Fiscal Year-End Patents*

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Abstract

We investigate whether inventors opportunistically file low-quality patents during the fiscal year-end (FYE) month due to the pressure from annual performance appraisals. We find that US public firms file 43% more patents in FYE months compared to other months. This pattern persists over time, across various firm sizes, industries, and technologies, and extends internationally. These additional patents, compared to their counterparts, exhibit significantly lower quality and lead to lower future firm performance. Furthermore, the seasonality is more pronounced among inventors with less experience and poor track records, who face heightened performance appraisal pressures. Our findings suggest that opportunistic behavior contributes to the excessive filing of low-quality patents, a significant issue in the innovation system.

Keywords: Inventors, opportunistic behavior, patent filing, fiscal year-end, patent quality, annual performance appraisals.

JEL Classification: O31, J24, M52

High-quality innovation is essential for economic growth and firm performance (e.g., Hall et al. 2005; Kogan et al. 2017; Hirshleifer, Hsu, and Li 2018). However, there is longstanding criticism that an excessive number of poor-quality patents are issued (Pakes 1986; Hall, Jaffe, and Trajtenberg 2001). These low-quality patents discourage R&D, hinder commercialization, and increase litigation risk, consequently harming firm operations and innovation incentives (e.g., Frakes and Wasserman 2015; De Rassenfosse et al. 2021).[1] Additionally, low-quality patents significantly impede the efficiency of the patenting process. For example, as of September 2024, United States Patent and Trademark Office (USPTO) has a backlog of 793,824 unexamined patent applications.[2] On average, a patent application takes over a year to be assigned to a USPTO examiner.

Previous studies have examined fundamental drivers of patent quality, including firm characteristics, CEO traits, financial intermediaries, government policies, corporate events, and patent examiner attributes.[3] In this paper, we differ from prior research by examining whether *opportunistic behavior* contributes to the prevalence of low-quality innovation. Specifically, we investigate whether opportunistic behavior by inventors can result in increased filings of low-quality patents.

Inventors, like other employees, experience pressure from performance appraisals. Performance appraisal has been a widely practiced management activity for centuries (Burke and Wilcox 1969; Lansbury 1988; Islam and Rasad 2006). The majority of employers in the US

[1] This issue has also attracted media attention. For example, a 2012 Wall Street Journal article reports that low-quality patents cause increased litigation (https://www.wsj.com/articles/SB10001424052702303513404577351723039568072).
[2] See https://www.uspto.gov/dashboard/patents/production-unexamined-filing.html.
[3] An incomplete list of this literature includes Audretsch (1995), Balasubramanian and Lee (2008), Makri, Hitt, and Lane (2010), Becker-Blease (2011), Hirshleifer, Low, and Teoh (2012), Valentini (2012), He and Tian (2013), Mukherjee, Singh, and Žaldokas (2017), Chemmanur et al. (2019), Righi and Simcoe (2019), Islam and Zein (2020), Chen, Hshieh, and Zhang (2021), Hegde, Ljungqvist, and Raj (2022), Shu, Tian, and Zhan (2022), Dyer et al. (2024).

conduct formal performance appraisals at least annually to determine employees' compensation and career outcomes, such as promotion and retention. For illustrative purposes, Figure 1 presents employee testimonies regarding the performance appraisal processes at Google (Panel A) and Microsoft (Panel B), sourced from Quora, a major social Q&A platform. As shown in Figure 1, it is common for firms to schedule performance reviews at the *fiscal year-end* (FYE), evaluating employees based on their ability to meet or exceed predefined objectives.

Does the performance pressure from annual performance appraisal prompt inventors to engage in opportunistic behavior by filing poor-quality patents to enhance their performance metrics? If such behavior occurs, it is likely to be more pronounced as the evaluation period concludes, specifically at the *fiscal year-end*. The answer to this question is not clear ex ante. On one hand, the number of patent filings is a crucial indicator in an inventor's performance review.[4] Additionally, the quantity of innovation output (number of patent applications) is more readily observable than patent quality, which often requires specialized expertise to evaluate and is subject to a significant time lag.[5] Consequently, inventors might be inclined to file low-quality patents to meet or surpass their targets, especially in the FYE month. On the other hand, inventors may avoid such opportunistic behavior due to concerns about their long-term reputation or due to the monitoring mechanisms institute by their firms.

Using data on all patents filed by US publicly listed firms from 1980 to 2019, we investigate three key questions. First, do inventors engage in disproportionally high patent filings in the FYE month? Second, do these additional patents have lower quality compared to other patents? Third, how do these patents impact firms' future performance?

[4] The most significant performance criteria for individual inventors are patent applications, conference papers, patent grants, and journal publications (Balasubramanian, Lee, and Sivadasan 2018).
[5] It takes more than three years for a patent to be granted from the application date (Lemley and Sampat 2012), and even longer for a patent to accumulate citations.

To address the first question, we begin by examining the seasonality of corporate patent filings throughout the year. We find that 10.12% of all patents are filed in December, a figure significantly higher than the average of 8.17% for other months. Notably, this spike in December patent filings is observed only for firms whose fiscal year ends in December, and is absent in firms with fiscal years ending in other months. Therefore, we focus on FYE patent filings for all sample firms. During our sample period, public firms file a total of 262,719 patents in the FYE months, significantly higher than an average of 183,589 patents filed in non-FYE months. This results in firms filing 43.1% more patents during FYE months compared to other months, a finding consistent with opportunistic behavior related to annual performance appraisals.

For comparison, we examine patent filings by individuals, government agencies, and universities. Unlike the corporate pattern, we do not find a similar surge in year-end patent filings for these groups, suggesting that the spike in FYE patent filings is a corporate phenomenon. Further analyses reveal that this surge in corporate FYE patent filings persists over time, across various firm sizes, industries, and technologies. Additionally, this pattern exists in other countries beyond the United States. For example, Chinese public firms exhibit an 120% increase in patent filings in December compared to other months during 2004 to 2023, given that all Chinse public firms have a fiscal year ending in December. This seasonality is robust when we conduct formal OLS and Poisson regression analyses that control for firm size, patent stock, as well as firm and year fixed effects.

Next, we address the second question by examining the quality of FYE patents. It is important to note that not all patent filings during the FYE months (FYE patents) are the results of opportunistic behavior. To differentiate between regular and opportunistic patent filings in the FYE months, we categorize FYE patents into spike patents (opportunistic) and non-spike patents (non-

opportunistic) based on the inventors' propensity to file patents in the FYE months. Specifically, if inventors exhibit an abnormally high propensity to file FYE patents in a year, their FYE patents in the year are more likely to be opportunistic behavior and are thus classified as *spike patents*. The remaining FYE patents are classified as non-spike patents. Under the hypothesis of opportunistic behavior by inventors, we anticipate that FYE patents, particularly spike patents, will exhibit significantly lower quality compared to other patents.

We follow the literature and construct five measures of patent quality: forward citations, truncation-adjusted citations (Hall, Jaffe, and Trajtenberg 2001, 2005), patent originality (Hirshleifer, Hsu, and Li 2018), an indicator variable for patents with no citation (Balsmeier, Fleming and Manso 2017), and an indicator variable for breakthrough patents (Singh and Fleming, 2010). We estimate patent-level regressions of patent quality, controlling for firm, art unit, and year fixed effects. The regression results show that FYE patents have significantly lower quality compared to other patents across all patent quality metrics. Further analyses reveal that this decline in patent quality for FYE patents is concentrated in spike patents rather than non-spike patents. The patent quality measures for spike patents are 7% to 10% lower compared to other patents. This decline in patent quality is consistent with the hypothesis of opportunistic patent filings.

To complement the analysis of patent quality, we follow the literature and examine the disclosure quality of spike patents (Dyer et al. 2024). Our findings indicate that, compared to other patents, spike patents have significantly lower disclosure quality. Specifically, spike patents have a shorter description section, reduced readability, and fewer figures and sheets. They also contain fewer claims, indicating narrower protection (Marco, Sarnoff, and Charles 2019; Ganglmair, Robinson, and Seeligson 2022). These results corroborate our findings on patent quality and lend further support to the opportunistic behavior hypothesis.

We next examine the relationship between spike patent filings and inventor characteristics. Inventors with less experience or a worse track record may face intensified scrutiny during performance appraisals, potentially leading to a greater propensity to file spike patents. We measure inventor experience using tenure and the number of past patents, and measure inventor past performance based on the average quality measures of the inventor's past patents. Consistent with our predictions, we find that inventors with less experience and weaker track records are significantly more likely to file spike patents.

Conversely, we find little relationship between spike patent filings and measures of CEO incentives, such as CEO horizon (proxied by remaining tenure and unexcised options) and firm performance (proxied by contemporary and historical financial performance and stock returns). Therefore, spike patent filings are likely the result of opportunistic behavior by inventors rather than firm managers.

We further analyze four cases where firms abandon the practice of annual performance appraisals during our sample period. If the FYE patent filings are due to annual performance appraisal, we would expect such behavior to significantly weaken after the abandonment of annual performance appraisal. Consistent with our prediction, we observe that the surge in FYE patent filings is significantly weakened after for these firms after the abandonment of annual performance appraisals. In contrast, there is no change in the FYE patent filings for their peer firms that do not abandon annual performance appraisals.

To address our third research question, we examine the relationship between spike patents and firms' future performance, as previous studies show that patent quality can significantly impact a firm's future financial performance and stock returns (e.g., Hirshleifer, Hsu, and Li 2018; Shu, Tian, and Zhan 2022). Given that spike patents are of lower quality than their peers, firms with a

higher proportion of spike patents in their patent stock may experience lower future financial performance. This effect should be more pronounced for firms with high innovation intensity, as innovation is pivotal to their performance.

We estimate firm-level regressions where the dependent variable is a measure of firm's future financial performance, including operating cash flow and ROA for the next two years. For firms with high innovation intensity (past patents above the annual sample median), the regression results indicate that a higher proportion of spike patents in patent stock leads to significantly lower future financial performance. For example, a one standard deviation increase in the proportion of spike patents in a firm's patent stock leads to a 0.92% decrease in the firm's ROA, which is a 13.1% decrease compared to the mean. Additionally, the results of Fama-MacBeth regressions of monthly stock returns also show that, for high innovation intensity firms, a higher proportion of spike patents leads to significantly lower future stock returns.[6]

We contribute to the literature on corporate innovation by being the first to document that opportunistic behavior contributes to the excessive filing of low-quality patents, a significant issue in contemporary innovation. Our findings suggest that inventor opportunism, driven by the pressure of annual performance appraisals, can substantially increase patent filings in the FYE months. These additional patents, compared to their counterparts, exhibit significantly lower quality and lead to diminished firm performance. It is worth noting that spike patents may represent only the visible portion of opportunistic behavior in patent filings, as such behavior could also occur during non-FYE months, albeit to a smaller scale.

Our paper also contributes to the literature on the opportunistic behavior driven by fixed-term performance evaluations. For example, previous studies show that mutual fund managers

[6] We also examine firms with low innovation intensity and find that, consistent with our prediction, there is little relationship between the proportion of spike patents and future financial performance and stock returns.

may mislead investors by engaging in portfolio pumping (tape painting) or window dressing at quarter- and especially year-ends to opportunistically showcase their portfolio management skills and attract fund inflows (e.g., Lakonishok 1991; Chevalier and Ellison 1997; Musto 1999; Carhart et al. 2002; He, Ng, and Wang 2004; Ng and Wang 2004; Agarwal, Gay, and Ling 2014; Hu et al. 2014; Patel and Sarkissian 2021; Wang 2024). We extend this literature by finding that inventors also engage in opportunistic patent filing behavior due to the pressure from annual performance appraisals, and this behavior significantly impacts corporate innovation and patent quality.

1. INSTITUTIONAL BACKGROUND

1.1 Patent Filing Process

The patent filing process in a firm begins with inventors submitting one- to two-page disclosure note outlining their idea to the internal review committee. This committee typically comprises senior managers from the R&D department and staff from the legal department (internal lawyers). The internal committee assesses the idea's patentability. If the committee approves the idea for a patent application, the process of drafting the patent application begins. The inventors are responsible for preparing the patent applications, with potential input from the internal lawyer. Once the patent application is finalized, it is filed with the relevant USPTO patent office, either by an internal lawyer or externally hired lawyer. The lawyer also handles further negotiations with USPTO patent examiners until the patent is granted.

The time from management approval to filing typically ranges from two weeks to one year, with 72% of cases taking less than three months (Balasubramanian, Lee, and Sivadasan 2018). This relatively short interval between internal approval and filing enables inventors to opportunistically file more patents in the fiscal year end month, especially for those are familiar with their firms' patent filing procedures.

One may wonder whether the surge in FYE patent filings could be driven by the incentives of external lawyers rather than inventors, given that the majority of firms hire external lawyers to assist inventors in completing the patent applications. This, however, is unlikely, as external law firms typically operate on a monthly billing cycle. As a result, external lawyers have an incentive to meet monthly deadlines to receive payments sooner, rather than concentrating their efforts towards the fiscal year-end. Moreover, we show that the surge in patent filings is concentrated in the companies' FYE months, rather than being a December phenomenon. It is unlikely that these companies' law firms share the same fiscal year-ends as their clients.

1.2 Performance Review of Inventors

Balasubramanian, Lee, and Sivadasan (2018) conduct a survey among the 140 inventors, where 130 of them consider patent applications as a crucial criterion in their performance reviews. The other three main criteria are conference papers (cited by 128 inventors), paper publications (127 inventors), and patent grants (127 inventors). Among these four main criteria, patent grants receive the highest importance score of 6.65 out of 10, followed by patent applications (6.38), conference papers (4.21), and paper publications (4.17).

If inventors wish to engage in opportunistic behavior to boost their performance before the annual performance review, increasing the number of patent filings is the most viable method. This is because the patent filing date is relatively easier for inventors to control (see our discussion in the previous section). In contrast, controlling the timing for the other three criteria is far more challenging. Inventors cannot set the dates of conferences, and conference paper acceptance is determined by the conference committee, making it beyond their control. Similarly, paper publication and patent grants are time-consuming processes with unpredictable timelines. For instance, it often takes over a year for a patent application to be assigned to an examiner and more

than three years for it to be granted. Therefore, inventors are both capable and have incentives to opportunistically file more patents in the fiscal year end to meet or exceed predefined objectives.

2. DATA AND SAMPLE CONSTRUCTION

2.1 Data

We obtain the data of all patents filed in the United States between 1980 and 2019 from the USPTO, including patent application number, patent number, filing date, examiner art unit, and technology class. We then match the patents to public firms using the patent-public firm linkage file from the KPSS database.[7] Our sample includes *granted* patents, as the KPSS linkage file covers only the granted patents for public firms. We obtain inventor information and the patent text from the PatentView database, CEO compensation data from the Capital IQ database, financial information from the Compustat database, and monthly stock returns from the CRSP database.

We obtained patents filed with the China National Intellectual Property Administration by Chinese listed firms from the CSMAR database. To identify patents filed with the USPTO by other countries or regions, we retrieved the patent applicant's country code from the PatentView database. Information regarding the nature of patent applicants, whether they are individuals, corporations, government agencies, or universities, also came from the PatentView database. To control for outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

2.2 Summary Statistics

Table 1 presents the summary statistics of the variables used in our analyses. Our final sample comprises 2,259,596 patents filed by US public firms during 1980 to 2019. On average, patents in our sample receive 12.98 future citations, and about 24% of patents in our sample receive

[7] We thank the authors of Kogan, Papanikolaou, Seru, and Stoffman (2017) for making this dataset available at https://github.com/KPSS2017/Technological-Innovation-Resource-Allocation-and-Growth-Extended-Data.

zero future citations. A patent in our sample on average contains 17 claims. The originality is about 9, indicating that, on average, the patents in our sample cite patents from 9 different technology subclasses. The average number of words in the description section is 4,830. Additionally, a patent document in our sample, on average, contain 12 figures and 9 sheets.

In a given year during our sample period, an average inventor in our sample has nine years work experience and have filed 23 patents. At the firm-year level, firms in our sample have a patent stock of 284 patents, with a firm age of about 22 years, R&D expenditures (scaled by total assets) of 0.09, and an ROA of -0.07. At the firm-month level, firms in our sample file about 4 patents each month. The average monthly stock return is about 1%. Detailed variable definitions are provided in Appendix A.

3. EMPIRICAL ANALYSIS: FISCAL-YEAR END PATENT FILINGS

3.1 Seasonality in Corporate Patent Filings

We begin by examining whether there are seasonal patterns in corporate patent filings throughout the year. Panel A of Figure 2 plots the monthly distribution of patent filings by U.S. public firms from 1980 to 2019. We observe a pronounced spike in patent filings during December, with 10.12% of all patents filed in December alone, which is significantly higher than the average of 8.17% for each of the months from January to November.

Since the annual performance review is conducted at the end of fiscal year rather than the end of calendar year, we further investigate whether this pattern is attributable to the surge in patent filings at the fiscal year-end rather or at the calendar year-end. We separate our sample firms into two groups: firms whose fiscal year ends in December and those with fiscal year ends in other months. Panel B of figure 2 shows that firms with December fiscal year-ends demonstrate a spike in patent filings in December, mirroring the trend seen in the full sample. Interestingly, Panel C of

figure 2 shows that firms with fiscal year ends in other months do not show any increase in patent filings for December. This distinction suggests that the increase in patent filings is a fiscal year-end phenomenon, consistent with the pressure from annual performance review.

Therefore, we focus on the seasonal patterns in patent filings through the fiscal year for all our sample firms. In Figure 3, we plot the distribution of patent filings by months within the fiscal year. During 1980 to 2019, public firms file a total of 262,719 patents in the final month of the fiscal year. This contrasts with an average of 183,589 patents filed in a non-fiscal year-end month. This indicates that firms file 43.1% more patents in the last month of the fiscal year compared to other months. Moreover, Figure 4 plots the annual difference in patent filings between the fiscal year-end month and other months for each year during our sample period. We find that the surge in patent filings at the fiscal year-end is a consistent pattern in every year of our sample period.

