

# Quality and Litigation in Patent System

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## Abstract

This paper develops a methodology to compare the quality of patent litigation system in major economics: US, UK, Germany, Korea, China and Japan. Quality is defined as whether it provides a fair and just legal environment for nullifying weak patents and judging infringement actions. The ultimate part of this study finds that filing of litigation trials is negatively related with degree of the law enforcement. Jurisdictions with rigorous and predictable judgment have low risk of opportunistic and anti-competitive filings.

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# 1 Introduction

In recent decades, the market has faced an increasing patent disputes. Cases as in China infringement lawsuits related to patent increases more than three times from 2004 to 2014[23]. Besides, massive damage award keep increasing. Prior to 2012, only three patent infringement damages awards eclipsed the \$1 billion mark. But only in 2012, three cases resulted in awards of \$1 billion or greater: Monsanto v. DuPont, Apple v. Samsung, and Carnegie Mellon University v. Marvell[1]. The current situation makes impacts on companies and individuals to innovate, imitate and cooperate, and led major economies to consider reforms on litigation systems.

In a world of perfect litigation system, firms can precisely expect litigation cost and outcomes.(Priest and Klein (1984)[24], Harhoff et al (2003)[13],Lanjouw and Schankerman[17]) This hypothesis ignores the heterogeneity of patent systems across the major economies. We can expect that *Designs and cost of litigation systems affect the selection of disputes for litigation*. The situation is that the more expensive of the litigation cost, the more firms prefer contractual negotiations but not trials; The lower quality of judgment, the more opportunities for weak patents holders to strategically being infringed to win the awards. In order to supplement the analysis on patent litigation, internationally evaluation of quality must be created.

In this paper, we adopt the methodology in Van Pottelsberghe (2011) [9]: assessing the system quality by comparing the operational designs in major economies. The research intention is to explore the relationship between quality of litigation systems and corresponding activities. *Quality of a litigation system is defined as whether it provides a fair legal environment for nullifying weak patents and judging infringement actions*. The analysis bases on a two-layer framework. The first layer is composed of “legal standard”, including the selection of litigation actions: *validity challenge (VC)* and *infringement suit (IS)*. The second layer compasses the “operational designs” put in place to ensure compliance with the legal standard: the rigor of “validity reevaluation”, the “predictability of infringement suit” and the affordability of “cost”. Most countries have similar ”law enforcement” conditions. We explore detailed elements that shape the rigor and transparency of judgment processes. The extent to which operational designs differ across countries may ultimately lead to different degrees of rigor and predictability in litigation processes. The ultimate part of this study finds that filing of litigation trials is negatively related with degree of the law enforcement. Jurisdictions with rigorous and predicable judgment have low risk of opportunistic and anti-competitive filings.

The present paper contributes to the literature from three aspects. First, this paper thoroughly investigates the quality of patent litigation systems with broader categories and applies it for six countries. There are numerous studies on patent litigation systems, but limit to certain features of patent laws exist,few has gauged overall quality analysis. Graham and Harhoff(2014)[11] matches patents attacked through opposition in EPO and equivalents in USPTO, provides strong evidence that adding a post-grant opposition

mechanism in USPTO can improve socially beneficial. Index constructed by Ginarte and Park[10] discussed indicators related to the strength of patent protection, such as preliminary injunction, but some strengthened factors are criticized as “weakness” of quality. Second, this paper provides a new perspective to explain the demand trends for litigation “services”. The number of relevant references to litigation filings is about the involved firms and litigated patents. (Lanjouw and Schankerman (2001)[17]; D. Harhoff et al (2003)[13]; Cremers.K (2004)[7]). This paper discusses how do the system designs affect firm’s incentive to go to the trial. Finally, we comment on the implications of the evaluation results for litigation systems, especially for the future Unified Patent Court (UPC) in Europe.

## 2 Backgrounds of Litigation Systems

We start the analysis by introducing two main processes related to litigation system: first is *validity challenge*, which is used to attack questionable patents. Another is *infringement suit*, by which patent holders can defend his patents. At present (2015), worldwide litigation systems haven’t established any collaborative projects, such as World Intellectual Property Organization (WIPO) for the examination process. Especially for challenging validity of issued patents, countries adopt various forms of proceedings: opposition in patent offices, invalidation trials or revocation as counterclaim in an infringement suit.

Opposition in European Patent Office is a sole way to attack granted European patent with unified effect for all designated states. “Any person”, except the patent owner, may an the opposition request within nine months after the publication of the grant<sup>6</sup>. After nine months, the patent’s validity can only be challenged under the legal rules of the respective designated countries.

In this paper, when we evaluate the litigation system of Germany and UK, we will separate the effect of EPO. In the following section, we describe litigation proceedings in the six countries covered by our analysis. (see Figure 1 to Figure 6)

### 2.1 United States:

**Validity Challenge** After USPTO issues the grant decision, the patent becomes valid immediately. US set up two mechanisms to test post-issue validity. In patent infringement proceedings, the defendant may attack the validity of patent -in-suit. In other words, validity challenge in courts is initiated only after a demand by the patent holder to stop infringing. Another mechanism is post-issue reviews in USPTO. The legislative history of validity challenge in the USPTO suggests that the “post reviews” was intended to be a mechanism that would be less expensive and more interaction with interested parties. The 1980 Bayh-Dole Act created original reexamination, Initiation requires to

present undisclosed "new" and relevant piece of prior art to the agency. Reexamination is "ex parte", where only patentees maintains communications with the decision makers, offering amendments or adding new claims during the reexamination <sup>2</sup>. In 1999, the American Inventors Protection Act(AIPA) introduced "inter partes reexamination" , permitting an involvement of challengers<sup>3</sup> in the process. In 2011, the Leahy-Smith America Invent Act (AIA) further strengthened the interactivity. USPTO finally has two inter partes reviews: "inter reviews" requires a relevant disclosure must be printed in either a prior patent or prior publication<sup>4</sup>. Another is Post-grant review, which allows the challenges in more circumstances such as the invention not being useful<sup>5</sup>.

**Infringement Suit** In the United States, any federal district court can look at complaint for infringement. Parties dissatisfied with decisions may appeal to the Court of Appeals for the Federal Circuit.

**Double Tracks** We define the litigation processes in US as double tracks, where Validity challenge in USPTO and federal courts operate separately on invalidation requests. When infringement suit are filed before the final decision of invalidation requests in USPTO, the judge will estimate the possibility of the nullify and decides to stay or not for invalidation decision by USPTO. Besides, a decision by the patent office declaring a patent invalid will not have retroactive effect on any judgment of patent infringement by the Federal Court. The patentee will recover costs (where the infringer has been demanded to pay for damages), only a disclaimer of the invalid claim has been entered before the commencement of the suit.

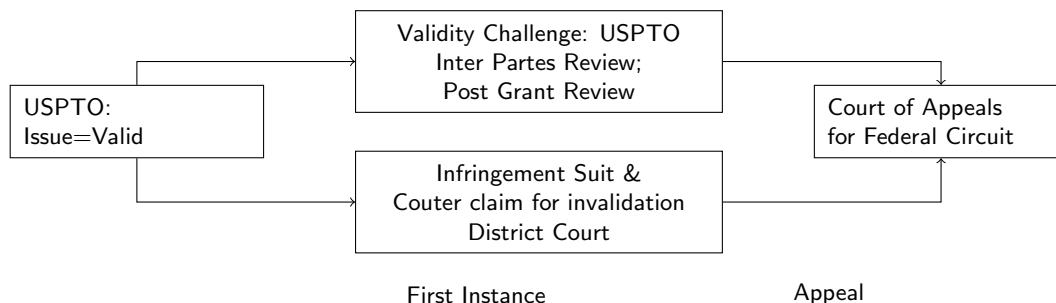


Figure 1: US Patent Litigation System

<sup>2</sup>section 2210 USMPEP

<sup>3</sup>Section 314 pre (AIA) U.S.C

<sup>4</sup>Section 311 U.S.C

<sup>5</sup>Section 322 U.S.C

## 2.2 Germany:

**Validity Challenge** Deutsches Patent and Markenamt (DPMA) has an opposition division to accept the request within three months from the publication of the patent specification<sup>7</sup>. After the opposition period expires, German patent or the German part of a European patent can be challenged before the Bundespatentgericht (BParG, Germany Federal Patent Court) at any time. With the EPO patent, if an opposition demand is filed in EPO before the final decisions in national invalidated process, staying for the opposition decision is necessary.

**Infringement Suit** Civil chambers of the twelve Regional Courts, Landgerichte (LGs) hold the first instance of infringement suits. Dusseldorf, Mannheim and Munich the chambers hear predominantly patent-related cases. Appeals of infringement suits are submitted to Federal Supreme Court.

**Bifurcation** Germany implements strict bifurcation, which uses two separate tracks to hear invalidation and infringement request. Invalidation is in general not binding for the court in infringement proceedings, or vice versa. Bifurcation maximum simplify proceedings but may increase the judgment pendency. The accused infringer also runs the risk if the infringement court makes an award decision before the invalidation court.

