



Does the outsourcing of prior art search increase the efficiency of patent examination? Evidence from Japan



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ABSTRACT

This paper investigates the effects of outsourcing of prior art search on the efficiency of patent examination, using a large scale Japanese patent examination data. Outsourcing may increase examination quality by expanding the scope of prior art search, while it may have a negative effect if the synergy between search and examination is important. Controlling for the endogeneity of outsourcing decision as well as the changes in the time resources available for an examiner, we find that the outsourcing of prior art search significantly decreases the frequency of appeals against both examiners' rejections and grant decisions and reduces the length of examination duration. At the same time we find that the prior art search of complex inventions is not outsourced. These results suggest that the opportunity for exploiting external knowledge and capability can increase the quality as well as the speed of examination.

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1. Introduction

Patent system should be designed to effectively promote innovation. Especially, the outcome of patent examination defines the scope of public domain and affects the appropriability of firms' R&D. The timely completion of an examination is also important for these objectives. Therefore, the design of efficient patent examination process is crucial to keep the patent system functional. The global surge of patent applications causes a great concern about the increasing backlog of pending patent applications in many countries. The increased backlog causes the delays in the examinations. It also causes the overloading of examiners, which can decrease the quality of examination and lead to an increase of the patents with dubious patentability. The increasing complexity of inventions also aggravates the problems.

In response to these concerns, the Japan Patent Office (JPO) has increased outsourcing of prior art search, in order to reduce the pendency period and to maintain adequate quality of patent exam-

ination. The number of applications of which the prior art search is outsourced reached 246 thousands in 2010 (about 65% of all examined applications). The JPO spent about 212 million dollars (calculated at 1 USD = 100 yen) for outsourcing in 2010, while the total direct cost of examination (which includes the outsourcing cost) is estimated to be around 525 million dollars.¹ This means that the cost of outsourcing accounted for about 40% of the total direct cost in this year. Supported by the large investment in outsourcing, the number of decisions per examiner per month has been significantly increasing: the average number of monthly examinations per examiner increased from 13.6 to 16.0 between 1999 and 2007, as the rate of outsourcing increased from 30% to 70%.² The present paper provides the first quantitative evidence of the effects of outsourcing on examination quality, controlling for the endogeneity of outsourcing decision as well as the changes in the time resources available for an examiner.

¹ According to the JPO's estimates, the direct cost of examination is 22,000 yen (220 USD) per claim in 2010. Since the number of examined claims per examiner is 1400 and the total number of examiners is 1703 in 2010, the total direct cost of examination is estimated as 525 million dollars.

² Using the examiner-level panel data, we found that 1% increase in the rate of outsourcing of prior art search increases the number of decisions of each examiner per month by about 0.39% on average, based on the linear OLS estimation.

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There are some previous researches that show significant effects of the complexity of examination tasks and the patenting value of an invention on the examination duration, such as Harhoff and Wagner (2009) and Popp et al. (2003). However, no study addresses an examiner's decision on which applications should be outsourced and how significant the outsourcing of prior art search contributes to the efficiency of examination process. Note that an individual examiner manages the outsourcing process and takes the ultimate responsibility for the search results even when they outsourced the prior art search.³ That is, the outsourcing is for supporting the examiner's task and the examiner supplements the search results if needed in the examination.

The work of patent examiners is divided into two tasks: (1) searching and identifying prior art relevant for the evaluation of novelty and inventive step in patents and published literatures, and (2) conducting a substantive examination to decide whether the invention meets the patentability requirements (novelty, non-obviousness and industrial application). The central question of this paper is whether the outsourcing of prior art search increases the efficiency of patent examination measured in terms of quality and speed, controlling for the capability of an examiner and for the complexity of a patent application.

One possible view ("*synergy view*") is that the quality and the speed of examination become higher if the same examiner conducts both prior art search and substantive examination. This is because the integration of two closely interconnected tasks deepens the examiner's understanding of the contents of the invention and enhances the efficiency of both search and examination. The integration can also save the time necessary for communication and coordination between two individuals, examiners and searchers, if the two tasks were divided. An alternative view ("*search scope view*") is that the outsourcing of prior art search enhances the efficiency of the examination process, since the examiner can take advantage of the search ability of the searchers specialized in prior art identification and thus he/she can expand the potential search scope. Identifying the adequate prior art is a vital step in the patent examination.