We further examine whether this seasonality is unique among corporate patent filings or a broad trend affecting all patent filers. In Figure 5, we focus on patents that are filed by individuals (Panel A), government agencies (Panel B), and universities (Panel C). Contrary to the corporate pattern, we do not find a similar surge in year-end patent filings for these groups.

We then examine if the seasonality in patent filings is concentrated in certain types of firms or technology fields. Figure 6 shows that the seasonality in patent filings is pervasive across all industries, as classified by one-digit SIC codes (Panel A), except for the agriculture industry, and across the different USPTO technology classes, as defined by the examiner art units (Panel B). Moreover, Figure 7 shows that the seasonality is pronounced across all firm size groups classified by market capitalization (Panel A) or total assets (Panel B). These results suggest that the tendency for end-of-fiscal-year increases in patent filings is a general phenomenon.

One concern is that since our sample include only granted patents, the surge in FYE patents

could be driven by a higher grant rate for patent applications filed in the FYE month compared to other months.[8] For example, if the patent applications filed in FYE months are of higher quality relative to other months, then even if firms file the same number of patent applications in the FYE month as in other months, they will have a higher number of *granted* patents filed in the FYE month. To address this concern, we calculated the grant rate for patent applications filed in a month as the number of patents filed in the month and are eventually granted, scaled by the total number of patent applications filed in the month. As shown in Figure 8, the grant rate for patent applications filed in December is slightly lower (rather than higher) compared to other months. We acknowledge that this analysis does not distinguish between public firms and other types of patent applicants.[9] However, given that more than 65% of public firms have their fiscal year-end in December, this finding provides suggestive evidence that the surge in FYE patents for public firms are unlikely driven by higher grant rates for FYE patent applications.

Finally, we examine whether the surge in fiscal-year end patent filing also extends beyond the US. We first examine the seasonality of patents filed by Chinese public firms with the China National Intellectual Property Administration. We obtain the patent data of Chinese public firms during 2004 to 2023 from the CSMAR database. Note that all publicly listed firms in China have a fiscal year ending in December. Panel A of Figure 9 shows that, similar to the US, there is a pronounced spike in patent filings in December, with 16.64% of all patents filed in December alone, significantly higher than the average of 7.58% for each of the months from January to November. Therefore, the spike in patent filings by Chinese public firms is even higher than their US counterparts.

[8] Note that it takes on average over a year for a patent application to be assigned to a USPTO examiner, so it is uncertain in which months the application will be assigned and reviewed.

[9] We are unable to conduct this analysis for the subsample of public firms because the KPSS linkage file includes only the *granted* patents of public firms.

Next, we examine patents filed with the USPTO by other countries or regions, including Australia, Germany, Switzerland, the UK, Finland, France, Taiwan, Japan, China, and Korea. We included these countries or regions because their companies have homogeneous fiscal year and their companies filed more than 10,000 patents with the USPTO from 1980 to 2019. For example, Japanese firms have a fiscal year-end in March, Australian firms in June, and German and Swiss firms in December. Panel B of Figure 9 shows the percentage difference between patents filed in the FYE month and the average patent filings in other months. Similar to the US, there is a pronounced spike in patent filings in the FYE month, with the percentage difference ranging from 5% to 50%. These results demonstrate that the FYE patent spike exists globally.

Finally, we conduct formal regression analysis to further examine the seasonality in corporate patent filings. We estimate firm-level panel regressions of monthly patent filings, where the dependent variable is the number of patent filings for a given firm-month. The main independent variable is *FYE*, a dummy variable for the final month of the fiscal year. We control for firm size and patent stock, as well as firm and year fixed effects.[10] We report t-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level. For robustness, we conduct both Ordinary Least Squares (OLS) regressions and Poisson regressions (Cohn, Liu and Wardlaw, 2022). Table 2 presents the regression results. The coefficient of *FYE* is significantly positive in all models. For example, the coefficient in the OLS regression (Column 2) indicates that firms file 1.30 more patents in the FYE month relative to other months, or a 33.8% increase from the sample mean of 3.85 patents per month. Similarly, the coefficient in the Poisson regression (Column 4) indicates a 31.5% increase in patent filings in the FYE month.

3.2 FYE Patent Filings and Opportunistic Behavior: Analysis of Patent Quality

[10] The regression sample includes only firms that file at least one patent in a year.

If the fiscal-year end spike in corporate patent filings is associated with opportunistic behavior, we would expect the corresponding patents filed in the fiscal year end month to be of lower quality compared to those filed in other months.

To test this prediction, we follow the literature and construct five measures of patent quality. The first two measures are the total number of forward citations and the truncation-adjusted citations (Hall, Jaffe, and Trajtenberg 2001, 2005). The third measure is patent originality, which assess the ability to combine different technologies in a novel way (Hirshleifer, Hsu, and Li 2018). The fourth measure is a dummy variable for a patent receiving no citation (Balsmeier, Fleming and Manso 2017), and the fifth measure is a dummy variable for breakthrough patents with citations in the top 5 percent out of all patents (Singh and Fleming 2010).

We estimate patent-level regressions of patent quality using patents filed by the US public firms. The dependent variable is one of the patent-quality measures, and the main independent variable is *FYE Patent*, a dummy variable for patents filed in the FYE month. We control for firm, art unit, and filing year fixed effects and report t-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level.

Panel A of Table 3 presents the regressions using the two citation measures based on raw citations and truncation-adjusted citations. The coefficient of *FYE Patent* is significantly negative, which reveals a significant decrease in quality for patents filed in the last month of the fiscal year. The results are also economically significant. For example, patents filed at the end of the fiscal year receive 4.0% fewer raw citations and 3.7% fewer adjusted citation compared to patents filed in other months.

In Panel B of Table 3, we present the regressions using the other three patent quality measures. The coefficient of *FYE Patent* is significantly negative in Columns (1) and (3), and

significantly positive in Column (2). The results consistently indicate that FYE patents have significantly lower quality than patents filed in the other months. Specifically, FYE patents are less novel and less likely to be breakthrough patents, but more likely to receive no citations in the future. The results also show economic significance, suggesting that patents filed at the fiscal year-end month exhibit lower quality, with differences ranging from 2% to 5% based on these measures. Overall, the results in Table 3 suggest that the surge in FYE patent filings is associated with opportunistic behavior as the FYE patents have significantly lower quality.

3.3 Identifying Spike Patents Associated with Opportunistic Behavior

As shown in Table 3, the overall quality difference between FYE patents and patents filed in other months does not seem to be very large (2%-5% lower quality for FYE patents). However, it is worth noting that FYE patents include both normal patents and the ones with opportunistic behaviors. That is, not all patent filings in the FYE month are opportunistic. Therefore, the quality difference observed in Table 3 underrepresents the reduction in quality caused by opportunistic patent filings.

To distinguish normal and opportunistic patent filings in the FYE month, we divide FYE patents into two groups, namely spike patents (opportunistic) and non-spike patents (non-opportunistic) based on inventors' tendency of filing FYE patents. Specifically, for each FYE patent, we first calculate the tendency of FYE patent filings for each of its inventors (FYE tendency), defined as the proportion of the inventor's FYE patent filings among all her patent filings in the year. We then calculate the average inventor FYE tendency for the patent. For example, consider a patent is filed by inventors A, B, and C. Inventor A's FYE tendency is 1/12, i.e., 1/12 of her patent filings in this year are in the FYE month. Inventor B and C's FYE tendencies are 1/3 and 3/4, respectively. Then the average inventor FYE tendency of the patent is

(1/12+1/3+3/4)/3=0.389. We classify a FYE patent as spike patent if its average inventor FYE tendency is above the median of the FYE patents in the previous year. The intuition of this approach is that if inventors engage in abnormally high FYE patent filings in the year, then their FYE patents are more likely to result from opportunistic behavior.

Table 4 presents the results of patent quality for the two subgroups of FYE patents: spike patents and non-spike patents. Panel A of Table 4 presents the regression of citation measures based on raw and adjusted citations using the full sample. The coefficient of *Spike Patent* is significantly negative in all models. The results are also economically significant, as they indicate that spike patents receive 6.9% fewer raw citations and 7.9% fewer adjusted citations compared to other patents. These figures are much larger than the baseline analysis, suggesting that the classification of spike patents helps us capture the abnormal FYE patent filings and sharpen the patent quality analysis.

We further compare the quality of spike patents and non-spike patents with patents filed in other months (non-FYE patents) separately. In Panel B of Table 4, we directly compare the quality differences between spike patents and non-FYE patents by excluding non-spike patents from the sample. The coefficients of *Spike Patent* are negative and significant, similar to those in Panel A. Panel C of Table 4 presents the results of quality differences between non-spike patents and non-FYE patents by excluding spike patents from the sample. The coefficients of *Non-Spike Patent* are marginally significant or insignificant with a small magnitude, suggesting that there are no significant quality differences between non-spike patents and non-FYE patents.

Table 5 is similar to Table 4, except we present the results of patent quality for the two subgroups of FYE patents using the other three patent quality measures, namely *Originality*, *No Citation*, and *Breakthrough Patent*. Panel A of Table 5 presents the regression of the three quality

measures using the full sample. The coefficient of *Spike Patent* is significantly negative in Columns (1) and (3), and significantly positive in Column (2). The results are also economically significant, as they indicate that spike patents have a lower quality ranging from 7% to 10% using these measures.

We further compare the quality of spike patents and non-spike patents with patents filed in other months separately using the three quality measures. In Panel B of Table 5, we directly compare the quality differences between spike patents and non-FYE patents by excluding non-spike patents from the sample. The coefficients of *Spike Patent* are negative and significant, similar to those in Panel A. Panel C of Table 5 presents the results of quality differences between non-spike patents and non-FYE patents by excluding spike patents from the sample. The coefficients of *Non-Spike Patent* are positively significant in Column (1), positively significant with much smaller magnitude compare to spike patents in Column (2) (0.022 and 0.004, respectively) or insignificant in Column (3). The results suggest that non-spike patents do not have a significantly lower quality, than non-FYE patents using these three quality measures.

For a robustness tests, we also use an alternative approach to detect the opportunistic patents among the FYE patents that further controls for firms' industries. Under this method, a patent is classified as *Spike Industry Patent* if its FYE tendency is above the median of firms in the same 2-digit SIC industry from the previous year. The results on patent quality are similar to the baseline analysis (Table B1 in Appendix B).

Our previous analysis shows that, unlike companies, other types of patent applicants such as individuals, government agencies, and universities do not exhibit abnormal FYE patent filing. For comparison with companies, we also examine the quality of patents filed in December by these groups of applicants. As shown in Table B2 in Appendix B, there are no significant quality

differences between these applicant's December patents and other patents, suggesting that the lower quality for firms' FYE patents results from the firms' surge in FYE patent fillings.

3.4 Disclosure Quality of Spike Patents

According to the requirements of 35 U.S.C. 112, a patent disclosure should be "full, clear, concise, and exact" to enable a person familiar with the technology to replicate the patented innovation. Existing literature shows that disclosure quality is a crucial dimension of patent quality that can significantly impact follow-on innovation (e.g., Dyer et al. 2024). Therefore, we further investigate whether spike patents also have lower disclosure quality compared to their peers. Following Dyer et al. (2024), we construct four measures of disclosure quality, including the number of words in the description section, text readability, and the number of figures and sheets. Patents with a longer description section, easier readability, and more figures and sheets exhibit higher disclosure quality.

Panel A of Table 6 presents the results of the number of words in the description section. The coefficient of *Spike Patent* is significantly negative, indicating that spike patents have a shorter description section compared to other patents. Panel B of Table 6 presents the results on the text readability of the description section. To assess text readability, we utilize three measures: *Gunning Fog*, *Automated Readability*, and *Flesch Reading*. The Gunning Fog index estimates the years of formal education required to understand a text on the first reading, with a higher value indicating less readability. The Automated Readability index determines the U.S. grade level needed to read a piece of text, with a higher value indicating less readability. In contrast, the Flesch Reading index rates texts on a scale from 0 to 100, with higher scores indicating easier readability. We multiply the Flesch Reading score by -1 to make all three measures indicate readability in the same direction. The coefficient of *Spike Patent* is significantly positive in all models, indicating that spike patents

have lower readability compared to other patents.

Panel C of Table 6 presents the results on the number of figures and sheets in the patent text. Many patents have a spatial nature, where figures and sheets serve as effective tools for conveying information about complex concepts. Additionally, figures and sheets can succinctly summarize information and enhance the transparency of the disclosure. We find that the coefficient of *Spike Patent* is significantly negative in both models, suggesting that spike patents contain fewer figures and sheets in the patent text compared to their peers.

To complement the disclosure quality measures based on textual analysis, we use an alternative measure of disclosure quality based on the number of claims in a patent. Patents with more claims offer broader protection, indicating higher patent quality (e.g., Marco, Sarnoff, and Charles, 2019; Ganglmair, Robinson, and Seeligson, 2022). In Panel D of Table 6, Column (1) shows that spike patents have significantly fewer claims than their peers. In Columns (2) and (3), we further divide claims into independent and dependent claims. Independent claims are more important than dependent claims, as the latter outline specific applications or embodiments that fall under the broader concepts established by the former (Marco, Sarnoff, & Charles, 2019). We find that the coefficient of *Spike Patent* is significantly negative in both regressions, and the coefficient is larger and more significant in the regression of independent claims than that of dependent claims. Overall, the results in Table 6 provide further evidence that spike patents have significantly lower quality compared to their peers.

4. FURTHER ANALYSES ON INVENTOR OPPORUNITIC BEHAIVOR

The surge in spike patent filings is consistent with inventors' opportunistic behavior due to the pressure from annual performance appraisal. In this section, we further examine the explanation based on opportunistic behavior by investigating the relation between spike patent

filings and inventor characteristics. Next, we evaluate an alternative explanation based on managerial opportunistic behavior.

4.1 Spike Patent Filings and Inventor Characteristics

It has been well documented that individuals' career concerns influence their decision-making (Prendergast and Stole 1996; Holmstrom 1999). Inventors with less experience or a worse track record may be subject to intensified scrutiny during performance appraisals, potentially leading to a more pronounced tendency of opportunistic behaviors. As a result, we expect these inventors to have a greater tendency to file spike patents than their peers. To test this prediction, we estimate an inventor-patent level regression where the dependent variable is a dummy variable for spike patents, and the primary independent variable is a measure of inventor experience or past performance.

Panel A of Table 7 presents the regression analysis for inventor experience. We construct two measures of inventor experience based on the inventor's tenure and the historical number of patents filed by the inventor up to the previous year. The results show that, consistent with our prediction, inventors with a shorter tenure and fewer past patents are more likely to file spike patents. The result is also economically significant. A one standard deviation decrease in the inventor experience based on historical patents leads to a 20.2% increase in the probability of filing spike patents relative to the mean.

Panel B of Table 7 presents the regressions for inventor past performance. We use three measures of inventor's past performance based on the average adjusted citations of an inventor's past patents, the average patent originality measure of the inventor's past patents, and the total number of breakthrough patents from the inventor up to the previous year. Consistent with our prediction, we find that inventors with worse track record are significantly more likely to file spike

patents.

A patent is typically filed by an invention team with an average of three members, and we include all inventors for each patent in the analysis. We conduct a robustness test by considering only the lead inventors for the patents and find similar results in Table B3 of Appendix B. Overall, the results in this subsection provides evidence supporting the inventor opportunistic behavior due to inventor performance appraisals.

4.2 Managerial Opportunistic Behavior?

Like inventors, CEOs undergo annual performance appraisals, which can significantly influence their compensation and career outcomes. As a result, managers could possibly instruct inventors to increase patent filings during FYE months to embellish their list of accomplishments, potentially explaining our findings. To investigate this alternative explanation based on managerial opportunistic behavior, we conduct two analyses focused on CEO's long-term incentives and past performance.

CEOs' long-term incentives can align their actions more closely with shareholder interests and reduce opportunistic behaviors (e.g., Eisenhardt, 1989; Makri et al., 2006). If spike patents are driven by CEOs' opportunistic behavior, we would expect these patent filings to be less pronounced among CEOs with stronger long-term incentives. We estimate firm-year level regressions where the dependent variable is *% Spike Patent*, defined as the number of spike patents scaled by the total patents filed in a year, and the primary independent variable is a measure of inventor CEO long-term incentives.[11]

We follow previous literature and construct two measures of CEO long-term incentives. The first measure, *Career Horizon*, is calculated as the estimated time remaining until a CEO's

[11] This analysis includes only firm-years with at least one patent filings, where *% Spike Patent* can be calculated.

departure due to retirement or termination (Antia, Pantzalis, and Park, 2010; Lee, Park, and Folta, 2018). The second measure, *Unexercised Options*, is calculated as the value of unexercised options scaled by total compensation.[12] Longer tenure and more unexercised options indicate a longer CEO horizon. Panel A of Table 8 presents the regressions results, in which the coefficients of CEO long-term incentives are insignificant across all models. The results are inconsistent with the spike patents being driven by CEO incentives.

We further investigate the explanation of CEO opportunistic behavior by examining the relation between spike patents and firm performance. CEOs with poorer performance may face increased pressure from performance appraisals, potentially leading to opportunistic behavior. Therefore, if spike patents are driven by CEO incentives, we would expect these patent filings to be more pronounced for firms with poor performance.

We employ stock return and ROA from the previous year and the current year as measures of CEO performance. In Panel B of Table 8, we find little relationship between these measures and spike patents, which is inconsistent with the hypothesis that spike patents are associated with CEO opportunistic behavior. Overall, the results in Tables 7 and 8 suggest that spike patent filings are likely the result of opportunistic behavior by inventors rather than firm managers.