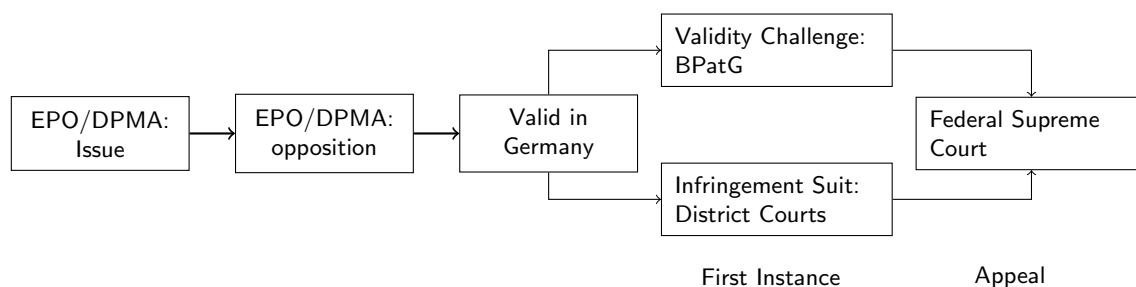


Figure 2: Germany Patent Litigation System

## 2.3 UK (England and Wales)

**Validity Challenge** UKIPO has no opposition division. Challenging the validity of a patent is a permissible and frequent defense in UK infringement actions.

**Infringement Suit** In UK, England and Wales, Scotland and Northern Ireland have separate legal system, whereby, enforcement system of England and Wales is by far

<sup>6</sup>Art. 99 EPC

<sup>7</sup>Section 59 GPL

the most important in the context of patent litigation. Claims are assigned to one of three tracks dependent on value and complexity. The Intellectual Property Enterprise Court (IPEC) has a multi-track and a small claims track. The IPEC multi-track has a limit on damages of up to £500,000. The small claims track is for suitable claims in the IPEC with a value of up to £10,000. If people have a more complex or valuable claim, the case may be heard in the Patent Court of High Court.

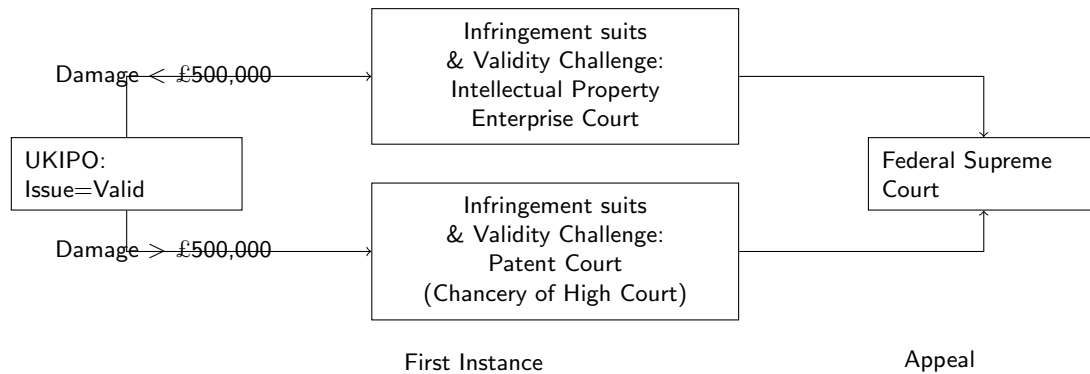


Figure 3: UK Patent Litigation System

## 2.4 Korea

**Validity Challenge** Korea sets up three-instances procedure for the post grant reviews: Intellectual Property Tribunal (IPT), the Patent Court, and the Supreme Court. IPT is established under the jurisdiction of commissioner of the Korean Intellectual Property Office to be responsible for trials and retrials for patents. The board is composed of the President and trial examiners. Trial examiners are not judicial judges, but administrative examiners with expertise in intellectual property matters. IPT institute ex parte cases and inter partes proceedings. Ex parte cases are those in which the Chief Administrator of KIPO is the defendant, such as suits against examiner's refusal of patent registration, suits against the decisions to revoke patent registration, etc. Inter partes cases are those in which patent right holders or interested parties are defendants, such as suits against decisions related to patent invalidation, invalidation of patent term extension, etc, Of which, the petitioner of the invalidation trial need to identify the interest to the involved patent, and made the request not more than three months after the publication date.

**Infringement Suit** District courts in Korea take the first instance of infringement suit, and there is no jurisdiction over nullity petition.

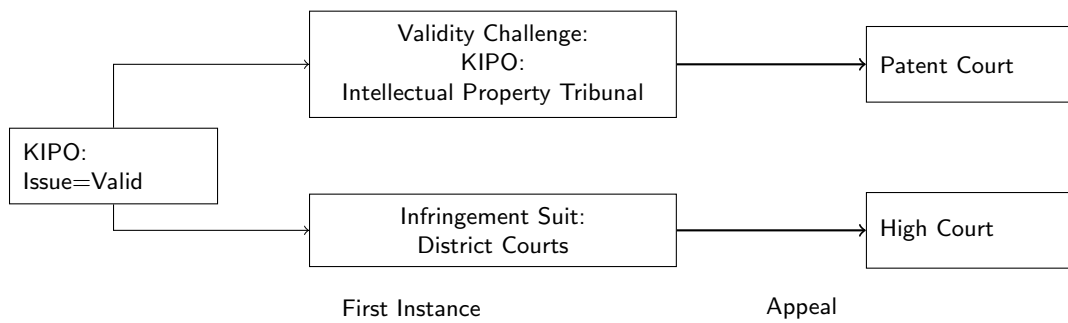


Figure 4: Korea Patent Litigation System

## 2.5 China:

**Validity Challenge** post-issue validity can be tested in the Reexamination Board in SIPO. A collegiate panel consists of three to five examiners, and makes a decision by major voting. The review procedure is inter partes in nature, and appeals to the Intermediate People’s Courts in Beijing.

**Infringement Suit** China sets up specialized divisions in one fifth of civil courts to solve the patent dispute. Since 1996, the Supreme People’s Court also established an intellectual property division. China also adopts governmental power to arbitrate IPR disputes. When a patent is deemed as infringed, the patentee or any interested party may request local authorities involved taking the injunction action.

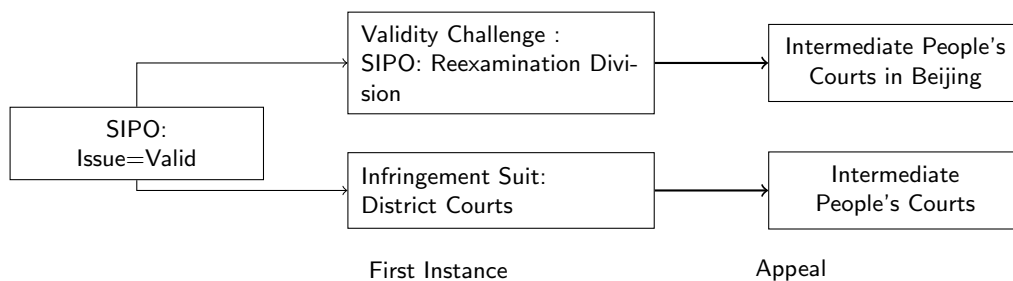


Figure 5: China Patent Litigation System

## 2.6 Japan

**Validity Challenge** Before 2013, only Japan Patent Office has the Board of Appeals and Trials to conduct judgment on invalidation request. After the new Patent Act in 2013, civil courts in Japan have power to declare nullity. The validity challenge system is double-tracks, similar as in US. <sup>8</sup>.

**Infringement Suit** Experts on IP disputes are concentrated in two district courts in Japan: the Tokyo and Osaka District Courts. The two courts set up specialized panels with experienced judges and “research officials” who have technical background and help judges understand technical details. Appeals can be submitted to the Intellectual Property High Court.

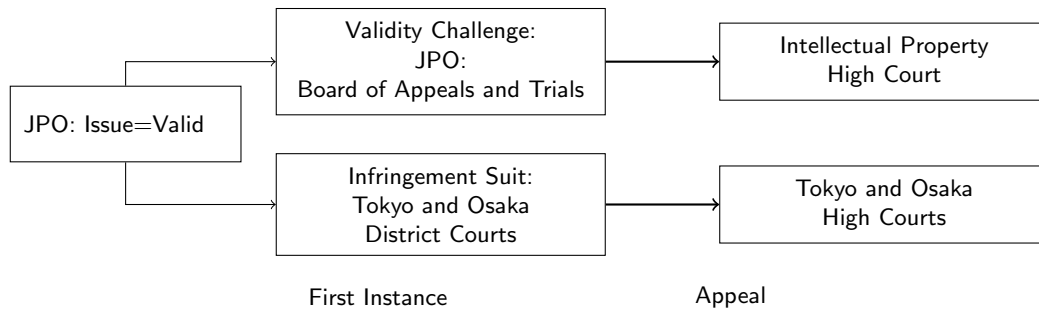


Figure 6: Japan Litigation System

### 3 Research Motivation: Different Trends in Patent Litigation

Different with worldwide constant increase in the number of patent applications van Pottelsberghe (2011) [9], trends in patent litigations displays a high heterogeneity across activities and countries. In China, 2011 brought a record-breaking number of infringement lawsuits: about 7819, which was an increase of more than three times from 2004. However, Figure 7 shows that this is not a worldwide occurrence; filing infringement suit in US stayed constantly in a high position and increased again since 2009. Japan consistently received less than 15% of the lawsuits as many as US judicial courts, and even slightly decreased in 2011.

Table1 presents more details of different propensity to file a lawsuit in six countries. China received the most suits for invalidation (2941) and infringement(9680), and the suit rates of patent in-force (0.34% and 1.1% respectively) were much higher than other countries,( since China received less than half as many as patent-in-force as US and Japan).Furthermore, UK and Japan received the least infringement lawsuits (less than 100 and 488) nor invalidation cases (less than 50 and 217), even Japan has the second most patent-in-force (1694435). US and Germany have a high propensity to infringement suits, but agencies related to the validity challenge, USPTO and BPatG received fewer filings. The fact that filing in USPTO is few is somewhat endogenous. Firms, especially the alleged infringers, often attack the validity of the patent through the courts( Chien and Helmers(2015)[6], Allison.JR et al (2014) [3]. Mann and Underweiser & 2012 [20] ).

