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Effectiveness of the Patent Prosecution Highway

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Abstract

Effectiveness of the Patent Prosecution Highway Vanessa Behrens. Center for European Economic Research (ZEW, Germany). Enrolled at KU Leuven University (Belgium) in 2014, expected completion of Ph.D. in 2018, behrens@zew.de. Keywords: Patent Prosecution Highway, accelerated patent examination, pendency. A rising number of patent applications combined with growing patent family size (i.e. seeking protection across more countries for the same invention) is a known cause for concern in the patent literature. Particularly because it has been associated with a growing patent backlog and increased pendency, which in turn could lead the patent system to become less attractive due to increased uncertainty and thereby have detrimental effects on innovation, knowledge diffusion as well as inefficiencies at the patent offices. Patent offices are seeking ways in which to increase efficiency of the application process by leveraging international cooperation. One such collaboration is the Patent Prosecution Highway (PPH), which has been established to avoid unnecessary duplication of work by increasingly using the search and examination results of other patent offices for the same invention, and thereby speeding up the examination process. State of the Art A joint paper by the USPTO and UKIPO (Mitra-Kahn et al., 2013) study the determinants of pendency at different stages of the application process, discuss the associated problems of increasing pendency (extra costs at the patent offices, increasing backlog, a positive correlation between pendency and abandonment etc.) and also provide suggestions on how to combat long grant lags. Gans et al. (2008) emphasize the increased uncertainty that results from longer pendency. They also empirically show the important role that the timing of patent issuance plays for achieving a

cooperative licensing agreement; the hazard rate significantly increases after the patent issuance. They also find that pendency plays a particularly important role for technological fields that are characterized by longer life cycles and where patents represent a particularly important appropriation mechanisms (e.g. in Biotech). Harhoff and Wagner (2009) find that applicants try to speed up the grant proceedings for their most valuable patent applications, but at the same time prolong the battle for those applications if a refusal is imminent. Numerous other papers have also found patent characteristics – such as the number of claims, citations or patent complexity, type of applicant – to be linked to the time it takes to process an application. Research Gap Despite these studies on the determinants and consequences of pendency, the literature has not yet provided empirical evidence on the effectiveness of the measures that are implemented to combat pendency using econometric approaches. This study tries to fill this gap by measuring how effective the PPH program has been in reducing the time it takes to process an application (pendency). We focus on the first PPH initiative which was implemented in June 2006 as a bilateral agreement between the USPTO and JPO. From the perspective of the USPTO, this means Japanese applications that filed a subsequent filing at the USPTO are able to request a fast track examination (i.e. request PPH) given that they meet some eligibility criteria. We are not aware of any literature that explores the relationship between pendency and the PPH specifically in an econometric framework. Theoretical Arguments We expect that the work-sharing character of the PPH will allow the patent offices to process applications faster and thereby reduce the total pendency. However, we also expect that other factors, such as patent value, patent complexity, technological classes and certain patent characteristics will influence pendency and therefore have to be controlled for. Method We have constructed a unique dataset by combining the USPTO Public PAIR Data with Patstat as well as an indicator that marks those applications that underwent the PPH (not publicly available). Our sample restricts to PPH-eligible applications at the USPTO that claim priority on Japanese patent application(s). Propensity Score Matching as well as Survival Analysis form the main econometric modelling techniques of the paper, but OLS and Tobit are also applied. The variables mentioned in the 'State of the Art' section are used as controls in addition to some others. Furthermore, pendency is split into three different stages in order to tease out effects of the patent office compared to applicant-induced delays. Still pending patents are also accounted for. Results Preliminary results of this paper find that applications which underwent PPH have an overall hazard rate of 1.43, and are therefore issued/abandoned significantly faster than non-PPH applications. OLS results indicate a reduction in overall pendency of around 12%, and interestingly this effect is much larger during the patent examination period, where applications that underwent PPH were examined 42% faster than their non-PPH counterparts.
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Effectiveness of the Patent Prosecution Highway

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Keywords: Patent Prosecution Highway, accelerated patent examination, pendency.

Abstract

A rising number of patent applications combined with growing patent family size (i.e. seeking protection across more countries for the same invention) is a known cause for concern in the patent literature. Particularly because it has been associated with a growing patent backlog and increased pendency, which in turn could lead the patent system to become less attractive due to increased uncertainty and thereby have detrimental effects on innovation, knowledge diffusion as well as inefficiencies at the patent offices. Patent offices are seeking ways in which to increase efficiency of the application process by leveraging international cooperation. One such collaboration is the Patent Prosecution Highway (PPH), which has been established to avoid unnecessary duplication of work by increasingly using the search and examination results of other patent offices for the same invention, and thereby speeding up the examination process. This study is to analyses the effectiveness of the first PPH program, implemented in June 2006 as a bilateral agreement between the USPTO and JPO. Preliminary results of this paper find that applications which underwent PPH have an overall hazard rate of 2.05, and are therefore issued/abandoned significantly faster than non-PPH applications.

Introduction

The increasing geographical coverage that is sought in patent applications results in a lot of duplicative work, as the same invention is examined by each patent office individually. The trend of intellectual property becoming more globalised in combination with a rising number of patent applications, particularly in the US (Fink, Khan and Zhou, 2013), as well as a growing patent backlog and increased pendency (de Rassenfosse and Zaby, 2015), has lead patent offices to seek ways in which to increase efficiency of the application process. Longer patent pendency creates uncertainty for competitors and defers the introduction of new products to the market, which may even slow down the overall pace of technological development and transfer and thereby reduce welfare. Lengthier application procedures also causes greater patent backlog, which in turn strains the patent offices' processing capacity. Patent offices recognise that this is a problem - the USPTO explicitly states that it aims to "deliver high quality and timely examination [with the] commitment to reducing/maintaining pendency by increasing efficiencies and leveraging international cooperation" (USPTO 2014-2018 Strategic Plan, page 5).