4.3 Event Analysis: Abandonment of Annual Performance Appraisal

To further investigate the relationship between the surge in FYE patent filings and employee annual performance appraisals, we examine several events where firms abandon annual performance reviews. There is a growing trend among publicly listed firms to move away from the traditional annual performance reviews in favor of continuous and real-time feedback. This shift is driven by the time-consuming nature of annual performance reviews, which can negatively

[12] The sample period for the CEO analysis is from 1994 to 2019, as the first available year of detailed CEO compensation data in the Capital IQ database is 1994.

impact employee productivity and the relationship between employees and their managers. For example, in August 2015, General Electric's spokesperson, Laura Paredes, announced that GE had transitioned away from annual performance reviews in an effort to foster a more positive work environment and attract younger employees.[13] According to a Washington Post article, as of 2015, approximately 10% of Fortune 500 companies had eliminated annual performance reviews.[14]

If the abnormal FYE month patent filings are caused by the pressure from annual performance reviews, we would expect a less pronounced surge in FYE patent filings following the abandonment of annual performance review. Although there is no publicly available data for firms' annual performance review processes, we are able to identify four companies that abandon annual performance reviews during our sample period, using a report by the Society for Human Resource Management, the world's largest HR association.[15] The four companies include Medtronic PLC, Microsoft, General Electric, and Intel Corporation, which abandon annual performance reviews in 2012, 2013, 2015, and 2016, respectively.

Panels A to D of Figure 10 plot the percentage of FYE patent filings for these four companies before and after the abandonment of annual performance reviews. Consistent with our prediction, we find that for all four companies, the percentage of FYE patent filings experiences a significant decrease after the abandonment. To ensure that these results are not driven by a general trend of declining FYE patent filings, we examine four other large tech firms–Apple Inc, Micron Technology, Texas Industries Inc, and Procter & Gamble–in Panels E to H of Figure 10. In contrast to the four event firms, there is no observable decrease in FYE patent filings for these benchmark

[13] For details, see the CNBC article at https://www.cnbc.com/2015/08/19/general-electric-rethinks-from-annual-job-reviews.html.
[14] See the news article at https://www.washingtonpost.com/news/on-leadership/wp/2015/08/17/why-big-business-is-falling-out-of-love-with-annual-performance-reviews/.
[15] See https://www.shrm.org/topics-tools/news/employee-relations/annual-performance-review-dead.

firms. These findings provide further evidence that the surge in FYE patent filings is directly associated with annual performance appraisals.

5. SPIKE PATENTS AND FUTURE FIRM PERFORMANCE

Patent quality can significantly impact a firm's future financial performance and stock returns (e.g., Hirshleifer, Hsu, and Li, 2018; Shu, Tian, and Zhan, 2022). Our results so far indicate that spike patents are of significantly lower quality compared to other patents. In this section, we examine whether spike patents influence firms' future performance.

5.1 Spike Patents and Future Financial Performance

We begin by examining the relationship between spike patents and firms' future financial performance. Given that spike patents are of lower quality than their peers, firms with a higher proportion of spike patents in their patent stock may experience lower future financial performance. For this analysis, we focus on firms with high innovation intensity, as innovation is pivotal to their performance. For comparison, we also conduct a placebo test using firms with low innovation intensity.

We estimate firm-level regressions where the dependent variable is a measure of firm's future financial performance, including operating cash flow for the next year and the next two years, and *ROA* for the next year and the next two years. We exclude utility firms (SIC codes from 6000 to 6999) and financial firms (SIC codes from 4900 to 4999) for this analysis. The main independent variable is *Proportion Spike*, which is defined as the cumulative number of spike patents up to the current year, scaled by the total cumulative number of patents filed up to the current year (henceforth patent stock).[16] We follow the literature and control for a broad set of firm

[16] We require the firms that have filed at least one patent up to the current year

characteristics including patent stock, firm size, firm age, leverage, cash holdings, book-to-market, R&D expenditures, capital expenditures, PPE, as well as firm and year fixed effects. We report t-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level.

Panel A of Table 9 presents regressions of future financial performance for high innovation intensity firms. We define a firm as a high innovation intensity firm in a year if its patent stock in the year exceeds the annual sample median. We find that the coefficient of *Proportion Spike* is significantly negative in all models, showing that firms with a higher proportion of spike patents in the patent stock experience lower future financial performance. The results are also economically significant. For example, a one standard deviation increase in *Proportion Spike* leads to a 0.92% decrease in ROA, which is a 13.1% decrease compared to the mean.

For a placebo test, we present results for low innovation intensity firms in Panel B of Table 9. We find that, consistent with our prediction, the coefficient of *Proportion Spike* is statistically insignificant in all models. Taken together, the results in Panels A and B indicate that spike patents, relative to other patents, have a significantly negative impact on future financial performance in high innovation intensity firms.

5.2 Spike Patents and Future Stock Returns

If investors underreact to the negative impact of spike patents on firm performance relative to their peers, then firms with a higher proportion of spike patents in their patents stock may be overpriced and will likely experience lower returns when the overvaluation is corrected. In this subsection, we examine the relationship between spike patents and future stock returns.

We estimate Fama-MacBeth regressions where the dependent variable is the monthly stock return from July year t to June year t+1 and the independent variable is *Proportion Spike* of the year t-1. We further control for firm characteristics corresponding to price factors, including patent

stock, market capitalization, book-to-market, past one-year returns up to month -2, past one-month return, asset growth and ROE. We also control for industry fixed effects. We follow the literature and drop penny stocks that are priced below $5.

Panel A of Table 10 presents the regression results for high innovation intensity firms. The coefficients of *Proportion Spike* are negative and significant in all models, indicating that firms with a higher proportion of spike patents have lower future stock returns. Panel B is similar to Panel A, except we present the results for low innovation intensity firms. The coefficients of *Proportion Spike* are statistically insignificant, suggesting that there is no correlation between spike patents and future stock returns in low innovation intensity firms. These results are consistent with the financial performance results in Table 9.

6. CONCLUSION

This paper investigates whether inventors opportunistically file more low-quality patents in the fiscal year-end month due to the pressure from annual performance appraisals. Analyzing patents filed by US publicly listed firms from 1980 to 2019, we find that firms file 43% more patents in the fiscal year-end month compared to other months. This pattern is a corporate phenomenon, as it is absent in patents filed by individuals, government agencies, or universities. Furthermore, this pattern persists over time, across various firm sizes, industries, and technologies, and extends beyond the United States.

Further analyses show that, consistent with opportunistic patent filings, the FYE patents, particularly the spike patents (the opportunistic component of FYE patents), exhibit significantly lower patent quality and disclosure quality compared to other patents. Additionally, inventors with less experience or a worse track record, who may face intensified scrutiny during performance appraisals, are significantly more likely to file spike patents. Conversely, we find little relationship

between spike patent filings and measures of CEO incentives. We further examine four events where publicly listed firms abandon annual performance reviews, and find that the abnormal FYE patent filings become significantly less pronounced after the abandonment of annual performance reviews. Finally, we find that the opportunistic patent filings can negatively impact firm performance. Among innovation intensive firms, a higher proportion of spike patents in patent stock leads to significantly lower future financial performance and stock returns.

The excessive filing of low-quality patents has become a major issue in contemporary innovation system (Frakes, Melissa, and Wasserman 2015; De Rassenfosse et al. 2021). We are the first to provide evidence that opportunistic behavior contributes to this phenomenon, and our findings call for firms and regulators to implement improved monitoring and performance appraisal systems to mitigate potential opportunistic actions. While we focus on inventor behavior driven by performance appraisal pressure, future research could explore how other opportunistic behaviors by inventors and firms impact the quantity and quality of corporate innovation.

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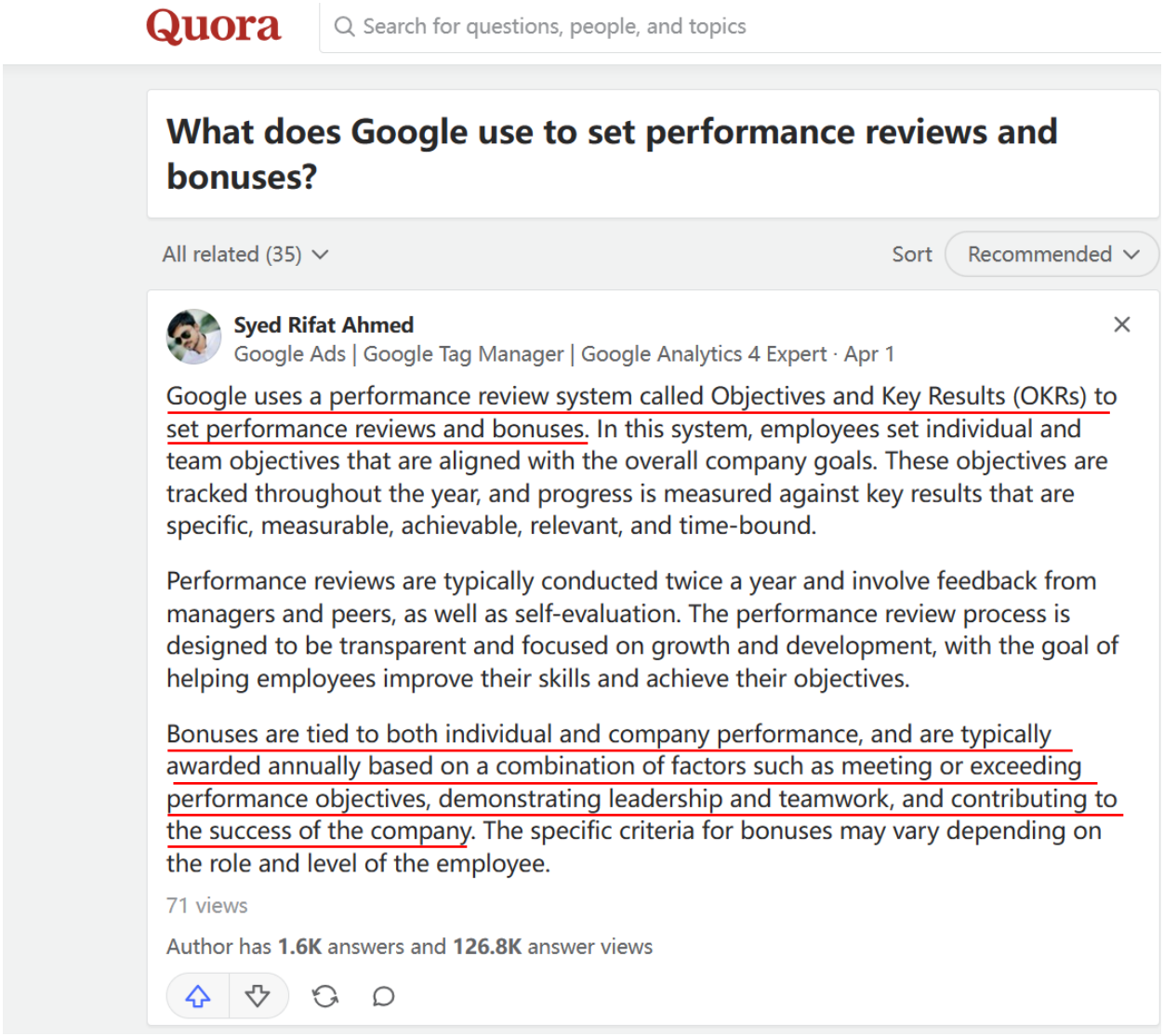
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Figure 1
Examples of Employee Performance Appraisal on Quora

This figure presents a webpage discussing employee performance appraisal at Google and Microsoft on Quora, a major social question-and-answer website. The discussion includes details about how and when the employee performance appraisal occurs in their respective companies. The page was downloaded on March 24, 2024.

Panel A: Discussion on Employee Performance Appraisal at Google



Panel B: Discussion on Employee Performance Appraisal at Microsoft

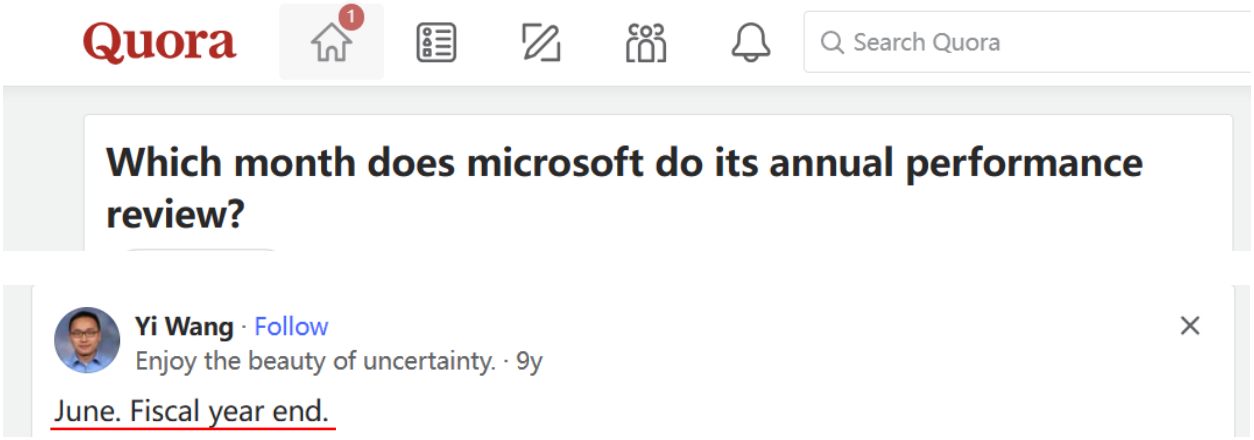
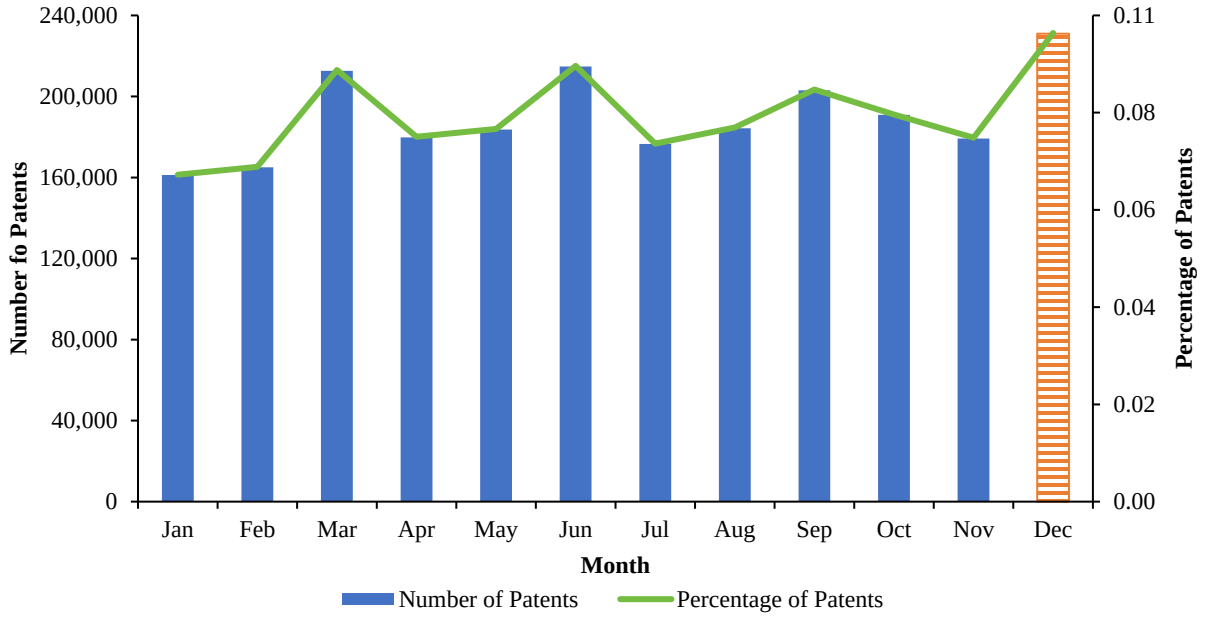


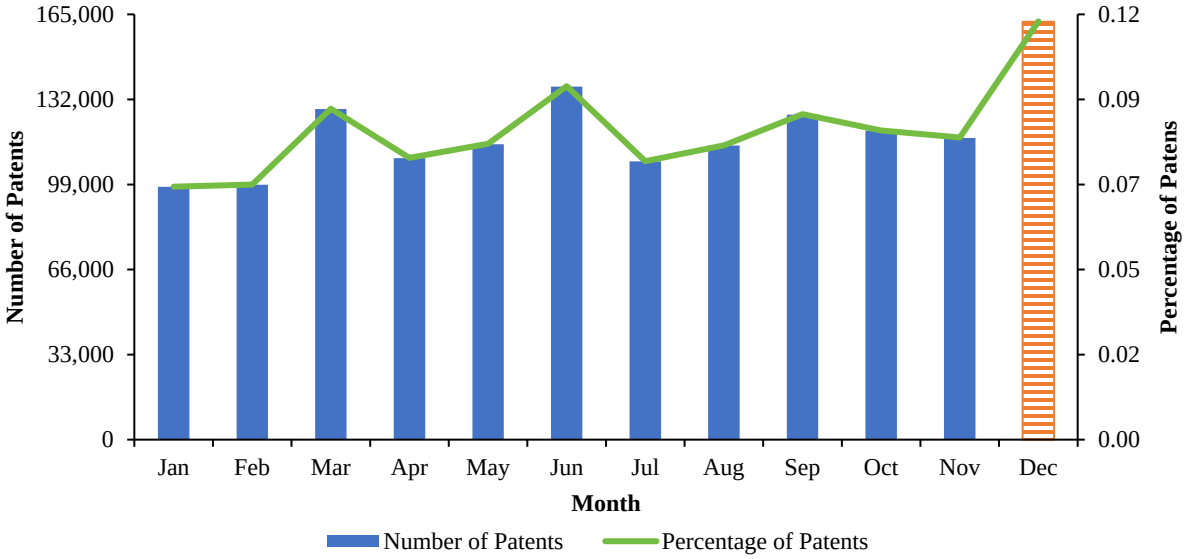
Figure 2
Patents Filed by US Public Firms Across Calendar Months

This figure presents patents filings by US public firms across calendar months. Panel A presents the number and percentage of patents filed by all public listed firms from 1980 to 2019. Panel B presents patents filed by firms with a fiscal year-end in December. Panel C presents patents filed by firms with a fiscal year-end in a month other than December.

