Economics Letters 145 (2016) 73–78

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

The heterogeneous effect of software patents on expected returns: Evidence from India

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HIGHLIGHTS

- Impact of patent protection for software on publicly traded software companies in India.
- Analysis of series of unanticipated policy changes affecting patentability of software in India.
- Substantial heterogeneity among firms in response by stock market to policy changes.

ARTICLE INFO

Article history:
Received 2 December 2015
Received in revised form
15 April 2016
Accepted 18 May 2016
Available online 1 June 2016

JEL classification:
D22
O14
O34
O38

Keywords:
Patents
Software
Innovation
India

ABSTRACT

We contribute to the literature on the role of patenting for economic development by analyzing the impact of patent protection for software in India. We find that a proposed broadening of patent eligibility to include software in 2004 had a large positive effect on average returns for listed software companies in India. An unanticipated reversal of this proposed policy change in 2005 resulted in substantial negative returns. We illustrate substantial heterogeneity in the dynamics of these effects across the sequence of events. We also find smaller firms to have been systematically and most significantly affected by the tightening of patent law with regard to software patents.

1. Introduction

There is a long-standing yet unsettled debate on the effect of intellectual property (IP) rights, in particular in form of patents, on innovation and economic development (Nordhaus, 1969; Helpman, 1993; Grossman and Lai, 2004). One strand of this debate focuses on the impact of patents on innovation in high-tech industries, mostly in advanced economies (Scherer and Weisburst, 1995; Sakakibara and Branstetter, 2001; Jaffe and Lerner, 2004), whereas another analyzes the role that patents can play for economic development in emerging and developing economies (Penrose, 1973; Chen and Puttitanum, 2005; Hu and Jefferson, 2009).

Our study relates to both of these strands by providing empirical evidence for the effect of various changes in the Indian patent law which affected patent eligibility of software. In India, software *per se* is explicitly excluded from patentable subject matter. In December 2004, however, the Indian government announced an ordinance that aimed to substantially loosen the restrictions on the patent eligibility of software. The proposed ordinance was unexpectedly rejected by parliament in April 2005, with the result that the original restrictions remained in place. Since neither of these events were anticipated we can treat them as natural experiments and hereby provide a causal link between patentability and the economic value of patents,

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http://dx.doi.org/10.1016/j.econlet.2016.05.016
0165-1765/

measured as 'abnormal' stock market returns for the affected software companies.

Our findings show that the announcement of a loosening of the restrictions on patentability, on average, resulted in significant positive stock market returns for affected companies. When parliament rejected the proposed change four months later, we observe again, on average, positive returns. This counter-intuitive result is explained by substantial heterogeneity in these effects. When the ordinance was announced in 2004, positive returns for a subset of companies dominated. When the ordinance was rejected in 2005, those companies that had seen negative returns in 2004 experienced positive returns that outweighed the drop in returns for the subset of companies that had experienced positive returns in 2004. This reversal of fortunes suggests that the stock market expected some software companies to capitalize on an improved ability to protect software inventions through patents. In fact, when the Indian intellectual property office reinforced the restrictions on the patentability of software later in 2005, those companies experienced again substantial stock market losses.

Our analysis contributes to the existing literature on innovation by offering empirical evidence on the impact of changes in the availability and strength of patent protection on companies in a developing economy. Most of the existing literature on IP in developing markets focuses either on pharmaceutical patents (Arora et al., 2009; Sampat, 2010; Arora et al., 2011; Kyle and Qian, 2013) or relies on cross-country analysis (Lerner, 2002; Kanwar and Evenson, 2003; Qian, 2007; Hu and Png, 2013). Our study provides evidence on the effect of patents on private returns in a highly-innovative industry that has contributed enormously to India's recent economic growth.[1]

2. Software patents in India

A 2002 amendment to India's 1970 Patents Act excluded software from patent eligibility. According to this amendment, inventions in the form of "a mathematical or business method or a computer programme *per se* or algorithms" (Section 3(k) amended Patents Act) are not patent eligible. This meant that software on its own cannot be patented, although software in combination with hardware may be patentable.

