by short-termism associated with public listing status, we use an unexpected court ruling in the U.S. Ninth Circuit court that discouraged shareholders from initiating class action lawsuits against firms headquartered in states covered by the Ninth Circuit (see Huang, Roychowdhury, and Sletten, 2020).[5] This decision is expected to affect public firms more than private ones because the former have many more shareholders and thus are more subject to class action lawsuits from shareholders. Managers of public firms headquartered in the jurisdiction of the Ninth Circuit court should therefore be much less likely to face class action lawsuits after the ruling and thus be expected to act in ways more associated with short-termism (Huang, Roychowdhury, and Sletten, 2020) as compared to non-Ninth Circuit jurisdictions. In difference-in-differences tests, we find public firms (but not private firms) headquartered in Ninth

[4] In the U.S., a private firm must file an Exchange Act registration statement if it has a class of equity securities, such as common stock, with 500 or more shareholders and has more than $10 million in total assets. After that, the company is required to continue reporting via annual and quarterly reports and proxy statements to the SEC. Thus, the S&P Capital IQ database provides financial and accounting information on private U.S. firms that satisfy the above requirements with a similar level of detail as that provided by Compustat on public firms.

[5] The Ninth Circuit covers Alaska, Arizona, California, Guam, Hawaii, Idaho, Oregon, Montana, Nevada, and Washington, as illustrated in Figure 1.

Circuit jurisdictions launch more product inventions with a lower survival likelihood, thus supporting a causal short-termism interpretation of our main results.

We organize the remainder of our paper as follows. In Section 2, we discuss how we connect the USPTO trademark database to the S&P Capital IQ database and how we constructed trademark-based measures for product inventions. Next, we present our main results, mechanism tests, and identification tests in Section 3, and conclude in Section 4. In the Internet Appendix, we discuss the basics of trademarks (Section A), examine if firms' trademark-based measures for product inventions explain their future operating performance, and present several robustness tests.

2. Data, Sample Construction, and Summary Statistics

We provide the details of our data merge in Section B in the Internet Appendix, and briefly discuss the procedure here. We first construct a list of unique assignee names in the USPTO Trademark Case Files Dataset, and then prepare a list of standardized assignee names. We then match each of these names to the company names (and names of their subsidiaries) in the S&P Capital IQ database that provides financial and accounting information of public firms and large private firms that are required to file financial reports to the SEC.

After merging the trademark data to financial data for public and private firms, we only keep a firm-year observation if it has at least one active trademark in the year. The sample ranges from 1984 to 2014[6] for our baseline results for the number of new trademarks. When we analyze the survival rate of new trademarks, we further limit our sample to the period 1984-2007 because it takes six years for us to observe whether a trademark survives at the six-year renewal milestone. We are aware of the issue that the Trademark Law Revision Act (TLRA) that was enacted in 1989 changed several aspects of trademark laws and regulations, and have also considered alternative sample periods 1990-2014 (or 1990-2007). We find consistent results to those reported in this paper.

In Panels A and B in Figure 1, we present industry distributions of all new trademarks of private and public firms, respectively. For private firms, the top five trademark-filing industries

[6] We do not have the full data of S&P Capital IQ database in 2015; thus, our sample stops at 2014.

based on two-digit Standard Industry Classification (SIC) codes[7] are Depository Institutions (17%, SIC 60), Business Services (11%, SIC 73), Wholesale Trade – Durable Goods (6%, SIC 50), Wholesale Trade – Nondurable Goods (5%, SIC 51), and Engineering & Management Services (4%, SIC 87). For public firms, the top five trademark-filing industries are Chemicals and Allied Products (12%, SIC 28), Business Services (11%, SIC 73), Industrial and Commercial Machinery and Computer Equipment (7%, SIC 35), Communications (6%, SIC 48), and Instruments & Related Products (6%, SIC 38).

In Panels A and B of Figure 2, we further examine our sample firms' trademark activities relative to their patent activities in private and public firms, respectively. In particular, we plot the relative percentage of firm-year observations that have filed at least one new trademark and one new patent in a year (denoted in blue bars), those that have filed at least one new trademark but no new patent in a year (denoted in red bars), and those that have filed at least one new patent but no new trademark in a year (denoted in green bars) in each SIC two-digit industry. We observe that the percentages of firms with new trademarks but not new patents dominate those of the other two groups in the majority of industries in Panel B for public firms and in almost all industries in Panel A for private firms. The dominating role of trademark activities presented in Figure 2 suggests that our investigation of trademark activities is important and meaningful in the sense that trademarks as a form of intellectual property (IP) apply to a much broader set of firms and industries as compared to patents, which have received overwhelming attention in the IP literature.

We focus on the following two measures of product inventions: Our first measure is *Trademark*, which is the log of *Trademark_raw* plus one, in which *Trademark_raw* denotes the number of new trademarks registered by a firm in a year.[8] We use such log-linearization to mitigate outliers and skewness in the number of new trademarks. To ensure robustness, we also consider *Trademark_raw* as the dependent variable in our Poisson regressions and negative binomial regressions in Section C in the Internet Appendix. Our second measure, *Survival*, is defined as the log of *Survival_raw* plus one. *Survival_raw* is the percentage of newly registered product

[7] For the definitions, please see: https://www.osha.gov/data/sic-manual

[8] It is common in the literature to use the number of new trademarks to measure the intensity of firms' product inventions (Mendonca, Pereira, and Godinho, 2004; Gao and Hitt, 2012; Block, De Vries, Schumann, and Sandner, 2014; Flikkema, De Man, and Castaldi, 2014; Flikkema, Castaldi, De Man, and Seip, 2015, 2019; Hsu, Li, Li, Teoh, and Tseng, 2020; Hsu, Li, Liu, and Wu, 2021).

trademarks that are renewed at the six-year maintenance milestone (of all the firm's newly-registered trademarks).[9] While the *Trademark* variable captures the "quantity" of product inventions, the *Survival* variable captures the "quality" or long-term-orientation of product inventions. We find that both *Trademark* and *Survival* explain future firm profitability in Section D in the Internet Appendix, confirming the value-relevance of our two measures of product inventions.

Our key explanatory variable is *Public*, an indicator variable that equals one for public firms and zero for private firms in year *t*. We also consider additional variables in our regression analysis to control for the possible differences between private and public firms, and these variables include the firm's total assets (*Size*), profitability (*ROA*), leverage (*Leverage*), age (*Age*), advertisement expenses scaled by total assets (*ADV*),[10] a dummy variable that captures firms with zero or missing advertisement expenses (*ADV_D*), R&D expenses scaled by total assets (*RD*),[11] a dummy variable that captures firms with zero or missing R&D expenses (*RD_D*). The Appendix provides detailed definitions of all variables used in this study.

Table 1 presents summary statistics of our sample of all firms. For our analysis for the number of new trademarks, we have a sample of 129,394 firm-year observations. For our analysis for the survival ratio, our sample size reduces to 38,269 firm-year observations due to the shorter sample period (1984-2007) and the requirement of non-zero new trademarks. Table 1 shows that 54% of our firm-year observations are public firms. An average sample firm has 2.71 new trademarks, and 53% of them eventually survive to the sixth-year renewal milestone. We also present the summary statistics of private firms and public firms (separately) in our sample in Table IA1 in the Internet Appendix. An average public (private) firm has 4.42 (0.73) new trademarks, and 51% (59%) of them eventually survive to the sixth-year renewal milestone.

