Intellectual Property Rights Reform, Inter-firm Patent Litigation and Innovation Competition

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Abstract

We examine the impact of China's National Intellectual Property Strategy (NIPS) reform on U.S. firms' innovation. Strengthened IP rights in China incentivize U.S. multinationals to protect their Chinese market profits from potential misappropriation by domestic rivals. Consequently, firms exposed to NIPS face increased litigation and, when litigated as defendants, significantly reduce patenting and focus more on incremental innovation. While these strategies minimize future litigation, they result in greater product homogeneity and heightened market competition. Overall, we show that U.S. multinationals play a key role in transferring regulatory shocks from emerging economies to U.S. markets, underscoring the importance of global business integration for corporate innovation policies.

Keywords: China's Intellectual Property Reform, NIPS, Inter-firm patent litigation, Intellectual property rights boundary and product market dynamics, Innovation activity, Innovation strategy.

JEL Classification: G30, K41, L24, O32, O34

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1. Introduction

Innovation is the key driver of long-term economic development and national prosperity, playing a crucial role in the growth of domestic firms and fostering their ability to compete in global product markets (Castaldi, Giuliani, Kyle, and Nuvolari, 2024). Although countries implement various policies aimed at strengthening their competitiveness in the global business landscape, the development of intellectual property rights (IPRs) in emerging markets and their effects on global corporate innovation activities have not been explored in detail. In this study, we focus on China's National Intellectual Property Strategy (NIPS) reform of 2008 as an example of such a policy. NIPS sought to substantially improve the quality of Chinese patent law and align it with global standards by reforming China's intellectual property laws, regulations, and enforcement mechanisms (Hong, Edler, and Massini, 2022). By bolstering the IP regime and raising public awareness, NIPS had a significant economic impact in China, distinguishing it from previous changes to IP law (Hong et al., 2022).

Following the implementation of NIPS, there was a significant increase in patenting activity, and the number of IP-related patent litigation cases rose from 30,626 to 42,902, demonstrating the profound impact of NIPS on Chinese firms (National Bureau of Asian Research, 2011). In a world of isolated economies, such a policy impact would remain confined to China. However, in today's interconnected world, a policy shock in one country can swiftly spread to others. For instance, stronger IPR in China acts as a positive incentive for U.S. firms, encouraging them to enter the Chinese market to exploit the growing profitable business opportunities arising from enhanced profit protection. Nevertheless, the decision to enter a new market is non-trivial when U.S. incumbents are already present in China, and these incumbents potentially dissuade other U.S. rivals from entering.[1]

In this paper, we aim to examine the impact of NIPS on U.S. firms, with a focus on domestic patent litigation as one of the important and plausible channels through which

[1] Even these U.S. incumbents could start debating the potential misappropriation of their IP rights committed by each other.

U.S. firms compete to secure benefits arising from NIPS. Our investigation of this question is unlikely to be in vain, as there is some aggregate-level evidence of how strengthening IPR protection in China has had significant economic impacts on U.S. firms. USITC (2011) estimates that U.S. firms experience $6.7 billion in welfare gains from general IPR improvements in China, realized through increasing U.S. exports to China. Santacreu and Peake (2019) also show a dramatic increase in China's licensing and royalty payments from $755 million to $8.3 billion between 1999 and 2017, with a large increase around the time of NIPS.

Since product market profits depend on protecting core technology from misappropriation, NIPS can prompt U.S. firms to reconfigure and strengthen their patent boundaries, securing monopoly profits in the Chinese market over domestic competitors. These patent disputes often take place in U.S. courts due to the territorial limitations of patent law. Consequently, we anticipate that NIPS will affect the innovation volume and strategy of U.S. firms as they compete with other domestic rivals entering this new business realm.

We hypothesize that NIPS will decrease the volume of U.S. corporate innovation due to increased patent litigation among domestic firms competing for the growing economic rents in the Chinese market following the implementation of NIPS. The rise in patent litigation reduces U.S. corporate innovation because costly litigation raises the hurdle for undertaking innovation projects, even if they are marginally profitable.[2] However, reducing patent activity is not a viable long-term solution, as firms can lose their competitive advantage in product markets without innovation. Thus, firms could consequently engage in innovation strategies that lower such legal risks. In this regard, we further hypothesize that firms will pursue a more exploitative than exploratory innovation strategy because the risks of litigation are higher when a patent's scope is broader (Lerner, 1994) and when patents explore new technologies with hidden, unclear, or unpredictable legal protection boundaries (Bessen and Meurer, 2009).[3]

[2] Patent litigation is costly; the median legal cost is approximately $5 million AIPLA (2015), while the median damage award ranged from $2 million to $17 million over 1997-2016.

[3] The literature has identified numerous important determinants of innovation strategies. These determinants include managerial myopia (Levinthal and March, 1993), variance seeking (McGrath, 2001), fluctua-

We estimate these potential effects of NIPS using difference-in-differences (DID) specifications, identifying granular firm-level exposure to NIPS through preexisting Chinese product market exposures. Specifically, we define a firm's NIPS exposure based on its own sales in the Chinese market or those of its product market peers. Using the DID approach, we first examine how NIPS affects U.S. corporate patenting activity and firms' innovation strategies. We find that firms with NIPS exposure (treated firms hereafter) significantly reduce their number of patent applications by 6.6% compared to control firms following the implementation of NIPS. We also find that treated firms narrow their scope of innovation by relying 21% more on incremental, exploitative innovation strategies and 5% less on exploratory innovation. These results are driven by firms whose peers had established considerable exposure to Chinese markets prior to NIPS and are not driven by firms that were already performing poorly or exhibited declining innovation before NIPS. Instead, we find that the treated firms are relatively larger and more profitable and have a higher Tobin's Q pre-NIPS. In a battery of robustness checks, we consistently verify that our results are not driven by differential pre-trends in patenting and innovation strategy, any observable differences between the treated and control firms, industry-specific trends, or confounding effects of the financial crisis.

Next, we formally verify whether the growing IP-related profits in China post-NIPS result in domestic patent litigation cases. NIPS could encourage U.S. incumbents to preemptively protect their profits in the Chinese market against domestic rivals. To test this channel, we use novel hand-collected inter-firm patent litigation data around NIPS. We find that NIPS-exposed firms experience a significant increase of 5.3% in patent litigation defendant cases. Potential new entrants without preexisting Chinese market exposure are shown to be mainly targeted as defendants in rising patent litigation following the implementation of NIPS. These results suggest that NIPS has an impact on U.S. firms through the domestic IP rights debate.

tions in demand and supply (Sidhu, Commandeur, and Volberda, 2007), tolerance for early failure (Manso, 2011), and the form of equity financing or public market listing (Ferreira, Manso, and Silva, 2014; Gao, Hsu, and Li, 2018), among others. Our hypothesis distinctively considers litigation risks and predicts that the ex post innovation strategy of firms varies between exploitative and exploratory strategies according to the firms' exposure to future patent litigation under fierce technological competition.

To secure profits in the Chinese market, incumbents try to obtain monopolistic rights and clarify their IPR boundaries through patent litigation. Such NIPS-driven patent litigation in the U.S. significantly reduces defendants' patenting activity. The costly nature of inter-firm patent litigation increases the threshold for undertaking a positive NPV innovation project and forces firms to forgo some low-return innovation projects.

We posit that treated firms pursue a more exploitative, incremental innovation strategy to avoid future patent litigation. To test these hedging incentives, we conduct a formal regression analysis and find that firms pursuing an exploitative strategy experience fewer defendant patent litigation cases in the future compared to firms that continue to pursue an exploratory strategy (Lerner, 1994). The hedging effect persists for up to four years following litigation cases. Taken together, these results convey a consistent message: treated firms respond to NIPS through curbing patenting activity in the short-run while shifting their long-term innovation strategy toward more incremental innovation with clearer IPR boundaries.

Finally, we further examine how patent litigation amplifies the effects of NIPS through domestic product market competition. We expect the NIPS effect to be more pronounced in competitive product markets, where patent litigation is more likely and reinforces product market consequences through changes in inter-firm patent litigation. We divide our sample into high and low product market competition and re-estimate the main regressions. We find that the NIPS effect is pronounced in the high product market competition subsample, which substantiates patent litigation as a plausible underlying channel through which NIPS affects domestic U.S. firms. We also investigate whether an exploitative innovation strategy intensifies competition among product market rivals due to its narrower technological scope and focus. We indeed find suggestive evidence that NIPS intensifies competition particularly among close rivals rather than distant rivals within the existing product space.

Our paper makes several important contributions to the literature on IPR reforms and their impacts on corporate innovation and product market dynamics. While the importance of IPR reforms in developing economies such as China are widely recognized in the literature (Castaldi et al., 2024), the focus has mainly been on the emerging economies themselves. Studies in this line of the literature show that the effectiveness of reforms heavily hinges on the level of industrial and technological development, output growth, and the fiscal capacity to conduct innovative research in each emerging economy (Lerner, 2002a; Lall, 2002; Chen and Puttitanum, 2005; Kim, Lee, Park, and Choo, 2012). Only a few studies have focused on the impact of such reforms on other advanced economies (Lerner, 2002a,b; Branstetter, Fisman, and Foley, 2006).