Note for Table1, data for US court (validity challenge), UK and Germany infringe-

<sup>8</sup>Article 123, JPL



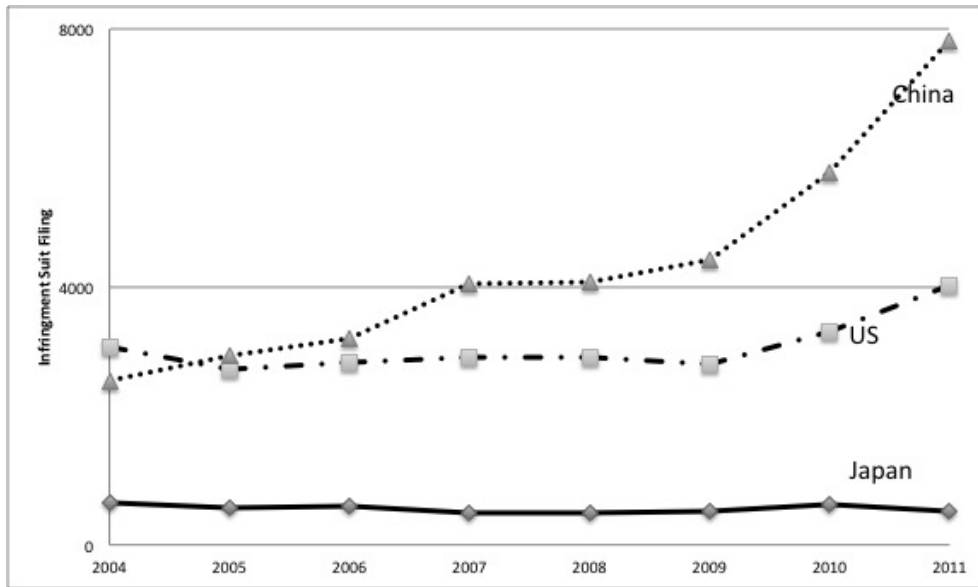


Figure 7: Evolution of Infringement Suits in Major Countries

Source: Own calculations from annual reports of judicial courts.

ment is estimated based on the available literature. The general trends is ensured, but we also can use words description. such as "few, many" to replace the estimated number.

Scholars who analyze the incentive to file a litigation trails focus on facets of patents and patentees: commercial value of the patent, capacity to cover the litigation cost, or a combination of these. Another factor that may explain different filings relate to heterogeneous legal frameworks. Only recently have researchers begun to develop a systematic understanding of the differences in patent systems across countries, but no published studies study the empirical determinants of linkages between characteristics of patent litigation systems and lawsuit demand. This paper focuses on comparison of operational designs. Identification of the roots of these international differences might serve to highlight new solutions to explain the different incentive to approach litigation. This paper aims to provide empirical evidence for the idea that disparity among the procedure designs may be the result of quality and cost differences and affect the litigation demand. Details are compared in the next section.

#### 4 Quality analysis: a two-layer framework

This paper sets up a two-layer analytical framework to gauge quality of litigation system. *Quality is defined as the extent to which litigation systems comply with their own*

|                   |                           | Validity Challenge (VC)<br>Invalidation Trial<br>or Revocation Defense |                     |                  | Infringement Suit (IS) |                |
|-------------------|---------------------------|--|---------------------|------------------|------------------------|----------------|
| Patent<br>Regions | Patent<br>in-force<br>[1] | Institution  | Invalidation<br>[2] | VC<br>Rate [3]   | Suit<br>Filing [4]     | IS<br>Rate [5] |
| US                | 2239231                   | USPTO<br>Court   | 704<br>> 500        | 0.03%<br>> 0.02% | 6497                   | 0.30%          |
| DE                | 549521                    | BPatG  | 261                 | 0.05%            | ≈1044                  | 0.19%          |
| GB                | 459447                    | Patent<br>Courts   | <50                 | ≈0               | <100                   | 0.02%          |
| KR                | 738312                    | KIPO   | 664                 | 0.10%            | n.a                    | n.a            |
| CN                | 875385                    | SIPO   | 2941                | 0.34%            | 9680                   | 1.10%          |
| JP                | 1694435                   | JPO  | 217                 | 0.01%            | 488                    | 0.03%          |

Table 1: Demand of Validity Challenge and Infringement suit in major countries, 2012

source: [1] is adapted from the database of WIPO. [2] presents the validity challenge cases. Data for USPTO combines "ex parte reexamination" by the third party and "inter partes reexamination" in the annual report of USPTO. "ex parte reexamination" by patent owner is, in practice, used appeal for refused decisions. Data for the court is own estimation: Validity challenge is frequently used as defense, but more than 80% suits get settled in US (Chien and Helmers(2015)[6], Allison.JR et al (2014) [3]). Based on the sample in Allison and Allison and Lemley (1998)[2] and Lemley (2014)XX, 46% patents are invalid in the final judgement. Therefore, we estimate that validity challenge in the court is at least  $46\% * 14\% * 6497$  (suits filings). Data of Germany is from annual report of GPC (under eingegangen- Nichtigkeits, revocation received), Data of UK is adapted from Helmers and McDonagh (2013)[14], which claims that around half of infringement suits contain revocation defense in UK patent courts; Data of Korea and Japan are from annual report of patent offices. [4] is from each national justice statistics report. Data of UK is adapted from Malwina Mejer and Bruno van Pottelsberghe de la Potterie (2009)[21] and Harhoff.D [12], data of Germany is calculated by the information in Harhoff.D [12] and Cremers, Katrin et al. (2013)[8]: revocation actions were initiated in 25% of all litigation cases therefore  $1044 = 261/0.25\%$ . [3] and [5] is computed as the number of validity challenge and infringement suit divided by the number of all patents-in-force.

*judgment conditions in a transparent way.*(Figure 8): The first layer is composed of legal standards that reflects broad dimensions of litigation policy making. Three interdependent legal standards shape the main actions: the validity challenge(rigor), the infringement suit (predictability) and cost (affordability). The second layer is characterized by operational designs put in place to evaluate legal standards.

"Legal standards" is less easy to compare across selected systems since the routines or implementation vary drastically. This paper puts forward that the degree to which a legal standard is satisfied depends on the "operational design" put in place by the patent offices or jurisdiction. Significant divergence in operational designs could lead to different degrees of quality (or rigor) in complying with patentability conditions. Figure

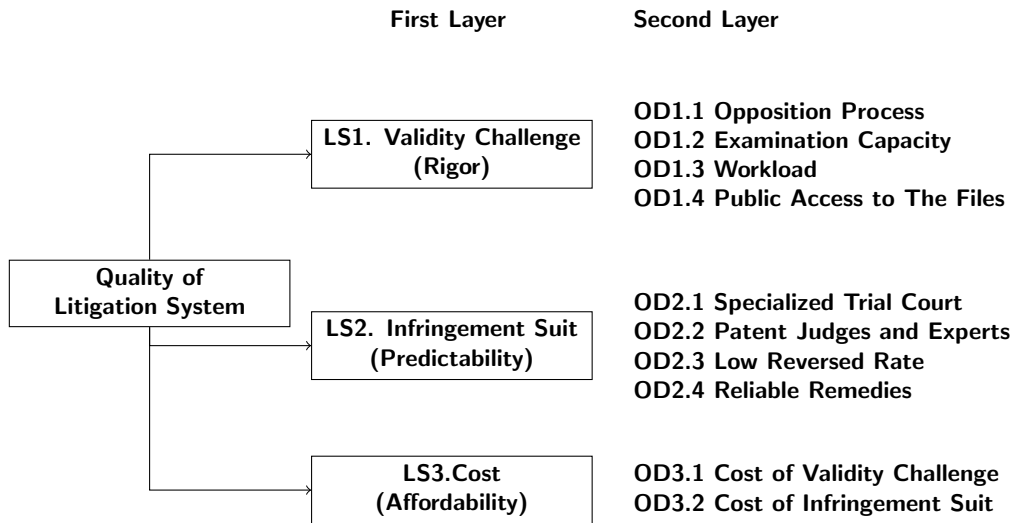


Figure 8: Analysis framework: legal standards and operation designs

8 lists the three main legal standards (LS) and describes the corresponding components of the operational designs (OD). It also briefly explains why each of these components might eventually affect quality and transparency in patent systems.

Some of these components are more important or relevant than others in securing a transparent and thorough judgment process. A relevance scale can therefore be used to gauge each component's relative importance. Two approaches were used to build this relevance scale. The first method consists of allocating a relevance level on a 1 to 3 scale. A value of "1" means low relevance, "2" means medium relevance and "3" means high relevance. For instance, the low workload to the files (relevance: 1) is less important than the opposition process (relevance: 3). The second method consists of pair-wise comparisons of all of the components of an operational design. If component A is considered to be more relevant than component B, the former receives one point (see the comparison matrices in Appendix 1, Tables A.5 and A.6). The sum of the points received by each component creates a relevance scale. This second method shows more variance in the relevance level. For instance, for the novelty legal standard, the validity reevaluation varies from 1 for the public access to the files to 4 for the Specialized trial courts.

