The Dark Side of Patents:

Effects of Strategic Patenting on Firms and Their Peers

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This version: August 10, 2020

ABSTRACT

This paper analyses the effect of strategic patenting on firm and competitor performance, productivity, innovative output and market concentration. Using a novel definition of strategic patenting, this paper finds a positive effect of strategic patenting on market concentration. The results for the patentee show a positive effect of profit growth, and positive but significantly smaller contribution of strategic patenting to total factor productivity compared to novel technological patents. In contrast, peers suffer from a decrease in total factor productivity, innovative output and both profit and sales growth following strategic patenting by the focal firm. These findings suggest a conflict between patent policies designed to promote innovation while still providing incentives for the firms to capture market share and defend monopolistic positions.

*David Eccles School of Business, University of Utah; E-mail: Maria.Kurakina@eccles.utah.edu. I am indebted to my advisors, David Sraer, Ulrike Malmendier, Lee Fleming, and Dmitry Livdan for their support and guidance. Special thanks to the Coleman Fung Institute for Engineering Leadership and Guan-Cheng Li for providing access to the patent application database. I would also like to thank Matthew J. Higgins, Deepak Hedge, Benjamin Balsmeier, Gustavo Manso, Amir Kermani, Yuriy Gorodnichenko, Hoai-Luu Nguyen, Carlos F. Avenancio-León, Tristan Fitzgerald, Christopher Lako, Troup Howard, Dayin Zhang, and Marius Guenzel as well as numerous seminar participants at the Haas School of Business, Economics Department at UC Berkeley, and David Eccles School of Business for their valuable comments and suggestions.

1 Introduction

In recent years, the benefits of patenting for the firm and market are no longer obvious. Prior literature has focused heavily on the positive aspects of patents as an embodiment of the innovative activity of the firm, leading to sales growth, job creation, and an increase in total factor productivity. But this "bright side" of patenting is just one side of the coin, as firms can also benefit from the "dark side" of patenting or the harm a new patent can do to a competitor in the same product market space. Sometimes firms strategically patent for defensive reasons to specifically block or harm a competitor. This phenomenon of so-called "strategic patenting" is still largely theoretical, and its existence has yet to be demonstrated empirically in a general market setting. The goal of this paper is to provide a more novel definition of strategic patenting, identify which firms tend to engage in this type of patenting, and understand how they shape the industry environment.

This novel measure for defining strategic patents combines observations from Abrams et al. (2013) on the non-linear nature of the relationship between the economic value of a patent and its scientific value and Kogan et al.'s (2017) stock market-based measure of private value of innovation. More specifically, strategic patents exhibit a negative relationship between forward citations and their economic value as opposed to the positive relationship conventionally attributed to productive (technological) patenting activity. More technologically valuable patents bring greater value to both the innovating firm as well as the market through positive spillovers.

This paper has four core findings. First, when firms strategically patent to defend their market position, overall market competition decreases following strategic patent issuance. Second, compared to technological patents, strategic patents contribute less to increases in a firm's total factor productivity. Highly cited, high-value patents tend to be more radical in nature. These kinds of patents increase a firm's labor productivity and create positive spillovers for potential market entrants and existing competitors. In contrast, a strategic patent derives value not from its contribution to a firm's technological improvement – be that through either product or process innovation – but rather from protection it offers to previously granted technological patents. Third, strategic patenting has a negative effect on profit growth, output, and total factor productivity of peer firms. Fourth, strategic patenting following technological patents that are deemed "breakthrough" generate greater firm profits than similar technological patents not protected by strategic patents.

These findings contribute to the following strands of research. First and foremost, this paper extends the analysis of the effect of patenting on firm performance from the focal patenting firm to its peers across industries. The extant literature on the impact of innovation defined by patenting activity, focuses mostly on how it affects a firm's own performance, equity price, and market value (e.g., Pakes, 1986; Hall, Jaffe, and Trajtenberg, 2001; Kline, Petkova, Williams, and Zidar, 2019; Farre-Mensa, Hegde, and Ljungqvist, 2016; Balasubramanian and Sivadasan, 2011; Kogan, Papanikolaou, Seru, and Stoffman, 2017). Of the papers examining the effect of firm's patenting on rival or peer firms, it is worth noting Austin (1993), whose analysis is limited to a sample of biotechnology firms in the early 1990s. Additional works by Megna and Klock (1993), Jaffe, Trajtenberg, and Henderson (1993), and Cockburn and MacGarvie (2011) examine R&D spillovers but only on a subsample of industries. These studies conclude that firms may benefit from the patents of rival firms, though there is evidence that patents can impose costs on these firms; the main focus of this paper.

Second, this is the first paper to empirically demonstrate the impacts of strategic patenting on the performance of the patentee, the patentee's closest market peers, and overall market structure. Previous literature on the strategic use of patents (e.g., Abrams, Akcigit, and Grennan, 2013; Farrell and Shapiro, 2008; Noel and Schankerman, 2013; Hall and Ziedonis, 2001; Ziedonis, 2004; Hegde, Mowery, and Graham, 2009; Galasso and Schankerman, 2010; Cockburn and MacGarvie, 2011; Von Graevenitz, Wagner, and Harhoff, 2011) examines either the theoretical implications of strategic patenting or, on the empirical side, its effect on the subsequent patenting activity by the firm and often within a specific technology class or industry. In contrast, this paper introduces a novel definition of strategic patenting that allows for the examination of its effects across public firms in all industries.

The rest of the paper is organized as follows. Section 2 describes the data and empirical setting, including the methodology of constructing the economic value of innovation used in classifying patents as strategic or technological. Section 3 outlines the empirical strategy, while Section 4 presents the main results, followed by conclusion in Section 7.

2 Empirical Setting and Data

The approach of identifying strategic patents among a firm's patent portfolio relies on finding an appropriate measure of their economic value. This section discusses the methodology of estimating a return-based patent value introduced in Kogan et al. (2017). After describing the data focus shifts to illustrating that this measure of patent value can consistently distinguish strategic patents from technological ones. This is done by testing established observations in the literature about strategic patent behavior. That is, strategic patents are more likely to be continuation and divisional patents (Abrams et al., 2013). Finally, using this new definition of strategic patents, additional stylized facts are presented on the types of innovations these patents tend to cover and which industries this type of patenting activity has become most prevalent. Patent technological classification follows Hall et al. (2001), where over 400 USPTO classes are aggregated into six main categories: Chemical, Computers & Communications, Drugs & Medical, Electrical & Electronic, Mechanical, and Others.[1]

2.1 Motivation for Patenting: Strategic vs. Technological Patents

Patents play an important role in a firm's value creation process. Owning a patent gives a firm the exclusive right to make and sell its innovation within a specific market. Patent ownership can be used by a firm to enter a profitable new market and attract extra revenue, thus positively affecting its balance sheet, increasing profit margins, and leading to an overall increase in a firm's equity price and valuation. The direct source of income derived from patent ownership ranges from licensing and ownership transfer to entering the litigation process with the purpose of obtaining damages for infringement (Miele, 2000).

In addition to the direct profits that a firm can accrue from patent ownership, firms can also derive an indirect benefit from the defensive nature of patents. In this context patents can be used to deter competitors from operating or entering a patentee's product market. The mere threat of a patent infringement suit can lead to the delay of competitor entry into a new market. This can negatively affect a competitor's growth and overall competitive position within an industry. For example, the number of patents filed within the same product market may decline following a strategic patent.

[1] For details on this aggregation see Hall, Jaffe, and Trajtenberg (2001).

While more valuable (technological) patents generate both direct (revenue increasing – *productive* value) and indirect (entrance deterring – *strategic* value) benefits to their owners, recent studies (e.g., Abrams et al., 2013; Farrell and Shapiro, 2008; Noel and Schankerman, 2013) have shown a resurgence of patents predominantly of a strategic nature. These are patents whose sole purpose are to prevent subsequent entry into a given product market and thus protect the profits generated by related technological patents issued by focal firms. They also tend to be mostly continuation applications, focused on a different aspect of the same technology, or divisional applications, focused on a particular invention mentioned in the original patent.

An example of a continuation strategic patent is the "slide-to-unlock" patent by Apple issued on October 2012, the third in the series of "slide-to-unlock" patents issued to the firm.[2] The initial patents specified the "predefined path" of the movement on a screen to unlock the device, which was an easy obstacle for competitors to overcome thereby avoiding patent infringement suits. This newly issued patent, on the other hand, covers any uninterrupted movement on a touch-sensitive display which leads to unlocking the device. Hence, this patent can be classified as strategic for two reasons. First, it was effective in preventing other firms from using this design without licensing, hence making Apple products superior and more desirable in the eyes of customers. Thus, this patent helped shield the monopolistic profits the firm was deriving from previous technological patents. Second, the patent did not contribute to further technological advancement since it was not a breakthrough invention. The novelty of this particular invention, i.e., the slide-to-unlock mechanism, had already been included in two previous patents, which was reflected in the low number of forward citations the patent received compared to its predecessors.

2.2 Data and Sample Selection

To estimate the effect that strategic patents have on firms and industries, a dataset is constructed that combines information on individual patent applications, firm stock market returns, balance sheet information and total factor productivity.

Data on U.S. patent applications, invention classifications, filing dates, publication dates, issue dates, and patent numbers come from the public-use administrative data provided by the United

[2]See in http://ipassetmaximizerblog.com/strategic-patenting-part-1-why-so-few-patents-create-business-value/ (January 24, 2014).

States Patent and Trademark Office (USPTO). The sample of patent applications used in this paper were filed after November 29, 2000 and published by December 31, 2013. This period was picked because this is when the USPTO began providing information on rejected patent applications in addition to granted ones. The information on rejected applications is important because they are used as a control group to compare the impact of strategic versus technological patent grants on firm and peer performance. This dataset is merged with administrative data from the USPTO Patent Application Information Retrieval (PAIR) to get patent examiner information (Kline et al., 2019). Data on application assignee name and patent citations for granted patents are extracted from Google Patents.

Following Wasi and Flaaen (2015) and Hall et al. (2001) each patent application is matched to the respective firm that filed it based on probabilistic record linkage. This method uses the name of the patent assignee and the name of the firm in the CRSP/Compustat Merged database. Additionally, patent applications were classified into six broad technology groups following Hall et al. (2001). Technology classes not previously attributed to one of the categories by Hall et al. (2001) were manually added to one of the six categories.

To identify strategic patents from technological ones, patent application data are merged with daily stock return data from CRSP.[3] Firm and peer profitability and performance data come from the CRSP/Compustat Merged database. Following Hoberg and Phillips (2010, 2016) product market competitors are defined using Text-based Industry Classification TNIC3. For the main analysis only the top 50th percentile of closest product market competitors based on the product description proximity score accompanying every firm pair in TNIC3 is used. An average patentee in any given year has 40.48 close competitors[4]. All continuous variables are winsorized at the 5th and 95th percentiles of their distributions. Financial variables are adjusted for inflation using the CPI from the Bureau of Economic Analysis with 2014 serving as the base year.

Table 1 describes the construction of the final sample of patent applications linked to the patenting firm's balance sheet. The following restrictions are made to the final sample. First, all

[3]The definition of a strategic and technological patent is based on the private economic value, estimated using the stock market return response to patent filing news from CRSP (Kogan et al., 2017), and scientific value of a patent, proxied by its number of forward citations from USPTO. A strategic patent falls into the top 50th percentile of the distribution of the private economic value and bottom 50th percentile of the distribution of scientific value. A technological patent, on the other hand, has both high (top 50th percentile) economic and scientific patent value.

[4]Main results are robust to alternative definitions of competitor space, including the top 75 and top 90 percent closest competitors (see Table 21 and Table 22).

patent applications that are not matched based on assignee name are dropped, leaving a sample of only public firms. Second, the analysis is limited to utility patents (Kline et al., 2019). Third, only applications filed by a single assignee are considered in order to avoid possible complications related to joint ownership of patents. Finally, only companies that have at least five years of pre- and post- filing outcomes are kept (similar to Dobbie and Song (2015); Kline et al. (2019)). These restrictions leave a sample of 102,807 patent applications filed by 1,423 firms, out of which 57.11 percent were granted[5].

2.3 Measures of Economic and Technological Value of Patents

We follow Kogan, Papanikolaou, Seru, and Stoffman (2017) and base the economic value of a patent on a firm's stock market response to a patent application announcement. The economic value of patent j, or ξ_j, is constructed as the product of market capitalization M_j at $t = -1$, where t is the date of patent filing and an estimate of stock returns related to a patent application filing, $\mathbb{E}[\upsilon_j|r_j]$. This product is weighted by the number of patents applied for by the firm during the same day N_j, and adjusted by the unconditional probability of a patent application being successful, $\bar{\pi}$[6]:

$$\xi_j = (1 - \bar{\pi})^{-1} \frac{1}{N_j} \mathbb{E}[\upsilon_j|r_j] M_j \tag{1}$$

The filing date of a patent is used as opposed to the granting date in order to control for the value of patent applications that were eventually rejected (Kogan et al., 2017). To ensure that stock returns only reflect patent announcement-related events, they are decomposed into patent-specific and patent-unrelated components. Kogan et al. (2017) assumes that the private value of a patent follows a normal distribution truncated at zero. This implies that for patenting firms patents have a positive value.

The *technological value* of a patent, or its estimated knowledge contribution, is calculated by the number of forward citations. Unfortunately, this variable suffers from a truncation problem. That is, more recent patents tend to have fewer forward citations (Hall et al., 2001). To alleviate this concern, we control for the time period over which the forward citations were measured. The availability of citations data up to 2014 allows for the computation of forward citations over the three-year period after patent filing[7].

The evolution of strategic patenting over time is presented in Figure 4. There has been a steady increase in the percentage of granted strategic patents across all technological categories from 2004

[5] Figure 1 shows the total number of patent applications grouped by technological category and year of patent filing. The largest category is Computers & Communications. This figure also illustrates changes in patenting activity year over year. One can observe a significant increase between 2001 and 2005 (32 percent) with a dramatic drop (54 percent) over the following four years in the absolute number of patent applications filed within Computers & Communications field. This trend was mimicked closely by patent filings in Electric & Electronic.