Among them, Branstetter et al. (2006) examine a series of IPR reforms undertaken by sixteen countries and find that U.S. multinational corporate patent holders benefit greatly from the transfer of rents through royalty payments and the R&D expenditures of their foreign affiliates. A subset of studies also highlights how such knowledge and rent spillover are stronger when countries establish tight trade relationships with emerging economies (Schmiele, 2013; Campi and Duenas, 2019; Arza, Lopez, Montes-Rojas, and Pascuini, 2023). In contrast, we study the potential regulatory spillover of China's IPR reform on U.S. firms. Leveraging integrated product markets with the domestic legal enforcement system, we identify how such foreign reforms could affect the quantity and quality of U.S. corporate innovation. We provide consistent evidence that U.S. multinational entities play a pivotal role in propagating the shock of the reforms from emerging economies to the U.S., highlighting the importance of global business integration and its ramifications for corporate innovation policies.

Our paper also underscores innovation competition and intellectual property rights disputes as important determinants of industrial-organizational dynamics. Patent litigation can strengthen IP rights, which could reduce ex ante hold-up problems in corporate innovation activities. However, these strengthened IP rights could also cause firms to decrease their level and scope of innovations to a safer category to avoid costly IP rights disputes. Given the empirical nature of our key research question, we provide a series of direct and large-scale evidence of how *inter-firm* patent litigation shapes innovation competition among operating entities. Our results offer a richer empirical foundation for corporate innovation policies at the individual company level. They also highlight the role of patent litigation as a key driver that shapes the mode of technological competition in recent decades in the U.S. private sector. The inter-firm nature of our patent litigation data lays a novel foundation for identifying such industry dynamics in corporate innovation activities, extending the findings in the literature that focuses on the litigation among nonpracticing entities (NPEs)(Cohen, Gurun, and Kominers, 2019; Mezzanotti, 2021).

2. Hypothesis Development

H1: NIPS reduces U.S. firm patenting activity.

The strengthening of IPR in China creates a positive incentive for U.S. firms to enter the Chinese market. China's enhanced IPR has been shown to have increased licensing and royalty payments from Chinese to U.S. firms, increased U.S. exports to China, and increased U.S. firms' sales and profits in the Chinese market (USITC, 2011; Santacreu and Peake, 2019). We conjecture that the competition for these profitable business opportunities will manifest through domestic patent litigation. Incumbents will seek to protect the monopoly rights arising from the substantial economic rent spillover and prevent misappropriation by domestic product market rivals in the United States because of the territorial limitations of patent law (Trimble, 2009). Such domestic legal debates on the potential misappropriation of IP rights could intensity even among U.S. incumbents after NIPS. However, patent litigation is costly. The median legal cost is approximately $5 million (AIPLA, 2015), while the median damage award ranged from $2 million to $17 million over the period 1997-2016 (PWC, 2017). Moreover, patent litigation among practicing entities tends to occur back-to-back, taking a long time to be fully resolved. Based on these previous findings, we predict that NIPS decreases treated firms' patenting in the short-run, as the threshold for undertaking a positive NPV innovation project is likely to increase, forcing firms to forgo some low-return innovation projects that fail to provide the necessary returns.

H2: NIPS narrows the scope of U.S. firm innovation.

Treated firms cannot sustain a reduction in patenting activity; without innovation, they would gradually lose their competitive edge in product markets. Given the increase in patent litigation risk post-NIPS, treated firms will engage in actions to mitigate litigation risk (Stiglitz, 2008). The risk of patent litigation is positively correlated with the scope and breadth of patents (Bessen and Meurer, 2005) for two reasons. First, a broader patent scope encompasses a larger number of potentially competing products and competitors. Second, patents with wider applicability are generally more valuable, and, hence, more likely to be litigated. Patent litigation risks are also higher when firms explore new technologies, where the patent boundaries are hidden, unclear, or unpredictable (Bessen and Meurer, 2009). In fact, Lerner (1994) finds that broader patents are significantly more likely to be litigated. Therefore, we predict that NIPS-exposed firms facing higher levels of patent litigation risk will pursue more incremental, *exploitative* innovation. This innovation strategy relies on and builds on existing knowledge, reducing the probability of inadvertently infringing upon other patents in the process (Gao et al., 2018).

H3: Patent litigation intensifies product market competition.

Product market competition and patent litigation are closely intertwined, as firms strive to safeguard their competitive advantage in the market by enforcing their intellectual property rights over technologies essential to their products, particularly in rapidly evolving high-tech industries. Consequently, we first predict that the effects of NIPS will be amplified in more competitive product markets. Second, we predict that the increasingly exploitative innovation strategy among U.S. domestic product market competitors ultimately leads to increased product similarity and more intense product market competition as a result.

3. Data and Summary Statistics

3.1 Data source and sample selection

Our final data combine three data sources. First, we obtain patent litigation cases from *Lex Machina*. *Lex Machina* is the most comprehensive database of U.S. patent lawsuits starting in January 2000 and has been used in many recent studies (Akcigit, Celik, and Greenwood, 2016; Cohen et al., 2019; Allison, Lemley, and Schwartz, 2018; Bereskin, Hsu, Latham, and Wang, 2023). This database leverages primary data from Public Access to Court Electronic Records (PACER), the United States Patent and Trademark Office (USPTO), and the International Trade Commission (ITC) and provides comprehensive information about each patent lawsuit, including the names of all litigants, the judge, and the court, damages awarded (when available) and remedies and case resolutions.[4]

The second source of data is the updated version of KPSS patent data (Kogan, Papanikolaou, Seru, and Stoffman, 2017). Using the universe of patents issued to U.S. firms between 1926 and 2022, Kogan et al. (2017) construct a new measure of patent value based on the stock market response to news about patents on the grant date. The data also includes detailed information on the patent (e.g. patent number, filing date, grant date), backward and forward citations, assignee, and technology classification code based on the USPTO system. CRSP PERMNO is used to match patent numbers to U.S. public firms in Compustat.

Finally, we start with all Compustat firms between 2005 and 2011 and name-match the patent litigation and KPSS data over the sample period. We exclude financial firms and utilities. Our sample period is focused on the NIPS in 2008 to clearly isolate the reform's effect. Since we focus on inter-firm patent litigation, we filter NPE cases by verifying litigant

[4]The US District Court, ITC, and Patent Trial and Appeal Board (PTAB) are three venues for patent disputes. We only include US District Court cases as most patent cases are filed at the district court level. ITC cases are relatively few, i.e., the average number of ITC cases were 12 per year between 1990-2000 and 33 per year between 2001-2012. The US district court cases and ITC cases are similar. However, an important difference is that imposing monetary damages and/or establishing reasonable royalty is only possible through district courts (Chien and Lemley, 2012). However, we acknowledge that omitting the ITC cases may cause an overstatement of our results as ITC cases can indicate that a larger stake is involved through the importation of infringing goods and the entire related domestic industry.

names.[5] We further restrict our sample to patenting firms with a history of at least one patent granted as we measure innovation strategies with *Exploitative* and *Exploratory* variables, which require a past record of patenting activity and citations. Our final sample consists of 10,914 firm-year observations.

3.2 Summary statistics

Table 1, Panel A, reports the firm-year level summary statistics of our sample firms. Our main goal is to estimate the NIPS effect through domestic patent litigation on U.S. firms' innovation quantity and strategies. We use patent application counts to measure the quantity of innovation.[6] We measure time-varying innovation strategies using *Exploitative* and *Exploratory* variables. Our sample firms unconditionally undertake, on average, more exploratory innovation by relying on knowledge outside the firms' existing expertise. In terms of financial characteristics, compared to an average Compustat firm, our sample firms have relatively lower cash flow volatility (0.23 vs. 0.05) and leverage ratio (0.24 vs. 0.17), and operate in more competitive $(1-HHI)$ industries (0.64 vs. 0.86). In Panel B of Table 1, we compare the key variables in the pre- and post-NIPS periods. The number of defendant cases is significantly greater in the post-NIPS period indicating that firms are more likely to be involved in patent litigation as defendants after NIPS. Firms on average have greater size, higher profitability, lower Tobin's q, and higher HHI in the post-NIPS period. We control for these pre-NIPS differences in observable variables in all of our analyses.

In Appendix B, we additionally present summary statistics for patent litigation cases of our sample firms. Table A.1 indicates that our sample firms are linked to 15,711 unique patent litigation cases, and the average length of litigation from filing to termination is 1.5 years. Our sample firms are plaintiffs in approximately 34% of the cases. Plaintiffs win 8% of cases and defendants win 6%. The rest 74% of cases are dismissed before a verdict is delivered, and the remaining 12% accounts for procedural transfers or likely settlement.