An interesting policy measure, the Patent Prosecution Highway (PPH), was implemented to address these challenges. From its initial bilateral pilot program that stated in mid-2006, the PPH is rapidly expanding and increasingly being employed. Heterogeneity in patent office standards and language barriers however, may complicate collaborative work-sharing, making the outcome of the PPH non-trivial. Rapid uptake of the programme and questionable outcome render this an important research question to address. Yet its' effectiveness has not yet been studied econometrically. This paper will contribute to the literature on patent pendency by measuring how effective the first PPH agreement between the USPTO and JPO has been in reducing pendency. A unique dataset which merged Patstat data with USPTO data as well as a non-public variable indicating which patent underwent the PPH allows us to address this question. A Cox Proportional Hazard Model is employed, with supporting results from OLS and Tobit. Preliminary results of this paper suggest that the first PPH program is likely to have been highly effective in reducing patent processing time. As expected, if there is a positive effect, then PPH will be particularly effective at reducing the examination phase of a patent application process. But interestingly, continuations also play an important role in pendency, and this will have to be investigated further.

Policy Description

The PPH was implemented in light of increasing pendency trends and efforts to further harmonise the international patent system. It was established to avoid unnecessary duplication of work by increasingly using the search and examination results of other patent offices for the same invention, and thereby speeding up the examination process. The PPH has already been adopted by many patent offices around the world, signaling its non-negligence. Program expansions such as the Mottainai-, PCT-, IP5- and Global-PPH could represent the preliminary steps towards a truly global IP system with substantially fewer administrative issues and perhaps even the creation of uniform patent rights.

The objective of this study is to analyze the effectiveness of the first PPH program, implemented in June 2006 as a bilateral agreement between the USPTO and JPO. We expect that the work-sharing character of the PPH will allow the patent offices to process applications faster and thereby reduce the total pendency. From the perspective of the USPTO, this means Japanese applications that filed a subsequent filing at the USPTO are able to request a fast track examination (i.e. request PPH) if: (1) the US application shares a common earliest priority date with the Japanese filing, (2) the Japanese filing has received an indication of allowable subject matter on at least one of its claims, and (3) the application has not yet entered the examination phase at the USPTO. Under the first agreement, only the subsequent filing was able to request PPH based on results of the priority filing. The priority filing was **not** eligible to request PPH, even if the subsequent filing had been granted before the priority filing.[1]

Literature

Johnson and Popp (2003) find that patents that take longer to get processed are more valuable (in terms of forward citations). They show that knowledge diffusion already begins with patent publication. Hence, they argue that earlier patent disclosure can have beneficial effects on knowledge diffusion. Even though they study the American Inventors Protection Act, which is concerned with the publication rather than the grant of a patent, one could extrapolate their argument to say that earlier grant disclosure also supports knowledge diffusion by reduced uncertainty. In fact, Gans et. al (2008) use grant delays to show that the timing of a grant has substantial impact on the the timing of licensing agreements by start-up technology entrepreneurs. The hazard rate for achieving a cooperative licensing agreement significantly increases after patent allowance. Czarnitzki et al. (2015) build on this strand of literature by showing that market uncertainty induced by longer pendency leads to reduced collaboration between firms. In a similar vein, de Rassenfosse et al. (2016) show that long processing times and pending patents impair technology transactions (sale, licence, cross-licence etc. of IP) and give a warning that backlogs and lengthy grant a slow-down of the pace of technology transfers, or

[1] This restriction was eliminated between US and Japan in mid-2011 with the introduction of the Mottainai-PPH but is not relevant for the purpose of our paper.

even prevent it. Another study that investigates the effect of pendency on welfare is one of Farre-Mensa et al. (2015), who find that excessive pendency has a substantial negative impact on the growth and success entrepreneurial firms. Their quantitative results suggest that two additional years of pendency has the same effect as a rejection of the patent application.

But what can prior literature tell us about the patent characteristics associated with pendency? Harhoff and Wagner (2009) analyse the duration of patent examination at the EPO and find strong evidence that applicants try to accelerate grant proceedings for their most valuable patents, but that they also prolong the battle for such patents if a withdrawal or refusal is imminent. Studies by Johnson and Popp (2003) and Popp et al. (2004) also point to a positive relationship between patent value and process duration. Differences in technological field seem to be of importance. Xie and Giles (2011) model the length of time that it takes for a patent application to be granted by the USPTO by categorising technological fields into six different industries (chemical, computers and communications, drugs and medical, electrical and electronics, mechanical and others). They find that patents in the mechanical category have the shortest duration, while those in the computers and communications category take the longest. Quantitative research supported by interviews with patent examiners suggest that the technological field is the biggest factor influencing examination time (Popp, Juhl and Johnson, 2003). Biotech and computers (newer, more complex technologies) take significantly longer and it is more common for patents in chemicals and biotech fields to file subsequent divisional applications. The USPTO is the only patent office that allows applicants to file continuations, continuations-in-part and divisional filings. Hegde, Mowery and Graham (2009) argue that the parent applications – i.e. those that give rise to continuations – take longer to get processed. A further finding of Xie and Giles (2011) is that the greater the number of claims or citations a patent makes, the longer it will take to get approval, ceteris paribus. This result is supported by Popp et al. (2004, p.35) because more claims increases the likelihood of additional communications needed between the examiner and the applicant, which considerably delays the process. Lazaridis and van Pottelsberghe (2007) quantify this and show that two additional claims at the EPO are associated with one additional communication, prolonging the examination process by a year. Higher degrees of patent complexity are also likely to lead to more frequent communication between applicant and examiner. Van Zeebroeck Van Pottelsberghe Guellec (2009) identify the number of inventors, IPC8, backward citations and non-patent citations as relevant measures of technical complexity. Accounting for most of these pendency-relevant parameters, Berger, Blind and Thumm (2012) conduct an empirical analysis on standard essential patents in the ICT sector, where correct timing of application processes are crucial. They find that all parameters which allow the applicant to influence and delay the application process seem to be used to a much higher extent for essential patents.

