# Busy Patent Examiners and Stock Returns

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The sharp time constraints faced by patent examiners can negatively impact the quality of patents they allowed. We measure the busyness of an examiner of a year using the number of patents approved by the examiner in the year, and find that patents approved by busier examiners have lower future citations and lead to lower profitability of innovating firms. Stock returns of firms with patents approved by busy examiners are 0.65 percent per month lower than those of firms with patents approved by nonbusy examiners. The effect of examiner busyness on stock returns increases in limited investor attention and firms' R&D expenditure, and lasts for two years without a subsequent reversal. We rule out the risk and endogeneity explanations by exploiting the random assignment of patent examiners within art unit. Our results suggest that investors underreact to the negative causal impact of examiner busyness on patent quality and stock prices.

**P**atent examiners are extremely busy. While patent examination takes three years on average (Allison and Lemley, 2000), examiners on average spend only about 18 hours over the entire process (Lemley, 2001; Frakes and Wasserman, 2017a). For an illustration of the busyness of patent examiners, Figure 1 presents the page of U.S. Patents and Trademarks Office (USPTO) at Glassdoor, a major website for employees to anonymously review their companies. Out of the 409 reviews, the two major "cons" are that "*… your ability to succeed… is seated in your ability to meet production requirements*" and that "*Lots of stress to meet production*".

Despite the large number of financial studies on corporate innoviation and patenting, there is little research on the impact of patent examiners who play a critical role in shaping innovation. This paper examines how the busyness of patent examiners impacts stock returns of the companies to which the patents are issued. Our research is based on the intuition that the sharp time constraints faced by patent examiners can potentially hurt the quality of patents. Among an abundance of anecdotal evidence, a study by the Manhattan Strategy Group cites a patent examiner's claim that "*rather than doing what I feel is ultimately right, I'm essentially fighting for my life*" (Washington Post, 2012).[1] Several legal studies also document that the time constraints faced by examiners negatively affect patent quality (e.g., Jaffe and Lerner, 2014; Lemley, 2001; Lemley and Sampat, 2012). Using a unique setting of examiner promotion that causes reduction in examination-time allocation, Frakes and Wasserman (2017a) show that less time allocated to review applications causes a decrease in patent quality.[2] Section 1 provides a comprehensive review of the patent examination process and the evidence of examiner busyness.

[1] See the news article at https://www.washingtonpost.com/news/the-switch/wp/2014/07/31/inside-the-stressed-out-time-crunched-patent-examiner-workforce/?utm_term=.869367685670.

[2] The evidence on busy patent examiners is in line with the finance literature that busier directors monitor less effectively (Core, Holthausen, and Larcker, 1999; Fich and Shivdasani, 2006; Falato, Kadyrzhanova, and Lel, 2014).

If busyness of patent examiners negatively impacts the quality of patents, then it can in turn affect the performance and stock prices of the firms holding these patents. We study this question using a large dataset from USPTO that covers all U.S. patents from 1981 to 2010, including a total of 3,341,951 patents granted by 11,215 unique examiners. We measure the busyness of an examiner in a year as the total number of patents granted by her over the year. Intuitively the more patents granted by an examiner during the year, the busier she is. A patent examiner on average issues 32 (in 2009) to 67 (in 1987) patents a year, and this number varies significantly across individual examiners. In any given year, the 90$^{th}$ percentile is normally above 100 but the 10$^{th}$ percentile is below five.

Next, we measure exmaminer busyness for a firm-year as the average of examiner-level busyness of all patents issued to the firm during the year. We drop penny stocks and requires a firm to have at least one patent issued during the year to construct the measure. Higher busyness measure for a firm-year indicates that the patents of the firm-year on average are allowed by busier examiners. The firm-level busyness measure has a mean of 71 and a large cross-sectional dispersion, with the 90$^{th}$ percentile about 100 in any given year, much higher than the 10$^{th}$ percentile of about 40. Our sample contains 4,176 unique firms from 1981 to 2010, with an average of 1,098 firms in each cross-section (32,928 firm-years). These firms account for one-third of U.S. patents in the sample period and 90% of the patent examiners.

Our analyses focus on stock returns because it is the most comprehensive measure of a firm's performance and value. For example, a firm's patents could take a relatively long time to translate into product and in turn revenue and profit, but it can be captured by the firm's stock price promptly. To motivate our stock return analysis, we nevertheless make attempts to examine the effect of examiner busyness on patent quality and firm profitability. We conduct panel regression analyses and find that patents approved by busier examiners receive significantly fewer future citations. Additionally, in the two-year period after patent issuance, firms with patents approved by busy examiners have significantly lower ROA and gross margin than those with patents approved by nonbusy examiners. These results are consistent with Kogan, Papanikolaou, Seru, and Stoffman's (2017) finding that scientific value and economic value of a patent are highly correlated.

We then start to examine if examiner busyness affect stock returns of firms holding the patents. While under the efficient market hypothesis stock prices fully reflect all available information, previous studies suggest that limited attention can make investors underreact to public information, especially complex and hard-to-process information (e.g., Hirshleifer and Teoh, 2003; DellaVigna and Pollet, 2009; Hirshleifer, Lim, and Teoh, 2009). Since innovation activity and patent quality are hard to evaluate, investors may underreact to the information about patents. For example, Hirshleifer, Hsu, and Li (2017) show that investors underreact to the originality of patent, causing a positive relation between innovative originality of a firm's patents and the firm's future stock returns. In our setting, if investors underreact to the negative impact of examiner busyness, then we expect that examiner busyness negatively predicts stock returns of firms holding the patents.

We first examine returns of stock portfolios sorted on examiner busyness. At the beginning of each month from July of year $t$ to June of year $t$+1, we sort sample firms into quintiles of the examiner busyness measure of year $t$-1, and calculate monthly value-weighted portfolio returns. We then report time-series averages of portfolio returns as well as t-statistics using Newey-West (1987) robust standard errors. We find a strong negative relation between examiner busyness and future stock returns in terms of raw return, CAPM alpha, Fama-French 3-factor alpha, and Carhart 4-factor alpha. For example, 4-factor alpha is 0.37% per month (t-stat 2.90) for the bottom quintile of busyness but -0.28% (t-stat -2.35) for the top quintile, with a spread of 0.65% per month (t-stat 3.32), both economically and statistically significant. The effect of examiner busyness is driven by both long and short portfolios, unlike most documented anomalies that are mainly driven by short portfolio.

We use value-weighted portfolio return because it is not driven by small stocks and outliers. We also examine equal-weighted return and find much weaker results. For example, the 4-factor alpha is 0.25% per month (t-stat 2.17) for the bottom quintile and -0.04% (t-stat -0.43) for the top quintile, with a spread of 0.30% (t-stat 2.12). This result indicates that the effect of examiner busyness is stronger for large stocks, probably because larger firms' innovation activity is harder to value as they are more complex and having more patents, as pointed out by Hirshleifer, Hsu, and Li (2017). This finding also shows that our finding on examiner busyess is not subject to the common critique that anomalies are generally driven by small stocks.

We corroborate the sorting analysis by estimating Fama-Macbeth regressions of stock returns on examiner busyness that control for firm characteristics including size, book-to-market ratio, momentum, short-term reversal, asset growth, ROE, and industry fixed effects. We also control for a firm's overall patenting activity by including the number of patents of the firm-year. In regressions using raw return, industry adjusted return, or FF3-adjusted return (Brennan, Chordia, and Subrahmanyam, 1998) as dependent variable, the coefficient of examiner busyness is significantly negative, indicating that our findings of examiner busyness is robust after controlling for firm chararcteristics and industry.[3]

The observed relation between examiner busyness and stock return can be driven by omitted variables, reverse causality, or risk. For example, some omitted variables may drive both stock returns and examiner busyness, or firms that submit higher-quality patent applications or have higher risk tend to get non-busy examiners. We use two approaches to addess these concerns. First, we conduct robustness tests using the Fama-French 5-factor model (Fama and French, 2015) and the *q*-factor model (Hou, Xue, and Zhang, 2015) to more thoroughly control for return factors. Both the Fama-

[3] We also conduct subgroup analysis based on firm size. Consistent with the sorting analysis, the coefficient of examiner busyness is significantly negative in large stocks but not in small stocks.

French 5-factor model and the *q*-factor model are shown to better capture variation in stock returns and explain a much larger set of anomalies than the traditionally used factor models. We further complement these models with a momentum factor. Our results show that the effect of examiner busyness in fact becomes stronger using these models. For example, the spread of alpha between the top and bottom quintiles of examiner busyness is 0.94% (t-stat 4.60) using Fama-French 5-factor model and 0.93% (t-stat 4.11) using *q*-factor model.

Our second approach exploits the random assignments of patent examiners. A patent application filed with USPTO is first sent to an art unit according to the technology field, and then the supervisory patent examiner (SPE) of the art-unit assigns the application to an examiner in a random fashion (Lemley and Sampat, 2012; Farre-Mensa, Hedge, and Lungqvist, 2017, more details in Section 1). We construct an art-unit adjusted busyness measure based on the busyness of an examiner relative to other examiners in the same art-unit. This adjuste measure therefore is exogenous to firm fundamentals or quality of patent application. Empirically, this adjusted measure has very low correlations with firm characteristics, consistent with it being an exogenous measure.[4] Because the art-unit adjustment eliminates part of the variation of examiner busyness, the variation in art-unit adjusted busyness measure is only about two-third of that in the original busyness measure. Nevertheless, we find that the effect of busyness remains using the adjusted busyness measure. For example, the 4-factor alpha is 0.15% (t-stat 1.46) for bottom quintile of adjusted busyness measure and -0.23% (t-stat -2.33) for the top quintile, with a spread of 0.38% (t-stat 2.56). This result shows that the effect of examiner busyness is unlikely to be explained by omitted variables, endogeneity, or risk.

We also examine an alternative explanation based on examiner leniency. Examiner busyness is measured using the number of patents granted by an examiner. Everything else equal, more lenient

[4] The adjusted busyness measure has correlations of 0.00 with contemporaneous stock return, ROE, and ROA, -0.01 with market capitalization and momentum, 0.01 with gross margin, -0.02 with asset growth, 0.02 with capital expenditure, -0.03 with R&D, and 0.03 with book-to-market ratio.

examer tend to grant more patents. We follow Farre-Mensa, Hegde, and Ljungqvist (2017) and construct a measure of examiner leniency, and find no relation between examiner leniency and future stock returns. This result indicates that the observed effect of examiner busyness is not explained by examiner leniency.

We conduct two subgroup analyses to further understand the effect of examiner busyness. The first anlaysis is based on R&D expenses because the effect of examiner busyness is expected to be stronger in high R&D firms where innovation and patents are more important drivers of stock prices. We indeed find that the effect of examiner busyness is large and significant in high R&D stock but small and insignificant in low R&D stock. The second analysis is based on limited investor attention, as investor underreaction is expected to be stronger when there is limited attention. We construct a unique measure of limited investor attention in the patent setting. Specifically, USPTO discloses issuance of patents on Tuesdays in its *Official Gazette of the United States Patent and Trademark Office*. There is likely to be a greater degree of limited attention to a patent announcement if a larger number of patents in the same technology field are announced on that day. We construct a measure of *innovation distraction* for a patent as the total number of patents in the same technology field issued on the same day, and then for a firm-year as the average of innovation distraction of all patents of the firm-year. We find that the effect of examiner busyness on stock returns is twice as large in high distraction stocks as that in the low distraction stocks.