The European Patent Office (EPO) pursues the *synergy view*, where a single lead examiner undertakes both search and examination under the "BEST" ("Bringing Examination and Search Together") program. On the other hand the JPO takes the *search scope view*, substantially because the JPO has not been able to significantly increase the number of examiners, given the budgetary ceiling on the number of civil servants in Japan. In reality we expect that both forces are at work. This paper tries to identify which view is true at the margin, using the Japanese patent examination data. Especially, if examination quality is the predominant concern of an examiner in its outsourcing decision and the outsourcing is constrained by budgetary resources, we expect that outsourcing enhances examination quality at its margin.

We found that the outsourcing of prior art search significantly decreased the frequency of appeals against the rejection decisions of examiners as well as against their grant decisions. Note that our estimation controls for the endogeneity of outsourcing, the complexity of examination task, the value of patenting the inventions, the heterogeneity of the examiners' capabilities and the changes in the time resources available for the examiners. We also found that the outsourcing increased the speed of examination by reducing the period of communications between examiners and applicants

³ The novelty and inventive step of an invention are evaluated in light of related prior art, and the source of prior art – whether it is disclosed by the applicant, the third party or an outsourced searcher – does not affect the evaluation standard. However, as shown in Cortopia et al (2013), the examiners use significantly less frequently the applicants' disclosure than their own search results.

in both grant and rejection process. These effects are still observed despite of the fact that the volume of the final decisions by an examiner per unit of time increased significantly with an increase in outsourcing of prior art search. This paper, therefore, suggests that the outsourcing of prior art search has increased the quality as well as the speed of examination. At the same time, we found that outsourcing was chosen for less complex patent applications. This result indicates the advantage of integrating the two tasks for complex patent applications. Therefore, providing an examiner with an option to use the outsourcing of prior art search can play an important role for improving the efficiency of patent examination, given the large variation of the complexity of inventions.

The rest of the paper is organized as follows. Section 2 surveys related studies, and Section 3 provides the analytical framework. We describe the data and give an estimation framework in Section 4, and show the estimation results in Section 5. Finally, Section 6 concludes the paper.

2. Related studies

Not many but some studies address the issue of patent examination process. However, empirical analysis focusing on the quality of examination process is scarce and, to the best of our knowledge, no studies have analyzed the effects of outsourcing of prior art search. The most related paper is Harhoff and Wagner (2009). They analyze the determinants of the examination duration, and examine how they vary depending on whether the applications are granted, withdrawn or refused. They divide the main determinants into three groups: the characteristics of applicants, the value related characteristics of inventions, and the complexity of examination task. According to their study, the potentially valuable applications are granted earlier and withdrawn slower. Moreover, they show that more complex inventions, measured by the number of claims and backward citations, need more time to complete the examination process. Similarly, the importance of the complexity of technology as a determinant of the examination duration is emphasized by Popp et al. (2003).

Based on their works, we introduce a similar group of variables as the determinants of the performance of patent examination: complexity of examination task and the patenting value. However, as the performance variables of patent examination, we newly introduce the direct measures of the examination quality: the frequency of appeals against the decisions of the Patent Office, not used in the above prior works, in addition to the speed of examination. High examination quality in terms of high probability of making correct decisions is likely to be more important than the speed of examination, since correcting wrong decisions can be time consuming and the third parties as well as the patentee may suffer significantly from a wrong decision. This paper investigates how outsourcing affects the examination quality as defined by the above measures and the speed of examination, as well as how the complexity of inventions affects the examiner's decision on outsourcing of prior art search.

Caillaud and Duchene (2011) theoretically analyze how the workload of examiners affects the firms' R&D incentives, assuming the tradeoff between the workload and the quality of examination. They suggest that the introduction of a penalty system on the applicants for rejected patent applications and the commitment to high non-obviousness standard could attain the high-R&D equilibrium, since those policies increase the firms' incentive to screen out the low-quality inventions, which reduces the workload of examiners and thus increases the quality of examination. Their theoretical results indicate the importance of controlling for the effect of the workload on the examination quality and the frequency of the communication between examiners and applicants.

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