[6] Carley, Hegde, and Marco (2015) estimate this unconditional probability at 56 percent.

[7] Figure 2 illustrates the distribution of forward citations using both raw and truncated measures. As evident from the figure, the distribution of raw citations is heavily skewed to the right, which is alleviated with the measure based on a three-year window.

to its peak in 2008[8].

By regressing the number of forward citations on patent value (as defined in Equation (1)) and patent value squared, the inverted U-shape relationship between the economic and technological value found in Abrams et al. (2013) can be replicated. These results are presented in Table 2. All specifications control for year of filing, examiner art unit, and firm fixed effects. Standard errors are clustered by examiner art unit and filing year. The measure of patent value is normalized to unit standard deviation for ease of interpretation. Using the measure for patent value in Equation (1), the positive relationship between value and forward citations remains across all specifications. Moreover, the inclusion of a quadratic term, which is highly significant, does not lead to a deterioration of the overall fit.

Hence, based on this nonlinear relationship between value and forward citations for high-value patents, the following analysis will focus on the differences in the effect strategic patents have on the patentee and its competitors in comparison to technological patents. A patent is defined as strategic if it falls into the top 50th percentile of the distribution of economic value as measured by Equation (1), and the bottom 50th percentile of the distribution of technological value (Balsmeier et al., 2019). Likewise, a patent is defined as technological if it falls in the top 50th percentile of the distribution of economic value and the top 50th percentile of the distribution of technological value.

3 Research Design

The following model analyzes the effect that strategic patenting has on both the patenting firm and its peers performance and productivity, y_{it}:

$$y_{it} = \beta_0 + \beta_1 \cdot X_{i,t-1} + \beta_2 \cdot X_{-i,t-1} + \gamma \cdot I(PatentGranted_{ij}) + \delta \cdot I(StrategicPatent_{ij}) + \alpha_i + \theta_{jt} + \epsilon_{ijt} \quad (2)$$

where i denotes the patenting firm, $\{$-$i\}$ is the portfolio of patenting firm peers, j is the examiner art unit, t is the year of patent filing, γ is the effect of a patent being granted, δ is the effect of

[8] Figure 3 shows the total share of granted patents as well as the proportion of strategic versus technological patents by technological category. The category Electrical & Electronic has the highest share of granted patents (70 percent), while the lowest share of granted patents is in the Drugs & Medical (30 percent). Besides Other, Computers & Communications and Drugs & Medical are the two categories with the highest share of granted strategic patents.

a strategic patent being granted as opposed to other granted patents, $X_{i,t-1}$ is a vector of firm controls including the previous year's return on assets, cash flow, firm's Tobin's Q, sales volatility and growth, and leverage. α_i is a firm fixed effect, θ_{jt} is the examiner art unit by year of filing fixed effect, and ϵ_{ijt} is noise.

This equation suffers from a potential endogeneity problem. Both the estimates of γ and δ could be biased if the status of the patent (rejected or accepted) and its strategic characteristic are correlated with unobservable characteristics of later firm outcomes: $\mathbb{E}[\epsilon_{ijt}|I(PatentGranted_{ij})] \neq 0$ and $\mathbb{E}[\epsilon_{ijt}|I(StrategicPatent_{ij})] \neq 0$. For example, at the time of filing, a firm might be of a higher intrinsic quality, thus being able to both file for a more valuable patent and have it granted as a novel innovation, and at the same time improve its future performance (Farre-Mensa et al., 2016). Thus, it is possible that post-filing outcomes are determined simultaneously with the type of the patent a firm files. This issue is solved by employing the matching technique used in Blackwell et al. (2009), Angrist (1998), Card and Sullivan (1988), and Sarsons (2017).

The use of matching as an empirical tool helps to control for any confounding effects of pre-treatment variables in the data. This improves the balance between the control and treated groups by making them more similar in terms of their distribution of covariates. Coarsened-exact match for granted and non-granted patents, as well as for strategic and other patents within the matched granted subsample, was implemented. Starting with the sample of patent applications described in Section 2.2 generates 102,807 distinct observations. The first exact matching between granted and non-granted patents based on the year of patent application and its technological category. The next match is a coarse match on the size of the patentee and economic value of the patent application using an average of 25 bins for each variable. This procedure was repeated on a subsample of granted patents only, matching between strategic and nonstrategic granted patents. Both matches are completed with replacement of individual patents but each patent pair is only matched once. The final matched sample is comprised of 8,858 granted – non-granted pairs, and 4,430 strategic – non-strategic granted patent pairs[9].

Table 3 Panel A presents the comparison between the economic values of the patent for the

[9]The choice of the matching criteria is based on the assumption that the examiner's choice on which patents to grant within application year, technological category, patentee size and economic value of innovation is random. The placebo test results in Table 23 illustrate that random assignment of granted (and strategic) status within each group leads to the disappearance of the results, thus showing that they are not driven by the selection of matching criteria.

control and treatment groups (i.e., strategic versus other patents and granted versus non-granted patents). By construction there is no difference in the economic values of these patents across these groups. At the same time, as in Panel B, strategic patents exhibit a significantly lower number of forward citations within the matched sample, also by construction. Overall, Table 3 illustrates the main goal of the matching procedure, which is to control for the economic value of a patent. This process is important so as to avoid the performance effects of strategic patents being driven purely by the higher economic values as opposed to technological and non-granted applications (i.e., in general higher performing patents).

Finally, Table 4 presents summary statistics for the final samples grouped by type of issued patent. All variables are calculated as firm averages over the five-year period preceding patent filing. From Table 4, firms issuing strategic patents tend to have lower baseline profit, return on assets, and growth opportunities as measured by Tobin's Q, as well as being more financially constrained by lower cash flows and higher leverage. At the same time, there is no significant difference between the two samples in terms of sales, total assets, and R&D costs.

4 Results

4.1 Strategic Patent Characteristics

Prior to discussing the main results of the paper, this section presents a descriptive analysis of characteristics of strategic and technological patents. First, the paper shows that firms are more likely to engage in strategic patenting following a breakthrough innovation. To illustrate this, Table 5 presents the results of the regression of the probability that a patent is of strategic nature on an indicator variable whether the previously granted patent to the firm is a breakthrough innovation (technological patent). Models (1) through (3) illustrate using the full sample of granted patents that having a breakthrough patent increases the probability that the next patent will be strategic by 6.44 to 8.45 percent. Models (4) through (6) repeat the analysis using the matched sample, with respective probabilities being 10.64 to 12.72 percent.

Following Abrams et al. (2013), Table 6 shows the prevalence of continuing applications among those issued for purely strategic reasons (i.e, to extend the patent protection of previously patented technology). Panel A presents the estimates from Equation (2) using the full sample of high-

performing granted patents and a matched sample of granted patents in Panel B. The dependent variables are indicators whether a particular patent is classified in the USPTO PAIR dataset as a continuation (PAIR: CON) – Model (1), continuation in part (PAIR: CIP) – Model (2), divisional patent (PAIR: DIV) – Model (3), or any one of these three mentioned before – Model (4). In Model (1), the estimated coefficient on $I(StrategicPatent_{ij})$, δ, is significant and positive, suggesting that strategic patents are more likely to be continuing applications as opposed to their technological counterparts. This result can be explained by noting that the strategy of filing a continuation or divisional patent is less beneficial for technological patents, as the marginal benefit of extending patent prosecution is lower.

Next, using a similar model as Table 6, Table 7 reports results on the type of innovative search strategies undertaken by the patenting firm. Model (1) shows that strategic patents, on average, have a higher number of backward citations, indicating that a larger share of innovative search was being performed in more well-developed and mature fields with rapid innovative growth (Abrams et al., 2013; Balsmeier et al., 2017). Results in Models (2) and (3) signal a patentee's tendency towards engaging in exploitation of technologies within previously known areas of expertise, reflected in the increased number of self-citations (citations of other patents owned by the same patentee) and the increase in the probability that the patent was filed within a technological class previously known to the firm (i.e., firm has at least one patent granted in this technological class since 1976).

The results discussed above – namely the higher probability of engaging in strategic patenting following a breakthrough patent, the prevalence of continuation/divisional patents and patents both within more developed mature fields and derived from previously known areas of firm's expertise – confirm that the newly introduced measure of strategic innovation based on the stock market response to the patent application and number of forward citations is consistent with the purpose and characteristics of strategic patenting described in the existing literature (e.g, Abrams et al., 2013).

4.2 Effect of Strategic Patenting on Market Concentration

In this section the main results of this paper are presented, namely the effect of strategic patenting on product market concentration. Table 8 shows the results of the estimation of Equation (2) on a matched sample of top-performing patent applications using the baseline measure of

product market concentration. The baseline Herfindahl-Hirschman Index, based on a firm's net sales and Hoberg and Phillips (2010) TNIC3 industry classification, is defined as:

$$HHI_{jt} = \sum_{i=1}^{F_j} s_{ijt}^2 \tag{3}$$

where s_{ijt}^2 is the squared market share of firm i, in industry j, at year t. Market share is computed as the ratio of firm i sales to total industry j sales, and F_j is the number of firms within the product market. TNIC3 based HHI is firm specific in that each firm has a unique set of competitors in each year. For the main analysis, the industry classification based on TNIC3 is used to determine a firm's closest peers that are likely to be affected by patent issuance based on the proximity of the products offered by the firms within the market. The industry definition based on firms' product description is important in this case given the importance of the hypothesis that strategic patents prevent other firms from continuing to operate (or enter) into the same product market as the patentee. Overall, TNIC3 provides a more accurate industry classification compared to SIC or NAICS (Hoberg and Phillips, 2010, 2016). Alternative industry classifications are described in Section 6.1. The coefficients of interest from Equation (2) are γ, which shows the effect of technological patent granting on market concentration, while $\gamma + \delta$ shows the impact of strategic patent issuance. The dependent variable are measures of market concentration (i.e., HHI in this case) averaged over five post-filing years. All specifications control for filing year, examiner art unit, and firm fixed effects. Standard errors are clustered by examiner art unit and filing year.

Model (1) presents the results from the baseline model, including only indicators related to whether the patent application was granted, $I(PatentGranted_{ij})$, whether the granted patent was of strategic nature, $I(StrategicPatent_{ij})$, and fixed effects. δ, or the coefficient on $I(StrategicPatent_{ij})$ is positive and significant equaling 0.0026. γ or the effect of technological patent grant on market concentration is negative and significant equaling -0.0020. Thus, the overall effect of strategic patenting, $\gamma + \delta$, remains positive and significant. Model (2) adds controls for firm level characteristics ($X_{i,t-1}$), while Model (3) incorporates respective peer firm controls($X_{-i,t-1}$). All three models suggest a significant increase in market concentration following strategic patent issuance. Models (4) through (6) repeat the analysis using an alternative measure of market concentration, namely the total number of product market peers. The results remain qualitatively the same; a

decrease in the number of firm competitors following strategic patent issuance. In sum, these estimates are consistent with the stated purpose of strategic patenting: protection of market share and prevention of entry into a product market.

4.3 Effect of Strategic Patenting on Total Factor Productivity (TFPR)

We next consider the contribution of strategic patenting to total factor productivity. While technologically novel innovation leads to higher mark-ups and improvement in firm productivity, thereby positively contributing to aggregate economic growth (Kline et al., 2019), strategic patenting, on the other hand, does not have technological advancement as a main goal. On the contrary, these patents are aimed at supporting and preserving monopolistic profits generated by previously issued technological patents. Thus, by themselves these patents tend to be of intrinsically low scientific value. Table 9 considers this gap between technological and strategic patents on total factor productivity. The dependent variable in Table 9 follows İmrohoroğlu, Ayşe and Tüzel, Şelale (2014) and is defined as a revenue-based measure of total factor productivity, TFPR.[10]

Model (1) includes only $I(PatentGranted_{ij})$, $I(StrategicPatent_{ij})$ and fixed effects. Model (2) adds firm level controls. In both of these models coefficients on $I(PatentGranted_{ij})$ are positive and significant, which is consistent with a beneficial effect of innovative activity on a firm's TFPR (e.g., Kogan et al., 2017). Additionally, a strategic patent grant, $\gamma + \delta$, leads to a 75.21 to 79.37 percent lower but still positive effect on TFPR compared to a technological patent. Thus, strategic patents have a lower contribution to post-filing TFPR.

Models (3) and (4) consider the impact of patenting on competitor TFPR. Both coefficients γ (effect of technological patent issue) and δ (effect of strategic patent grant relative to technological patent) have the same signs as for the patentee: γ is positive and significant, while δ is negative. However, the overall effect of strategic patenting, $\delta + \gamma$ is negative, and constitutes, on average, 2.6 (Model (3)) to 2.26 (Model (4)) percent drop in competitor TFPR. Conversely, technological patenting leads to a quantitatively similar increase in competitor TFPR (2.3 and 2.92 percent respectively). The magnitude of the results is consistent with previous research on the effect of firm's innovative output on total factor productivity (i.e., Kogan et al. (2017) show that one

[10] TFPR is defined as a measure of the capital and labor effectiveness free of the effect of measured firm costs (İmrohoroğlu, Ayşe and Tüzel, Şelale, 2014).

standard deviation increase in innovative output estimated using economic value of innovation is associated with 2.3 percent increase in TFPR over the five years following a patent issue).

Thus, these results suggest that the presence of positive spillovers from technological patents on the productivity of market competitors. Competitors appear to benefit from new technology and knowledge created by the patenting firm despite their inability to use it without infringing or paying licensing fees. On the other hand, strategic patent issuance appears to have a negative spillover effect on competitors. These negative effects come from: a) a low TFPR effect from strategic patents on the patenting firm itself, b) low technological knowledge spillovers from strategic patents (reflected in low forward citations), and c) the highly defensive nature of these patents aimed at pushing competitors out of a market.

Hence, as far as TFPR is concerned, technological patents lead to an increase of TFPR for all firms within a product market, while strategic patents have only a negligibly positive impact on the patentee's own TFPR and a significant detrimental effect on the TFPR of its competitors.

