Speed vs. Length of Patent Protection
Evidence from innovations patented in U.S and China

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Abstract

The time delay in patent grant and the fixed term in patent protection diminish its value as an incentive in research. The demand for IP protection is reflected in firm's strategies for applying and maintaining patents. We examine the characteristics of patent application and renewal behaviors by combining information about inventions that are both filed in China and the United States. The Chinese patent regime provides two types of patents (for product innovation only) that reflect applicants' willingness to secure fast granted but short patents versus slowly granted but long patents. By using this choice as a proxy for applicants' demand for patent protection, we find consistent patenting strategies across the two patent offices. These results suggest that applicants differ in their preference over time delay and length of patent protection; those who values fast grant more than duration opt to protect valuable inventions with the fast and short patent protection.

JEL classification: O34, O38.

Keywords: Patent Protection, Speed, Length, Invention Patent, Utility Model

1 INTRODUCTION

The primary function of patent regime is to provide incentive for research and development (R&D). Firms engage in research and production often require their inventions to be protected by effective patent rights. In the United States, it normally takes several years for a pending patent application to be issued. In addition, the patent is protected for a fixed term of 20 years. Firms, when choosing to file for patent protection, needs to adjust their strategies to make sure that patents are able to meet the requirements for product commercialization and technology partnership. An empirical analysis of how patenting behaviors are related to intellectual property strategies provides a useful insight towards understanding the effectiveness of patent in promoting R&D.

We take an initial step, by analyzing firms' IP strategies with respect to two specific and, we believe fundamental, dimensions with regard to patent protection: how fast firms want their patents to be granted and how long they would like their patents to be protected. Empirical effort is emphasized on providing statistical characterization of patent applications and renewals in the United States. Since firms seek patents for a variety of reasons[2], it is in general hard to directly quantify their demands for different attributes of patent protection. We address this concern by employing a *revealed preference* approach. The State Intellectual Patent Office of China (SIPO) provides two types of patents for product innovations: invention patent and utility model. The invention patent is the conventional patent that requires substantial examination and protects for 20 years. The utility model is granted almost "immediately" (on average 14 months) after application and is protected for only 10 years. Patent applicants' choices of which patent to file, therefore, reveal their joint strategies of speed and length of patent protections. We therefore select inventions that are both filed for patents first

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[2]Reasons for patenting include prevention of copying, earning of licensing revenue, blocking others' patenting, increasing patent portfolio for cores-licensing and prevention of infringement suits, enhancing reputation and product image, and for start-ups, improving chances of securing imvestment. See, for example, Cohen, Nelson, and Walsh 2000, Hall and Ziedonis 2001, Gans, Hsu, and Stern 2008, Graham et al. 2009

in China and then in the United States (henceforth SIPO-USPTO patent dyads with Chinese priority) as our sample of investigation[3].

It should be noted that the short examination delay of utility model is at the cost of no substantial examination[4]. Previous studies have pointed out that utility model is designed to serve as a stimulus to domestic inventive activities, and to protect minor innovations (Bosworth and Yang 2000). The evidences suggest, in China, patent applicants in general choose utility model because they do not have inventions that are innovative enough to be granted invention patent. However we focus on patents that are included in SIPO-USPTO dyads. This selection has two advantages. The USPTO employ a uniform and rigorous patent examination standard. Patentability standards are presumably at least comparable to the patentability standard for invention patent at SIPO[5] . Furthermore, application fees at USPTO are much higher than those at SIPO[6]. Thus the *ex-ante* private values of these inventions should at lease exceed the minimum values of invention patents in China.

Our empirical findings suggest at the United States Patent and Trademark Office, applicants' patenting and renewal behaviors are strongly correlated with their choices of invention patents and utility models at SIPO in a way that is consistent with previous economics of innovation literature. For example, U.S. patentees who have chosen to utility model for the same invention in China are distributed among fast moving technology fields such as Electrics&Electronics and Mechanics, while those who opted for invention patents are mostly in Chemicals, Drugs&Medicals. This finding is consistent with the survey literature that reveals patent's heterogeneous effectiveness in recouping investment of R&D across different industries (Cohen, Nelson, and Walsh 2000). Even with the same technology fields, patent applicants that opted for utility model at SIPO deliberately choose patenting strategies to secure early patent grants at USPTO but only keep the patents in force for short periods. Specifically, patentees are more likely to file U.S. patent applications at early dates, less likely to pursue continuing patent applications (which significantly delays patent issue) and conditioning on filing for continuations, file them early. These findings suggest in China, patent applicants have different preferences for patent protections. Applicants that favor fast patent grant but are not bothered by the short protection period prefer utility model to invention patent.