[5] We thank the authors of Cotropia, Kesan, and Schwartz (2014) for sharing the NPE list with us.

[6] The patent data consist only of patent applications that are eventually granted.

However, firms involved in dismissed cases can still reach costly settlements. For example, Apple paid Qualcomm $4.5 billion to settle in 2019, and Samsung paid nearly $539 million to settle with Apple in 2018.

4. Empirical methodology

In this section, we provide the detailed institutional setting of the NIPS and its impacts on both China and the United States. We explain how U.S. firms and their domestic product market competition are affected by NIPS when some firms have existing sales exposure in the Chinese market. Our goal is to estimate the firm-level effects of NIPS on U.S. firms' innovation using difference-in-differences estimations.

4.1 National Intellectual Property Strategy (NIPS) reform in China

China made a few substantial revisions to its intellectual property rights laws between 1992 and 2020. Among these, the Trade-Related Aspects of Intellectual Property Rights Agreement (TRIPS) of 2001 is considered to have been the first step toward aligning with global standards. Although TRIPS attempted to initiate China's efforts to abide by international norms of intellectual property protection, it was discussed as part of the country's World Trade Organization (WTO) accession and was therefore arguably exposed to various cultural, legal, and economic factors that impeded the robust implementation of those commitments (National Bureau of Asian Research, 2011). While the implementations of provisions under TRIPS laid the foundation for a more modern, transparent, and effective IPR system in China, the most impactful and notable improvements in the legal system and enforcement of stricter IP rights laws came with the implementation of NIPS (Hong et al., 2022; WIPO, 2008).

China released NIPS in 2008; NIPS outlined reforms for intellectual property laws, regulations, and enforcement in the country. These reforms were internally promoted as China recognized the growing importance of intellectual property in the globalization of the knowledge-based economy. This assessment called for a stronger intellectual property regime and public awareness to strengthen the country's international competitiveness (National Bureau of Asian Research, 2011). Specifically, the scope of patent protection was expanded, and the strength of patent protection was enhanced by increasing the fines for patent infringement. Additionally, procedural provisions for applying for and transferring patent rights were clarified. The revised legal system has promoted the expansion of specialized IP courts led by reputable judges in the Chinese court system and enhanced human resources through extensive education and training of IP professionals in China. As a result, the number of patent applications has undergone explosive growth, and IP-related civic cases increased from 30,626 in 2009 to 42,902 in 2010 (National Bureau of Asian Research, 2011; Hong et al., 2022).

Strengthening IPR in China had a significant economic impact on the United States. Using OECD data on U.S. exports of services to China, Santacreu and Peake (2019) document that China's payments for the use of U.S. intellectual property grew more than 11-fold from $755 million in 1999 to $8.3 billion in 2017. Interestingly, the payments appear to have dramatically increased since the implementation of NIPS in 2008, which is particularly relevant to our study. This observation is consistent with, and in some respects even larger than, the estimates by the International Trade Commission (ITC) regarding improved IPR protection and enforcement in China (USITC, 2011). The ITC survey estimated that U.S. firm sales, royalties, and license fees increased by approximately 10 to 20%. Consequently, NIPS had a sizable real impact on U.S. firms through domestic product market competition, driven by the growing IP-related profits from China for U.S. firms with Chinese market exposure.

As NIPS raises U.S. firms' expected sales, royalties, and licensing fees through the stronger enforceability of IPRs in China, such IP-related profit opportunities attract new U.S. entrants to the Chinese market. Consequently, NIPS has a direct and isolated effect on patent litigation incentives, since the ability to secure increasing marginal profits in China hinges on the enforceability of *existing* IPRs. In other words, NIPS increases the incentives of U.S. firms with existing operations in China to secure their existing IP rights and clarify patent boundaries through preemptive litigation, thereby obstructing domestic rivals' entry into the lucrative Chinese market. However, due to the territorial limitations of patent law, U.S. firms must file patent disputes in the country where the patent was issued even when the opponent's assets are located in foreign countries. Therefore, disputes over claims to new profitable opportunities in China would result in an increase in patent litigation in the United States.

Finally, the incentives for patent litigation are intricately linked to domestic product market competition, as market competitiveness often relies heavily on the underlying core technology. First, the enforcement of U.S. injunctions abroad, i.e., cross-border injunctions, protects a firm's monopoly rights over the production and sales of its products (Trimble, 2009).[7] Second, there are indirect benefits to be realized in China from patent enforcement in the United States. Although IP laws are national, patent litigation in the global institutional landscape can be replicable and make a case to potential competitors by sending signals beyond the country of litigation (Wang, An, and Zhao, 2023). Collectively, cross-border injunction through patent litigation helps protect potential profits related to strengthening IPR post-NIPS. Hence, we propose that patent litigation is a plausible underlying channel through which NIPS affects U.S. firms.

4.2 Empirical specification

Our primary goal is to estimate the effect NIPS on U.S. firms' innovation around the implementation of NIPS in 2008. We estimate the difference-in-differences regression shown in Equation (1).

$$\begin{aligned} Innovation\,Outcome_{i,t} = \quad & \beta_0 + \beta_1 NIPS\,Exposure_i \times Post\,NIPS_t + \beta_2 Post\,NIPS_t \\ & + \beta_3 NIPS\,Exposure_i + \beta_4 Controls_{i,t} + \eta_i + \eta_t + \epsilon_{i,t}, \qquad (1) \end{aligned}$$

[7]Even if the injunction is not strictly enforceable by foreign courts, parties may comply due to business relationships and concerns about reputation among their business partners and customers (Trimble, 2009).

where i indexes firm and t indexes year. We use granular firm-level exposure to NIPS through preexisting Chinese product market exposures. We define a firm's NIPS exposure (treatment) based on its own sales in the Chinese market or those of its product market peers, who are the focal firm's 25 closest product market rivals. Product market rivals are determined by Hoberg and Phillips (2016) text-based network industry classification (TNIC) cosine-similarity score, which is computed from the textual parsing of detailed product descriptions from annual 10-K filings as a word vector. A higher score indicates a higher degree of similarity, and firm pairs with a higher score are nearer rivals. The benefit of using this measure is that the scores are firm-level and time-varying and capture continuously evolving product market competition, in contrast to the static SIC code. $Post\ NIPS$ is an indicator variable equal to one if the year is on or after 2008 and zero otherwise. We include firm (η_i) and year fixed effects (η_t). Our main variable of interest is the interaction term, $NIPS\ Exposure \times Post\ NIPS$, which captures changes in U.S. firm innovation as a result of domestic product market competition with rivals with already established sales in the Chinese market. The dependent variables include the log of one plus the number of patent applications and exploitative and exploratory innovation measures.

We further provide a formal comparison of our treated ($NIPS\ Exposure = 1$) and control ($NIPS\ Exposure = 0$) firms pre-NIPS in Table A.2 Panel A. We find some observable differences between the treated and control firms. For example, treated firms are relatively larger, more profitable, and have higher Tobin's Q. We control for these observable differences by using propensity score matched regressions and provide a visual inspection of parallel trends ensuring that these differences are not driving our results.

5. Results

5.1 Patenting and innovation strategy

We first examine the effects of NIPS on U.S. firm innovation in Table 2. We include firm and year fixed effects in all regressions to account for any time-invariant firm characteristics and year-specific shocks. The fixed effects absorb $NIPS\ Exposure$ and $Post\ NIPS$ stand-alone terms. Standard errors are clustered at the industry-year level. We find in column (1) that treated firms decrease patenting activity, as measured by the number of patent applications, by 6.6% post-NIPS. The coefficients on the control variables are as expected—large, more financially flexible (lower leverage), and high Tobin's Q firms are likely to invest more in innovation with greater output.

In column (2), we additionally examine the treatment effects over time by interacting $NIPS\ Exposure$ by year dummies. We make a few important observations regarding the treatment effects over time. First, the coefficients on the interaction terms prior to the NIPS shock are statistically indistinguishable from zero. This finding ensures that there are no differential trends in the patenting activity prior to NIPS and mitigates potential concerns with omitted variables. Second, the treatment effect is strongest in the year following the implementation of NIPS, then quickly moderates in the next two years. This result implies that scaling back the level of innovation is unlikely to be a viable response to NIPS in the long-term. Hence, we next examine the effect of NIPS on firms' strategic dimension of innovation.

In columns (3) through (6), we regress the measures of innovation strategy, *Exploitative* and *Exploratory*, on NIPS exposure. Following Gao et al. (2018), a patent is categorized as *Exploitative* if the technology builds on the firm's existing patents and the citations made by those patents. In contrast, a patent is categorized as *Exploratory* if the technology relies on new knowledge outside a firm's existing patents or the citations made by those patents.[8] In columns (3) and (5), we find that treated firms engage in 1.1 percentage points more exploitative innovation but 3 percentage points less exploratory innovation post-NIPS. These coefficients translate into a 21% increase in exploitative strategy and a 5% decrease in exploratory strategy compared to the treated firms' pre-NIPS mean of 0.0525 and 0.611,

[8] Benner and Tushman (2002) define exploitative innovation as involving improvements to existing components and advancing the existing technological trajectory; they define exploratory innovation as involving a shift to a different technological trajectory. See March (1991), Levinthal and March (1993), Benner and Tushman (2002), and Gao et al. (2018) for studies on innovation strategies.

respectively. Columns (4) and (6) again present the treatment effect over time and ensure that there are no pre-trends in innovation strategies.