Finally, we examine long-term returns because under the hypothesis of investor underreaction, we should expect no long-term reversal of the effect of examiner busyness. We sorted firms into the quintiles of the busyness measure of $t$, and examine monthly 4-factor alphas in the four years from $t$+1 to $t$+4. The spread of monthly alpha between the bottom and the top quintiles is 0.37% (t-stat 1.75) for the first year, 0.72% (t-stat 3.96) for the second year, 0.10% (t-stat 0.58) for the third year, and 0.15% (t-stat 0.74) for the fourth year. Therefore, consistent with investor underreaction, the effect of examiner busyness on future returns lasts for two years and does not reverse.

While most financial studies on innovation examine the drivers of corporate innovation activities, we study how patent examiners impact patent quality and in turn innovating firms. Our findings have implications for how to value patents, which is critical for optimal management and financing of innovating activities. We show that the busyness of examiners can have significant impact on patent quality and firm values, yet investors seem to underreact to such impact, causing a strong negative relation between examiner busyness and future stock returns.[5]

Our study also contributes to the literature of market efficiency, especially investor underreaction to public information. Two major critiques about the behavioral finance literature are that the anomalies are driven by small stocks which are neligible, and that ruling out explanations of risk or endogeneity is very difficult. The effect of examiner busyness on stock returns is much stronger in large stocks, and the random assignment of examiners allows us to construct an exogeneous measure to rule out the explanations based on risk or endogeneity. Therefore, our findings establish a solid case of investor underreaction to public information in the financial markets.

Our paper also has policy implications. It is widely believed that too many invalid patents are issued in the U.S., imposing significant costs to the society and draining social welfare.[6] Both anecdotal evidence and legal studies have set out to relate issuance of bad patents to the sharp time constraints faced by patent examiners. Our evidence from the financial markets suggests that relaxing the time constraints faced by patent examiners may improve the patent examination process and overall quality of patents issued in U.S.

[5] Farre-Mensa, Hegde, and Ljungqvist (2017) also examine the impact of patent examiners on innovation activity. They show that the start-ups whose patent applications get more lenient examiners are more likely to have patents issued and in turn have higher future growth and innovation.

[6] See a summary of anecdotal evidence and academic studies in Frakes and Wasserman (2015).

## 1. Process of Patent Examination and Examiner Assignment

### 1.1 Process of Patent Examination

After a patent application is filed with the USPTO, it is first sent to one of the art units based on its technology field. An art unit has eight to fifteen patent examiners, and the supervisory patent examiner (SPE) of the art unit assigns the application to a specific examiner. The examiner then reviews the application and search for "prior art" (previous patents, previous patent applications, or other relevant material) to assess the novelty and nonobviousness of the claims in the application. Patent examination takes three years on average (Allison and Lemley, 2000), including reading and evaluating an application, searching for prior art, wirting a rejection, responding to an amendment with a second office action, having an interview, and fulfilling various format requirements. However, examiners on average spend only about eighteen hours on any given patent application over the entire process (Lemley, 2001; Frakes and Wasserman, 2017a).

For majority of the applications, examiners issue an initial rejection which describes the problems such as the claimed invention does not involve statutory subject matter, the invention is not useful, applicants fail to satisfy the disclosure requirements, lack of novelty, or lack or obviousness.[7] The applicants generally respond by amending the application or dispute rejection, and examiners then decide whether to allow the applications or issue final rejections. Even after final rejections, applicants can still respond by amending the applications. Interviews between applicants and reviewers are often arranged during the review process. On average, an application takes 0.7 year to be assigned to an examiner and about three years from the application date to reach a final decision (Lemley and Sampat, 2012; Farre-Mensa, Hegde, and Ljungqvist, 2017). There have been increasing criticisms about the U.S. patent system in recent years, especially too many invalid patents are issued. Invalid patents

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[7] Examiners allow a patent application in the first round for a small number patents.

impede competition, imposes large costs to the society, and cause issues such as patent trolls by nonpracticing entities (Frakes and Wasserman, 2015).

### 1.2 Busy Patent Examiners

There is an abundance of evidence that patent examiners face sharp time constraints during the patent examination. For example, Figure 1 presents the page of USPTO at Glassdoor, a major website of anonymous employee reviews, and the two major "cons" from employee reviews are both about the stress to meet production requirements. For another example, In a report commissioned by USPTO, the Manhattan Strategy Group (2010) stated that "*Examinres consistently expressed the need for additional time. This was stated mostly in concern to not being able to do a highly quality examination and to avoid taking short-cuts*."

Several legal studies also document that the time constraints faced by examiners can negatively impact patent quality (e.g., Jaffe and Lerner, 2014; Lemley, 2001; Lemley and Sampat, 2012). Frakes and Wasserman (2017a) use a unique setting of examiner promotion that causes reduction in examination-time allocation to examine this question. They find that less time allocated to review applications causes an examiner to reduce examination scrutiny, increase granting tendencies, and the patents granted by them decrease in patent quality.[8] Frakes and Wasserman (2017b) show that nearly half of the first substantive reports (first round decisions) by patent examiners are completed immediately prior to the operable deadlines, and these reports are associated with a higher probability of "short-gun" rejections in the initial round as well as final round rejections.[9]

### 1.3 Random Assignments of Patent Examiners

[8] Their measure of patent quality is if inventors of U.S. issued patents successfully patentize the underlying inventions at the European Patent Office and the Japanese Patent Office.

[9] "Short-gun" rejection referes to the cases where patent examiners reject applications for "*questionable reasons… because of time pressure of work at the* [*Agency*]" (Pressman and Stim, 2015).

A unique feature of examiner assignment is that within an art-unit, examiners are assigned in a random fashion. Although there are no explicit regulations about examiner assignment within an art unit, surveys and interviews conducted by previous studies (e.g., Lemley and Sampat, 2012; Farre-Mensa, Hegde, and Ljungqvist, 2017) show that examiner assignment is based on examiner's current workload, the last digit of the application number, or the "first-in-and-first-out" principle where the application with the earliest filing date is assigned to the first available examiner. Note that with any of these approaches, the selection of examiner is beyond the applicant's control and unrelated to the quality of the application.

As far as we know, Farre-Mensa, Hegde, and Ljungqvist (2017) is the first and the only other finance study that exploits the exogenous assignment of patent examiners. They measure individual examiners' propsensities of approving patent applications, and find that the start-ups whose patent applications get more lenient examiners, i.e., winners of the "patent lottery", are more likely to have their applications approved, which in turn results in higher subsequent growth in employement, sales, and further innovation. We differ from them in that we study examiner busyness and how it is related future stock returns of innovating firms.

## 2. Data and Summary Statistics

### 2.1 Sample selection

We obtained the data on patent applications and examiners from USPTO which includes all the patent applications with decision dates from 1981 to 2010. For each patent application, the data include the patent ID, examiner ID, dates of application and decision, and four-digit art-unit code. We use two samples of patents in this paper. The first sample is all issued patents in U.S. from 1981 to 2010, including a total of 3,741,767 patents reviewed by 11,215 unique examiners. We use this sample to construct the examiner-level busyness measure. The left panel of Table 1 presents numbers of patents and examiners over time. The number of patents increases dramatically over time, from 32,113 in 1981 to 245,153 in 2010. The number of patent examiners per year also increases by 9.5 times from 1981 (601) to 2010 (6,370).

The second sample is the patents of our sample firms, which includes 1,078,007 patents reviewed by 10,392 examiners for 4,176 unique U.S. listed firms. We matched the patent examiner data from the first sample to the patents of public firms using the linkages constructed by Kogan, Papanikolaou, Seru, and Stoffman (2017).[10] We require the sample firms to have at least one patent during a sample year to construct the busyness measure. We include only common shares with available return data from CRSP, and drop penny stocks with prices lower than $5. Our sample includes a total of 32,928 firm-years from 1981 to 2010, or on average of 1,098 firms in each cross-section, and these firms account for 29% of the patents of the first sample (full sample). The right panel of Table 1 presents corresponding numbers for the sample firms. Number of firms gradually increases from 711 in 1981 to 1,444 in 2001, and then gradually decline to 984 in 2010, a pattern consistent with the decline in U.S. public firms since early 2000s.

### 2.2 Construction of Firm-Level Measure of Examiner Busyness

We first construct the examiner-level busyness measure for each examiner in year *t* as the total number of patents approved by the examiner in year *t*. The intuition is that the more patents approved by an examiner during a year, the busier the examiner is in the year. We use the full sample of granted patents (not limited to sample firms' patents) to construct this measure. It is worth noting that the number of patents approved by an examiner is also associated with her leniency. That is, everything else equal, the more generous an examiner is, the more patents she allows. As we will show in later analysis our findings on examiner busyness is not driven by examine leniency. The left panel of Table

[10] We thank the authors of Kogan, Papanikolaou, Seru, and Stoffman (2017) for making their data available.

1 shows that the average examiner-level busyness measure increases from 53.43 in 1981 to the peak of 67.13 in 1987, and decreases to 38.49 in 2010.

Next, we construct firm-level measure of exmaminer busyness for firm *i* in year *t* as the average of examiner-level busyness measure of all patents of firm *i* in year *t*. Higher busyness measure for a firm-year indicates that the firm's patents are issued by busier examiners on average. The right panel of Table 1 presents the average of firm-level measure of examiner busyness across years. Consistent with examiner-level busyness measure, the firm-level busyness measure starts from 65.42 in 1981, peaks in 1989 (91.89), and then decreases to 58.10 in 2010. Firm-level busyness measure is higher than examiner-level busyness measure because busier examiners account for a greater percentage of patents at the firm level.

To examine cross-sectional dispersion of the busyness across examiners, we plot 10$^{th}$, 25$^{th}$, 50$^{th}$, 75$^{th}$, and 90$^{th}$ percentiles of examiner-level busyness across years in Panel A of Figure 2. The busyness measure is quite dispersed across examiners in all years of the sample period. For example, the number of patents is generally over a hundred for top 10% busiest examiners every year but fewer than five for the 10% least busy examiners every year. This gap starts to shrink a little from 2001 but remains large throughout the sample period. Panel B of Figure 2 further plots the percentiles of firm-level busyness measure, which also shows a large cross-sectional dispersion. For example, the 90$^{th}$ percentile of firm-level busyness measure is generally around 100, much higher than the 10$^{th}$ percentile of around 40.

### 2.3 Summary Statistics

Panel A of Table 2 presents summary statistics of the firm-level busyness measure. Consistent with Figure 2, the firm-level busyness measure is quite disperse over the sample period, with 90$^{th}$ percentile being 98.25, over twice as high as the 10$^{th}$ percentile of 41.77. Panel A also reports summary statistics of firm characteristics and stock metrics including market capitalization, book-to-market ratio, monthly stock return, momtnum, asset growth, gross margin, ROE, ROA, R&D, and capital expenditures. The constructions of these variables are described in detail in the Appendix. The sample firms are on average larger than the CRSP universe as their average market capitalization is at the 74 percentile of the CRSP universe. This is because sample firms are required to have patents granted and we exclude penny stocks. Additionally, the average book-to-market ratio is at the 40 percentile of the CRSP universe, consistent with growth firms having more innovationg activities.