In 2011, USPTO offers a fast track (Track One) patent examination that guarantees office action within 12 months of patent application[7]. Perhaps, a more direct way to empirically analyze patenting strategies is to examine the statistical patterns of USPTO patent applications relating to their choices of filing fast track. However, since the policy was implemented in mid 2011 and is relatively new, we were unable to acquire a dataset sufficiently large to conduct interesting econometric analyses. Our study offers early insights on the likely response of inventors to the "fast-track" system at USPTO.

There is, at least, another reason why we should be interested in the patterns of flexibility in patent protection. Recent literatures on the effectiveness of patents have revealed that patent protection is ranked at bottom among a list of mechanisms in appropriating returns to R&D (Levin et al. 1987; Cohen, Nelson, and Walsh 2000) except for pharmaceutical innovations. One of the possible explanations is that the current patents (slow grant and fixed term) are not catering to the specific demands for heterogenous applicants, creating a negative incentive in R&D.

The idea that a uniform patent system might distorts innovation has been discussed in previous literature. For example, Budish, Roin, and Williams 2013 discusses how a fixed patent term could distort research incentives. But to our best knowledge, this paper is the first to empirically demonstrate the applicants' heterogeneous demand for speed and length of patent protections. This topic relates to the previous literature on the discussion of optimal patent regime with respect to maximizing social welfare. Previous studies

[3]U.S. firms seldom file for utility models in China due to their understanding of a relatively low enforcement strength related to utility model. Therefore, including the USPTO-SIPO patent dyads with U.S. priority essentially will not add further insight into our analysis.

[4]Grant of utility model only requires preliminary check of formality. See e.g. *Patent Law of the People's Republic of China 2008*.

[5]The grant of invention patent at SIPO requires substantial examination of novelty, non-obviousness and practicability. See e.g. *Patent Law of the People's Republic of China 2008.*

[6]The application fee at USPTO for a (non-provisional) patent is over 6 times of that for invention patent.

[7]The program allows applicants, willing to pay additional special fees ($4,950 for large entities and $2,550 for small entities) to request for prioritized examination that guarantees a final decision within twelve months of the filing date (Track 1). Applicants can also request a delayed examination for up to 30 months (Track 3), or the standard examination (Track 2).

have pointed out that a uniform patent system provides distorted R&D incentives to firms and causes misallocation of resources across industries (Cornelli and Schankerman 1998; O'Donoghue and Zweimüller 2004). The existing literature focuses primarily on the U.S. and European patent system and hence does not pay much attention on the utility model patents. Japanese and Korean scholars emphasize evaluating invention patents in their own countries[8]. This study will contribute to the literature by analyzing an less-understood patent policy that exists in over 70 patent-issuing countries in the world[9].

Our paper also makes a methodological contribution to the literature on patent evaluation, by providing a novel perspective on the use of patent renewals as indicators of private patent value[10] In our sample, inventions filed with Chinese utility models and U.S. patents are less frequently renewed than inventions filed with Chinese invention patent and U.S. patents. Given that filing overseas at USPTO is considerably more expensive, this empirical result is not consistent with the understanding that utility models represent less valuable inventions. Rather, they are abandoned sooner because the flow of value they bring to the patentees is more heavily weighted toward the early years of patent life. The value flow is likely to be high in the early years for these patents, but to decline quickly to a level at which marginal expected returns are insufficient to justify further renewal expenditure.

The paper shed lights on a growing research line that explores patentee behavior regarding equivalent inventions in different patent systems, offering insight into firm patenting strategies as well as institutional differences across patent systems (Graham et al. 2009, Harhoff, Scherer, and Vopel 2003).

The remaining of this article is organized as follows. Section 2 presents a brief comparison of the policy designs for Chinese invention patent and utility model. Section 3 summarizes hypotheses about the determinants of patenting strategies. Section 4 describes the construction of the dataset and our empirical strategy. In Section 5 we describe the results of our empirical estimations. Section 6 provides brief concluding remarks.

2 China's two-tier patent protection for industrial product inventions

At SIPO, allowance of an invention patent requires substantive examination of utility, novelty and non-obviousness, and confers a statutory patent life of 20 years. By contrast, grant of a utility model, available only for product inventions offers a maximum term of 10 years but is quick and almost certain, as long as the applicant pays a (lower) filing fee and complies with the filing requirements. An applicant can simultaneously file "dual applications" at SIPO, for both an invention patent and a utility model, for the same invention. If both are granted eventually, he must choose one patent and abandon the other immediately[11].