Turn now to the determination (or scoring) of values in each operational designs (OD), each category consists of several conditions which, if satisfied, indicate a high level of quality in that category. Each condition is of a binary character: yes it is satisfied or no it is not. For example, if a country satisfies all or closer to all conditions required for high quality, it scores 3 out of 3 ; if it satisfies only few condition, it receives a score of 1 in this category. A description of these conditions and corresponding cross-country study are provided in the following section, and summarized in appendix Table

## A.4.

Table 2: Quality in litigation systems: legal standards(LS) and operational designs (OD)

| System design   | Importance for rigor, transparency and predictability  |
|---|--|
| (LS1) Validity Challenge                                    | Patent suits based on weak patents, are socially harmful (Meurer and Bessen(2005) [22] ). Effective adversarial procedure can revoke a wrong grant and weaken patent owners' threatening power by litigation. The extent to which the validity challenge is properly assessed can be gauged through four components of its operational design (OD1.1-OD1.4)  |
| -OD1.1 Opposition Process<br><i>-Relevance(4,2)</i>         | Given the possibility of filing an opposition, third parties can submit new, previously unidentified published material and documents to challenge the patentability of a patent with a much lower cost than litigation would entail. Also, post-grant opposition frequently lead to revocation or amendments of questionable claims at the early point, which reduce uncertainties on the market and propensity to costly litigation. |
| -OD1.2 Examination Capacity<br><i>-Relevance(4,3)</i>       | Two aspects affect the examination capacity: education and training of the examiners/judges and the frequency of initiating an ex officio research on prior art  |
| -OD1.3 Low Workload<br><i>-Relevance(2,1)</i>               | If examiners/judges are subject to a heavy workload, and have insufficient resources to perform searches and examinations, quality might be affected. A high workload per examiner might mean that examiners perform their tasks faster, which could result in a less thorough examination.  |
| -OD1.4 Public Access to the Files<br><i>-Relevance(1,1)</i> | Sufficiently and timely publishing information can reduce duplicated filing and uncertainty on the market.   |
| (LS2) Infringement Suit                                     | Infringement suit is a key entity in the patent litigation system. It verifies the scope of the claims, quantify patent's commercial value, and shape an judiciary threat to enforce the patent protection. The extent to which the infringement suit is properly assessed can be gauged through four components of its operational design (OD2.1- OD2.4).   |

|   |  |
|---|--|
| -OD2.1 Specialized Trial Courts<br><i>-Relevance(4,3)</i>   | Judicial patent specialization will improve the predictability and reliability of judgement. We discuss two kinds of specialization: Collect the judiciary on one field can have better case management and accumulating experience; Concentrate judiciary on limited court can reduce the inconsistency of patent rulings and forum shopping, improving the substantive fairness and convenience for patent defendants. |
| -OD2.2 Technical Judge and Expert<br><i>-Relevance(4,3)</i> | When the complex patent surface in an infringement suit, the court may have a difficulty to understand the nature of a technology and the patentability of involved patent. Technical judges and experts are practical solutions.  |
| -OD2.3 Low Reversed Rate<br><i>-Relevance(1,1)</i>          | Reversed rate counts the percentage of initial decisions that overturned by a more experienced court. It is frequently used as a reliable measure of competency of a trial court. High reversal rate indicate a low quality judgement and high litigation cost. (Kesan and Ball (2010)[15])  |
| -OD2.4 Reliable Remedies<br><i>-Relevance(4,3)</i>          | Remedies compensate the patentee for past infringement and to enjoin future infringement. There are similarities among the laws in term of remedies, but present differences in the preference to grant and difficulty to implement.   |
| (LS3) Cost  | high cost is double edged for a litigation system: it reduces the dubious petitions but also deter the accessibility for young, innovative firms; it contributes to the financial sustainability of the system, especially if the high-quality judgement is correlated with high fees, but also make financial burdens on innovative firms.  |

## 5 International Comparison

This section compares the legal standards and their operational designs in six countries: US, Germany, Korea, UK(England and Wales), China and Japan. Discuss of validity challenge proceedings relates to the post grant proceedings in USPTO, KIPO,SIPO and JPO, invalidation trials in BPatG and counterclaim of invalidation in US and UK judicial courts. To assess relative degrees of quality, the system are ranked for each component of the operational design of their legal standards. Ranks range from one to three, which indicate a low and a high level of rigor or affordability, respectively.

## 5.1 Legal Standard 1: Validity Challenge(VC)

Validity challenge is frequently used by firms, especially the potential infringer, as defense evidence. It can be enforced separately from infringement suit, such as Germany, or by the counter-claim in a trial, as in US court. Identifying the relevant state of the art is not straightforward and can be gauged through seven interrelated components of the standard's operational design.

**OD1.1 Opposition process** The EPO has a low-cost, post-grant opposition system that allows any third party to challenge the patentability of an European patent for a period of nine months from the decision to grant. Opposition makes effect with unified effect for all designated states. In Germany and UK, Revocation request can be brought only if no opposition proceedings are pending and the period for filing oppositions has lapsed. Germany patent office (DPMA) also has an opposition proceedings with similar function but shorten the filing period to three months from the grant decision.

Procedural differences between opposition and other validity challenge proceedings affect firms' filing strategy: First of all, opposition in EPO allows the existence of "straw man" while other processes require requestor to disclose the identity of the true party in interest. This is one factor for high participating rate of opposition. Combining cost advantage, opposition rates are about three times higher among European Patent Office (EPO) equivalents of US litigated patents (Graham and Harhoff (2014) [11]). Another matter approaches to rules for terminating the reexamination. Examiners in EPO may continue the reexamination even the demand has been withdrawn. Graham and Harhoff (2014) [11] points out that this ex officio reexamination discourages its strategic use by potential opponents to delay judgment of an infringement suit. The rest offices will stop the examination if parties have an agreement. In US, more than 80% infringements didn't approach to the final trial (Allison, JR et al (2014)[3]). If the suits got settled, the questionable patent is still valid on the market.

Opposition cannot be taken as indicators of quality in validity challenge mechanism. The only certainty is that opposition, as a cheap and efficient mechanism, can efficiently invalidate weak patent, especially in Germany and UK in an early stage.

**OD1.2 Examination Capacity** Examination capacity discusses three factors: technological knowledge, legally qualification, and turnover rate.

Experience in prior examination can be used as a proxy for examiner/judges' technological knowledge. Rogers (2012)[27] and Bajwa(2014)[5] use US evidence to confirm that if judges have direct experience of interpreting and evaluating patent applications, they could provide better claim construction with validity challenge. In the six countries, SIPO and BPatG ask for experience as technical examiners when they recruit new examiners/ judges for the invalidation divisions. UK patent courts have hired "Scientific Advisor". In KIPO and JPO, the board in charge of prior examination will explain

the patentability as defendant in an invalidation trial. In US, district courts are lack of technical judges in charge of patent cases, also for examiners working in post grant proceedings in USPTO, prior examination experience is not necessary. Only when the patent claimed need to refines, proceeding is transferred to Central Reexamination Unit (CRU), who is composed of three experienced specialist examiners.

The second factor is legally qualification. as an appellate proceeding, validity challenge doesn't re-conduct the examination, but review the legal formalities and decisions of previous tribunal with new submitted prior art. Therefore, familiarity of judicial rules are required. In this aspect, examiners in USPTO, and also KIPO, JPO, works as administrative judges while in SIPO are pure administrative staff. In USPTO, the reexamination board PTAB made 873 decisions of inter partes cases, and only 132 cases go to the appeal proceedings, where the appeal rate is only 15% in 2012. SIPO reports that in 2012, the reexamination board made 2599 decisions of invalidation cases and 684 continue the appeal suits in Beijing High Court ( with 26% appeal rate). However, judiciary agencies, BPatG and UK , have comparative high appeal rate. The potential explanation is the rule that "loser pays the winners litigation fees ", which increase requestors' incentive to appeal to upper judiciary organs.

Turn over rate, adopted in the van Pottelsberghe (2011) [9], evidently correlate with longer average experience of typical examiners, which in Lemley.MA(2009)[18] , is described as, an unexpected, socially suboptimal effect. Examiners in three Asian patent offices are all one of a branch of the National Ministry, which translate into low turnover. As described in van Pottelsberghe (2011) [9], almost 80% of patent examiners at the USPTO had less than three years of examining experience in 2009, while the share of examiners with more than 10 years fell from 20% in 2004 to 7% in 2009. Judges in BPatG and UK patent courts are judiciary servants, which is a lifetime and fixed-salary position, and they have exclusive judiciary power on patent cases, which facilitates collecting judicial experience in Patent Law.

Over above three factors, US related agencies and SIPO would have a lower rank(2) than the other countries(3) in terms of technical and legal qualification and experience.

**OD1.3 Workload and Pendency** As van Pottelsberghe (2011) [9], find that an increase in the workload of examiners may result in a less time thorough examination and grant low quality patents. This conclusion can be adopted for the validity challenge proceedings as well. Table 3 presents various measures for comparing the workload per examiner for the year 2007 and 2012. The ratio of incoming petitions per examiner/judge is presented in columns [3]. Column[3] shows that the number of petitions related to validity challenge is 20 in BPatG and even fewer in UK courts. Examiners in the KIPO and JPO post grant boards has addressed approximately more than three times as many as cases in the BPatG. USPTO and SIPO didn't published the exact statistics on examiners in the post grant boards, but we can find that the increase of the whole examiners in patent offices are far less than the increase of petitions. As list in column [1] and [2], the

number of patent reexamination filed in the post grant division kept increasing (80% in USPTO and three times more in SIPO) but no evidence shows that the two offices recruits corresponding new examiners.

