# Inventor Performance Pressure and Strategic Innovation Management*

**Xiangqian (Sharon) Huang**
CUHK Business School
Chinese University of Hong Kong
xiangqianhuang@cuhk.edu.hk

**Tao Shu**
CUHK Business School
Chinese University of Hong Kong and ABFER
taoshu@cuhk.edu.hk

**Xuan Tian**
PBC School of Finance
Tsinghua University
tianx@pbcsf.tsinghua.edu.cn

March 2025

* We appreciate the helpful comments from Vikas Agarwal, Sudipto Dasgupta, Andrew Ellul, Michael Hertzel, David Hirshleifer, Nadya Malenko, Xiao Ren, Siew Hong Teoh, Sheridan Titman, Bohui Zhang, and seminar participants at the Chinese University of Hong Kong. All errors are our own.

# Inventor Performance Pressure and Strategic Innovation Management

March 2025


## Abstract

We investigate whether corporate inventors, under pressure from annual performance appraisals, engage in opportunistic *innovation management* by filing an excessive number of low-quality patents during the fiscal year-end (FYE) month. Consistent with this behavior, 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. Patents associated with such innovation management exhibit significantly lower quality compared to their counterparts. Furthermore, innovation management is more pronounced among inventors who are trailing in patent filings earlier in the year, have less experience, or possess poor track records. Innovation management by inventors is associated with reduced inventor turnover in the initial years but increased turnover in subsequent years, highlighting a tradeoff between short-term gains from enhanced performance and long-term harm from lower patent quality and reputational damage. Finally, innovation management leads to lower future firm performance and stock returns. Our findings suggest that opportunistic innovation management contributes to the excessive filing of low-quality patents, a significant issue in the innovation system.



**Keywords**: Innovation management, inventor 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). Additionally, low-quality patents significantly impede the efficiency of the patenting process. For example, as of September 2024, the United States Patent and Trademark Office (USPTO) has a backlog of 793,824 unexamined patent applications. On average, a patent application takes over a year to be assigned to an USPTO examiner.[1]

Previous studies have examined fundamental drivers of patent quality, including firm characteristics, CEO traits, financial intermediaries, government policies, corporate events, and patent examiner attributes.[2] In this paper, we differ from prior research by examining whether opportunistic *innovation management* by inventors contributes to the prevalence of low-quality innovation.

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 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

[1] See https://www.uspto.gov/dashboard/patents/production-unexamined-filing.html.
[2] 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), Hirshleifer, Hsu, and Li (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).

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.

We examine whether the performance pressure from annual performance appraisal prompts inventors to engage in opportunistic innovation management by filing an excessive number of 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 the one hand, the number of patent filings is a crucial indicator in an inventor's performance review.[3] 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.[4] Consequently, inventors might be inclined to engage in innovation management. 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 innovation management by filing a disproportionately high number of patents in the FYE month? Second, do these additional patents have lower quality compared to other patents? Third, how do these patents impact firms' performance?

To address the first question, we begin by examining the seasonality of corporate patent

[3] The most significant performance criteria for individual inventors are patent applications, conference papers, patent grants, and journal publications (Balasubramanian, Lee, and Sivadasan 2018).
[4] 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.

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 innovation management due to annual performance appraisals.

For comparison, we examine patent filings by individuals, government agencies, and universities, and find no similar surge in year-end filings for these groups, suggesting that the spike in FYE patent filings is a corporate phenomenon. Further analyses reveal that innovation management among US firms persists over time, across various firm sizes, industries, and technologies. Innovation management also exists in other countries beyond the United States. For example, Chinese public firms exhibit a 120% increase in patent filings in December compared to other months during 2004 to 2023, given that all Chinse public firms have fiscal years ending in December. This seasonality remains robust in formal OLS and Poisson regression analyses that control for firm characteristics as well as firm and year fixed effects.

Next, we address the second question regarding patent quality. It is important to note that not all patent filings during the FYE months, i.e., FYE patents, are driven by innovation management. We thus categorize FYE patents into two groups – those associated with innovation management ("IM Patents"), and those not associated ("non-IM patents") – 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 associated with innovation management and are thus classified as *IM patents*. The remaining FYE patents are classified as non-IM patents. If inventors engage in opportunistic innovation management, we expect FYE patents, particularly IM patents, to exhibit significantly lower quality than 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 IM patents (rather than non-IM patents), whose quality measures are 7% to 10% lower compared to other patents.

To complement the analysis of patent quality, we follow the literature and examine patent disclosure quality (Dyer et al. 2024). Our findings indicate that innovation management also leads to significantly lower disclosure quality. Specifically, IM patents have shorter description sections, lower readability, and fewer figures and sheets compared to their peers. They also contain fewer claims, indicating narrower protection.

We next examine inventors' incentives and consequences of innovation management. Regarding incentives, we hypothesize that inventors who are trailing in patent filings earlier in the year are more likely to engage in innovation management.[5] Moreover, inventors with less experience or weaker track records may face intensified scrutiny during performance appraisals,

[5] This is similar to the well-documented tournament behavior of mutual fund managers, where mid-year losers tend to increase portfolio risk in the second half of the year (e.g., Brown, Harlow, and Starks, 1996).

potentially increasing their propensity for innovation management. Consistent with our predictions, we find that innovation management is significantly more prevalent among investors who are trailing in patent filings earlier in the year, have less experience (as measured by tenure and the number of past patents), and possess weaker track records (as measured by the average quality of their past patents).

Regarding consequences, we find that innovation management, which enhances annual innovation performance for inventors, is associated with a significantly lower likelihood of inventor turnover in the following four years. However, these inventors experience a significantly higher likelihood of turnover in subsequent years, consistent with the long-term negative effects from lower patent quality and reputational damage.

To directly examine the linkage between innovation management and annual performance appraisals, we analyze four cases in our sample period where firms abandon the practice of annual performance appraisals. We observe that innovation management significantly declines at these firms after the abandonment of annual performance appraisals. In contrast, peer firms that do not abandon annual performance appraisals exhibit no change in innovation management. We further conduct an inventor-level difference-in-differences (DiD) regression analysis and find that inventors engage in significantly less innovation management after their companies abandon annual performance appraisals. In the meantime, we find little relationship between innovation management and measures of CEO incentives, such as CEO horizon (proxied by remaining tenure and unexcised options) and firm performance (proxied by contemporaneous and historical financial performance and stock returns). These results suggest that innovation management is the result of opportunistic behavior by inventors rather than firm managers.

To address our third research question, we examine the relationship between innovation management 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 innovation management leads to lower patent quality, firms with a higher proportion of IM 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. We find that, for firms with high innovation intensity (past patents above the annual sample median), a higher proportion of IM patents in patent stock leads to significantly lower future financial performance. For example, a one-standard-deviation increase in the proportion of IM 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 IM patents is associated with significantly lower future stock returns.[6]

We contribute to the literature on corporate innovation by providing the first evidence of opportunistic innovation management and documenting its role in driving the excessive filing of low-quality patents, a significant issue in contemporary innovation. Our findings suggest that innovation management by inventors, driven by the pressure of annual performance appraisals, can lead to an excessive number of low-quality patents filed in the FYE months. It is worth noting that the observed innovation management 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

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

smaller scale.

Our paper also contributes to the literature on opportunistic behavior driven by fixed-term performance evaluations. For example, firms are well known to boost reported accounting performance through accrual-based and real-based earnings announcement (e.g., Dechow, Sloan, and Sweeney 1996; Healy and Wahlen 1999; Roychowdhury 2006). Similarly, mutual fund managers have been documented to engage in portfolio pumping or window dressing at quarter- and year-ends, showcasing their portfolio management skills to attract fund inflows (e.g., Lakonishok 1991; Chevalier and Ellison 1997; Musto 1999; Carhart et al. 2002). We extend this literature by documenting that inventors also engage in innovation management due to the pressure from annual performance appraisals, and this behavior significantly impacts corporate innovation, patent quality, and firm performance.

## 1. INSITUTIONAL BACKGROUND

### 1.1 Performance Review of Inventors

Balasubramanian, Lee, and Sivadasan (2018) conduct a survey among 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, particularly for those familiar with a firm's patent filing procedures and timelines. 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 engage in “innovation management” by filing more patents in the fiscal year-end to meet or exceed predefined objectives.

**1.2 Patent Filing Process**

The patent filing process in a firm begins with inventors submitting a 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 an 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 engage in innovation management in the fiscal year end month, especially for those who are familiar with their firms’ patent filing procedures.

One may wonder whether the observed innovation management, i.e., the excessive patent filings in the FYE month, 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.

## 2. DATA AND SAMPLE CONSTRUCTION

### 2.1 Data and Sample

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 PatentsView 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 PatentsView

[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.

database. Information regarding the nature of patent applicants, whether they are individuals, corporations, government agencies, or universities, also came from the PatentsView 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 2,259,890 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 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. INNOVATION MANAGEMENT AND 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 than 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 encouraging inventors' opportunistic innovation management.

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 innovation management, i.e., 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 innovation management for these groups.

We then examine if innovation management 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 innovation management is pronounced across all firm size groups classified by market capitalization (Panel A) or total assets (Panel B). These results suggest innovation management is a widespread phenomenon among U.S. public firms.

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 observed innovation management is unlikely to be driven by higher grant rates for FYE patent applications.

[8] Note that it takes on average over a year for a patent application to be assigned to an 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 whether innovation management 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 innovation management, 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, innovation management among Chinese public firms is even more pronounced than their US counterparts.

We further 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 innovation management exists globally.

Finally, we conduct formal regression analysis to further examine innovation management. 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

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

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, consistent with innovation management. 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 Innovation Management and Patent Quality

If innovation management 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 assesses 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 other patents.

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 Patents Associated with Innovation Management

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 result from opportunistic innovation management. Therefore, the quality difference observed in Table 3 underrepresents the reduction in quality caused by innovation management.

To distinguish normal and opportunistic patent filings in the FYE month, we divide FYE patents into two groups, namely IM patents (innovation management) and non-IM patents 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 IM 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 innovation management.

Table 4 presents the results of patent quality for the two subgroups of FYE patents: IM patents and non-IM 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 *IM Patent* is significantly negative in all models. The results are also economically significant, as they indicate that IM 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 IM patents helps us capture innovation management and sharpen the patent quality analysis.

We further compare the quality of IM patents and non-IM patents with patents filed in other months (non-FYE patents) separately. In Panel B of Table 4, we directly compare the quality differences between IM patents and non-FYE patents by excluding non-IM patents from the sample. The coefficients of *IM Patent* are negative and significant, similar to those in Panel A. Panel C of Table 4 presents the results of quality differences between non-IM patents and non-

FYE patents by excluding IM patents from the sample. The coefficients of *Non-IM Patent* are marginally significant or insignificant with a small magnitude, suggesting that there are no significant quality differences between non-IM patents and non-FYE patents.

Table 5 is similar to Table 4, except we present the results of patent quality 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 *IM 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 IM patents have a lower quality ranging from 7% to 10% using these measures.

We further compare the quality of IM patents and non-IM 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 IM patents and non-FYE patents by excluding non-IM patents from the sample. The coefficients of *IM Patent* are negative and significant, similar to those in Panel A. Panel C of Table 5 presents the results of quality differences between non-IM patents and non-FYE patents by excluding IM patents from the sample. The coefficients of *Non-IM Patent* are positively significant in Column (1), positively significant with much smaller magnitude compare to IM patents in Column (2) (0.022 and 0.004, respectively) or insignificant in Column (3). The results suggest that non-IM 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 patents associated with innovation management that further controls for firms' industries. Under this method, a patent is classified as *IM 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 Innovation Management and Disclosure Quality of 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 patents associated with innovation management 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 *IM Patent* is significantly negative, indicating that IM 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 *IM Patent* is significantly positive in all models, indicating that IM 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 *IM Patent* is significantly negative in both models, suggesting that patents associated with innovation management 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 IM 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 *IM 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 patents associated with innovation management have significantly lower quality compared to their peers.

## 4. INNOVATION MANAGEMENT: INVENTOR INCENTIVES AND CONSEQUENCES

Innovation management is consistent with inventors' opportunistic behavior due to the pressure from annual performance appraisal. In this section, we further examine inventors' incentives of innovation management by investigating the relation between innovation management and inventor characteristics. We then test the consequences of innovation management to inventors, including its short-term benefits and long-term costs in terms of job security.

### 4.1 Innovation Management and Inventor Characteristics

It has been well documented that individuals' career concerns influence their decision-making (Prendergast and Stole 1996; Holmstrom 1999). In this subsection, we examine three inventor characteristics that are likely associated with stronger incentives for innovation management. The first characteristic is motivated by the well-documented tournament behavior of mutual fund managers, where mid-year losers tend to increase portfolio risk in the second half of the year (e.g., Brown, Harlow, and Starks 1996). Similarly, inventors who are trailing in patent filing earlier in the year may be more likely to engage in innovation management to push up patent filings towards the end of the year.