SIPO does not hold responsibility in checking the technical quality of the utility model applications. Utility models are viewed as "petty" innovations that would not be qualified for invention patent[12]. However, they offer an advantage that might be crucial for patentees: quick patent allowance in an average of 14 months, as oppose to an average of 54 months for invention patents. If applicants wish to establish the validity of their utility model, they can *ex-post* obtain substantive examination reports form the SIPO. Table 1 presents a detailed comparison of invention patents *versus* utility models in China.

Figure 1 illustrates the changes in the annual average grant lags of Chinese invention patents and utility models for the period 1985-2012. Invention patents are granted, on average, 1621 days (or 54 months) after application with a minimum of 732 days and a maximum of 2148 days. Utility models, on the other hand, are granted 434 days (14 months) with a minimum of only 199 days

[8] See e.g. Gallini and Scotchmer (2002) for an excellent literature review for the optimal design of patent system.

[9] Patent offices in many countries, including developed countries such as Germany, Denmark, Greece, Spain, France, Ireland Italy, Netherlands, Austria, Portugal, Finland, Japan and South Korea, also provide some form of utility model protection. See Suthersanen 2006.

[10] See Lanjouw, Pakes, and Putnam 1998 for a review of this literature. Also, see Schankerman and Pakes 1987, Schankerman 1998, Bessen 2008.

[11] See e.g. *Patent Law of the People's Republic of China 2008*.

[12] However, Chinese observers advise us that in infringement suits, utility models are not necessarily more likely to be invalidated. Further, Chinese damages for infringing a utility model can be very high. The recent IP enforcement case in China, *Chint vs Schneider Electric* marked a record breaking damage award of $ 45 million rendered for patent infringement. See http://www.law360.com/articles/37050/ip-enforcement-in-china-chint-v-schneider-electric

and a maximum of 599 days. In addition, there is a large variation in the trend associated with the invention patent: the grant lag increases significantly during the period 1985-1995 and decreases constantly afterwards. In contrast, the trend for the utility model is more stable. Through out the period, the average grant lags at a given year of utility model ranges from 19% to 37% of that of invention patents with an average of only 27%, slightly less than one third. Compared to invention patent, the utility model offers a much quicker and much more reliable time line for receiving patent.

Besides quick in grant, another advantage of utility model is they are cheaper in application, attorney and renewal costs. This advantage is less likely to be relevant for this study, as the difference in these fees are relatively small given that the applicants in our data spent much more to apply for patents at USPTO (see footnote 5).

3 Firms' Heterogeneous Patenting Strategies

Patent protection can be viewed as a service bundled with multiple attributes such as scope and length of patent rights. Since firms seek patens for a variety of reasons, it is likely that they differ in their patenting strategies due to their heterogeneous demands for various attributes of patent protection.

With respect to the speed of patent grant, one would expect firms to desire fast patent protection for inventions with high prospective value flows but short product value horizon. Firms seeking patents for purposes such as attracting investment, meeting a venture capital fund's milestone date or increasing firm reputation might place especially high value on securing patent rights as quickly as possible. On the other hand, firms have also used patent continuations in the U.S. or "deferred examinations" in many other countries to delay patent issuance (Hall and Harhoff 2012).

In terms of length of patent protection, it is well understood that in industries featuring fast technology and product turnover (such as electronics and information technologies), value of patent protection declines quickly. Firms in these technologies may consider long patent protection to be unnecessary. However, the Hatch-Waxman Act offers drug patents an additional 30 months of patent protection, highlighting that the length of patent right is crucial for pharmaceutical companies.

Patent(s) secures the underlying invention's value by providing a temporary monopoly. We hypothesize that if an applicant has selected the Chinese utility model and also file an application (eventually granted) in the United States, it is likely that the value horizon of the protected invention starts at an early period but is also relatively short. The firm will follow a patenting strategy that pursues for a quick patent allowance but might not necessarily keep the patent in force for long. If the applicant instead has decided to file for invention patent, this means the value stream of the invention remains high enough beyond the protection term of utility model. We build our two empirical hypotheses based on the above theoretical arguments:

Hypothesis 1:
Firms that choose utility models in China care more about the speed of patent protection than those that choose invention patents.

Hypothesis 2:
Firms that choose utility models in China have a shorter value horizon than those that choose invention patents.

4 Empirical Strategy and Data

The dataset we use to test our hypotheses are a sample of Chinese invention patents and utility models that are also successfully granted patents in the United States. Since the USPTO requires substantial examination of every application's technical quality, it is very likely that the inventions protected by the utility models would have been qualified for invention patent in China, had them been

filed for.