4.4 Effect of Strategic Patenting on Firm Performance

How does strategic patenting affect performance for the focal firm and their competitors? Previous studies have, generally shown a positive effect between a firm's innovative activity and future performance measured in terms of sales, profit, output, capital, employment and total factor productivity (Kogan et al., 2017; Farre-Mensa et al., 2016), firm productivity and worker compensation (Kline et al., 2019), and firm size, factor intensity, and scope (Balasubramanian and Sivadasan, 2011). Following Kogan et al. (2017), Table 10 presents the results of estimating Equation (4), where the dependent variable, $Y_{i,t+\tau}$, is defined as the growth of the firm profits, sales, and cost of goods sold (COGS) over the horizon τ of one to five years post-patent filing:

$$\begin{aligned} logY_{i,t+\tau} - logY_{it} =& \beta_0 + \beta_1 \cdot X_{i,t-1} + \beta_2 \cdot X_{-i,t-1} + \gamma \cdot I(PatentGranted_{ij}) + \\ & \delta \cdot I(StrategicPatent_{ij}) + \alpha_i + \theta_{jt} + \epsilon_{ijt} \end{aligned} \tag{4}$$

Results in Table 10 show that a technological patent grant has an immediate negative effect on firm profit growth that appears to persist over the following four years. Strategic patents, on the other hand, exhibit a long-run positive increase in profit growth in later years (i.e., years

four and five). Hence, a focus on novel technologies puts a short-term strain on profit growth, while at the same time generating positive product market spillovers. This combination leads to dilution of monopolistic profits of the patentee. Panel B considers sales growth as the dependent variable. Neither patent type – technological or strategic – has a statistically significant effect on sales growth. These results imply that the changes in profit growth are not coming from changes in sales. Instead, the main mechanism behind this change in patentee profit growth appears to come from changes in COGS, as illustrated in Panel C.

Technological patent issuance (γ) has a significant positive effect on COGS growth over the following five years, while the effect from strategic patent grant ($\gamma + \delta$) is negative and significant in the long run (i.e., years four and five). Thus, the fluctuations in profit growth identified in Panel A appear to come through the cost channel. Focusing of novel technologies seems to put a strain on profitability by increasing the COGS. Interestingly, strategic patents have a limited effect on a firm's costs due to their lack of intrinsic scientific value. Moreover, the gradual decrease in COGS growth over the following years can be attributed to increased monopolistic power of a patentee within a product market.

While Table 10 illustrates the positive effect of strategic patenting on focal firm performance, Table 11 demonstrates that same strategic patenting has a negative spillover effect on competitor performance. Overall, the analysis in Table 11 shows a significant but short-lived, two-year, negative effect of focal firm strategic patenting on the average growth rate of competitor profits. This appears to be followed by a long-term negative effect from technological patenting. A similar trend is observed for competitors' sales growth, providing support to the idea of market share capture by the patentee through strategic patent issuance.

Panel C of Table 11 examines the relationship between the type of innovative activity by a focal firm and their closest competitors' COGS. The effect is similar to the one observed for the patentee itself (Panel C, Table 10): an increase in the COGS following the issuance of technological patents, and a decline in the COGS following an issuance of strategic patents. Despite the same direction of the sign on the COGS growth for the focal firm (Panel C, Table 10) and competitors (Panel C, Table 11), the underlying mechanisms are different, especially for strategic patents. Technological patents, for example, provide positive knowledge spillovers through which the firm may access new technologies, thereby potentially increasing COGS growth. At the same time, however, strategic

patenting leads to a decline in COGS growth that appear to be a direct consequence of the decrease in sales growth as the result of the patentee pushing its competitors out of their product market.

Profit and output growth results are in line with the aggregate estimates of the contribution of innovation to firms' profit and output growth from Kogan et al. (2017) – 0.8 percent increase in firm growth and 0.1 percent in firm output (compare to 0.5 and 0.09 percent in this paper, respectively, for five year growths).

4.5 Effect of Strategic Patenting on Competitor Innovative Activity

In Section 4.1, I established that strategic patents are more likely to be continuation patents. In this section I focus on how strategic patenting by the firm affects its competitors' innovative search and activity. For this analysis I follow Manso et al. (2018) and utilize multiple measures of innovation for dependent variables. As in the previous analysis there variables are averaged over five post-filing years. The first measure is R&D expenditures divided by total assets and captures a competitor's innovative input. Second, the number of patent applications and grants are used to measure competitor output. Finally, prior competitor patenting by technological class is used as an indicator for the type of innovative search the firm is conducting (exploration versus exploitation). A firm patent is defined as explorative if at least 70 percent of its citations are not derived from the firm's existing patent stock within the last five years (Manso et al., 2018).[11] As in the previous analysis, all of the competitors' outcomes and controls are computed as equally weighted averages over all of the patentees' competitors within the same TNIC3 defined industry.

Results are presented in Table 12. One of the main goals of a strategic patent is to stifle further innovative activity in the field, and we indeed observe this effect. More specifically, we find a negative impact (3.11 percent decrease) of strategic patent issue on the number of competitor patents filed the following five years. At the same time, however, there is no significant effect on the average number of competitor patents grants. This can be possibly explained by: a) an absence of deterioration in the quality of competitor patents, or b) independence of the examination procedure of the competitor patents from focal firm patents. Though we observe a decrease in innovative output by competitors, there is a significant increase in competitor expenditures on R&D. Combined with the results on fewer competitor patent filings and patents becoming less

[11] The results are robust to using 80 or 90 percent cut-offs.

explorative, one can conclude that strategic patent issuance has made it harder for competitors to produce follow-on innovation.[12] As competing firms shift away from a product market, they are forced into other markets that do not clash with the patentee's strategic patent area of market dominance.

5 Heterogeneous Effects

5.1 The Role of Technological and Product Proximity Within Peer Groups

If the main goal of strategic patenting is to protect a firm's monopolistic position by preventing competitors from innovating and operating in the same area, then we would expect a differential response depending on how close the competitors are to the patentee in technological space exposure and their product market proximity. Following Bloom et al. (2013) and Jaffe (1986), I construct two measures of technological and product proximity. Technological proximity, TP_{ij}, between firms i and j is defined as:

$$TP_{ij} = \frac{(K_i K_j')}{(K_i K_i')^{1/2}(K_j K_j')^{1/2}} \tag{5}$$

where K_i is the vector of average shares over the last five years of a firm's i patents within each technological class. Similarly, following Equation (5), I calculate product proximity using the vector of average shares over the last five years of a firm's i sales within their four-digit SIC industry.

To test the impact of technological and product proximity on strategic patent issue, I allocate all patentee's competitors into two groups, *Low* and *High*, depending on whether the proximity score (technological or product) of the firm with this competitor is below or above the year's sample median. I then rerun the baseline estimation of Equations (2) and (4) on competitors' outcomes; these result are reported in Table 13, 14 and 15. Table 13 presents results for competitors' total factor productivity and R&D expenditures, Table 14 for competitors' performance growth[13], and

[12] Recent literature finds limited or no evidence that patent issue hinders follow-on innovation (e.g, Williams, 2013; Sampat and Williams, 2019; Galasso and Schankerman, 2015), despite the common concern among patent law practitioners. The strategic patent effect presented in this paper may be a first step in reconciling these two opposing views: that is, the described negative effect could only be an attribute of patents of specific type (i.e., strategic), and not of the patenting practice in general. But this discussion is outside the scope of the current study.

[13] For the sake of conciseness I present the results of the growth over the two years following the patent application filing, since this is the time period over which the original results in Table 11 were most pronounced; this is likely due to the timing of the patent application's publication, which happens 18 months after the filing, thus making the

Table 15 for the effect of competitors' innovative activity.

One can observe that the results of the effect of strategic patenting on competitors' productivity and performance are stronger within more technological and product-diverse industries (the coefficient estimate on $I(StrategicPatent_{ij})$ is negative and significant for the *Low*-group only on TFPR (Models (1) through (4) in Table 13) and two year profit and sales growth (Panels A and B in Table 14), while it is positive and significant for the effect on R&D expenditures (Models (5) through (8) in Table 13). One possible interpretation of this result is that strategic patenting prevents distant competitors – in terms of technological and product similarity within the product market – from extending their business operations into a patentee's specific technology and product space. This potentially limits competitors' options for growth out of their own product market.

As for the type of innovative search and the effect of strategic patent issue on innovative output, similar trends are present for product proximity; results are stronger for competitors that are more distant in product space (Panel B, Table 15). There is no heterogeneity in terms of the effect of technological proximity on the number of granted patents, nor on the number of explorative patents (negative and significant for both *Low* and *High* samples). However, technologically close firms suffer more in terms of a decline in the number of patents filed as well as a decline in the number of patents filed within the previously known technological classes. This result supports the main idea behind strategic patenting – preventing follow-on innovation within the same technological class of the patentee.

5.2 The Role of Patentee's Level of Technological Advancement

While the previous section examines the role of technological and product proximity, in this section I focus on an additional dimension of heterogeneity based on the level of technological advancement of the patentee. This helps answer the question: What types of firms tend to benefit the most from strategic patents? Following Aghion et al. (2005), I classify firms as either technological leaders or laggards. A firm is classified as a technological "leader" if its technological gap is lower than the median value in a focal year, signaling that the firm is closer to the technological frontier firm. If the gap is larger than a focal year's median value, then the firm is classified as a "laggard". The technological gap for each firm is calculated as:

pending patent's existence public knowledge.

$$Gap_i = (TFP_{F,t} - TFP_{i,t})/TFP_{F,t} \tag{6}$$

where F (for "frontier") is the firm with the highest total factor productivity within the industry defined by TNIC3 in year t.

Table 16 presents results from Equation (2) separately estimated for the subsamples of technological leaders and laggards for market concentration (Models (1) and (2)), number of competitors (Models (3) and (4)), and effect on competitors' total factor productivity (Models (5) and (6)) and R&D expenditures (Models (7) and (8)). The effect of strategic patenting on market concentration and number of firms within the same product market is statistically significant for laggard firms (Models (1) and (3)), but not leader firms (Models (2) and (4)). These striking results suggest that laggard firms benefit the most from defensive patents. This implies these firms may not otherwise be able to compete successfully in the race of novel innovative ideas with their product market competitors. As such, they appear to be resorting to strategic patenting to protect their market share.

Finally, there is no difference in the effect of strategic patenting by either leader or laggard firms on competitor total factor productivity. In both cases, there is a significant negative effect on competitor productivity following strategic patent grants. As for innovation inputs by competitors, there is a significant increase in R&D expenditures if the strategic patent is granted to a technological leader. Competitors experience hits to sales and productivity when competing with a market leader thereby forcing them to spend more on innovative activity in an attempt to regain their footing.

6 External Validity

This section is devoted to robustness checks to ensure the validity of the prior results. I will focus on two potential concerns related to the analysis: (1) the definition of competitor firms, and (2) the thresholds for classifying patents as either strategic or technological.

6.1 Alternative Definition of Competitor Firms

The main analysis of this paper uses the Text-based Industry Classification (TNIC3) introduced by Hoberg and Phillips (2010). A firm's closest competitor is defined based on the product similarity score using product descriptions available from SEC 10-K filings. The authors show that the TNIC3 classification system is superior to classification based on three-digit SIC codes. The concern is whether TNIC3 is a reasonable classification system to capture the areas of technological competition between firms. Thus, the first robustness check reconsiders the main results with alternative industry classifications. Similar to Ozoguz et al. (2018), by repeating the analyses in Table 8, 9 and 11 are replicated using three-digit SIC codes and randomly assigned industry classifications.

First, I present the results of the effect of strategic patent filing on market concentration using three-digit SIC codes. Models (1) to (3) of Table 17 shows that regardless of regression specification (fixed effects only, firm level controls, and peer level controls), the positive effect of strategic patenting on market concentration remains independent of the approach used in identifying competitors. Models (4) to (6) provide falsification tests. For each patentee, I identify "pseudo-competitors" by generating a random sample of firms from other industries and assign them as the focal firm's competitor (Ozoguz et al., 2018). As expected, there is no significant effect of having a strategic patent granted to the firm on the composition and concentration of such a pseudo-industry.

The same analysis is repeated in Table 18 and Table 19 and examines the effect of strategic patenting on competitor total factor productivity and performance. As with the market concentration findings, these results remain unaffected by the change in industry classification in terms of their significance and direction of the sign. Likewise, the falsification results show no significant effect of a firm's own patenting activity on randomly selected market participants.

6.2 Strategic vs. Technological Patents Definition Thresholds

Heretofore the paper relies on the definition of a strategic patent as one that falls into the top 50th percentile of economic value measured by Equation (1) and the bottom 50th percentile of scientific value estimated by forward citations. Table 20 presents the results of the baseline regression, Equation (2), for the effect of strategic patenting on market concentration using alternative cut-offs to classify patents as either strategic or technological. The models include the top and

bottom 40/30/20 and 10 percent (Model (1) to (4)) and the top 40 and bottom 60 percent (Model (5)), top 30 and bottom 70 percent (Model (6)), top 20 and bottom 80 percent (Model (7)), and top 10 and bottom 90 percent (Model (8)). There is a positive and significant effect of strategic patent grant on market concentration across the spectrum of cut-offs. The only exceptions is the most restrictive one (10 percent in Models (4) and (8)) where the share of strategic patents in the sample is extremely small – 3.74 and 2.70 percent, respectively.

7 Conclusion

In this paper, I introduce a new way of classifying patents as strategic (purely defensive) and technological (productive). I show that, consistent with previous research, strategic patents are more likely to fall into continuation and divisional categories, and are more likely patents generated within well-established and previously known technological areas to a firm. Using a new-market based measure of patent classification, I estimate the impact of firm-level strategic patenting on market concentration, focal firm and competitor productivity and performance, and competitor follow-on innovative activity. I find that, compared to novel technological patents, strategic patents lead to an increase in firm product market concentration. This result is further confirmed by a corresponding decrease in the number of competitors in the market following a strategic patent grant.

Next, I find that strategic patent grants lead to an increase in focal firm profit growth. There is a much lower, though still positive, impact on the revenue-based total factor productivity of the firm. I find evidence that strategic patents can have a harmful impact on a firm's closest competitors. There is a significant decrease in average sales and profit growth, as well as a decrease in competitor productivity, along with a drop in innovative activity. There also appears to be a shift in a competitor's innovative search strategy towards exploitation of their previously existing knowledge pool in response to focal firm patenting activity in new technological classes.