3. Baseline Results

[9] Prior studies have shown that renewed trademarks are more valuable (Sandner and Block, 2011; Gao and Hitt, 2012; Bei, 2019; Nasirov, 2020). Between the fifth and sixth year after registration, the owner must file the Declaration of Use and/or Excusable Non-use of a Mark under Section 8 to show the continued use of the trademark and pay fees to maintain the registration (https://www.uspto.gov/trademarks/maintain).

[10] If a firm does not report advertisement expenses in a year, we set the value to be zero.

[11] If a firm does not report R&D expenses in a year, we set the value to be zero.

3.1 Public Listing and Product Inventions

To empirically test the differences in product inventions of public and private firms, we estimate the following ordinary least squares regression model (subscript *i* denotes firm, subscript *j* denotes industry, and subscript *t* denotes time):[12]

$$Trademark\ or\ Survival_{i,t+1} = \alpha + \beta_1 Public_{i,t} + Controls_{i,t} + Industry_{FE_j} + Year_{FE_t} + \epsilon_{i,t}, \quad (1)$$

for which all variables have been defined in the prior section. We further control for industry fixed effects (*Industry_FE*) and year fixed effects (*Year_FE*) in the regression where an industry is defined using three-digit SIC codes. In our estimation, we cluster the standard error at the firm level to correct for estimation errors related to firms, such as autocorrelation.

Some issues about our empirical setting are worth discussion. First, we cannot include firm fixed effects in this setting, as our main variable of interest, *Public*, largely overlaps with firm fixed effects. Second, there is a one-year lag between the dependent variable and the independent variable in our baseline setting. We have also considered a two-year lag, and find consistent results. Third, we include fixed effects for each industry-year pair to eliminate all time-varying industry effects, and find consistent results. Fourth, we also consider alternative trademark measures that are more product-specific and find consistent results. All these results are reported in the Internet Appendix, Section C.

Table 2 shows that public firms, on average, produce more product inventions but these inventions are less likely to survive long. In Column (1), the coefficient on *Public* is 0.297 and is significant at the 1% level. Considering that an average firm launches 2.71 trademarks each year in our sample, public firms launch 1.28 more trademarks per year.[13] In Column (2), we find that the coefficient on *Public* is -0.045, and this estimate is significant at the 1% level. This indicates that the survival ratio of new products launched by public firms is significantly less than those of

[12] When we use *Trademark* as the dependent variable, *t* runs from 1984 to 2014; when we use Survival as the dependent variable, *t* runs from 1984 to 2007 (so we have six years to calculate the their survival rate).

[13] Since Ln(1+ *Trademark_raw*) = X and Ln(1+ *Trademark_raw* + Δ*Trademark_raw*) = X + ΔX where ΔX = 0.297×1, Δ*Trademark_raw* = (1+ *Trademark_raw*)×[exp(ΔX) – 1]. When we use the mean of *Trademark_raw* (2.71), we obtain 1.28.

private firms. Such a coefficient estimate corresponds to a drop of 6.7% in new trademarks' survival ratio, which is substantial compared to our sample mean of 53%.

3.2 Mechanism: Short-termism

We further examine if our baseline results can be attributed to this short-termism mechanism using the ownership of institutional investors among public firms. Some institutional investors are short-term-oriented, which exacerbates public firms' myopic behavior (Bushee, 1998, 2001). Therefore, we calculate the ratio of a firm's outstanding shares held by short-term institutional investors (*Short-term IO*),[14] and estimate the following regression model using all public firms in our sample:

$$Trademark\ or\ Survival_{i,t+1} = \alpha + \beta_1 Short-term\ IO_{i,t} + Controls_{i,t}, + Industry\_FE_j + Year\_FE_t + \epsilon_{i,t}\ . \quad (2)$$

We present the results in Table 3. Column (1) shows that the coefficient on *Short-term IO* is positive and significant, suggesting that public firms with more short-term-oriented institutional investors tend to launch more new products. Column (2), on the other hand, shows a negative and significant coefficient on *Short-term IO*, suggesting that the product inventions of firms with more short-term-oriented institutional investors are less likely to survive in the long run. These results are consistent with Table 2 and supports short-termism as the mechanism underlying the difference in product inventions between public and private firms.

3.3 Identification Test: An Unexpected Court Ruling in the Ninth Circuit Court

To be assured that our finding was not due to unobserved factors, we use an unexpected court ruling that makes class action lawsuit more difficult towards firms headquartered in the U.S. Ninth Circuit jurisdiction area,[15] following Huang, Roychowdhury, and Sletten (2020). On July 2nd, 1999, an unexpected court ruling was issued by the Ninth Circuit Court (Re: Silicon Graphics Inc. Securities Litigation, 183 F.3d 970) that resulted in a much stricter pleading standard. As

[14] We follow Bushee (1998, 2001) in using "transient type institutional investor" as short-term-oriented institutional investors.

[15] The Ninth Circuit includes the following states: Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, Oregon, and Washington. We present the jurisdiction of the Ninth Circuit in Figure IA1 in the Internet Appendix.

pointed out in Huang, Roychowdhury, and Sletten (2020), public firms become more short-term-oriented because managers are under lower litigation risk. Therefore, we expect the difference in the performance of product inventions between private and public firms covered by the Ninth Circuit will further diverge from that between private and public firms in other states after 1999. To study the impact of this unexpected court ruling, we introduce the following difference-in-differences model:

$$Trademark\ or\ Survival_{i,t+1} = \alpha + \beta_1 Post_{i,t} \times Ninth_{i,t} \times Public_{i,t} + \beta_2 Pre_{i,t} \times Ninth_{i,t} \times Public_{i,t} + \beta_3 Pre_{i,t} \times Public_{i,t} + \beta_4 Pre_{i,t} + \beta_5 Ninth_{i,t} \times Public_{i,t} + \beta_6 Ninth_{i,t} + \beta_7 Post_{i,t} \times Ninth_{i,t} + \beta_8 Post_{i,t} \times Public_{i,t} + \beta_9 Public_{i,t} + Controls_{i,t}, + Industry\_FE_j + Year\_FE_t + \epsilon_{i,t}, \quad (3)$$

in which *Ninth* is a dummy variable for firms headquartered in the Ninth Circuit states and *Post* is a dummy variable that equals one after 1999. We choose a five-year window around the event as a tradeoff between the time it takes for the effect of the court ruling to be observed in product inventions and the noise of the data that result from using longer time periods. Our sample period in this difference-in-differences event study is therefore 1995 to 2004. Standard errors are clustered at the state level, given that the treatment is based on states (Png, 2017).

The results are reported in Table 4. In Column (1), we observe a positive and significant coefficient on the difference-in-differences term *Post* × *Ninth* × *Public*. As for the survival ratio result in Column (2), the coefficient on *Post* × *Ninth* × *Public* is negative and significant. More importantly, we find that the coefficients on *Pre* × *Ninth* × *Public* are insignificant in both columns, which suggests that there is no difference in product inventions before the court ruling and confirms the parallel trend assumption that is a necessary condition for a difference-in-differences test. Table 4 thus supports a causal interpretation for the effect of public listing status on product inventions, which can be attributed to the differences in short-termism that arises from managerial myopia.

4. Summary and Discussion

In this paper, we construct a comprehensive and unique database by combining the recently available U.S. trademark database with the S&P Capital IQ database, and we find that, when compared with private firms, public firms launch more new trademarks. However, the survival

ratio of these new trademarks is lower than that of private firms. These results suggest public firms are more short-term-oriented in their product inventions compared with public firms. This explanation is supported by our analysis based on short-term institutional investors' shareholding. Using an unexpected court ruling in the U.S. Ninth Circuit in 1999, which increase short-termism of public firms more than private ones, we find that public firms located in the Ninth Circuit exhibit behavior associated with short-termism. These affected public firms launch more new products, but fewer of these products survive. This difference-in-differences test supports a causal interpretation of our main results.