The capacity of the patent office may also contribute to the timeliness of the application process. Increases in backlogs (the amount of patents awaiting a grant/refusal decision) were first thought to be a direct consequence of patent offices not being able to handle the great upsurge in patents and that these backlogs in turn result in lengthy grant delays (de Rassenfosse and Zaby, 2015). It can be difficult for patent offices to sporadically increase their capacity to process a growing number of applications as this requires specific technological and legal training. Despite this, a report by the USPTO and UK IPO (2013) on the growth of backlog in the US has found that the number of applications has not actually increased so drastically after considering the amount of new patent examiners hired. This makes it even more important to understand what is causing the increasing pendency.

Despite these studies on pendency and its determinants, this paper appears to be the first to explore the relationship between pendency and the PPH specifically in an econometric framework.

Data and Descriptive Statistics

In order to address our research question, we have constructed a unique dataset. The USPTO Public PAIR Data (known as PatEx) has recently been made available online in Stata-format. It contains detailed information (such as the application's characteristics, prosecution history, continuation history, claims of foreign priority etc.) on patent applications filed at the USPTO. Our sample restricts to PPH-eligible USPTO filings. This means that we only consider subsequent patents filed at the USPTO which have at least one priority claim at the JPO that has been granted[2] and whose examination had not started before June 2006. Therefore, the actual application date can be several years before 2006. The earliest filing date of an application that underwent PPH was 2002, so we restrict the sample to applications filed from 2002 onwards, but no later than in the year 2012 (see Table A.1 in the appendix). Since PatEx data does not contain information of whether priority filings have been granted or not, it was necessary for us to merge PatEx with Patstat. This was not a straight-forward, but a crucial task in order for us to specify the correct control group; we want to compare those that underwent PPH to those that were eligible for PPH, but did not request it. We are not aware of any other study that has merged PatEx with Patstat. Our sample is also supplemented with non-publicly available USPTO data that indicate which applications underwent PPH and on what date it was requested.

A USPTO filing can claim priority (to the same invention) in multiple different countries. This paper, however, excludes filings with priorities in more than one country and only considers those which have one or more priorities in Japan. This is done to avoid the possibility of the US subsequent filing requesting PPH not based on a Japanese priority, but based on, for example, a priority in Great Britain.[3] This leaves us with a sample of 285,998 patent applications, of which 6,915 (2.4%) entered the PPH (see Table 1.).

Descriptive Statistics

Table 1 presents key summary statistics of the variables for the total sample as well as the split sample according to PPH and non-PPH applications. Once the patent application has been processed, it 'terminates' either by being issue or abandoned. The date on which a patent terminates is what determines our dependent variable; pendency, which measures the number of days from application date to termination date. Issuance in the United States is the synonym for the grant of a patent and the majority of applications in our sample were issued (73.8%). An abandoned application can mean that it was either rejected, or that the applicant abandoned the application, intentionally or not, for example due to non-payment of fees, not providing necessary documents or simply having decided not to pursue further with the application. This applied to 18.7% of the cases. If a patent is pending, it means that the application is still being processed. Since the Public Pair Data release used for this analysis is up to date and complete up until the 31.12.2014, we replace the termination date of still pending patents to this date. This will allow us to use these observations with models that can accommodate right-censoring.

Total pendency (so from application date to termination date) took 1,145 days, or 3.2 years. PPH applications however, spent much less time being processed, only 801 days on average (2.2 years). The largest reduction in pendency appears to be during the examination phase (docket – first action), which is exactly where we would

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[2] To be eligible for PPH, the priority claim(s) at the JPO do not actually have to be granted. It suffices that it has been allowed. If the data allows us, we will fine-tune the sample accordingly.

[3] PPH requests originating from Japanese priorities are by far the largest requests made, accounting for around 73% of all PPH requests made at the USPTO, to date. Out of those that claimed priority on at least one Japanese filing, less than 0.5% also claimed priority in another country. Note: it is typical to only claim priority on the first filing, this does not mean that they didn't file in other countries.

expect the PPH to have the largest impact. Table A.2 in the appendix shows a detailed trend of pendency over the years.

Table 1 also shows that a noticeably higher share of the PPH applications originated from PCT applications. The variable names “Is Continuation” takes the value one, if the application was either a continuation, a continuations-in-part or a divisional filing. The procedure is used by a significant number of patent applicants—30.2%. Number of inventors per applications are fairly similar across the sample. The number of claims and search citations are slightly lower for PPH patents, whereas non-patent literature and applicant citations are slightly higher.