Panel A: Patents Filed by Calendar Months



Panel B: Subsample of Firms Whose Fiscal Year-End Month is December



Panel C: Subsample of Firms Whose Fiscal Year Ends in Months Other Than December

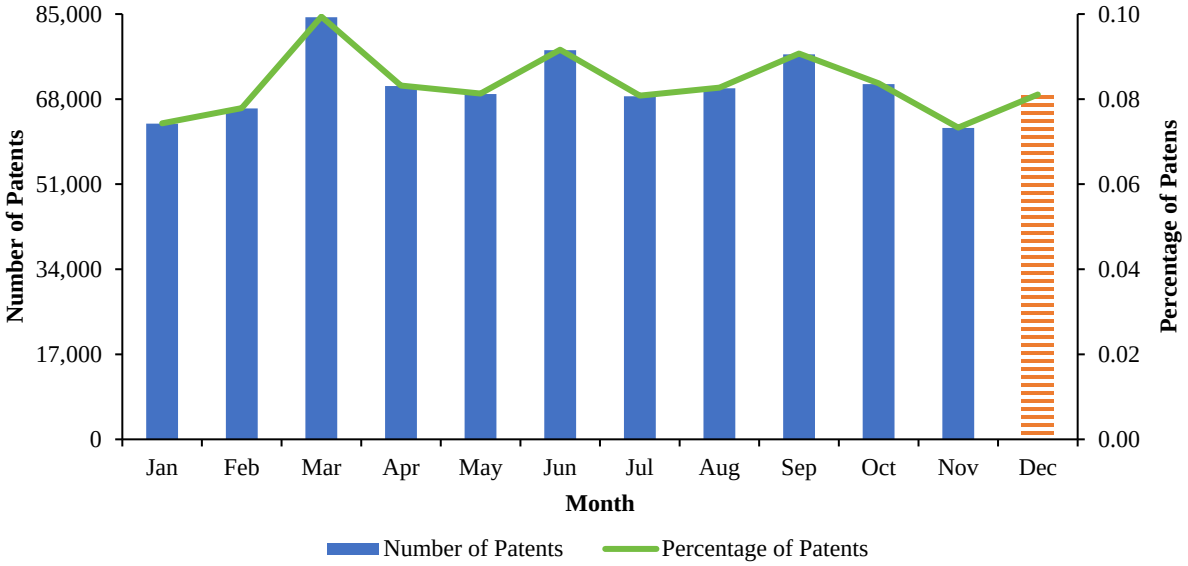


Figure 3
Patents Filed by US Public Firms Across Fiscal Months

This figure presents the number and percentage of patents filed by US public firms across fiscal months 1980 to 2019. FYE presents the fiscal year-end month.

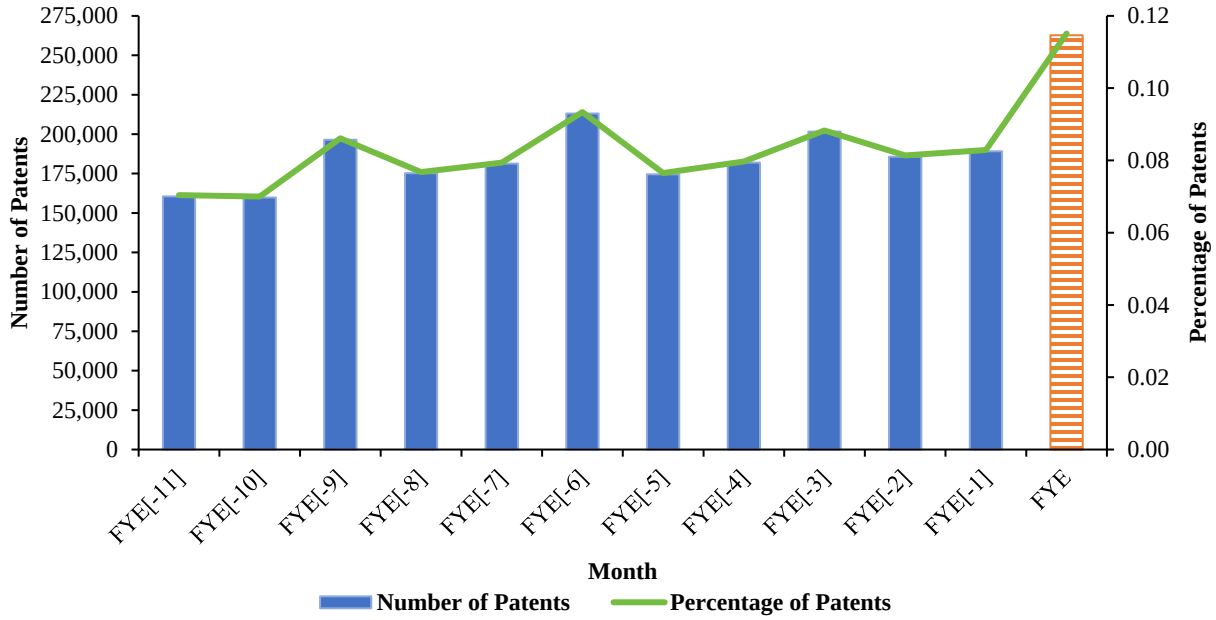


Figure 4

Differences in Patents Filed By US Public Firms Between Fiscal-Year End Month vs. Other Months

This figure presents the annual number and percentage differences between patents filed in the fiscal year-end month and other months from 1980 to 2019. The number difference is calculated as the number of patents filed in FYE month minus the average number of patents filed in other months. The percentage difference is calculated by scaling the number difference with the number of patents filed in the FYE month.

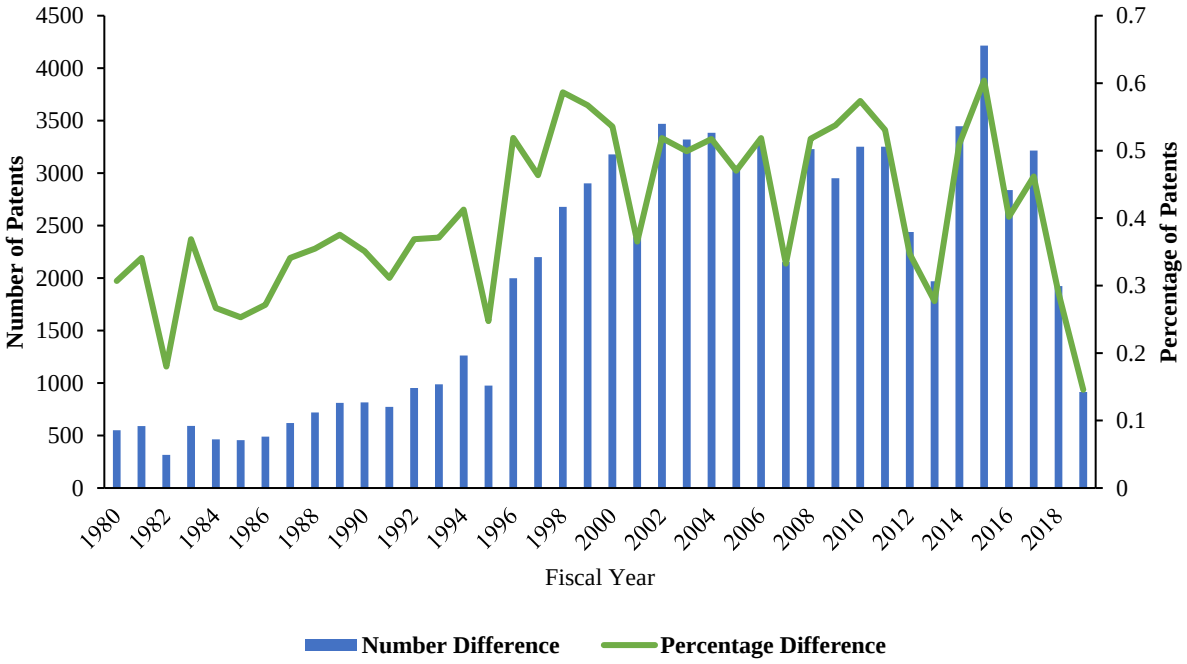
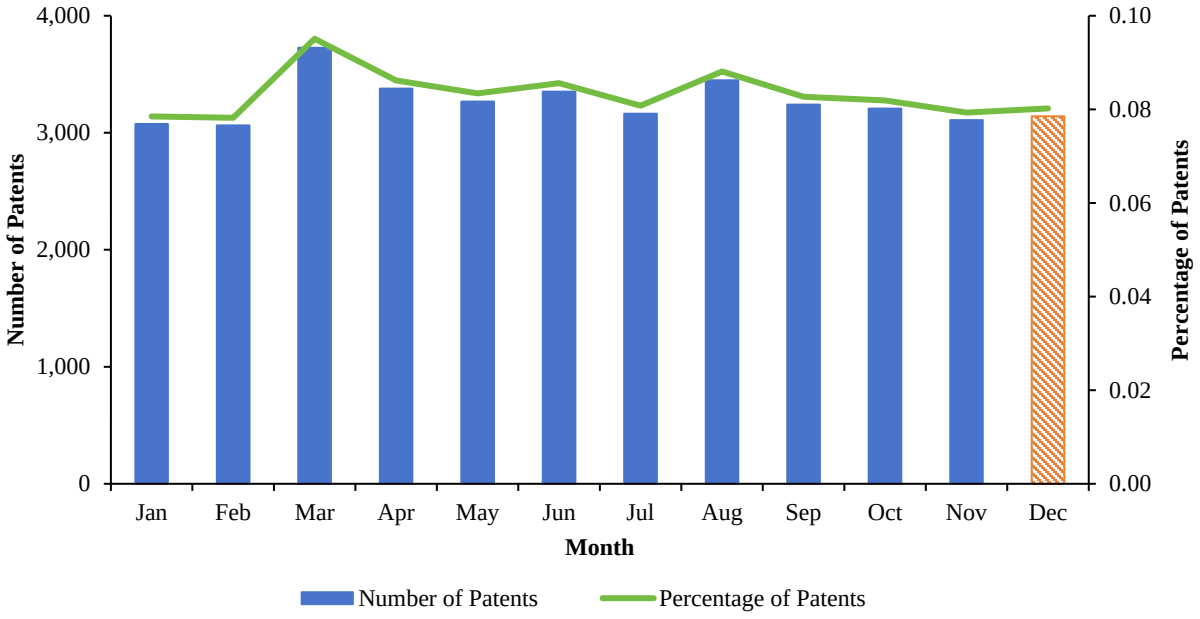


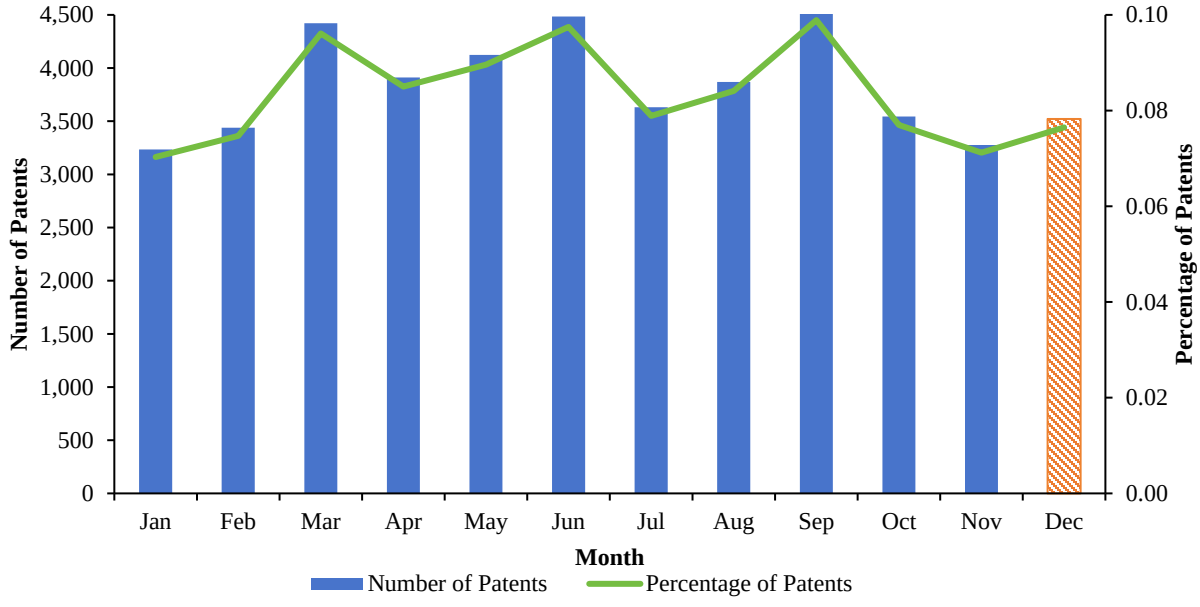
Figure 5
Patents Filed by Individuals, Government Agencies, and Universities

This figure presents the number and percentage of patents filed by individuals (Panel A), government agencies (Panel B), and universities (Panel C) across different calendar months.

Panel A: Patents Filed by Individuals



Panel B: Patents Filed by Government Agencies



Panel C: Patents Filed by Universities

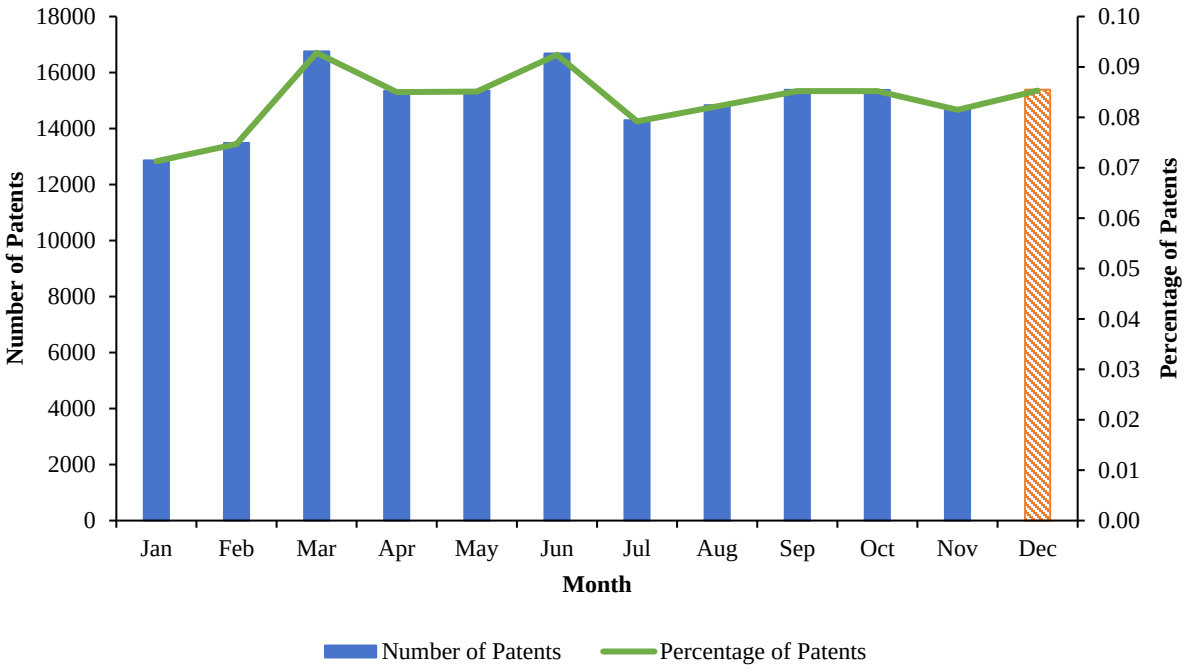
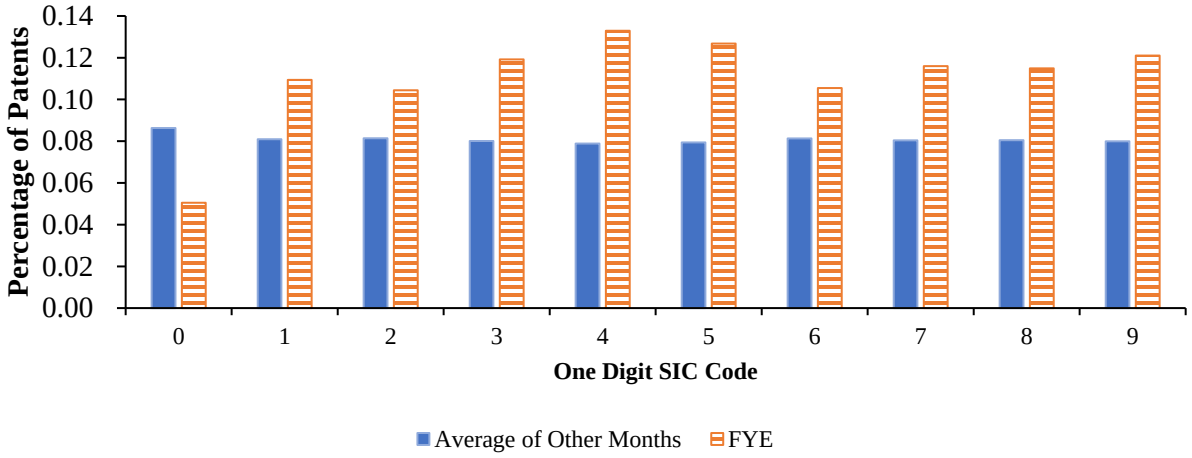


Figure 6
Surge in Fiscal-Year End Patent Filings: Subsamples of Industries and Technologies

This figure presents the surge in fiscal-year end patent filings across different industries and technology centers. Panel A presents the percentage of patents filed in the FYE month and the average of patents filed in other months for different industries. *FYE* represents the percentage of patents filed in the fiscal year-end month. *Average of Other Months* is the average percentage of patents filed in other months. We use the SIC one-digit code to categorize industries (0-Agriculture, Forestry, and Fishing, 1-Mining, 2-Construction, 3-Manufacturing, 4-Transportation, Communications, Electric, Gas, and Sanitary Services, 5-Wholesale Trade, 6-Retail Trade, 7-Finance, Insurance, and Real Estate, 8-Services, 9-Public Administration). Panel B presents the percentage of patents filed in the FYE month and the average of patents filed in other months for USPTO technology centers (1600-Biotechnology and Organic Chemistry, 1700-Chemical and Materials Engineering, 2100-Computer Architecture, Software, and Information Security, 2400-Computer Networks, Multiplex Communication, Video Distribution, and Security, 2600-Communications, 2800-Semiconductors, Electrical and Optical Systems and Components, 3600-Transportation, Construction, Electronic Commerce, Agriculture, National Security and License & Review, 3700-Mechanical Engineering, Manufacturing, Products).