Our sample includes 3660 SIPO-USPTO patent dyads whose Chinese patents have been filed at SIPO between January 1^{st} 1993 and December 31^{st} 2008. These dyads are collected by identifying U.S. patents with priority Chinese applications. The priority Chinese applications inform us whether applicants filed for invention patent and(or) utility models at SIPO before filing at USPTO. We further match Chinese priority applications with the Chinese patent dataset (1993-2012) to extract relevant information on the Chinese patents in the dyad data.. Among them, 2920 have Chinese invention patent priorities and 663 have utility model priorities; only 77 are "dual applications" at SIPO[13]. We exclude process innovations from the sample because they are not eligible for utility models in China[14]. "Dual applications" are also excluded.

As shown in Table 2, about 19% of SIPO-USPTO patent dyads in our sample involve a Chinese utility model. The percentages of Chinese utility models vary across different technologies. In the fields of Electrics & Electronics, Mechanicals and Others, where the lags between "date of invention" and "date of commercialization" tend to be relatively short one third to one half of patents are utility models. To the contrary, few utility model is seen in technologies such as Chemicals, Drugs & Medical and Computer & Communication, a group of less than 6% of total. The percentages of SIPO-USPTO patent dyads with Chinese utility models in Electrics & Electronics, Mechanicals and Others persist over time, as shown in Figure 2.

We use several metrics to measure applicant's patenting behaviors in order to secure early patent grants in the United States. First, we use the lags between the filing dates at SIPO and at USPTO[15] Here we assume that if speedy patent protection is important for the applicant in China, it will be important for him in the U.S. market and thus he should file an application quickly at USPTO. We compute three filing lags: (1) *Total Filing Lag*, the lag between the Chinese filing date and the last filing date at USPTO; (2) *Filing Lag*, the lag between the Chinese filing date and the first USPTO filing date or the date of entering the U.S. national stage for a PCT filing; (3) *Continuation Lag*, the lag between the first USPTO filing date and the last USPTO filing date if the U.S. patent has some history of continuation (and 0 otherwise). Second, since the first USPTO filing or PCT filing must occur within the grace period of one year after the Chinese filing date, we define an indicator, *Filing Last Minute*, taking value of 1 if the U.S. or PCT filing is filed in the last 10 days of the grace period[16]. Third, we use a dummy variable, *Continuation*, to indicate whether the applicant files continuation at USPTO before the U.S. patent gets granted. Our conjecture here is that if the applicant cares about the speed of patent protection, she should file at USPTO sooner, she might be less likely to file a continuation and, if she files a continuation, file it sooner. Finally, we look at the *Grant Lag* of the U.S. patent, from the last USPTo filing date to the grant date. Although much of the grant lag is related to the delay by examiners and bureaucracy at USPTO, we suspect that the grant lag is a noisy measure of how quickly the applicant responds during the examination, another indicator of his eagerness to obtain the patent sooner (Popp, Juhl, and Johnson 2003).

We use the renewal decisions of the U.S. patents in the sample to indicate how long the patentees are willing to keep their U.S. patents in force. If patentees expect their patents' market value is too low to justify renewals, they will stop renewing them. In particular, we use binary indicators, *Maintain 4*, *Maintain 8* and *Maintain 12*, to indicate whether a U.S> patent has been minted in force after 4, 8 and 12 years of issuance, respectively. We expect that the probability of maintaining patents should differ between U.S. patents with Chinese utility model and invention patent priorities.

[13]We identify "dual applications" by searching the entire Chinese patent dataset and looking for other applications that have similar abstract and identical ssignees and inventors. The titles for an invention patent and utility mode in an dual application are often not identical. The title for the utility model usually starts as "a product that...", while the title for the invention patent starts as "a method and product that..."

[14]We manually identify process innovations by reading the title and abstract of each patent in the sample. 441 U.S. patents on process innovations are excluded. The results largely hold if we do not exclude those patents.

[15]In our sample, a chinese applicant always files Chinese application at SIPO first, and then has his USPTO filing or PCT filing at WIPO within 12 months of the Chinese filing date. Before the 3^{rd} amendment to the Chinese patent law in 2008, for inventions made by Chinese entities, applicants had to file domestic applications before filing abroad.