The most commonly selected technological class was Computer Technology (20.7% of the total sample). Interestingly, Computer Technology was listed noticeably more often in PPH applications (28.1%). This might reflect the need for a quicker application process since this sector is typically associated with shorter product life cycles. PPH patents also filed more often in the second most common technological class, Audio-Visual Technology, with 24.3% of PPH patents seeking protection in this field compared to 16.7% for non-PPH patents. Two other prominent fields, Optics and Semiconducters, were less represented by PPH patents compared to non-PPH patents; 6.4% and 5.7% compared to 14.0% and 13.6% respectively.

Table 1. Summary Statistics

	Total Sample					PPH		Non-PPH	
	count	mean	sd	min	max	mean	sd	mean	sd
PPH	285,988	0.024	0.154	0	1	1.000	0.000	0.000	0.000
Abandoned	285,988	0.187	0.390	0	1	0.174	0.379	0.188	0.390
Issued	285,988	0.738	0.440	0	1	0.744	0.436	0.738	0.440
Pending	285,988	0.075	0.263	0	1	0.081	0.273	0.075	0.263
Pendency (Days)	285,988	1145.016	518.472	15	4702	800.956	374.565	1153.541	518.644
Application - Docket	285,974	305.261	236.503	7	2904	275.809	198.301	305.990	237.326
Docket - First Action	258,815	590.142	356.542	0	3764	340.124	266.320	596.621	356.254
First Action - Termination	240,989	256.731	289.358	13	2947	170.688	183.442	258.844	291.156
log(Application - Docket)	285,974	5.399	0.860	2	8	5.341	0.797	5.401	0.861
log(Docket - First Action)	258,766	6.103	0.939	0	8	5.408	1.136	6.121	0.926
log(First Action - Termination)	240,989	5.127	0.859	3	8	4.827	0.717	5.135	0.861
Originates from PCT	285,988	0.283	0.450	0	1	0.538	0.499	0.277	0.447
Is Continuation	285,988	0.302	0.459	0	1	0.221	0.415	0.304	0.460
Number of Granted Priorities	285,988	0.926	0.620	0	27	0.692	0.591	0.932	0.620
Small entity	285,988	0.023	0.150	0	1	0.030	0.172	0.023	0.150
Number of Inventors	285,988	2.638	1.868	1	38	2.612	1.769	2.639	1.871
Claims	285,988	12.050	8.651	1	348	10.618	7.478	12.085	8.675
Non-Patent Literature Citations	285,988	1.855	5.756	0	115	2.697	6.515	1.834	5.734
Search Citations	285,988	3.625	5.220	0	99	3.398	4.963	3.631	5.226
Applicant Citations	285,988	8.297	13.335	0	105	9.406	11.716	8.269	13.371
prior_reqex	154,666	6.063	0.821	0	8	5.261	0.738	6.068	0.819
Electrical machinery, apparatus, e	285,988	0.125	0.331	0	1	0.112	0.315	0.125	0.331
Audio-visual technology	285,988	0.169	0.374	0	1	0.243	0.429	0.167	0.373
Telecommunications	285,988	0.092	0.289	0	1	0.093	0.291	0.092	0.289
Digital communication	285,988	0.065	0.246	0	1	0.076	0.265	0.065	0.246
Basic communication processes	285,988	0.035	0.183	0	1	0.073	0.260	0.034	0.181
Computer technology	285,988	0.207	0.405	0	1	0.281	0.450	0.205	0.404
IT methods for management	285,988	0.013	0.112	0	1	0.010	0.099	0.013	0.113
Semiconductors	285,988	0.134	0.340	0	1	0.057	0.231	0.136	0.342
Optics	285,988	0.138	0.345	0	1	0.064	0.245	0.140	0.347
Measurement	285,988	0.074	0.261	0	1	0.069	0.253	0.074	0.261
Analysis of biological materials	285,988	0.009	0.092	0	1	0.007	0.082	0.009	0.092
Control	285,988	0.035	0.184	0	1	0.051	0.220	0.035	0.183
Medical technology	285,988	0.033	0.179	0	1	0.049	0.215	0.033	0.178
Organic fine chemistry	285,988	0.023	0.151	0	1	0.016	0.126	0.023	0.151
Biotechnology	285,988	0.017	0.129	0	1	0.011	0.104	0.017	0.129
Pharmaceuticals	285,988	0.016	0.126	0	1	0.010	0.101	0.016	0.127
Macromolecular chemistry, polym	285,988	0.023	0.151	0	1	0.021	0.142	0.023	0.151
Food chemistry	285,988	0.005	0.071	0	1	0.007	0.081	0.005	0.070
Basic materials chemistry	285,988	0.025	0.157	0	1	0.021	0.143	0.026	0.158
Materials, metallurgy	285,988	0.026	0.160	0	1	0.031	0.172	0.026	0.160
Surface technology, coating	285,988	0.061	0.240	0	1	0.063	0.244	0.061	0.240
Micro-structural and nano-techno	285,988	0.005	0.069	0	1	0.008	0.086	0.005	0.068
Chemical engineering	285,988	0.027	0.163	0	1	0.021	0.144	0.027	0.163
Environmental technology	285,988	0.015	0.120	0	1	0.022	0.146	0.014	0.119
Handling	285,988	0.026	0.159	0	1	0.017	0.131	0.026	0.159
Machine tools	285,988	0.032	0.175	0	1	0.032	0.177	0.032	0.175
Engines, pumps, turbines	285,988	0.038	0.191	0	1	0.062	0.241	0.037	0.189
Textile and paper machines	285,988	0.047	0.212	0	1	0.014	0.116	0.048	0.214
Other special machines	285,988	0.029	0.168	0	1	0.026	0.159	0.029	0.168
Thermal processes and apparatus	285,988	0.012	0.107	0	1	0.011	0.104	0.012	0.107
Mechanical elements	285,988	0.036	0.187	0	1	0.038	0.190	0.036	0.187
Transport	285,988	0.057	0.232	0	1	0.083	0.275	0.056	0.231
Furniture, games	285,988	0.015	0.122	0	1	0.012	0.108	0.015	0.122
Other consumer goods	285,988	0.016	0.126	0	1	0.016	0.124	0.016	0.126
Civil engineering	285,988	0.009	0.095	0	1	0.011	0.104	0.009	0.095