To test this prediction, we construct two measures to identify trailing inventors. The first measure, *Trailing_3Qtrs*, is a dummy variable equals to one if the total number of patents filed by an inventor in the first three quarters of the year is lower than the first three quarters of the previous year, and zero otherwise. The second measure, *Trailing_11M*, is similarly constructed but based on the first eleven months of the year instead of the first three quarters. Panel A of Table 7 presents inventor-patent level regressions of a dummy variable for IM patents on these two measures.[11] The results show that, consistent with our prediction, the coefficients on both measures are significantly positive, indicating that inventors who are trailing earlier in a year are significantly more likely to engage in innovation management.

Next, we expect that 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 engage in innovation management compared to their peers.

Panel B 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 IM 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 innovation management.

Panel C 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 engage in innovation management.[12]

[11] We control for firm, filing year, and art unit fixed effects in the main results. In untabulated analysis, we control for firm by filing year and art unit fixed effects and find similar results.

[12] 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

## 4.2 Consequences of Innovation Management for Inventors

We further examine the short-term and long-term consequences of innovation management for inventors in terms of job security. On the one hand, inventors can use innovation management to enhance their annual performance and improve short-term job security. On the other, the decline patent quality arising from innovation management may damage the inventors' reputation, hinder long-term performance, and ultimately reduce long-term job security.

To test these predictions, we follow the literature and identify inventor turnovers by tracking their patent filing history. Specifically, an inventor's job switch is assumed to occur in the middle of the filing years of two consecutive patents with different companies (e.g., Marx, Strumsky, and Fleming 2009; Song, Almeida, and Wu 2003; Liu, Mao, and Tian 2023). For example, if an inventor files a patent for Firm A in 2008 and the next for Firm B in 2012, we assume the inventor moves from Firm A to Firm B in 2010.

Table 8 presents the regression results, where the dependent variables are $Turnover_{t+1}$ to $Turnover_{t+8}$, which are dummy variables equal to one if an inventor experiences a turnover in the corresponding years. The main independent variable, *%Inventor IM Patent*, is calculated as number of *IM* patents filed by the inventor in year *t*, scaled by the total number of patents filed by the inventor in year *t*. We find that the coefficient is significantly negative in columns (1) to (4), indicating that innovation management is associated with a significantly lower probability of turnover in the next four years. Interestingly, the coefficient becomes insignificantly positive in columns (5) and (6) and significantly positive in columns (7) and (8), suggesting that the negative consequences, in terms of an increased likelihood of turnover, begin to emerge in later years. These results illustrate the tradeoff between short-term gains and long-term harm associated with

find similar results in Table B3 of Appendix B. Overall, the results in this subsection provides evidence supporting the inventor opportunistic innovation management due to inventor performance appraisals.

innovation management.

## 5. IS INNOVATION MANAGEMENT DRIVEN BY INVENTORS OR MANAGERS?

While the observed innovation management is consistent with inventors' opportunistic behavior driven by pressure from annual performance appraisals, it could also stem from managerial performance pressures. In this section, we conduct balanced analyses to further investigate the relationships between innovation management, employee annual performance appraisal, and managerial (or firm) performance.

### 5.1 Innovation Management and Abandonment of Annual Performance Appraisal

To directly investigate the influence of inventor's annual performance appraisals on innovation management, 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 impact employee productivity and the relationship between employees and their managers. For example, in August 2015, General Electric announced that it 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 innovation management is associated with inventors' pressure from annual performance reviews, we would expect significantly less innovation management following the

[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/.

abandonment of annual performance review. Although there is no publicly available data for firms' annual performance review process, 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 innovation management, 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 fiscal year-end patent filings for these benchmark firms. These findings provide direct evidence that the innovation management is associated with annual performance appraisals.

We further exploit the cases where inventors move between the firms with annual performance appraisals and the firms that have abandoned annual performance appraisals. Although we can only observe four cases of abandonment of annual performance appraisals ("event firms"), these four firms are large tech companies that collectively account for 6.5% of corporate patent filings during our sample. We estimate an inventor-patent level regression using inventors who have filed at least one patent for an event firm. The dependent variable, *%Inventor FYE*, is defined as the number of FYE patents filed by the inventor in a given year, scaled by the

[15] See https://www.shrm.org/topics-tools/news/employee-relations/annual-performance-review-dead.

inventor's total patent filings in that year. The main independent variable, *Abandon*, is a dummy variable equal to one for inventors in the event firms in the years following the abandonment, and zero otherwise. In Table 9, the coefficient of *Abandon* is significantly negative, which is consistent with our univariate analysis that inventors are significantly less likely to engage in innovation management after the abandonment of annual performance review.

**5.2 Is Innovation Management Driven by Managerial Incentives?**

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 engage in innovation management to embellish their list of accomplishments, potentially explaining our findings. To investigate this alternative explanation, we conduct two analyses focused on CEO's long-term incentives and past performance.

CEO's 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 IM 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 *%IM Patent*, defined as the number of IM patents scaled by the total patents filed in a year, and the primary independent variable is a measure of inventor CEO long-term incentives.[16]

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 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

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

scaled by total compensation.[17] Longer tenure and more unexercised options indicate a longer CEO horizon. Panel A of Table 10 presents the regressions results, in which the coefficients of CEO long-term incentives are insignificant across all models. The results are inconsistent with the IM patents being driven by CEO incentives.

We further investigate the relationship between innovation management and CEO performance. CEOs with poorer performance may face increased pressure from performance appraisals, potentially driving innovation management. We examine this possibility using stock returns and ROA from the previous year and the current year as proxies for CEO performance. In Panel B of Table 10, we find little relationship between these measures and innovation management, which is inconsistent with the explanation based on managerial incentives. To summarize, the results this section suggest that innovation management is likely driven by inventors' pressure from annual performance appraisal rather than managerial opportunistic behavior.

## 6. INNOVATION MANAGEMENT AND FIRM PERFORMANCE

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

### 6.1 Innovation Management and Future Financial Performance

We begin by examining the relationship between innovation management and firms' future

[17] 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.

financial performance. Given that innovation management leads to lower patent quality, firms with a higher proportion of IM 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 IM*, which is defined as the cumulative number of IM patents up to the current year, scaled by the total cumulative number of patents filed up to the current year (henceforth patent stock).[18] We follow the literature and control for a broad set of firm 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 11 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 IM* is significantly negative in all models, showing that firms with a higher proportion of IM 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 IM* leads to a 0.92% decrease in ROA, which is a 13.1% decrease compared to the mean.

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

For a placebo test, we present results for low innovation intensity firms in Panel B of Table 11. We find that, consistent with our prediction, the coefficient of *Proportion IM* is statistically insignificant in all models. Taken together, the results in Panels A and B indicate that patents involving innovation management, relative to other patents, have a significantly negative impact on future financial performance in high innovation intensity firms.

### 6.2 Innovation Management and Future Stock Returns

If investors underreact to the negative impact of innovation management on firm performance relative to their peers, then firms with a higher proportion of IM 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 innovation management 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 IM* 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 12 presents the regression results for high innovation intensity firms. The coefficients of *Proportion IM* are negative and significant in all models, indicating that firms with a higher proportion of IM 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 IM* are statistically insignificant, suggesting that there is no correlation between IM patents and future stock returns in low innovation intensity firms. These results are consistent with the financial performance results in Table 11.

## 7. CONCLUSION

This paper investigates whether inventors engage in innovation management by filing an excessive number of 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 inventor opportunistic behavior, the patents associated with innovation management exhibit significantly lower patent quality and disclosure quality compared to other patents. Additionally, inventors trailing in patent filings earlier in the year, as well as those with less experience or weaker track record, who may face intensified scrutiny during performance appraisals, are significantly more likely to engage in innovation management. Additionally, innovation management by inventors leads to a lower turnover rate in the first several years but a heightened turnover rate in subsequent years, highlighting a tradeoff between short-term benefits and long-term costs.

We further examine four events where publicly listed firms abandon annual performance reviews and find that innovation management becomes significantly less pronounced after the abandonment of annual performance reviews. DiD analysis at the inventor level also reveals that inventors are less likely to engage in innovation management after their firms abandon annual performance reviews. In contrast, we find little relationship between innovation management and measures of CEO incentives, suggesting that innovation management likely stems from inventor behavior rather than managerial behavior. Finally, we provide evidence that innovation management negatively impacts future firm performance. Among innovation intensive firms, a higher proportion of IM 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 innovation management 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.

## REFERENCES


Antia, Murad, Christos Pantzalis, and Jung Chul Park, 2010, CEO decision horizon and firm performance: An empirical investigation, *Journal of Corporate Finance* 16, 288-301.

Audretsch, David B., 1995, Firm profitability, growth, and innovation, *Review of Industrial Organization* 10, 579-588.

Balasubramanian, Natarajan, and Jeongsik Lee, 2008, Firm age and innovation, *Industrial and corporate change* 17, 1019-1047.

Balasubramanian, Natarajan, Jeongsik Lee, and Jagadeesh Sivadasan, 2018, Deadlines, workflows, task sorting, and work quality, *Management Science* 64, 1804-1824.

Balsmeier, Benjamin, Lee Fleming, and Gustavo Manso, 2017, Independent boards and innovation, *Journal of Financial Economics* 123, 536-557.

Becker-Blease, John R., 2011, Governance and innovation, *Journal of Corporate Finance* 17, 947-958.

Brown, Keith C, W Van Harlow, and Laura T Starks, 1996, Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry, *Journal of Finance* 51, 85-110.

Burke, Ronald J., and Douglas S. Wilcox, 1969, Characteristics of effective employee performance review and development interviews, *Personnel Psychology* 3, 22.

Carhart, Mark M., Ron Kaniel, David K. Musto, and Adam V. Reed, 2002, Leaning for the tape: Evidence of gaming behavior in equity mutual funds, *Journal of Finance* 57, 661-693.

Chemmanur, Thomas J., Lei Kong, Karthik Krishnan, and Qianqian Yu, 2019, Top Management Human Capital, Inventor Mobility, and Corporate Innovation, *Journal of Financial and Quantitative Analysis* 54, 2383–2422.

Chen, Jun, Shenje Hshieh, and Feng Zhang, 2021, The role of high-skilled foreign labor in startup performance: Evidence from two natural experiments, *Journal of Financial Economics* 142, 430-452.

Chevalier, Judith, and Glenn Ellison, 1997, Risk taking by mutual funds as a response to incentives, *Journal of Political Economy* 105, 1167-1200.

Cohn, Jonathan B., Zack Liu, and Malcolm I. Wardlaw, 2022, Count (and count-like) data in finance, *Journal of Financial Economics* 146, 529-551.

Dechow, Patricia M., Richard G. Sloan, and Amy P. Sweeney, 1996, *Contemporary Accounting Research* 13, 1-36.

De Rassenfosse, Gaétan, William E. Griffiths, Adam B. Jaffe, and Elizabeth Webster, 2021, Low-quality patents in the eye of the beholder: Evidence from multiple examiners, *Journal of Law, Economics, and Organization* 37, 607-636.

Dyer, Travis A., Stephen Glaeser, Mark H. Lang, and Caroline Sprecher, 2024, The effect of patent disclosure quality on innovation, *Journal of Accounting and Economics* 77, 101647.

Eisenhardt, Kathleen M., 1989, Agency theory: An assessment and review, *Academy of management review* 14, 57-74.

Frakes, Michael D., and Melissa F. Wasserman, 2015, Does the US patent and trademark office grant too many bad patents: Evidence from a quasi-experiment, *Stan. L. Rev.* 67, 613.

Ganglmair, Bernhard, W. Keith Robinson, and Michael Seeligson, 2022, The rise of process claims: Evidence from a century of US patents, Working Paper.

Hall, Bronwyn H., Adam B. Jaffe, and Manuel Trajtenberg, 2001, The NBER patent citation data file: Lessons, insights and methodological tools, National Bureau of Economic Research Cambridge, Print.

Hall, Bronwyn H., Adam Jaffe, and Manuel Trajtenberg, 2005, Market value and patent citations, *RAND Journal of economics*, 16-38.

He, Jie Jack, and Xuan Tian, 2013, The dark side of analyst coverage: The case of innovation, *Journal of Financial Economics* 109, 856-878.

Healy, Paul M. and James Michael Wahlen, 1999, A Review of the Earnings Management Literature and its Implications for Standard Setting, *Accounting Horizons* 13, 365-383.

Hegde, Deepak, Alexander Ljungqvist, and Manav Raj, 2022, Quick or broad patents? Evidence from US startups, *Review of Financial Studies* 35, 2705-2742.

Hirshleifer, David, Angie Low, and Siew Hong Teoh, 2012, Are overconfident CEOs better innovators?, *Journal of Finance* 67, 1457-1498.

Hirshleifer, David, Po-Hsuan Hsu, and Dongmei Li, 2013, Innovative efficiency and stock returns, *Journal of Financial Economics* 107, 632-654.

