



# An economic analysis of deferred examination system: Evidence from a policy reform in Japan<sup>☆</sup>



Isamu Yamauchi<sup>a,\*</sup>, Sadao Nagaoka<sup>b</sup>

<sup>a</sup> Research Institute of Economy, Trade and Industry, Japan

<sup>b</sup> Institute of Innovation Research, Hitotsubashi University, Japan

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## ABSTRACT

We investigate how a deferred patent examination system promotes ex-ante screening of patent applications, which reduces both the number of granted patents and the use of economic resources for examinations, without reducing the return from R&D. Based on a real option theory, we develop a model of examination request behaviors. Exploiting the responses of Japanese firms to recent policy reform, we find that the shortening of the allowable period for an examination request significantly increases both eventual and early requests, controlling for the blocking use of a pending patent application. This effect is stronger in technology areas with higher uncertainty. These results support the importance of uncertainty for an applicant and of ex-ante screening.

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## 1. Introduction

Unlike the United States Patent and Trademark Office (USPTO), the Japan Patent Office (JPO) and the European Patent Office (EPO) only examine patent applications after receiving formal examination requests from applicants. In Japan, if such a request is not received within three years from the date of the application, the application is deemed withdrawn. Under the first-to-file system, an inventor has an incentive to file his patent application as soon as possible. Therefore, inventors apply for a patent on even such an invention that has significant uncertainty in patentability and in the probability of its commercialization. Examining all applications has two important economic costs. First, it increases significantly the number of patent grants. Such grants

constrain third parties without increasing the ex-ante profit of an applicant from its R&D. Second, economic resources are used for more examinations. Under the recent environment of “patent explosions,” increasing patent applications place strains on the patent office, which can result in longer pendency periods and a higher probability of mistakes in grant decisions.

A deferred examination or an examination request system provides an important mechanism reducing these social costs. It does so by providing patent applicants with more time to screen their inventions before requesting examinations. Such an arrangement is likely to be especially important when uncertainty in commercialization is high. In this regard, what ultimately matters for a firm in seeking patent protection is not the technical quality of an invention per se but the value of patenting such invention, which depends on a number of factors, including the availability of complementary assets. For many inventions, the resolution of uncertainty in the value of patenting can take a long time.<sup>1</sup> However, the examination request system may also induce applicants to use pending applications, even if they do not meet patentability standards, to block third-party innovative investment. An examination

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\* Corresponding author at: 1-3-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8901, Japan. Tel.: +81 3 3501 1393.

E-mail addresses: [yamauchi-isamu@rieti.go.jp](mailto:yamauchi-isamu@rieti.go.jp) (I. Yamauchi), [nagaoka@iir.hit-u.ac.jp](mailto:nagaoka@iir.hit-u.ac.jp) (S. Nagaoka).

<sup>1</sup> A telling example is a drug patent. In the pharmaceutical industry, firms often need more than ten years after filing a patent to introduce a new drug into the market. Uncertainty is gradually reduced through laboratory testing, preclinical testing, and clinical trials.

request by a third party may not adequately prevent this blocking use of pending applications.<sup>2</sup>

Thus, a trade off may well exist in introducing or designing a deferred examination system: a longer examination request period enhances the ex-ante “screening effect” of examinations, thereby decreasing the number of patent examinations (as well as patent grants) and reducing the burden on a patent office, while increasing the “blocking effect” of pending applications. Perhaps reflecting this tradeoff, not all countries have adopted an examination request system, and the allowable period for examination requests varies among patent offices. In particular, all patent applications are automatically examined at the USPTO, although there have been debates on whether the U.S. should also introduce a deferred examination system.<sup>3</sup> Moreover, in 2001, concern over pending applications led to the reduction of the allowable period for examination requests from seven to three years in Japan.

A comprehensive economic analysis of the deferred examination system does not exist. This paper provides both a theoretical model for such a system, based on a real option theory and an empirical validation of the importance of the ex-ante screening effect predicted by the model, by examining the responses of Japanese firms to this policy change. Our theoretical model explains why applicants might delay examination requests in an environment in which new information arrives in the future, with particular focus on the importance of the screening effect. We take into account the blocking value of a pending application, although we do not model the interactions between firms. We analytically solve the model and provide comparative statics results on how the maximum length of the pending period affects the volume of examination requests and their timing. In particular, we show theoretically that examination requests increase with the reduction of the maximum pending period more in sectors where ex-ante screening is important and that ultimate examination requests are not affected by the blocking value of pending applications.

Our empirical analysis seeks to validate these theoretical results. The reduction of the allowable period for Japanese examination requests from seven to three years in 2001 provides us with a unique exogenous shock, which affects the amount of information that an applicant can use in making an examination request decision. Utilizing the panel data at the monthly and individual patent application levels, we can control for demand, technology, and patent system changes over time, when we identify the effects of the policy change. We can also control for the importance of blocking motivations of pending and granted patents in our estimations.