Our results in Table 2 show that NIPS appears to affect both the innovation quantity and innovation strategy firms employ. However, one may still have concerns about how to interpret our results because U.S. firms with (treated) and without (control) NIPS exposure might be systematically different. Hence, we further provide robustness tests to help precisely interpret our results before we delve into the underlying mechanism of how NIPS affects U.S. firms' innovation.

5.2 Robustness tests

We first examine how treated and control firms are observably different by comparing their firm-level characteristics prior to NIPS. In Table A.2, Panel A, we find that the treated firms are relatively larger and more profitable and have higher Tobin's Q. That is, our results are not driven by firms that were already performing poorly or declining in innovation during the pre-NIPS period. To additionally account for the observable differences in firm characteristics and industry factors, we estimate propensity scores and match treated firms to control firms within the same industry on the propensity score.[9] We report matching variables and balancing test results in Table A.2, Panel B, which show that there are no meaningful differences remain in the observable characteristics after the matching. We present the PSM regression results using the matched sample in Table 3, Panel A. The number of observations decreases because we use the propensity score matched sample only. We find that our results remain consistent and statistically strong. In fact, the NIPS effects on innovation strategies become even stronger in the matched sample. That is, our main results are not driven by observable differences between the treated and control firms or

[9] Specifically, we obtain the control sample by estimating the likelihood of *NIPS Exposure* using firm size, leverage, profitability, Tobin's Q, cash flow volatility, the SIC 3-digit level industry-year characteristics (HHI, industry-level growth rate of patent number, industry median R&D scaled by total assets, industry median profit margin) and the NAICS 6-digit level industry-year China Import data from the US Census as the explanatory variables. We then use the predicted probability to match a treated firm with a control firm in the same 3-digit SIC industry and year with the closest propensity score using a caliper of 0.01 without replacement.

across industries. In Table 3, Panel B, we further rule out the possibility of unobservable industry-wide technological shocks by additionally including industry-by-year fixed effects. Again, we find that our results remain robust.

Next, the fact that the NIPS shock overlaps with the financial crisis of 2008 may raise concerns about confounding effects. Although it is difficult to think of a reason why the financial crisis differentially affects treated firms and control firms given our granular definition of treatment, we further address this concern in two ways. The best way to address this concern is to show similar strengthening IPR effects using an alternative shock during a different period, which helps to reduce any potential biases and noise associated with our main NIPS shock in 2008 (Roberts and Whited, 2012). In 2001, China's joining of the World Trade Organization (WTO) not only marked a milestone in the country's integration into the global economy but also required an overhaul of China's patent law to commit to complying with the requirements of the TRIPS Agreement (Hu and Jefferson, 2009; USITC, 2010, 2011). The goals of the TRIPS Agreement were to reduce distortions and impediments to international trade, promote the effective and adequate protection of intellectual property rights and establish general principles applicable to intellectual property rights enforcement procedures, similar to NIPS.[10] However, because the passage of the TRIPS agreement was part of the WTO accession process, it is unlikely to have been driven by US-China-specific diplomatic or economic goals, as it could only be approved by the consensus of all the members of the WTO.

We use the TRIPS setting in a difference-in-differences estimation. *TRIPS Exposure* is defined in a manner similar to the *NIPS Exposure* dummy. *Post TRIPS* is now an indicator variable equal to one if the year is on or after 2001 and zero otherwise. In Table 3, Panel C, we find qualitatively similar effects using TRIPS. Therefore, the TRIPS results provide some external validity to our main results by showing that the NIPS effect is unlikely

[10]The reason we use NIPS as our main shock is that our sample period starts in 2000, which leaves a much smaller number of pre-period observations for the TRIPS shock over the period 2000-2004. Additionally, since TRIPS was implemented as part of China's WTO accession, as mentioned at the beginning of Section 4.1, NIPS provides a cleaner empirical setting.

to have been driven by any particular set of treated firms affected by the financial crisis of 2008. In Table 3, Panel D, we additionally reestimate our main regressions by excluding the 2008 financial crisis period from our sample to further alleviate potential concerns about the confounding effects of the financial crisis. As a result, the number of observations is reduced, but we find qualitatively similar results.

5.3 Product Market Competition and Patent Litigation

We acknowledge that NIPS can affect U.S. firms in several ways, including changes in Chinese imports and exports. Among a few potential channels, we propose domestic patent litigation as a novel and plausible mechanism through which NIPS effects propagate to U.S. firms. Below, we provide detailed evidence to support this claim. The growing IP-related profits from China would have the most direct and isolated effect through U.S. firms' ability to secure growing profits and enforce patent rights, particularly in the domestic market where the territorial right is the strongest. Therefore, patent litigation is the most effective way to protect patent boundaries and associated profits, ultimately granting exclusive rights to control the product market. We formally verify whether these incentives result in increasing the number of patent litigation cases.

The results are reported in Table 4. Columns (1) and (2) show that treated firms' patent litigation increases by about 5.3% post-NIPS particularly through an increasing number of defendant cases but only weakly through plaintiff cases as shown in columns (3) and (4). In Table A.3, we also find stronger defendant case results when we restrict the effect to a smaller sphere of product market rivals. The magnitude and statistical significance of the effects of NIPS on defendant litigation cases monotonically decline as we progressively expand the definition of *NIPS Exposure* to include 15, 25, 50, and 100 closest rivals. That is, the incentives to prevent domestic product market peers from entering the Chinese market is stronger among close rivals. To better understand the patent litigation dynamics among the treated firms, we further split our treatment group into peer-exposure firms, which are exposed to NIPS only through their domestic peers who operate in the Chinese market (Peer

Exposure to NIPS), and focal-exposure firms, which are also exposed to NIPS through their own sales in the Chinese market (Focal Exposure to NIPS).

A few important observations should be noted from the comparisons between focal- and peer-exposure firms in Table A.4. First, there are substantially more observations of peer-exposure firms, which are affected by NIPS only through their peers with preexisting sales in China. This is because the direct effects of NIPS on focal-exposure firms propagate through a much broader network of domestic product market peers. Second, peer-exposure firms also experience an increase in litigation exclusively through defendant litigation cases, as they, by definition, do not have existing sales to protect in the Chinese market. The increase in defendant cases for peer-exposure firms seems to take toll on their firm size and profitability post-NIPS. These findings imply that our documented NIPS effects on U.S. firms' innovation are predominantly driven by firms whose peers had established considerable Chinese market exposure prior to NIPS (i.e., Peer Exposure to NIPS). In Table A.5, we confirm that our main results in Table 4 are indeed largely driven by peer-exposure firms and their defendant cases by excluding focal-exposure firms from our sample.

Notably, despite a small increase in the number of plaintiff cases post-NIPS, plaintiffs could also bear some of the costs associated with inter-firm patent litigation. First, as shown in Table A.4, focal-exposure firms mainly drive the increase in the number of plaintiff cases but also experience a larger increase in the number of defendant cases. That is, they could also be challenged by other incumbents with established Chinese market sales. Second, unlike nonpracticing entities (NPEs), practicing entities in inter-firm patent litigation could bear some opportunity costs during lengthy legal debates. Damage awards typically only compensate for lost profits and legal fees, unlike those awarded to NPEs. However, there are substantial opportunity costs associated with the diversion of corporate resources from other important ongoing R&D projects. This could also lead to more incremental, exploitative innovation projects being undertaken by plaintiffs.

Finally, we show the effectiveness of the exploitative strategy as a hedge against future patent litigation risks. We have posited that treated firms exposed to NIPS through the patent litigation channel would pursue more incremental innovation, which builds upon and relies on existing knowledge with fewer uncertainties (Gao et al., 2018) to reduce the possibility of patent litigation. Consistent with this interpretation, Table 5 shows that pursuing a more exploitative innovation strategy in general reduces future litigation risks. More specifically, conditioning on the patent litigation cases in year t, a one standard deviation increase in exploitative innovation score marginally reduces patent litigation risk by 5.4% (=0.36*0.15) in the second year. The hedging effect remains strong and significant in the next four subsequent years. Therefore, the long-term hedging effect reinforces the notion that altering innovation strategy would be a more viable and long-term solution in response to NIPS.