Panel B of Table 2 reports the correlations among firm characteristics. The firm-level busyness measure has very low correlations with majority of the firm characteristics including stock return (0.00), market capitalization (-0.01), momentum (-0.01), asset growth (-0.05), ROE (0.04), ROA (0.05), and capital expenditures (0.04). The busyness measure has mild correlations with book-to-market ratio (0.13), gross margin (-0.11), and R&D (-0.19), suggesting that firms with higher examiner busyness measure tend to be slightly tilted towards value firms, have slightly lower profitability, and slightly lower research and development expenditures.[11] The correlations among firm characteristics are consistent with the existing literature. For example, market capitalization and book-to-market ratio have a negative correlation of -0.23, indicating that smaller-cap firms have higher book-to-market ratios.

## 3. Examiner Busyness and Stock Returns

### 3.1 Examiner Busyness and Patent Quality

The analyses of our paper focus on stock returns because it is the most comprehensive measure of a firm's performance and value. For example, a firm's patents could take a relatively long

[11] We control for these firm characteristics in mutilpe regressisons. Additionally, in Section 3.4.1 we construct an exogenous measure of examiner busyness that adjusts for art-units, which has close-to-zero correlations with all firm characteristics.

time to translate into new product and in turn revenue and profit, but they can impact the firm's stock price promptly when investors learn about the qualities and potentials of the patents.

To motivate our return analysis, we nevertheless attempt to investigate the effect of examiner busyness on patent quality and in turn the innovating firm's accounting performance. We first estimate firm-level panel regression of patent citations on examiner busyenss. The dependent variable is average future citations of patents granted to a firm in year *t*, and the independent variable is firm-level examiner busyness measure of year *t*.[12] We further control for firm size, market-to-book ratio, R&D, and capital expenditures. We also include the total number of patents granted in year *t* to control for the firm's overall patenting activities. All models include firm fixed effects and year fixed effects, and we report robust standard errors adjusted for heteroskedasticity and within-firm clustering. To exclude outliers, we classify firms into 100 groups every year based on their firm-level busyness measures, and then convert the ranks into values between 0 and 1, where the lowest group takes the value of 0.01 and the highest group takes the value of 1. Model (1) of Table 3 presents the result, where the coefficient of the busyness measure is significantly negative (t-stat -2.41), indicating that busier examiners predict lower future patent citations.

While citations reflect a patent's scientific value, it does not necessarily indicate economic impact on the innovating firm. The novel study by Kogan, Papanikolaou, Seru, and Stoffman (2017) provides strong evidence that scientific value and economic value of a patent are highly correlated. To examine economic impact, we estimate panel regressions of ROAs of years *t*+1 and *t*+2, where ROA is defined as income before extraordinary items divided by total assets. In models (2) and (4) of Table 3, the coefficient of the busyness measure is negative for both *t*+1 and *t*+2, and statistically significant for *t*+2 (t-stat -2.10). The coefficient of -0.604 in Model (4) indicating that increasing the busyness

[12] We thank the authors of Kogan, Papanikolaou, Seru, and Stoffman (2017) for making their measure of citations available.

measure from the bottom quintile to the top quintile will decrease ROA by 4.4 percent of its mean, which is meaningfully large.[13]

We further estimate regressions of the firm's gross profit margins of years *t*+1 and *t*+2, respectively, where gross profit margin is defined as sales minus cost of goods sold divided by total sales. In models (3) and (5) of Table 3, the coefficient of the examiner busyness measure is significantly negative in both *t*+1 and *t*+2. Overall, the results in Table 3 provide some evidence that examiner busyness negatively impacts patent quality and future firm performance.

### 3.2 Stock Returns Sorted on Examiner Busyness

At the beginning of each month from July year *t* to June year *t*+1, we sort sample firms into quintiles of the firm-level measure of examiner busyness of *t*-1, and examine monthly value-weighted portfolio returns. The busyness measure of year *t*-1 is publicly available at the end of year *t*-1, since USPTO discloses patent issuance in the weekly *Official Gazette of the United States Patent and Trademark Office*. We allow a six-month window before return measurement to be consistent with existing literature and to ensure the information is widely disseminated to investors. We calculate monthly portfolio returns and then report time-series averages. We report t-statistics using the Newey-West (1987) robust standard errors that adjust for serial correlations.

Panel A of Table 4 shows that porfolio returns decrease in the measure of examiner busyness. The raw return is 1.27% per month for the bottom quintile, but only 0.78% for the top quintile, with the spread being 0.49% per month and statistically significant (t-stat 2.23). We further report alphas of market model, Fama-French 3-factor model, or Carhart 4-factor model that includes the three Fama-French factors and a momentum factor. The spread of 3-factor or 4-factor alpha is larger than

[13] Since we convert the busyness measure into ranks between 0 and 1, the bottom quintile of busyness has an average value of 0.1 and the top qinitle has an average value of 0.9. Therefore the gap of ROA between the bottom and the top quintile is (0.9-0.1)*(-0.604%) = -0.48%, which is 4 percent of the mean ROA of 11% (Table 2).

that of the raw return. For example, the 4-factor alpha is 0.37% (t-stat 2.90) for the bottom quintile and -0.28% (t-stat -2.35) for the top quintile, with the spread being 0.65% and statistically significant at the 0.01 level (t-stat 3.32). The effect of examiner busyness comes from both long and short portfolios, which differs from most anomalies in the existing literature that are driven by short portfolios,

We focus on value-weighted portfolio returns because they are not affected by outliers or small firms. For completeness, we report equal-weighted returns in Panel B of Table 4 where the return spread is much smaller than value-weighted results and significant for 3-factor alpha and 4-factor alpha only. For example, the spread of 4-factor alpha between bottom quintile and top quintile is 0.30% (t-stat 2.12), only half of that for value-weighted scheme. The different results in Panels A and B suggest that the effect of examiner busyness is stronger for large stocks. In unreported result, we conduct two-dimensional sort on firm size and firm-level examiner busyness, and find that the effect of examiner busyness is stronger in large firms. This finding is consisetent with Hirshleifer et al. (2017) who point out that innovation activity by larger firms can be harder to evaluate because they tend to be more complex and have a larger number of patents.

### 3.3 Fama-Macbeth Regressions of Stock Returns

To corroborate the sorting analysis, we further estimate Fama-Macbeth regressions of stock returns on examiner busyness. The dependent variable is monthly return from July year $t$ to June year $t$+1, and the main independent variable is firm-level busyness measure of year $t$-1. For robustness we use raw return, industry adjusted return, or FF3-adjusted return (Brennan, Chordia, and Subrahmanyam, 1998).[14] Like the regression analysis in Table 3, we convert the busyness measure into

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[14] We construct industry-adjusted return using Fama-French 48-industry classification. We follow Brennan, Chordia, and Subrahmanyam (1998) and construct FF3-adjusted returns using factor loadings of the Fama-French 3-factor model from the previous 60-month rolling window.

ranks between 0 and 1 to exclude outliers. We further control for firm charateristics including size, book-to-market ratio, momentum, and short-term reversal. We also control for asset growth and ROE, the two characteristics associated with investment factor and profitability factor. We further control for overall patenting activity of a firm by including the total number of patents granted in the firm-year. We control for industry by including fixed effects based on Fama-French 48 industries or using industry-adjusted return as independent variable. We report statistics using Newey-West (1987) robust standard errors that adjust for serial correlations.

In the regression of raw return in Panel A of Table 5, the coefficient of examiner busyness is -0.223, significant at the 5% level (t-stat -2.11). This result is stronger if we use industry adjusted return or FF3-adjusted return as dependent variable. For example, the coefficient in the regression of FF3-adjusted return is -0.322 (t-stat -2.52). These results support the sorting analysis that examiner busyness has a significantly negative impact on future stock returns. Regarding control variables, the coefficient is significantly positive for book-to-market ratio (except in the model of FF3-adjusted return) and ROE, and significantly negative for lagged monthly return and asset growth, consistent with the value premium, profitability anomaly, short-term reveral, and investment anomaly documentd in the literature.

Because the sorting analysis shows the effect of examiner busyness is stronger for large stocks, we further divide stocks into two groups based on their market capitalizations at the beginning of the month and estimate regressions for them separately. Panel B of Table 5 presents the regression results for stocks in the top 50% of market capitalization. Consistent with the sorting analysis, the impact of examiner busyness on future stock return is more pronounced for larger firms. For example, in the model of FF3-adjusted return the coefficient of examiner busyness is -0.421 (t-stat -2.49), and this result is robust across different return measures. Panel C of Table 5 presents the regressions for firms in the bottom 50% of the market capitalization. Consistent with the sorting analysis, the effect of examiner busyness on future stock return becomes mostly insignificant.

### 3.4 Alternative Explanations based on Omitted Variables, Risk, or Endogeneity

The observed effect of examiner busyness and stock returns can have alternative explanations. For example, some omitted variables may drive both examiner busyness and stock returns. It is also possible that firms which submit higher-quality patent applications are assigned non-busy examiners. Additionally, it is also possible that high-risk firms somehow get non-busy examiners and low-risk firms somehow get busier examiners. We take two approaches to address these concerns.

#### 3.4.1 Exogenous Busyness Measure

Our first approach exploits the random assignment of patent examiner within an art unit. As described in Section 1, a patent application filed with USPTO is first sent to an art unit, and then the supervisory patent examiner (SPE) of the art-unit assigns the application to an examiner. While the assignment to art unit is based on technology field, the assignment within an art unit is random (detail described in Section 1.3). We therefore construct an art-unit adjusted busyness measure to filter out any inter-art-unit effect so that the adjusted measure is focused on the relative busyness of examiners in an art-unit. Because the assignment within art-unit is random, this adjusted measure is exogeneous to firm fundamentals or patent application quality.

Each year, we first calculate art-unit adjusted busyness measure for an examiner by subtracting the average busyness of all examiners in the same art-unit. We use the four-digit art-unit classification for this analysis, which is the finest classification in the USPTO database.[15] We then calculate art-unit adjusted firm-level busyness measure by averaging adjusted examiner-level busyness measure across all patents of a firm-year.

[15] The results are similar if we use a broader classification based on two digit art-unit code.

We first examine the correlations of the adjusted examiner busyness measure with firm characteristics in Table 2. If, as suggested by the literature, the assignment of examiners within an art unit is random, then we expect the adjusted busyness measure to have low relations with firm characteristics, which is indeed the case. The adjusted busyness measure has correlations of 0.00 with contemporaneous stock return, ROE, and ROA, -0.01 with market capitalization and momentum, 0.01 with gross margin, -0.02 with asset growth, 0.02 with capital expenditure, -0.03 with R&D, and 0.03 with book-to-market ratio.

Table 6 presents returns of portfoilos of adjusted busyness measures. This sorting analysis is similar to Table 4 except that we use the adjusted busyness measure rather than the original measure. Panel A and Panel B of Table 6 report value-weighted returns and equal-weighted returns, respectively. Although the adjustment for art-unit eliminates across-art-unit variation of examiner busyness, the return spread remain large and significant. For example, Panel A shows that the return spread in 4-factor alpha is 0.39% per month (t-stat 2.56), about two-third of the 0.65% (t-stat 3.32) for the original busyness measure (Panel A of Table 4). Results of equal-weighted returns in Panel B are also similar to those using the original busyness measure (Panel B of Table 4). Therefore, the effect of examiner busyness on stock returns is unlikely to be explained by omitted variables, endogeneity, or risk.