Our empirical evidence offers several managerial and policy implications. First, it highlights a potential negative effect of public listing in product inventions due to short-term pressure. Managers' attention and energy are constrained; thus, their focus can be easily shifted toward myopic investments and projects after IPO.[16] Such an organizational tendency should be included in the IPO decisions of entrepreneurs and major shareholders of start-ups when weighing the benefits and costs of the going public decision. Possible mitigating actions to counteract short-termism associated with going public may include establishing effective corporate governance, introducing (institutional) investors who care about long-term firm value, and granting broadly-held stock options within the organization (long vesting periods).

Second, product inventions are a major driving force for economic growth (Argente, Lee, and Moreira, 2018) and social welfare because they contribute to consumers' preferences for quantity and variety. This study provides novel evidence of the potential dark side of public equity markets from the perspective of product inventions. Overall, this paper adds to our understanding of the determinants of successful product inventions and highlights the important role that public equity markets play with respect to national innovation systems (NIS) (Nelson, 1986, 1993; Mowery, 1998).

Our paper also contributes to a fundamental research question: how does ownership structure influence innovation? This research question is particularly important in the sense that

[16] A letter from Google's founders Larry Page and Sergey Brin is illustrative: "*In the transition to public ownership, we have set up a corporate structure that will make it harder for outside parties to take over or influence Google. This structure will also make it easier for our management team to follow the long term, innovative approach emphasized earlier*."

our knowledge in this direction is mainly based on public firms due to data limitations, which is certainly insufficient given the sheer number of private firms and the inventions they have created. The evidence we present in this paper based on product inventions is distinct from the findings of prior studies that are based on utility patents (which only cover a relatively *small* set of industries): public firms tend to produce more patents (Acharya and Xu, 2017), while private firms tend to engage in riskier exploration (Gao, Hsu, and Li, 2018). We highlight that private firms' product inventions are more likely to succeed in the long run than public firms' product inventions, suggesting that the former group adopt a conservative yet long-term-oriented strategy to guide product development. By constructing a comprehensive dataset of public and private firms' trademarks, we provide novel empirical evidence and new insights to this fundamental research question.

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Appendix. Variable Definitions

Trademark	The natural logarithm of the number of newly registered trademarks by a firm in a given year plus one.
Trademark_Raw	The number of newly registered trademarks by a firm in a given year.
Survival	The natural logarithm of newly registered trademarks that ultimately survive the 6th year renewal threshold plus one percent.
Survival_Raw	The percentage of newly registered trademarks that ultimately survive the 6th year renewal threshold.
Trademark_Prod	The natural logarithm of the number of newly registered product trademarks by a firm in a year plus one.
Survival_Prod	The log ratio of newly registered product trademarks that ultimately survive the 6th year renewal threshold plus one percent.
Public	The dummy variable which equals 1 if the firm is publicly listed, and 0 otherwise.
Size	Ln (total assets).
Leverage	Total debt scaled by total assets.
Age	Firm's age, as calculated from the year founded.
ADV	Advertising expenses plus SG&A scaled by total assets.
ADV_D	A dummy variable that equals one if ADV is zero or missing.
Long-term IO	The difference of institutional ownership by non-transient type minus that of transient type. The type of institutional investor is defined following Bushee (1998, 2001).
Good Governance	A dummy variable that equals one if a firm's G-index (Gompers, Ishii, and Metrick (2003)) is less or equal to five.

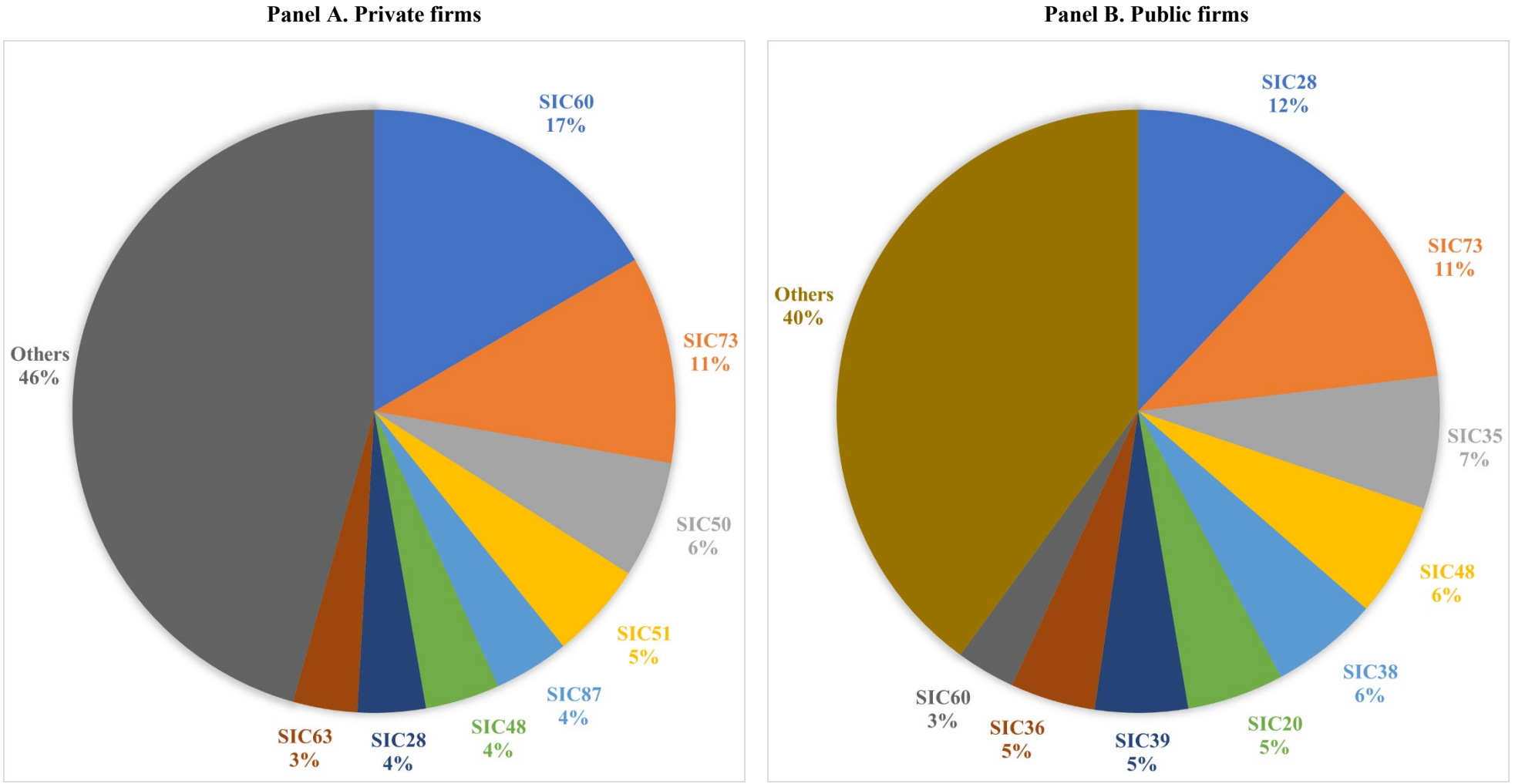

Figure 1. Industry Distribution of Trademarks

This figure presents industry distributions of all new trademarks registered in our sample period. We use SIC two-digit industries (see https://www.osha.gov/data/sic-manual). Panel A includes all private firms, and Panel B includes all public firms.