Hirshleifer, David, Po-Hsuan Hsu, and Dongmei Li, 2018, Innovative originality, profitability, and stock returns, *Review of Financial Studies* 31, 2553-2605.

Holmström, Bengt, 1999, Managerial incentive problems: A dynamic perspective, *Review of Economic Studies* 66, 169-182.

Kogan, Leonid, Dimitris Papanikolaou, Amit Seru, and Noah Stoffman, 2017, Technological innovation, resource allocation, and growth, *Quarterly Journal of Economics* 132, 665-712.

Islam, Rafikul, and Shuib bin Mohd Rasad, 2006, Employee performance evaluation by the AHP: A case study, *Asia Pacific Management Review* 11.

Islam, Emdad, and Jason Zein, 2020, Inventor CEOs, *Journal of Financial Economics* 135, 505-527.

Lakonishok, Josef, 1991, Window dressing by pension fund managers, *American Economic Review* 81, 227-231.

Lansbury, Russell, 1988, Performance management: A process approach, *Asia Pacific Journal of Human Resources* 26, 46-54.

Lee, Joon Mahn, Jung Chul Park, and Timothy B. Folta, 2018, CEO career horizon, corporate governance, and real options: The role of economic short-termism, *Strategic Management Journal* 39, 2703-2725.

Lemley, Mark A., and Bhaven Sampat, 2012, Examiner characteristics and patent office outcomes, *Review of Economics and Statistics* 94, 817-827.

Liu, Tong, Yifei Mao, and Xuan Tian, 2023, The role of human capital: Evidence from corporate innovation, *Journal of Empirical Finance* 74, 101435.

Makri, Marianna, Peter J. Lane, and Luis R. Gomez-Mejia, 2006, CEO incentives, innovation, and performance in technology-intensive firms: A reconciliation of outcome and behavior-based incentive schemes, *Strategic Management Journal* 27, 1057-1080.

Makri, Marianna, Michael A. Hitt, and Peter J. Lane, 2010, Complementary technologies, knowledge relatedness, and invention outcomes in high technology mergers and acquisitions, *Strategic Management Journal* 31, 602-628.

Marco, Alan C., Joshua D. Sarnoff, and AW. Charles, 2019, Patent claims and patent scope, *Research Policy* 48, 103790.

Marx, Matt, Deborah Strumsky, and Lee Fleming, 2009, Mobility, Skills, and the Michigan Non-Compete Experiment, *Management science* 55, 875–889.

Mukherjee, Abhiroop, Manpreet Singh, and Alminas Žaldokas, 2017, Do corporate taxes hinder innovation?, *Journal of Financial Economics* 124, 195-221.

Musto, David K, 1999, Investment decisions depend on portfolio disclosures, *Journal of Finance* 54, 935-952.

Pakes, Ariel, 1986, Patents as options: Some estimates of the value of holding European patent socks, *Econometrica* 54.

Prendergast, Canice, and Lars Stole, 1996, Impetuous youngsters and jaded old-timers: Acquiring a reputation for learning, *Journal of Political Economy* 104, 1105-1134.

Righi, Cesare, and Timothy Simcoe, 2019, Patent examiner specialization, *Research Policy* 48, 137-148.

Roychowdhury, Sugata, 2006, Earnings Management Through Real Activities Manipulation, *Journal of Accounting and Economics* 42, 335-370.

Shu, Tao, Xuan Tian, and Xintong Zhan, 2022, Patent quality, firm value, and investor underreaction: Evidence from patent examiner busyness, *Journal of Financial Economics* 143, 1043-1069.

Singh, Jasjit, and Lee Fleming, 2010, Lone inventors as sources of breakthroughs: Myth or reality?, *Management Science* 56, 41-56.

Song, Jaeyong, Paul Almeida, and Geraldine Wu, 2003, Learning by hiring: When is mobility more likely to facilitate interfirm knowledge transfer?, *Management Science* 49, 351-365.

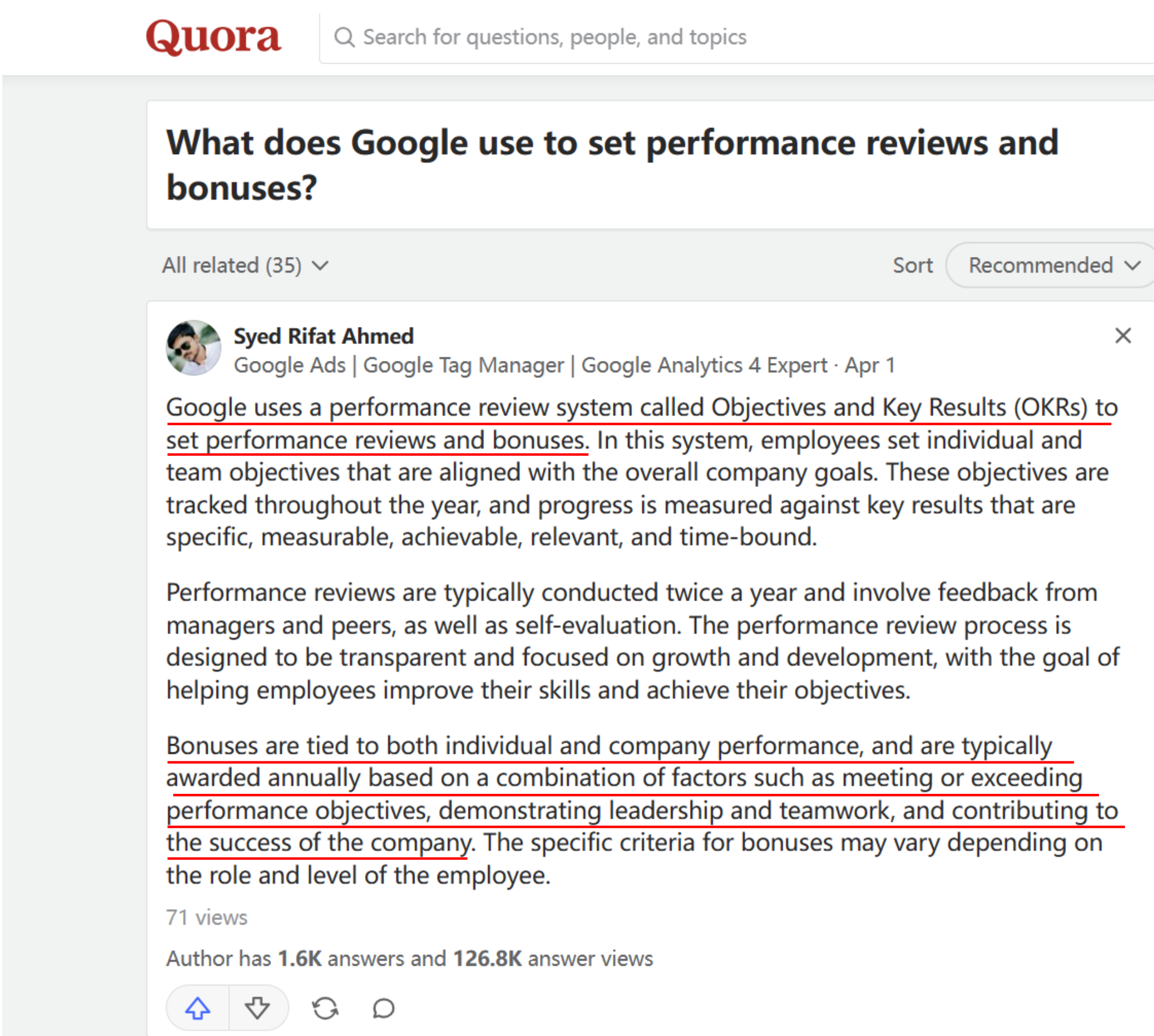
Valentini, Giovanni, 2012, Measuring the effect of M&A on patenting quantity and quality, *Strategic Management Journal* 33, 336-346.

**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**



Quora

Search for questions, people, and topics

**What does Google use to set performance reviews and bonuses?**

All related (35)

Sort Recommended

**Syed Rifat Ahmed**

Google Ads | Google Tag Manager | Google Analytics 4 Expert · Apr 1

Google uses a performance review system called Objectives and Key Results (OKRs) to set performance reviews and bonuses. In this system, employees set individual and team objectives that are aligned with the overall company goals. These objectives are tracked throughout the year, and progress is measured against key results that are specific, measurable, achievable, relevant, and time-bound.

Performance reviews are typically conducted twice a year and involve feedback from managers and peers, as well as self-evaluation. The performance review process is designed to be transparent and focused on growth and development, with the goal of helping employees improve their skills and achieve their objectives.

Bonuses are tied to both individual and company performance, and are typically awarded annually based on a combination of factors such as meeting or exceeding performance objectives, demonstrating leadership and teamwork, and contributing to the success of the company. The specific criteria for bonuses may vary depending on the role and level of the employee.

71 views

Author has **1.6K** answers and **126.8K** answer views

**Panel B: Discussion on Employee Performance Appraisal at Microsoft**

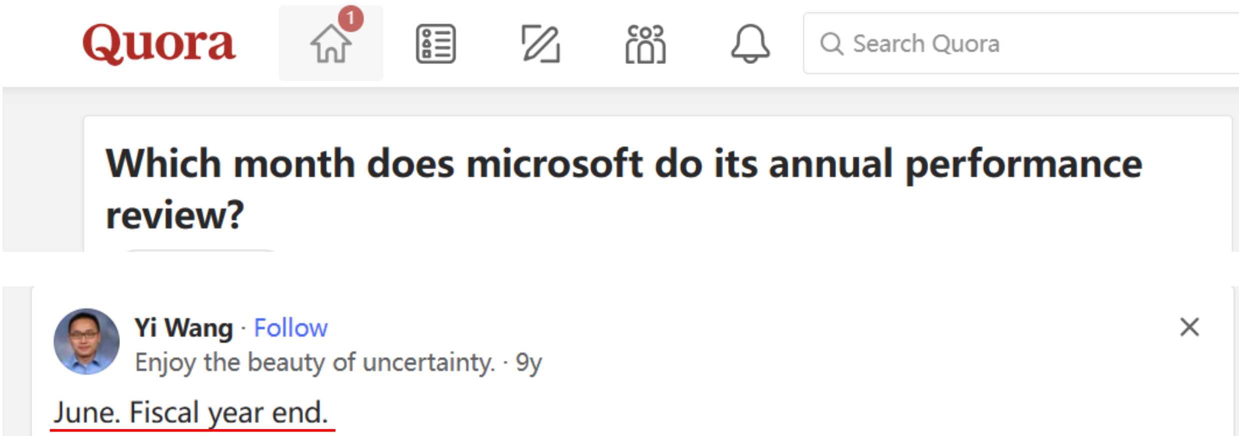
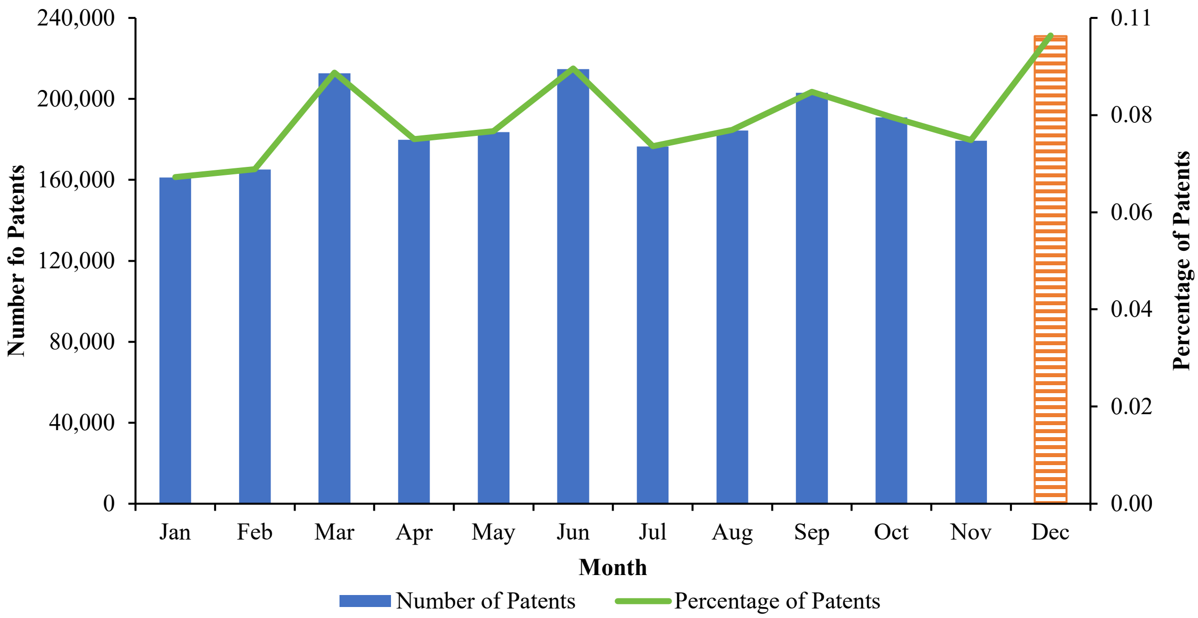