Pendency also imply the various time spent by examiners/judges on each patent. BpatG and UK has the longer average pendency. some special procedure design may lengthen the pendency but positively impact the judgement quality. For example, BPatG adopts Ex officio Search, which means the court will initiate search on their own initiative<sup>9</sup>, not bound by the submissions and applications for the hearing of evidence made by the parties. The additional search on prior art contributes to enhance the rigor of decision, especially when original search didn't approach certain important elements. In UK, patent court frequently adopt cross-examination of evidence, which takes time but benefit the judgement quality as well(Klink ,2004)[16].

| Region | Post grant activities [1] |       |             | Examiners(EX) in charge of validity challenge[2] |      |             | post /EX [3] | Pendency (mons)[4] |
|--------|---------------------------|-------|-------------|--|------|-------------|--------------|--------------------|
|        | 2007                      | 2012  | RQ increase | 2007   | 2012 | EX increase |              |                    |
| USPTO  | 769                       | 1387  | 80.36%      | -  | -    | < 45.7%     | -            | 9                  |
| BPatG  | 741                       | 2208  | 197.98%     | 118  | 108  | -8.5%       | 20.44        | 24.6               |
| UK     | -                         | <100  | -           | -  | -    | -           | < 10         | 18                 |
| KIPO   | 17600                     | 14747 | -16.21%     | 99   | 99   | 0           | 148.9        | 10.2               |
| SIPO   | 4748                      | 20261 | 326.73%     | -  | -    | <7.5%       | -            | 6-12               |
| JPO    | 38519                     | 28240 | -26.69%     | 386  | 387  | 0.3%        | 73           | 16                 |

Table 3: Workloads of examiners in charge of validity challenge, 2012

source: Own calculations based on data provided in annual reports of the related patent offices, courts and WIPO Annual Report, 2012. [1] covers all the post-grant activities. The range of the activities is wider than the invalidation activities in Table 1, as examiners, in charge of invalidation cases, also deal with other post-grant activities. Specifically, we collect the workloads with “ ex parte and inter partes ” review/trials in USPTO, KIPO and JPO, trials in BPatG and UK court, and “reexamination and invalidation ” cases in SIPO; [2] indicate the quantity of examiners/ judges in post grant divisions of related patent offices or courts.[3] is the rate of invalidation requests by total examiners in post grant divisions; [4] is from annual reports of each patent offices, data of UK is the same as average pendency of infringement trial in UK since in practice, invalidation is filed as counterclaim in an infringement suit in UK

OD1.4 Public Access to the Files Cases as UK and Germany, validity challenge is filed before court, notice and following oral hearing is public available. Final judicial decisions are also published on official websites. USPTO also provide an timely and comprehensive

<sup>9</sup>(Article 99 EPC)



online database. Reexamination files are open to inspection by the general public by way of the Public PAIR via the USPTO Internet. There will be about a ten day lag between filing and data entry into the PALM database. The public can search for the filing information, follow the reexamination status and also view the entire content of the reexamination file. Comparatively, Three Asian offices only publish the results of reexamination, which are least transparent.

**Summary for Validity Challenge** US and China fail to provide sufficient qualified and experienced examiners. In addition, transparency of the systems ( online database, update speed and language) in three Asian countries, is less developed than other systems. The opposite is only adopted in Germany. For these reasons, the reevaluation of relevant claims might be more comprehensive in UK and Germany than in China and US, Japan and Korea stay at intermediate position.

## 5.2 Legal Standard 2: Infringement Suits(IS)

**OD2.1 Specialized trial courts** Two variables identify the specialization of federal courts: exclusivity (exclusive courts hear every case of a certain type) and limitation (limited courts hear only a particular type of case)(Revesz,1990)[26]. Litigation system in UK and Japan satisfy the both conditions. Infringement cases in UK only can be filed in IPEC or HPC. In Japan, Infringement suits can be filed in two district courts: Tokyo and Osaka. Both courts set up special division comprising judges working exclusively on IP cases.

Germany and Korea establish “de facto” specialization in infringement suit, where cases are concentrated in certain judicial districts and a small number of judges preside over a large number of patent disputes.( Kesan and Ball, 2011)[15] .For instance, in Germany, More than 80% infringement suits filed in three district courts: Dusseldorf, Mannheim and Munich. (Harhoff.D,2009)[12].

US and China are less able to unify district courts. US set up ”CAFC” to take exclusive jurisdiction but only over patent appeals. All the federal district courts can hear the first instance of patent cases. In China, special divisions over patent cases were created in many regional courts. Parties still have large rooms to search for a favorable jurisdiction whose interpretation of doctrine is most favorable.

**OD2.2 Patent Judges and Expert** First of all, patent- specific judicial experience does increase the accuracy of rulings in patent cases(Schwartz (2008)[29]. Judges in a specialized court, such as in UK and Japan, can focus on patent law and then quickly improve knowledge and experience. Cases as US, most patent cases are still presided over by judges with little or no patent experience. As Kesan and Ball (2011)[15] reports, 40% of all judges presided over only about one patent case a year between 1995 and 2003.

The second factor we considered is technology knowledge. High percentage of judges in US have degree of technological specialization<sup>10</sup>. In UK, Four of the eleven active judges on the Federal Circuit are technically trained., the court will provide technical Difficulty Rating prior to trial. Trials of cases with high technical difficulty rating will be heard by special judges.

In addition, technical advisors or scientific expert witnesses can help judges understand technical details. Patent courts in UK and Japan both create technical assistant ( Named as“ Scientific Advisor ” in UK), who give a neutral explanation of the technical matters at issue, reducing the burden of claim construction rests upon the judges. Technical assistant in Japan are full-time public servants. Many of them are experienced patent examiners on loan from the Japan Patent Office. Comparatively, the judges in Germany district courts are trained legal professionals but rarely have any technical training. (Graham and Harhoff, D(2014)[11]) Neither in China.

Overall, judges in UK patent courts show the highest with respect to the patent-specific experience and technical training.

**OD2.3 Reversed Rate** The most reliable data of reversed rate of infringement suits is from empirical research work. China, recorded in the official national litigation report, has the highest reversed rate (39%) over the infringement suits. A study, by Bajwa (2014)[5], reports that Infringement cases in UK and Japan have much lower reversed report than other countries(19% and 14% respectively. ) Cremers et al. (2013) [8]verified the low reversed rate in UK patent courts, and also point out that in Germany, the share of cases that proceed to the higher regional courts and the share of judgments overturned are even lower than UK. US and Korea are reported to stay at the intermediate position Bajwa (2014)[5].

**OD2.4 Reliable Remedies** This catalog consists of three indicators: Sufficient Remedy Grant; Stringent entitlement of injunction; Easy to enforce the decision.

The prime objective of an infringement suit is to recover economic damages from infringer. China is the mostly criticized as applying inadequate fine compared to the likely degree of harm caused. Legal scholars, Sepetys and Cox( 2009) [30]provides two aspects of evidences: one is that China patent law doesn't clearly makes rules of punished fine for conducting bad faith litigation. note<sup>11</sup>. In addition, Insufficient technologies and service, such as retail scanner data, deter the comprehensive and accurate estimation on damage.

When the remedy rule is too plaintiff-friend, trials on purpose will happen. As a kind of remedy, Injunction is mostly discussed by economists. Preliminary Injunction

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<sup>10</sup>Setsuko Asami (1998) [4]claims that 20% of all the Federal District Court judges have technical degrees.

<sup>11</sup>In US: "increase the damages up to three times the amount found or assessed " 35 U.S.C. 284

is granted if the court can find sufficient evidence prior to a final determination. When plaintiff wins the trial, preliminary injunction is most likely converted to a permanent injunction. Lemley and Shapiro (2006) [19] claims that injunction remedy does not only enjoin the infringement but also the infringer’s profit. Schankerman and Scotchmer(2000) [28] claims that even the threat of a permanent injunction greatly enhance the patent holders inappropriate negotiating power. In the selected countries, U.S court tends strictly control the entitlement to injunction relief, for example, they deny the injunctive relief to non-manufacturing patent owner. Based on the report by China Supreme Court, the national courts decided the 55 preliminary injunction requests in 2010, 130 in 2011 and 27 in 2012. The success rate approaches 90%<sup>12</sup>. Such a supportive policy on injunction relief may create potential risk of more strategically filings.

The final factor is the enforcement of remedy decision. ”Doing Business” study, by the World Bank , is often obtained for estimating the difficulty of contract enforcement. According to the table 4, firms in the selected countries require similar numbers of procedures to enforce a deal, but China and UK will spend two times days as Korea.

| Economy | Enforcing Contracts rank | Enforcing Contracts DTF | Time (days) | Cost (% of claim) | Procedures (number) |
|---------|--------------------------|-------------------------|-------------|-------------------|---------------------|
| China   | 35                       | 68.21                   | 452.8       | 16.2              | 37                  |
| Germany | 13                       | 76.74                   | 394         | 14.4              | 31                  |
| Japan   | 26                       | 69.95                   | 360         | 32.2              | 32                  |
| Korea   | 4                        | 81.71                   | 230         | 10.3              | 32                  |
| US      | 41                       | 67.26                   | 420         | 30.5              | 33.6                |
| UK      | 36                       | 68.08                   | 437         | 39.9              | 29                  |

Table 4: World Bank, Doing Business Project, ”Difficult to Enforce Contracts”

Overall, Germany, Korea and Japan get the highest rank (3) of rules and enforcement related to the remedy. UK stays in the medium with long periods requirement of enforcing a decision. US and China get the lowest rank(1).

**Summary for Infringement Suit** Four components of the operational design related to the infringement suit, taken as a whole or individually, suggest that the China and US have taken a softer approach to the predictability of the judgment than UK and Japan. This is true in terms of specialization of courts , quality of judiciary boards and remedy grant. Korea and Germany are in an intermediate position. One softness of the two countries is characterized by: lack of technical trained judges or technical assistant.

<sup>12</sup>see 2010-2012, report on “protection of intellectual property rights” from the Supreme People’s Court. English Version: [http://www.court.gov.cn/zscq/bhcg/201304/t20130426\\_183662.html](http://www.court.gov.cn/zscq/bhcg/201304/t20130426_183662.html).