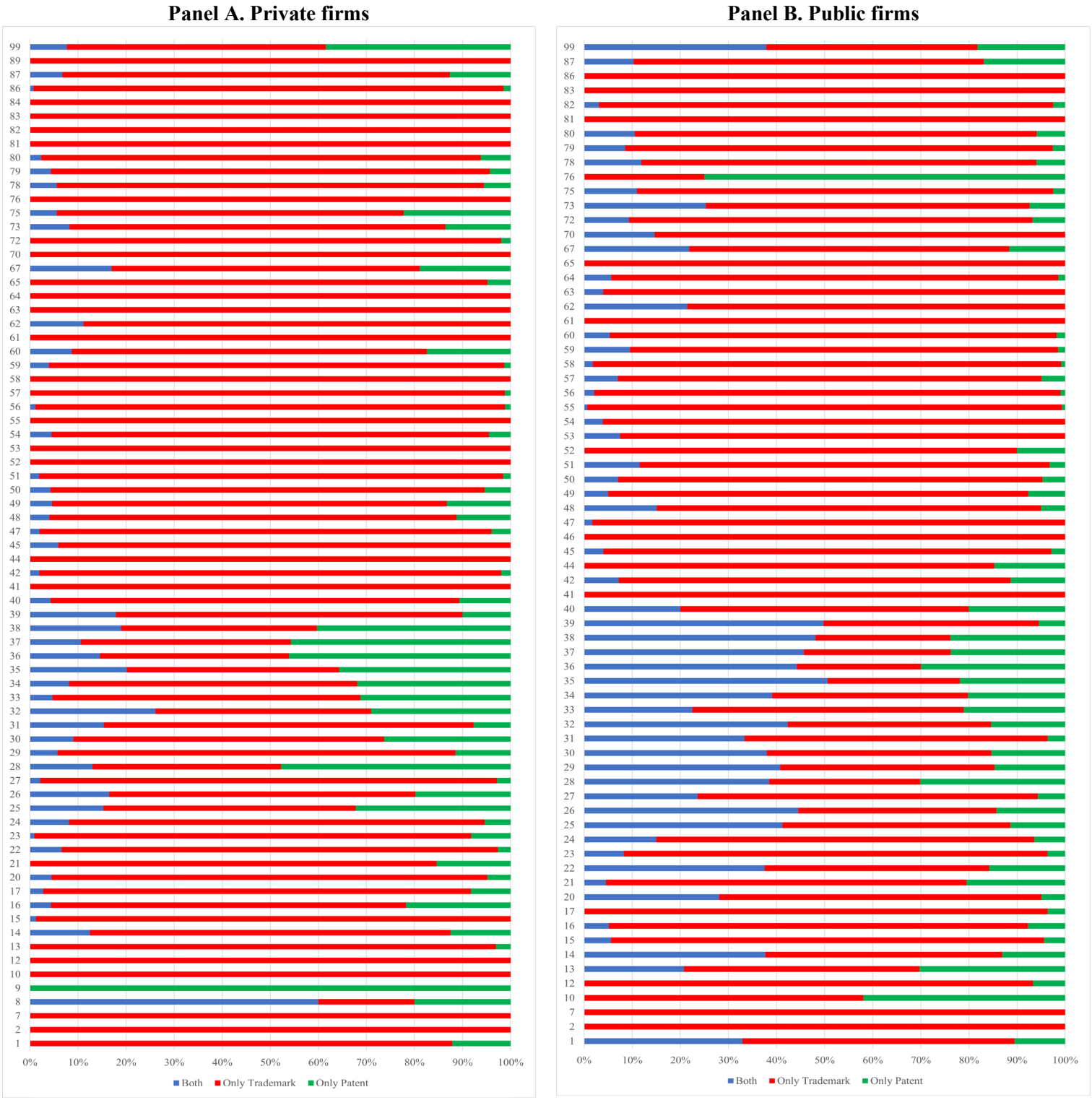

Figure 2. Firms' Trademarks and Patents by Industry

Panel A includes all private firms, and Panel B includes all public firms. We plot the relative percentage of firm-year observations that have filed at least one new trademark and one new patent in a year (denoted in blue bars), those that have filed at least one new trademark but no new patent (denoted in red bars), and those that have filed at least one new patent but no new trademark (denoted in green bars) in each SIC two-digit industry (see https://www.osha.gov/data/sic-manual).

Table 1. Summary Statistics

This table provides summary statistics for the main variables used in this paper. Trademark denotes the log number of newly registered trademarks plus one. Trademark_Raw is the number of newly registered trademarks. Survival is the survival ratio of trademarks, calculated as the log of the percentage of newly registered trademarks that survive at the 6th year maintenance threshold plus one. Survival_Raw is the percentage of newly registered trademarks that survive at the 6th year maintenance threshold. Trademark_Prod and Survival_Prod is calculated similarly as Trademark and Survival, respectively, for product trademarks. Public is a dummy variable that equals one for public firms. All other variables are defined in the Appendix. The sample period for trademarks is from 1984 to 2014, while for survival ratios, the sample period ends at 2007, due to the time needed to evaluate whether a trademark survives.

	N	Mean	STD	25th Percentile	Median	75th Percentile
Trademark	129,394	0.63	0.92	0.00	0.00	1.10
Trademark_Raw	129,394	2.71	10.11	0.00	0.00	2.00
Survival	38,269	0.39	0.28	0.00	0.41	0.69
Survival_Raw	38,269	0.53	0.41	0.00	0.50	1.00
Trademark_Prod	118,795	0.54	0.83	0.00	0.00	1.10
Survival_Prod	33,206	0.38	0.29	0.00	0.41	0.69
Public	129,394	0.54	0.50	0.00	1.00	1.00
Size	129,394	2.77	10.25	0.03	0.19	0.96
ROA	129,394	0.03	0.21	0.00	0.00	0.12
Leverage	129,394	0.14	0.23	0.00	0.01	0.23
Age	129,394	3.44	0.95	2.77	3.47	4.23
ADV	129,394	0.17	0.27	0.00	0.04	0.25
ADV_D	129,394	0.41	0.49	0.00	0.00	1.00
RD	129,394	0.03	0.08	0.00	0.00	0.00
RD_D	129,394	0.79	0.41	1.00	1.00	1.00
Short Term IO	69,366	0.11	0.11	0.02	0.08	0.17

Table 2. Public Listing and Product Inventions

This table present the relationship between public listing and product inventions in terms of the launch of new brands, as reflected in the number of new trademarks and the survival ratio of launched trademarks. Trademark denotes the log number of new trademarks plus one. Survival is the survival ratio of trademarks, calculated as the log of the ratio of newly registered trademarks that survive at the 6th year maintenance threshold plus one. Public is a dummy variable that equals one for public-listed firms. All other variables are defined in the Appendix. The sample period for trademarks is from 1984 to 2014, while for survival ratios, the sample period ends at 2007, due to the time needed to evaluate whether a trademark survives. Detailed definitions can be found in Appendix B. p-values are calculated based on standard errors clustered at the firm level and are in parentheses. *, **, and *** represents statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)
VARIABLES	Trademark	Survival
Public	**0.297*** **	**-0.045*** **
	(0.000)	**(0.000)**
Size	0.028***	-0.001***
	(0.000)	(0.000)
ROA	0.506***	0.098***
	(0.000)	(0.000)
Leverage	0.153***	-0.028***
	(0.000)	(0.001)
Age	0.045***	0.015***
	(0.000)	(0.000)
ADV	0.184***	-0.011
	(0.000)	(0.181)
ADV_D	-0.080***	0.017**
	(0.000)	(0.029)
RD	-0.147*	0.044
	(0.063)	(0.162)
RD_D	-0.186***	0.003
	(0.000)	(0.628)
Constant	0.443***	0.336***
	(0.000)	(0.000)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	129,394	38,269
Adjusted R2	0.290	0.057