The rest of the paper is organized as follows. Section 2 presents a survey of related studies. In Section 3, we provide an option-based theoretical model and develop hypotheses grounded on comparative statics results. Section 4 describes the dataset and provides the empirical results. Section 5 concludes the paper, discussing the policy implications of our analysis.

## 2. Related studies

A patent renewal decision is similar to that of postponing a patent examination request, in the sense that both involve the evaluation of option values. Our research addresses related but distinct questions, compared with the existing studies on patent renewals. Pakes (1986) is a pioneering paper, which develops the option theory of patents

<sup>2</sup> A third party can request an examination and will do so if it benefits from an early clarification of the patentability of pending applications are greater than the cost of requesting an examination. However, the individual benefit for a third party may not be large, when the possibility of being blocked is relatively small, the cost of developing a circumventing invention is small, or the invention may not immediately be used. Still, the collective benefit for third parties from early clarification can be significant. However, even if that is the case, a free rider problem among third parties for examination requests makes it difficult to realize such aggregate benefits.

<sup>3</sup> On January 28, 2009 the USPTO solicited public comments on whether a deferred examination procedure should be introduced in the US.

and assesses the value of patent protection from patent renewal data. In his model, the underlying stochastic process of patent renewal incorporates the possibility of discovering the zero value of maintaining a patent for an invention, the decay of the current return, and some probability of innovation (a multiplicative increase of the return). He estimates the parameters characterizing the above stochastic process by using historical patent renewal data in three patent offices (France, Germany, and United Kingdom).<sup>4</sup> Although his model is very general, the research focuses on the calibration of the model to the patent renewal schedules in order to derive the statistical distribution of patent values. Furthermore, in his paper, analytical solutions are not provided; thus, comparative statics are not available. Our research addresses ex-ante screening of patent examination, which can avoid the tradeoff between the number of granted patents and the profit from R&D and it can reduce the use of resources for examinations. We provide analytical results on the effect of shorter deferral period on examination requests from comparative statics and their empirical assessments.

Cornelli and Schankerman (1999) and Scotchmer (1999) focus on renewal fees as instruments for socially optimal patent protection.<sup>5</sup> They show that policy makers can maximize social welfare by setting renewal fees to make firms choose optimal patent lengths. Scotchmer suggests that firms honestly reveal their willingness to pay under the effective renewal fee (or subsidy) structure, when the value and the cost of innovation have positive correlations. In both analyses, a firm knows the private value and the cost of an invention, while the government does not, and the renewal fee schedule works as a revelation mechanism. In comparison, this paper focuses on the uncertainty of the firm. In our model, the firm itself does not know the value of patent protection for its invention so that the pendency period before the examination request allows the firm to accumulate information for its decision on patenting. The policy issue addressed is also different: the optimal length of patent protection vs. ex-ante screening for patent examination.

Rigibeau and Rockett (2010) analyze the relationship between the examination duration of the patent office and the importance of patents. They assume that the duration of a patent examination is endogenous to the effort of the applicant and that its accuracy improves as technology matures. They show that the more important inventions are examined earlier and that over time the examination duration decreases for good applications and increases for bad applications, all things being equal. Their framework includes an information asymmetry between applicant and examiner regarding the patentability of the application. The applicant changes the amount of the effort that he exerts in the examination process according to the importance of applications so that a patent is granted earlier to its more important invention. Our model focuses on the applicant's learning process of the application value and analyses the screening effect of the examination request system, while we do not consider the examiner's learning.

Harhoff and Wagner (2009) also find that potentially valuable patents will be granted earlier and that a withdrawal of such patents will be delayed. Further, they indicate that applications with complex examination tasks (a large number of references, claims, and so on) are withdrawn earlier by applicants during the examination process. Moreover, the applicant becomes more cooperative in this process when the value of an invention is high.

A few studies investigate the applicant's behavior for delaying an examination request.<sup>6</sup> Using a matched sample of patent applications filed simultaneously in four patent offices, Palangkaraya et al. (2008) show

<sup>4</sup> Using Pakes' approach, Deng (2007) analyzes the changes in the value of patents after the establishment of the EPO. She suggests that the harmonization of the patenting process in the EPO reduced the differences in the patent value among these countries, while the changes in patent length and renewal fees had only modest effects on patent value.

<sup>5</sup> There are seminal papers that examine the influence of patent breadth and patent length on the innovative activities of firms or social welfare, such as Gilbert and Shapiro (1990), Matutes et al. (1996), and O'Donoghue et al. (1998).

<sup>6</sup> Sampat (2011) suggests that the applicants have an incentive to contribute more to the prior art search when the inventions are more important for them.

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