Alternatively, firms could attempt to offset patent litigation risks by increasing R&D investments to achieve a technological leap rather than shifting their innovation strategy. Which strategy is more cost-effective is an empirical question. Interestingly, we do not find a statistically significant increase in R&D spending to "escape the competition" following NIPS (untabulated). We conjecture that with a relatively smaller success probability of bypassing existing patents and creating new ones, it might be more cost-effective to focus on the exploitative innovations that narrow innovation scopes and consequently help avoid potential IP rights disputes with product market rivals. In a competitive market with rapidly evolving technological cycles, the pressure to deliver outcomes quickly (Porter, 1992; Bernstein, 2015; Gao et al., 2018) could incentivize firms to pursue an exploitative innovation strategy rather than aiming for a technological leap or exploration of new and unfamiliar areas of research.

5.4 Implications for product market dynamics

We explore broader implications of NIPS effects on domestic product market dynamics through the patent litigation channel. First, we examine whether the NIPS effect is stronger for firms that face high ex ante product market competition. That is, the incentives to hedge future litigation risk by narrowing the scope of innovation are likely stronger, as intense competition necessitates ongoing innovation to maintain product differentiation. We measure the ex ante product market competition using Hoberg, Phillips, and Prabhala (2014) market fluidity measure. This measure captures how intensively the product market around a firm is changing each year by tracking how rivals are changing the product words that overlap with a firm's vocabulary in the business description provided in 10-K filings. Market fluidity is calculated using the cosine similarity between a firm's word usage in a given year and the aggregate change vector representing unique words used in product descriptions across all firms during the same year to assess the level of competitive threat. The fluidity is higher when a focal firm's words overlap more with the changes in rival actions.[11] Table 6 reports the results, showing that the NIPS effects through patent litigation are concentrated in the subsample of firms facing more intense competition. That is, when a firm faces a greater product market threat as more rivals use overlapping product descriptions, the effect of patent litigation is more severe. Thus, product market competition amplifies how NIPS affects treated firms' innovation outcomes through patent litigation.

As firms narrow the scope of their innovation, it is possible that the product market competition intensifies within a small sphere of rivals as they compete over similar products. We proxy for the intensity of product market overlap among close rivals using the TNIC score (Hoberg and Phillips, 2016). This pairwise TNIC score identifies rivals based on the similarity of product descriptions, where a higher score indicates higher product similarity and, hence, a greater threat of competition. Table 7 shows that the NIPS effect increases the product market overlap, which becomes more pronounced as we shrink the sphere of rivals. Overall, our findings suggest that NIPS also intensifies product market competition locally among close rivals, revealing the broad implications of NIPS for U.S. domestic product market competition.

[11]For example, consider smartphone vocabulary terms, e.g., internet, iphone, and Android, among three firms. Even if Firm 1 does not change the usage of these vocabularies in $t+1$, an increase in overlap driven by the changes in Firm 2's and 3's usage of these vocabularies in $t+1$ will increase Firm 1's exposure to Firm 2's and Firm 3's movements, which is viewed as a competitive threat to Firm 1.

6. Conclusion

We examine China's IPR reform through NIPS and its impact on U.S. firms' patenting activity and innovation strategy. A positive economic rent spillover affects U.S. firms already operating as incumbents in the Chinese market, leading them to reconfigure and strengthen their patent boundaries, thereby securing monopoly profits in the Chinese market against U.S. domestic product market rivals. Hence, we focus on highlighting domestic inter-firm patent litigation as a possible underlying channel through which NIPS affects U.S firms.

Using a difference-in-differences setting, we find that treated firms with exposure to the NIPS shock through product markets reduce their patenting activity as a result of increasing domestic patent litigation among firms exposed to NIPS. However, in the long-term, treated firms alter their innovation strategy to pursue more exploitative innovation in order to remain competitive in the product market without continuing to reduce innovation efforts. We also find that the exploitative innovation strategy indeed helps treated firms reduce their future patent litigation risks. Additionally, we show broad implications of the exploitative strategy on product market competition. We find that patent litigation intensifies product market competition locally among close rivals with greater product similarity. This result suggests that NIPS ultimately affects broad product market dynamics among U.S. firms.

Overall, our results provide a detailed examination of how foreign policy reform may spill over and affect U.S. firms through globally integrated product markets. Such novel interactions between inter-firm innovation and product market dynamics could have important ramifications for corporate innovation policy in terms of how to guide the scope and diversity of innovation activities in the U.S. corporate sectors.

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Table 1: Summary Statistics

The table presents summary statistics for our main sample in Panel A and compares variables used in regressions between the pre- and post-NIPS periods in Panel B. Our sample consists of Compustat firms between 2005 and 2011, resulting in 10,914 firm-year observations. The sample comprises all firms in the Compustat database that had at least one patent during our sample period. We exclude firms that operate in the financial and utilities industries from the sample. All variables are defined in detail in Appendix A.

Panel A. Summary Statistics

	Mean	Std.dev	Min	Med	Max	Obs.
Log(1+Number of Defendant Cases)	0.15	0.40	0.00	0.00	4.06	10,914
Log(1+Number of Plaintiff Cases)	0.07	0.27	0.00	0.00	3.22	10,914
Log(1+Patent Application)	1.19	1.52	0.00	0.69	7.76	10,914
Exploitative	0.06	0.15	0.00	0.00	1.00	10,914
Exploratory	0.62	0.37	0.00	0.75	1.00	10,914
Size	5.85	2.23	-0.71	5.89	10.90	10,914
Leverage	0.17	0.18	0.00	0.12	0.90	10,914
Profitability	0.04	0.21	-1.14	0.10	0.33	10,914
Tobin's Q	1.69	1.22	0.39	1.32	9.64	10,914
Cash Flow Volatility	0.05	0.06	0.00	0.03	0.61	10,914
1 - HHI	0.86	0.12	0.24	0.89	0.97	10,914
Average TNIC3 within 25 Closest Rivals	8.79	19.08	0.00	4.56	545.65	9,970
Average TNIC3 within 50 Closest Rivals	4.54	7.88	0.00	3.33	220.50	9,970
Average TNIC3 within 100 Closest Rivals	2.34	3.25	0.00	1.90	95.98	9,970

Panel B. Univariate Analysis

	Pre NIPS			Post NIPS			Post-Pre
	Mean	Med	Obs.	Mean	Med	Obs.	Difference
Log(1+Number of Defendant Cases)	0.12	0.00	5,159	0.18	0.00	5,755	0.06***
Log(1+Number of Plaintiff Cases)	0.07	0.00	5,159	0.07	0.00	5,755	0.00
Log(1+Patent Application)	1.12	0.69	5,159	1.25	0.69	5,755	0.12***
Exploitative	0.05	0.00	5,159	0.07	0.00	5,755	0.02***
Exploratory	0.64	0.80	5,159	0.61	0.70	5,755	-0.03***
Size	5.67	5.65	5,159	6.01	6.07	5,755	0.33***
Leverage	0.16	0.11	5,159	0.17	0.13	5,755	0.01**
Profitability	0.03	0.10	5,159	0.05	0.10	5,755	0.02***
Tobin's Q	1.93	1.53	5,159	1.49	1.16	5,755	-0.44***
Cash Flow Volatility	0.05	0.03	5,159	0.05	0.03	5,755	-0.00
1 - HHI	0.87	0.90	5,159	0.86	0.89	5,755	-0.01***
Average TNIC3 within 25 Closest Rivals	9.30	4.21	4,754	8.32	4.76	5,216	-0.99***
Average TNIC3 within 50 Closest Rivals	4.77	3.45	4,754	4.32	3.23	5,216	-0.45***
Average TNIC3 within 100 Closest Rivals	2.48	1.99	4,754	2.20	1.81	5,216	-0.28***

Table 2: The Effects of NIPS on Innovation

The table examines the effects of China's National Intellectual Property Strategy (NIPS) on U.S. firms' innovation outcomes using the difference-in-differences estimation. *NIPS Exposure* is a firm-level indicator variable, which takes the value of one if either the focal firm or any of its 25 closest product market rivals have Chinese market exposure prior to NIPS and zero otherwise. *Post NIPS* is an indicator that takes the value of one after NIPS and zero otherwise. The dependent variables are innovation outcomes: the log of one plus the number of patent applications (*Log(1+ Patent Application)*) in columns 1 and 2, exploitative innovation proxy (*Exploitative*) in columns 3 and 4, and exploratory innovation proxy (*Exploratory*) in columns 5 and 6. All regressions include firm and year fixed effects. Appendix A provides the detailed definitions of the variables used in the table. The heteroscedasticity-robust standard errors are reported in parentheses and clustered at the industry-year level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	Log(1+Patent Application)		Exploitative		Exploratory	
	(1)	(2)	(3)	(4)	(5)	(6)
NIPS Exposure × Post NIPS	-0.066***		0.011**		-0.030***	
	(0.019)		(0.004)		(0.010)	
NIPS Exposure × Post NIPS t-2		-0.033		0.002		-0.021
		(0.031)		(0.006)		(0.019)
NIPS Exposure × Post NIPS t-1		-0.005		0.001		-0.023
		(0.033)		(0.007)		(0.015)
NIPS Exposure × Post NIPS t0		-0.084**		0.000		-0.025
		(0.033)		(0.008)		(0.017)
NIPS Exposure × Post NIPS t+1		-0.101***		0.016**		-0.042**
		(0.033)		(0.008)		(0.017)
NIPS Exposure × Post NIPS t+2		-0.081**		0.014**		-0.049***
		(0.039)		(0.007)		(0.017)
NIPS Exposure × Post NIPS t+3		-0.040		0.021***		-0.067***
		(0.034)		(0.007)		(0.018)
Size	0.135***	0.135***	0.019***	0.019***	0.009	0.009
	(0.021)	(0.021)	(0.005)	(0.005)	(0.008)	(0.008)
Leverage	-0.086	-0.085	-0.010	-0.010	-0.079***	-0.078***
	(0.059)	(0.059)	(0.014)	(0.014)	(0.024)	(0.024)
Profitability	-0.105	-0.103	0.000	0.001	-0.042	-0.043
	(0.068)	(0.068)	(0.015)	(0.015)	(0.030)	(0.030)
Tobin's q	0.014**	0.014**	-0.005**	-0.005**	0.005	0.005
	(0.006)	(0.006)	(0.002)	(0.002)	(0.003)	(0.003)
Cash Flow Volatility	-0.102	-0.107	-0.034	-0.034	0.055	0.059
	(0.143)	(0.142)	(0.032)	(0.032)	(0.055)	(0.055)
1 - HHI	0.224	0.224	0.003	0.002	0.102	0.108
	(0.191)	(0.192)	(0.035)	(0.035)	(0.112)	(0.113)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,914	10,914	10,914	10,914	10,914	10,914
Adjusted R-squared	0.902	0.902	0.490	0.490	0.572	0.572