3.4.2 Fama-French 5-Factor Model and *q*-Factor Model

Our second approach calculates alpha using the Fama-French 5-factor model (Fama and French, 2015) or the *q*-factor model (Hou, Xue, and Zhang, 2015). Both models include additional price factors and capture additional variation in stock returns to the traditional factor models. These models explain majority of the documented anomalies. Therefore, using these two models helps address the concern that omitted variables drive both stock returns and examiner busyness. For both models, we further include a momentum (UMD) factor to control for momentum.[16]

[16] The results are similar if we do not include the momentum factor.

Panel A of Table 7 presents the sorting results using the Fama-French 5-factor model and *q*-factor model, where we again find that portfolio returns monotonically decrease in examiner busyness. The results are even stronger than those using the traditional factor models. For example, using value-weighted returns, the spread of Fama-French 5-factor alpha between the bottom quintile and the top quintile is 0.94% and significant at the 1% level (t-stat 4.60). Both long- and short-portfolios are enhanced with additional factors, with the alpha being -0.37% (t-stat -3.01) for the top quintile and 0.57% (t-stat 4.35) for the bottom quintile, larger than the -0.28% (t-stat -2.35) and 0.37% (t-stat 2.90) using the 4-factor model (Panel A of Table 4). We obtain a similar spread of alpha (0.93%, t-stat 4.11) using *q*-factor model. For robustness, we present in Panel B the results for the adjusted busyness measure, and the relation between return and adjusted busyness measure also hold using the Fama-French 5-factor model and the *q*-factor model.

3.4.3 Examiner Leniency

We further examine an alternative explanation based on examiner leniency. Specifically, our measure of examiner busyness is constructed using the number of patents approved by an examiner, which can be affected by examiner leniency. Everything else equal, the more lenient an examiner is, the more patents she will allow rather reject, and the higher the busyness measure. Therefore it is possible that the effect of examiner busyness is driven by examiner leniency.

We follow Farre-Mensa, Hegde, and Ljungqvist (2017) and construct an examiner-level leniency measure in year $t$ as the total number of patents approved by the examiner up to the end of year $t$ divided by the total number of patent applications assigned to the examiner up to the end of year $t$. We then construct the leniency measure for a firm-year as the average examiner-level leniency of all patents of the firm-year.

Table 8 repeats the sorting analysis of Table 4 but using the examiner leniency measure, where panels A and B report value-weighted returns and equal-weighted returns, respectively. In a stark contrast to the results using examiner busyness, the return differences between low and high leniency portfolios are small and satistically insignificant. For example, the spread of value-weighted return in terms of 4-factor alpha is 0.04% per month (t-stat 0.28) between the bottom and the top leniency portfolios, vastly different from the 0.65% per month (t-stat 3.32) using the examiner busyness measure (Panel A of Table 4). Therefore, the observed effect of examiner busyness on future return is unlikely to be explained by examiner leniency.

**3.5 Subgroup Analyses Based on R&D and Limited Investor Attention**

To further understand the potential channels through which the examiner busyness impact stock returns, we conduct two subgroup analyses based on R&D expenditure and limited investor attention.

3.5.1 Subgroup Analysis Based on R&D.

If busyness of patent examiners impacts patent quality and in turn firm value, then we expect the effect to be stronger for firms with high R&D expenditures where innovation is a more important driver of business and firm value. If, on the contrary, the effect of busyness on stock return is due to its correlation with some omitted variables, then such an effect may not vary across R&D levels.

We simultaneously sort stocks into two groups of R&D and quintiles of examiner busyness and present the portfolio returns in Panel A of Table 9. We follow the literature and match R&D of fiscal year ending in year *t*-1 to monthly stock returns from July of year *t* to June of year *t*+1. We take the conservative approach and drop the firms with missing R&D data rather than replacing with zero. For brevity we focus on value-weighted portfolios and 4-factor alphas. Panel A of Table 9 shows that the effect of examiner busyness concentrates in high R&D firms. Specifically, the spread of alpha between bottom and top quintiles of examiner busyness is 0.71% (t-stat 2.25) for high R&D firms but only 0.11% (t-stat 0.48) for low R&D firms. Their difference is 0.60% and significant at the 10% level (t-stat 1.74). For robustness we repeat this analysis using art-unit adjusted busyness measure, where the spread of alpha is 1.17% (t-stat 3.94) for high R&D firms but only 0.09 (t-stat 0.50) for low R&D firms, with a difference of 1.08% (t-stat 3.77).

3.5.2 Subgroup Analysis Based on Limited Investor Attention

If limited investor attention makes investors underreact to examiner busyness, then we expect the effect of examiner busyness to increase in limited investor attention. We construct a unque measure of limited investor attention in the patent setting. Specifically, USPTO discloses issuance of patents in its *Official Gazette of the United States Patent and Trademark Office* every Tuesday. For a given patent announced, there is likely to be limited investor attention if a large number of other patents in the same technology field are announced on the same day. This intuition follows Hirshleifer, Lim, and Teoh (2009) who document greater underreaction to earnings news when there is a larger number of earnings announcements at the same time. We construct the measure of innovation distraction for a patent as the total number of patents in the same technology field announced on the same day, and then for a firm-year as the average of innovation distraction of all patents of the firm-year.

We repeat the two-dimensional sorting analysis on the innovation distraction measure and examiner busyness, and report the results in Panel B of Table 8. Consistent with our expectation, the effect of examiner busyness on future stock return is much stronger in high distraction group than that in low distraction group. For example, the spread of 4-factor alpha between top and bottom busyness quintiles is 0.76% (t-stat 3.36) for stocks with high innovation distraction, twice as much as the 0.36% (t-sttat 1.94) for stock with low innovation distraction. Their difference of 0.40% is also significant at the 10% level (t-stat 1.66). For robustness, we repeat the analysis using art-unit adjusted busyness measure and the results are similar in the lower part of Panel B. These results is consistent with limited investor attention making investors underreact to examiner busyness.

**3.6 Examiner Busyness and Long-Term Returns**

We further examine the relation between examiner busyness and long-term stock returns to answer two questions. First, how long is the effect of examiner busyness on stock returns? Second, does the effect of examiner busyness reverse in the long run? The second question is especially important because if the relation between examiner busyness and future return is indeed due to investor underraction, then we should not see a reversal in long-term return.

Table 10 presents monthly 4-factor alphas of quintile portfolios sorted on the firm-level measures of examiner busyness. Specifically, at the beginning of a month in year *t*, stocks are sorted into quintiles of the firm-level busyness measure of *t*-1. We then calculate monthly value-weighted 4-factor alphas for each year in the four-year window from the month of portfolio formation. We also calculate t-statistics using Newey-West (1987) robust standard erros that adjust for serial correlations. The spread of alpha between the bottom and the top quintiles of examiner busyenss is significant in the first two years after portfolio formation, namely 0.37% (t-stat 1.75) for the first year and 0.72% (t-stat 3.96) for the second year. The spread then becomes much smaller and insignificant in the third year (0.10%, t-stat 0.58) and the fourth year (0.15%, t-stat 0.74). These results show that the effect of examiner busyness on future returns lasts for two years and does not reverse over time. The lack of a long-term reversal is consistent with the effect of examiner busyness being driven by investor underreaction.

**4 Examiner Busyness and Examiner Characteristics**

Now that we find the busyness of patent examiners significantly impacts future stock returns, what are the factors driving the busyness of examiners? While Table 1 presents the trend of average examiner busyness over time, in this section we attempt to shed some light on the relations between examiner busyness and examiner characteristics.

Motivated by the existing literature, we examine two examiner characteristics that can be potentially related to examiner busyness. The first characteristic is examiner experience, as Frakes and

Wasserman (2017) document that more experienced patent examiners tend to receive more applications. Therefore, we expect examiner busyness to be positively related to examiner experience. The second characteristic is how quickly an examiner approves a patent. As discussed in Section 1.3, some art units use the "first-in-first-out" approach that assigns the first patent application in line to the first available examiner. In this case, examiners who review applications faster tend to get more applications and become busier.

Table 11 presents patent-level panel regressions of examiner busyness on examiner characteristics. The dependent variable is the examiner-level busyness measure of year *t*, and the independent variables include examiner experience and examiner duration. Experience for an examiner-year is measured as the number of years from the reviewer's first patent review to year *t*-1, and duration for an examiner is measured as the average number of days for an application to be allowed by the examiner using all patents issued in year *t*-1. The regressions also include year fixed effects, firm fixed effects, and art-unit fixed effects. Consistent with our prediction, the coefficient of examiner experience is significantly positive and that of examiner duration is significantly negative, suggesting that more experienced examiners and quicker examiners tend to be busier.

## 4. Conclusion

The U.S. patent system has been under increasing criticism that too many invalid patents are issued, and legal studies have related this problem with the sharp time constraints faced by patent examiners (e.g., Jaffe and Lerner, 2014; Lemley, 2001; Lemley and Sampat, 2012; Frakes and Wasserman, 2017). In this paper, we examine whether the busyness of patent examiners impacts future stock returns of the innovating firms.

Using a large data of patents and examiners covering 4,176 unique firms from 1981 to 2010, we first construct an examiner-level busyness measure based on the number of patents granted by the examiner during the year, and then a firm-level measure of examiner busyness as the average of examiner-level busyness of all patents granted to the firm during the year. Consistent with a negative relation between examiner busyness and patent quality, we find that examiner busyness negatively predicts future patent citations and the profitability of innovating firms.

We examine future returns of stock portfolios sorted on examiner busyness and find that the top quintile of busyness underperform the bottom quintile by 0.65 percent per month. This difference comes from both long and short portfolios, and is more pronounced in large firms. Additionally, the effect of examiner busyness is robust to various factor models and regression analyses. The effect of examiner busyness also persists when we construct an art-unit adjusted measure of examiner busyness that is exogenous to firm fundamentals and quality of patent application. The effect of examiner busyness is stronger in high R&D firms where patents are more important to firm values, and in firms with limited investor attention with respect to patent disclosures. The effect of examiner busyness lasts for two years and does not reverse over time. These results together suggest that investors underreact to the negative impact of examiner busyness on patent quality and firm value.

Our results show that patent examiners, in particular their busyness, can significantly impact patent quality and firm value. While most of the financial studies on innovation focus on the incentives and drivers of corporate innovations, our findings provide new implications for how to value patents, which is critical for optimal management and financing of innovation activies. Our study also contributes to the literature of behavioral finance by providing evidence that limited attention makes investors underreact to complex public information, in particular, the information about patent value. Our findings are not driven by small stocks, and the unique setting of random examiner assignment rules out explanations based on risk or endogeneity. Therefore, our findings establish a solid case of investor underreaction due to limited attention. Our paper also has policy implications as the U.S. patenting system experiences increasing criticism that too many invalid patents are issued in the U.S.

Our financial markets evidence suggests that relaxing the sharp time constraints faced by patent examiners can help improve the patent examination process.