### 5.3 Legal Standard 3 Cost

Calculating litigation cost always depend on the amount of stake and complexity of the case, therefore it is far from being straightforward. We decompose the cost structure into four main categories associated with the trial process: invalidation procedural fees, length of procedures, efficiency of the trial courts (indicated by insurance cost) and survey on external cost (attorney fees, etc.)

Invalidation in a trial takes more complex procedures and cost in UK, Germany and US. It takes evidence disclose and frequently oral hearing. Besides, the procedural cost is calculated not by the number of asserted claims, but the commercial value of the involved patent to the patentee. Therefore, validity challenge cost in the UK, Germany and US court is comparatively high. Comparing the cost in the patent offices, US charges the highest filing fees for post-grant reexamination proceedings among the four patent offices. The first part of Table 5 compares the relative cost of invalidation filing fees per patent, USPTO is almost ten time higher than other three asian offices. The appendix 1.1 provide specific comparison method.

Another factor is the judgement duration. Economists support that long time of examination positively relate to the decision quality, but leads to heavy cost on attorney fee and uncertainty to the party (McDonagh and Helmers, 2013)[14]. Bifurcation systems such as Germany require longer pendency since the judges frequently stay for the decisions of validity challenge. Not all the systems publish the pendency statistics, we collect the related information from official report and major surveys. The results lists in the second part of Table 5).

Insurance and Liability Cost is frequently used as a proxy for the efficiency of a court. As discussed in Rasmusen(2013)[25] two countries cause the same number of accidents, and that the courts value human life at the same level. Given the higher administrative costs involved, insurance will cost more in inefficient court. The third part of Table 5 presents the “OECD’s estimates of the mean automobile insurance costs in 2012”, US, Korea and UK face higher costs than other countries.

The final part is to approximate the external cost (professional services, attorneys, etc.). External cost would increase with the amount at stake and with the complexity of the case. The fourth part of Table 5 presents the information based on main surveys on litigation cost (Details is in Appendix Table A.3). UK and US is by far the most expensive jurisdiction. One potential explanation is compulsory evidence discovery. According to a 2009 economic survey commissioned by the AIPLA, roughly 60 percent of litigation cost is incurred during the discovery.

**Summary of Cost** We give the final rank by the analysis of total four indicators. UK and US are expensive with each factors. The absolute cost for Korea and Japan are not much lower than US and UK, but the gap gets narrow if we consider the countries’ GDP/capital. Comparatively, China and Germany take less costs for litigation, but

invalidation in Germany will take longer period.

## 5.4 Summary

Qualitative analysis presented in this section is shown in Table 6. In order to assess the relative levels of quality for the validity and challenge legal standards, the six countries were assessed for each of the operational design components on a 1 to 3 scale, from a low to a high stringency and predictability. The quality scale for each component is motivated by the arguments provided in this section. For instance, the DE and UK scores 3 for the “Opposition Process” (OD1.1), compared to a score of 1 for the other countries. Since the components of a given operational design do not have the same relevance, they were positioned on a “relevance scale” reflecting the extent to which they matter in terms of satisfying the legal standard in a transparent way. Two relevance scales were created (see Figure 8 and Section 4). The first (W1-3) goes from 1 to 3, while the second (weights based on bilateral comparisons, WB) was created by comparing each component with all other components (see Figure 8 for a description of each component, and Appendix Tables A.5 and A.6, for the bilateral comparisons of all components). The “weight” columns (W1-3 and WB) in Table 6 provide the relevance level for each component.

In order to arrive at a broad approximation of the degree of quality of validity challenge and infringement suit legal standards, the weighted sum of the ranks for the components of their operational design was computed. The results are indexed using the USPTO as a base (USPTO=100). There might be a degree of subjectivity (self-assessment by the author) in allocating the weights. Table 6 indicates that the quality of the litigation system is substantially higher in Germany and UK than in US and China, while the quality of the litigation system in Korea and Japan falls somewhere in the middle.

In the China, the relatively low quality of validity challenge and infringement suit (due to the less qualified examiners and judges, the heavy workload per examiners, high risk of forum shopping, and not sufficient remedy) that is associated with low costs, have probably lead to a very high propensity to patent, as it is easy and inexpensive to strategically file a trial suit. At the opposite end of the spectrum is UK, where a thorough highly specialization, associated with high rigor in validity evaluation and high fees, has led to relatively low demand for litigation and a much less worrying patent trolls. Germany has a high quality for the validity challenge process while infringement suit part get lower grade and costs. Other countries stay in an intermediate position.

**Note: I haven't add description about the matrix, Figure 12**

The ultimate consequence of these heterogeneous degrees of quality across patent systems can be gauged through the demand for invalidation and infringement suit. Figure

| Organization                                      | US       | DE        | UK   | KR      | CN       | JP       |
|---|----------|-----------|--|---------|----------|----------|
| Validation Challenge (Filing fees)                |          |           |  |         |          |          |
| Basic filing fee (\$1000) [1]                     | 9        | Expensive | Judiciary proceeding, but reimburse to the winning party is possible | 0.097   | 0.48     | 0.488    |
| Fees Per GDP/Capital (*10) [2]                    | 1.75     |           |  | 0.03    | 0.044    | 0.13     |
| Time Cost of Litigation                           |          |           |  |         |          |          |
| Bifurcation or not                                | No       | Yes       | No   | yes     | Yes      | Yes      |
| Average time spent of VC (1st Action, months) [3] | 9        | 24.6      | -  | -       | 10.2     | 16*      |
| Average time spent of IS (1st Action, months) [4] | 18-24    | 9 - 12    | 18   | 14      | 12       | 8-18     |
| Motor Insurance Costs (US (\$) per car)[5]        | 1464     | 792       | 927  | 949     | -        | 754      |
| Motor Insurance Costs (US (\$) % of GDP)[6]       | 1.45     | 1.11      | 0.93   | 1.09    | -        | 0.72     |
| Survey of litigation cost (1000 dollars) [7]      | 560-4000 | 50-590    | 400-3370   | 300-800 | 150-250  | 100-3000 |
| litigation costs per GDP/Capital [8]              | 10 to 77 | 1.2 to 14 | 11 to 96   | 9 to 25 | 13 to 22 | 2 to 84  |
| <b>Rank(from low to high)[9]</b>                  | 5        | 2         | 6  | 3       | 1        | 4        |

Table 5: Index for Patent Litigation Cost

Raw data of [1] and [3] are published on patent office webs. [4],[7]and[8] are adopted from annual report of “WIPO Arbitration and Mediation Center” and Harness Dickey Cremers et al (2013)[8]. [5] and [6] is from OECD, Insurance Statistics Yearbook 1998-2007, 2007 data. Exchange rates, and GDP/Capital used in the calculations are from the World Bank, WorldDataBank, <http://databank.worldbank.org/ddp/home.do>. [9] is based on the weighted sum of ranks of each cost indicator.)

| WB <sup>1</sup>                              | W-<br>3 <sup>1</sup> |  | <i>USA</i> | <i>DE</i> | <i>GB</i> | <i>KR</i> | <i>CN</i> | <i>JP</i> |
|--|----------------------|--|------------|-----------|-----------|-----------|-----------|-----------|
| <i>Legal Standard 1: Validity Challenge</i>  |                      |  |            |           |           |           |           |           |
| 3  | 2                    | OD1.1 Opposition                       | 1          | 3         | 3         | 1         | 1         | 1         |
| 4  | 3                    | OD1.2 Examination Skills and Expertise | 2          | 3         | 3         | 3         | 2         | 3         |
| 2  | 1                    | OD1.3 Workload                         | 2          | 3         | 3         | 2         | 1         | 2         |
| 1  | 1                    | OD1.4 Public Access to the Files       | 3          | 3         | 3         | 1         | 1         | 1         |
| Weighted sum of OD 1.x(WB;USPTO=100)         |                      |  | 100        | 167       | 167       | 111       | 78        | 111       |
| Weighted sum of OD 1.x(W1-3; USPTO=100)      |                      |  | 100        | 162       | 162       | 108       | 77        | 108       |
| <i>Thoroughness of Validity Challenge</i>    |                      |  | L          | H         | H         | M         | L         | M         |
| <i>Legal Standard2 : Infringement Suit</i>   |                      |  |            |           |           |           |           |           |
| 4  | 3                    | OD2.1 Specialization                   | 2          | 2         | 3         | 2         | 2         | 3         |
| 4  | 3                    | OD2.2 Technical Judges or Expert       | 1          | 1         | 3         | 1         | 1         | 2         |
| 1  | 1                    | OD2.3 Reversed Rate                    | 2          | 3         | 3         | 2         | 1         | 3         |
| 4  | 3                    | OD2.4 Indemnification                  | 1          | 3         | 2         | 3         | 1         | 3         |
| Weighted sum of OD.2.x(WB;USPTO=100)         |                      |  | 100        | 150       | 194       | 144       | 94        | 194       |
| Weighted sum of OD.2.x(W1-3; USPTO=100)      |                      |  | 100        | 150       | 193       | 143       | 93        | 193       |
| Quality Rank of Infringement Suit            |                      |  | L          | M         | H         | M         | L         | H         |
| Legal Standard 3: Cost (Low:1; Expensive: 6) |                      |  | 5          | 2         | 6         | 3         | 1         | 4         |
| Broad selectivity (three legal standards)    |                      |  | L          | H         | H         | M         | L         | M         |

Table 6: Quality assessment of the two-layer Litigation System

Notation: (1) see Appendix Table A.5 and A.6 for a description of the relevant of these components for quality assessment.