Table 3: The Effects of NIPS on Innovation - Robustness tests

The table presents the results of robustness tests for China's National Intellectual Property Strategy (NIPS) effects on U.S. firms' innovation outcomes using the same regression specifications in Table 2. In Panel A, we use a propensity score-matched sample. In Panel B, we additionally include the industry-by-year fixed effects to control for industry-specific trends. In Panel C, we use TRIPS as an alternative empirical setting in 2001 similar to NIPS. In Panel D, we use a refined sample that excludes the observations during the financial crisis period between 2008 and 2009. All regressions except Panel B include firm and year fixed effects. Appendix A provides the detailed definitions of the variables used in the table. The heteroscedasticity-robust standard errors are reported in parentheses and clustered at the industry-year level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Using Propensity Score Matched Sample

	(1) Log(1+Patent Application)	(2) Exploitative	(3) Exploratory
NIPS Exposure × Post NIPS	-0.066**	0.037***	-0.040***
	(0.027)	(0.006)	(0.014)
Firm Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	4,392	4,392	4,392
Adjusted R-squared	0.813	0.446	0.558

Panel B. Including Industry × Year Fixed Effects

	(1) Log(1+Patent Application)	(2) Exploitative	(3) Exploratory
NIPS Exposure × Post NIPS	-0.058***	0.011**	-0.028***
	(0.021)	(0.005)	(0.010)
Firm Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes	Yes
Observations	10,610	10,610	10,610
Adjusted R-squared	0.898	0.475	0.568

(Table 3 continued)

Panel C. Using TRIPS as Alternative Shock

	(1) Log(1+Patent Application)	(2) Exploitative	(3) Exploratory
TRIPS Exposure × Post TRIPS	-0.086**	0.011*	-0.064***
	(0.036)	(0.006)	(0.018)
Firm Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	8,544	8,544	8,544
Adjusted R-squared	0.876	0.373	0.461

Panel D. Excluding the Financial Crisis Period (2008-2009)

	(1) Log(1+Patent Application)	(2) Exploitative	(3) Exploratory
NIPS Exposure × Post NIPS	-0.047**	0.016***	-0.036***
	(0.023)	(0.005)	(0.013)
Firm Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	7,843	7,843	7,843
Adjusted R-squared	0.831	0.453	0.558

Table 4: Mechanism - NIPS and Patent Litigation Risk

The table examines the effects of China's National Intellectual Property Strategy (NIPS) on U.S. firms' patent litigation risks using the difference-in-differences estimation. *NIPS Exposure* is a firm-level indicator variable, which takes the value of one if either the focal firm or any of its 25 closest product market rivals have Chinese market exposure prior to NIPS and zero otherwise. *Post NIPS* is an indicator that takes the value of one after NIPS and zero otherwise. In columns 1 and 2, the dependent variable is *Log (1+Number of Defendant Cases)*, which is the log of one plus the total number of defendant cases. In columns 3 and 4, the dependent variable is *Log (1+Number of Plaintiff Cases)*, which is the log of one plus total number of plaintiff cases. All regressions include firm and year fixed effects. Appendix A provides the detailed definitions of the variables used in the table. The heteroscedasticity-robust standard errors are reported in parentheses and clustered at the industry-year level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	Log(1+Number of Defendant Cases)		Log(1+Number of Plaintiff Cases)	
	(1)	(2)	(3)	(4)
NIPS Exposure × Post NIPS	0.053***	0.052***	0.008	0.007
	(0.013)	(0.013)	(0.010)	(0.010)
Size		0.035***		0.020***
		(0.007)		(0.005)
Leverage		0.048*		-0.008
		(0.029)		(0.019)
Profitability		-0.067***		-0.017
		(0.024)		(0.022)
Tobin's Q		-0.002		-0.002
		(0.004)		(0.004)
Cash Flow Volatility		-0.044		-0.031
		(0.045)		(0.039)
1 - HHI		-0.083		-0.033
		(0.152)		(0.098)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	10,914	10,914	10,914	10,914
Adjusted R-squared	0.529	0.530	0.420	0.420

Table 5: Mechanism - Hedging Effects of Innovation Strategy

The table examines the effects of exploitative innovation strategy on defendant firms' future patent litigation risks over the next one to four years. The dependent variable is *Log (1+Number of Defendant Cases in Year)*, which is the log of one plus the number of defendant cases in year t+1, t+2, t+3 and t+4, respectively. *Exploitative* denotes the percentage of a patent's citations made by the patentee firm's existing patents and the citations made by those patents (Gao et al. (2018)). All regressions include firm and year fixed effects. Appendix A provides the detailed definitions of the variables used in the table. The heteroscedasticity-robust standard errors are reported in parentheses and clustered at the industry-year level. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively.

	Log (1+Number of Defendant Case in Year)			
	(1)	(2)	(3)	(4)
	t+1	t+2	t+3	t+4
Exploitative × Log(1+Number of Defendant Cases)	-0.075	-0.362***	-0.243*	-0.386**
	(0.147)	(0.122)	(0.133)	(0.186)
Exploitative	-0.015	0.262	-0.136	-0.297
	(0.293)	(0.312)	(0.399)	(0.385)
Log(1+Number of Defendant Cases)	-0.011	-0.091***	0.009	0.041
	(0.031)	(0.034)	(0.038)	(0.041)
Size	0.018**	0.006	-0.003	0.003
	(0.008)	(0.009)	(0.009)	(0.012)
Leverage	0.037	0.015	0.059	-0.016
	(0.024)	(0.035)	(0.040)	(0.044)
Profitability	-0.012	0.034	0.034	0.010
	(0.024)	(0.024)	(0.030)	(0.044)
Tobin's Q	-0.007**	-0.006	-0.003	-0.000
	(0.003)	(0.004)	(0.005)	(0.005)
Cash Flow Volatility	-0.041	0.007	0.035	0.159
	(0.038)	(0.054)	(0.062)	(0.112)
1 - HHI	-0.118	-0.316	-0.293	-0.010
	(0.140)	(0.205)	(0.184)	(0.234)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	10,912	8,480	6,448	4,583
Adjusted R-squared	0.583	0.640	0.651	0.687

Table 6: Mechanism - Product Market Fluidity, Defendant Risk, and Innovation

The table reexamines the effects of China's National Intellectual Property Strategy (NIPS) on U.S. firms' innovation outcomes by high and low product market fluidity (Hoberg et al., 2014) firms in difference-in-differences estimations. *NIPS Exposure* is a firm-level indicator variable, which takes the value of one if either the focal firm or any of its 25 closest product market rivals have Chinese market exposure prior to NIPS and zero otherwise. *Post NIPS* takes the value of one after NIPS and zero otherwise. Panel A consists of firms with high product market fluidity, based on the sample median product market fluidity in 2007. Panel B consists of firms with low product market fluidity. The dependent variable in column 1 is *Log (1+Number of Defendant Cases)*, which is the log of one plus the total number of defendant cases. In columns 2 through 4, the dependent variables are corporate innovation outcomes: the log of one plus the number of patent applications (*Log(1+ Patent Application)*) in column 2, exploitative innovation proxy (*Exploitative*) in column 3, and exploratory innovation proxy (*Exploratory*) in column 4. All regressions include firm and year fixed effects. Appendix A provides the detailed definitions of the variables used in the table. The heteroscedasticity-robust standard errors are reported in parentheses and clustered at the industry-year level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Sub-sample with High Product Market Fluidity