The results are conditional on the sample of active well-established public firms with at least ten years of performance data on Compustat. The inclusion of younger earlier stage public or private firms into the analysis might reduce the magnitude of the results of strategic patenting on firm's and its peers market concentration and performance as the benefit of issuing a strategic

patent for younger firms could be smaller and affect the competitive environment less due to yet less well-established firm's market share that a patent issued for strategic purposes could protect (especially if the firm is competing with other well established firms within the same technological area). Examining the effect of strategic patents on private small firms is outside the scope of this study.

These results support the main purpose of strategic patenting – to protect a firm's market and prevent competitor entry. This paper provides new evidence on the detrimental effect of a specific type of patent activity on innovation, and thus potentially on aggregate economic growth. The estimates presented in this paper suggest that patentees have a greater incentive to file such defensive patents relative to technological ones. This potentially compromises product market structure and leads to an increase in concentration at the expense of technological progress. The implications of these results are especially important and should considered during the patent examination process. The patent examination office should enforce stricter rules to allow only truly innovative patents to be granted, thus preventing firms from exploiting the patent system by undertaking aggressive campaigns of strategic patenting.

Finally, a limitation of this paper's analysis is that it is yet impossible to establish ex-ante the type of patent that a firm has filed for. Thus, this paper should be viewed as the first step towards identifying the impact of strategic patenting on the market and its participants.

References

Abrams, David S., Ufuk Akcigit, and Jillian Grennan, 2013, Patent Value and Citations: Creative Destruction or Strategic Disruption?, NBER Working Papers 19647, National Bureau of Economic Research, Inc.

Aghion, Philippe, Ufuk Akcigit, and Peter Howitt, 2014, What Do We Learn From Schumpeterian Growth Theory?, in *Handbook of Economic Growth*, volume 2 of *Handbook of Economic Growth*, chapter 0, 515–563 (Elsevier).

Aghion, Philippe, Nicholas Bloom, Richard Blundell, Rachel Griffith, and Peter Howitt, 2005, Competition and Innovation: an Inverted-U Relationship, *The Quarterly Journal of Economics* 120, 701–728.

Angrist, Joshua D., 1998, Estimating the Labor Market Impact of Voluntary Military Service Using Social Security Data on Military Applicants, *Econometrica* 66, 249–288.

Austin, David H., 1993, An Event-Study Approach to Measuring Innovative Output: The Case of Biotechnology, *The American Economic Review* 83, 253–258.

Austin, David H., 2000, Patents, Spillovers, and Competition in Biotechnology, Technical report.

Balasubramanian, Natarajan, and Jagadeesh Sivadasan, 2011, What Happens When Firms Patent? New Evidence from U.S. Economic Census Data, *The Review of Economics and Statistics* 93.

Balsmeier, Benjamin, Mohamad Assaf, Tyler Chesebro, Gabe Fierro, Kevin Johnson, Scott Johnson, Guan-Cheng Li, Sonja Lück, Doug O'Reagan, Bill Yeh, Guangzheng Zang, and Lee Fleming, 2018, Machine Learning and Natural Language Processing on the Patent Corpus: Data, Tools, and New Measures, *Journal of Economics & Management Strategy* 27, 535–553.

Balsmeier, Benjamin, Lee Fleming, and Gustavo Manso, 2017, Independent Boards and Innovation, *Journal of Financial Economics* 123, 536–557.

Balsmeier, Benjamin, Maria Kurakina, Joel Stiebale, and Lee Fleming, 2019, R&D Tax Credits, Innovation Search Stratetgy, and Unintended Outcomes, Working paper.

Blackwell, Matthew, Stefano Iacus, Gary King, and Giuseppe Porro, 2009, CEM: Coarsened Exact Matching in Stata, *Stata Journal* 9, 524–546.

Bloom, Nicholas, Mark Schankerman, and John Van Reenen, 2013, Identifying Technology Spillovers and Product Market Rivalry, *Econometrica* 81, 1347–1393.

Blundell, Richard, Rachel Griffith, and John van Reenen, 1999, Market Share, Market Value and Innovation in a Panel of British Manufacturing Firms, *Review of Economic Studies* 66, 529–554.

Brav, Alon, Wei Jiang, Song Ma, and Xuan Tian, 2016, How Does Hedge Fund Activism Reshape Corporate Innovation?, Working Paper 22273, National Bureau of Economic Research.

Card, David, and Daniel Sullivan, 1988, Measuring the Effect of Subsidized Training Programs on Movements in and out of Employment, *Econometrica* 56, 497–530.

Carley, Michael, Deepak Hegde, and Alan Marco, 2015, What is the Probability of Receiving a U.S. Patent?, *Yale Journal of Law and Technology* 17, article 5.

Cockburn, Iain, and Megan MacGarvie, 2011, Entry and Patenting in the Software Industry, *Management Science* 57, 915–933.

Cohen, Wesley M., 2010, Chapter 4 - Fifty Years of Empirical Studies of Innovative Activity and Performance, in *Handbook of The Economics of Innovation, Vol. 1*, volume 1 of *Handbook of the Economics of Innovation*, 129 – 213 (North-Holland).

Dobbie, Will, and Jae Song, 2015, Debt Relief and Debtor Outcomes: Measuring the Effects of Consumer Bankruptcy Protection, *American Economic Review* 105, 1272–1311.

Farre-Mensa, Joan, Deepak Hegde, and Alexander Ljungqvist, 2016, The Bright Side of Patents, Working Paper 21959, National Bureau of Economic Research.

Farrell, Joseph, and Carl Shapiro, 2008, How Strong Are Weak Patents?, *American Economic Review* 98, 1347–69.

Frakes, Michael D., and Melissa F. Wasserman, 2016, Procrastination in the Workplace: Evidence from the U.S. Patent Office, NBER Working Papers 22987, National Bureau of Economic Research, Inc.

Frakes, Michael D., and Melissa F. Wasserman, 2017, Is the Time Allocated to Review Patent Applications Inducing Examiners to Grant Invalid Patents? Evidence from Microlevel Application Data, *The Review of Economics and Statistics* 99, 550–563.

Galasso, Alberto, and Mark Schankerman, 2010, Patent Thickets, Courts, and the Market for Innovation, *The RAND Journal of Economics* 41, 472–503.

Galasso, Alberto, and Mark Schankerman, 2015, Patents and Cumulative Innovation: Causal Evidence from the Courts, *The Quarterly Journal of Economics* 130, 317–369.

Gallini, Nancy T., 1984, Deterrence by Market Sharing: A Strategic Incentive for Licensing, *The American Economic Review* 74, 931–941.

Hall, Bronwyn H., Adam B. Jaffe, and Manuel Trajtenberg, 2001, The NBER Patent Citation Data File: Lessons, Insights and Methodological Tools., NBER Working Papers 8498, National Bureau of Economic Research, Inc.

Hall, Bronwyn H., Adam B. Jaffe, and Manuel Trajtenberg, 2005, Market Value and Patent Citations, *RAND Journal of Economics* 36, 16–38.

Hall, Bronwyn H., and Rosemarie Ham Ziedonis, 2001, The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995, *The RAND Journal of Economics* 32, 101–128.

Harhoff, Dietmar, Francis Narin, F. M. Scherer, and Katrin Vopel, 1999, Citation Frequency And The Value Of Patented Inventions, *The Review of Economics and Statistics* 81, 511–515.

Hegde, Deepak, David C. Mowery, and Stuart Graham, 2009, Pioneering Inventors or Thicket Builders: Which U.S. Firms Use Continuations in Patenting?, *Management Science* 55, 1214–1226.

Henderson, Rebecca, and Iain Cockburn, 1994, Measuring Competence? Exploring Firm Effects in Pharmaceutical Research, *Strategic Management Journal* 15, 63–84.

Hoberg, Gerard, and Gordon Phillips, 2010, Product Market Synergies and Competition in Mergers and Acquisitions: A Text-Based Analysis, *Review of Financial Studies* 23, 3773–3811.

Hoberg, Gerard, and Gordon Phillips, 2016, Text-Based Network Industries and Endogenous Product Differentiation, *Journal of Political Economy* 124, 1423–1465.

Im, Hyun Joong, Young Joon Park, and Janghoon Shon, 2015, Product Market Competition and the Value of Innovation: Evidence from US Patent Data, *Economics Letters* 137, 78–82.

İmrohoroğlu, Ayşe and Tüzel, Şelale, 2014, Firm-Level Productivity, Risk, and Return, *Management Science* 60, 2073–2090.

Jaffe, Adam B., 1986, Technological Opportunity and Spillovers of R&D: Evidence from Firms' Patents, Profits, and Market Value, *American Economic Review* 76, 984–1001.

Jaffe, Adam B., and Josh Lerner, 2004, *Innovation and Its Discontents: How Our Broken Patent System is Endangering Innovation and Progress, and What to do About it* (Princeton University Press).

Jaffe, Adam B., Manuel Trajtenberg, and Rebecca Henderson, 1993, Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations, *The Quarterly Journal of Economics* 108, 577–598.

Kelly, Bryan, Dimitris Papanikolaou, Amit Seru, and Matt Taddy, 2018, Measuring Technological Innovation over the Long Run, NBER Working Papers 25266, National Bureau of Economic Research, Inc.

Kline, Patrick, Neviana Petkova, Heidi Williams, and Owen Zidar, 2019, Who Profits from Patents? Rent-Sharing at Innovative Firms, *The Quarterly Journal of Economics* 134, 1343–1404.

Kogan, Leonid, Dimitris Papanikolaou, Amit Seru, and Noah Stoffman, 2017, Technological Innovation, Resource Allocation, and Growth, *The Quarterly Journal of Economics* 132, 665–712.

Lerner, Josh, and Amit Seru, 2017, The Use and Misuse of Patent Data: Issues for Corporate Finance and Beyond, NBER Working Papers 24053, National Bureau of Economic Research, Inc.

Lerner, Josh, and Jean Tirole, 2002, Some Simple Economics of Open Source, *The Journal of Industrial Economics* 50, 197–234.

Lerner, Josh, and Jean Tirole, 2005, The Scope of Open Source Licensing, *Journal of Law, Economics, Organization* 21, 20–56.

Malmendier, Ulrike, Enrico Moretti, and Florian Peters, 2011, Winning by Losing: Evidence on Overbidding in Mergers, Tinbergen Institute Discussion Papers 11-101/2/DSF25, Tinbergen Institute.

Manso, Gustavo, Chen Lin, and Sibo Liu, 2018, Shareholder Litigation and Corporate Innovation, Available at: http://faculty.haas.berkeley.edu/manso/litigation.pdf.

Megna, Pamela, and Mark Klock, 1993, The Impact on Intangible Capital on Tobin's q in the Semiconductor Industry, *American Economic Review* 83, 265–69.

Miele, Anthony L., 2000, *Patent Strategy: The Manager's Guide to Profiting from Patent Portfolios* (John Wiley & Sons, Inc.).

Nicholas, Tom, 2008, Does Innovation Cause Stock Market Runups? Evidence from the Great Crash, *American Economic Review* 98, 1370–96.

Nicholas, Tom, 2014, Are Patents Creative or Destructive?, *Antitrust Law Journal* 79, 405–421.

Noel, Michael, and Mark Schankerman, 2013, Strategic Patenting and Software Innovation, *The Journal of Industrial Economics* 61, 481–520.

Ozoguz, Arzu, Michael J. Rebello, and Malcolm Wardlaw, 2018, Information, Competition, and Investment Sensitivity to Peer Stock Prices, *SMU Cox School of Business Research Paper* .

Pakes, Ariel, 1985, On Patents, R&D, and the Stock Market Rate of Return, *Journal of Political Economy* 93, 390–409.

Pakes, Ariel, 1986, Patents as Options: Some Estimates of the Value of Holding European Patent Stocks, *Econometrica* 54, 755–784.

Rockett, Katharine E., 1990, Choosing the Competition and Patent Licensing, *The RAND Journal of Economics* 21, 161–171.

Sampat, Bhaven, and Heidi Williams, 2019, How Do Patents Affect Follow-On Innovation? Evidence from the Human Genome, *American Economic Review* 109, 203–36.

Sarsons, Heather, 2017, Interpreting Signals in the Labor Market: Evidence from Medical Referrals [Job Market Paper], Working Paper.

Serrano, Carlos J., 2010, The Dynamics of the Transfer and Renewal of Patents, *The RAND Journal of Economics* 41, 686–708.

Shapiro, Carl, 2011, Competition and Innovation: Did Arrow Hit the Bull's Eye?, in *The Rate and Direction of Inventive Activity Revisited*, 361–404 (National Bureau of Economic Research, Inc).

Von Graevenitz, Georg, Stefan Wagner, and Dietmar Harhoff, 2011, How to Measure Patent Thickets–A Novel Approach, *Economics Letters* 111, 6–9.

Wasi, Nada, and Aaron Flaaen, 2015, Record Linkage using Stata: Preprocessing, Linking, and Reviewing Utilities, *Stata Journal* 15, 672–697.