[16]We test various cut-offs including last months, 10 days or the last day of the grace period. Results are qualitatively similar

5 Results

5.1 Comparison of Patent Quality: invention patents vs. utility models

First, we check whether there is any difference in patent quality between U.S. patents with Chinese invention patent and utility model priorities. We look at five indicators for patent quality: number of claims (Lanjouw and Schankerman 2004), number of patent classifications (Lerner 1994)[17], number of backward and forward citations (Hall, Jaffe, and Trajtenberg 2001; Harhoff, Scherer, and Vopel 2003)[18] and number of inventors.

Specifically, for a U.S. patent i in technology field j with USPTO filing year t, we estimate the following equation:

$$Y_{ijt} = \alpha_0 + \alpha_1 \cdot UM_i + u_j + v_t + \epsilon_{ijt} \tag{1}$$

where Y_{ijt} represents one of the five patent quality indicators above. The key regressor is UM_i, a binary variable that is equal to one if the patent has a Chinese utility model priority. We also includes technology and U.S. filing year fixed effects, u_j and v_t.

Results from OLS regressions are presented in Table 3. Controlling for technology fields and USPTO filing year fixed effects, there seems to be no significant differences between these two groups, except that patents with Chinese invention patent priority have more inventors (at the 5% level). The results lend further support to the claim that Chinese utility models in the sample are likely to quality for invention patent at SIPO.

5.2 Speed and Length of Patent Protection: Utility Models *vs.* Invention Patents

We test whether speedy patent protection is more important, and length of protection is less important, for U.S. patents with Chinese utility model priorities. As shown in Table 4, U.S. patents with Chinese utility model priorities have significantly shorter filing lags between SIPO filings and USPTO filings, are less likely to delay filing abroad until the end of the grace period, are less likely to file continuations, and have a shorter grant lag at USPTO[19]. Table 4 also shows that U.S. patents with Chinese utility model priorities have a short value horizon: they are less likely to be maintained by patentees by the end of the 4^{th}, 8^{th} and 12^{th} years, respectively, after grant.

To formally examine the two hypotheses, we run the following econometric specification:

$$Y_{ijt} = \alpha_0 + \alpha_1 \cdot UM_i + \alpha_2 \cdot X_i + u_j + v_t + \epsilon_{ijt} \tag{2}$$

where Y_{ijt} represents the indicators for demand for speed and length patenting strategies described above for U.S. patent i in technology field j with USPTO filing year t. We use OLS if the outcome variable is continuous and Logit if the outcome is a binary variable. The key variable of interest is UM_t. X_i include patent quality control variables. Technology and U.S filing year fixed effects, u_j and v_t, are also included.

Table 5 presents the results. The lag between Chinese filing dates and the last U.S. filing dates, *Total Filing Lag*, is 81 days shorter for U.S. patents with Chinese utility model priorities. This difference reflect variations both across and within technology fields. If we control for technology, u_j, the difference drops to 30 days, but is still significant at the 5% level. We then decompose *Total Filing Lag* into two components: *Filing Lag* and *Continuation Lag*. The difference in *Filing Lag*, the delay between the SIPO filing date and the fist USPTo filing date or the date of the PCT filing, is significant, averaging 35 days earlier for utility models. The difference becomes smaller and insignificant, though with the same sign after controlling for technology fields. Under our hypotheses, applicants want to file at USPTo sooner for inventions with Chinese utility model priorities. However, it is conceivable that it takes more time to confer

[17] Lerner 1994 uses number of international patent classificaionts (IPC). We use the number of U.S. patent classifications (USPC).

[18] An average U.S. patent in our sample has 13 claims, 2.78 inventors, 2.26 U.S. patent classifications, 12 cited references and receives 2.83 citations.

[19] Given that all these metrics are at best noisy measures of applicants' eagerness to secure patent protection, it is likely that the observe significant differences underestimate the actual difference in the focus on speed protection between the two groups of patent applications

a Chinese utility model application to a U.S appellation than Convert a Chinese invention patent application. This is one possible reason why the difference in *Filing Lag* is less significant when we add in u_j. *Continuation Lag*, the time lag between the first and the last filing date at USPTO, is also significantly shorter for utility models: 48 days and 27 days with or without controlling for u_j, respectively. If we, instead, focus on the subs maple of U.S. patents that filed continuations at USPTO, the results are much larger (not shown here): patents with Chinese utility model priorities have continuation lags 180 days less than those with invention patent priorities in the same technology fields (significant at 1% level).

Panel B of Table 5 shows that U.S. patents with Chinese utility models priorities are 12 percentage points less likely to be filed at USPTO in the last 10 yeas of the grace period, and3 percentage points less likely to be have continuations filed at USPTO. Their grant lags are 157 days shorter as well. Altogether, these results support our first hypothesis that appliance who desire a fast patent protection tend to file utility models in China.