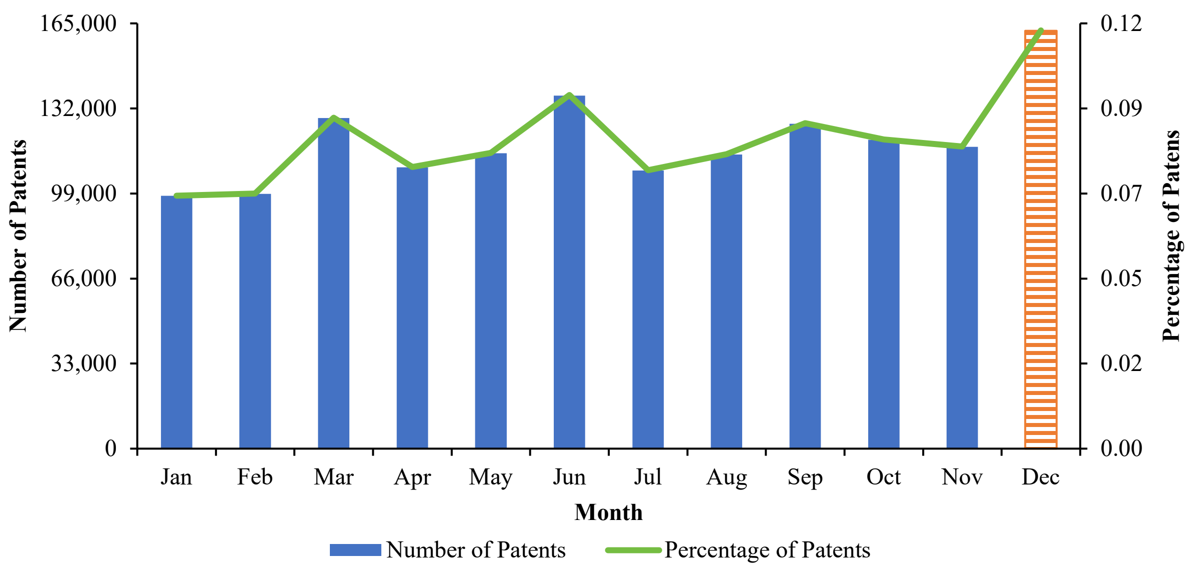
**Figure 2**
**Patents Filed by US Public Firms Across Calendar Months**

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**

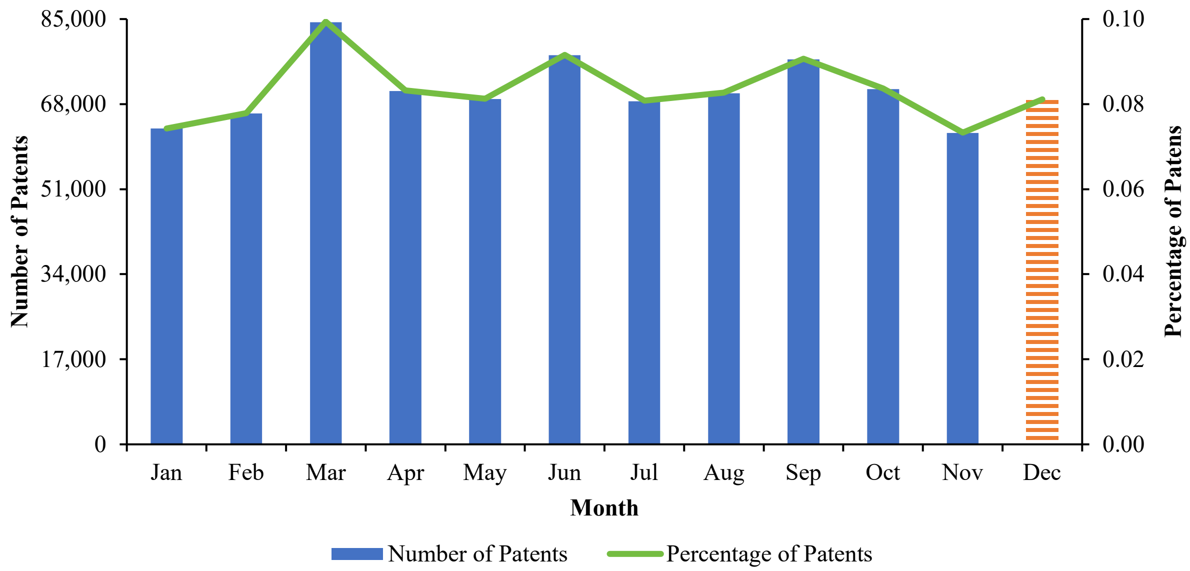


**Figure 3**
**Patents Filed by US Public Firms Across Fiscal Months**

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.

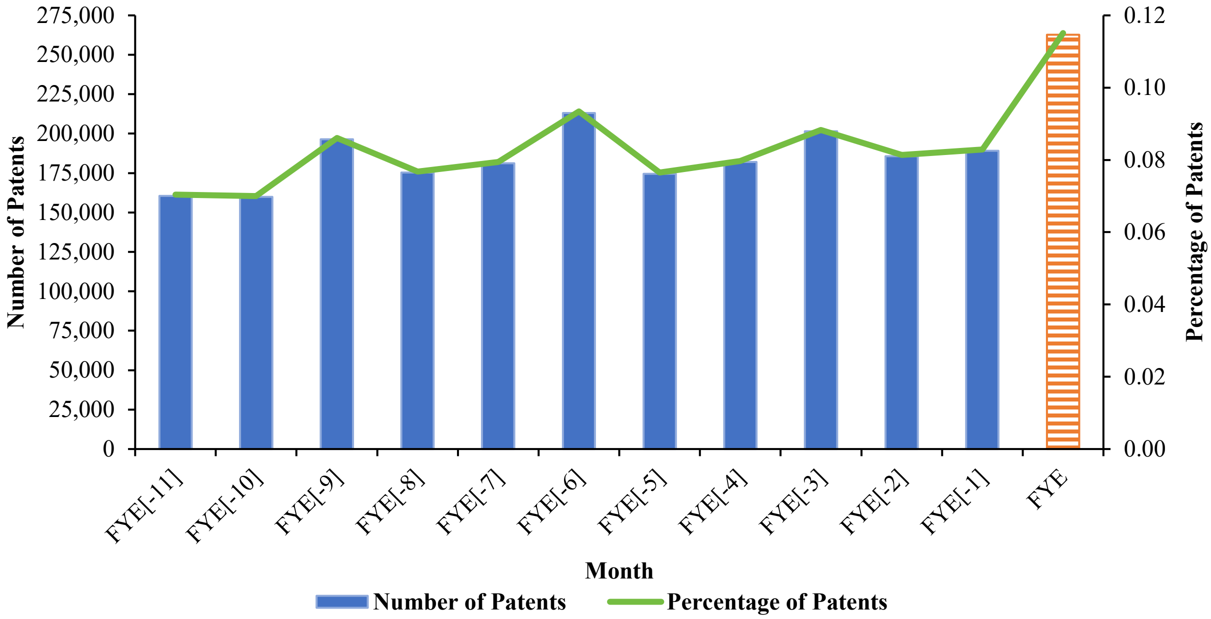


**Figure 4**

**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.

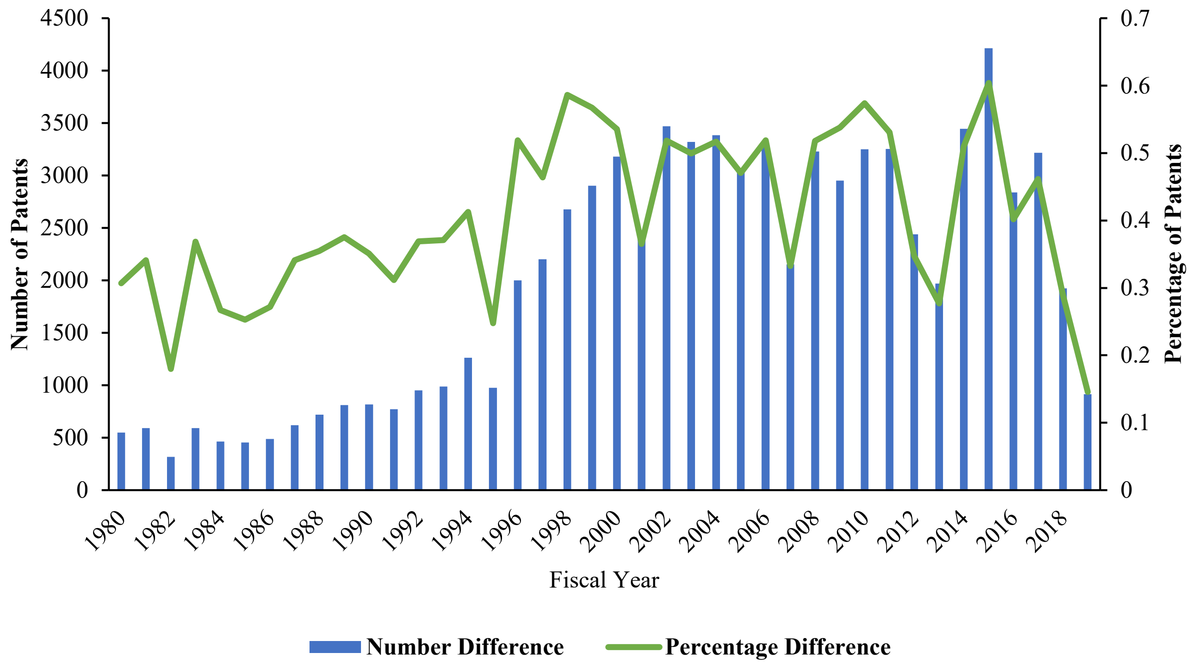
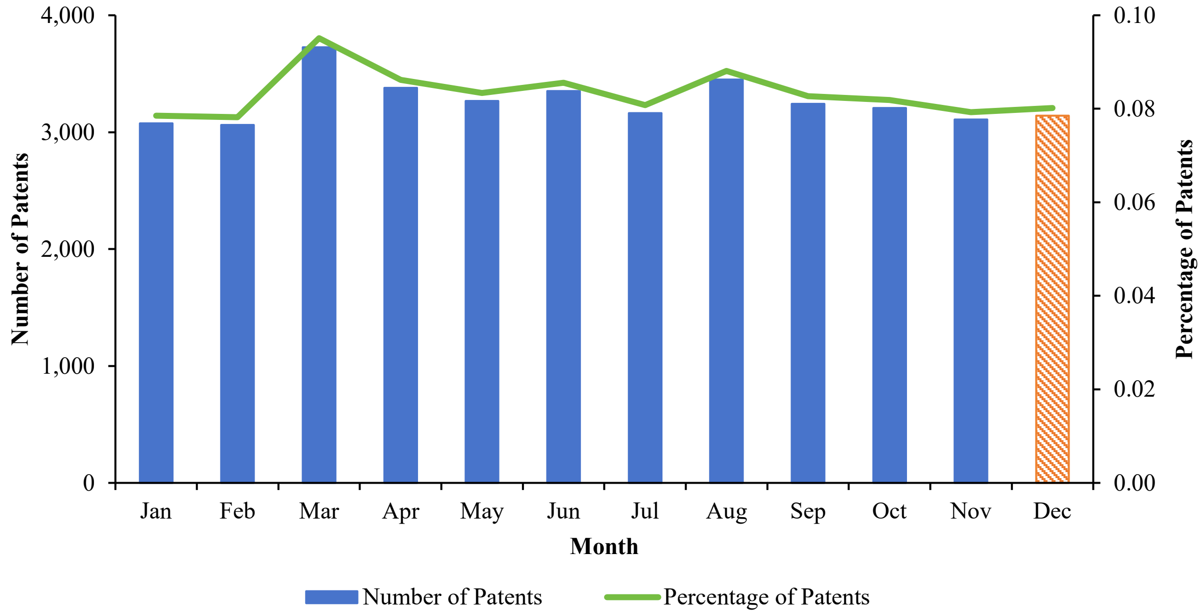