Table 3. Public Listing and Product Inventions: The Role of Short-term Institutional Ownership

This table presents the relationship between short-term institutional ownership (IO) and product inventions in terms of the launch of new brands, as reflected in the number of new trademarks and the survival ratio of launched trademarks for public firms. Trademark denotes the log number of new trademarks plus one. Survival is the survival ratio of trademarks, calculated as the log of the ratio of newly registered trademarks that survive at the 6th year maintenance threshold plus one. Short-term IO is institutional ownership by transient type institutional investors. All other variables are defined in the Appendix. The sample period for trademarks is from 1984 to 2014, while for survival ratios, the sample period ends at 2007, due to the time needed to evaluate whether a trademark survives. Detailed definitions can be found in Appendix B. p-values are calculated based on standard errors clustered at the firm level and are in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) Trademark	(2) Survival
Short-term IO	**1.182*** **	**-0.058*** **
	(0.000)	**(0.001)**
Size	0.033***	-0.001***
	(0.000)	(0.000)
ROA	0.485***	0.116***
	(0.000)	(0.000)
Leverage	0.131***	-0.028***
	(0.001)	(0.009)
Age	0.091***	0.017***
	(0.000)	(0.000)
ADV	0.152***	-0.007
	(0.000)	(0.483)
ADV_D	0.065	-0.012
	(0.155)	(0.313)
RD	-0.188*	0.049
	(0.054)	(0.210)
RD_D	-0.127***	0.002
	(0.000)	(0.817)
Constant	0.237	0.128
	(0.385)	(0.165)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	69,366	28,399
Adjusted R2	0.277	0.063

Table 4. Public Listing and Product Inventions: Ninth Circuit

This table present the relationship between public listing and product inventions in terms of the launch and survival of new brands, as reflected in the number and survival ratio of new trademarks in a difference-in-differences setting utilizing a Ninth Circuit court ruling. Public is a dummy variable that equals one for public-listed firms. Post is a dummy variable that takes the value of one after 1999. Pre is a dummy for year 1998 and year 1999. Ninth is a dummy for states covered by the Ninth Circuit. Trademark denotes the log number of new trademarks plus one. Survival is the survival ratio of trademarks, calculated as the log of the ratio of newly registered trademarks that survive at the 6th year maintenance threshold plus one. All other variables are defined in the Appendix. The sample period is from 1995 to 2014. Detailed definitions can be found in Appendix B. p-values are calculated based on standard errors clustered at the state level and are in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) Trademark	(2) Survival
Post × Ninth × Public	**0.087****	**-0.035***
	(0.040)	**(0.085)**
Pre × Ninth × Public	0.029	-0.004
	(0.284)	(0.786)
Pre × Public	0.041	-0.016
	(0.352)	(0.465)
Pre	-0.073	0.016
	(0.101)	(0.450)
Ninth × Public	-0.125**	0.014
	(0.013)	(0.455)
Ninth	0.114**	0.008
	(0.015)	(0.587)
Post × Ninth	-0.053	0.010
	(0.134)	(0.584)
Post × Public	0.129***	0.008
	(0.007)	(0.724)
Public	0.183***	-0.049***
	(0.000)	(0.005)
Size	0.054***	-0.001***
	(0.000)	(0.001)
ROA	0.332***	0.098***
	(0.000)	(0.000)
Leverage	0.096**	-0.022*
	(0.038)	(0.089)
Age	0.078***	0.012***
	(0.000)	(0.000)
ADV	0.112***	-0.014
	(0.003)	(0.104)
ADV_D	-0.206***	0.005
	(0.000)	(0.687)
RD	-0.122	0.055
	(0.270)	(0.135)
RD_D	-0.102***	0.002

	(0.000)	(0.779)
Constant	0.353***	0.363***
	(0.000)	(0.000)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	36,571	19,378
Adjusted R2	0.273	0.067

Internet Appendix for "Public Listing, Managerial Short-termism, and Product Inventions"

A. Basics about U.S. Trademarks

A trademark is a word, phrase, symbol, and/or design that serves to differentiate the source of goods or services of one party from those of others. The modern U.S. federal trademark registration system was established with the Lanham Act in 1946.[1] A firm may register a trademark application with the USPTO for a new trademark that will be used in some particular product/service classes.[2] In the application file, the applicant also needs to provide proof of the actual use of the trademark in commerce, such as a specimen, or can instead file an Intent-to-Use statement to agree to provide such proof in the next six months (i.e., Statement of Use) by filing (Graham et al., 2013).[3] When the application has met the minimum filing requirements, an application serial number is assigned, and the application is forwarded to an examining attorney in the USPTO. This attorney will review the trademark application, which includes a search for conflicting marks and an examination of the written application, the drawing, and any specimen. The attorney's job is to ensure the novelty of the filed trademark that is reasonably distinct from existing trademarks and that can be easily identified by the public.[4]

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[1] Although the Act has been amended several times since, it remains the primary federal trademark statute in providing nationwide regulation and protection for trademark registration (Graham et al., 2013).

[2] The exclusive right to use the trademark is also confined to the registered trademark classes. For example, if the mark "Apple" is registered only in the class "Electrical and scientific apparatus," its legal protection is only effective in this class, but not in an unregistered class such as "Wine and spirits" or "Medical apparatus." Most countries, including the U.S., adopt the International Classification of Goods and Services, for which there are 45 classes in total (34 for goods and 11 for services). There are 45 product/service classes: http://www.wipo.int/classifications/nice/nclpub/en/fr/home.xhtml. A trademark can be filed in one or multiple classes, and 86.5% of trademark applications are registered in single classes (Graham et al., 2013). The application fees can be found via: https://www.uspto.gov/trademarks-application-process/filing-online/trademark-application-fee-structure

[3] It is noteworthy that 45.9% of intent-to-use applications are abandoned without being registered.

[4] The attorney may reject the application if the proposed trademark has been commonly used by the public (e.g., "Police"), if it is only descriptive of the product or of its quality (e.g., "Cheese" and "Delicious"), if it has no distinctive characters, if it has a scandalous connotation, or if it refers to specific official emblems (e.g., "California") (e.g., Millot, 2009; Graham et al., 2013). Of note, 8.3% of trademark applications were rejected by examining attorneys (Graham et al., 2013). If an applicant decides that minor corrections are required, he/she will issue a letter (Office Action) to request corrections. If the attorney decides that the proposed trademark should not be registered, he/she will issue a letter (Office Action) explaining any substantive reasons for refusal, and any technical or procedural deficiencies in the application. The applicant

If the examining attorney raises no correction requests or objections, or if the applicant has addressed all concerns and overcome all objections raised by the attorney, the examining attorney will approve the trademark to be published in the *Official Gazette*, a weekly publication of the USPTO published on Tuesday. After the mark is published in the *Official Gazette*, a third party may file a notice of opposition to the trademark's registration during this 30-day period after publication.[5] If no opposition is filed or if the opposition is unsuccessful, the application enters the next stage of the registration process.