Empirical Implementation and Results

A number of different econometric models are applied in order for us to address our research question – results are presented in Table 2. The coefficients in columns (1) – (2) can be interpreted as semi-elasticities, as the dependent variable pendency has been log transformed. The OLS and Tobit results are very similar, so we will focus our analysis on the latter.[4] From the Tobit regression results in column (2) we see a highly significant coefficient of -0.34% on the PPH dummy variable. This means that patents that underwent the PPH, took around one third (34%) less time to get processed (from application date to termination date), all else equal. Applications that originate from PCT filings take 7% longer on average. This can be expected because one of the reasons that the PCT route is chosen is because it provides the applicant with more time.[5] Therefore, this variable is probably capturing some intentional applicant induced effects on gaining more time and hence, prolonging pendency. When the application is a continuation/continuation-in-part/divisional, it seems to get processed a lot faster than non-continuations. As mentioned earlier the filings that eventually lead to continuations have been found to have much longer pendency, and our results do not contradict this. However, we did not expect an effect of this magnitude – continuations take 40% less time to get processed and calls for further investigation. We plan to re-run the regressions including a dummy variable "Is Parent" and to split the "Is Continuation" variable into its respective category: continuation, continuation-in-part or division.

Column (5) and (6) report OLS and Tobit results for pendency measured in number of days. The constant reported in column (6) indicates that the average pendency for the 'base patent' was 1,464 days (4.0 years). The 'base patent' is a patent that was filed in 2002, did not undergo the PPH, nor did it originate from a PCT filing, was not a continuation, not a small entity, had one inventor, one claim, no citations and all other variables are zero.

Duration analysis can account for censored data and can make use of the detailed data on the dates and timing of the events that take place during the application process. Additionally, duration analysis provides the flexibility of using semi-parametric estimation methods which means that no assumptions about the distribution of termination times have to be made. This approach is also useful if you want to measure the effect of the explanatory variables on the risk of failure (hazard rates) or survival, where the failure is the termination of a patent. Results are presented in columns (3) and (4). The coefficients for each binary variable of column (3) indicate the percentage increase in risk of failure for a patent having that characteristic compared to the baseline hazard. Those applications that underwent PPH are associated with 2.05-1 =105% increase in the hazard rates. Smoothed hazard rates and Kaplan-Meier survival estimates are presented in Graph A.3 in the appendix.

We also plan to use propensity score matching in order to ensure that we are comparing patents that are similar with respect to the control variables, only differing between PPH and non-PPH patents. This approach allows us to compare applications that entered the PPH (treated) to a control group that is close to identical to the treated – in terms of patent characteristics – the only difference being, that they did not enter PPH (untreated). The drawback of using propensity score matching is that we cannot consider still pending applications and we are not fully utilizing the 'time'-aspect of the variables. The dependent variable for the first stage Probit regression will be a PPH dummy variable (treatment) equal to one if the application underwent

[4] Cencored data should not be used in OLS, so we re-ran the regression without the still pending obseervations. Results remain more or less robust.

[5] Rather than filing a subsequent filing at a national office, which has to be done within 12 months of the priority filings, the applicant can file a PCT within 12 months, where then the international phase may take up to 18 months This effectively gives the applicant 30 months from priority date rather than the usual 12.

PPH. The predicted probability estimates from the Probit will then be used to find matches for the treated observations.

Table 2. Regression Results of OLS, Tobit, and Duration Analysis.