	(1) Log(1+Number of Defendant Cases)	(2) Log(1+Patent Application)	(3) Exploitative	(4) Exploratory
NIPS Exposure × Post NIPS	0.078***	-0.077**	0.024**	-0.033**
	(0.019)	(0.034)	(0.010)	(0.015)
Firm Controls	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	4,625	4,625	4,625	4,625
Adjusted R-squared	0.586	0.885	0.519	0.534

Panel B. Sub-sample with Low Product Market Fluidity

	(1) Log(1+Number of Defendant Cases)	(2) Log(1+Patent Application)	(3) Exploitative	(4) Exploratory
NIPS Exposure × Post NIPS	0.015	-0.030*	-0.004	0.000
	(0.016)	(0.018)	(0.006)	(0.014)
Firm Controls	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	5,014	5,014	5,014	5,014
Adjusted R-squared	0.461	0.744	0.453	0.596

Table 7: The Effects of NIPS on Product Similarity

The table examines the effects of China's National Intellectual Property Strategy (NIPS) on U.S. firms' innovation outcomes using the difference-in-differences estimation. We measure product similarity using the text-based network industry classifications (TNIC-3 classification) from Hoberg and Phillips (2016). *NIPS Exposure* is a firm-level indicator variable, which takes the value of one if either the focal firm or any of its 25 closest product market rivals have Chinese market exposure prior to NIPS and zero otherwise. *Post NIPS* takes the value of one after NIPS and zero otherwise. The dependent variables are the average pairwise similarity scores among the 25, 50, and 100 closest rivals, scaled by the sample average score. All regressions include firm and year fixed effects. Appendix A provides the detailed definitions of the variables used in the table. The heteroscedasticity-robust standard errors are reported in parentheses and clustered at the industry-year level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	Average $TNIC_{t+1}$		
	Within 25 Closest Rivals (1)	Within 50 Closest Rivals (2)	Within 100 Closest Rivals (3)
NIPS Exposure × Post NIPS	0.180***	0.146***	0.041**
	(0.044)	(0.038)	(0.020)
Size	-0.117***	-0.051*	0.002
	(0.041)	(0.028)	(0.014)
Leverage	0.103	-0.086	-0.054
	(0.135)	(0.099)	(0.054)
Profitability	0.128	0.079	0.051
	(0.179)	(0.140)	(0.074)
Tobin's Q	-0.027	-0.039**	-0.003
	(0.018)	(0.016)	(0.008)
Cash Flow Volatility	0.298	0.549*	-0.098
	(0.370)	(0.295)	(0.147)
1 - HHI	0.947	0.549	0.046
	(0.829)	(0.679)	(0.339)
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	9,139	9,139	9,139
Adjusted R-squared	0.815	0.756	0.636

Appendix A. Variable Definition

Variable Name	Definition
Post NIPS	An indicator that equals one after China's IP reform in 2008 and zero otherwise
NIPS Exposure	An indicator that equals one for firms whose 25 closest peers have Chinese market exposure prior to NIPS in 2008 and zero otherwise
Log(1+Number of Defendant Cases)	Logarithm of one plus the total number of defendant cases in a certain year
Log(1+Number of Plaintiff Cases)	Logarithm of one plus the total number of plaintiff cases in a certain year
Log(1+ Patent Application)	Logarithm of one plus the number of patent applications in a certain year
Exploitative	A percentage of a patent's citations made by the patentee firm's existing patents and the citations made by those patents (Gao et al. (2018))
Exploratory	A percentage of a patent's citations made *not* by the patentee firm's existing patents or the citations made by those patents (Gao et al. (2018))
High (low) Product Market Fluidity	An indicator that equals one if four-digit SIC industry average product market fluidity in the pre-period is greater (lower) than the sample median *Product Market Fluidity* from Hoberg et al. (2014).
Average TNIC within 25/50/100 Closest Rivals	Mean pairwise product similarity score of each firm-year with its 25/50/100 closest industry peers scaled by the sample average based on text-based network industry classification (TNIC) from Hoberg and Phillips (2016).
Size	Logarithm of total assets
Leverage	Book value of total debt divided by book assets
Profitability	Operating income before depreciation and amortization scaled by total assets
Tobin's Q	(Total assets - book value of equity + market value of equity) divided by total assets
Cash Flow Volatility	Earning volatility in the last 3 years
1-HHI	One minus the Herfindahl index of three-digit SIC industry measured at the end of fiscal year

Appendix B. Patent litigation summary statistics

Table A.1: Summary Statistics

	Mean	Std.dev	Min	Med	Max	Obs.
Litigation Length (years)	1.49	1.62	0.00	1.00	14.00	15,711
Plaintiff (indicator)	0.34	0.47	0.00	0.00	1.00	15,711
Plaintiff Win (indicator)	0.08	0.27	0.00	0.00	1.00	15,711
Defendant Win (indicator)	0.06	0.23	0.00	0.00	1.00	15,711
Dismiss (indicator)	0.74	0.44	0.00	1.00	1.00	15,711
Damages ($mil)	26.80	135.0	0.00	0.16	1,850	732

Table A.1 describes patent litigation cases. Our sample firms are linked to 15,711 unique patent litigation cases between 2005 and 2011 from *Lex Machina*. Of the 2,869 unique firms in our sample, close to 70% of firms have had at least one patent litigation and about 60% of firms have been a patent litigation defendant during the sample period. The average length of litigation from filing to termination is 1.5 years. This is comparable to previous studies that find an average lengths of litigation of 18 to 42 months (WIPO, 2018), 622 days for non-NPE litigation (Risch, 2014), and 443 days (Kesan and Ball, 2006). The sample firms are plaintiffs in approximately 34% of cases. Plaintiffs win 8% of cases and defendants win 6% of cases. The rest 74% of cases are dismissed before a verdict is delivered and the rest accounts for procedural transfers or likely settlement. However, firms in dismissed cases can still reach costly settlements. For example, Apple paid Qualcomm $4.5 billion to settle in 2019, and Samsung paid $539 million to settle with Apple in 2018.

Damages awards are not always reported in the case dockets. About 5% of our sample cases have litigation damages award reported. The mean value of reported damages awards is $26.8 million in our sample. Notably, our sample includes mega-award cases between 1997 and 2016 reported in PWC (2017).[1] The mean damages awards, excluding the cases with damages awards over $500 million, is approximately $12.4 million.

[1]These are Centocor Ortho Biotech v. Abbott Laboratories, Lucent Technologies Inc. v. Microsoft Corp, Apple v. Samsung Electronics, Monsanto Company v. E.I. Du Pont De Nemours, Cordis Corp. v. Medtronic Vascular, and Bruce N. Saffran M.D. v. Johnson& Johnson. The damages awards for these mega cases range between $500 million and $1.7 billion.

Table A.2: Pre-NIPS Condition Comparison

The table presents a comparison of pre-NIPS conditions. In Panel A, we present the summary statistics for the full sample, which consists of 5,159 firm-year observations (3,332 firm-year observations with NIPS Exposure and 1,827 firm-year observations without NIPS Exposure). In Panel B, we present the summary statistics for the propensity score matched sample, which consists of 868 firms (434 treatment firms with NIPS Exposure and 434 control firms without NIPS Exposure) over the pre-NIPS period of 2005 to 2007. *NIPS Exposure* is a firm-level indicator variable, which takes the value of one if either the focal firm or any of its 25 closest product market rivals have Chinese market exposure prior to NIPS and zero otherwise. We obtain the control sample by estimating the likelihood of *NIPS Exposure* using firm size, leverage, profitability, Tobin's Q, cash flow volatility, the SIC 3-digit level industry-year characteristics (HHI, industry-level growth rate of patent number, industry median R&D scaled by total assets, industry median profit margin) and the NAICS 6-digit level industry-year China Import from the US Census as the explanatory variables. We then use the predicted probability to match, without replacement, a treated firm with a control firm in the same industry and year with the closest propensity score using a caliper of 0.01. Appendix A provides the detailed definitions of the variables used in the table. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Full Sample

	NIPS Exposure=1 (N=3,343)		NIPS Exposure=0 (N=1,816)		Mean Difference	t-stat
	Mean	Median	Mean	Median		
Size	6.12	6.14	4.85	4.77	1.27***	20.15
Leverage	0.17	0.12	0.16	0.09	0.01**	2.26
Profitability	0.05	0.10	0.01	0.09	0.04***	6.83
Tobin's Q	1.95	1.56	1.88	1.46	0.07*	1.82
Cash Flow Volatility	0.05	0.02	0.06	0.03	-0.01***	-6.20
1 - HHI	0.87	0.90	0.86	0.88	0.01***	2.90
Ave. Ind. Patent Growth Rate	-0.04	-0.08	-0.05	-0.09	0.01	0.68
Ind. Med. R&D	0.08	0.08	0.08	0.08	0.00	0.25
Ind. Med. Profit Margin	-0.03	0.07	-0.03	0.07	0.00	0.52
Ind. China Import	1.02	0.02	0.85	0.02	0.17*	1.88