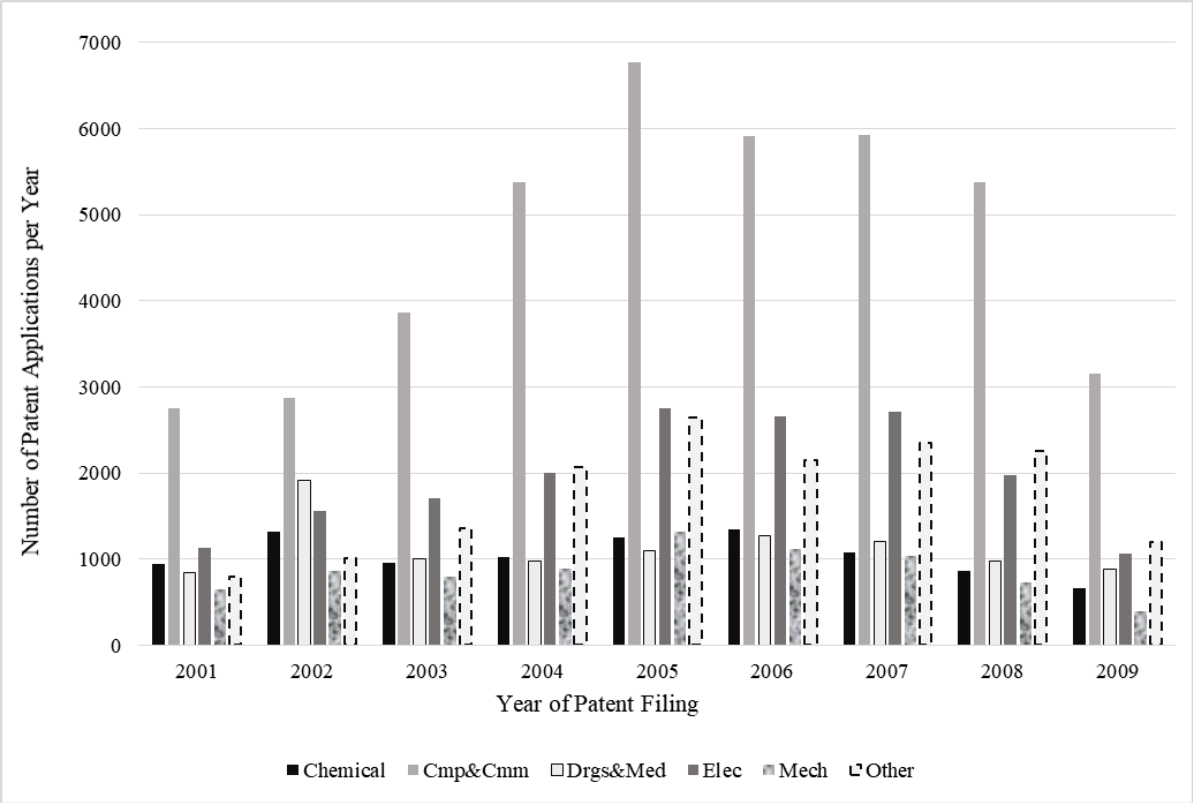
Williams, Heidi, 2013, Intellectual Property Rights and Innovation: Evidence from the Human Genome, *Journal of Political Economy* 121, 1–27.

Williams, Ryan, and Steven Chong Xiao, 2017, The Real Effect of Stock Prices on the Supply Chain, Available at SSRN: https://ssrn.com/abstract=2528021.

Ziedonis, Rosemarie Ham, 2004, Don't Fence Me In: Fragmented Markets for Technology and the Patent Acquisition Strategies of Firms, *Management Science* 50, 804–820.

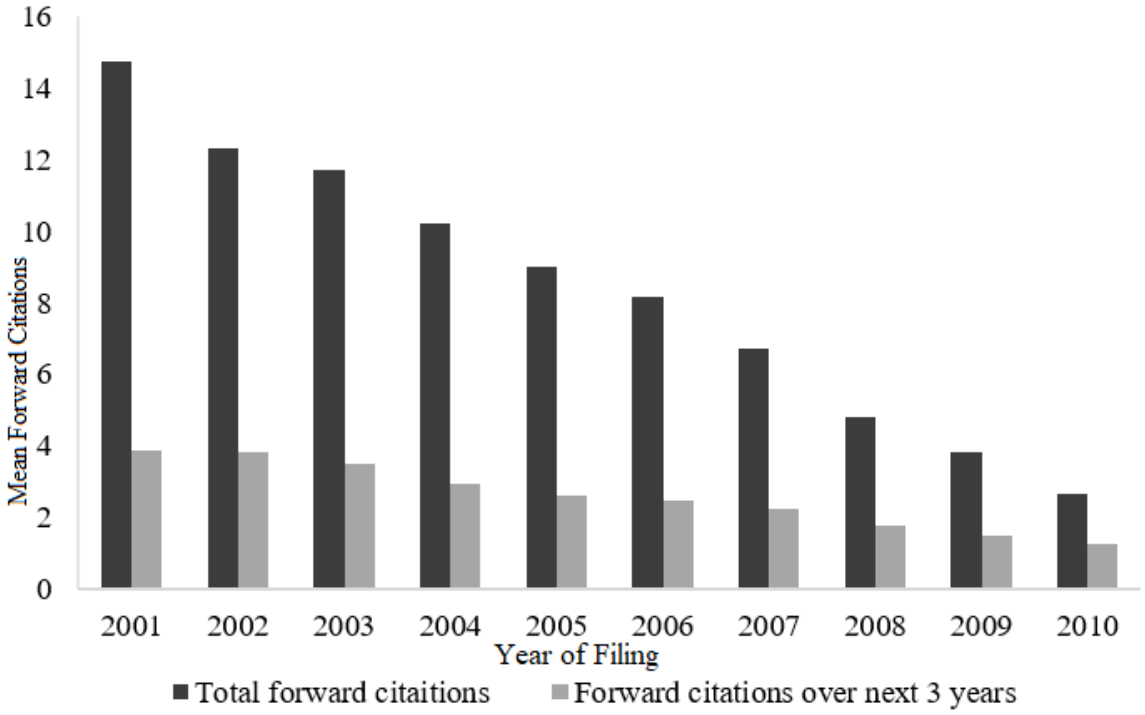
8 Figures and Tables

Figure 1. Distribution of Patent Applications by Technological Categories



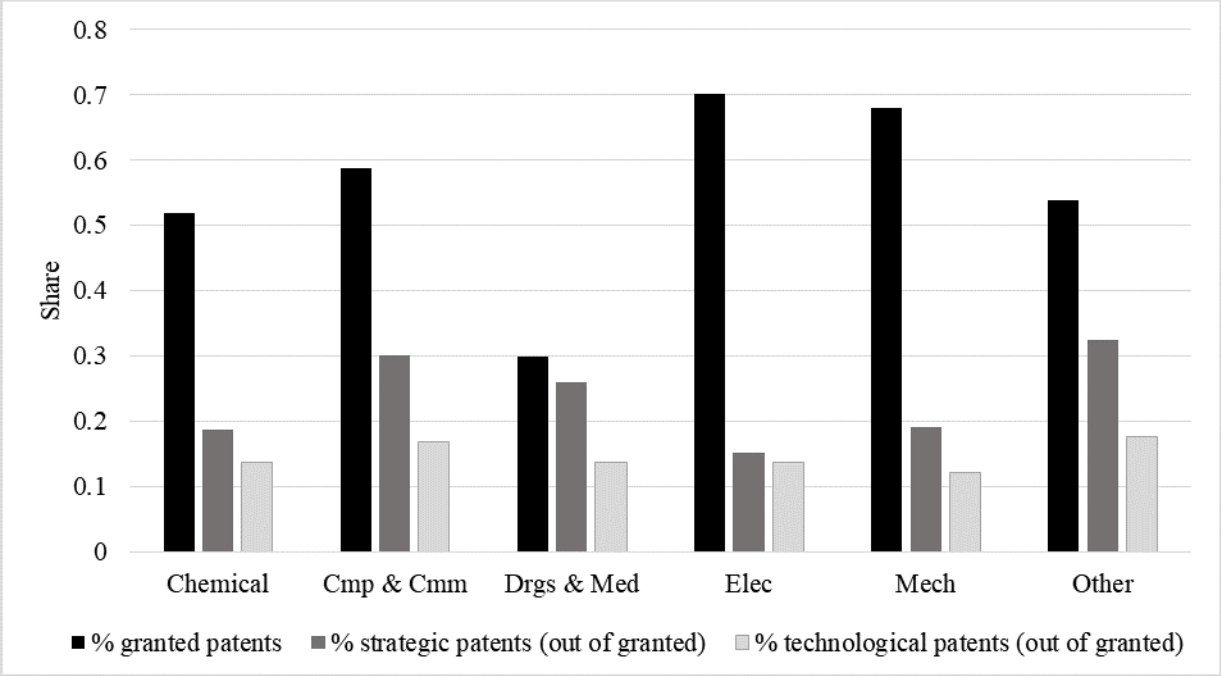
Notes: This graph plots the total number of patent applications by year of filing for each of the six technological categories as in Hall et al. (2001): Chemical, Computers & Communications, Drugs & Medical, Electrical & Electronic, Mechanical, and Others.

Figure 2. Average Forward Citations by Year of Filing



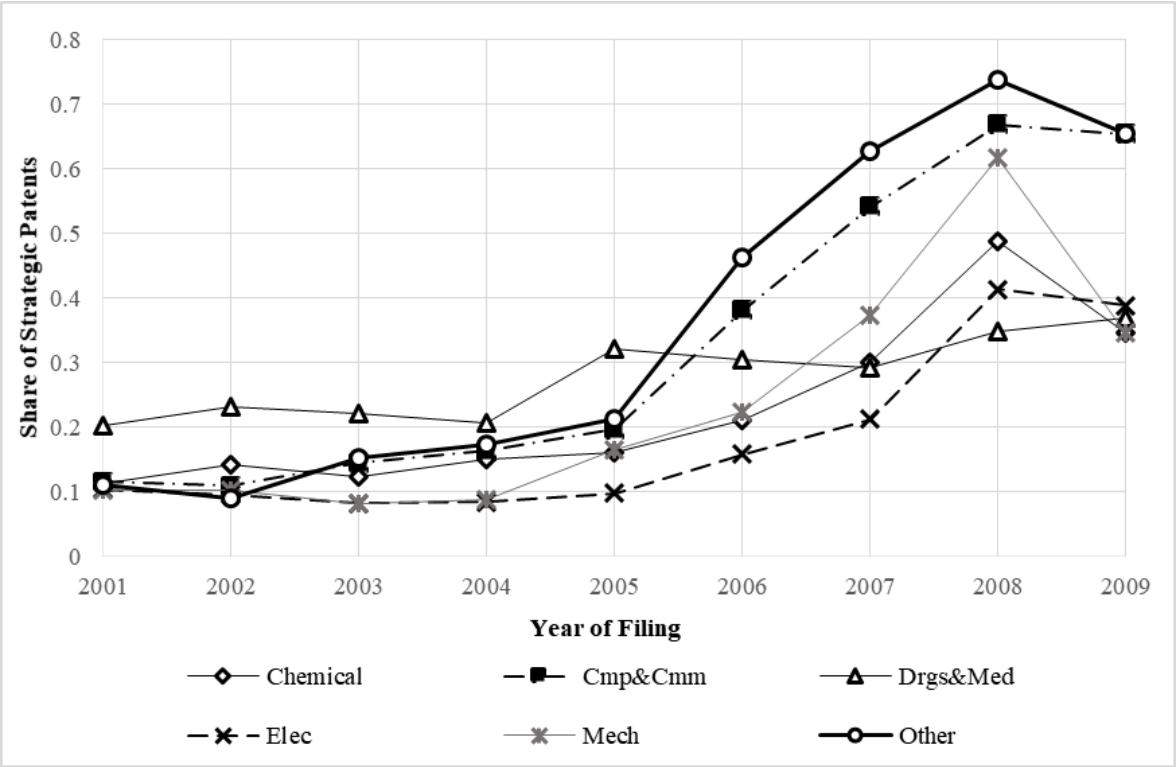
Notes: This graph plots the mean patent forward citations by year of patent application filing using the total number of forward citations received by the patent calculated as of December 2014 (total forward citations) versus the number of forward citations over the three years following the filing of the patent.

Figure 3. Share of Granted, Strategic and Technological Patents by Technological Categories



Notes: This graph plots the percentage of granted patents (out of the total number of applications filed across all sample years) vs. the shares of strategic vs. technological patents among the granted applications only for each of the six technological categories as in Hall et al. (2001). A patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), and bottom (top) 50th percentile of scientific value measured by forward citations.

Figure 4. Share of Strategic Patents Granted by Technological Categories



Notes: This graph plots the share of strategic patents (out of the total number of granted applications) by year of filing for each of the six technological categories as in Hall et al. (2001). A patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), and bottom (top) 50th percentile of scientific value measured by forward citations.

Table 1. Sample Construction

	Application-assignee pairs	Applications	Assignees
Panel A: USPTO Sample			
Full sample (applications filed, 1910-2014)	9,231,170		
Published between 2001 and 2013	3,622,547		
Utility application	3,618,310		
Non-missing assignee	2,020,837	1,938,922	287,632
Panel B: USPTO-Compustat merge			
Assignee is a public firm (matched to PERMNO)	651,112	478274	4530
Filled by single assignee	387,380	387,380	4432
Non-missing TNIC3 industry classification	210,004	210,004	2127
At least 5 years of pre- and post- filing outcomes	102,807	102,807	1423
Panel C: Final sample composition	Frequency	Percent	
% non-granted patents	44,120	42.90%	
% granted patents	58,717	57.10%	
% strategic patents	16,074	27.38%	
% nonstrategic patents	42,643	72.62%	

Notes: This table shows the construction of the final sample used in the analysis. I start with selecting the patent applications for which the publication date is available (applications filed after November, 29 2000 and published before December, 31 2013). Secondly, I limit the analysis to utility patents only. Each patent application is then matched to the respective public firm that owns the patent based on probabilistic record linkage (Wasi and Flaaen, 2015; Hall et al., 2001) using the name of the patent assignee and the name of the firm in CRSP/Compustat Merged database. I focus only on applications filed by a single assignee to avoid the possible complications related to the joint ownership of a patent. Finally, I only keep companies that have at least five years of pre- and post-filing outcomes to make sure there are enough observations covering the post-filing and post-granting period for the subsample of granted patents.