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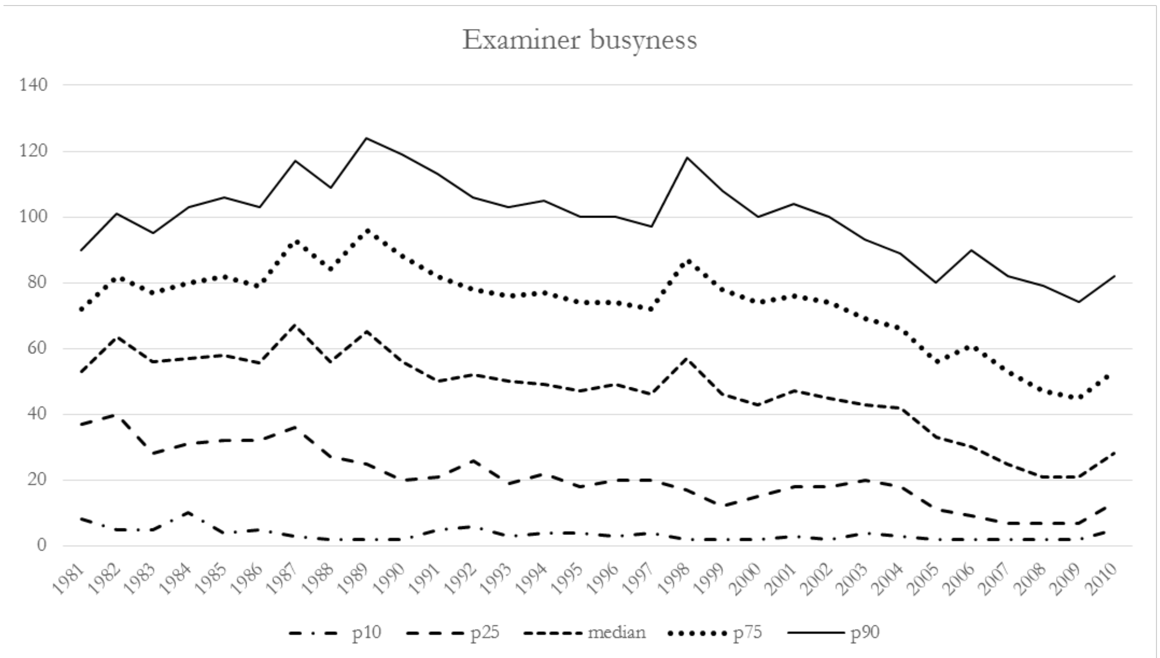
**Figure 1**
**Employee Reviews of Patent Examiners of USPTO at Glassdoor**

This figure presents the webpage of employee reviews of pantent examiners of United States Patents and Trademarks Office (USPTO) at Glassdoor, a major website for employees to anonymously review their companies. The page was downloaded on January 15, 2018, which summarizes the most popular "Pros" and "Cons" from employee reviews.

**Figure 2**
**Cutoff Points of Examiner Busyness: 1981-2010**

Panel A plots the 90th, 75th, 50th, 25th, and 10th cutoff points of examiner-level busyness measure for each year during our sample period of 1981 to 2010. Examiner-level busyness measure of a year is defined as the number of patents approved by the examiner during the year. Panel B plots the cutoff points of the firm-level busyness measure, where the busyness measure for a firm-year is calculated as the average of examiner-level busyness of the patents of the firm-year.

**Panel A: Cutoff Points of Examiner-Level Busyness Measure**




**Panel B: Cutoff Points of Firm-Level Busyness Measure**

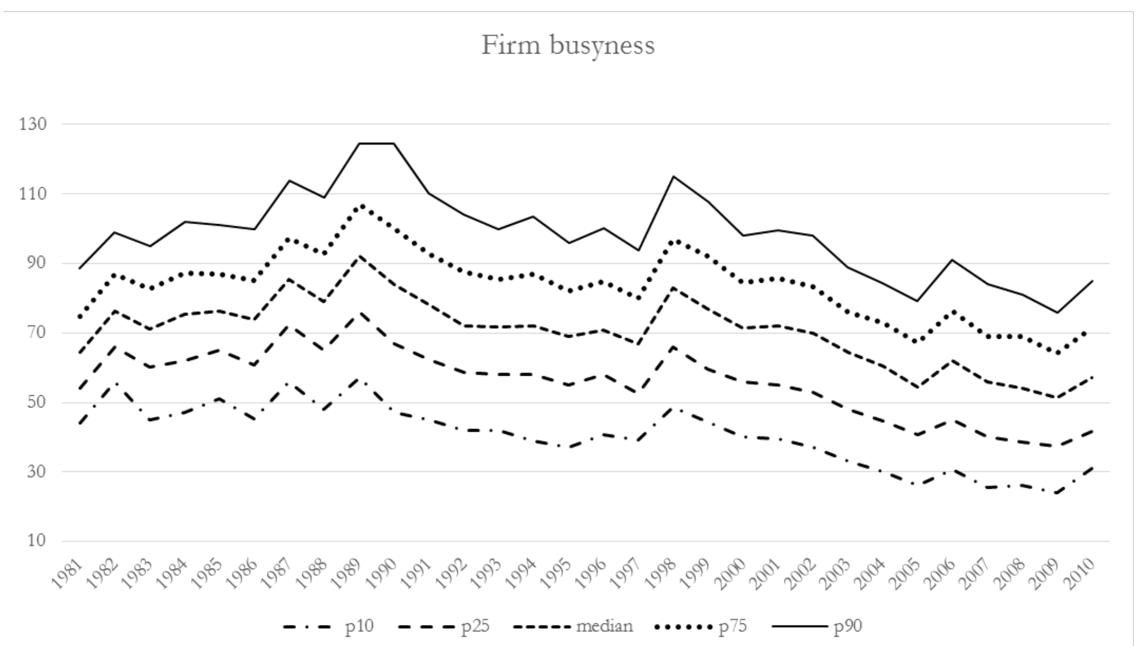


**Figure 3**
**Timeline of Return Analysis**

This table plot the measurement windows of firm-level busyness measure and stock return. We first construct busyness measure for a firm in year *t*-1, and then matched it to the firm's monthly stock returns from July of year *t* to June of year *t*+1.

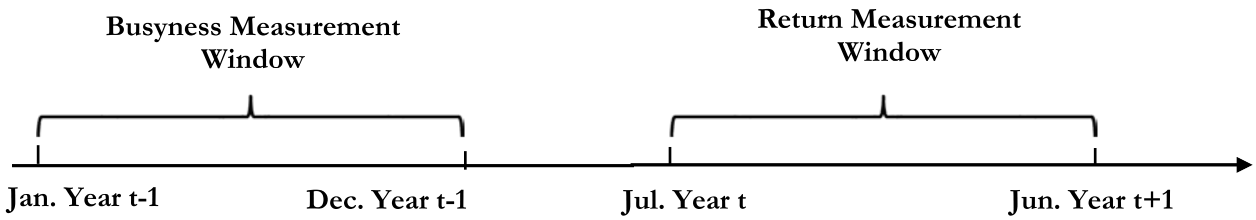


**Table 1**
**Patents and Examiner Busyness over Time**

This table presents the annual statistics of number of patents, number of examiners, and examiner-level and firm-level busyness measure over 1981-2010. The left panel includes all patents issued by USPTO, and the right panel includes patents for our sample firms. We require the sample firms to have at least one patent issued in a given year to construct the businesss measure. We include only CRSP ordinary common shares and drop penny stocks priced below $5. Examiner-level busyness measure of a year is defined as total number of patents approved by an examiner during the year. Firm-level busyness measure for a firm-year is defined as the average examiner-level busyness of all patents of the firm-year.

| | All Patents | | | Patents of Sample Firms | | |
|---|---|---|---|---|---|---|
| year | #Patents | #Examiners | Examiner-Level Business | #Firms | #Patents | Firm-Level Busyness |
| 1981 | 32,113 | 601 | 53.43 | 711 | 9,749 | 65.42 |
| 1982 | 39,599 | 632 | 62.66 | 757 | 11,845 | 76.89 |
| 1983 | 40,235 | 717 | 56.12 | 775 | 12,375 | 71.20 |
| 1984 | 46,877 | 781 | 60.02 | 809 | 13,991 | 75.45 |
| 1985 | 49,756 | 841 | 59.16 | 757 | 14,338 | 76.62 |
| 1986 | 50,993 | 874 | 58.34 | 772 | 13,345 | 73.39 |
| 1987 | 62,897 | 937 | 67.13 | 852 | 16,315 | 85.57 |
| 1988 | 62,152 | 1,042 | 59.65 | 850 | 15,547 | 78.69 |
| 1989 | 80,169 | 1,211 | 66.20 | 911 | 19,792 | 91.89 |
| 1990 | 84,934 | 1,431 | 59.35 | 911 | 20,122 | 84.19 |
| 1991 | 97,997 | 1,732 | 56.58 | 949 | 23,251 | 78.54 |
| 1992 | 105,223 | 1,873 | 56.18 | 1,046 | 26,219 | 73.12 |
| 1993 | 108,884 | 2,027 | 53.72 | 1,067 | 27,472 | 71.88 |
| 1994 | 112,743 | 2,046 | 55.10 | 1,177 | 28,924 | 72.87 |
| 1995 | 113,137 | 2,164 | 52.28 | 1,201 | 28,794 | 68.36 |
| 1996 | 121,247 | 2,306 | 52.58 | 1,317 | 32,290 | 71.18 |
| 1997 | 124,070 | 2,435 | 50.95 | 1,340 | 32,398 | 67.16 |
| 1998 | 163,408 | 2,691 | 60.72 | 1,393 | 42,419 | 82.79 |
| 1999 | 169,340 | 3,235 | 52.35 | 1,345 | 44,070 | 76.69 |
| 2000 | 176,331 | 3,464 | 50.90 | 1,401 | 47,407 | 70.67 |
| 2001 | 184,298 | 3,442 | 53.54 | 1,444 | 54,045 | 70.58 |
| 2002 | 184,640 | 3,604 | 51.23 | 1,388 | 57,357 | 68.73 |
| 2003 | 187,248 | 3,806 | 49.20 | 1,391 | 59,230 | 62.86 |
| 2004 | 181,492 | 3,857 | 47.06 | 1,343 | 58,188 | 59.13 |
| 2005 | 157,954 | 4,079 | 38.72 | 1,299 | 59,446 | 53.96 |
| 2006 | 196,854 | 4,763 | 41.33 | 1,313 | 68,482 | 61.71 |
| 2007 | 183,393 | 5,003 | 36.66 | 1,213 | 60,692 | 55.52 |
| 2008 | 185,825 | 5,395 | 34.44 | 1,121 | 56,616 | 54.30 |
| 2009 | 192,805 | 5,956 | 32.37 | 1,091 | 60,152 | 51.17 |
| 2010 | 245,153 | 6,370 | 38.49 | 984 | 63,136 | 58.10 |