	DV: Log of Pendency				DV: Pendency in Days	
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	TOBIT	DURATION (Coeffs.)	DURATION (Haz.Rate)	OLS	TOBIT
PPH	-0.31***	-0.34***	0.72***	2.05***	-271.34***	-306.10***
	(0.01)	(0.01)	(0.01)	(0.03)	(4.39)	(5.76)
Originates from PCT	0.06***	0.07***	-0.15***	0.86***	58.28***	66.28***
	(0.00)	(0.00)	(0.00)	(0.00)	(1.97)	(2.11)
Is Continuation	-0.38***	-0.40***	0.65***	1.91***	-321.89***	-343.52***
	(0.00)	(0.00)	(0.00)	(0.1)	(2.14)	(2.22)
Small entity	-0.07***	-0.07***	0.17***	1.19***	-83.40***	-88.68***
	(0.01)	(0.01)	(0.01)	(0.02)	(5.58)	(5.88)
Number of Inventors	0.00***	0.00***	-0.01***	0.99***	3.61***	4.56***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.46)	(0.48)
Claims	0.00***	0.00***	-0.01***	0.99***	2.44***	2.88***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.11)	(0.1)
Non-Patent Literature Citations	0.01***	0.01***	-0.01***	0.99***	5.68***	5.82***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.21)	(0.18)
Search Citations	0.00***	0.00***	0.00*	1.00*	2.69***	1.65***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.18)	(0.17)
Applicant Citations	0.00***	0.00*	0.00***	1.00***	0.68***	0.07
	(0.00)	(0.00)	(0.00)	(0.00)	(0.08)	(0.08)
Electrical machinery, apparatus, energy	-0.06***	-0.06***	0.06***	1.06***	-53.98***	-53.67***
	(0.00)	(0.00)	(0.01)	(0.01)	(2.63)	(2.73)
Audio-visual technology	0.10***	0.10***	-0.23***	0.79***	104.17***	110.69***
	(0.00)	(0.00)	(0.01)	(0.00)	(2.35)	(2.41)
Telecommunications	0.08***	0.08***	-0.16***	0.85***	87.05***	86.93***
	(0.00)	(0.00)	(0.01)	(0.01)	(3.18)	(3.28)
Digital communication	0.14***	0.15***	-0.29***	0.75***	156.73***	165.53***
	(0.00)	(0.00)	(0.01)	(0.01)	(3.88)	(3.87)
Basic communication processes	-0.18***	-0.19***	0.41***	1.51***	-181.66***	-190.03***
	(0.00)	(0.00)	(0.01)	(0.02)	(4.31)	(4.76)
Computer technology	0.11***	0.12***	-0.26***	0.77***	131.41***	138.15***
	(0.00)	(0.00)	(0.01)	(0.00)	(2.29)	(2.34)
IT methods for management	0.15***	0.17***	-0.45***	0.64***	211.50***	234.57***
	(0.01)	(0.01)	(0.02)	(0.01)	(10.2)	(8.06)
Semiconductors	-0.02***	-0.02***	0.07***	1.08***	-34.80***	-36.70***
	(0.00)	(0.00)	(0.01)	(0.01)	(2.57)	(2.71)
Optics	-0.06***	-0.07***	0.16***	1.17***	-73.75***	-76.77***
	(0.00)	(0.00)	(0.01)	(0.01)	(2.46)	(2.64)
Measurement	-0.08***	-0.08***	0.18***	1.19***	-94.58***	-94.93***
	(0.00)	(0.00)	(0.01)	(0.01)	(3.1)	(3.41)
Analysis of biological materials	0.06***	0.06***	-0.19***	0.83***	69.60***	71.94***
	(0.01)	(0.01)	(0.02)	(0.02)	(11.65)	(10.41)
Control	-0.01**	-0.01**	0.04***	1.04**	-21.37***	-23.24***
	(0.00)	(0.00)	(0.01)	(0.01)	(4.56)	(4.82)
Medical technology	0.16***	0.17***	-0.46***	0.63***	173.97***	194.66***
	(0.00)	(0.00)	(0.01)	(0.01)	(5.36)	(5.01)
Organic fine chemistry	-0.07***	-0.08***	0.17***	1.18***	-71.11***	-78.85***
	(0.01)	(0.01)	(0.01)	(0.02)	(6.49)	(6.4)
Biotechnology	0.08***	0.09***	-0.19***	0.83***	67.15***	74.14***
	(0.01)	(0.01)	(0.02)	(0.01)	(8.83)	(7.85)
Pharmaceuticals	0.04***	0.05***	-0.15***	0.86***	47.26***	49.01***
	(0.01)	(0.01)	(0.02)	(0.01)	(9.12)	(7.86)
Macromolecular chemistry, polymers	-0.02***	-0.02***	0	1	-15.71**	-17.70**
	(0.01)	(0.01)	(0.01)	(0.01)	(6.02)	(6.07)
Food chemistry	0.07***	0.08***	-0.30***	0.74***	96.58***	111.73***
	(0.01)	(0.01)	(0.03)	(0.02)	(15.1)	(12.88)
Basic materials chemistry	0.01*	0.02**	-0.08***	0.93***	18.95**	22.37***
	(0.01)	(0.01)	(0.01)	(0.01)	(5.88)	(5.83)