Table 2. Effect of Private Value of Innovation on Forward Citations

	Forward citations vs. Patent value					
	Level of patent value winsorization					
	1%		5%		10%	
	(1)	(2)	(3)	(4)	(5)	(6)
Patent value	0.125***	0.3026***	0.123***	0.3325***	0.126***	0.3700***
	(0.031)	(0.0991)	(0.028)	(0.1047)	(0.029)	(0.1099)
Patent value^2		-0.1839**		-0.2015**		-0.2250***
		(0.0798)		(0.0789)		(0.0815)
Observations	58402	58402	58402	58402	58402	58402
Adjusted R^2	0.356	0.356	0.356	0.356	0.356	0.356

Notes: This table shows regression results for the number of forward citations on the economic value of a patent and the value of the patent squared. The economic value of a patent is constructed using Equation (1). The number of forward citations are measured over the five year period after patent grant. The table uses the data on the full sample of granted patents, taking into account the sample restriction criteria described in Section 2.3. The economic value of a patent is normalized to unit standard deviation and winsorized at the top and bottom 1, 5 or 10% level for Models (1) and (2), Models (3) and (4), and Models (5) and (6) respectively. Patent value is scaled to unit standard deviation. All specifications control for filing year, examiner art unit, and firm fixed effect. Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 3. Granted versus Non-Granted and Strategic versus Technological Patents

Matched patent characteristics				
Panel A: Economic value of patent				
	Strategic patent	Technological patent	Diff	P-value
Mean	0.6246	0.6062	0.0184	0.0526
SD	(0.4396)	(0.4514)		
N	4,428	4,430		
	Granted	Not Granted	Diff	P-value
Mean	0.6113	0.6154	-0.0041	0.7282
SD	(0.4502)	(0.4456)		
N	8,858	8,858		
Panel B: Forward citations				
	Strategic patent	Technological patent	Diff	P-value
Mean	0.5392	7.5524	-7.0131	0.000
SD	(0.7646)	(7.2986)		
N	4,428	4,430		

Notes: This table shows summary statistics for the economic value of patents (Equation (1)) and their scientific value (forward citations) for the matched sample by application status (granted versus non-granted) and by patent type (strategic versus technological). The samples are matched on year of patent filing and patent category, and they are matched coarsely on the economic value of the patent and the firm's baseline sales (averaged over five pre-filing years). Patents are classified as either strategic and technological. Strategic patents are defined as those that fall in the top 50th percentile of economic and bottom 50th percentile of forward citation distribution, while technological patents are defined as those that fall in the top 50th percentile of both economic value and forward citations. The economic value of patents and their forward citations are normalized to unit standard deviation and winsorized at 5% using annual breakpoints.

Table 4. Summary Statistics: Matched Sample

	Full sample (matched)		Not granted		Granted		Strategic patent		Technological patent	
Baseline outcomes 5 years before filing	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Sales	5791.304	1240.726	5802.071	1244.701	5780.402	1236.668	5829.199	1153.648	5852.046	1148.209
COGS	3429.973	1053.839	3561.139	1047.446	3297.173	1043.671	3343.279	1012.953	3281.264	1013.571
Profit	3.1065	0.8794	2.9379	0.6741	3.2773	1.0190	3.2768	0.9548	3.4175	1.0707
CAPX	0.0384	0.0111	0.0387	0.0112	0.0381	0.0110	0.0375	0.0109	0.0390	0.0102
R&D	0.0215	0.0253	0.0210	0.0236	0.0221	0.0270	0.0211	0.0240	0.0215	0.0259
Total Assets	10317.130	2426.412	10377.410	2401.520	10256.100	2449.990	10384.340	2254.226	10377.730	2293.066
ROA	0.0986	0.0332	0.0971	0.0324	0.1002	0.0339	0.0983	0.0321	0.1004	0.0327
Tobin's Q	1032.730	1118.440	1028.601	1025.847	1036.915	1205.078	979.100	1162.159	1078.862	1179.356
Free cash flow	0.0877	0.0456	0.0859	0.0433	0.0896	0.0478	0.0866	0.0421	0.0900	0.0474
Leverage	0.1436	0.1183	0.1725	0.1108	0.1143	0.1184	0.1160	0.1139	0.0993	0.1135
HHI	0.2350	0.1943	0.3086	0.2187	0.1605	0.1287	0.1615	0.1285	0.1473	0.1217
N	16802		8453		8349		4165		3337	

Notes: This table reports summary statistics for the full matched sample and for strategic and technological subsamples. The sample is matched on the year of patent filing and patent category, and it is matched coarsely on the economic value of the patent and firm's baseline sales (averaged over five pre-filing years). A patent is classified as strategic (technological) if it falls in the top 50th percentile of the distribution of private economic value as measured by Equation (1), but bottom (top) 50th percentile of the distribution of scientific value (measured by forward citations). Profit is defined as sales minus COGS, divided by lagged total assets. R&D is the ratio of the firm's research and development expenditures to lagged total assets. Assets are the firm's total assets. ROA is the ratio of income before extraordinary items to total assets. Tobin's Q is the ratio of the sum of total assets and the difference between market and book value of total common equity, to total assets. Leverage is the sum of long-term debt and debt in current liabilities divided by total assets. HHI is the Herfindahl-Hirschman Index defined by the TNIC3 classification (Hoberg and Phillips, 2010). Sales, COGS, CAPX, and free cash flows are defined as ratios to the firm's total assets. Each baseline variable is measured as an average over five pre-filing years. All monetary values are expressed in real 2014 dollars. All variables are winsorized at 5% using annual breakpoints.

Table 5. Strategic Patent Characteristics – Breakthrough Innovation Follow-on

Dependent variable:	I(strategic patent$_t$)					
	Full sample			Matched sample		
	(1)	(2)	(3)	(4)	(5)	(6)
I(Breakthrough patent$_{t-1}$)	0.08449***	0.06355***	0.06442***	0.12719***	0.10930***	0.10638***
	(0.00629)	(0.00646)	(0.00652)	(0.01077)	(0.01095)	(0.01094)
Firm level controls	N	Y	Y	N	Y	Y
Peer firm averages controls	N	N	Y	N	N	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y
N.	51242	51242	51031	15215	15215	15160
Adjusted R^2	0.102	0.117	0.122	0.053	0.063	0.066

Notes: This table reports regression results for the probability of the patent being strategic on an indicator variable if the previously granted patent to the firm is a breakthrough innovation (technological patent). The results are estimated on the sample of top-performing patents using both full (non-matched) and matched samples. Patent applications are classified as top-performing if at the date of patent filing the economic value of the patent is higher than the year's median. The patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), but bottom (top) 50th percentile of scientific value (measured by forward citations). All specifications control for filing year, examiner art unit, and firm fixed effect. Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 6. Strategic Patent Characteristics – Continuation Patents

Dependent variable:	Continuation (CON)	Cont. in part (CIP)	Divisional (DIV)	CON+CIP+DIV
	(1)	(2)	(3)	(4)
Panel A: Full sample				
I(strategic patent)	0.0258***	0.0026	0.0194***	0.0425***
	(0.0041)	(0.0025)	(0.0032)	(0.0049)
N	51242	51242	51242	51242
Adjusted R^2	0.073	0.043	0.065	0.087
Panel B: Matched sample				
I(strategic patent)	0.0204***	-0.0045	0.0142**	0.0294***
	(0.0071)	(0.0046)	(0.0059)	(0.0087)
N	14283	14283	14283	14283
Adjusted R^2	0.076	0.047	0.057	0.074

Notes: This table reports regression results for the probability of the patent being a continuation (USPTO PAIR: CON – continuation, CIP – continuation in part) or divisional patent (USPTO PAIR: DIV) on an indicator variable of patent strategic status. The results are estimated on the sample of top-performing patents using both full (non-matched) and matched samples. Patent applications are classified as top-performing if at the date of patent filing the economic value of the patent is higher than the year's median. The patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), but bottom (top) 50th percentile of scientific value (measured by forward citations). All specifications control for filing year, examiner art unit, and firm fixed effect. Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 7. Strategic Patent Characteristics – Self- and Backward Citations

Dependent variable:	Backward citations	Self-citation	Known class patent
	(1)	(2)	(3)
Panel A: Full sample			
I(strategic patent)	4.7751***	1.3794***	0.6812***
	(0.2713)	(0.0626)	(0.0057)
N	51242	51242	51242
Adjusted R^2	0.058	0.051	0.529
Panel B: Matched sample			
I(strategic patent)	3.4105***	1.0603***	0.5948***
	(0.4776)	(0.1087)	(0.0085)
N	14283	14283	14283
Adjusted R^2	0.032	0.056	0.381

Notes: This table reports results for measures of innovation search strategies on an indicator of patent strategic status. The results are estimated on the sample of top-performing patents in the full (non-matched sample) and matched sample. Patent applications are classified as top-performing if at the date of patent filing the economic value of the patent is higher than the year's median. A patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), but bottom (top) 50th percentile of the distribution of scientific value (measured by forward citations). Model (1) dependent variable is the total number of backward citations. Model (2) regresses the total number of self-citations. In Model (3) the dependent variable is an indicator if the firm already has a patent granted within the same technology class (back to 1976). All specifications control for filing year, examiner art unit, and firm fixed effect. Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 8. Strategic Patent Effect on Market Concentration

Dependent variable:	HHI (TNIC3)			Number of competitors		
	(1)	(2)	(3)	(4)	(5)	(6)
I(granted patent)	-0.0020**	-0.0018*	0.0004	-0.0864	-0.0040	-0.0017
	(0.0009)	(0.0009)	(0.0008)	(0.1579)	(0.1399)	(0.1343)
I(strategic patent)	0.0026***	0.0026***	0.0021***	-0.2989**	-0.2734**	-0.2721**
	(0.0008)	(0.0007)	(0.0007)	(0.1471)	(0.1360)	(0.1325)
Firm level controls	N	Y	Y	N	Y	Y
Peer firm averages controls	N	N	Y	N	N	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y
Mean of outcome variable	0.19	0.19	0.19	40.48	40.48	40.48
N.	15166	15166	15111	15049	15049	14994
Adjusted R^2	0.931	0.934	0.943	0.972	0.976	0.977

Notes: This table shows the results from Equation (2) of the impact of the strategic patent issue on the patentee using the matched sample. The sample is matched on the year of patent filing and patent category, and it is matched coarsely on the economic value of the patent and the firm's baseline sales (averaged over five pre-filing years). A patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), but bottom (top) 50th percentile of the distribution of scientific value (measured by forward citations). Models (1), (2) and (3) report the effect of technological and strategic patent grant on post-filing HHI based on TNIC3 industry classification and measured in Equation (3). Compared to Model (1), Model (2) adds firm level controls from Table 4. Model (3) adds the respective competitor firms controls to the regression. Competitor firms are defined as the top 50th percentile of closest peers using the TNIC3 industry classification. The controls for competitors are calculated as equal-weighted averages. Models (4), (5) and (6) repeat the analysis using the number of competitors within the firm's product market as a dependent variable. All specifications control for filing year, examiner art unit, and firm fixed effect, as well as the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 9. Strategic Patent Effect on Firm's and Competitors' Productivity

Dependent variable:	Total factor productivity (TFPR)			
	Patenting firm		Competitors	
	(1)	(2)	(3)	(4)
I(granted patent)	0.0044**	0.0047***	0.0046*	0.0058**
	(0.0017)	(0.0017)	(0.0027)	(0.0025)
I(strategic patent)	-0.0035**	-0.0035**	-0.0098***	-0.0104***
	(0.0016)	(0.0016)	(0.0024)	(0.0022)
Firm level controls	N	Y	N	N
Competitor controls	N	N	N	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y
Mean of outcome variable	0.40	0.40	-0.20	-0.20
N.	14491	14423	14383	14333
Adjusted R^2	0.820	0.989	0.548	0.594

Notes: This table shows the results from Equation (2) of the impact of the strategic patent issue on both patentee's and competitors' total factor productivity using the matched sample. The sample is matched on the year of patent filing and patent category, and it is matched coarsely on the economic value of the patent and the firm's baseline sales (averaged over five pre-filing years). A patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), but bottom (top) 50th percentile of the distribution of scientific value (measured by forward citations). This table reports the effect of technological and strategic patent grants on post-filing revenue-based total factor productivity (TFPR) as in İmrohoroğlu, Ayşe and Tüzel, Şelale (2014). Models (1) and (2) show the effect on patenting firm TFPR. Compared to Model (1), Model (2) adds firm level controls from Table 4. Models (3) and (4) repeat the analysis for the firm's competitors. Competitors are defined as the top 50th percentile of closest peers using the TNIC3 industry classification. Both the dependent variable and controls for competitors are calculated as equal-weighted averages. All specifications control for filing year, examiner art unit, and firm fixed effect, as well as the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 10. Effect of Strategic Patenting on Patenting Firm Performance

	Patenting Firm Horizon				
Growth over *t* years	1y	2y	3y	4y	5y
Panel A: Profit growth					
I(granted patent)	-0.0061***	-0.0044**	-0.0041**	-0.0044*	0.0001
	(0.0017)	(0.0021)	(0.0020)	(0.0025)	(0.0019)
I(strategic patent)	0.0039**	-0.0004	0.0025	0.0065***	0.0052***
	(0.0018)	(0.0021)	(0.0019)	(0.0023)	(0.0019)
Panel B: Sales growth					
I(granted patent)	-0.0003	0.0005	-0.0004	-0.0017	-0.00005
	(0.0015)	(0.0017)	(0.0016)	(0.0017)	(0.0014)
I(strategic patent)	0.0011	-0.0021	-0.0005	0.0006	0.0009
	(0.0014)	(0.0014)	(0.0013)	(0.0015)	(0.0012)
Panel C: COGS growth					
I(granted patent)	0.0069***	0.0110***	0.0071***	0.0044*	0.0071***
	(0.0025)	(0.0025)	(0.0022)	(0.0025)	(0.0023)
I(strategic patent)	-0.0029	-0.0082***	-0.0070***	-0.0059**	-0.0073***
	(0.0026)	(0.0026)	(0.0024)	(0.0026)	(0.0025)
Mean of variables					
Profit growth	-0.0116	-0.0187	-0.0184	-0.0227	-0.0323
COGS growth	0.0101	0.0137	0.0243	0.0304	0.0344
Sales growth	-0.0020	-0.0019	0.0021	0.0056	0.0013
Firm level controls	Y	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y
N.	14482	14433	14289	14069	13909

Notes: This table reports the estimates of Equation (4) for firm profit, sales, and COGS growth over the horizon of one to five years (all variables are scaled by firm's total assets). Profit is measured as sales minus COGS. All specifications control for filing year, examiner art unit, and firm fixed effect, as well as firm controls as in Table 4 and the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 11. Effect of Strategic Patenting on Competitor Performance