In Panel C of Table 5, we test the second hypothesis that inventions filed for utility models at SIPO have a shorter value horizon. U.S. patents with Chinese utility model priorities are significantly less likely to be renewed at the 4^{th} year after grant. For the dyads in our sample, the 4^{th} year renewal decision at USPTO tends to come towards the late stage of the 10-year life of a Chinese utility model. This is because in our sample, the average lag between SIPO filing dates and USPTO grant dates is about 3.8 years. So a U.S. patent's 4^{th} year renewal is about 7.3-7.8 years after SIPO filing, towards the late stage of a utility model's 10 year patent term. U.S. patents with Chinese utility model priorities that are renewed at the 4^{th} (4^{th} and 8^{th}) year are also less likely to be maintained at the 8^{th} (12^{th}) year. The point estimates for *Maintain 8* and *Maintain 12* are negative and larger in absolute terms than those for *Maintain 4*. They are less significant when controlling for technologies, partly because of the reduction in sample size. Overall, these results suggest that applicants tend to protect these inventions with relatively short value horizons for relatively short periods.

6 Conclusion

This paper provides a first empirical study on patent applicants' heterogenous strategies for speed of patent grant and length of paten protection. We use a dataset of SIPO-USPTO patent dyads owned by Chinese inventors who first filed applications for patents in China. We investigate the linkage between the choice of utility models and invention patents in China and the subsequent filings and renewal decisions in the United States. The results suggest that applicants differ in their patenting strategies in terms of how fast they want patent to be granted and how long they want them to be protected. Applicants opt for the appropriate type of protection that best suit their needs and invention characteristics. Chinese inventors are willing to choose utility model even for inventions of substantial value in the world market.

Our study sheds empirical lights on the literature of optimal design of patent systems, and on the recent policies of officering various options of patent examination by major patent offices. The pater also makes a methodological contribution to the literature on patent evaluation, in particular with regard to using patent renewals as an indicator of patent value.

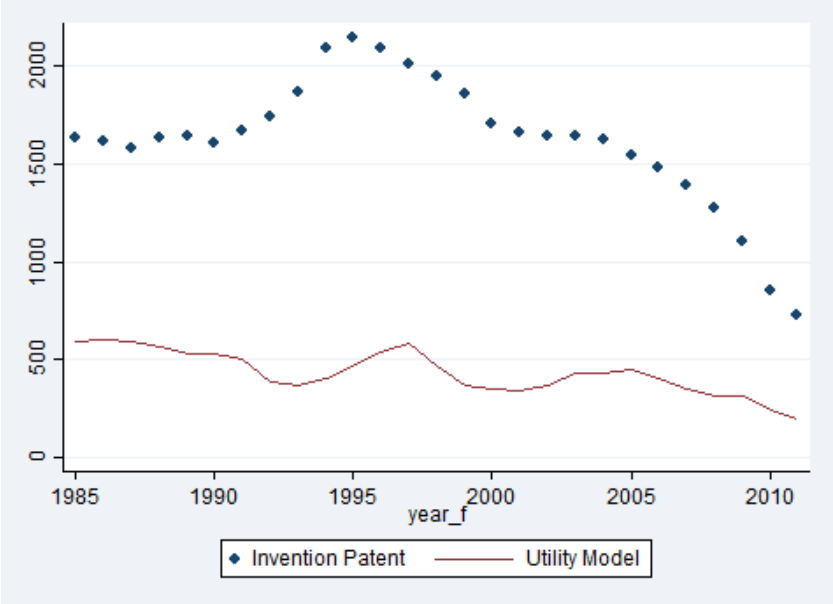

Figure 1: Invention Patent vs. Utility Models: delay in patent grant (days), 1985-2012

note: Mean grant lags for invention patents and utility models are estimated, using SIPO patent dataset which contains all Chinese patents with filing dates between 1985-2012. The cost of patent application and renewal are obtained from SIPO website at www.sipo.gov.cn.