**Table 2**

**Summery Statistics and Correlations**

Panel A reports summary statistics for firm-months in our sample. We first calculate the statistics in each cross-section, and then report the time-series averages. *Busyness* is the firm-level measure of examiner busyness, calculated as the average of examiner-level busyness of all patents of a firm-year, where examiner-level busyness is the number of patents approved by the examiner during the year. We match busyness of year *t*-1 to the months from July of year *t* to June of year *t*+1. *Stock return* is monthly stock return. *Ln(ME)* is the natural log of a firm's market capitalization, measured at the end of previous year. *Ln(BM)* is the natural log of a firm's book-to-market ratio. *CRSP ME Percentile* and *CRSP BM Percentile* is the average percentile rank of sample firms' market capitalization and book-to-market ratio relative to the CRSP universe. *Ret[-13, -2]* is buy-and-hold stock returns in the [-13,-2] window, where 0 is the current month. *Asset Growth* is change in total assets scaled by lagged totally assets. *Gross margin* is Sales less Cost of Goods Sold, scaled by Sales. *ROE* is return on equity, and *ROA* is the return on assets. *R&D* is research and development expenses scaled by total assets. *Capx* is capital expenditure scaled by total assets. The accounting measures of fiscal year ending in calendar year *t* is matched to the months from July of *t* to June of *t+1*. The constructions of all the measures are described in the Appendix. Panel B reports the time-series average of the cross-section Spearman correlation among firm characteristics over 1981-2010.

| Panel A: Summary Statistics of Firm Characteristics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Mean | STD | P10 | P25 | Median | P75 | P90 |
| Busyness | 70.78 | 23.20 | 41.77 | 56.86 | 70.85 | 83.59 | 98.25 |
| Stock Return | 0.01 | 0.12 | -0.12 | -0.05 | 0.01 | 0.07 | 0.14 |
| Ln(ME) | 6.55 | 1.85 | 4.27 | 5.16 | 6.37 | 7.80 | 9.08 |
| CRSP ME Percentile | 0.74 | 0.21 | 0.43 | 0.60 | 0.79 | 0.92 | 0.97 |
| Ln(BM) | -0.78 | 0.73 | -1.71 | -1.20 | -0.70 | -0.28 | 0.07 |
| CRSP BM Percentile | 0.40 | 0.24 | 0.11 | 0.21 | 0.37 | 0.58 | 0.75 |
| Ret [-13, -2] | 0.21 | 0.57 | -0.27 | -0.10 | 0.11 | 0.37 | 0.76 |
| Asset Growth (%) | 1.29 | 2.45 | 0.91 | 0.99 | 1.08 | 1.21 | 1.52 |
| Gross Margin | 0.14 | 0.25 | 0.38 | 0.53 | 0.67 | 0.14 | 0.25 |
| ROE | 0.02 | 0.09 | -0.05 | 0.01 | 0.03 | 0.05 | 0.07 |
| ROA | 0.11 | 0.14 | -0.04 | 0.08 | 0.13 | 0.19 | 0.24 |
| R&D | 0.08 | 0.09 | 0.01 | 0.02 | 0.05 | 0.10 | 0.18 |
| Capex | 0.05 | 0.04 | 0.00 | 0.02 | 0.04 | 0.07 | 0.11 |

| Panel B: Correlations | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Busyness | Stock Return | Ln(ME) | Ln(BM) | Ret [-13,-2] | Asset Growth | ROE | ROA | Gross Margin | R&D | Capex |
| Busyness | 1.00 | | | | | | | | | | |
| Stock Return | 0.00 | 1.00 | | | | | | | | | |
| Ln(ME) | -0.01 | 0.03 | 1.00 | | | | | | | | |
| Ln(BM) | 0.13 | 0.01 | -0.23 | 1.00 | | | | | | | |
| Ret [-13,-2] | -0.01 | 0.03 | 0.11 | 0.02 | 1.00 | | | | | | |
| Asset Growth | -0.05 | -0.01 | 0.06 | -0.29 | -0.09 | 1.00 | | | | | |
| ROE | 0.04 | 0.04 | 0.31 | -0.32 | 0.26 | 0.11 | 1.00 | | | | |
| ROA | 0.05 | 0.04 | 0.32 | -0.30 | 0.03 | 0.17 | 0.55 | 1.00 | | | |
| Gross Margin | -0.11 | 0.01 | 0.07 | -0.32 | 0.01 | 0.15 | 0.18 | 0.31 | 1.00 | | |
| R&D | -0.19 | -0.02 | -0.18 | -0.32 | 0.01 | 0.07 | -0.14 | -0.20 | 0.32 | 1.00 | |
| Capex | 0.04 | 0.00 | 0.14 | -0.11 | -0.04 | 0.10 | 0.09 | 0.30 | 0.03 | -0.01 | 1.00 |

**Table 3**

**Panel Regressions of Patent Citation or Firm Profitability**

The table presents firm-level panel regressions of patent citation or firm profitability measures on examiner busyenss. The dependent variable in model (1) is *citations*, measured as the average future citations of a firm's patents issued in year *t*. The dependent variables in models (2) and (4) are a firm's *ROA* of years *t*+1 and *t*+2, respectively, where ROA is defined as income before extraordinary items divided by total assets. The dependent variables in models (3) and (5) are a firm's gross profit margin (*GM*) of years *t*+1 and *t*+2, respectively, where gross profit margin is defined as sales minus cost of goods sold, divided by total sales. The main independent variable is firm-level examiner *busyness* measure of year *t*. To exclude outliers and facilitate the evaluation of economic significance and, we convert the busyness measure into ranks between 0 and 1. Specifically, we classify firms into 100 groups every year according to the firm-level busyness measure, and then convert the ranks into values in [0.01, 1], where the lowest group takes the value 0.01 and the highest group takes the value of 1. *Size* is the logarithsm of total assets. *MtoB* is defined as market value of equity divided by book value of equity. *R&D* is the research and development expenditures divided by total assets. *Capx* is the capital expenditure adjusted by total assets. *Ln(patents)* is the logarithm of number of patents of the firm-year. All models include firm fixed effects and year fixed effects. Standard errors adjusting for heteroskedasticity and within-firm clustering are reported in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| VARIABLES | Citations | ROA$_{t+1}$ (%) | GM$_{t+1}$ (%) | ROA$_{t+2}$ (%) | GM$_{t+2}$ (%) |
| Busyness | -1.761** | -0.428 | -4.413* | -0.604** | -5.269** |
| | (-2.41) | (-1.54) | (-1.75) | (-2.10) | (-2.36) |
| Size | -1.589*** | 3.664*** | 5.106*** | 1.622*** | 3.433** |
| | (-2.91) | (14.93) | (3.11) | (6.26) | (2.13) |
| MtoB | 1.731*** | 0.650*** | 1.915 | 0.232* | 0.973 |
| | (5.95) | (5.36) | (1.54) | (1.90) | (0.87) |
| R&D | -4.802 | -28.927*** | -92.575** | 12.173*** | -126.327*** |
| | (-1.05) | (-8.24) | (-1.98) | (-3.03) | (-2.87) |
| Capx | 5.013 | 1.916 | 38.533 | 7.847** | 36.036 |
| | (0.86) | (0.65) | (1.30) | (2.45) | (1.27) |
| Ln(patents) | -3.470*** | -0.818*** | 0.589 | -0.580*** | -0.967 |
| | (-7.84) | (-5.90) | (0.59) | (-4.30) | (-1.15) |
| | | | | | |
| Firm Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 22,938 | 22,854 | 22,814 | 21,899 | 21,872 |
| Adj. R-squared | 0.553 | 0.769 | 0.684 | 0.757 | 0.684 |

**Table 4**
**Stock Returns of Portfolios Sorted on Examiner Busyness**

This table presents returns of the portfolios sorted on the firm-level examiner busyness measure from 1981-2010. The examiner busyness measure for a firm-year is calculated as the average of examiner-level busyness of the patents of the firm-year, where examiner-level busyness is the number of patents approved by the examiner in the year. At the beginning of each month from July of year *t* to June of *t*+1, stocks are sorted into quintiles of the firm-level busyness measure of *t*-1. We calculate monthly returns of these quintile portfolios and then report the time-series averages and t-statistics. In addition to raw return, we further report CAPM alpha based on the market model, 3-factor alpha based on the Fama-French three factor model, and 4-factor alpha based on the Carhart 4-factor model that includes the three Fama-French factors and a momentum factor. Panel A reports value-weighted portfolio returns, and Panel B reports equal-weighted portfolio return. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

| | **Firm-Level Measure of Examiner Busyness** | | | | | |
|---|---|---|---|---|---|---|
| | Low | 2 | 3 | 4 | High | L - H |
| **Panel A: Value-Weighted Portfolio Returns** | | | | | | |
| Raw Return | 1.27 | 1.11 | 1.06 | 1.03 | 0.78 | 0.49** |
| | (3.65) | (3.99) | (4.48) | (4.32) | (2.67) | (2.23) |
| CAPM Alpha | 0.14 | 0.06 | 0.12 | 0.08 | -0.29 | 0.43** |
| | (0.86) | (0.54) | (1.59) | (0.89) | (-2.31) | (1.99) |
| 3-factor Alpha | 0.35 | 0.18 | 0.12 | 0.05 | -0.32 | 0.67*** |
| | (2.58) | (1.76) | (1.76) | (0.59) | (-2.59) | (3.25) |
| 4-factor Alpha | 0.37 | 0.29 | 0.09 | 0.00 | -0.28 | 0.65*** |
| | (2.90) | (2.46) | (1.25) | (0.05) | (-2.35) | (3.32) |
| **Panel B: Equal-Weighted Portfolio Returns** | | | | | | |
| Raw Return | 1.25 | 1.32 | 1.26 | 1.19 | 1.08 | 0.17 |
| | (3.27) | (3.79) | (3.84) | (3.61) | (3.12) | (0.90) |
| CAPM Alpha | 0.06 | 0.17 | 0.14 | 0.07 | -0.04 | 0.10 |
| | (0.31) | (1.10) | (0.98) | (0.51) | (-0.25) | (0.53) |
| 3-factor Alpha | 0.18 | 0.21 | 0.11 | -0.01 | -0.16 | 0.34** |
| | (1.40) | (2.01) | (1.17) | (-0.10) | (-1.54) | (2.23) |
| 4-factor Alpha | 0.25 | 0.33 | 0.17 | 0.07 | -0.04 | 0.30** |
| | (2.17) | (3.25) | (1.85) | (0.70) | (-0.43) | (2.12) |