Panel B. Propensity-score Matched Sample

	NIPS Exposure=1 (N=422)		NIPS Exposure=0 (N=422)		Mean Difference	t-stat
	Mean	Median	Mean	Median		
Size	4.88	4.82	4.97	4.83	-0.08	-0.58
Leverage	0.15	0.06	0.16	0.09	-0.01	-0.37
Profitability	-0.01	0.06	-0.01	0.08	0.00	0.23
Tobin's Q	1.96	1.57	1.87	1.50	0.09	0.95
Cash Flow Volatility	0.06	0.03	0.06	0.03	0.00	0.30
1 - HHI	0.89	0.95	0.88	0.92	0.01	1.49
Ave. Ind. Patent Growth Rate	-0.16	-0.16	-0.18	-0.16	0.02	1.10
Ind. Med. R&D	0.09	0.08	0.09	0.08	0.00	0.63
Ind. Med. Profit Margin	-0.04	0.08	-0.03	0.08	-0.01	-0.52
Ind. China Import	1.52	0.12	1.23	0.10	0.29	1.04

Table A.3: NIPS and Patent Litigation Risk - Peer Exposure

The table examines the effects of China's National Intellectual Property Strategy (NIPS) on U.S. firms' innovation outcomes using the difference-in-differences estimation. *NIPS Exposure (N Closest Rivals)* is a firm-level indicator variable, which takes the value of one if either the focal firm or any of its *N* closest product market rivals have Chinese market exposure prior to NIPS and zero otherwise. *Post NIPS* is an indicator that takes the value of one after NIPS and zero otherwise. The dependent variable is *Log (1+Number of Defendant Cases)*, which is the log of one plus the total number of defendant cases. Appendix A provides the detailed definitions of the variables used in the table. The heteroscedasticity-robust standard errors are reported in parentheses and clustered at the industry-year level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	Log(1+Number of Defendant Cases)			
	(1)	(2)	(3)	(4)
NIPS Exposure (15 Closest Rivals) × Post NIPS	0.059***			
	(0.013)			
NIPS Exposure (25 Closest Rivals) × Post NIPS		0.052***		
		(0.013)		
NIPS Exposure (50 Closest Rivals) × Post NIPS			0.021**	
			(0.009)	
NIPS Exposure (100 Closest Rivals) × Post NIPS				0.014*
				(0.009)
Size	0.036***	0.035***	0.019***	0.019***
	(0.007)	(0.007)	(0.005)	(0.005)
Leverage	0.048*	0.048*	0.027	0.026
	(0.029)	(0.029)	(0.021)	(0.021)
Profitability	-0.066***	-0.067***	-0.031*	-0.031*
	(0.024)	(0.024)	(0.018)	(0.018)
Tobin's q	-0.003	-0.002	-0.001	-0.001
	(0.004)	(0.004)	(0.003)	(0.003)
Cash Flow Volatility	-0.039	-0.044	-0.035	-0.034
	(0.045)	(0.045)	(0.036)	(0.036)
1 - HHI	-0.081	-0.083	0.060	0.063
	(0.152)	(0.152)	(0.096)	(0.096)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	10,902	10,914	10,921	10,921
Adjusted R-squared	0.530	0.530	0.374	0.374

Table A.4: Pre and Post Comparison among Treated Sample

The table presents the summary statistics for the sample with NIPS Exposure (treated sample) over the full sample period from 2005 to 2012. *NIPS Exposure* is a firm-level indicator variable, which takes the value of one if either the focal firm or any of its 25 closest product market rivals have Chinese market exposure prior to NIPS and zero otherwise. We split this sample into firms with focal exposure and peer exposure to NIPS. *Focal Exposure to NIPS* takes the value of one if a firm has Chinese market exposure (direct sales). *Peer Exposure to NIPS* takes the value of one if a firm has no focal exposure to the Chinese market (direct sales), but any of the 25 closest product market rivals have Chinese market exposure. *Post NIPS* is an indicator that takes the value of one after NIPS and zero otherwise. Appendix A provides the detailed definitions of the variables used in the table. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Pre-NIPS Period

	Focal Exposure to NIPS (N=478)		Peer Exposure to NIPS (N=2,865)		Mean Difference	t-stat
	Mean	Median	Mean	Median		
Log(1+Number of Defendant Cases)	0.26	0.00	0.13	0.00	0.13***	6.95
Log(1+Number of Plaintiff Cases)	0.14	0.00	0.08	0.00	0.06***	4.40
Log(1+Patent Application)	1.98	1.39	1.31	0.69	0.67***	8.30
Exploitative	0.06	0.00	0.05	0.00	0.01**	2.18
Exploratory	0.67	0.86	0.60	0.82	0.07***	3.25
Size	6.11	5.92	6.12	6.19	-0.01	-0.11
Leverage	0.16	0.10	0.17	0.13	-0.01	-1.50
Profitability	0.04	0.09	0.05	0.10	-0.01	-0.67
Tobin's Q	2.01	1.73	1.94	1.53	0.07	1.04
Cash Flow Volatility	0.04	0.03	0.05	0.02	-0.00	-1.14
1 - HHI	0.90	0.94	0.87	0.90	0.03***	5.97
Ave. Ind. Patent Growth Rate	-0.04	-0.09	-0.04	-0.08	0.00	0.17
Ind. Med. R&D	0.09	0.09	0.08	0.08	0.02***	4.65
Ind. Med. Profit Margin	-0.02	0.07	-0.03	0.08	0.00	0.14
Ind. China Import	1.69	0.13	0.91	0.02	0.78***	4.93

Panel B. Post-NIPS Period

	Focal Exposure to NIPS (N=516)		Peer Exposure to NIPS (N=3,267)		Mean Difference	t-stat
	Mean	Median	Mean	Median		
Log(1+Number of Defendant Cases)	0.35	0.00	0.21	0.00	0.14***	6.27
Log(1+Number of Plaintiff Cases)	0.16	0.00	0.08	0.00	0.08***	5.36
Log(1+Patent Application)	2.24	1.95	1.45	0.69	0.80***	9.97
Exploitative	0.10	0.02	0.07	0.00	0.03***	3.70
Exploratory	0.62	0.75	0.58	0.75	0.04**	2.31
Size	6.65	6.61	6.45	6.52	0.20**	1.98
Leverage	0.17	0.15	0.18	0.14	-0.00	-0.37
Profitability	0.09	0.12	0.06	0.11	0.02***	2.87
Tobin's Q	1.56	1.38	1.51	1.18	0.05	1.00
Cash Flow Volatility	0.04	0.02	0.05	0.03	-0.01***	-2.81
1 - HHI	0.89	0.94	0.86	0.89	0.04***	6.21
Ave. Ind. Patent Growth Rate	0.09	0.03	0.06	0.04	0.02	1.48
Ind. Med. R&D	0.10	0.09	0.08	0.08	0.02***	5.89
Ind. Med. Profit Margin	0.03	0.07	0.04	0.09	-0.02*	-1.95
Ind. China Import	0.71	0.00	0.53	0.00	0.18	1.39

Table A.5: The Effects of NIPS on Innovation - Additional Robustness Test

The table presents the results of robustness tests for the effects of China's National Intellectual Property Strategy (NIPS) on U.S. firms' innovation outcomes using the difference-in-differences estimation in Table 2 by excluding focal firms with direct sales in China (focal-exposure firms). *NIPS Exposure* is a firm-level indicator variable, which takes the value of one if either the focal firm or any of its 25 closest product market rivals have Chinese market exposure prior to NIPS and zero otherwise. *Post NIPS* is an indicator that takes the value of one after NIPS and zero otherwise. All regressions include firm and year fixed effects. Appendix A provides the detailed definitions of the variables used in the table. The heteroscedasticity-robust standard errors are reported in parentheses and clustered at the industry-year level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	(1) Log(1+Number of Defendant Cases)	(2) Log(1+Patent Application)	(3) Exploitative	(4) Exploratory
NIPS Exposure × Post NIPS	0.044***	-0.064***	0.011***	-0.021**
	(0.014)	(0.021)	(0.004)	(0.010)
Size	0.027***	0.124***	0.021***	0.005
	(0.007)	(0.021)	(0.005)	(0.008)
Leverage	0.063**	-0.069	-0.025	-0.081***
	(0.030)	(0.064)	(0.016)	(0.027)
Profitability	-0.047**	-0.104	0.009	-0.046
	(0.023)	(0.075)	(0.015)	(0.032)
Tobin's q	-0.004	0.011	-0.007***	0.006*
	(0.003)	(0.007)	(0.002)	(0.004)
Cash Flow Volatility	-0.045	-0.110	0.070**	0.076
	(0.047)	(0.149)	(0.035)	(0.059)
1 - HHI	-0.059	0.223	0.046	0.055
	(0.148)	(0.203)	(0.039)	(0.123)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	9,479	9,479	9,479	9,479
Adjusted R-squared	0.508	0.896	0.363	0.566