Before the official registration of the trademark, the applicant will need to file a statement of use to prove the actual use of the trademark in commerce if such proof has not been provided in an initial application. After all these necessary conditions are met, the trademark can then be officially registered. As shown in Graham et al. (2013), 78.8% of all applications were eventually granted. The median time from application to registration is 1.2 years for all registrations filed with actual use, and is 1.9 years for all those filed based on intent-to-use.

Firms can hold permanent ownership of their trademarks if they can maintain the trademarks in the sixth year from registration dates and if they renew the trademarks every 10 years from their respective registration dates.[6] Failure to file the required maintenance and renewal documents in the specified time periods will result in the cancellation of the trademark or invalidation of legal protection. Between the fifth and sixth year after registration, the owner must file the Declaration of Use of Mark in Commerce to show the continued use of the trademark and pay fees to maintain its registration.[7] In particular, the owner needs to present a specimen that is currently used for each class of goods or services

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needs to respond to the Office Action within six (6) months of the mailing date of the Office action, or the application will be declared abandoned.

[5] When a notice of opposition is filed, the owner of the opposed application has 30 days to file an answer with the TTAB. Thereafter, an opposition proceeding is held before the Trademark Trial and Appeal Board (TTAB), a body within the USPTO responsible for hearing and deciding certain kinds of trademark-related cases. 98.1% of published applications were registered (Graham et al., 2013).

[6] The relevant procedures for maintaining and renewing trademarks can be found on the USPTO website: https://www.uspto.gov/trademarks-maintaining-trademark-registration/keeping-your-registration-alive and https://www.uspto.gov/trademarks-application-process/filing-online/registration-maintenancerenewalcorrection-forms. The renewal frequency was 20 years before November 1989 and reduced to 10 years after the enactment of the Trademark Law Revision Act of 1988 [Title 1 of Pub. L. 100-667, 102 Stat. 3935 (15 U.S.C. 1051)]. Registrations can be renewed within one year before the end of every 10-year period after the registration date or within the 6-month grace period thereafter.

[7] The owner can still file an extension for six months after the sixth year from registration.

in which the trademark has been registered.[8] Based on the statistics of Graham et al. (2013), 47.1% of trademarks registered were maintained after the sixth year.

Currently in the US, trademark registration can be made at either the state or federal level. A state-level trademark enjoys protection only within the jurisdiction of the state, whereas a federal-level trademark can enjoy nationwide protection. In addition, state-level trademark laws are much less effective in protecting trademark owners because trademark litigation often involves many states in which the products and services; the state courts are reluctant in granting out-of-state injunctions; and firms could forum-shop which state court to file litigation (Peterson, Smith, and Zerrillo, 1999; Morrin and Jacoby, 2000; Roe, 2008).

B. Merge of Databases

The USPTO Trademark Case Files Dataset, our primary data source, documents all federally registered trademarks from 1870 and 2015. The data contains information on trademark characteristics, prosecution events, ownership, classification, and renewal history for nearly 7.9 million trademarks. For each trademark record, it has the following information: key dates (filing, registration, renewal, or cancellation), status (registered, abandoned, renewed, or canceled), trademark class, mark textual content, and owner information (owner name and location).

The S&P Capital IQ database, on the other hand, provides financial and accounting information of public firms and private firms that file financial reports to the SEC. In the U.S., a private firm must file an Exchange Act registration statement if it has a class of equity securities, such as common stock, with 500 or more shareholders and has more than $10 million in total assets. After that, the company is required to continue reporting via annual and quarterly reports and proxy statements to the SEC. Thus, the S&P Capital IQ database provides financial and accounting information on private U.S. firms that satisfy the above requirements with a similar level of detail as that provided by Compustat on public firms.

Because the USPTO Trademark Case File Dataset only provides an owner's name and location for each trademark record, we take the following steps to link it to the public

[8] Other materials such as the promotion documents or advertisements that demonstrate that the trademark is in use are also acceptable.

and private firms' identifiers. First, from the Trademark Case Files Dataset, we obtain a list of owner names, denoted as List A. From the Capital IQ database, we obtain a list of company names and their S&P Capital IQ identifiers, denoted as List B. Since the number of private firms is huge, we only include those that are domiciled in the U.S. and have at least one year with reported total assets above 1 million USD.

Second, we notice that sometimes firms hold intellectual properties such as trademarks through subsidiaries. For example, most of Toys "R" Us' trademarks are registered and held by its subsidiary Geoffrey, LLC. Therefore, simply matching the trademark owners with the names of its parent entity is insufficient. To address this problem, we use the list of firms' subsidiaries in Capital IQ to expand List B to include all their (current) subsidiaries. As a result, both the parent's name "Toys 'R' Us" and the subsidiaries' names (e.g., "Toys 'R' Us International LLC," "Geoffrey, LLC") are included in our expanded List B.

We then conduct fuzzy matching between List A and List B using the Levenshtein distance to keep the closest ten possible matches and then manually verify each one. To ensure accuracy in matching, we also cross-check our matches using available information from online searches (e.g., Bloomberg BusinessWeek) and the location information in the trademark dataset and S&P Capital IQ database.

C. Robustness Checks

C.1. Different Specifications

We adopt an ordinary least square (OLS) regression and log transformation in our estimation for Equation (1) when the dependent variable is *Trademark*. As the number of new trademarks is a count variable, we can also opt for a count model. We thus re-run Equation (1) in this section, but use *Trademark_raw* as the dependent variable and estimate Poisson regressions and negative binomial regressions. Our results are reported in Table IA2. In Column (1) we use a Poisson regression while in Column (2) we use a negative binomial regression. In both columns, we observe a positive and significant coefficient on *Public*, consistent with our baseline finding.

C.2. Additional Time Lag

We adopt the standard one-year lag between the dependent variable and independent variable in our baseline results, based on Equation (1). In this section, we extend that time lag to two years and examine if our results are robust to this specification. We re-run Equation (1) using *Trademark* and *Survival* with a two-year time lag (i.e., in year t+2) and report our results in Table IA3. We obtain almost the same results: public firms have more product inventions than private ones; however, their mortality rate for these product inventions is higher than that of private firms.

C.3. Time-varying Industry Effects

To ensure that our baseline results are not driven by some time-varying, industry-specific factors, we include industry times year fixed effects in Equation (1) and report our results in Table IA4. Again, we obtain consistent results: public firms have more product inventions. The mortality rate of these product inventions, however, is higher for public firms. Therefore, our baseline results are not driven by industry-year specific factors.

C.4. Product Trademarks

We acknowledge that not all newly registered trademarks correspond to new product inventions because some trademarks are pure logos or slogans that are designed for marketing purposes, rather than designed to identify new products. We thus perform robustness tests by focusing on product trademarks. To separate 'product' and 'marketing' trademarks, we employ the following mechanism by relying on two variables: 'mark identification character' (the textual content of trademark) and 'mark drawing code' (the design type of trademark).[9] Essentially, if the mark contains many words, it is more likely to be a marketing slogan rather than a product name. Additionally, if the mark is more about the logo design rather than the simple product name, it is considered a marketing trademark. Using the method of Hsu, Li, Liu, and Wu (2021), we find that about 63% of trademarks are product trademarks while the remaining are marketing trademarks.

We replace the number of new trademarks by the number of new product trademarks, and replace the corresponding survival ratio with the survival ratio of product trademarks in Equation (1). As reported in Table IA5, the results are similar to our baseline

[9] This approach is based on Faurel, Li, Shanthikumar, and Teoh (2019) and Hsu, Li, Liu, and Wu (2021).

results. We again observe that public firms register more new product trademarks, and that their survival ratio for product trademarks is lower.