Panel A: Industry



Panel B: Technology Center

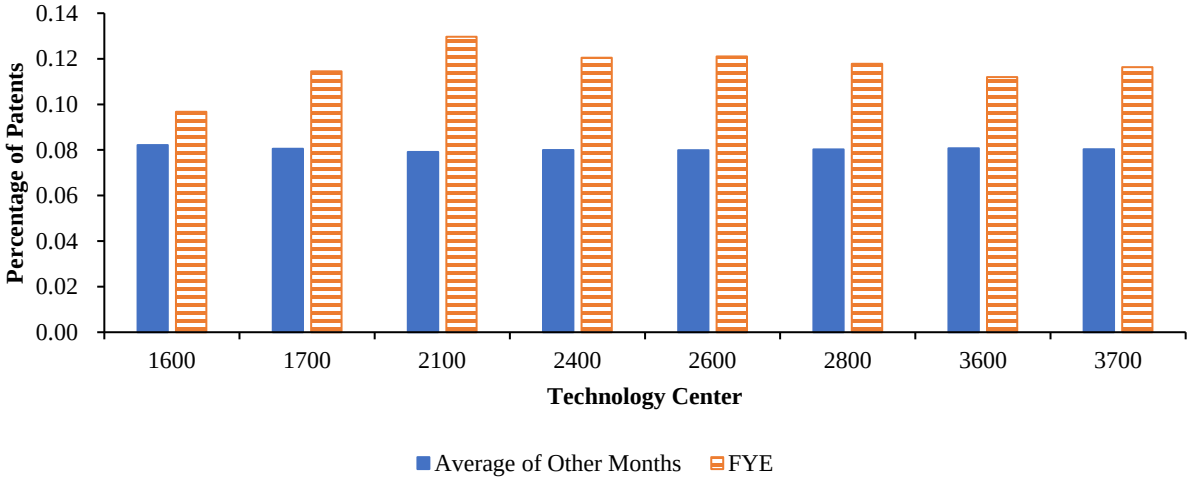
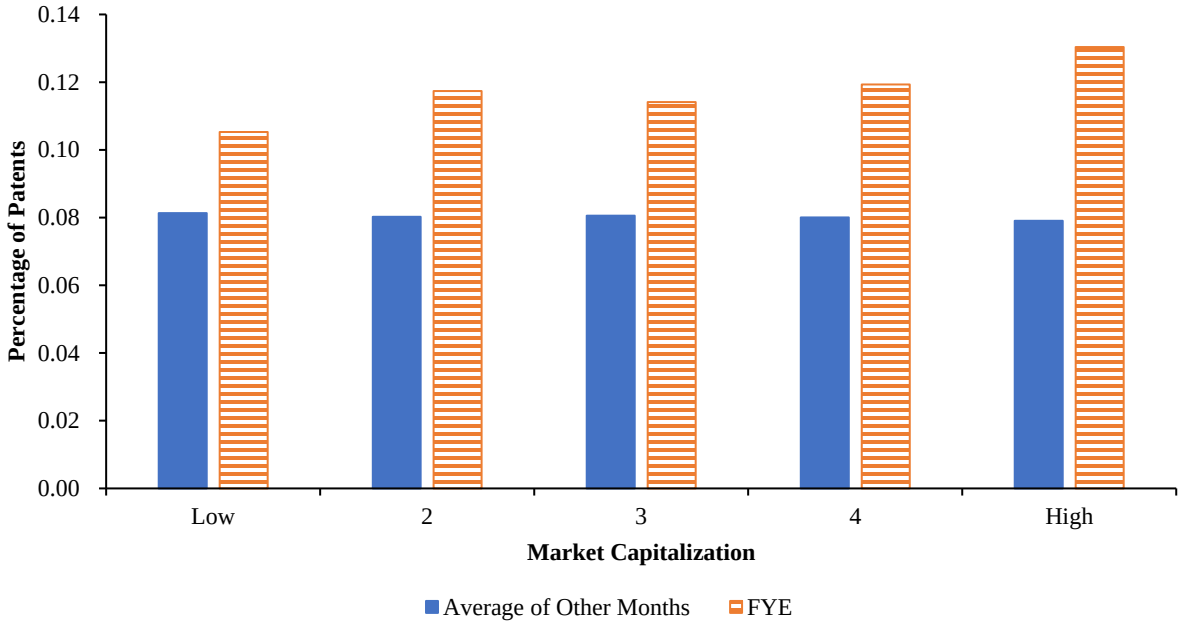


Figure 7
Surge in Fiscal-Year End Patent Filings: Subsamples Base on Firm Size

This figure presents patent filings in different groups of firm size, which is proxied by market capitalization in Panel A and total assets in Panel B. For each year, we divide firms into five groups based on the firm size measures. *FYE* represents the percentage of patents filed in the fiscal year-end month. *Average of Other Months* is the average percentage of patents filed in other months.

Panel A: Market Capitalization



Panel B: Total Assets

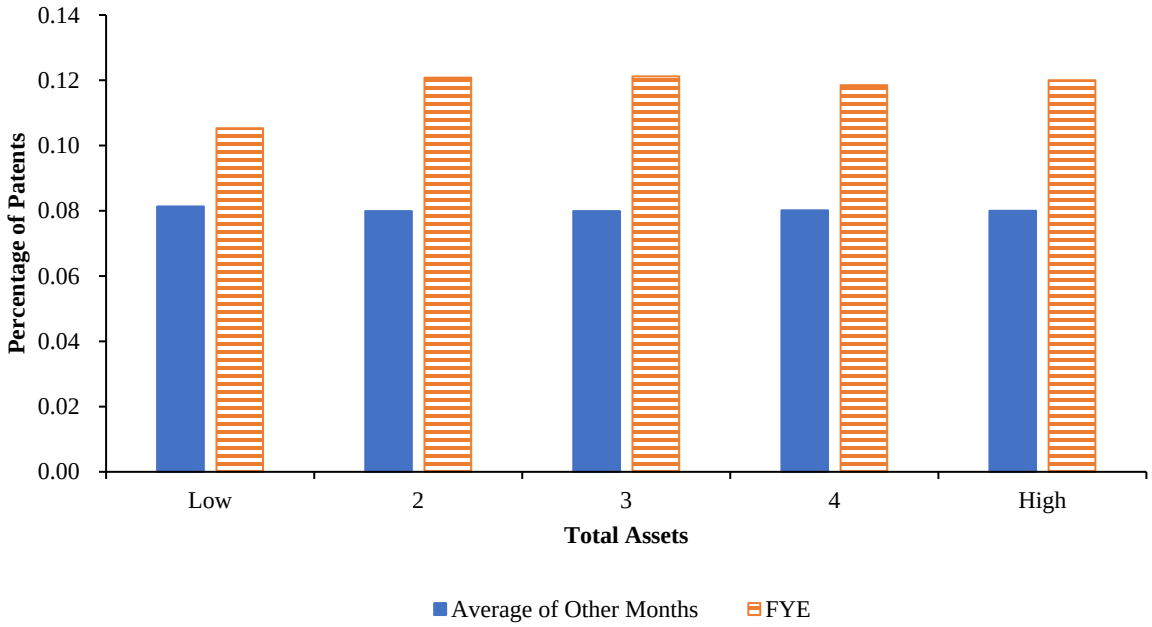


Figure 8
Grant Rate of Patent Filings by Month

This figure presents the grant rate of patent filings in each calendar month. The sample includes all patent applications filed with USPTO from 1980 to 2019. The patent grant rate for a month is calculated as the number of patents filed in that month that were eventually granted, scaled by the total number of patent applications filed in that month.

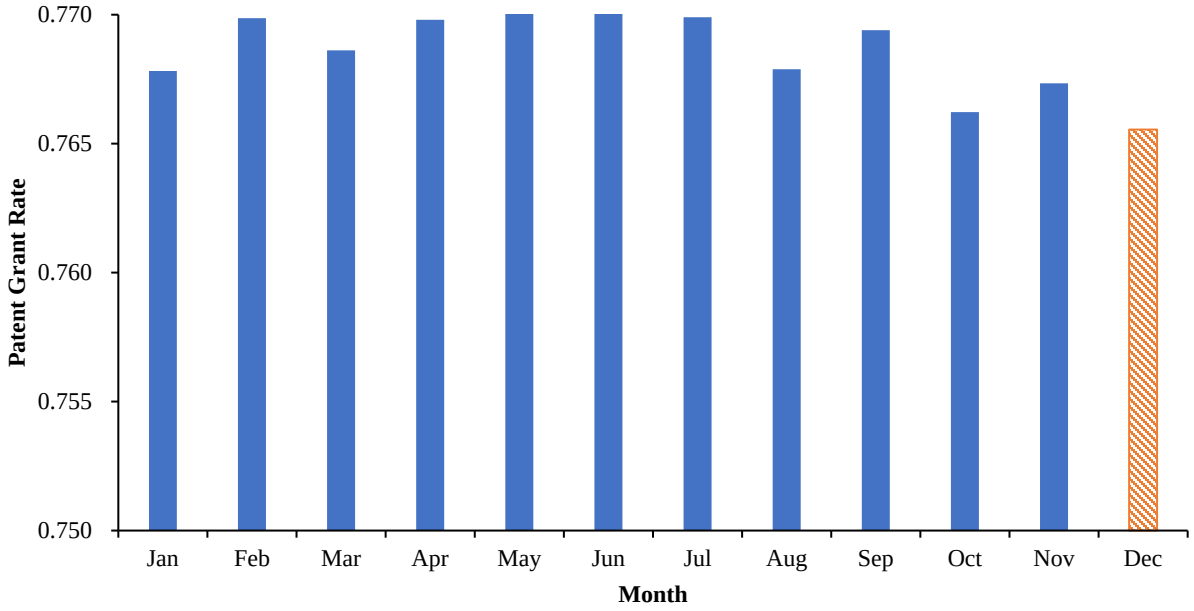
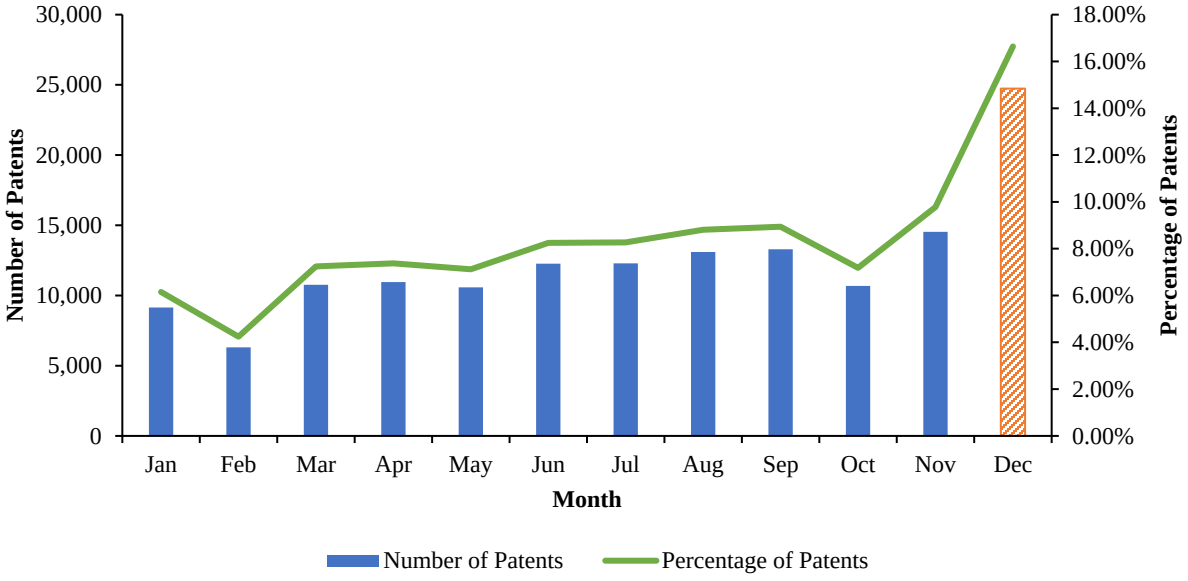


Figure 9
FYE Patent Filings: International Evidence

This figure presents the abnormal FYE patent filings globally. Panel A presents the number and percentage of patents filed with the China National Intellectual Property Administration by Chinese public firms across different months from 2004 to 2023. The fiscal year end of all public firms in China is in December. Panel B presents the number of patents filed with the USPTO by applicants from foreign countries or regions including Australia, Germany, Switzerland, UK, Finland, France, Taiwan, Japan, China, and Korea from 1980 to 2019. The y-axis shows the percentage difference between patents filed in the FYE month and the average patent filings in other months across countries.

Panel A: Patents filed by Chinese Listed Firms with CNIPA in Different Months



Panel B: Percentage Difference between FYE and Non-FYE Patent Filings: Interntional Evidence

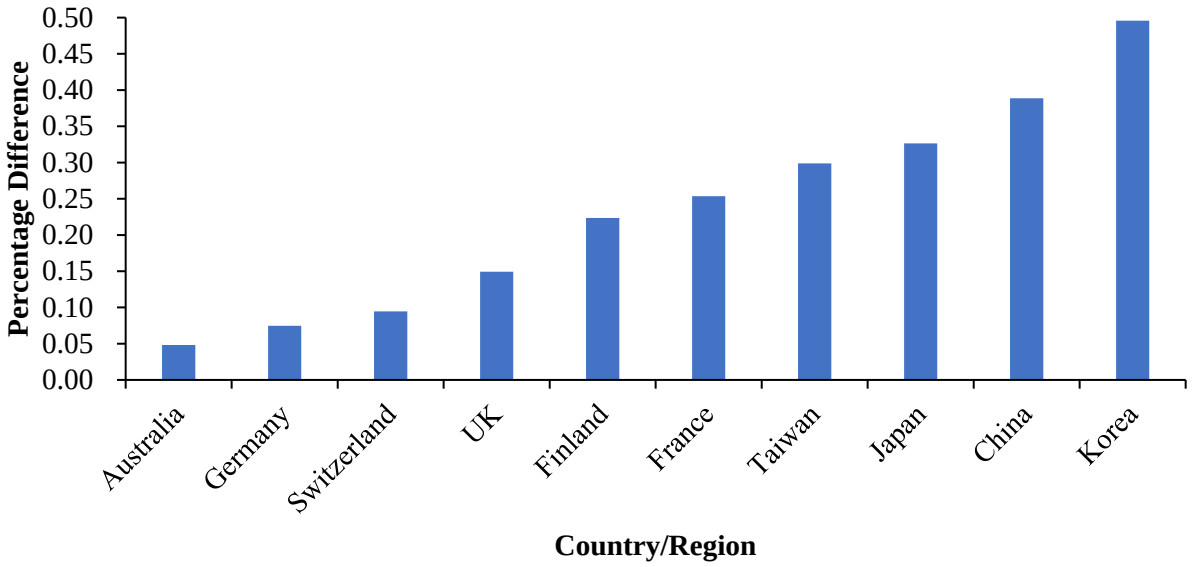
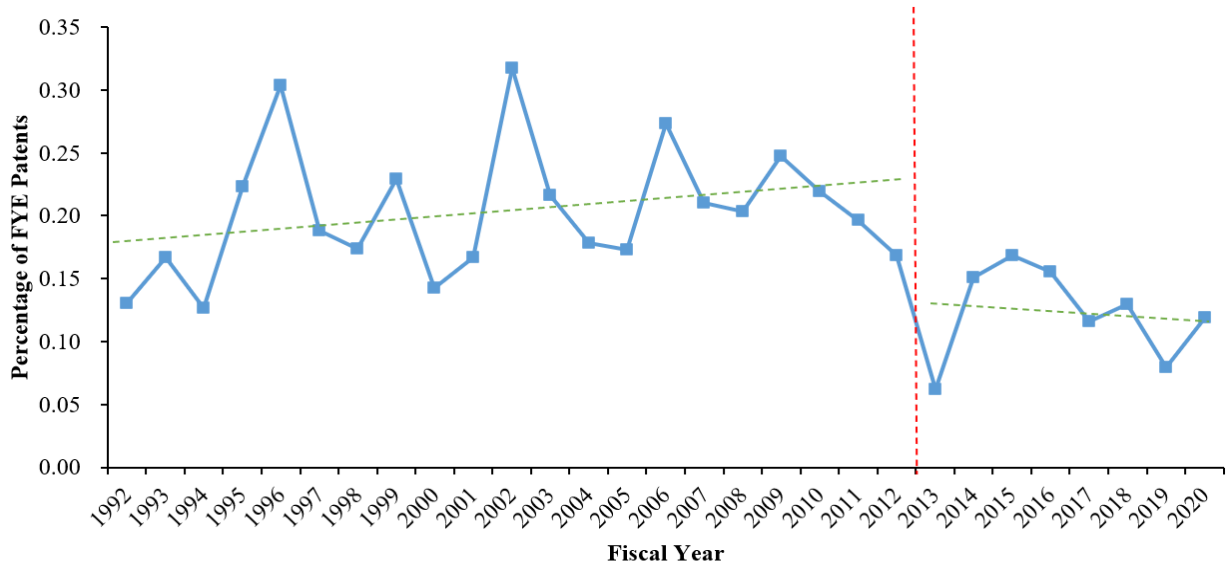


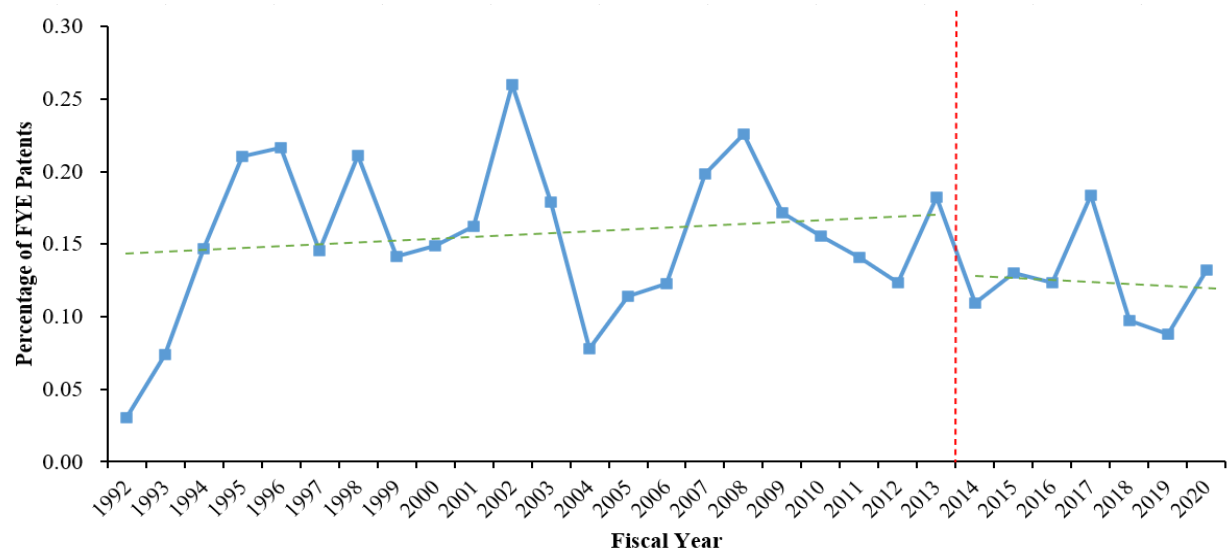
Figure 10
Abandonment of Annual Performance Reviews and FYE Patent Filings

This figure presents the percentage of FYE patents for firms that announced to abandon the annual performance review in Panels A to D, and randomly selected firms without the announcement in Panels E to H. The vertical red dashed line in Panels A to D represents the announcement time. The x-axis represents the fiscal year, and the y-axis represents the percentage of FYE patents, which is the number of patents filed in the FYE month scaled by the total patents filed in that year. The sample period is from 1992 to 2020.