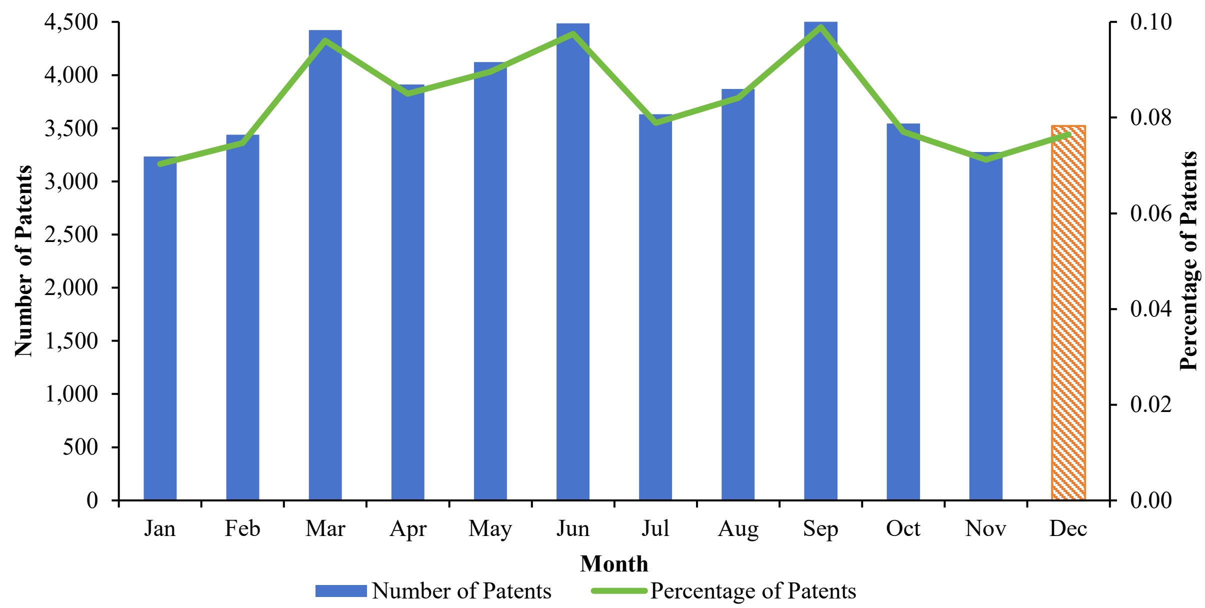
**Figure 5**
**Patents Filed by Individuals, Government Agencies, and Universities**

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**

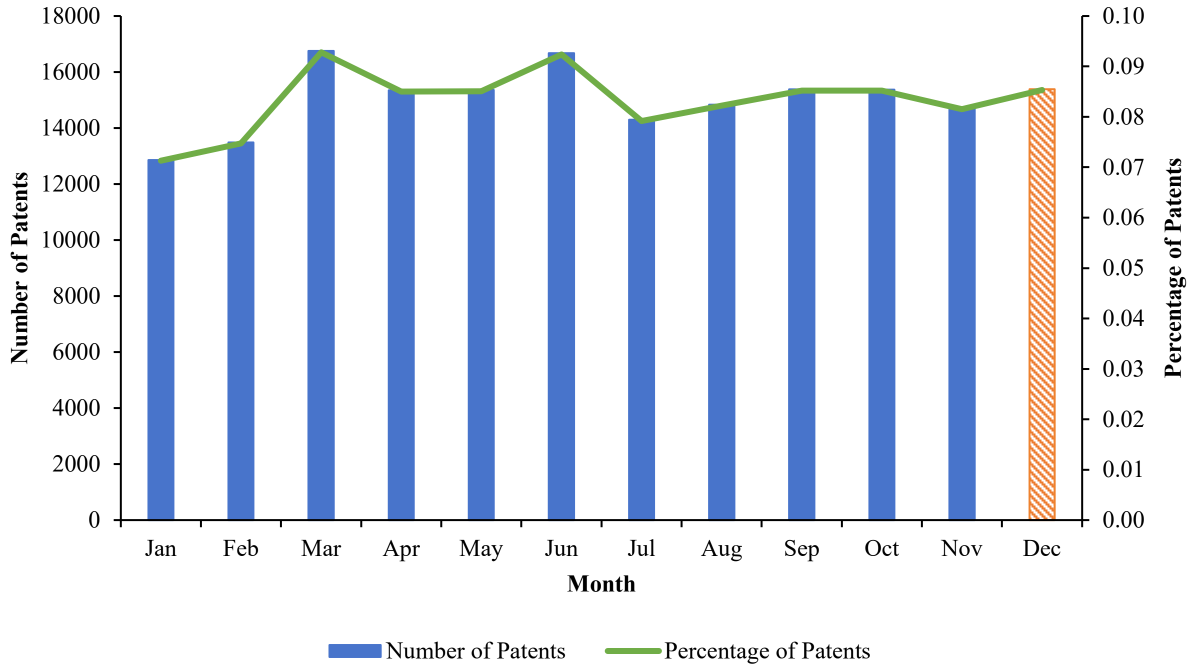
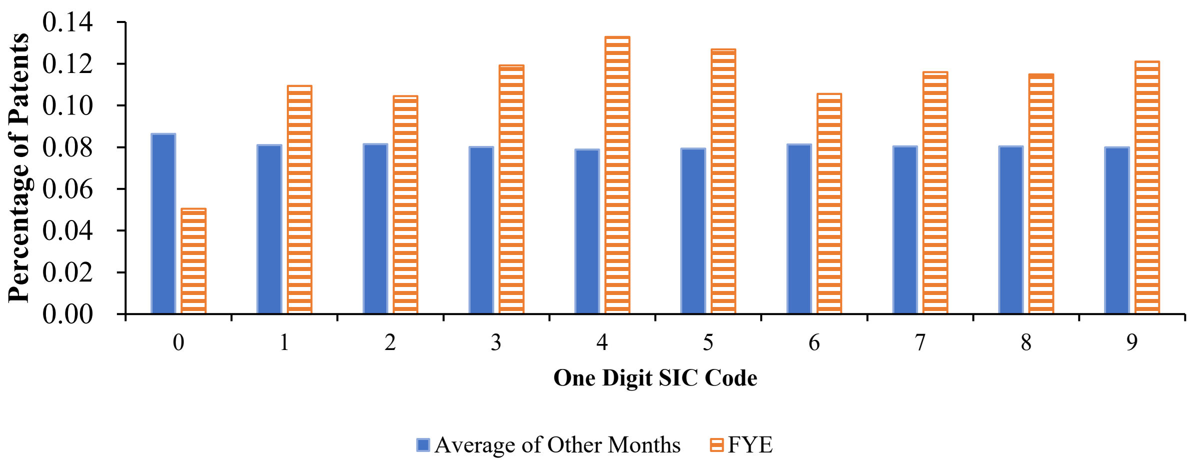


**Figure 6**
**Innovation Management across Industries and Technologies**

This figure presents innovation management 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**

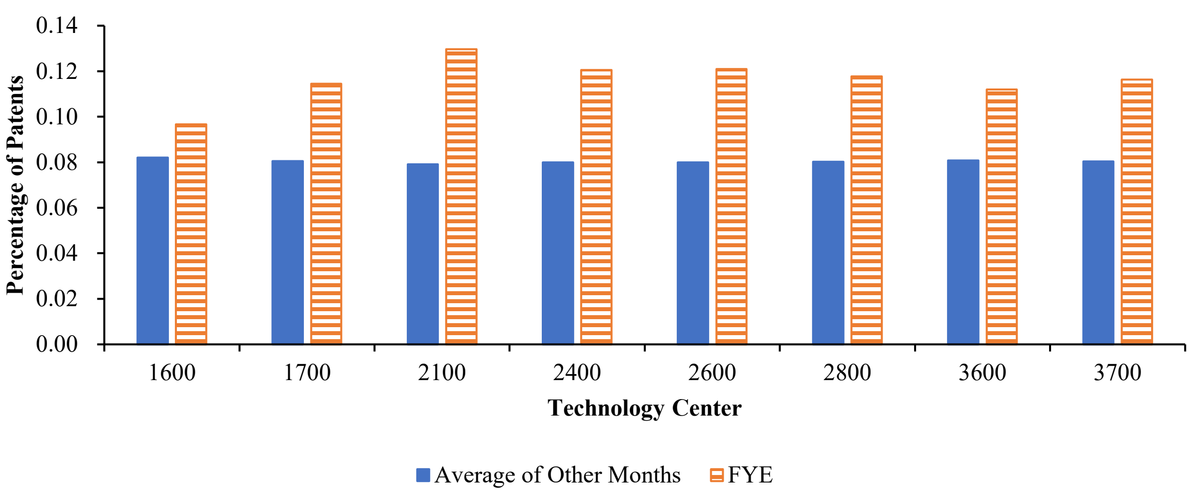
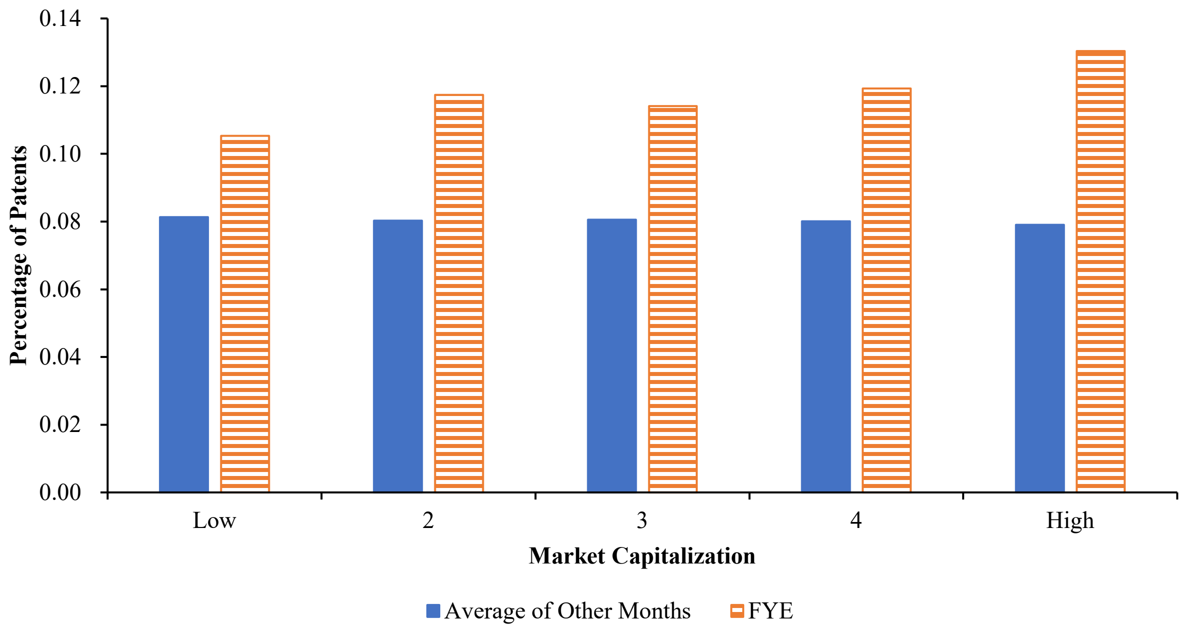


**Figure 7**
**Innovation Management across Firm Size**

This figure presents innovation management 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**

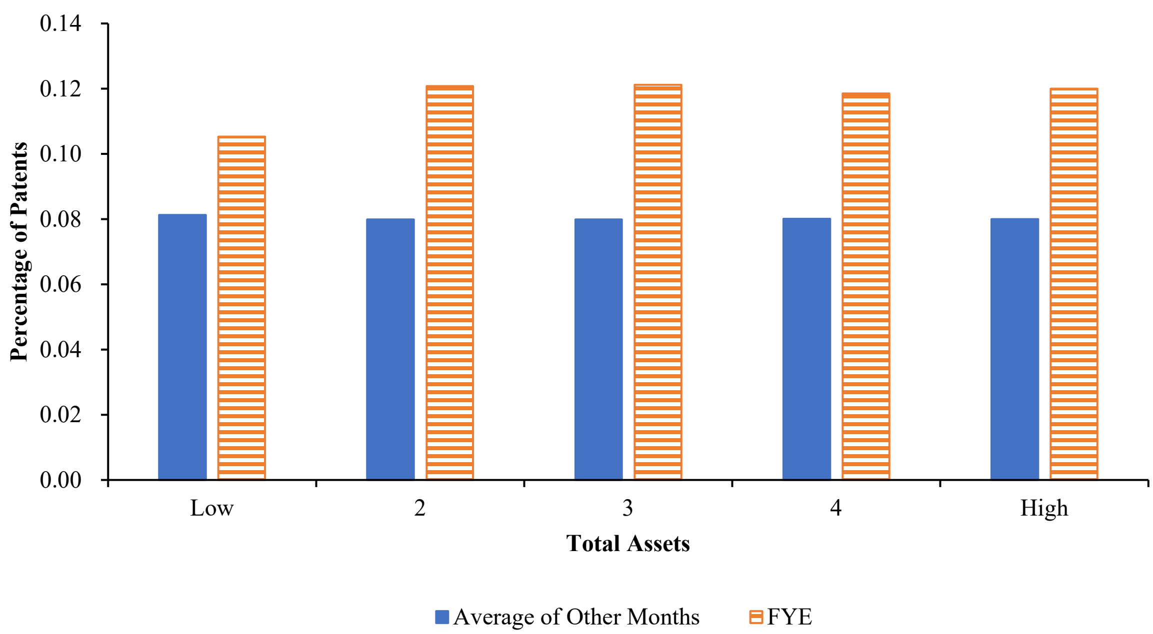


**Figure 8**
**Grant Rate of Patent Filings by Month**

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.