	Competitors' Horizon				
Growth over *t* years	1y	2y	3y	4y	5y
Panel A: Profit growth					
I(granted patent)	0.0007	0.0012	-0.0068*	-0.0080**	-0.0071**
	(0.0025)	(0.0030)	(0.0035)	(0.0033)	(0.0032)
I(strategic patent)	-0.0029	-0.0079***	-0.0037	0.0013	-0.0004
	(0.0024)	(0.0027)	(0.0033)	(0.0028)	(0.0029)
Panel B: Sales growth					
I(granted patent)	0.0019	0.0027	-0.0011	-0.0046*	-0.0043*
	(0.0018)	(0.0022)	(0.0028)	(0.0027)	(0.0026)
I(strategic patent)	-0.0035**	-0.0071***	-0.0059**	-0.0029	-0.0016
	(0.0017)	(0.0021)	(0.0027)	(0.0025)	(0.0024)
Panel C: COGS growth					
I(granted patent)	0.0024	0.0050**	0.0051*	-0.0005	-0.0013
	(0.0018)	(0.0022)	(0.0027)	(0.0026)	(0.0029)
I(strategic patent)	-0.0031*	-0.0061***	-0.0042*	0.0005	-0.0002
	(0.0016)	(0.0019)	(0.0024)	(0.0022)	(0.0026)
Mean of variables					
Profit growth	-0.0129	-0.0176	-0.0134	-0.0229	-0.0174
COGS growth	-0.0073	-0.0049	-0.0044	-0.0141	-0.0131
Sales growth	-0.0086	-0.0063	-0.0119	-0.0186	-0.0135
Competitor controls	Y	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y
N.	14414	14414	14405	14395	14395

Notes: This table reports the estimates of Equation (4) for firm profit (sales minus COGS), sales, and COGS growth over the horizon of one to five years for competitors (all variables are scaled by firm's total assets). Competing firms are defined as the top 50th percentile of closest peers using TNIC3 industry classification from Hoberg and Phillips (2010). The dependent variables and controls are calculated as equal-weighted averages for specified competing firms. All specifications control for filing year, examiner art unit, and firm fixed effect, as well as competitors' portfolio controls as in Table 4 and baseline level measures of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 12. Strategic Patent Effect on Innovation by Competitors

Dependent variable:	*R&D/Assets*	Explorative Patent, 70%	Explorative Patent, 80%	Explorative Patent, 90%	Filed patents	Granted patents	Known class patents
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
I(strategic patent)	0.0018***	-0.1367**	-0.1149**	-0.1002**	-1.3585*	-0.5296	-3.3411***
	(0.0004)	(0.0643)	(0.0538)	(0.0485)	(0.7399)	(0.4374)	(1.0181)
Competitor controls	Y	Y	Y	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y	Y
Mean of variables	0.09	3.56	2.96	2.67	43.71	24.44	42.61
N.	14450	14234	14234	14234	14234	14234	14234
Adjusted R^2	0.941	0.521	0.512	0.525	0.660	0.596	0.660

Notes: The table reports the results of Equation (2) of an indicator of strategic patent status on a competitors' innovative activity and search following Manso et al. (2018). Competing firms are defined as the top 50th percentile of closest peers using TNIC3 industry classification from Hoberg and Phillips (2010). Model (1) shows the effect of strategic patenting by the focal firm on competitors' R&D expenditures scaled by total assets. Models (2) through (4) shows the effect on the number of explorative patents issued by competitors. A patent is defined as explorative if at least 70 (80/90) percent of its citations are not derived from a firm's existing knowledge pool, which is comprised of previous patents, or patents cited before by the firm's earlier patents filed within last five years. Model (5) shows the impact on the total number of patents filed by competitors, while Model (6) – number of patents granted. Results from Model (7) examine the effect of strategic patent issue on the number of patents filed by competitors within the previously known to them technological classes (firm has at least one patent granted in this technological class since 1976). The dependent variables and controls are calculated as equal-weighted averages for specified competing firms. All specifications control for filing year, examiner art unit, and firm fixed effect as well as competitors' portfolio controls. Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 13. Effect of Strategic Patenting on Competitors: Role of Technological and Product Proximity Within Competitor Groups

Dependent variable:	Competitors' total factor productivity (TFPR)				Competitors' R&D/Assets			
	Technological proximity		Product proximity		Technological proximity		Product proximity	
	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I(strategic patent)	-0.0108***	-0.0051	-0.0124***	0.0006	0.0031***	-0.00004	0.0013**	-0.0008*
	(0.0037)	(0.0035)	(0.0037)	(0.0027)	(0.0008)	(0.0005)	(0.0006)	(0.0005)
Competitor controls	Y	Y	Y	Y	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean of variables	-0.18	-0.11	-0.12	-0.17	0.10	0.08	0.09	0.08
N.	13763	13393	13885	13107	14287	13556	14287	13163
Adjusted R^2	0.610	0.603	0.567	0.571	0.820	0.862	0.845	0.889

Notes: This table shows the results from Equation (2) of the impact of strategic patent issue on competitor productivity and R&D expenditures (scaled by total assets) by technological and product proximity. The sample is matched on the year of patent filing and patent category, and it is matched coarsely on the economic value of the patent and the firm's baseline sales (averaged over five pre-filing years). A patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), but bottom (top) 50th percentile of distribution of scientific value (measured by forward citations). Competing firms are defined as the top 50th percentile of closest peers using TNIC3 industry classification from Hoberg and Phillips (2010). Following Bloom et al. (2013) and Jaffe (1986) technological and product proximity are defined using Equation (5). All patentee's competitors are allocated into two group, *Low* and *High*, depending on whether the proximity score (technological or product) of the firm with this competitor is below or above the year's sample median. Models (1) through (4) report the effect of technological and strategic patent grant on post-filing competitor TFPR (İmrohoroğlu, Ayşe and Tüzel, Şelale, 2014). Models (5) through (6) show the effect on competitors' R&D/Assets. All specifications control for filing year, examiner art unit, and firm fixed effect, as well as competitors' portfolio controls and the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 14. Effect of Strategic Patenting on Future Profitability of Competitors: Role of Technological and Product Proximity Within Competitor Groups

Dependent variable:	Competitors' Horizon (2y)			
	Technological proximity		Product proximity	
	Low	High	Low	High
	(1)	(2)	(3)	(4)
Panel A: Profit growth				
I(strategic patent)	-0.0117***	-0.0023	-0.0065**	-0.0003
	(0.0043)	(0.0023)	(0.0033)	(0.0029)
Panel B: Sales growth				
I(strategic patent)	-0.0124***	-0.0023	-0.0068***	-0.0028
	(0.0035)	(0.0028)	(0.0026)	(0.0023)
Panel C: COGS growth				
I(strategic patent)	-0.0048	-0.0001	-0.0025	0.0016
	(0.0038)	(0.0033)	(0.0033)	(0.0032)
Mean of variables				
Profit growth	0.0309	0.0089	0.0257	0.0142
COGS growth	0.0323	0.0158	0.0241	0.0234
Sales growth	0.0271	0.0041	0.0114	0.0184
Competitor controls	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y
N.	14204	13528	14194	13135

Notes: This table reports the estimates of Equation (4) for firm profit (sales minus COGS), sales, and COGS growth over the horizon of two years for competitors (all variables are scaled by firm's total assets) by technological and product proximity. The sample is matched on the year of patent filing and patent category, and it is matched coarsely on the economic value of the patent and the firm's baseline sales (averaged over five pre-filing years). A patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), but bottom (top) 50th percentile of the distribution of scientific value (measured by forward citations). Competing firms are defined as the top 50th percentile of closest peers using TNIC3 industry classification from Hoberg and Phillips (2010). Following Bloom et al. (2013) and Jaffe (1986) technological and product proximity are defined using Equation (5). All patentee's competitors are allocated into two group, *Low* and *High*, depending on whether the proximity score (technological or product) of the firm with this competitor is below or above the year's sample median. Models (1) and (2) report the effect of technological and strategic patent grant on competitors performance by technological proximity. Models (3) and (4) repeat the analysis by product proximity. All specifications control for filing year, examiner art unit, and firm fixed effect, as well as competitors' portfolio controls and the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 15. Strategic Patent Effect on Innovation by Competitors: Role of Technological and Product Proximity Within Competitor Groups

Dependent variable:	Explorative Patent, 90%		Filed patents		Granted patents		Known class patents	
	Panel A: Technological proximity							
	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I(strategic patent)	-0.3808***	-0.4903***	-1.7894	-10.6612***	-1.6058**	-4.7281***	-1.8141	-10.5561***
	(0.1069)	(0.1807)	(1.7102)	(2.6802)	(0.6292)	(1.5571)	(1.6878)	(2.6612)
Competitor controls	Y	Y	Y	Y	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean of variables	4.96	10.02	57.34	188.04	35.39	99.04	54.75	185.471
N.	13349	13493	13349	13493	13349	13493	13349	13493
Adjusted R^2	0.740	0.721	0.617	0.810	0.732	0.773	0.622	0.811
	Panel B: Product proximity							
	Low	High	Low	High	Low	High	Low	High
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
I(strategic patent)	-0.6926***	0.0391	-9.7530***	1.3053	-5.4348***	0.4647	-9.7553***	1.3046
	(0.1598)	(0.1053)	(2.7809)	(1.8538)	(1.5919)	(0.9863)	(2.7723)	(1.8488)
Competitor controls	Y	Y	Y	Y	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean of variables	9.90	6.07	193.39	55.907	105.70	34.81	190.63	53.684
N.	13891	12961	13891	12961	13891	12961	13891	12961
Adjusted R^2	0.755	0.560	0.837	0.505	0.804	0.461	0.838	0.500

Notes: The table reports the results of Equation (2) of an indicator of strategic patent status on competitors' innovative activity and search following Manso et al. (2018) by technological and product proximity. Competing firms are defined as the top 50th percentile of closest peers using TNIC3 industry classification from Hoberg and Phillips (2010). Following Bloom et al. (2013) and Jaffe (1986) technological and product proximity are defined using Equation (5). All patentee's competitors are allocated into two group, *Low* and *High*, depending on whether the proximity score (technological or product) of the firm with this competitor is below or above the year's sample median. A patent is defined as explorative if at least 70 (80/90) percent of its citations are not derived from firm's previously existing knowledge pool, which is comprised of previous patents, or patents cited before by the firm's earlier patents filed within last five years. A patent is a "known class patents" if a firm has at least one patent granted in this technological class since 1976. All specifications control for filing year, examiner art unit, and firm fixed effect, as well as peer level controls as in Table 4 and the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 16. Strategic Patent Effect on Market Concentration and Competitors by Patenting Firm's Proximity to Technological Frontier

Dependent variable:	HHI		Number of Firms		Competitors' TFPR		Competitors' R&D/Assets	
	Laggard	Leader	Laggard	Leader	Laggard	Leader	Laggard	Leader
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I(strategic patent)	0.0033***	0.0003	-0.6299***	0.0781	-0.0089**	-0.0070***	0.0004	0.0014***
	(0.0012)	(0.0005)	(0.1734)	(0.1111)	(0.0042)	(0.0023)	(0.0007)	(0.0005)
Firm level controls	Y	Y	Y	Y	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean of variables	0.23	0.17	29.49	42.56	-0.19	-0.20	0.07	0.11
N.	5404	8912	5394	8850	5321	8920	5434	8921
Adjusted R^2	0.969	0.985	0.987	0.979	0.598	0.692	0.955	0.937

Notes: This table shows the results from Equation (2) of the impact of strategic patent issue on the patentee using the matched sample separately by group using the proximity of the patentee to the technological frontier firm. The firm is defined as a leader if its technological gap measured, as in Equation (6), is lower than the year's median value, signaling that the firm is closer to the frontier firm. If the gap is larger than the year's median value, then the firm is classified as a laggard. Models (1) and (2) report the effect of technological and strategic patent grants on post-filing HHI based on TNIC3 industry classification and measured in Equation (3). Models (3) and (4) repeat the analysis using the number of competitors within the firm's product market as a dependent variable. Models (5) and (6) examine the effect on the competitors' TFPR defined (İmrohoroğlu, Ayşe and Tüzel, Şelale, 2014), and Models (7) and (8) – on competitor R&D expenditures. Competing firms are defined as the top 50th percentile of closest peers using TNIC3 industry classification from Hoberg and Phillips (2010). All specifications control for filing year, examiner art unit, and firm fixed effect, as well as firm (or peers) controls as in Table 4 and the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 17. Strategic Patent Effect on Market Concentration: Robustness

	SIC3			Random		
Dependent variable:	Herfindahl-Hirschman Index (HHI)					
	(1)	(2)	(3)	(4)	(5)	(6)
I(strategic patent)	0.0004**	0.0004**	0.0003*	0.0015	0.0015	0.0019
	(0.0002)	(0.0002)	(0.0002)	(0.0018)	(0.0018)	(0.0015)
Firm level controls	N	Y	Y	N	Y	Y
Competitor controls	N	N	Y	N	N	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y
Mean of outcome variable	0.06	0.06	0.06	0.24	0.24	0.24
N.	15171	15171	15171	14987	14987	14790
Adjusted R^2	0.993	0.993	0.993	0.920	0.921	0.943

Notes: This table shows the results from Equation (2) of the impact of the strategic patent issue on market concentration using the matched sample. The sample is matched on the year of patent filing and patent category, and it is matched coarsely on the economic value of the patent and the firm's baseline sales (averaged over five pre-filing years). A patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value of the patent as measured by Equation (1), but bottom (top) 50th percentile of the distribution of scientific value (measured by forward citations). Models (1), (2) and (3) report the effect of technological and strategic patent grant on post-filing HHI measured in Equation (3) based on industry classification using three-digit SIC codes. Model (2) adds firm level controls from Table 4, while Model (3) adds the respective competitor controls to the regression. The controls for competitors are calculated as equal-weighted averages. Models (4), (5) and (6) repeat the analysis using the set of "pseudo-competitors", created by generating a random sample of firms from other industries and assign them as the focal firm's competitors (Ozoguz et al., 2018). All specifications control for filing year, examiner art unit, and firm fixed effect, as well as the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 18. Strategic Patent Effect on Competitors' Productivity: Robustness