D. Value Implications of Trademarks

D.1. Prior Literature

Due to the lack of US-based trademark databases in the past, prior studies on the value-relevance of trademarks are mainly based on public firms in Europe (Graham et al., 2013). Greenhalgh and Rogers (2006) find that the number of trademarks scaled by total assets is positively associated with the non-manufacturing firms' market values in a sample of 347 British firms in the 1989-1999 period. Also, using 1,216 international firms in the 1996-2002 period, Sandner and Block (2011) find that a firm's trademark number is significantly and positively associated with its Tobin's Q. Finally, using a sample of 10,230 German firms, Crass, Czarnitzki, and Toole (2016) show that a firm's trademark number positively predicts long-term future profit margins. The survey of Flikkema, Castaldi, de Man, and Seip (2019) suggest a positive correlation between the number of trademarks and the number of product innovations among start-ups. Schautschick and Greenhalgh (2016), Nasirov (2018), and Castaldi (2020) provide a helpful summary of prior studies on firms' intention to file trademarks and the value-relevance and potential use of trademark-based indicators.

Ever since the USPTO trademark database became available around 2013, researchers have started to use U.S. firms to examine the value implications of trademarks. Block, De Vries, Schumann, and Sandner (2014) find that start-up firms' trademark number is positively related to their evaluation from venture capitalists in 2,341 start-ups. Focusing on S&P 1500 firms from 1993 to 2011, Faurel, Li, Shanthikumar, and Teoh (2019) find that firms registering more trademarks earn future increases in sales and profitability. Meanwhile, Hsu, Li, Li, Teoh, and Tseng (2020) examine the value and pricing implications of all U.S. public firms, finding that firms that have registered more trademarks are associated with higher increases in future profitability and stock returns. All these analyses support the information content of trademark data and confirm the economic value of trademarks.

D.2. The Relation between Profitability and Trademarks

A natural follow-up question is: do product inventions matter in terms of firm operations? In what follows, we attempt to answer this question by examining the relationship between product inventions and future operating performance. To begin, we estimate the following model for all our sample firms:

$$ROA_{i,t+3(t+5)} = \alpha + \beta_1 Trademark\ or\ Survival_{i,t} + Controls_{i,t}, + Industry_{FE_j} + Year_{FE_t} + \epsilon_{i,t}, \text{(A1)}$$

for which *ROA* is return on assets calculated three-year or five-year ahead of product inventions (i.e., ROA in year *t*+3 or *t*+5) and measures firms' long-term operating performance. The estimation results are reported in Table IA6. In Columns (1) to (2), in which we focus on the number of newly launched products, we observe a clear pattern: the coefficients on *Trademark* are positive and significant, indicating that the more trademarks a firm has, the better future operating performance it will experience, which is largely consistent with the literature. The coefficients of 0.7% and 0.8% are fairly substantial. More importantly, in Columns (3) to (4), in which we focus on the relationship between survival ratios of trademarks and operating performance three-years or five-years ahead, we again find positive and significant coefficients on *Survival*, which means the higher the survival ratio of trademarks, the better future operating performance will be. These results indicate that both the quantity and quality of product inventions are important for firms' future profits and values.

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Figure IA1. The Coverage of the Ninth Circuit

This figure presents the geographic coverage of the Ninth Circuit, which includes Alaska, Arizona, California, Guam, Hawaii, Idaho, Oregon, Montana, Nevada, and Washington. The source: https://www.ca9.uscourts.gov/content/view.php?pk_id=0000000135

Table IA1. Summary Statistics

This table provides summary statistics for the main variables used in this paper. Panel A includes all private firms, and Panel B includes all public firms. Trademark denotes the log number of newly registered trademarks plus one. Trademark_Raw is the number of newly registered trademarks. Survival is the survival ratio of trademarks, calculated as the log of the percentage of newly registered trademarks that survive at the 6th year maintenance threshold plus one. Survival_Raw is the percentage of newly registered trademarks that survive at the 6th year maintenance threshold. Trademark_Prod and Survival_Prod is calculated similarly as Trademark and Survival, respectively, for product trademarks. Public is a dummy variable that equals one for public firms. All other variables are defined in the Appendix. The sample period for trademarks is from 1984 to 2014, while for survival ratios, the sample period ends at 2007, due to the time needed to evaluate whether a trademark survives.

Panel A. Private	N	Mean	STD	25th Percentile	Median	75th Percentile
Trademark	60,028	0.29	0.57	0.00	0.00	0.00
Trademark_Raw	60,028	0.73	2.44	0.00	0.00	0.00
Survival	9,870	0.42	0.31	0.00	0.00	0.59
Survival_Raw	9,870	0.59	0.45	0.00	0.00	0.80
Trademark_Prod	51,453	0.24	0.50	0.00	0.00	0.00
Survival_Prod	7,809	0.41	0.31	0.00	0.00	0.61
Public	60,028	0.00	0.00	0.00	0.00	0.00
Size	60,028	1.28	6.98	0.00	0.01	0.06
ROA	60,028	-0.01	0.18	-1.95	0.00	0.00
Leverage	60,028	0.07	0.23	0.00	0.00	0.00
Age	60,028	3.45	0.98	0.69	2.83	3.56
ADV	60,028	0.07	0.25	0.00	0.00	0.00
ADV_D	60,028	0.82	0.38	0.00	1.00	1.00
RD	60,028	0.01	0.07	0.00	0.00	0.00
RD_D	60,028	0.94	0.23	0.00	1.00	1.00

Panel B. Public	N	Mean	STD	25th Percentile	Median	75th Percentile
Trademark	69,366	0.93	1.06	0.00	0.00	0.69
Trademark_Raw	69,366	4.42	13.39	0.00	0.00	1.00
Survival	28,399	0.37	0.27	0.00	0.00	0.41
Survival_Raw	28,399	0.51	0.39	0.00	0.00	0.50
Trademark_Prod	67,342	0.77	0.94	0.00	0.00	0.69
Survival_Prod	25,397	0.37	0.28	0.00	0.00	0.41
Public	69,366	1.00	0.00	1.00	1.00	1.00
Size	69,366	3.96	11.57	0.00	0.09	0.41
ROA	69,366	0.06	0.22	-1.95	0.00	0.10
Leverage	69,366	0.20	0.21	0.00	0.02	0.15
Age	69,366	3.44	0.92	0.69	2.77	3.40
ADV	69,366	0.25	0.27	0.00	0.07	0.18
ADV_D	69,366	0.06	0.23	0.00	0.00	0.00
RD	69,366	0.04	0.09	0.00	0.00	0.00
RD_D	69,366	0.66	0.48	0.00	0.00	1.00
Short Term IO	69,366	0.11	0.11	0.02	0.08	0.17

Table IA2. Public Listing and Product Inventions: Different Specifications

This table presents the relationship between public listing and product inventions in terms of the launch of new brands as reflected in the number of new trademarks for which we use Poisson or Negative Binomial regressions. Trademark_raw denotes the number of new trademarks. Public is a dummy variable that equals one for publicly-listed firms. All other variables are defined in the Appendix. The sample period for trademarks is from 1984 to 2014. Detailed definitions can be found in Appendix B. p-values are calculated based on standard errors clustered at the firm level and are in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)
	Poisson	Negative Binomial
VARIABLES	Trademark_Raw	Trademark_Raw
Public	**0.843*** **	**0.668*** **
	(0.000)	**(0.000)**
Size	0.034***	0.050***
	(0.000)	(0.000)
ROA	1.693***	0.995***
	(0.000)	(0.000)
Leverage	0.353***	0.393***
	(0.000)	(0.000)
Age	0.253***	0.080***
	(0.000)	(0.000)
ADV	0.214**	0.372***
	(0.017)	(0.000)
ADV_D	-0.387***	-0.451***
	(0.000)	(0.000)
RD	-0.031	-0.184
	(0.920)	(0.281)
RD_D	-0.093	-0.215***
	(0.290)	(0.000)
Constant	0.402	0.969***
	(0.395)	(0.000)
Industry	Yes	Yes
Year FE	Yes	Yes
Observations	129,394	129,394