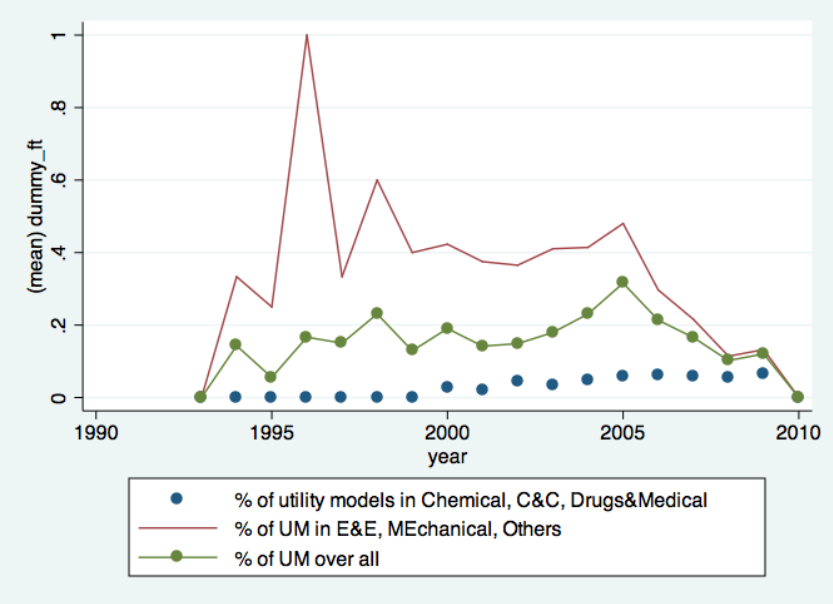

Figure 2: Percentage of U.S. patents with Chinese Utility Model Priority: U.S. application date 1993-2010

note: percentages of U.S. patents with Chinese utility model patents are estimated, using SIPO-USPTO patent dataset which contains all Chinese patents with filing dates between 1993-2008 and the corresponding U.S. patent applications with filing dates between 1993-2010.

Table 1: Invention Patents *vs.* Utility Models in China

	Invention Patent	Utility Model
Definition	Any new technical solution or improvement relating to a product or a process.	Any new technical solution or improvement relating to the shape, structure or their combination of a product.
Subject Matter	process and product innovations	product innovations
Patentability	substantial examination of novelty, non-obviousness and utility.	No substantial examination of novelty and non-obviousness.
Average Grant Lag	54 months	14 months
Term	20 years	10 years
Application (YMB):	950	500
Examination (YMB):	2500	N/A
Attorney fee (YMB):	4000-10000	2500-6000
Maintenance Fees (YMB) (annual renewal schedule)	900, $1^{st} - 3^{rd}$ years; 1200, $4^{th} - 6^{th}$ years; 2000, $7^{th} - 9^{th}$ years; 4000, $10^{th} - 12^{th}$ years; 6000, $13^{th} - 15^{th}$ years; 8000, $16^{th} - 20^{th}$ years;	600 $1^{st} - 3^{rd}$ years 900 $4^{th} - 5^{th}$ years 1200 $6^{th} - 8^{rth}$ years 2000 $9^{th} - 10^{th}$ years

Note: Mean grant lags for invention patents and utility models are estimated, using SIPO patent dataset which contains all Chinese patents with filing dates between 1985-2012. The cost of patent application and renewal are obtained from SIPO website at www.sipo.gov.cn. For attorney fees, we interviewed several lawyers from different law firms located in Beijing, China. We asked for the attorney fees they charge for invention patents and utility models, respectively. In general, law firms charge the same rate regardless of the locations of their clients.

Table 2: Distribution of Chinese Invention Patent and Utility Model Patent by Technology fields

Technology Fields	Invention Patent	Utility Model	Dual	% of U
Chemicals	473	15	5	3.26
Computer & Communication	714	44	5	5.95
Drugs & Medical	222	8	1	4.32
Electrics & Electronics	1029	334	28	25.10
Mechanicals	256	96	16	28.72
Others	226	156	22	39.49
Total	2920	663	77	19

note: The six technology fields are defined as in Hall, Jaffe, and Trajtenberg 2001, based on U.S. patent classifications. Sample includes SIPO-USPTO patent dyads with Chinese priorities between 1993-2008.

Table 3: Attributes of U.S. patents: Chinese invention patent priorities *vs.* Chinese utility model priorities

	No. of Claims	No. of Inventors	No. of USPC	No. of references made	No. of references received
	(1)	(2)	(3)	(4)	(5)
UM_i	-0.85	-0.45	-0.21	0.66	0.44
	(0.50)	(0.11)***	(0.25)	(0.57)	(0.26)
U.S. application year	yes	yes	yes	yes	yes
U.S. technology field	yes	yes	yes	yes	yes
N	3660	3660	3660	3660	3660
R^2	0.05	0.16	0.08	0.12	0.15

Notes: Patent-Level Observation. All estimates are from OLS models. Sample includes all USPTO (The United States Patent and Trademark Office) patent (applications) with Chinese Priority from 1993-2010 cohort. Heterogenous Robust standard errors are shown in parentheses. *: p<0.10; **: p<0.05; ***: p<0.01. Dependent variables are number of claims, inventors, U.S. patent classification, references made and references received. UM_i is a dummy variable indicating whether the U.S. patent has a Chinese utility model priority. *Application Year Dummies*: 0/1 indicator variable for application year. *Technology Field Dummies*: 0/1 indicator variables for technology fields (total of 6 technology classifications following Hall, Jaffe, and Trajtenberg 2001).