9 presents the relationship between the degree of quality in an organization for validity challenge, and the invalidation request rate (by total patent in force). Only 0.01% of patent in force are involved into invalidation in Japan and UK, compared to 0.33% of invalidation request in China. Figure 10 depicts the relationship between the degree of quality in total litigation systems (average grade of validity challenge and infringement suit) and the rate of infringement suits rate of total patent in force<sup>12</sup>. Rigor of the infringement suit proceedings can avoid the strategical suits, such as UK and Japan with high grade in enforcement and low suit filing.

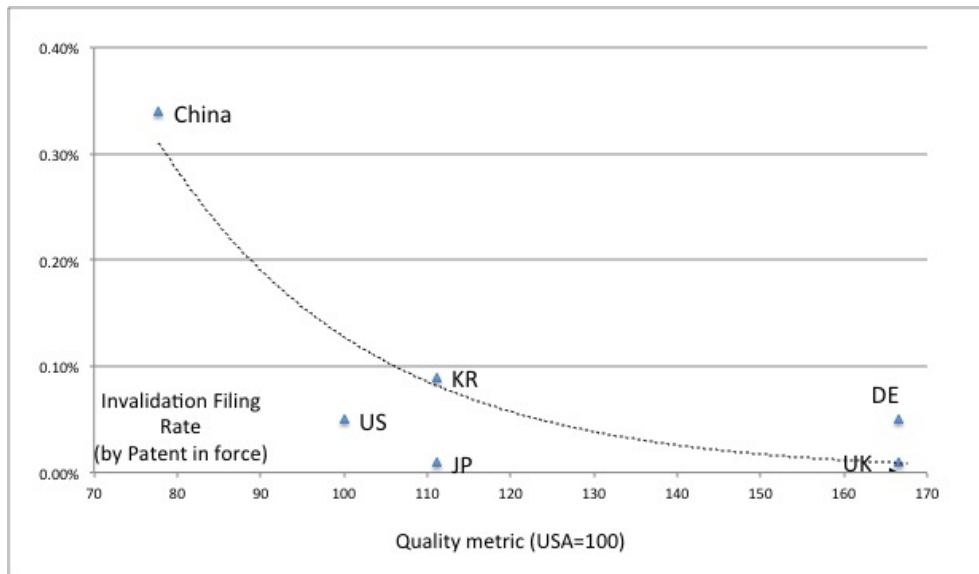


Figure 9: Quality Level and Demand for Validity Challenge, 2012

Source: see Table 6. The quality metric on the horizontal axis shows the WB grade of validity challenge. (US=100; Germany=183; UK= 183; Korea=122; China= 61; Japan=122). The vertical axes show the rate of invalidation request by total patent in force in 2012. Rate of US is calculated by the filings of “ex parte” by third parties and “inter partes” review filings in USPTO while US\* use the data of US plus the estimated filings as counterclaims in infringement suits.

## 6 Conclusion and Policy implications

The objective of this paper is to create a quality framework for litigation systems for solving patent disputes and test whether quality affects the behavior of petitioners. The first part of the paper study the patent litigation system of major economic areas ( the US, Germany , UK , Korea, China and Japan), which highlights international differences of patent litigation demands and routines. For example, , the rate of invalidation by

<sup>12</sup>since the data limitation, we exclude the Koreain the relationship analysis



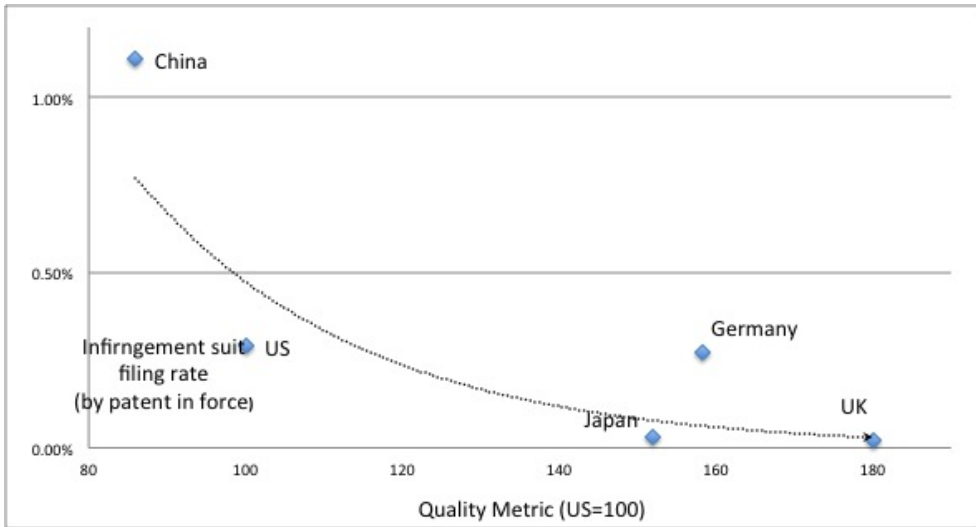


Figure 10: Quality Level and Demand for Infringement Suits

Source: see Table 6. The quality metric on the horizontal axis shows the average position for the two quality metrics (the validity challenge and infringement suit) presented in Table 6 (US=100;Germany=158; UK= 181 ;Korea=128; China=75; Japan= 153 ). The vertical axes show the rate of infringement suits (by total patent in force) filed in each national litigation systems. Public information of Korea is not available.

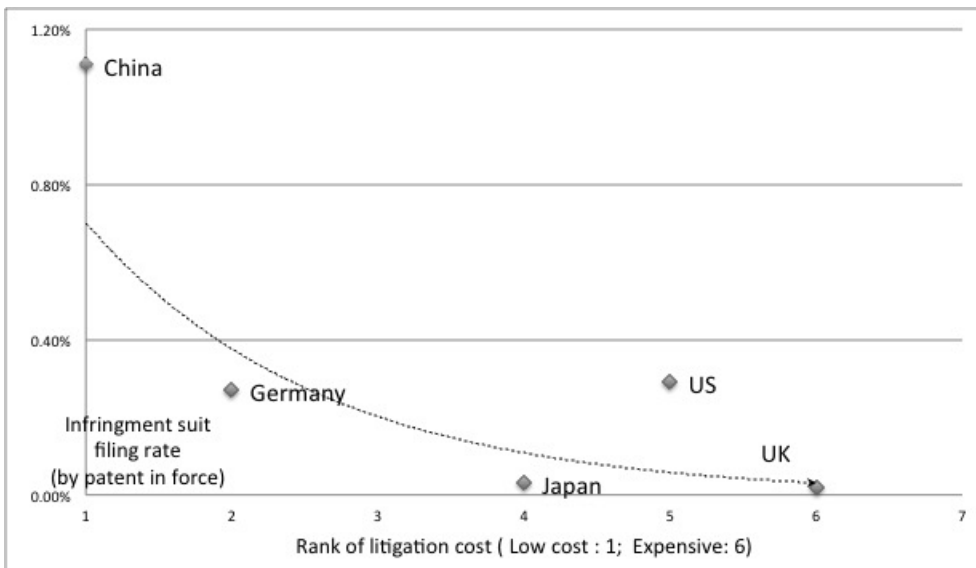


Figure 11: Cost and Demand for Infringement Suits

Source:The horizontal axis shows the rank of cost presented in Table 5, the details are explained in the Appendix Table A.3

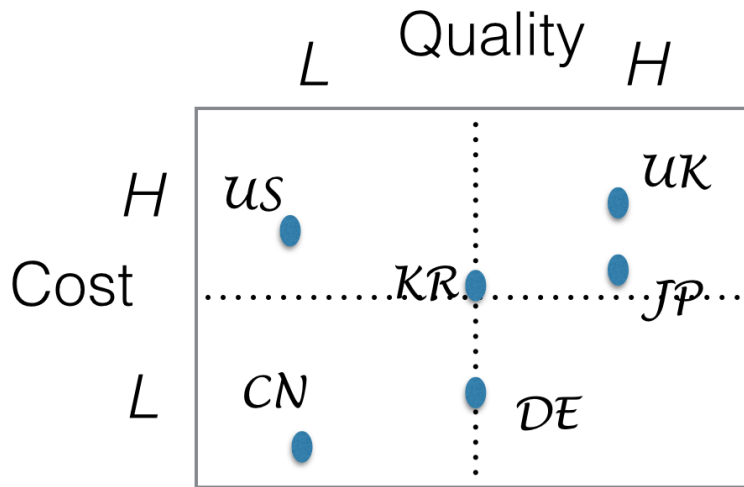


Figure 12: Quality vs Cost Matrix

Source:see Table 6

patent in force ranges from 0.01% in UK and Japan to 0.34% in China. The rate of infringement suit by patent in force ranges from 0.02% in UK to 1.11% in China.

The second part of the paper set up systemic frameworks to evaluate the quality. Heterogeneity is observed across countries both in validity reevaluation and infringement suits proceedings. The litigation systems in US and China are less rigorous and predictable than in UK and Germany, as evidenced by less degree of validity reevaluation, lack of specialization of patent court and judges, and less reliable remedy grant. This lower rigor and transparency, led to the more litigation filings in US and China. In other words, petitioner gauges the quality of litigation systems and adapt their filing behavior accordingly. Interestingly, this negative relationship between quality and the demand for patent rights is even more significant when the roles of relative costs taken into account.

As long as the quality of the litigation process is not harmonised across regions within a countries, and as long as their operational designs diverge, moves towards several bilateral work sharing and strategically filing might actually drive global litigation exploration. One important policy implication in this paper concerns on going attempts to a specialized patent court both in Europe and China. In addition, post-grant opposition processes, intermediate requests for examination and the degree to which patent applications can be adapted during the examination through continuation in parts or divisional applications must also be similar. In this respect, the components of the operational designs presented in this paper can act as a useful checklist for a potential

convergence process. Furthermore, one must keep in mind that although Europe performs better in terms of quality, it does little in terms of accessibility or affordability for young, innovative companies, universities and scientists. Several components of a patent system's operational design exist to provide easier access to the system, including sharp fee reductions for SMEs and grace periods. These details do not improve the degree of quality in a patent system but they might ensure that those for whom the patent system was originally created can make use of it.