Table IA3. Public Listing and Product Inventions: Additional Lag

This table presents the relationship between public listing and product inventions in terms of the launch and survival of new brands, as reflected in the number and survival ratio of new trademarks for which the lag between dependent and independent variables are two-years instead of one-year in our baseline specification. Trademark denotes the log number of new trademarks plus one. Survival is the survival ratio of trademarks, calculated as the log of the ratio of newly registered trademarks that survive at the 6th year maintenance threshold plus one. Public is a dummy variable that equals one for public-listed firms. All other variables are defined in the Appendix. The sample period for trademarks is from 1984 to 2014, while for survival ratios, the sample period ends at 2007, due to the time needed to evaluate whether a trademark survives. Detailed definitions can be found in Appendix B. p-values are calculated based on standard errors clustered at the firm level and are in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)
VARIABLES	Trademark(t+2)	Survival(t+2)
Public	**0.281*** **	**-0.028*** **
	(0.000)	**(0.000)**
Size	0.028***	-0.001***
	(0.000)	(0.000)
ROA	0.488***	0.089***
	(0.000)	(0.000)
Leverage	0.143***	-0.008
	(0.000)	(0.362)
Age	0.042***	0.015***
	(0.000)	(0.000)
ADV	0.184***	-0.008
	(0.000)	(0.286)
ADV_D	-0.102***	0.024***
	(0.000)	(0.001)
RD	-0.109	0.039
	(0.173)	(0.180)
RD_D	-0.188***	0.001
	(0.000)	(0.840)
Constant	0.370***	0.290***
	(0.000)	(0.000)
Industry	Yes	Yes
Year FE	Yes	Yes
Observations	127,984	38,287
Adjusted R2	0.296	0.160

Table IA4. Public Listing and Product Inventions: Industry-year Fixed Effects

This table present the relationship between public listing and product inventions in terms of the launch and survival of new brands, as reflected in the number and survival ratio of new trademarks for which industry times year fixed effects are controlled. Trademark denotes the log number of new trademarks plus one. Survival is the survival ratio of trademarks, calculated as the log of the ratio of newly registered trademarks that survive at the 6th year maintenance threshold plus one. Public is a dummy variable that equals one for publicly-listed firms. All other variables are defined in the Appendix. The sample period for trademarks is from 1984 to 2014, while for survival ratios, the sample period ends at 2007, due to the time needed to evaluate whether a trademark survives. Detailed definitions can be found in Appendix B. p-values are calculated based on standard errors clustered at the firm level and are in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)
VARIABLES	Trademark	Survival
Public	**0.295*** **	**-0.046*** **
	(0.000)	**(0.000)**
Size	0.028***	-0.001***
	(0.000)	(0.000)
ROA	0.516***	0.096***
	(0.000)	(0.000)
Leverage	0.163***	-0.030***
	(0.000)	(0.001)
Age	0.044***	0.015***
	(0.000)	(0.000)
ADV	0.184***	-0.007
	(0.000)	(0.377)
ADV_D	-0.085***	0.017**
	(0.000)	(0.033)
RD	-0.138*	0.035
	(0.092)	(0.290)
RD_D	-0.181***	0.004
	(0.000)	(0.527)
Constant	0.357***	0.367***
	(0.000)	(0.000)
Industry × Year FE	Yes	Yes
Observations	129,394	38,269
Adjusted R2	0.290	0.052

Table IA5. Public Listing and Product Inventions: Product Trademarks

This table presents the relationship between public listing and product inventions in terms of the launch and survival of new brands, as reflected in the number and survival ratio of new product trademarks. Trademark_prod denotes the log number of new product trademarks plus one. Survival_prod is the survival ratio of product trademarks, calculated as the log of the ratio of newly registered product trademarks that survive at the 6th year maintenance threshold plus one. Public is a dummy variable that equals one for public-listed firms. All other variables are defined in the Appendix. The sample period for trademarks is from 1984 to 2014, while for survival ratios, the sample period ends at 2007, due to the time needed to evaluate whether a trademark survives. Detailed definitions can be found in Appendix B. p-values are calculated based on standard errors clustered at the firm level and are in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) Trademark_Prod	(2) Survival_Prod
Public	**0.245*** **	**-0.045*** **
	(0.000)	**(0.000)**
Size	0.024***	-0.001***
	(0.000)	(0.000)
ROA	0.417***	0.096***
	(0.000)	(0.000)
Leverage	0.134***	-0.030***
	(0.000)	(0.001)
Age	0.043***	0.012***
	(0.000)	(0.000)
ADV	0.131***	-0.013
	(0.000)	(0.136)
ADV_D	-0.059***	0.022***
	(0.001)	(0.007)
RD	-0.159**	0.057*
	(0.029)	(0.083)
RD_D	-0.175***	0.006
	(0.000)	(0.350)
Constant	0.388***	0.376***
	(0.000)	(0.000)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	118,795	33,206
Adjusted R2	0.265	0.055

Table IA6. Product Inventions and Future Operating Performance

This table presents the relationship between product inventions and future operating performance. ROA is return on assets calculated three-years and five-years ahead in column (1)/(3) and (2)/(4), respectively. Trademark denotes the log number of new trademarks plus one. Survival is the survival ratio of trademarks, calculated as the log of the ratio of newly registered trademarks that survive at the 6th year maintenance threshold plus one. All other variables are defined in the Appendix. The sample period for trademarks is from 1984 to 2014, while for survival ratios, the sample period ends at 2007, due to the time needed to evaluate whether a trademark survives. Detailed definitions can be found in Appendix B. p-values are calculated based on standard errors clustered at the firm level and are in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) ROA t+3	(2) ROA t+5	(3) ROA t+3	(4) ROA t+5
Trademark	**0.013***** **(0.000)**	**0.016***** **(0.000)**		
Survival			**0.038***** **(0.000)**	**0.036***** **(0.000)**
Size	-0.000** (0.035)	-0.000** (0.015)	0.000*** (0.000)	0.000*** (0.000)
	0.580*** (0.000)	0.487*** (0.000)	0.565*** (0.000)	0.481*** (0.000)
Leverage	0.060*** (0.000)	0.068*** (0.000)	0.066*** (0.000)	0.064*** (0.000)
Age	0.008*** (0.000)	0.007*** (0.000)	0.012*** (0.000)	0.011*** (0.000)
ADV	0.058*** (0.000)	0.059*** (0.000)	0.064*** (0.000)	0.066*** (0.000)
ADV_D	0.012*** (0.000)	0.010*** (0.000)	0.011*** (0.000)	0.009*** (0.004)
RD	-0.152*** (0.000)	-0.217*** (0.000)	-0.072 (0.129)	-0.129** (0.030)
RD_D	-0.005 (0.290)	-0.009 (0.165)	-0.005 (0.351)	-0.014** (0.039)
Constant	-0.040*** (0.000)	-0.026*** (0.004)	-0.049*** (0.000)	-0.022* (0.055)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	87,906	69,871	32,998	29,821
Adjusted R2	0.453	0.374	0.429	0.340