In December 2004 the Indian government issued an ordinance which stated that the clause governing software patentability added in 2002 should be modified to exclude "a computer programme *per se* other than its technical application to industry *or* a combination with hardware" [emphasis added]. Hence, it explicitly opened the possibility for software to be patent eligible provided it had technical application. The proposed amendments would have had a major impact on the granting practice of software patents. However, parliament unexpectedly rejected this modification and the amendment adopted in April 2005 did not include the software-related amendment put forward in the ordinance. This creates a window of just over 4 months during which it was expected that software would become patent eligible.

As a consequence of the rejection of the ordinance, ambiguity persisted in the granting practice of the Indian patent office (IPO) until June 2005 when the granting practice with regard to software patents was clarified in a set of guidelines.[2] The chronology of all the eventsdescribed is summarized in Fig. 1.

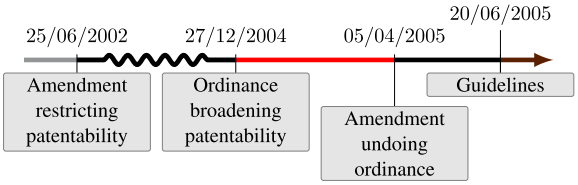

Fig. 1. Chronology of patentability of software *de jure* and *de facto*. Notes: Red color indicates softening of restrictions on software patentability. Black color indicates a tightening of restrictions on software patentability. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

3. Data

To analyze the effects of changes in the availability of patent protection on software in India, we construct a firm-level dataset by matching domestic and USPTO patent filings (see online Appendix A) of all 294 publicly traded software companies registered in India to data on these firms from the PROWESS database (Center for Monitoring of the Indian Economy) for the period 2000–2007.

4. Results

4.1. Patent filings

Fig. 2 shows total patent filings of publicly traded software companies in India by quarter over the entire 2000–2007 period.[3] The graph shows that the absolute number of filings by Indian software companies at both the Indian and the US patent offices is very modest. That said, a total of 217 patent filings with the IPO and an overall share of 9% of patenting companies among all listed software companies is still substantial, keeping in mind that software in principle remained unpatentable throughout the period studied.

While Fig. 2 indicates that despite the restrictions placed on patentability software companies have been filing software-related patent applications, Figure A-2 in the online appendix indicates that very few of these filings with the IPO were granted: only 14.5%. Perhaps even more revealing, the only patent applications officially rejected by the IPO are applications filed immediately after the announcement of the 2004 ordinance. For comparison, until the end of 2004 all filings *at the USPTO* were granted.[4] The substantially larger grant rate at the USPTO underscores the restrictive approach adopted by the IPO and shows that despite a relatively large number of software patent filings at the IPO, hardly any software patents were granted. This suggests that the Ordinance would have had an important impact on patent granting practices.

4.2. Event study

Next, we analyze stock market reactions to the (proposed) policy changes for the entire set of software companies in our data: if including software in patentable subject matter is privately beneficial to firms, we would expect the softening (tightening) of restrictions on software patentability to have a positive (negative) effect on firm valuation. Fig. 3 provides a graphical representation of the Cumulative Abnormal Returns (CAR) computed over the

[1] Software accounts for around 12%–16% (depending on industry definition) of total Indian exports (2010/11) and employs around 2.5 million mostly skilled workers (UNCTAD, 2012).

[2] The IPO established that "claims relating to software program product [sic] are nothing but computer program per se simply expressed on a computer readable storage medium and as such are not allowable" (Manual of Patent Practice and Procedure 2005, Annexure II 7.3).

[3] Although there is no official definition of software patents, we manually check all patent filings to ensure they cover software inventions.

[4] See Figure A-3 in the online Appendix. Note also that software patents continued to be patent-eligible in the US throughout our period of analysis.