## A Appendix

|         |  |            |
|---------|--|------------|
| USA     | United States Patent and Trademark Office                                | USPTO      |
|         | the Court of Appeals for the Federal Circuit                             | CAFC       |
|         | Patent Laws  | USPL       |
|         | Manual of Patent Examining Procedure                                     | USMPEP     |
|         | Leahy-Smith America Invents Act  | AIA        |
| EU      | European Patent Office   | EPO        |
|         | European Patent Convention   | EPC        |
|         | Agreement on Unified Patent Court  | AUPC       |
| Germany | Germany Patent and Trade Mark Office                                     | DPMA       |
|         | Germany Federal Patent Court   | BPatG      |
|         | Germany Patent Law (Patentgesetz-PatG)                                   | GPL        |
| UK      | UK Intellectual Property Office  | UKIPO      |
|         | Intellectual Property Enterprise Court                                   | IPEC       |
|         | Patent Court (Chancery of the High Court)                                | PHC        |
|         | Intellectual Property Enterprise Court Guild                             | IPEC Guild |
|         | Patents Court Guide  | PHC Guild  |
|         | the Patent Act (1977)(as amended)  | UKPA       |
| China   | The State Intellectual Property Office of the People's Republic of China | SIPO       |
|         | China Patent Law   | CPL        |
|         | 2012 Measures for Patent Administrative Law Enforcement                  | CPALE      |
| Japan   | Japan Patent Office  | JPO        |
|         | Japan Patent Act   | JPA        |
| Korea   | Korean Intellectual Property Office                                      | KIPO       |
|         | the Intellectual Property Tribunal                                       | IPT        |
|         | IP Laws of Korea   | KIPL       |

Table A.1: Abbreviation of related institutions and laws

| Region                | Opposition                  | Invalidation in the Patent Office          | Revocation Trial  | Appeal of Invalidation Decisions             | the First Instance of Infringement Suits                     |
|-----------------------|-----------------------------|--|---|--|--|
| United States         |                             | Patent Trial and Appeal Board in USPTO     | District Court  | the Court of Appeals for the Federal Circuit | District Court   |
| European Union        | Opposition Division in EPO  |  | United Patent Court (UPC)                                 | UPC  | UPC, and each national court                                 |
| Germany               | Opposition Division in DPMA |  | the Patent Court (BPatG)                                  | the Federal Court of Justice                 | District Court   |
| UK(England and Wales) | –                           |  | the Intellectual Property Enterprise Courts Patents Court | the Court of Appeal in England and Wales     | the Intellectual Property Enterprise Court and Patents Court |
| Korea                 | –                           | the Intellectual Property Tribunal in KIPO |   | the Patent Court                             | District Court   |
| China                 | –                           | the Patent Reexamination Board in SIPO     |   | Beijing Intermediate Courts                  | People's District Court                                      |
| Japan                 | –                           | the Appeal Department of the JPO           | the Tokyo District Courts                                 | The Intellectual Property High Court         | the Tokyo and Osaka District Courts                          |

Table A.2: Related Institutions.

source: Own collection

| Organization                                      | US         | DE          | UK       | KR         | CN       | JP          |
|---|------------|-------------|----------|------------|----------|-------------|
| Validation Challenge (Filing fees)                |            |             |          |            |          |             |
| Currency  | USD        | EUR         | EUR      | KRW        | CNY      | JPY         |
| Basic request fee                                 | 9000-12000 | na          | na       | 100000     | 3000     | 49500       |
| plus one claim                                    | 200-250    | na          |          | 10000      |          | 5500        |
| Average no of claims[1]                           | 23         | -           | -        | 9.5        | 10       | 9.5         |
|   | USPPP      | USPPP       | USPPP    | USPPP      | USPPP    | USPPP       |
| exchange rate                                     | 1          | 1.35        | 0.0009   | 0.16       | 0.0098   |             |
| Basic filing fee (\$1000) [1]                     | 9          | -           | -        | 0.097      | 0.48     | 0.488       |
| GDP per capitaUS dollars, current prices and PPPs | 51434.7    | 41097.9     | 34773.3  | 31821.7    | 10924.4  | 35317.2     |
| Fees Per GDP/Capital (*10) [2]                    | 1.75       |             |          | 0.03       | 0.044    | 0.13        |
| Survey of Litigation Cost                         |            |             |          |            |          |             |
| Van Pottelsberphe (1000 € ) 420                   | 140 to 440 | 300 to 2500 | -        | -          | -        |             |
| WIPO ( 1000\$)                                    | 4000       | 50          | 1500     | -          | 150      | 300         |
| Harness Dickey (1000 \$ )                         | 1000-2000  | 630         | -        | 300 to 800 | 250      | 100 to 3000 |
|   | USPPP      | USPPP       | USPPP    | USPPP      | USPPP    | USPPP       |
| Survey of litigation cost (1000 dollars) [7]      | 560-4000   | 50-590      | 400-3370 | 300-800    | 150-250  | 100-3000    |
| litigation costs per GDP/Capital [8]              | 10 to 77   | 1.2 to 14   | 11 to 96 | 9 to 25    | 13 to 22 | 2 to 84     |
| Rank (from low to high)[9]                        | 6          | 5           | 4        | 3          | 1        | 2           |

Table A.3: Details for analyzing litigation cost

|  | <i>USA</i> | <i>DE</i> | <i>GB</i> | <i>KR</i> | <i>CN</i> | <i>JP</i> |
|--|------------|-----------|-----------|-----------|-----------|-----------|
| <i>Legal Standard 1: Validity Challenge</i>                              |            |           |           |           |           |           |
| OD1.1 Opposition<br>Yes: 3; No:1   | 1          | 3         | 3         | 1         | 1         | 1         |
| OD1.2 Examination Skills and Expertise                                   |            |           |           |           |           |           |
| Experience in prior examination proceedings<br>(technical qualification) | N          | Y         | Y         | Y         | Y         | Y         |
| Low appeal rate<br>( legal qualification)                                | Y          | Y         | Y         | Y         | N         | Y         |
| Low turn over rate<br>(experience)                                       | N          | Y         | Y         | Y         | Y         | Y         |
| Grade  | 2          | 3         | 3         | 3         | 2         | 3         |
| OD1.3 Workload<br>Low:3; High: 1   | 2          | 3         | 3         | 2         | 1         | 2         |
| OD1.4 Public Access to the Files<br>Yes:3 ; No:1                         | 3          | 3         | 3         | 1         | 1         | 1         |
| <i>Legal Standard2 : Infringement Suit</i>                               |            |           |           |           |           |           |
| OD2.1 Specialization   |            |           |           |           |           |           |
| Judge only work on patent cases<br>(Exclusivity)                         | Y          | N         | Y         | N         | Y         | Y         |
| Limited courts for patent cases<br>(low risk of forum shopping)          | N          | Y         | Y         | Y         | N         | Y         |
| Grade  | 2          | 2         | 3         | 2         | 2         | 3         |
| OD2.2 Technical Judges or Expert   |            |           |           |           |           |           |
| Patent specific experience   | N          | N         | Y         | N         | N         | Y         |
| Judge with technical degree/background                                   | Y          | N         | Y         | N         | N         | N         |
| Technical Aids for the judge   | N          | Y         | Y         | N         | Y         | Y         |
| Grade  | 1          | 1         | 3         | 1         | 1         | 2         |
| OD2.3 Reversed Rate  | 2          | 3         | 3         | 2         | 1         | 3         |
| OD2.4 Reliable Remedy  |            |           |           |           |           |           |
| Service, such as retail scanner data, for damage<br>estimation           | Y          | Y         | Y         | Y         | N         | Y         |
| Punishment on deliberate infringement                                    | Y          | Y         | Y         | Y         | N         | Y         |
| Control the entitlement of the injunction relief                         | N          | Y         | Y         | Y         | N         | Y         |
| Easy to enforce the contract   | N          | Y         | N         | Y         | N         | Y         |
| Grade  | 1          | 3         | 2         | 3         | 1         | 3         |

Table A.4: Summary of the categories of the operational designs



|   | OD1.1 | OD1.2 | OD1.3 | OD1.4 |
|---|-------|-------|-------|-------|
| OD1.1 Opposition                          | 1     | 1     | 0     | 0     |
| OD1.2 Examination Skills<br>and Expertise | 0     | 1     | 0     | 0     |
| OD1.3 Workload                            | 1     | 1     | 1     | 0     |
| OD1.4 Public Access to<br>the Files       | 1     | 1     | 1     | 1     |
| sum                                       | 3     | 4     | 2     | 1     |

Table A.5: Relevance of operational design components for validity challenge

3C-index refers to the cost per claim per million capita. Source: Table A.3 appendix

|                                     | OD2.1 | OD2.2 | OD2.3 | OD2.4 |
|-------------------------------------|-------|-------|-------|-------|
| OD2.1 Specialization                | 1     | 1     | 0     | 1     |
| OD2.2 Technical Judges<br>or Expert | 1     | 1     | 0     | 1     |
| OD2.3 Reversed Rate                 | 1     | 1     | 1     | 1     |
| OD2.4 Indemnification               | 1     | 1     | 0     | 1     |
| sum                                 | 4     | 4     | 1     | 4     |

Table A.6: Relevance of operational design components for infringement suit

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