Materials, metallurgy	0.02**	0.02***	-0.09***	0.91***	20.92***	24.84***
	(0.01)	(0.01)	(0.01)	(0.01)	(5.77)	(5.65)
Surface technology, coating	0.12***	0.13***	-0.31***	0.73***	124.88***	136.19***
	(0.00)	(0.00)	(0.01)	(0.01)	(3.71)	(3.83)
Micro-structural and nano-technology	0.01	0.03*	-0.18***	0.84***	17.62	35.61**
	(0.01)	(0.01)	(0.03)	(0.03)	(12.43)	(13.23)
Chemical engineering	0.06***	0.07***	-0.17***	0.84***	67.48***	74.48***
	(0.00)	(0.01)	(0.01)	(0.01)	(5.46)	(5.59)
Environmental technology	-0.04***	-0.05***	0.13***	1.14***	-60.84***	-65.92***
	(0.01)	(0.01)	(0.02)	(0.02)	(6.69)	(7.47)
Handling	-0.03***	-0.03***	0.07***	1.08***	-41.92***	-43.85***
	(0.00)	(0.01)	(0.01)	(0.01)	(4.94)	(5.54)
Machine tools	0.01**	0.02***	-0.09***	0.91***	8.8	17.51***
	(0.00)	(0.00)	(0.01)	(0.01)	(4.77)	(5.06)
Engines, pumps, turbines	-0.09***	-0.08***	0.14***	1.15***	-101.04***	-98.65***
	(0.00)	(0.00)	(0.01)	(0.01)	(4.27)	(4.69)
Textile and paper machines	0.01*	0.01	0.05***	1.05***	-5.23	-8.77*
	(0.00)	(0.00)	(0.01)	(0.01)	(3.82)	(4.18)
Other special machines	0.01**	0.01**	-0.05***	0.95***	7.96	9.1
	(0.00)	(0.01)	(0.01)	(0.01)	(5.22)	(5.35)
Thermal processes and apparatus	0.08***	0.11***	-0.29***	0.75***	66.23***	94.88***
	(0.01)	(0.01)	(0.02)	(0.01)	(7.69)	(8.43)
Mechanical elements	0.01	0.01	0.01	1.01	-7.89	-8.8
	(0.00)	(0.00)	(0.01)	(0.01)	(4.15)	(4.78)
Transport	-0.04***	-0.05***	0.12***	1.12***	-65.42***	-67.24***
	(0.00)	(0.00)	(0.01)	(0.01)	(3.45)	(3.94)
Furniture, games	0.03***	0.04***	-0.16***	0.85***	49.84***	54.11***
	(0.01)	(0.01)	(0.02)	(0.01)	(7.78)	(7.2)
Other consumer goods	0	-0.01	-0.03	0.97	-7.17	-7.5
	(0.01)	(0.01)	(0.02)	(0.02)	(7.16)	(6.98)
Civil engineering	-0.05***	-0.05***	0.08***	1.08***	-59.31***	-62.14***
	(0.01)	(0.01)	(0.02)	(0.02)	(8.4)	(9.28)
2003	0.14***	0.14***	-0.08***	0.92***	66.89***	67.19***
	(0.01)	(0.01)	(0.02)	(0.02)	(13.36)	(9.47)
2004	0.06***	0.06***	0.13***	1.14***	-94.71***	-91.69***
	(0.01)	(0.01)	(0.02)	(0.02)	(12.46)	(8.67)
2005	-0.04***	-0.04***	0.28***	1.33***	-214.67***	-206.45***
	(0.01)	(0.01)	(0.02)	(0.02)	(12.3)	(8.47)
2006	-0.10***	-0.09***	0.35***	1.42***	-258.23***	-248.14***
	(0.01)	(0.01)	(0.02)	(0.03)	(12.27)	(8.43)
2007	-0.09***	-0.08***	0.36***	1.44***	-261.07***	-249.48***
	(0.01)	(0.01)	(0.02)	(0.03)	(12.23)	(8.42)
2008	-0.11***	-0.10***	0.45***	1.58***	-303.35***	-290.48***
	(0.01)	(0.01)	(0.02)	(0.03)	(12.18)	(8.42)
2009	-0.17***	-0.15***	0.63***	1.87***	-379.34***	-361.57***
	(0.01)	(0.01)	(0.02)	(0.03)	(12.12)	(8.44)
2010	-0.27***	-0.24***	0.84***	2.32***	-478.70***	-449.39***
	(0.01)	(0.01)	(0.02)	(0.04)	(12.1)	(8.47)
2011	-0.35***	-0.30***	1.05***	2.86***	-568.44***	-505.21***
	(0.01)	(0.01)	(0.02)	(0.05)	(12.08)	(8.55)
2012	-0.51***	-0.37***	1.32***	3.74***	-705.65***	-533.81***
	(0.01)	(0.01)	(0.02)	(0.07)	(12.07)	(8.74)
Constant	7.11***	7.10***			1472.19***	1463.82***
	(0.01)	(0.01)			(12.36)	(8.6)
sigma						
Constant		0.43***				459.33***
		(0.00)				(0.64)
Observations	285988	285988	285988	285988	285988	285988
R-squared	0.309				0.295	

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Future Developments

This paper is still in early stages and there are several things we still wish to develop further. For instance, splitting the dependent variable, pendency, into three different stages. Rather than measuring pendency from application date to termination date, we will measure it from (1) application date to the date that the examiner can start examination (docket date), (2) from docking-date to the date the examiner makes a decision on the patentability of the invention (actions of first merit) and (3) from the date of actions of first merit to the actual grant or abandonment of the application. Breaking up the pendency measure into these stages is quite important as each stage may be affected quite differently by the PPH and other factors. Splitting the pendency measure will also allow us to tease out applicant-induced delays to some extent.

Additional control variables that we still wish to include are measures of patent value and as has already been mentioned in the text, to split the “Is Continuation” dummy into its respective categories; (1) continuation, (2) continuation-in-part and (3) divisional. Continuations allow the applicant to re-initiate the examination process, while keeping the original application date. This is commonly used after an examiner has rejected one or more of the claims of an application, so the applicant responds by filing a continuation in which he discloses additional information to show that his claims are in fact valid or by modifying them to accommodate the examiners’ suggestions. This additional step, which may actually consist of several rounds is expected to prolong the application process. For continuations-in-part, the effect on pendency is not so clear cut, since these types of continuations contain new subject matter and also get assigned a new application filing date. A divisional can be filed when the original claims do not meet the so-called “restriction requirements”, meaning that the original application contained more than one invention and needs to be split into divisional patents. Therefore it does not contain new subject matter, nor does it receive a new filing date, but due to the additional step, one can expect pendency to be longer for such applications as well.