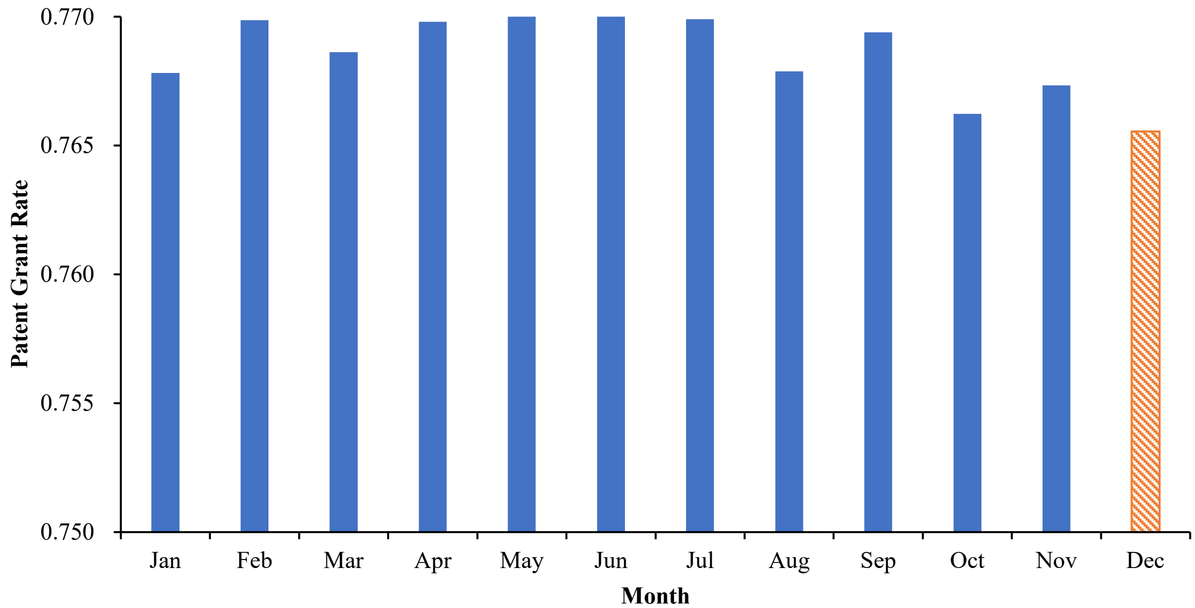
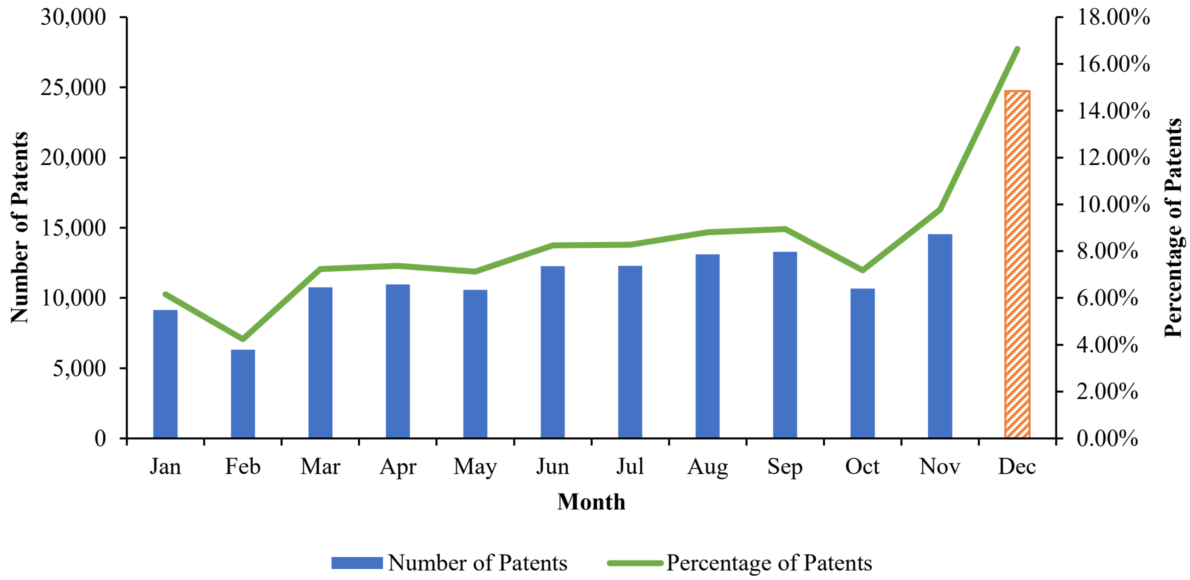


**Figure 9**
**Innovation Management: International Evidence**

This figure presents innovation management 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 between 2004 and 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: International Evidence**

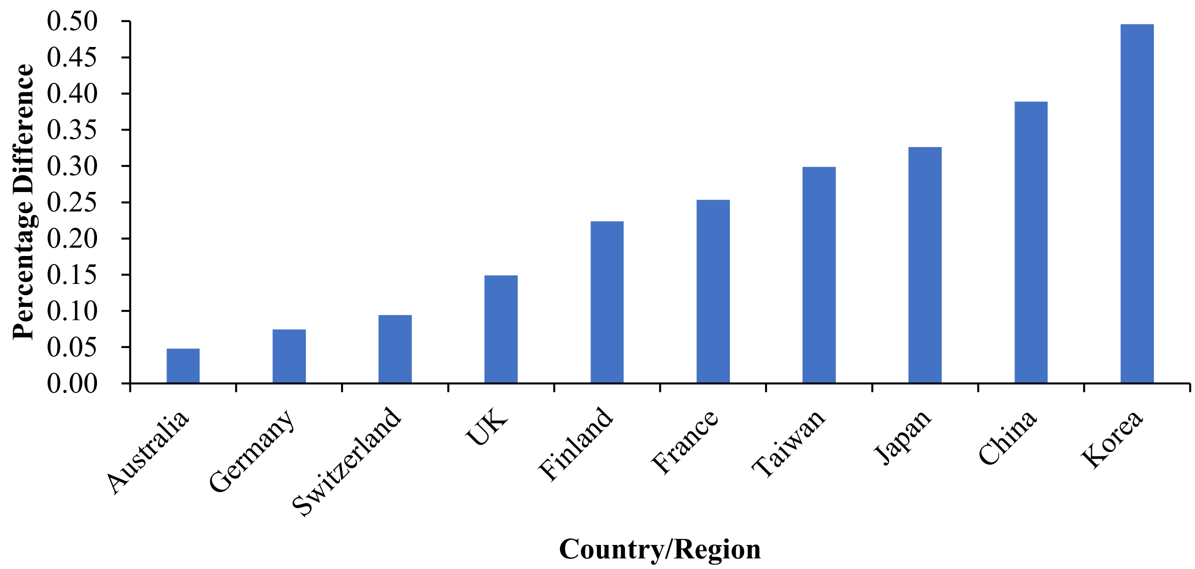
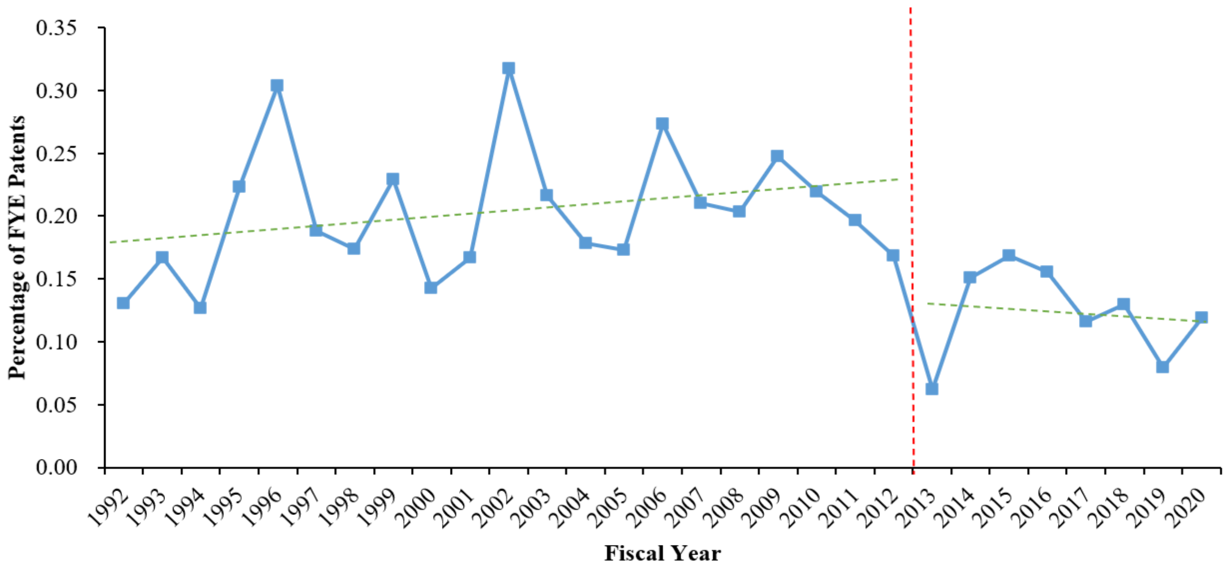


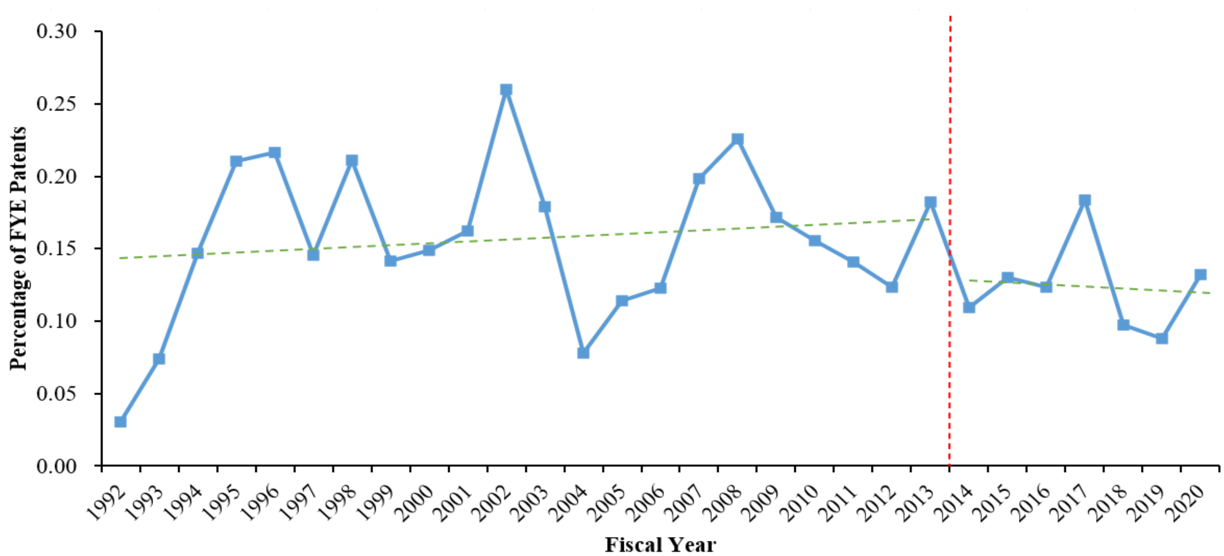
**Figure 10**
**Abandonment of Annual Performance Reviews and Innovation Management**

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.