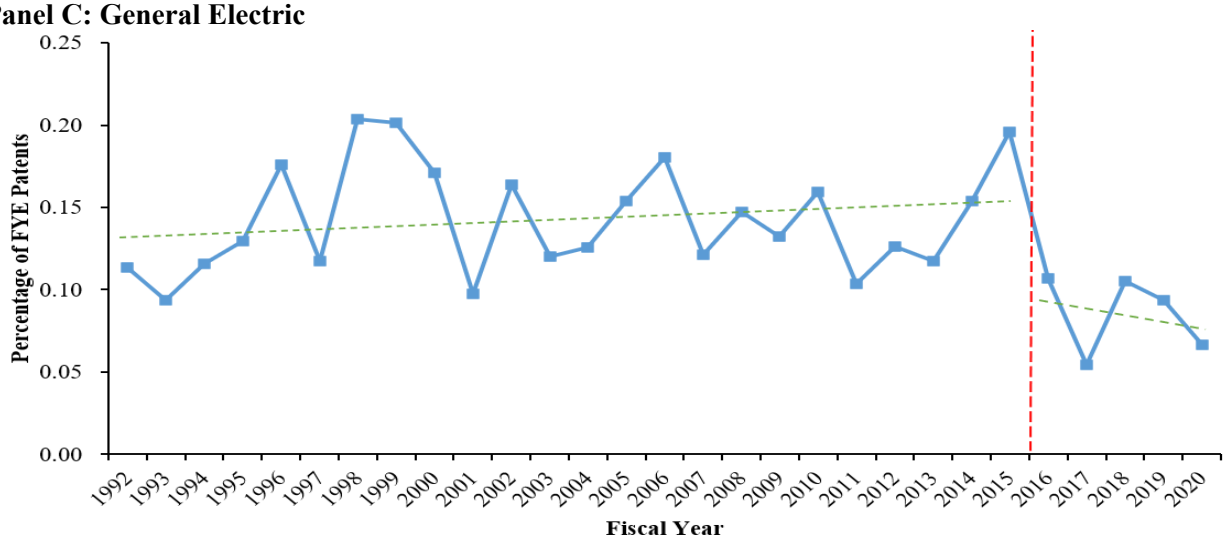
Panel A: Medtronic PLC



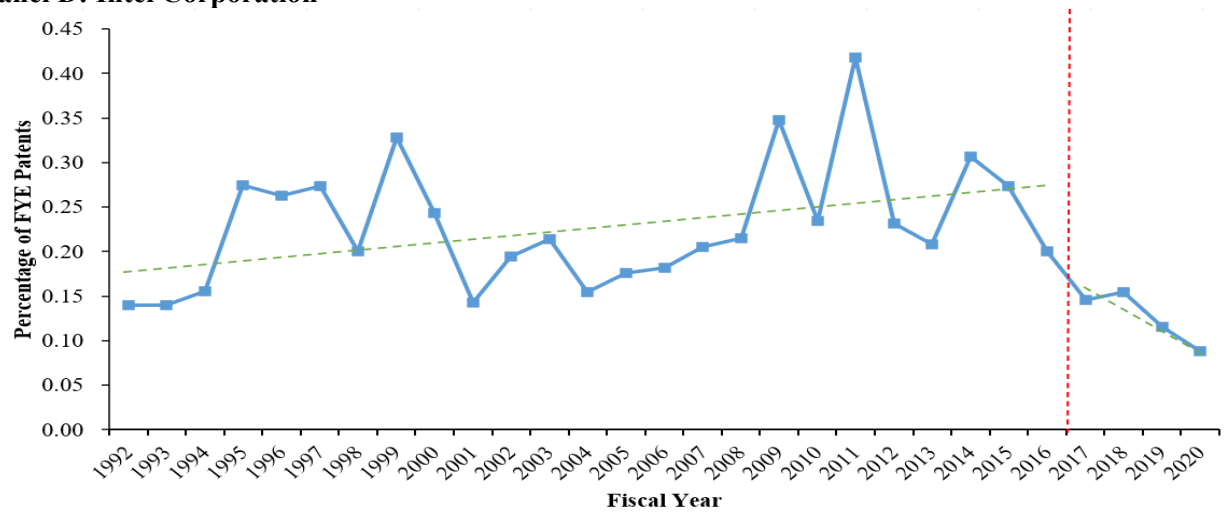
Panel B: Microsoft Corporation



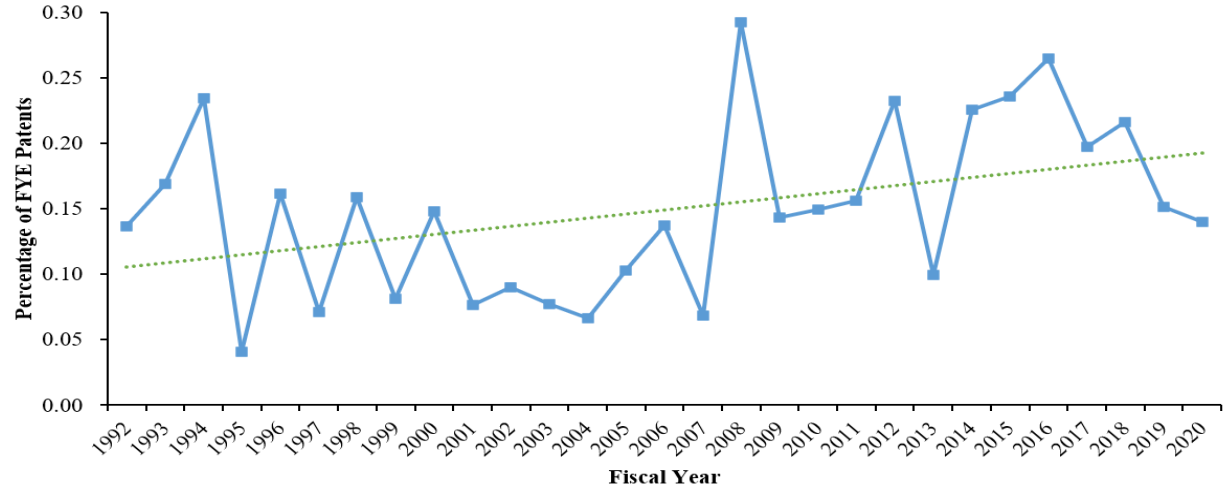
Panel C: General Electric



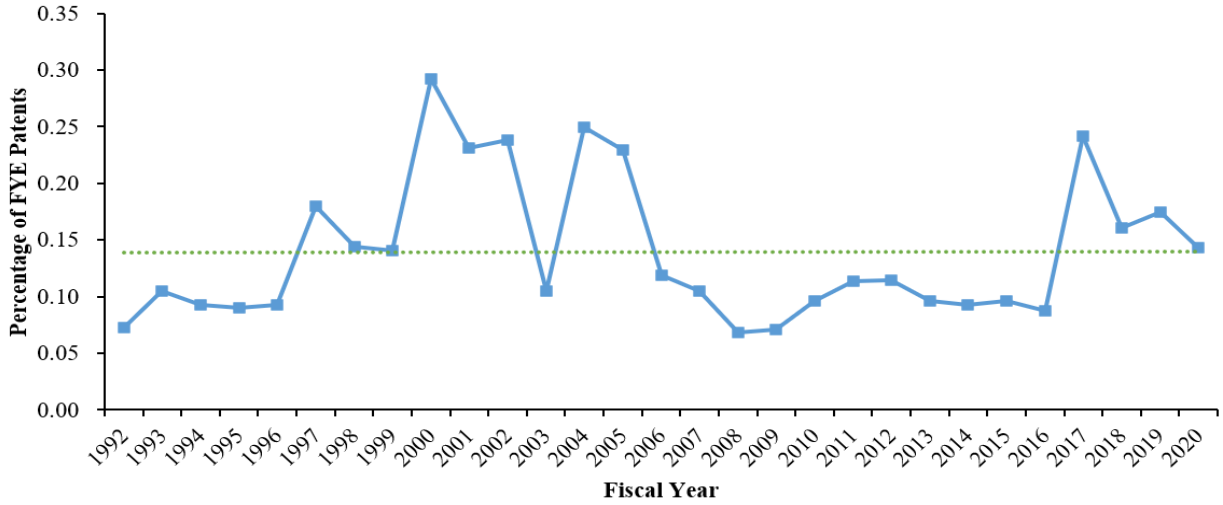
Panel D: Intel Corporation



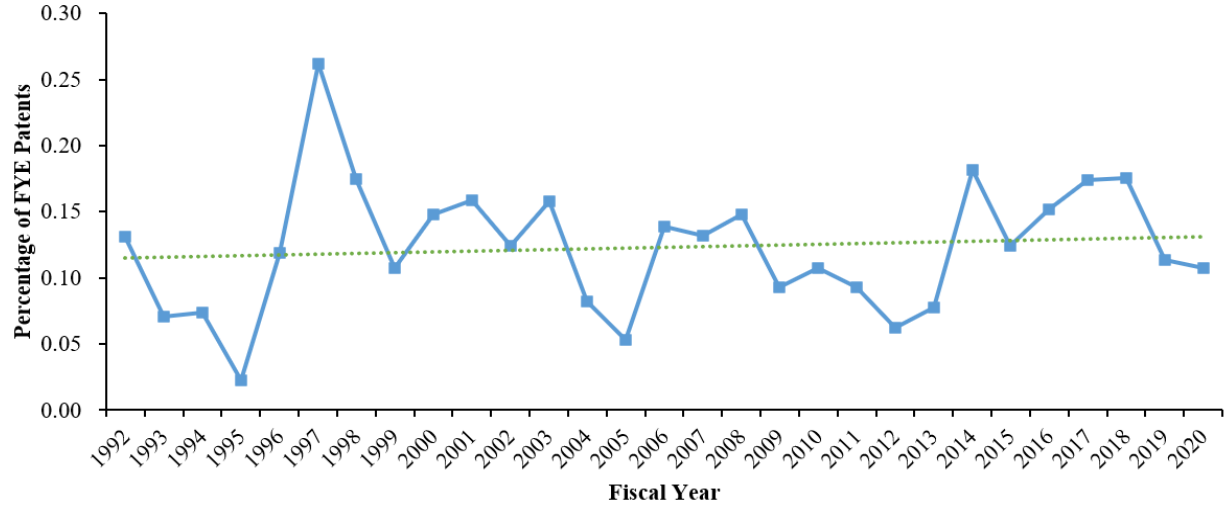
Panel E: Apple Inc



Panel F: Micron Technology



Panel G: Texas Industries Inc



Panel H: Procter & Gamble Company

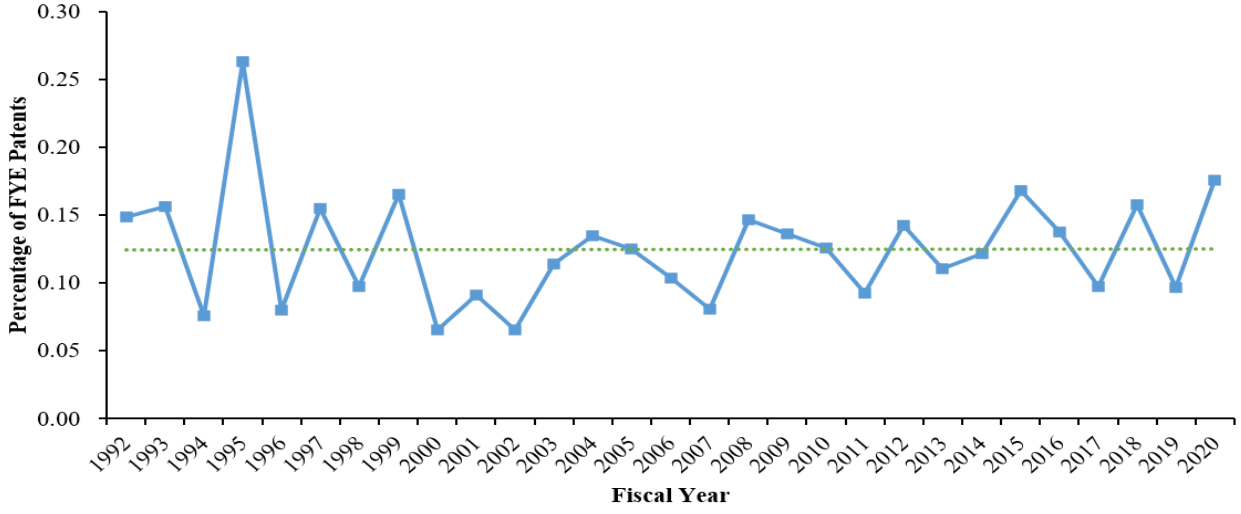


Table 1
Summary Statistics

This table reports summary statistics for patent-, firm-month, firm-year, and inventor-level variables from 1980 to 2019. *FYE Patent* is a dummy variable that equals one if a patent is filed in the fiscal year-end month, and zero otherwise. *Spike Patent* is a dummy variable that equals one if its average inventor FYE tendency is above the median of the FYE patents in the previous year, and zero otherwise. Inventors FYE tendency is defined as the proportion of the inventor's FYE patent filings among all her patent filings in the year. Average inventor FYE tendency is calculate as the average inventor FYE tendency for the patent. *Non-Spike Patent* are the remaining patents filed in the fiscal year-end month. *Adjusted Citation* is the truncation-adjusted future citations. *Originality* is the number of unique technology subclasses cited by the focal patent. *No Citation* is a dummy variable that equals one if the patent receives no future citation. *Breakthrough Patent* is a dummy variable that equals one if the forward citation counts being in the top 5% of all patents in the same application year and technology class. *#Claims* is the total number of claims in the patent. *#Independent Claims* is the number of independent claims in the patent. *#Dependent Claims* is the number of dependent claims in the patent. *ln(Number of Words)* is the natural logarithm of total number of words in the description section of a patent. *Gunning Fog* is the Fog index of the description section. *Automated Reading* is the Automated Readability index of the description section. *Flesch Reading* is the Flesch Reading index of the description. *#Figures* is the total number of figures in the patent text. *#Sheets* is the total number of sheets in the patent text. *Working Years* is the number of years an inventor has worked. *Total Patents Filed* is the average truncation adjusted citation for patents filed by the inventor up to the current year. *Average Adjusted Citation* is the average truncation adjusted citation for patents filed by the inventor up to the current year. *Average Originality* is the average originality of patents filed by the inventor up to the current year. *Total Breakthrough Patents* is the total number of breakthrough patents filed by the inventor up to the current year. OCF_{t+1} is the operating cash flow scaled by the total assets in the next year. ROA_{t+1} is the net income scaled by total assets in the next year. *Size* is the logarithm of total assets. *Firm Age* is the number of years since the year of the company's IPO. *Cash* is cash scaled by total assets. *Leverage* is total debt scaled by total equity. *BM* is the book to market ratio. *CAPX* is capital expenditures scaled by total assets. *PPE* is net property, plant, and equipment scaled by total assets. *%Spike Patent* is the number of spike patents scaled by the total patents filed in a year. *CEO Unexercised Options* is the total unexercised stock options scaled by total compensation in that year. *CEO Carrer Horizon* is the estimated time remaining until a CEO's departure due to retirement or termination. *Spike Proportion* is the cumulative number of spike patent scaled by all patents filed up to the current year. ln(*Patent Stock)* is the natural logarithm of total patent filed up to the current year. *#Patents* is the total number of patents filed in the fiscal month. *Stock Return* is the monthly stock return. *BM* is the book to market ratio. *ln(ME) is the natural logarithm of the market capitalization. Ret [-1] is the return of the month t-1. Ret [-12, -2] is the buy-and-hold return from month t-2 to t-12. Asset Growth* is change in total assets, scaled by lagged total assets. *ROE* is return on equity.