**Table 5**

**Fama-MacBeth Regressions of Stock Return on Examiner Busyness**

This table presents the Fama-MacBeth regressions of monthly stock returns on the firm-level examiner busyness measure from 1981 to 2010. Panel A reports the regressions for all sample firms, and panel B (panel C) reports the regressions for firms with market capitalizations in the top (bottom) 50% of the sample. The dependent variables include raw return, industry adjusted return and FF3-adjusted return. Industry adjusted return of a firm is calculated by subtracting average return of the firm's Fama-French 48 industry from the firm's raw return. FF3-adjusted return is constructed as abnormal return calculated with out-sample betas estimated using Fama-French 3-factor model in the 36-month rolling window. The main independent variable is firm-level busyness measure. The busyness measure of year *t*-1 is matched to monthly returns from July of year *t* to June of year *t*+1. Firm-level examiner busyness for a firm-year is calculated as the average of examiner-level busyness of the patents of the firm-year, where examiner-level busyness is the number of patents approved by the examiner in the year. To exclude outliers and facilitate the evaluation of economic significance, we convert the busyness measure into ranks between 0 and 1. Specifically, we classify firms into 100 groups every sample month according to the firm level busyness, and then conver the ranks into values in [0.01, 1], where the lowest group takes the value 0.01 and the highest group takes the value of 1. We also control for firm characteristics. *Ln(ME)* is natural log of market capitalization at the previous month-end. *Ln(B/M)* is natural log of book-to-market ratio. *Ret [-13, -2]* is the buy-and-hold return in the year up to month -2. *Ret [-1]* is the previous monthly return (reversal). *Assets growth* is the annual change in total assets, scaled by lagged total assets. *ROE* is return to equity. We also control for *Ln(#Patents)* in the same year as the busyness measure, where #Patents for a firm-year is the total number of the firm's patents issued in the year. Some models include Fama-French 48 industry fixed effects. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets. *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

| | Panel A: All Firms | | | Panel B: Largest 50% Firms | | | Panel C: Smallest 50% Firms | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Ret.** | **Industry Adj. Ret.** | **FF3-Adj. Ret.** | **Ret.** | **Industry Adj. Ret.** | **FF3-Adj. Ret.** | **Ret.** | **Industry Adj. Ret.** | **FF3-Adj. Ret.** |
| Busyness | -0.223** | -0.283** | -0.322** | -0.323** | -0.449*** | -0.421** | -0.256* | -0.176 | -0.225 |
| | (-2.11) | (-2.45) | (-2.52) | (-2.52) | (-3.76) | (-2.49) | (-1.93) | (-1.13) | (-1.45) |
| Ln(ME) | -0.047 | -0.055 | -0.040 | -0.122** | -0.104** | -0.051 | 0.118* | 0.118* | 0.062 |
| | (-1.10) | (-1.28) | (-1.38) | (-2.11) | (-2.11) | (-1.25) | (1.85) | (1.87) | (0.95) |
| Ln(B/M) | 0.270*** | 0.188** | 0.036 | 0.246** | 0.163** | -0.011 | 0.298*** | 0.217** | 0.092 |
| | (3.27) | (2.32) | (0.47) | (2.45) | (2.10) | (-0.14) | (3.04) | (2.07) | (0.96) |
| Ret (-13,-2) | 0.206 | 0.232 | 0.163 | -0.057 | -0.009 | -0.020 | 0.321* | 0.347** | 0.221 |
| | (1.24) | (1.47) | (0.90) | (-0.26) | (-0.05) | (-0.09) | (1.92) | (2.14) | (1.24) |
| Ret (-1) | -4.665*** | -4.447*** | -5.205*** | -3.536*** | -3.252*** | -3.761*** | -5.325*** | -5.047*** | -5.888*** |
| | (-8.47) | (-8.35) | (-9.22) | (-5.08) | (-5.34) | (-5.96) | (-8.99) | (-8.78) | (-9.56) |
| Assets Growth | -0.074 | -0.052 | -0.180** | -0.020 | -0.036 | 0.020 | -0.165 | -0.128 | -0.291*** |
| | (-1.07) | (-0.84) | (-2.27) | (-0.20) | (-0.36) | (0.16) | (-1.60) | (-1.44) | (-2.67) |
| ROE | 2.336*** | 2.258*** | 1.952*** | 3.587*** | 3.340*** | 2.903*** | 2.277*** | 2.211*** | 2.061*** |
| | (4.05) | (4.16) | (4.05) | (3.62) | (3.83) | (3.08) | (3.37) | (3.50) | (3.60) |
| Ln(#Patents) | 0.081*** | 0.081*** | 0.055** | 0.094*** | 0.081*** | 0.057* | 0.089** | 0.112*** | 0.074 |
| | (3.49) | (3.76) | (2.17) | (3.39) | (3.40) | (1.97) | (1.97) | (2.61) | (1.63) |
| Industry fixed effects | Yes | No | No | Yes | No | No | Yes | No | No |
| R-squared | 0.152 | 0.048 | 0.044 | 0.265 | 0.072 | 0.077 | 0.172 | 0.056 | 0.055 |
| # Obs | 255,718 | 255,718 | 252,092 | 129,107 | 129,107 | 127,929 | 126,611 | 126,611 | 124,146 |

## Table 6

**Stock Returns of Portfolios Sorted on Art-Unit Adjusted Measure of Examiner Busyness**

This table presents returns of portfolios sorted on the art-unit adjusted examiner busyness measure from 1981-2010. The firm-level art-unit adjusted measure is the average of the examiner-level adjusted busyness measure of the patents of the firm-year, where an examiner's adjusted busyness in a year is the examiner's raw busyness measure minus the average busyness of examiners within the same four-dight art unit. At the beginning of each month from July of year *t* to June of year *t*+1, stocks are sorted into quintiles of the adjusted firm-level busyness measure of year *t*-1. We calculate monthly returns of these quintile portfolios and then report the time-series averages over the months. In addition to raw return, we further report CAPM alpha based on the market model, 3-factor alpha based on the Fama-French three factor model, and 4-factor alpha based on Cthe arhart 4-factor model that includes the three Fama-French factors and a momentum factor. Panel A reports value-weighted portfolio returns and panel B report equal-weighted portfolio returns. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

| | Art-Unit Adjusted Examiner Busyness | | | | | |
|---|---|---|---|---|---|---|
| | Low | 2 | 3 | 4 | High | L - H |
| **Panel A: Value-Weighted Portfolio Returns** | | | | | | |
| Raw Return | 1.20 | 1.05 | 1.08 | 1.02 | 0.80 | 0.39*** |
| | (4.17) | (4.01) | (4.14) | (3.86) | (3.06) | (2.86) |
| CAPM Alpha | 0.16 | 0.06 | 0.08 | -0.00 | -0.23 | 0.39*** |
| | (1.71) | (0.57) | (0.92) | (-0.03) | (-2.28) | (2.84) |
| 3-factor Alpha | 0.22 | 0.11 | 0.15 | 0.03 | -0.21 | 0.42*** |
| | (2.11) | (1.17) | (1.78) | (0.35) | (-2.02) | (2.80) |
| 4-factor Alpha | 0.15 | 0.16 | 0.14 | 0.08 | -0.23 | 0.38** |
| | (1.46) | (1.77) | (1.61) | (0.91) | (-2.33) | (2.56) |
| **Panel B: Equal-Weighted Portfolio Returns** | | | | | | |
| Raw Return | 1.20 | 1.27 | 1.32 | 1.24 | 1.06 | 0.15 |
| | (3.48) | (3.75) | (4.00) | (3.55) | (3.05) | (1.44) |
| CAPM Alpha | 0.07 | 0.13 | 0.19 | 0.09 | -0.08 | 0.16 |
| | (0.49) | (0.88) | (1.36) | (0.56) | (-0.50) | (1.51) |
| 3-factor Alpha | 0.10 | 0.15 | 0.19 | 0.06 | -0.15 | 0.24** |
| | (1.00) | (1.52) | (1.86) | (0.51) | (-1.44) | (2.41) |
| 4-factor Alpha | 0.15 | 0.23 | 0.26 | 0.17 | -0.03 | 0.18** |
| | (1.67) | (2.57) | (2.70) | (1.68) | (-0.32) | (1.99) |

**Table 7**

**Robustness Tests: Alphas Using Fama-French 5-Factor Model and Q-Factor Model**

This table is similar to Table 4 except that we calculate alphas using the Fama-French 5-factor model or the *q*-factor model (Hou, Xue, Zhang, 2015). At the beginning of each month from July of year *t* to June of year *t*+1, stocks are sorted into quintiles of the firm-level busyness measure (Panel A) or art-unit adjusted busyness measure (Panel B) of year *t-1*. We calculate monthly value-weighted returns of these quintile portfolios and then report alphas using the Fama-French 5-factor model or the *q*-factor model (Hou, Xue, Zhang, 2015). We also add a momentum factor to both models. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

**Panel A: Examiner Busyness**

| | Firm-Level Measure of Examiner Busyness | | | | | |
|---|---|---|---|---|---|---|
| | Low | 2 | 3 | 4 | High | L - H |
| **Value-Weighted Return** | | | | | | |
| FF5 + UMD Alpha | 0.57 | 0.42 | -0.03 | -0.15 | -0.37 | 0.94*** |
| | (4.35) | (2.99) | (-0.32) | (-1.94) | (-3.01) | (4.60) |
| HXZ + UMD Alpha | 0.62 | 0.49 | -0.05 | -0.14 | -0.31 | 0.93*** |
| | (3.63) | (3.46) | (-0.62) | (-1.70) | (-2.49) | (4.11) |
| **Equal-Weighted Return** | | | | | | |
| FF5 + UMD Alpha | 0.43 | 0.42 | 0.16 | -0.02 | -0.20 | 0.63*** |
| | (3.36) | (4.05) | (1.76) | (-0.18) | (-2.07) | (4.23) |
| HXZ + UMD Alpha | 0.58 | 0.55 | 0.28 | 0.09 | -0.07 | 0.65*** |
| | (4.28) | (4.54) | (2.94) | (1.09) | (-0.73) | (3.83) |

**Panel B: Art-Unit Adjusted Examiner Busyness**

| | Art-Unit Adjusted Examiner Busyness | | | | | |
|---|---|---|---|---|---|---|
| | Low | 2 | 3 | 4 | High | L - H |
| **Value-Weighted Return** | | | | | | |
| FF5 + UMD Alpha | 0.20 | 0.18 | 0.17 | 0.02 | -0.30 | 0.50*** |
| | (1.81) | (1.79) | (1.89) | (0.18) | (-2.82) | (3.09) |
| HXZ + UMD Alpha | 0.20 | 0.22 | 0.21 | -0.00 | -0.25 | 0.45*** |
| | (1.77) | (2.19) | (2.18) | (-0.02) | (-2.34) | (2.76) |
| **Equal-Weighted Return** | | | | | | |
| FF5 + UMD Alpha | 0.21 | 0.26 | 0.29 | 0.16 | -0.13 | 0.34*** |
| | (2.21) | (2.99) | (3.09) | (1.71) | (-1.49) | (3.35) |
| HXZ + UMD Alpha | 0.34 | 0.38 | 0.42 | 0.30 | 0.00 | 0.34*** |
| | (3.91) | (3.93) | (4.17) | (2.94) | (0.03) | (3.32) |