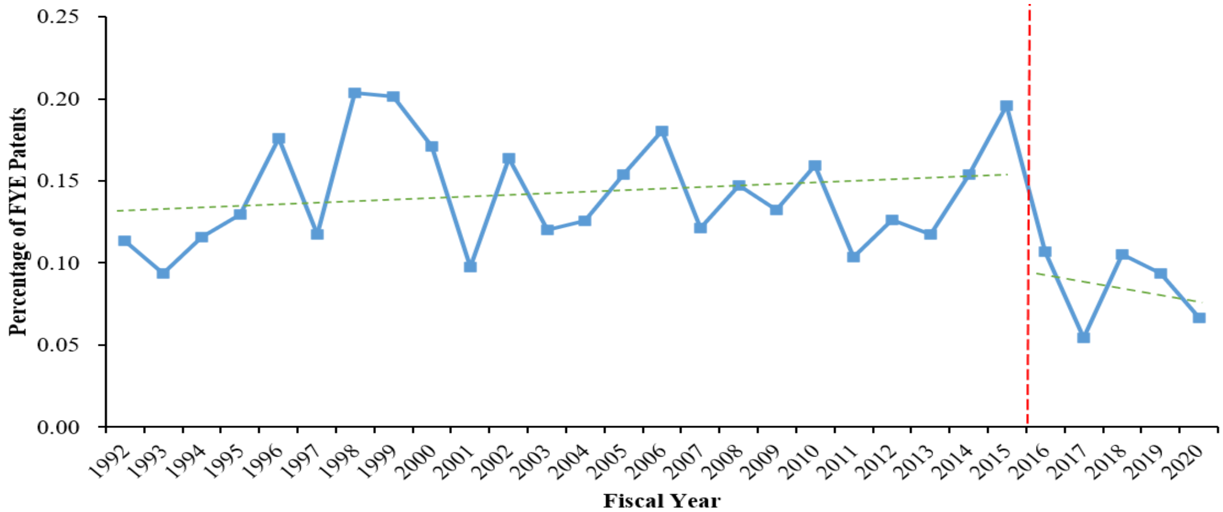
**Panel A: Medtronic PLC**



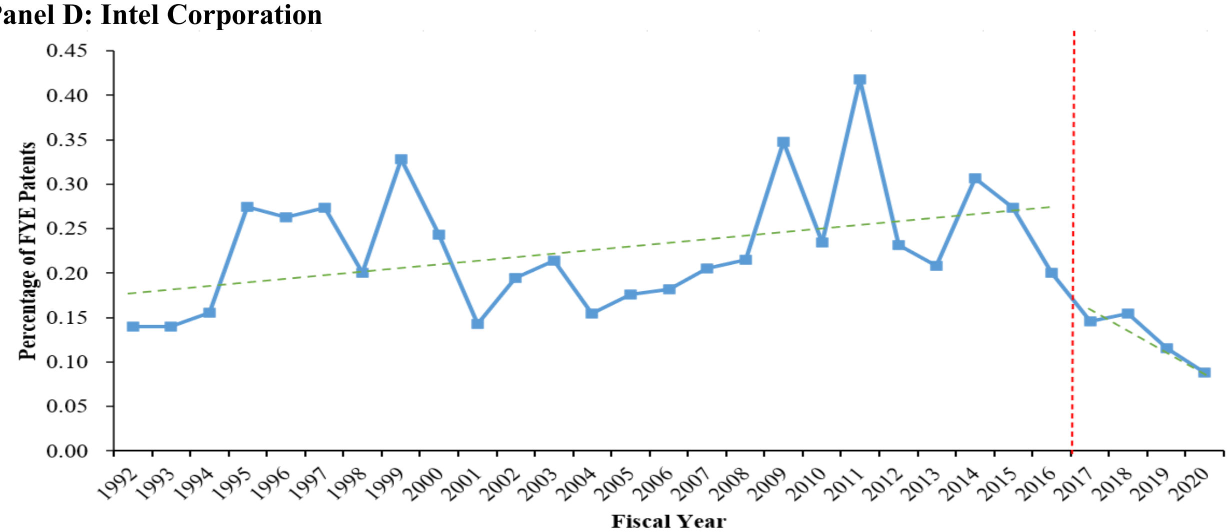

**Panel B: Microsoft Corporation**



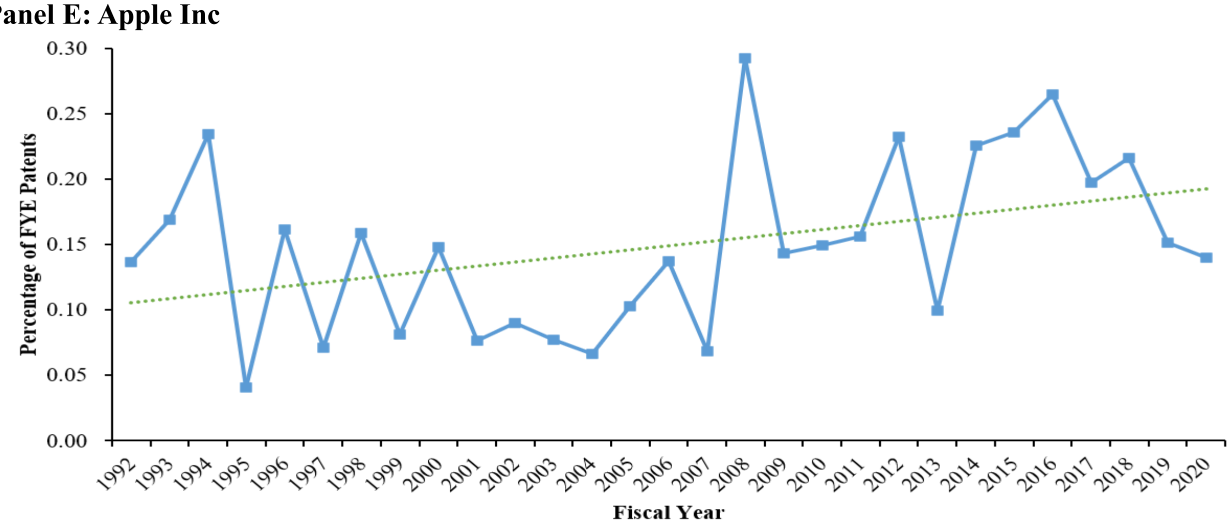
**Panel C: General Electric**



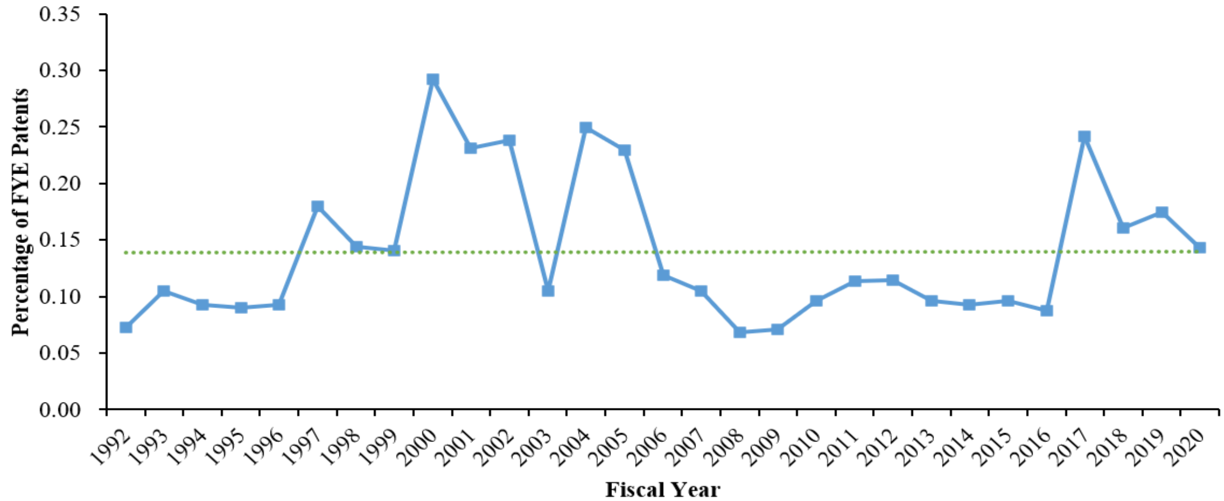

**Panel D: Intel Corporation**



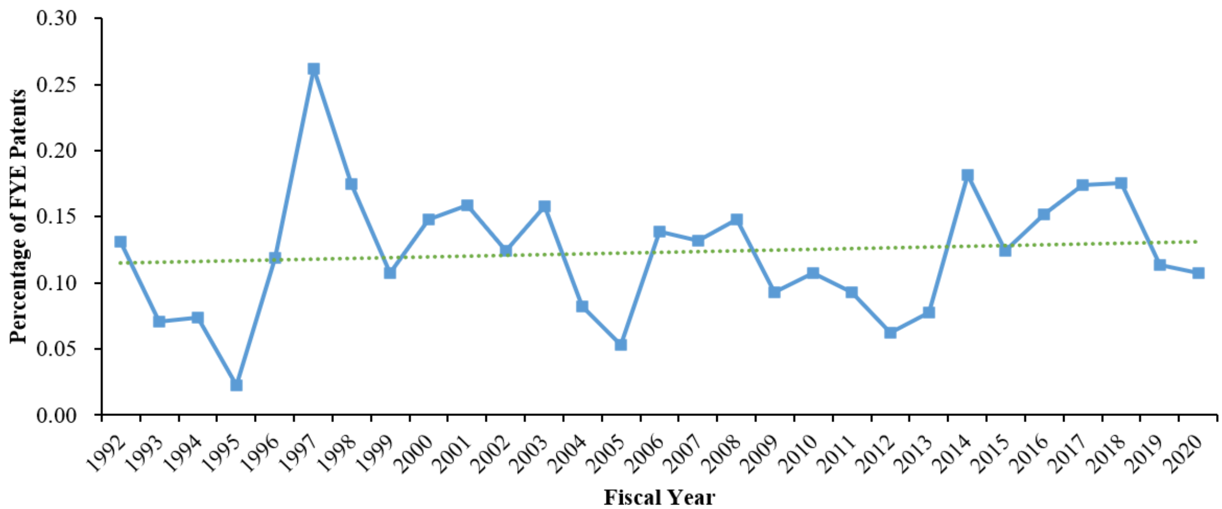

**Panel E: Apple Inc**



**Panel F: Micron Technology**




**Panel G: Texas Industries Inc**




**Panel H: Procter & Gamble Company**

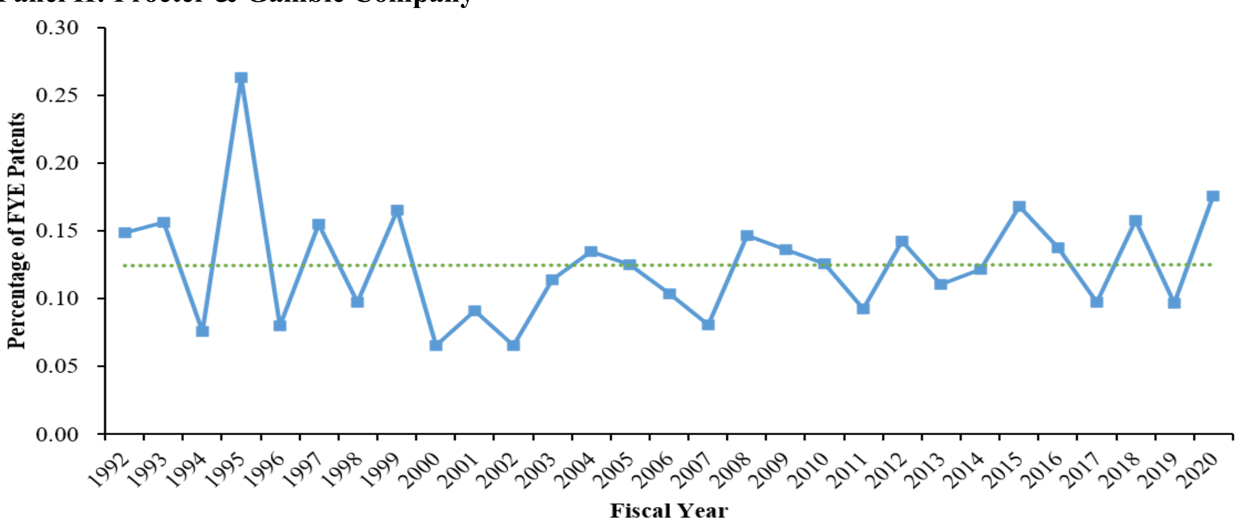


**Table 1**
**Summary Statistics**

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. *IM 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. Inventor 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 calculated as the average inventor FYE tendency for the patent. *Non-IM 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. *Trailing_3Qtrs* is a dummy variable equals to one if the total number of patents filed by an inventor in the first three quarters of the year is lower than the first three quarters of the previous year, and zero otherwise. *Trailing_11M* is a dummy variable equals to one if the total number of patents filed by an inventor in the first eleven months of the year is lower than the first eleven months of the previous year, and zero otherwise. *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. *%Inventor IM Patent* is the number of IM patents filed, scaled by the total number of patents filed by an inventor in a year. $Turnover_{t+1}$ is a dummy variable that equals one if an inventor moves to another company in the next 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. *%IM Patent* is the number of IM 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 Career Horizon* is the estimated time remaining until a CEO's departure due to retirement or termination. *IM Proportion* is the cumulative number of IM 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 | 2,259,890 | 0.11 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| IM Patent | 2,259,890 | 0.06 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Non-IM Patent | 2,259,890 | 0.06 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Citation | 2,259,890 | 12.98 | 26.53 | 0.00 | 0.00 | 3.00 | 13.00 | 34.00 |
| Adjusted citation | 2,259,890 | 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** | | | | | | | | |
| Trailing_3Qtrs | 4,791,747 | 0.26 | 0.44 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Trailing_11M | 4,791,747 | 0.25 | 0.43 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 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 |
| **Inventor Level Variables** | | | | | | | | |
| %Inventor IM Patent | 5,311,228 | 0.01 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Turnover_{t+1}$ | 5,311,228 | 0.05 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **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 IM | 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 |
| %IM 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 |

| **Variables** | **Obs.** | **Mean** | **SD** | **P10** | **P25** | **P50** | **P75** | **P90** |
|---|---|---|---|---|---|---|---|---|
| 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 |