	SIC3		Random	
Dependent variable:	Total factor productivity (TFPR)			
	(1)	(2)	(3)	(4)
I(strategic patent)	-0.0036***	-0.0024**	-0.0004	0.0006
	(0.0009)	(0.0009)	(0.0039)	(0.0038)
Competitor controls	N	Y	N	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y
Mean of outcome variable	-0.3329	-0.3329	-0.3268	-0.3268
N.	15086	15086	14256	14193
Adjusted R^2	0.407	0.485	0.382	0.404

Notes: This table shows the results from Equation (2) of the impact of strategic patent issue on the competitor productivity using the matched sample. The sample is matched on the year of patent filing and patent category, and it is matched coarsely on the economic value of the patent and the firm's baseline sales (averaged over five pre-filing years). A patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), but bottom (top) 50th percentile of the distribution of scientific value (measured by forward citations). Models (1) and (2) report the effect of technological and strategic patent grant on post-filing competitor TFPR (İmrohoroğlu, Ayşe and Tüzel, Şelale, 2014) based on industry classification using three-digit SIC codes. Model (2) adds competitor level controls from Table 4. The controls for competitors are calculated as equal-weighted averages. Models (3) and (4) repeat the analysis using the set of "pseudo-competitors", created by generating a random sample of firms from other industries and assign them as the focal firm's peers (Ozoguz et al., 2018). All specifications control for filing year, examiner art unit, and firm fixed effect, as well as the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 19. Effect of Strategic Patenting on Competitors Performance: Robustness

	Competitors' Horizon									
	SIC3					Random				
Growth over *t* years	1y	2y	3y	4y	5y	1y	2y	3y	4y	5y
Panel A: Profit growth										
I(strategic patent)	-0.0015	-0.0066***	-0.0019	0.0008	0.0001	-0.0004	0.0026	0.0017	0.0029	-0.0006
	(0.0016)	(0.0025)	(0.0025)	(0.0024)	(0.0026)	(0.0020)	(0.0025)	(0.0028)	(0.0032)	(0.0039)
Panel B: Sales growth										
I(strategic patent)	-0.0027*	-0.0062***	-0.0029	0.0004	0.0007	-0.0003	0.0028	0.0034	0.0028	0.0015
	(0.0014)	(0.0019)	(0.0021)	(0.0022)	(0.0022)	(0.0019)	(0.0023)	(0.0025)	(0.0027)	(0.0026)
Panel C: COGS growth										
I(strategic patent)	-0.0024**	-0.0045***	-0.0021	0.0009	0.00234	-0.0011	0.0004	0.0035	0.0034	0.0019
	(0.0012)	(0.0017)	(0.0019)	(0.0019)	(0.0019)	(0.0019)	(0.0027)	(0.0030)	(0.0033)	(0.0034)
Mean of variables										
Profit growth	-0.0041	-0.0045	0.0023	0.0007	0.0011	-0.0252	-0.0525	-0.0956	-0.1109	-0.0809
COGS growth	-0.0068	-0.0127	-0.0098	-0.0159	-0.0263	-0.0045	-0.0016	-0.0204	-0.0215	-0.0659
Sales growth	-0.0037	-0.0062	0.0016	0.0025	-0.0023	-0.0269	-0.0229	-0.0548	-0.0728	-0.0458
Competitor controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N.	15116	15116	15116	15116	15116	14486	14429	14429	14415	14396

Notes: This table reports the estimates of Equation (4) for firm profit (sales minus COGS), sales, and COGS growth over the horizon of one to five years for competitors (all variables are scaled by firm's total assets). The dependent variables and controls are calculated as equal-weighted averages for specified competing firms. Models (1) through (5) report the effect of technological and strategic patent grant on post-filing competitor profit, sales and COGS growth, where competitors are defined based on industry classification using three-digit SIC codes. Models (6) through (10) repeat the analysis using the set of "pseudo-competitors", created by generating a random sample of firms from other industries and assign them as the focal firm's peers (Ozoguz et al., 2018). All specifications control for filing year, examiner art unit, and firm fixed effect, as well as competitors' portfolio controls as in Table 4 and baseline level measures of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 20. Robustness Check: Alternative Definitions of Strategic and Technological Patents

Dependent variable:	Herfindahl-Hirschman Index (TNIC3)							
Definition of strategic patent: top % economics value, bottom % scientific value	top 40%, bottom 40%	top 30%, bottom 30%	top 20%, bottom 20%	top 10%, bottom 10%	top 40%, bottom 60%	top 30%, bottom 70%	top 20%, bottom 80%	top 10%, bottom 90%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I(granted patent)	-0.0002	0.00005	0.0004	0.0045***	0.0002	0.0009*	0.0007	0.0034***
	(0.0007)	(0.0007)	(0.0010)	(0.0018)	(0.0006)	(0.0006)	(0.0007)	(0.0009)
I(strategic patent)	0.0022***	0.0022***	0.0018*	-0.0014	0.0019***	0.0015***	0.0020***	-0.0003
	(0.0006)	(0.0006)	(0.0009)	(0.0017)	(0.0005)	(0.0006)	(0.0006)	(0.0009)
Firm level controls	Y	Y	Y	Y	Y	Y	Y	Y
Competitor controls	Y	Y	Y	Y	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
% strategic patents in the sample	0.1238	0.1008	0.0699	0.0375	0.1012	0.0652	0.0464	0.0270
N.	40765	30541	20321	10099	40765	30541	20321	10099
Adjusted R^2	0.958	0.969	0.981	0.988	0.958	0.969	0.981	0.988

Notes: This table shows the results from Equation (2) of the impact of strategic patent issue on the patentee's HHI measured in Equation (3) using the matched sample with alternative cut-offs for defining strategic patents. A patent is classified as strategic if it falls into the top 40th (30/20/10) percentile of the distribution of private economic value as measured by Equation (1), but (not) the bottom 40th (30/20/10) percentile of distribution of scientific value (measured by forward citations). All specifications control for filing year, examiner art unit, and firm fixed effect, as well as firm level controls as in Table 4 and baseline level measures of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 21. Effect of Strategic Patenting on Competitors Performance: Robustness Check – Alternative Definitions of Competitor Space (Top 75th and Top 90th Percentile of Closest Competitors)

	Competitors' Horizon (top 75%)					Competitors' Horizon (top 90%)				
Growth over *t* years	1y	2y	3y	4y	5y	1y	2y	3y	4y	5y
Panel A: Profit growth										
I(granted patent)	-0.0005	-0.0020	-0.0100***	-0.0075**	-0.0058**	-0.0002	-0.0004	-0.0076**	-0.0055*	-0.0022
	(0.0022)	(0.0029)	(0.0035)	(0.0031)	(0.0028)	(0.0022)	(0.0027)	(0.0033)	(0.0031)	(0.0027)
I(strategic patent)	-0.0018	-0.0067***	-0.0001	0.0017	0.0024	-0.0019	-0.0072***	-0.0008	0.0008	0.0004
	(0.0021)	(0.0026)	(0.0031)	(0.0026)	(0.0025)	(0.0020)	(0.0025)	(0.0030)	(0.0026)	(0.0025)
Panel B: Sales growth										
I(granted patent)	0.0008	-0.0001	-0.0029	-0.0039*	-0.0018	0.0014	0.0011	-0.0012	-0.0023	0.0013
	(0.0015)	(0.0021)	(0.0025)	(0.0023)	(0.0021)	(0.0014)	(0.0020)	(0.0023)	(0.0023)	(0.0021)
I(strategic patent)	-0.0019	-0.0053***	-0.0023	-0.00003	0.0016	-0.0022	-0.0057***	-0.0028	-0.0010	-0.0007
	(0.0014)	(0.0019)	(0.0023)	(0.0021)	(0.0018)	(0.0014)	(0.0018)	(0.0022)	(0.0020)	(0.0018)
Panel C: COGS growth										
I(granted patent)	0.0008	0.0008	0.0004	-0.0019	-0.0008	0.0006	0.0014	0.0030	0.0004	0.0008
	(0.0015)	(0.0019)	(0.0024)	(0.0023)	(0.0023)	(0.0014)	(0.0019)	(0.0023)	(0.0022)	(0.0022)
I(strategic patent)	-0.0005	-0.0026	0.0003	0.0028	0.0019	-0.0007	-0.0033*	-0.0011	0.0004	-0.0008
	(0.0013)	(0.0017)	(0.0021)	(0.0020)	(0.0020)	(0.0013)	(0.0017)	(0.0020)	(0.0019)	(0.0020)
Mean of outcome vear										
Profit growth	-0.0189	-0.0185	-0.0056	-0.0192	-0.0168	-0.0189	-0.0185	-0.0056	-0.0192	-0.0168
COGS growth	-0.0018	-0.0058	0.0016	-0.0075	-0.0163	-0.0050	-0.0094	-0.0052	-0.0151	-0.0255
Sales growth	-0.0079	-0.0090	-0.0049	-0.0109	-0.0109	-0.0171	-0.0197	-0.0075	-0.0202	-0.0204
Peer firm averages controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N.	15116	15116	15115	15105	15105	15116	15116	15115	15105	15105

Notes: This table reports the estimates of Equation (4) for firm profit (sales minus COGS), sales, and COGS growth over the horizon of one to five years for competitors (all variables are scaled by firm's total assets). Competitors are defined as top 75th percentile (90 percentile) of closest peers using TNIC3 industry classification from Hoberg and Phillips (2010). The dependent variables and controls are calculated as equal-weighted averages for specified competing firms. All specifications control for filing year, examiner art unit, and firm fixed effect, as well as competitors' portfolio controls as in Table 4 and baseline level measures of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 22. Strategic Patent Effect on Competitors' Productivity: Robustness Check – Alternative Definitions of Competitor Space (Top 75th and Top 90th Percentile of Closest Competitors)

Dependent variable:	Total factor productivity (TFPR)			
	Top 75% competitors		Top 90% competitors	
	(1)	(2)	(3)	(4)
I(strategic patent)	-0.0174***	-0.0164***	-0.0159***	-0.0155***
	(0.0020)	(0.0019)	(0.0020)	(0.0019)
Firm level controls	N	Y	N	N
Peer firm averages controls	N	N	N	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y
Mean of variable	-0.22	-0.22	-0.22	-0.22
N.	15218	15158	15237	15188
Adjusted R^2	0.444	0.500	0.423	0.477

Notes: This table shows the results from Equation (2) of the impact of strategic patent issue on the competitor productivity using the matched sample. The sample is matched on the year of patent filing and patent category, and it is matched coarsely on the economic value of the patent and the firm's baseline sales (averaged over five pre-filing years). A patent is classified as strategic (technological) if it falls into the top 50th percentile of economic value as measured by Equation (1), but bottom (top) 50th percentile of the distribution of scientific value (measured by forward citations). Models (1) and (2) report the effect of technological and strategic patent grant on post-filing competitor TFPR (İmrohoroğlu, Ayşe and Tüzel, Şelale, 2014),where competitors are defined as top 75th percentile of closest peers using TNIC3 industry classification from Hoberg and Phillips (2010). Model (2) adds competitor level controls from Table 4. The controls for competitors are calculated as equal-weighted averages. Models (3) and (4) repeat the analysis using the set of top 90th percentile of closest peers using TNIC3 industry classification. All specifications control for filing year, examiner art unit, and firm fixed effect, as well as the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.

Table 23. Strategic Patent Effect on Market Concentration and Total Factor Productivity – Placebo Test

Dependent variable:	HHI (TNIC3)			# competitors			Total factor productivity (TFPR)			
							Patenting firm		Competitors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
I(granted patent)	0.0004	0.0004	0.0002	-0.0394	-0.0536	-0.10542	-0.0004	-0.0003	-0.0002	-0.0008
	(0.0007)	(0.0007)	(0.0006)	(0.1128)	(0.1020)	(0.1000)	(0.0012)	(0.0011)	(0.0018)	(0.0017)
I(strategic patent)	-0.0007	-0.0008	-0.0003	-0.0844	-0.0080	0.0558	0.0003	0.0002	-0.0014	-0.0012
	(0.0008)	(0.0008)	(0.0007)	(0.1278)	(0.1191)	(0.1166)	(0.0014)	(0.0013)	(0.0021)	(0.0019)
Firm level controls	N	Y	Y	N	Y	Y	N	Y	N	N
Peer firm averages controls	N	N	Y	N	Y	Y	N	N	N	Y
Year, Art Unit, Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mean of outcome variable	0.19	0.20	0.21	40.48	40.49	40.50	0.40	0.40	-0.20	-0.20
N.	15166	15166	15111	15049	15049	14994	14423	14423	14383	14333
Adjusted R^2	0.931	0.932	0.943	0.972	0.976	0.977	0.988	0.989	0.547	0.593

Notes: This table replicates the results presented in Table 8 and Table 9 using a matched sample with each patent within the same year of filing, technological category and economic value bin is being randomly assigned as granted and non-granted, and strategic and technological within the granted subsample. Models (1), (2) and (3) report the effect of technological and strategic patent grant on post-filing HHI based on TNIC3 industry classification and measured in Equation (3). Compared to Model (1), Model (2) adds firm level controls from Table 4. Model (3) adds the respective competitor firms controls to the regression. Competitor firms are defined as the top 50th percentile of closest peers using the TNIC3 industry classification. The controls for competitors are calculated as equal-weighted averages. Models (4), (5) and (6) repeat the analysis using the number of competitors within the firm's product market as a dependent variable. Models (7) and (8) report the effect of technological and strategic patent grant on post-filing firm's TFPR (İmrohoroğlu, Ayşe and Tüzel, Şelale, 2014). Models (9) and (10) repeat the analysis for the set of top 50th percentile of closest peers using TNIC3 industry classification (Hoberg and Phillips, 2010). All specifications control for filing year, examiner art unit, and firm fixed effect, as well as the baseline measure of the dependent variable (calculated over the five pre-filing years). Standard errors are clustered at examiner art unit by year of filing, and are reported in parentheses. Levels of significance: *10%, **5%, and ***1%.