**Table 8**

**Returns of Portfolios Sorted on Firm-Level Measure of Examiner Leniency**

This table presents returns of the portfolios sorted on the firm-level examiner leniency measure from 1981-2010. The examiner leniency measure for a firm-year is calculated as the average of examiner-level leniency measure of the patents of the firm-year, where examiner-level leniency in year *t* is defined as the total number of patents passed by examiner up to the end of year *t* divided by the total number of patents assigned to the examiner up to the end of year *t*. At the beginning of each month from July of year *t* to June of year *t*+1, stocks are sorted into quintiles of the firm-level leniency measure of year *t*-1. We calculate monthly returns of these quintile portfolios and then report the time-series averages over the months. In addition to raw return, we further report CAPM alpha based on the market model, 3-factor alpha based on the Fama-French three factor model, and 4-factor alpha based on the Carhart 4-factor model that includes the three Fama-French factors and a momentum factor. Panel A reports the value-weighted portfolio return, and Panel B reports the equal-weighted portfolio return. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

| | | | | | | |
|---|---|---|---|---|---|---|
| **Panel A: Value-Weighted Portfolio Returns** | | | | | | |
| | **Examiner Leniency** | | | | | |
| | Low | 2 | 3 | 4 | High | L - H |
| Raw Return | 1.24 | 1.16 | 1.17 | 1.25 | 1.28 | 0.04 |
| | (3.09) | (3.23) | (3.47) | (4.04) | (4.04) | (0.29) |
| CAPM Alpha | 0.01 | -0.03 | 0.04 | 0.17 | 0.21 | 0.19 |
| | (0.07) | (-0.17) | (0.27) | (1.37) | (1.38) | (1.42) |
| 3-factor Alpha | 0.09 | -0.02 | -0.02 | 0.09 | 0.21 | 0.12 |
| | (0.64) | (-0.18) | (-0.22) | (1.06) | (2.00) | (1.01) |
| 4-factor Alpha | 0.20 | 0.09 | 0.09 | 0.18 | 0.23 | 0.04 |
| | (1.61) | (0.87) | (0.97) | (2.27) | (2.31) | (0.28) |
| **Panel B: Equal-Weighted Portfolio Returns** | | | | | | |
| Raw Return | 1.12 | 1.06 | 1.04 | 1.01 | 1.22 | 0.10 |
| | (3.18) | (3.43) | (3.63) | (4.17) | (5.16) | (0.50) |
| CAPM Alpha | -0.05 | -0.08 | -0.00 | 0.12 | 0.28 | 0.33 |
| | (-0.33) | (-0.61) | (-0.04) | (1.06) | (2.54) | (1.62) |
| 3-factor Alpha | 0.11 | 0.05 | 0.00 | 0.08 | 0.34 | 0.23 |
| | (0.77) | (0.39) | (0.05) | (0.88) | (3.25) | (1.20) |
| 4-factor Alpha | 0.14 | 0.17 | 0.03 | 0.07 | 0.27 | 0.13 |
| | (0.94) | (1.19) | (0.34) | (0.76) | (2.48) | (0.62) |

**Table 9**

**Portfolio Returns Sorted on Examiner Busyness: Subgroups of R&D and Limited Attention**

Panel A presents value-weighted monthly 4-factor alphas of the portfolios double sorted on R&D and firm-level busyness measure. At the beginning of each month from July of year *t* to June of year *t*+1, stocks are sorted into two groups of R&D expenses of fiscal year ending in calendar year *t*-1 and quintiles of busyness measures or adjusted busyness measures of *t*-1. R&D is research and development expenditures scaled by total assets. We then calculate monthly value-weighted returns of these quintile portfolios and then report 4-factor alphas using the Carhart model that includes the three Fama-French factors and a momentum factor. Panel B is similar to panel A except that we form subgroups of innovation distraction measure of *t*-1 rather than R&D. Innovation distraction for a firm-year is defined as the average of innovation distraction of all patents of the firm-year, where innovation distraction for a patent is the number of patents in the same technology field announced on the same day of the patent. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in parentheses. $^{*}$, $^{**}$, and $^{***}$ denote significance at 10%, 5%, and 1% level, respectively.

| | Examiner Busyness | | | | | |
|---|---|---|---|---|---|---|
| | Low | 2 | 3 | 4 | High | L - H |
| **Panel A: Subgroup Analysis Based on R&D** | | | | | | |
| **Sorted on Examiner Busyness Measure** | | | | | | |
| Low R&D Firms | -0.22 | 0.42 | 0.00 | 0.05 | -0.34 | 0.11 |
| | (-1.27) | (2.40) | (0.05) | (0.40) | (-2.26) | (0.48) |
| High R&D Firms | 0.78 | 0.19 | 0.12 | 0.05 | 0.07 | 0.71$^{**}$ |
| | (3.52) | (1.09) | (0.92) | (0.36) | (0.23) | (2.25) |
| High – Low | | | | | | 0.60$^{*}$ |
| | | | | | | (1.74) |
| **Sorted on Art-Unit Adjusted Examiner Busyness Measure** | | | | | | |
| Low R&D Firms | -0.14 | 0.16 | 0.17 | 0.02 | -0.23 | 0.09 |
| | (-0.93) | (1.28) | (1.57) | (0.18) | (-1.62) | (0.50) |
| High R&D Firms | 0.98 | 0.34 | 0.05 | 0.24 | -0.19 | 1.17$^{***}$ |
| | (4.05) | (2.30) | (0.36) | (1.45) | (-0.87) | (3.94) |
| High – Low | | | | | | 1.08$^{***}$ |
| | | | | | | (3.77) |
| **Panel B: Subgroup Analayis Based on Limited Attention** | | | | | | |
| **Sorted on Examiner Busyness Measure** | | | | | | |
| Low Distraction Firms | 0.13 | 0.28 | 0.19 | 0.06 | -0.23 | 0.36$^{*}$ |
| | (0.90) | (1.88) | (1.67) | (0.58) | (-1.66) | (1.94) |
| High Distraction Firms | 0.46 | 0.33 | 0.03 | -0.02 | -0.31 | 0.76$^{***}$ |
| | (2.87) | (2.46) | (0.29) | (-0.17) | (-1.87) | (3.36) |
| High – Low | | | | | | 0.41$^{*}$ |
| | | | | | | (1.69) |
| **Sorted on Art-Unit Adjusted Examiner Busyness Measure** | | | | | | |
| Low Distraction Firms | 0.17 | 0.16 | 0.10 | 0.12 | -0.15 | 0.33$^{*}$ |
| | (1.32) | (1.19) | (0.97) | (1.12) | (-1.16) | (1.78) |
| High Distraction Firms | 0.18 | 0.22 | 0.16 | 0.09 | -0.47 | 0.65$^{***}$ |
| | (1.20) | (1.82) | (1.49) | (0.70) | (-3.19) | (3.21) |
| High – Low | | | | | | 0.32$^{*}$ |
| | | | | | | (1.66) |

**Table 10**

**Monthly Alphas of Portfolios Sorted on Examiner Busyness: Long-Term Window**

This table presents monthly alphas in terms of 4-factor alphas of portfolios sorted on the examiner busyness measure. Examiner busyness measure for a firm-year is calculated as the average of examiner-level busyness of the patents of the firm-year, where examiner-level busyness is the number of patents approved by the examiner in the year. At the beginning of each month, stocks are sorted into quintiles of the firm-level busyness measure of year *t*-1. We then calculate monthly value-weighted returns for the portfolios and then 4-factor alphas for each year in the four-year window after the month. 4-factor alphas are estimated using the three Fama-French factors and a momentum factor. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

| | **Examiner Busyness** | | | | | |
|---|---|---|---|---|---|---|
| | **Low** | **2** | **3** | **4** | **High** | **L – H** |
| **Monthly Alpha (Year 1)** | 0.18 | 0.19 | 0.17 | 0.06 | -0.18 | 0.37* |
| | (1.38) | (1.89) | (2.30) | (0.64) | (-1.55) | (1.75) |
| **Monthly Alpha (Year 2)** | 0.48 | 0.20 | 0.02 | 0.04 | -0.24 | 0.72*** |
| | (4.47) | (1.56) | (0.29) | (0.46) | (-1.93) | (3.96) |
| **Monthly Alpha (Year 3)** | 0.14 | 0.22 | 0.08 | 0.02 | 0.04 | 0.10 |
| | (1.12) | (2.01) | (1.00) | (0.25) | (0.32) | (0.58) |
| **Monthly Alpha (Year 4)** | 0.33 | 0.21 | 0.03 | -0.02 | 0.18 | 0.15 |
| | (2.63) | (1.98) | (0.34) | (-0.23) | (1.45) | (0.74) |

**Table 11**
**Panel Regressions of Examiner Busyness on Examiner Characteristics**

This table presents patent-level panel regressions of examiner busyness on examiner characteristics. The dependent variable is the examiner-level busyness measure. The independent variables include examiner experience and examiner duration. Examiner experience is measured as the number of years an examiner has been with the patent office since the first time she approves a patent. Examiner duration is defined as the average number of days for an application to be approved by the examiner in year *t*-1. We take natural logarithm of both dependent and independent variables. Standard errors are clustered by firm and robust t-values are reported in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

| | **Dependent Variable: Ln(Examiner Busyness)** | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Ln(Examiner Experience) | 0.027*** | | 0.027*** | 0.026*** |
| | (36.09) | | (37.43) | (36.84) |
| Ln(Examiner Duration) | | -0.548*** | -0.547*** | -0.429*** |
| | | (-59.98) | (-59.25) | (-44.16) |
| Year fixed effects | No | No | No | Yes |
| Firm fixed effects | No | No | No | Yes |
| Art-unit fixed effects | No | No | No | Yes |
| Observations | 1,066,668 | 1,066,646 | 1,066,646 | 1,066,295 |
| Adjusted R-squared | 0.361 | 0.329 | 0.392 | 0.434 |

**Appendix: Variable definition**

| | |
|---|---|
| Examiner busyness | Number of patents granted by an examiner in year t.<br>Data source: USPTO application database. |
| Total patents | Number of patents granted to a firm in year t.<br>Data source: Patent data, Indiana University<br>https://iu.app.box.com/v/patents |
| Firm-level busyness | Average of examiner busyness of all patents for a firm-year. |
| Ln(ME) | Logarithm of market capitalization.<br>Data source: CSRP |
| Ln(BM) | Logarithm of book to market ratio as defined in Fama and French (1992).<br>Data source: CRSP and Compustat |
| Ret[-13, -2] | Cumulative return from month -13 to month -2.<br>Data source: CRSP |
| Ret [-1] | Stock return in last month.<br>Data source: CRSP |
| Assets Growth | Change in total assets adjusted by lagged total assets.<br>Data source: Compustat |
| ROE | Return on equity is defined as which is income before extraordinary items divided by 1-quarter-lagged book equity.<br>Data source: Compustat |
| Examiner art unit | The group art unit to which the examiner of record was assigned as of the last office action recorded for the application in question.<br>Data source: USPTO application database. |
| Examiner-level art-unit adjusted busyness | Number of patents granted by an examiner subtracting the average number of patents granted by all examiners within the same four-digit level art unit.<br>Data source: USPTO application database. |
| Firm-level art-unit adjusted busyness | Average of examiner art-unit-adjusted busyness of all patents for a firm-year. |
| Examiner leniency | The approval rate of an examiner, measured as total number of patents granted by an examiner up to year t, divided by the total number of patent applications assigned to the examiner up to year t.<br>Data source: USPTO application database. |
| ROA | Return on assets is defined as operating income before extraordinary itmes divided by total assets.<br>Data source: Compustat |
| Gross Margin | Gross margin is defined as the operating profitability (sales- cost of goods sold) divided by sales.<br>Data source: Compustat |
| Sales Growth | Sales Growth is defined as change in sales divided by lagged sales.<br>Data source: Compustat |
| Examiner experience | Number of years the examiner has been with the patent office since the first time he passed a patent application<br>Data source: USPTO application database. |
| Examiner Duration | The average number of days for an application to be passed by the examiner in year.<br>Data source: USPTO application database. |