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

This table examines whether there is innovation management in terms of 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 Patents associated with Innovation Management**

This table examines the quality of patents associated with innovation management. We categorize FYE patent into two groups: IM patents (innovation management) and non-IM patents based on FYE tendency. FYE tendency is the proportion of the inventor's FYE patent filings among all her patent filings in the year. The average FYE tendency for a patent is calculated as the average FYE tendency of all inventors who file that patent. *IM 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-IM patent. Panel A presents the quality of IM patents. The dependent variables are *Raw Citation* in Columns (1) and (2), and *Adjusted Citation* in Columns (3) and (4). The independent variable is *IM Patent*. In Panel B, we directly compare the quality differences between IM patents and patents filed in other months by excluding non-IM patents. Panel C presents the results of quality differences between non-IM patents and patents filed in other months, excluding IM 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) |
| **IM Patent** | **-0.776*****<br>**(-5.08)** | **-0.902*****<br>**(-6.86)** | **-0.076*****<br>**(-10.13)** | **-0.072*****<br>**(-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: IM Patents vs. Patents Filed in Other Months**

| **Dep. Var.** | Raw Citation | Adjusted Citation |
|---|---|---|
| | (1) | (2) |
| **IM Patent** | **-0.909*****<br>**(-6.90)** | **-0.071*****<br>**(-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-IM Patents vs. Patents Filed in Other Months**

| **Dep. Var.** | Raw Citation | Adjusted Citation |
|---|---|---|
| | (1) | (2) |
| **Non-IM 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 Patents associated with Innovation Management**

This table examines the quality of IM and Non-IM Patents using other patent quality measures including *Originality*, *No Citation* and *Breakthrough Patent*. We categorize FYE patent into two groups: IM patents (opportunistic) and non-IM patents (non-opportunistic) based on FYE tendency. FYE tendency is the proportion of the inventor's FYE patent filings among all her patent filings in the year. The average FYE tendency for a patent is calculated as the average FYE tendency of all inventors who file that patent. *IM 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-IM patents. Panel A presents the quality of IM patents. The dependent variables are *Originality* in Column (1), *No Citation* in Column (2) and *Breakthrough Patent* in Column (3). The independent variable is *IM Patent*. In Panel B, we directly compare the quality differences between IM patents and patents filed in other months by excluding non-IM patents. In Panel C, we directly compare the quality differences between non-IM patents and patents filed in other months by excluding IM 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) |
| **IM 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: IM Patents vs. Patents Filed in Other Months**

| **Dep. Var.** | Originality | No Citation | Breakthrough Patent |
|---|---|---|---|
| | (1) | (2) | (3) |
| **IM 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-IM Patents vs. Patents Filed in Other Months**

| **Dep. Var.** | Originality | No Citation | Breakthrough Patent |
|---|---|---|---|
| | (1) | (2) | (3) |
| **Non-IM 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 Patents associated with Innovation Management**

This table examines the disclosure quality of patents associated with innovation management. 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 *IM 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 variables are 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) |
| **IM 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) |
| **IM 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) |
| **IM Patent** | **-0.397*****<br>**(-3.21)** | **-0.197****<br>**(-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) |
| **IM Patent** | **-0.160****<br>**(-2.33)** | **-0.041*****<br>**(-3.38)** | **-0.112***<br>**(-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**
**Inventor Characteristics and Innovation Management**

This table examines the relationship between inventor characteristics and innovation management. In Panel A, the dependent variable is *IM Patent*, which is a dummy variable for patent associated with innovation management. The independent variable is *Trailing_3Qtrs* in Column (1) and *Trailing_11M* in Column (2). *Trailing_3Qtrs* is a dummy variable that equals one if the total patents filed by an inventor in the first three quarters of this year are less than the total number of patents filed in the first three quarters of the previous year, and zero otherwise. *Trailing_11M* is similarly defined as *Trailing_3Qtrs*, except it equals one if the total patents filed in the first eleven months of this year are less than those filed in the previous year. Panel B presents the results of inventor's working experience. 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 C 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: Trailing in Early Months**

| **Dep. Var.** | IM Patent | |
|---|---|---|
| | (1) | (2) |
| Trailing_3Qtrs | **0.058*****<br>**(18.02)** | |
| Trailing_11M | | **0.120*****<br>**(16.90)** |
| Filing Year FE | Yes | Yes |
| Firm FE | Yes | Yes |
| Art Unit FE | Yes | Yes |
| Adj. $R^2$ | 0.036 | 0.084 |
| Observations | 4,791,390 | 4,791,390 |

**Panel B: Working Experience**

| **Dep. Var.** | IM Patent | |
|---|---|---|
| | (1) | (2) |
| **Working Years$_{t-1}$** | **-0.0001*****<br>**(-2.74)** | |
| **Total Patents Filed$_{t-1}$** | | **-0.0003*****<br>**(-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 C: Past Performance**

| **Dep. Var.** | IM Patent | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| **Average Adjusted Citation$_{t-1}$** | **-0.0025*****<br>**(-8.18)** | | |
| **Average Originality$_{t-1}$** | | **-0.0003*****<br>**(-7.28)** | |
| **Total Breakthrough Patent$_{t-1}$** | | | **-0.0022*****<br>**(-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**
**Innovation Management and Future Inventor Turnovers**

This table examines the relationship between inventors' innovation management and their future turnovers. The dependent variable is Turnover $_{t+1}$ to Turnover $_{t+8}$ in Columns (1) to (8), respectively. Turnover $_{t+1}$ is a dummy variable that equals one if an inventor moves to another company in the next year, and zero otherwise. Turnover$_{t+2}$ to Turnover$_{t+8}$ are similarly defined, except they equal one if an inventor moves to another company in the next two to eight years. The independent variable is *%Inventor IM Patent*, which is defined as the number of IM patents filed, scaled by the total number of patents filed by an inventor in a year. We control for filing year and inventor fixed effects. T-statistics using robust standard errors adjusted for heteroscedasticity and clustered at the inventor level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| **Dep. Var.** | Turnover$_{t+1}$ | Turnover$_{t+2}$ | Turnover$_{t+3}$ | Turnover$_{t+4}$ | Turnover$_{t+5}$ | Turnover$_{t+6}$ | Turnover$_{t+7}$ | Turnover$_{t+8}$ |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **%Inventor IM Patent** | **-0.006**$^{***}$ | **-0.005**$^{***}$ | **-0.005**$^{***}$ | **-0.002**$^{**}$ | **0.000** | **0.000** | **0.004**$^{**}$ | **0.006**$^{***}$ |
| | **(-7.99)** | **(-6.14)** | **(-5.63)** | **(-2.13)** | **(0.34)** | **(0.05)** | **(2.43)** | **(3.78)** |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Inventor FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj. $R^2$ | 0.006 | 0.009 | 0.006 | 0.004 | 0.002 | 0.001 | 0.000 | 0.001 |
| Observations | 5,240,595 | 4,603,024 | 4,043,162 | 3,556,058 | 3,130,908 | 2,757,979 | 2,428,736 | 2,135,839 |

**Table 9**
**Abandonment of Annual Performance Appraisals and Innovation Management**

This table examines how a firm's abandonment of annual performance appraisals influences its inventors' innovation management. The dependent variable is *%Inventor FYE*, which is the number of FYE patents filed, scaled by the total patent filings by an inventor in a year. The independent variable is *Abandon*, which is a dummy variable that equals one for firms that announce the abandonment of annual performance reviews after the announcement year, and zero otherwise. We have identified four firms that announced their abandonment of the annual performance review: Medtronic (2012), Microsoft (2013), General Electric (2015), and Intel (2016). We control for firm and year fixed effects, or firm, year, and inventor fixed effects in some 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.** | %Inventor FYE | |
|---|---|---|
| | (1) | (2) |
| **Abandon** | **-0.016*****  | **-0.018***** |
| | **(-3.28)** | **(-3.40)** |
| Year FE | Yes | Yes |
| Firm FE | Yes | Yes |
| Inventor FE | No | Yes |
| Adj. $R^2$ | 0.006 | 0.038 |
| Observations | 446,315 | 434,370 |

**Table 10**
**Innovation Management and CEO Incentives**

This table examines the relationship between CEO characteristics and innovation management. Panel A presents the results of CEO's long-term incentives. The dependent variable is *%IM Patent*, which is defined as number of IM patents scaled by total patents filed in the year. The independent variable is *CEO Career 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.** | %IM Patent | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **CEO Career 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.** | %IM 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 11**
**IM Patents and Future Financial Performance**

This table examines the effect of IM 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 IM*, which is defined as the cumulative number of IM 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 IM** | **-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 IM** | **-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 12**
**IM Patents and Future Stock Return**

This table presents Fama-MacBeth regressions of monthly stock return on IM 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 IM* of year t-1. *Proportion IM* is defined as the cumulative number of IM 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 IM** | **-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 IM** | **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. |
| IM 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. Inventor 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 calculated as the average inventor FYE tendency for the patent. |
| Non-IM 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:** | |
| %IM Patent | Total number of IM scaled by total patents filed in the year. |
| Proportion IM | The cumulative number of IM 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 $Horizon_{i,t}$ = [$Tenure_{ind,t}$ - $Tenure_{i,t}$] + [$Age_{ind,t}$ – $Age_{i,t}$], where $Tenure_{ind,t}$ is the industry average tenure of all CEOs in year t, $Tenure_{i,t}$ is the tenure of CEO i in year t, $Age_{ind,t}$ is the industry average age of all CEOs in year t, and $Age_{i,t}$ is the age of CEO i in year t. |
| CEO Unexercised Options | Unexercised stock options scaled by total compensation. |
| **Inventor-Patent level Variables:** | |
| Trailing_3Qtrs | Dummy variable equals to one if the total number of patents filed by an inventor in the first three quarters of the year is lower than the first three quarters of the previous year, and zero otherwise. |
| Trailing_11M | Dummy variable equals to one if the total number of patents filed by an inventor in the first eleven months of the year is lower than the first eleven months of the previous year, and zero otherwise. |
| 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. |
| **Inventor Level Variables:** | |
| %Inventor IM Patent | Number of IM patents filed, scaled by the total number of patents filed by an inventor in a year. |
| $Turnover_{t+1}$ | Dummy variable that equals one if an inventor moves to another company in the next year. |

## Appendix B: Additional Results

### Table B1
### Alternative Measure of IM Patents

This table examines the quality of IM patents using an alternative innovation management 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 *IM Industry Patent*. *IM 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) |
| **IM Industry Patent** | **-0.832*****<br>**(-5.78)** | **-0.942*****<br>**(-7.47)** | **-0.074*****<br>**(-10.13)** | **-0.070*****<br>**(-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) |
| **IM Industry Patent** | **-0.144*****<br>**(-5.64)** | **0.021*****<br>**(10.90)** | **-0.005*****<br>**(-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 Innovation Management: Robustness Tests Using Lead Inventors**

This table is similar to Table 7, except that we only include the lead inventor for each patent in the analyses. In Panel A, the dependent variable is *IM Patent*, which is a dummy variable for patent associated with innovation management. The independent variable is *Trailing_3Qtrs* in Column (1) and *Trailing_11M* in Column (2). *Trailing_3Qtrs* is a dummy variable that equals one if the total patents filed by an inventor in the first three quarters of this year are less than the total number of patents filed in the first three quarters of the previous year, and zero otherwise. *Trailing_11M* is similarly defined as *Trailing_3Qtrs*, except it equals one if the total patents filed in the first eleven months of this year are less than those filed in the previous year. Panel B presents the results of inventor's working experience. The dependent variable is *IM Patent*. 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 C 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: Trailing in Early Months**

| **Dep. Var.** | IM Patent | |
|---|---|---|
| | (1) | (2) |
| Trailing_3Qtrs | **0.064**$^{***}$ | |
| | **(23.36)** | |
| Trailing_11M | | **0.160**$^{***}$ |
| | | **(28.08)** |
| Filing Year FE | Yes | Yes |
| Firm FE | Yes | Yes |
| Art Unit FE | Yes | Yes |
| Adj. $R^2$ | 0.059 | 0.096 |
| Observations | 1,709,625 | 1,709,625 |

**Panel B: Working Experience**

| **Dep. Var.** | IM 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 C: Past Performance**

| **Dep. Var.** | IM Patent | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| **Average Adjusted Citation$_{t-1}$** | **-0.0026*****<br>**(-8.70)** | | |
| **Average Originality$_{t-1}$** | | **-0.0003*****<br>**(-7.36)** | |
| **Total Breakthrough Patent$_{t-1}$** | | | **-0.0023*****<br>**(-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 |