Table 4: Descriptive Statistic of U.S. Patents with Chinese Priorities: invention patent *vs.* utility model

	utility model (mean)	invention patent (mean)	difference (UM-IPat)
(A) Indicators for eagerness to secure patent protection			
Total Filing Lag	266.415	354	-87.586***
Continuation Lag	26.08	82.679	-56.60***
Continuation	0.047	0.135	-0.088***
Filing Last Minute	0.219	0.347	-0.128***
Grant Lag	958.101	1060.124	-102.023***
(B) Indicators for demand for length of patent protection			
Maintain 4	0.91	0.96	-0.05***
Maintain 8	0.53	0.64	-0.11***
Maintain 12	0.21	0.37	-0.16***

Note: Unites of *Total Filing Lag Continuation Lag*, *Grant Lag* are days; *Continuation*, *Filing Last Minute* and *Maintain 4 Maintain 8 Maintain 12* are binary indicators. * Significant at 10%; ** significant at 5%; *** significant at %.

Table 5: Regression results: U.S. patent with Chinese invention patent priority *vs.* Chinese utility model priority

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
	Total Filing Lag	*Total Filing Lag*	*Filing Lag*	*Filing Lag*	*Continuation Lag*	*Continuation Lag*
UM_i	-81.077	-29.991	-35.174	-4.253	-48.143	-27.076
	(33.372)**	(15.275)**	(16.592)**	(14.778)	(19.644)**	(10.573)**
N	3660	3660	3660	3660	3660	3660
R^2	0.11	0.14	0.08	0.13	0.06	0.08
Panel B						
	Filing Last Minute	*Filing Last Minute*	*Continuation*	*Continuation*	*Grant Lag*	*Grant Lag*
UM_i	-0.124	-0.051	-0.033	-0.077	-157.076	-84.339
	(0.042)***	(0.028)*	(0.014)**	(0.039)***	(49.623)**	(32.092)**
N	3660	3660	3660	3660	3660	3660
$Pseudo - R^2$	0.10	0.13	0.12	0.08	0.07	0.09
Panel C						
	Maintain 4	*Maintain 4*	*Maintain 8*	*Maintain 8*	*Maintain 12*	*Maintain 12*
UM_i	-0.094	-0.059	-0.16	-0.092	-0.17	-0.12
	(0.03)***	(0.029)**	(0.08)**	(0.061)	(0.083)**	(0.08)
N	1450	1450	653	653	269	269
$Pseudo - R^2$	0.11	0.12	0.09	0.23	0.44	0.21
U.S. application year	yes	yes	yes	yes	yes	yes
U.S. technology field	no	yes	no	yes	no	yes

Notes: Patent-Level Observation. Panel A estimates are from OLS models; Panel B and C estimates are from Logit models. Sample includes all USPTO (The United States Patent and Trademark Office) patent (applications) with Chinese Priority from 1993-2010 cohort. Heterogenous Robust standard errors clustered at firm level are shown in parentheses. *: p<0.10; **: p<0.05; ***: p<0.01. UM_i is a dummy variable indicating whether the U.S. patent has a Chinese utility model priority. In columns (1) and (2) of panel C, the dependent variable is a binary indicator for whether a U.S. patent is minted at the 4^{th} year after grant, and the sample includes patents whose U.S. issue years are no later than 2008. In columns (3) and (4) of panel C, the dependent variables is a binary indicator for whether a U.S. patent is maintained at the 8^{th} year after grant, conditioning on the patent has been renewal after 4 years of grant. The sample includes patents whose U.S. issue years are no later than 2004. In columns (5) and (6) of panel C, the dependent variables is a binary indicator for whether a U.S. patent is maintained at the 12^{th} year after grant, conditioning on the patent has been renewal after 8 years of grant. The sample includes patents whose U.S. issue years are no later than 2000. *Application Year Dummies*: 0/1 indicator variable for application year. *Technology Field Dummies*: 0/1 indicator variables for technology fields (total of 6 technology classifications following Hall, Jaffe, and Trajtenberg 2001). The results from specifications with sub-technology fields fixed effects (36 total), not shown here, are similar.

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