Variables	Obs.	Mean	SD	P10	P25	P50	P75	P90
Patent Level Variables								
FYE Patent	2,259,596	0.11	0.32	0.00	0.00	0.00	0.00	1.00
Spike Patent	2,259,596	0.06	0.23	0.00	0.00	0.00	0.00	0.00
Non-Spike Patent	2,259,596	0.06	0.24	0.00	0.00	0.00	0.00	0.00
Citation	2,259,596	12.98	26.53	0.00	0.00	3.00	13.00	34.00
Adjusted citation	2,259,596	0.91	1.56	0.00	0.00	0.38	1.03	2.31
Originality	2,069,535	9.16	13.74	1.00	3.00	5.00	10.00	19.00
No Citation	2,069,535	0.24	0.43	0.00	0.00	0.00	0.00	1.00
Breakthrough	2,069,535	0.05	0.21	0.00	0.00	0.00	0.00	0.00
#Claims	1,585,404	16.90	11.12	5.00	9.00	15.00	21.00	30.00
#Independent Claims	1,585,404	2.94	2.00	1.00	2.00	3.00	4.00	5.00
#Dependent Claims	1,585,404	13.93	10.16	3.00	7.00	13.00	18.00	26.00
ln(Number of Words)	2,097,253	8.33	0.82	7.28	7.78	8.33	8.87	9.37
Gunning Fog	2,097,253	18.36	2.66	15.11	16.59	18.23	19.96	21.73
Automated Readability	2,097,253	15.72	3.06	12.06	13.73	15.53	17.46	19.53
Flesch Reading	2,097,253	35.36	10.51	48.81	42.45	35.40	28.38	21.92
#Figures	2,104,266	12.05	11.41	3.00	5.00	9.00	15.00	24.00
#Sheets	2,104,266	8.61	7.95	2.00	4.00	6.00	11.00	17.00
Patent-Inventor Level Variables								
Working Years	4,765,441	8.82	6.96	2.00	3.00	7.00	13.00	19.00
Total Patents Filed	4,765,441	22.42	40.45	1.00	3.00	8.00	22.00	55.00
Average Adjusted Citation	4,765,441	1.22	1.32	0.23	0.48	0.85	1.46	2.51
Average Originality	4,765,441	9.01	11.56	1.67	3.25	5.67	9.65	18.42
Total Breakthrough Patent	4,765,441	1.52	3.73	0.00	0.00	0.00	1.00	4.00
Firm-Year Level Variables								
OCF_{t+1}	59,662	0.00	0.24	-0.25	-0.01	0.07	0.13	0.18
ROA_{t+1}	59,662	-0.07	0.30	-0.39	-0.08	0.03	0.08	0.12
Proportion Spike	59,662	0.07	0.14	0.00	0.00	0.03	0.08	0.17
ln(Patent Stock)	59,662	2.93	2.19	0.00	1.10	2.64	4.25	6.08
Size	59,662	5.83	2.35	2.92	4.06	5.63	7.48	9.16
Firm Age	59,662	21.08	15.54	5.00	8.00	16.00	30.00	45.00
Cash	59,662	0.24	0.25	0.01	0.04	0.14	0.37	0.66
Leverage	59,662	0.53	1.40	0.00	0.01	0.24	0.70	1.44
BM	59,662	0.54	0.48	0.11	0.23	0.43	0.72	1.11
R&D	59,662	0.09	0.15	0.00	0.00	0.03	0.11	0.24
CAPX	59,662	0.05	0.05	0.01	0.02	0.04	0.06	0.10
PPE	59,662	0.22	0.19	0.04	0.08	0.17	0.32	0.50
%Spike Patent	21,055	0.04	0.13	0.00	0.00	0.00	0.00	0.10
CEO Horizon	21,055	-0.42	3.18	-4.58	-2.00	-0.09	1.67	3.50
CEO LT Incentives	21,055	1.97	4.98	0.00	0.00	0.12	1.57	5.06
Firm-Month Level Variables								
# Patents	586,680	3.85	19.96	0.00	0.00	0.00	1.00	6.00
Stock Return	618,883	0.01	0.15	-0.13	-0.06	0.01	0.07	0.16
BM	618,883	0.58	1.06	0.12	0.24	0.44	0.73	1.14
Ln(ME)	618,883	13.4	2.06	10.79	11.88	13.30	14.78	16.2
Ret[-1]	618,883	0.01	0.14	-0.13	-0.06	0.01	0.07	0.15
Ret[-12,-2]	618,883	0.13	0.59	-0.40	-0.17	0.07	0.31	0.64
Asset Growth	618,883	0.23	1.10	-0.09	-0.01	0.07	0.20	0.50
ROE	618,883	0.04	5.95	-0.23	0.01	0.10	0.17	0.25

Table 2
Number of Patents Filed in the Fiscal Year-End Month

This table examines whether there is a surge in patent filings in the fiscal year-end month. The sample period covers the firm-months from 1980 to 2019. The dependent variable is the total number of patents filed in the fiscal month. The main independent variable is *FYE*, which is a dummy variable that equals one for the fiscal year-end month, and zero otherwise. Columns (1) and (2) use OLS regression, while Columns (3) and (4) use Poisson regression. Control variables including Market Cap and ln(Patent Stock) are defined in Appendix A. We control for firm and year fixed effects in all models. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dep. Var.	#Patents			
	OLS		Poisson	
	(1)	(2)	(3)	(4)
FYE	**1.637*****	**1.301*****	**0.365*****	**0.315*****
	(7.25)	**(6.58)**	**(11.53)**	**(10.25)**
Market Cap		0.721***		0.135***
		(2.71)		(4.32)
ln(Patent Stock)		2.410***		0.621***
		(6.43)		(18.04)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adj. R^2/ Pseudo R^2	0.614	0.620	0.803	0.826
Observations	562,498	558,784	562,498	558,594

Table 3
Quality of Patents Filed in the Fiscal Year-End Month

This table examines the quality of patents filed in the fiscal year-end month relative to patents that filed in other months. Panel A presents the results of Citations. The dependent variable is *Raw Citation* in Columns (1) and (2), and *Adjusted Citation* in Columns (3) and (4). The main independent variable is *FYE Patent*, which is a dummy variable that equals one if a patent is filed in the fiscal year-end month, and zero otherwise. Panel B is similar to Panel A except we use other patent quality measures instead of citations. The dependent variable is *Originality* in Column (1), *No Citation* in Column (2), and *Breakthrough Patent* in Column (3). We control for the filing year, art unit, and firm fixed effects. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Citations

Dep. Var.	Raw Citation		Adjusted Citation	
	(1)	(2)	(3)	(4)
FYE Patent	**-0.507****	**-0.523*****	**-0.035*****	**-0.034*****
	(-5.98)	**(-6.86)**	**(-5.40)**	**(-5.37)**
Filing Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Art Unit FE	No	Yes	No	Yes
Adj. R^2	0.250	0.288	0.072	0.079
Observations	2,258,788	2,258,764	2,258,788	2,258,764

Panel B: Other Patent Quality Measures

Dep. Var.	Originality	No Citation	Breakthrough Patent
	(1)	(2)	(3)
FYE Patent	**-0.191*****	**0.013*****	**-0.002*****
	(-2.86)	**(9.38)**	**(-3.67)**
Filing Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Art Unit FE	Yes	Yes	Yes
Adj. R^2	0.229	0.320	0.044
Observations	2,068,395	2,068,395	2,068,395

Table 4
Patent Quality of the Spike and Non-Spike Patents

This table examines the quality of spike and non-spike patents. We categorize FYE patent into two groups: spike patents (opportunistic) and non-spike patents (non-opportunistic) based on FYE tendency. *Spike Patent* is a dummy variable that equals one if its average inventor FYE tendency is above the median of the FYE patents in the previous year, and zero otherwise. The remaining FYE patent are classified as non-spike patent. Panel A presents the quality of spike patents. The dependent variables are *Raw Citation* in Columns (1) and (2), and *Adjusted Citation* in Columns (3) and (4). The independent variable is *Spike Patent*. In Panel B, we directly compare the quality differences between spike patents and patents filed in other months by excluding non-spike patents. Panel C presents the results of quality differences between non-spike patents and patents filed in other months, excluding spike patents. We control for patent filing year, art unit, and firm fixed effects. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Full Sample

Dep. Var.	Raw Citation		Adjusted Citation	
	(1)	(2)	(3)	(4)
Spike Patent	**-0.776*****	**-0.902*****	**-0.076*****	**-0.072*****
	(-5.08)	**(-6.86)**	**(-10.13)**	**(-10.34)**
Filing Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Art Unit FE	No	Yes	No	Yes
Adj. R^2	0.250	0.288	0.072	0.079
Observations	2,258,496	2,258,472	2,258,496	2,258,472

Panel B: Spike Patent vs. Patents Filed in Other Months

Dep. Var.	Raw Citation	Adjusted Citation
	(1)	(2)
Spike Patent	**-0.909*****	**-0.071*****
	(-6.90)	**(-9.98)**
Filing Year FE	Yes	Yes
Firm FE	Yes	Yes
Art Unit FE	Yes	Yes
Adj. R^2	0.289	0.079
Observations	2,124,696	2,124,696

Panel C: Non-Spike Patent vs. Patent Filed in Other Months

Dep. Var.	Raw Citation	Adjusted Citation
	(1)	(2)
Non-Spike Patent	**-0.168***	**0.002**
	(-1.80)	**(0.20)**
Filing Year FE	Yes	Yes
Firm FE	Yes	Yes
Art Unit FE	Yes	Yes
Adj. R^2	0.290	0.079
Observations	2,133,136	2,133,136

Table 5
Other Patent Quality Measures of the Spike and Non-Spike Patents

This table examines the quality of Spike and Non-Spike Patents using other patent quality measures including *Originality*, *No Citation* and *Breakthrough Patent*. We categorize FYE patent into two groups: spike patents (opportunistic) and non-spike patents (non-opportunistic) based on FYE tendency. *Spike Patent* is a dummy variable that equals one if its average inventor FYE tendency is above the median of the FYE patents in the previous year, and zero otherwise. The remaining FYE patent are classified as non-spike patents. Panel A presents the quality of spike patents. The dependent variables are *Originality* in Column (1), *No Citation* in Column (2) and *Breakthrough Patent* in Column (3). The independent variable is *Spike Patent*. In Panel B, we directly compare the quality differences between spike patents and patents filed in other months by excluding non-spike patents. In Panel C, we directly compare the quality differences between non-spike patents and patents filed in other months by excluding spike patents. We control for patent filing year, art unit, and firm fixed effects. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Full Sample

Dep. Var.	Originality	No Citation	Breakthrough Patent
	(1)	(2)	(3)
Spike Patent	**-0.657*****	**0.022*****	**-0.006*****
	(-6.24)	**(11.74)**	**(-7.19)**
Filing Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Art Unit FE	Yes	Yes	Yes
Adj. R^2	0.229	0.320	0.044
Observations	2,068,292	2,068,292	2,068,292

Panel B: Spike Patent vs. Patents Filed in Other Months

Dep. Var.	Originality	No Citation	Breakthrough Patent
	(1)	(2)	(3)
Spike Patent	**-0.645*****	**0.022*****	**-0.006*****
	(-6.16)	**(11.67)**	**(-6.97)**
Filing Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Art Unit FE	Yes	Yes	Yes
Adj. R^2	0.228	0.321	0.044
Observations	1,945,544	1,945,544	1,945,544

Panel C: Non-Spike Patent vs. Patent Filed in Other Months

Dep. Var.	Originality	No Citation	Breakthrough Patent
	(1)	(2)	(3)
Non-Spike Patent	**0.224****	**0.004*****	**0.001**
	(2.28)	**(2.83)**	**(0.61)**
Filing Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Art Unit FE	Yes	Yes	Yes
Adj. R^2	0.231	0.320	0.045
Observations	1,953,350	1,953,350	1,953,350

Table 6
Disclosure Quality of Spike Patents

This table examines the disclosure quality of spike patents. Panel A presents the results of the length of the description section of a patent. The dependent variable is the natural logarithm of total number of words in the description section. The independent variable is *Spike Patent*, which is a dummy variable that equals one if its average inventor FYE tendency is above the median of the FYE patents in the previous year, and zero otherwise. Panel B presents the results of readability of the description section. The dependent variable is the *Gunning Fog* index in Column (1), *Automated Readability* index in Column (2) and *Flesch Reading* index in Column (3). For the Gunning Fog and Automated Readability, the larger the index number, the harder the text is to read. However, for the Flesch Reading, the smaller the index number, the harder the text is to read. To make all three measures indicate readability in the same direction, we multiply the Flesch Reading by -1. Panel C presents the results of number of figures and sheets in the patent text. Panel D presents the results of number of claims. The dependent variable is total number of claims in Column (1), total number of independent claims in Column (2), and total number of dependent claims in Column (3). We control for the patent filing year, art unit, and firm fixed effects. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Length of Description

Dep. Var.	ln(Number of Words)	
	(1)	(2)
Spike Patent	**-0.018****	**-0.021*****
	(-2.07)	**(-3.16)**
Filing Year FE	Yes	Yes
Firm FE	Yes	Yes
Art Unit FE	No	Yes
Adj. R^2	0.326	0.365
Observations	2,095,850	2,095,821

Panel B: Text Readability of Description

Dep. Var.	Gunning Fog	Automated Readability	Flesch Reading
	(1)	(2)	(3)
Spike Patent	**0.041****	**0.069*****	**0.129****
	(2.27)	**(2.65)**	**(2.16)**
Filing Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Art Unit FE	Yes	Yes	Yes
Adj. R^2	0.190	0.198	0.256
Observations	2,095,821	2,095,821	2,095,821

Panel C: Figures and Sheets

Dep. Var.	#Figures	#Sheets
	(1)	(2)
Spike Patent	**-0.397*****	**-0.197****
	(-3.21)	**(-2.17)**
Filing Year FE	Yes	Yes
Firm FE	Yes	Yes
Art Unit FE	Yes	Yes
Adj. R^2	0.193	0.215
Observations	2,102,845	2,102,845

Panel D: Number of Claims

Dep. Var.	# of Claims	# of Independent Claims	# of Dependent Claims
	(1)	(2)	(3)
Spike Patent	**-0.160****	**-0.041*****	**-0.112***
	(-2.33)	**(-3.38)**	**(-1.86)**
Filing Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Art Unit FE	Yes	Yes	Yes
Adj. R^2	0.167	0.138	0.157
Observations	1,583,948	1,583,948	1,583,948

Table 7

Performance Appraisal Channel: Opportunistic Behavior by Inventors?

This table examines the relationship between inventor characteristics and spike patent filings. Panel A presents the results of inventor's working experience. The independent variable is *Spike Patent*. *Spike Patent* is a dummy variable that equals one if its average inventor FYE tendency is above the median of the FYE patents in the previous year, and zero otherwise. The independent variable is *Working Years*$_{t-1}$ in Columns (1), and *Total Patents Filed*$_{t-1}$ in Columns (2). *Working Years*$_{t-1}$ is the number of years an inventor has worked up to the previous year. *Total Patents Filed* $_{t-1}$ is the total number of patents filed by the inventor up to the previous year. Panel B presents the results of inventor's past performance. The independent variable is the *Average Adjusted Citation*$_{t-1}$ in Column (1), and *Average Originality*$_{t-1}$ in Column (2), and *Total Breakthrough Patent*$_{t-1}$ in Column (3). *Average Adjusted Citation*$_{t-1}$ is the average truncation adjusted citation for patents filed by the inventor up to the previous year. *Average Originality* is the average originality of patents filed by the inventor up to the previous year. *Total Breakthrough Patents* is the total number of breakthrough patents filed by the inventor up to the previous year. We control for filing year, art unit, and firm fixed effects. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Working Experience

Dep. Var.	Spike Patent	
	(1)	(2)
Working Years$_{t-1}$	**-0.0001*****	
	(-2.74)	
Total Patents Filed$_{t-1}$		**-0.0003*****
		(-8.51)
Filing Year FE	Yes	Yes
Firm FE	Yes	Yes
Art Unit FE	Yes	Yes
Adj. R^2	0.020	0.022
Observations	4,764,482	4,764,482

Panel B: Past Performance

Dep. Var.	Spike Patent		
	(1)	(2)	(3)
Average Adjusted Citation$_{t-1}$	**-0.0025*****		
	(-8.18)		
Average Originality$_{t-1}$		**-0.0003*****	
		(-7.28)	
Total Breakthrough Patent$_{t-1}$			**-0.0022*****
			(-10.49)
Filing Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Art Unit FE	Yes	Yes	Yes
Adj. R^2	0.021	0.021	0.022
Observations	4,764,482	4,764,482	4,764,482

Table 8
Spike Patents and CEO Incentives

This table examines the relationship between CEO characteristics and spike patent filings. Panel A presents the results of CEO's long-term incentives. The dependent variable is %*Spike Patent*, which is defined as number of spike patents scaled by total patents filed in the year. The independent variable is *CEO Carrer Horizon* in Columns (1) and (2), and *CEO Unexercised Option* in Columns (3) and (4). The *CEO Career Horizon* is the estimated time remaining until a CEO's departure due to retirement or termination. *CEO Unexercised Option* is the value of the unexercised option scaled by total compensation. Panel B presents the results of CEO performance pressure. The independent variable is stock return in the previous year in Column (1), stock return in the current year in Column (2), ROA in the previous year in Column (3), and ROA in the current year in Column (4). Control variables including ln(Patent Stock), Size, Firm Age, Cash, Leverage, BM, R&D, CAPX and PPE in the previous year are defined in Appendix A. We control firm and year fixed effects in all models. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: CEO Long-Term Incentives

Dep. Var.	%Spike Patent			
	(1)	(2)	(3)	(4)
CEO Carrer Horizon	**-0.0612**	**-0.0540**		
	(-1.41)	**(-1.25)**		
CEO Unexercised Option			**-0.0226**	**-0.0193**
			(-1.05)	**(-0.92)**
ln(Patent Stock$_{t-1}$)		1.2686***		1.2744***
		(4.56)		(4.59)
Size$_{t-1}$		0.1652		0.1516
		(0.79)		(0.72)
Firm Age $_{t-1}$		-0.0281		-0.0307
		(-0.54)		(-0.58)
Cash $_{t-1}$		0.1458		0.1887
		(0.15)		(0.20)
Leverage $_{t-1}$		-0.4146		-0.4496
		(-0.49)		(-0.53)
BM$_{t-1}$		0.0893		0.0775
		(0.28)		(0.24)
R&D $_{t-1}$		0.6758		0.6538
		(0.57)		(0.55)
CAPX $_{t-1}$		7.3142*		7.4289*
		(1.69)		(1.72)
PPE $_{t-1}$		-2.3893		-2.4188
		(-1.18)		(-1.19)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adj. R^2	0.045	0.046	0.045	0.046
Observations	20,804	20,804	20,804	20,804