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Appendix

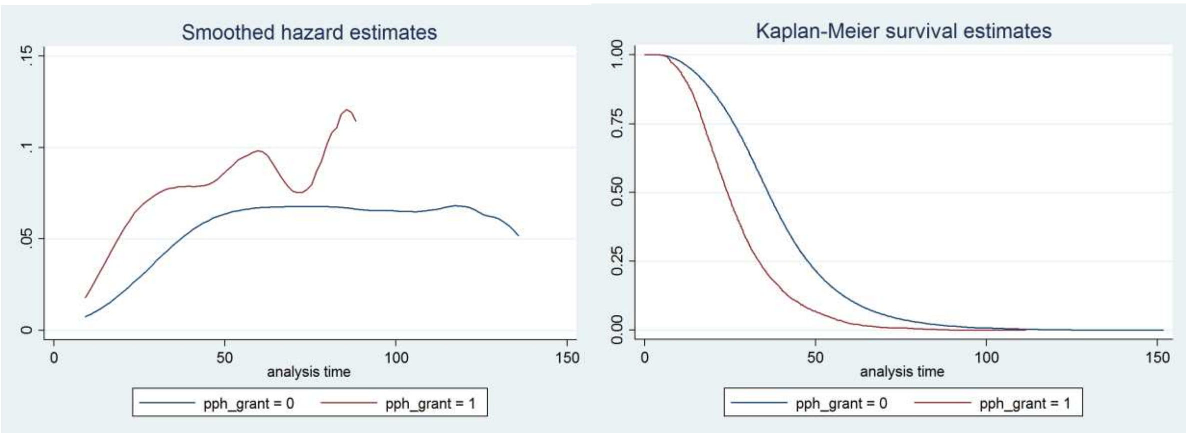
Table A.1: Number of applications per application year.

app_yr	PPH	No_PPH
2002	1	3315
2003	14	8186
2004	36	19409
2005	100	30159
2006	203	33953
2007	428	34709
2008	686	35122
2009	1241	33195
2010	1350	31486
2011	1348	27205
2012	1508	22334
Total	6915	279073

Table A.2: Total Pendency (excluding still pending) has been decreasing over time

	Non-PPH								PPH							
	Pendency (years)				Standard Deviation				Pendency (years)				Standard Deviation			
Application Year	Overall	Application - Docking	Docking - First Action	First Action - Termination	Overall	Application - Docking	Docking - First Action	First Action - Termination	Overall	Application - Docking	Docking - First Action	First Action - Termination	Overall	Application - Docking	Docking - First Action	First Action - Termination
2002	4.25	0.64	3.76	1.15	2.20	0.71	1.00	1.16	4.30	1.20	2.90	0.16				
2003	4.47	1.02	2.71	1.08	1.65	0.82	1.01	1.11	4.80	1.09	3.17	0.49	0.70	0.67	0.65	0.51
2004	3.91	0.85	2.23	0.94	1.45	0.73	0.93	1.01	4.23	1.36	2.13	0.68	1.20	1.11	1.02	0.70
2005	3.50	0.74	1.95	0.87	1.47	0.68	0.99	0.94	3.87	0.99	2.20	0.71	1.00	0.73	0.94	0.73
2006	3.33	0.78	1.79	0.83	1.49	0.63	1.00	0.92	3.17	1.00	1.63	0.55	1.19	0.69	1.05	0.60
2007	3.30	0.96	1.64	0.76	1.39	0.68	0.97	0.85	2.97	1.08	1.35	0.55	1.10	0.73	0.90	0.66
2008	3.20	1.09	1.45	0.70	1.23	0.67	0.90	0.76	2.49	1.06	0.95	0.48	1.04	0.60	0.75	0.52
2009	2.98	1.01	1.39	0.61	1.02	0.57	0.79	0.64	2.11	0.83	0.78	0.52	0.92	0.50	0.60	0.60
2010	2.61	0.73	1.37	0.53	0.93	0.57	0.78	0.50	1.89	0.62	0.84	0.48	0.92	0.48	0.67	0.54
2011	2.24	0.60	1.20	0.45	0.78	0.49	0.70	0.38	1.95	0.66	0.87	0.44	0.72	0.46	0.59	0.39
2012	1.66	0.46	0.81	0.39	0.60	0.37	0.50	0.28	1.62	0.59	0.65	0.36	0.54	0.38	0.46	0.24

Graph A.3



Correlation matrix shows no extremely strong correlations.

	lpend	has_in~d	is_con~n	tot_pr~s	small_~r	nr_inv~s	B2_cla~s	npl_cit	sea_cit	app_cit	termin~1	termin~2	termin~3
lpend	1.0000												
has_intern~d	-0.0803	1.0000											
is_contin	-0.3581	0.2030	1.0000										
tot_prior_~s	0.1375	-0.1475	-0.3576	1.0000									
small_enti~r	-0.0177	0.0694	0.0059	-0.0048	1.0000								
nr_inventors	-0.0167	0.1055	0.1148	0.0319	-0.0492	1.0000							
B2_claims	0.0708	-0.0217	0.0092	0.0081	-0.0096	0.0271	1.0000						
npl_cit	0.0170	0.1160	0.1390	-0.0503	0.0021	0.0920	0.0459	1.0000					
sea_cit	0.1064	-0.0764	-0.1322	0.0750	-0.0137	-0.0247	-0.0259	0.0294	1.0000				
app_cit	-0.0574	0.0572	0.2569	-0.0245	-0.0361	0.1147	0.0830	0.5020	0.0968	1.0000			
termination1	-0.0146	0.0659	0.1192	-0.0871	0.0561	0.0248	0.0818	-0.1471	-0.3334	-0.2987	1.0000		
termination2	-0.0527	-0.1213	-0.0883	0.0756	-0.0514	-0.0302	-0.0886	0.1447	0.3798	0.3282	-0.8057	1.0000	
termination3	0.1099	0.1051	-0.0293	0.0028	0.0028	0.0137	0.0269	-0.0236	-0.1404	-0.1057	-0.1364	-0.4768	1.0000