Panel B: CEO Performance Pressure

Dep. Var.	%Spike Patent			
	(1)	(2)	(3)	(4)
Stock Return$_{t-1}$	**-0.0763**			
	(-0.61)			
Stock Return$_{t}$		**0.1659**		
		(1.13)		
ROA$_{t-1}$			**0.3944**	
			(1.51)	
ROA$_{t}$				**0.0706**
				(0.25)
ln(Patent Stock $_{t-1}$)	1.2820***	1.2726***	1.2789***	1.2806***
	(4.61)	(4.57)	(4.60)	(4.61)
Size $_{t-1}$	0.1467	0.2176	0.1352	0.1597
	(0.71)	(1.01)	(0.64)	(0.76)
Firm Age $_{t-1}$	-0.0319	-0.0298	-0.0342	-0.0312
	(-0.60)	(-0.57)	(-0.64)	(-0.59)
Cash $_{t-1}$	0.1732	0.2219	0.1085	0.1673
	(0.18)	(0.23)	(0.11)	(0.17)
Leverage $_{t-1}$	-0.4530	-0.5398	-0.2916	-0.4218
	(-0.54)	(-0.64)	(-0.35)	(-0.50)
BM$_{t-1}$	0.0419	-0.0145	0.1145	0.1000
	(0.13)	(-0.04)	(0.36)	(0.31)
R&D $_{t-1}$	0.5794	0.6017	1.3418	0.7174
	(0.49)	(0.50)	(1.01)	(0.59)
CAPX $_{t-1}$	7.1002	7.4771*	7.3482*	7.3316*
	(1.64)	(1.72)	(1.70)	(1.70)
PPE $_{t-1}$	-2.3786	-2.4142	-2.3766	-2.4011
	(-1.17)	(-1.18)	(-1.17)	(-1.17)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adj. R^2	0.044	0.044	0.044	0.044
Observations	20,804	20,804	20,804	20,804

Table 9
Spike Patents and Future Financial Performance

This table examines the effect of spike patents on a firm's future financial performance based on innovation intensity. We separate firms into high and low innovation intensity based on the total number of patents filed by the firm up to the current year. A firm is classified as innovation intensity firm if its total patent filings up to the current year is above the yearly sample median. Panel A presents the results of high innovation intensity firms. The dependent variable is *OCF* in year t+1 in Column (1), *OCF* in year t+2 in Column (2), *ROA* in year t+1 in Column (3) and *ROA* in year t+2 in Column (4). The main independent variable is *Proportion Spike*, which is defined as the cumulative number of spike patents up to the current year scaled by the cumulative number of total patents filed by the firm up to the current year. Control variables including ln(Patent Stock), Size, Firm Age, Cash, Leverage, BM, R&D, CAPX and PPE are defined in Appendix A. We control for firm and year fixed effects in all models. Panel B is similar to Panel A, except it presents the results of low innovation intensity firms. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: High Innovation Intensity Firms

Dep. Var.	OCF_{t+1}	OCF_{t+2}	ROA_{t+1}	ROA_{t+2}
	(1)	(2)	(3)	(4)
Proportion Spike	**-0.096****	**-0.073***	**-0.127****	**-0.092***
	(-2.46)	**(-1.93)**	**(-2.20)**	**(-1.92)**
ln(Patent Stock)	-0.002	-0.001	0.002	0.005
	(-0.85)	(-0.44)	(0.63)	(1.32)
Size	0.005	-0.001	-0.008*	-0.020***
	(1.27)	(-0.22)	(-1.73)	(-3.85)
Firm Age	0.000	0.000	0.001	-0.000
	(0.36)	(0.31)	(0.66)	(-0.02)
Cash	-0.146***	-0.138***	-0.024	-0.100***
	(-9.28)	(-8.17)	(-1.10)	(-4.32)
Leverage	-0.001	-0.000	-0.000	0.001
	(-0.74)	(-0.22)	(-0.17)	(0.81)
BM	-0.027***	-0.023***	-0.090***	-0.046***
	(-7.55)	(-5.95)	(-16.37)	(-8.75)
R&D	-0.409***	-0.238***	-0.498***	-0.262***
	(-12.12)	(-6.94)	(-12.36)	(-5.97)
CAPX	0.002	0.050	-0.053	-0.045
	(0.05)	(1.14)	(-1.00)	(-0.79)
PPE	0.058***	0.063***	0.043	0.054*
	(2.71)	(2.85)	(1.58)	(1.90)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adj. R^2	0.688	0.677	0.603	0.592
Observations	30,004	27,668	30,004	27,668

Panel B: Low Innovation Intensity Firms

Dep. Var.	OCF_{t+1}	OCF_{t+2}	ROA_{t+1}	ROA_{t+2}
	(1)	(2)	(3)	(4)
Proportion Spike	**-0.026**	**-0.010**	**-0.013**	**-0.011**
	(-1.39)	**(-0.54)**	**(-0.55)**	**(-0.41)**
ln(Patent Stock)	-0.002	-0.000	0.006	0.004
	(-0.55)	(-0.10)	(1.41)	(0.87)
Size	0.005	-0.000	-0.016***	-0.022***
	(1.57)	(-0.13)	(-3.55)	(-4.76)
Firm Age	-0.000	-0.001	0.001	0.000
	(-0.12)	(-0.31)	(0.52)	(0.28)
Cash	-0.224***	-0.165***	-0.069***	-0.112***
	(-14.35)	(-9.62)	(-3.22)	(-4.90)
Leverage	-0.001	-0.001	-0.000	0.000
	(-0.65)	(-1.11)	(-0.19)	(0.09)
BM	-0.018***	-0.019***	-0.085***	-0.037***
	(-5.63)	(-6.00)	(-16.52)	(-8.20)
R&D	-0.416***	-0.163***	-0.437***	-0.153***
	(-13.75)	(-4.57)	(-11.34)	(-3.47)
CAPX	-0.116***	-0.059*	-0.059	-0.059
	(-3.19)	(-1.69)	(-1.21)	(-1.17)
PPE	-0.043*	-0.005	-0.019	-0.018
	(-1.86)	(-0.21)	(-0.56)	(-0.54)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adj. R^2	0.690	0.683	0.612	0.611
Observations	28,912	25,737	28,912	25,737

Table 10
Spike Patents and Future Stock Return

This table presents Fama-MacBeth regressions of monthly stock return on spike patents based on innovation intensity. We separate firms into high and low innovation intensity based on the total number of patents filed by the firm up to the current year. A firm is classified as innovation intensity firm if its total patent filings up to the current year is above the yearly sample median. Panel A presents the results of high innovation intensity firms. The dependent variable is the monthly stock return from July year t to June year t+1 and the independent variable is *Proportion Spike* of year t-1. *Proportion Spike* is defined as the cumulative number of spike patents up to the current year scaled by the cumulative number of total patents filed by the firm up to the current year. ln(*Patent Stock)* is the natural logarithm of the cumulative patents filed up to the current month. *BM* is the book-to-market ratio. *ln(ME)* is natural logarithm of market capitalization in June. *Ret [-1]* is the previous monthly return. *Ret [-12, -2]* is the buy-and-hold return from month t-12 to month t-2. *Assets growth* is annual change in total assets, scaled by lagged total assets. *ROE* is return to equity. Panel B is similar to Panel A, except it presents the results of low innovation intensity firms. Some models include one-digit SIC industry fixed effects. All t-statistics are based on Newey-West standard errors with nine lags.

Panel A: High Innovation Intensity Firms

Dep. Var.	Stock Return		
	(1)	(2)	(3)
Proportion Spike	**-0.0083****	**-0.0090****	**-0.0098****
	(-2.06)	**(-2.34)**	**(-2.50)**
ln(Patent Stock)		0.0007***	0.0006***
		(3.60)	(2.94)
BM		0.0033**	0.0036***
		(2.45)	(2.68)
ln(ME)		-0.0006	-0.0005
		(-1.48)	(-1.23)
Ret[-1]		-0.0332***	-0.0344***
		(-7.14)	(-7.40)
Ret[-12,-2]		0.0028	0.0026
		(1.22)	(1.11)
Asset Growth		-0.0015	-0.0014
		(-1.54)	(-1.44)
ROE		0.0018*	0.0016*
		(1.75)	(1.66)
Industry FE	No	No	Yes
Adj. R^2	0.002	0.063	0.084
Ave. #Firms	758	758	758

Panel B: Low Innovation Intensity Firms

Dep. Var.	Stock Return		
	(1)	(2)	(3)
Proportion Spike	**0.0007**	**0.0017**	**0.0017**
	(0.55)	**(1.27)**	**(1.30)**
ln(Patent Stock)		0.0002	0.0003
		(0.44)	(0.69)
BM		0.0026**	0.0026**
		(2.14)	(2.15)
ln(ME)		0.0002	0.0003
		(0.67)	(0.82)
Ret[-1]		-0.0330***	-0.0350***
		(-7.32)	(-7.64)
Ret[-12,-2]		0.0024	0.0022
		(0.93)	(0.82)
Asset Growth		-0.0020***	-0.0020***
		(-3.06)	(-3.18)
ROE		0.0010	0.0009
		(1.57)	(1.37)
Industry FE	No	No	Yes
Adj. R^2	0.002	0.057	0.082
Ave. #Firms	675	675	675

Appendix A
Variable Definition

Variable	Definition
Patent Level Variables:	
FYE Patent	Dummy variable that equals one if a patent is filed in the last month of the fiscal year, and zero otherwise.
Spike Patent	Dummy variable that equals one if its average inventor FYE tendency is above the median of the FYE patents in the previous year, and zero otherwise. Inventors FYE tendency is defined as the proportion of the inventor's FYE patent filings among all her patent filings in the year. Average inventor FYE tendency is calculate as the average inventor FYE tendency for the patent.
Non-Spike Patent	Dummy variable that equals one if the patent is filed in the fiscal year end month, and its FYE tendency is less than or equal to the sample median of the FYE patents in the previous year, and zero otherwise.
Citation	Number of forward citations received by the patent.
Adjusted Citation	Truncation-adjusted future citations. The truncation is adjusted by dividing patent citations by the mean number of citations filed in that year and within the same three-digit technology class.
Originality	Number of unique technology subclasses cited by the focal patent.
No Citation	Dummy variable that equals one if the patent receives no future citation.
Breakthrough Patent	Dummy variable that equals one if the forward citation counts being in the top 5% of all patents in the same application year and technology class.
#Claims	Total number of claims contained in the patent.
#Independent Claims	Total number of independent claims contained in the patent.
#Dependent Claims	Total number of dependent claims contained in the patent.
ln(Number of Words)	The natural logarithm of total number of words in the description section.
Gunning Fog	The Gunning Fog index of the description section of a patent.
Automated Reading	The Automated Readability index of the description section of a patent.
Claim Flesch Reading	The Flesch Reading index of the description section of a patent.
#Figures	The total number of figures in the patent text.
#Sheets	The total number of sheets in the patent text.
Firm-month level Variables:	
#Patents	The total number of patents filed in the fiscal month.
ln(Patent Stock)	Natural logarithm of patents filed up to the current year.
Stock Return	Monthly stock return.
Ret[-1]	Monthly stock return in month t-1.
Ret[-12,-2]	Buy-and-hold return from month t-12 to month t-2.
ROE	Income before extraordinary items scaled by total equity.
Asset Growth	Annual change in total assets, scaled by lagged total assets.
BM	Book to market ratio.
Firm-Year level Variables:	
% Spike Patent	Total number of FYE Spikers scaled by total patents filed in the year.
Proportion Spike	The cumulative number of FYE Spikers up to the current year scaled by cumulative number of total patents filed by the firm up to the current year.
OCF	Operating cash flow scaled by the total assets.
ROA	Net income scaled by total assets.
Size	The logarithm of total assets.
Firm Age	Number of years since the year of the company's IPO.
Cash	Cash scaled by total assets.

Variable	Definition
Leverage	Total debt scaled by total equity.
CAPX	Capital expenditures scaled by total assets.
PPE	Net property, plant, and equipment scaled by total assets.
CEO Horizon	CEO $\text{Horizon}_{i,t}$ = [$\text{Tenure}_{ind,t}$ - $\text{Tenure}_{i,t}$] + [$\text{Age}_{ind,t}$ – $\text{Age}_{i,t}$], where $\text{Tenure}_{ind,t}$ is the industry average tenure of all CEOs in year t, $\text{Tenure}_{i,t}$ is the tenure of CEO i in year t, $\text{Age}_{ind,t}$ is the industry average age of all CEOs in year t, and $\text{Age}_{i,t}$ is the age of CEO i in year t.
CEO Unexercised Options	Unexercised stock options scaled by total compensation.
Inventor level Variables:	
Working Years	The number of years an inventor has worked.
Total Patents Filed	The total number of patents filed by the inventor up to the current year.
Average Adjusted Citation	The average truncation adjusted citation for patents filed by the inventor up to the current year.
Average Originality	The average originality of patents filed by the inventor up to the current year.
Total Breakthrough Patents	The total number of breakthrough patents filed by the inventor up to the current year.

Appendix B: Additional Results

Table B1
Alternative Measure of Spike Patents

This table examines the quality of spike patents using an alternative spike measure. Panel A presents the results of citations. The dependent variable is *Raw Citation* in Columns (1) and (2), and *Adjusted Citation* in Columns (3) and (4). The independent variable is *Spike Industry Patent*. *Spike Industry Patent* is a dummy variable that equals one if the FYE tendency is above the sample median of firms in the same 2-digit SIC industry from the previous year, and zero otherwise. Panel B is similar to Panel A except we use other patent quality measures. The dependent variable is *Originality* in Column (1), *No Citation* in Column (2), and *Breakthrough Patent* in Column (3). We control for filing year, art unit, and firm fixed effects. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Adjusted Citation

Dep. Var.	Raw Citation		Adjusted Citation	
	(1)	(2)	(3)	(4)
Spike Industry Patent	**-0.832*****	**-0.942*****	**-0.074*****	**-0.070*****
	(-5.78)	**(-7.47)**	**(-10.13)**	**(-10.39)**
Filing Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Art Unit FE	No	Yes	No	Yes
Adj. R^2	0.250	0.288	0.072	0.079
Observations	2,255,307	2,255,283	2,255,307	2,255,283

Panel B: Other Patent Quality Measures

Dep. Var.	Originality	No Citation	Breakthrough Patent
	(1)	(2)	(3)
Spike Industry Patent	**-0.144*****	**0.021*****	**-0.005*****
	(-5.64)	**(10.90)**	**(-7.05)**
Filing Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Art Unit FE	Yes	Yes	Yes
Adj. R^2	0.225	0.320	0.044
Observations	2,067,214	2,067,214	2,067,214

Table B2
Quality of December Patents File by Other Organizations

This table presents the results of patent quality filed in December by other organizations, including individuals, government agencies, and universities. The dependent variable is *Raw Citation* in Column (1) and *Adjusted Citation* in Column (2). The independent variable is *December Patent*, a dummy variable that equals one if the patent is filed in December by an individual, government agency, or university. We control for filing year, art unit, and assignee fixed effects. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the assignee level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dep. Var.	Raw Citation	Adjusted Citation
	(1)	(2)
December Patent	**-0.375**	**-0.021**
	(-0.97)	**(-1.30)**
Filing Year FE	Yes	Yes
Assignee FE	Yes	Yes
Art Unit FE	Yes	Yes
Adj. R^2	0.280	0.123
Observations	6,812,838	6,812,838

Table B3

Inventor Pressure and Opportunistic Behavior: Robustness Tests Using Lead Inventors

This table is similar to Table 6, except that we only include the lead inventor for each patent in the analyses. Panel A presents the results of inventor's working experience. The independent variable is *Spike Patent*. *Spike Patent* is a dummy variable that equals one if the average FYE tendency of an FYE Patent is above the sample median of the previous year, and zero otherwise. The independent variable is *Working Years*$_{t-1}$ in Columns (1), and *Total Patents Filed*$_{t-1}$ in Columns (2). *Working Years*$_{t-1}$ is the number of years an inventor has worked up to the previous year. *Total Patents Filed* $_{t-1}$ is the total number of patents filed by the inventor up to the previous year. Panel B presents the results of inventor's past performance. The independent variable is the *Average Adjusted Citation*$_{t-1}$ in Column (1), and *Average Originality*$_{t-1}$ in Column (2), and *Total Breakthrough Patent*$_{t-1}$ in Column (3). *Average Adjusted Citation*$_{t-1}$ is the average truncation adjusted citation for patents filed by the inventor up to the previous year. *Average Originality* is the average originality of patents filed by the inventor up to the previous year. *Total Breakthrough Patents* is the total number of breakthrough patents filed by the inventor up to the previous year. We control for filing year, art unit, and firm fixed effects. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the firm level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Working Experience

Dep. Var.	Spike Patent	
	(1)	(2)
Working Years$_{t-1}$	**-0.0002*****	
	(-4.11)	
Total Patents Filed$_{t-1}$		**-0.0003*****
		(-10.06)
Filing Year FE	Yes	Yes
Firm FE	Yes	Yes
Art Unit FE	Yes	Yes
Adj. R^2	0.018	0.022
Observations	1,672,276	1,672,276

Panel B: Past Performance

Dep. Var.	Spike Patent		
	(1)	(2)	(3)
Average Adjusted Citation$_{t-1}$	**-0.0026*****		
	(-8.70)		
Average Originality$_{t-1}$		**-0.0003*****	
		(-7.36)	
Total Breakthrough Patent$_{t-1}$			**-0.0023*****
			(-12.11)
Filing Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Art Unit FE	Yes	Yes	Yes
Adj. R^2	0.018	0.018	0.020
Observations	1,672,276	1,672,276	1,672,276