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Patents as proxy for measuring innovations: A case of changing patent filing behavior in Indian public funded research organizations

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ABSTRACT

The process of innovation is crucial and essential part of economic growth. Public funded research organizations (PFROs) are believed to be an integral part of National Innovation Systems (NIS) and therefore form an important part of research focused on developing and enhancing national innovation capacities. PFROs have witnessed substantial changes in terms of increased patent filing over the years. Patenting rates and patent propensity have long been used as a well-grounded proxy for measuring technological innovations in the literature. Variant patent filing motives of researchers may reflect a fundamental weakness in use of patents for measuring innovations. Transition economies like India, with characteristics which may differ from those of heavily studied advanced western economies, are the focus of this study. Data were collected from 43 PFROs in India during the period 2005–2010. This study examined the patent filing behavior in PFROs by analyzing various motives that drive the patent filing of its researchers. Negative Binomial Regression Models were constructed to explain whether these patent filing motives impact patent portfolios in PFROs. We observed that only few of them strengthen the patent portfolios. The results connote the significance of taking granted patents, rather than filed patents, as a proxy for measure innovations in PFROs. Based on our results we also derive some policy and decision-making implications for public research particularly in the context of transition economies.

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1. Introduction

It is widely recognized that technology innovations are key elements of economic growth. Research shows that national innovation capacity (Furman et al., 2002) varies among countries, owing to differences in level of inputs devoted to innovation. Nations try to abbreviate this gap in capacity to catch-up with those that are more developed. National Innovation Systems (Freeman, 1987) approach is believed to hold high significance in this context. Every country organizes and manages Public funded research organizations (PFROs) for the purpose of increasing the production and proper diffusion of scientific research (Romer, 1990; Aghion and Howitt, 1998). Research emphasis the role of these PFROs as a significant constituent of National Innovation Systems (Lundvall, 1992; Patel and Pavitt, 1994; Metcalfe, 1995). While general agreement exists about the role of the PFROs as centers for fundamental basic research, a stronger interest has been expressed for proper follow-up of ideas from PFRO research which may lead to applications of industrial significance (Roberts, 1999).

Patenting rates and patent propensity have long been used as well-grounded proxies for measuring technological innovations in the

literature. Rate of patenting in public research has increased dramatically over the years (Henderson et al., 1998). Patent filing trends emerging from PFROs across the globe may, therefore, suggest the changing orientation of PFROs towards the applied nature of the research or a behavioral change among PFRO researchers under the circumstances that seek more patents as a research output.

Some of the researchers provide evidence to suggest that patents provide a fairly good, although not perfect, representation of innovation activities (Acs et al., 2002). Despite the fact that the patent system is generally defended, at least partly, on the basis that it increases the rate of innovation; some of the researchers like Mansfield (1986) have disagreed with this common notion.

The process of innovation is crucial and integral part of economic growth, however various problems associated with measuring innovation output remain completely unresolved. In this research, we address this fundamental weakness of National Innovation System (NIS) research – Variant patent filing motives among researchers in PFROs. Patent filing driven by motives that do not, necessarily, seek protection or grant of patents may signify patents as less perfect representation of innovations. We also look at the consideration of using granted patents, instead of patents filed, as a more appropriate measure of innovations in PFROs.

While developed economies have been extensively discussed in literature on innovation and patenting, emerging economies remain,

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broadly, unexplored. There is an underlying assumption that patenting is a corporate activity which is reflected in the research on patenting which has, primarily, focused on industry. PFROs, however, have witnessed substantial changes in terms of increased patent filing over the years. The present study fills this gap in research by taking the case of PFROs in India and brings the focus of research on transition economies which may differ, in various characteristics, from those of heavily studied advanced western economies. As presented here, a deeper understanding of how PFROs use the patent system will be an important step towards ensuring their greater role in NIS which is important for economic growth.

The sample focus of this study is public funded autonomous institutes and laboratories (referred as PFROs in this study) in India. We study the patent filing behavior of researchers in PFROs, assuming researchers to have autonomous nature of work and their collective behavior representing the patent filing activity of PFROs as explained by Siegel et al. (2004). The study begins with analyzing the impact of various patent filing motives on the patent portfolios of PFROs. The results lay the foundation for further analysis of patent filing motives of PFRO researchers which is taken subsequently in the present study.

The contribution of the present study can be summarized as following:

- i. The analysis is based on relatively focused sample and for the first time full survey on PFROs is considered taking one country – India – as an example. This should pave way for further research on the subject for comparative studies and generalization on emerging economies.
- ii. Motives for patent filing have widened over the years. The present study contributes to the body of knowledge in the present context and includes public research in the widely addressed debate of strategic patenting which, otherwise, remained focused to industry.
- iii. Public funded research is understood to play vital role in developing national innovative capacity of emerging economies. Asia, in particular, has received popular attention due to region's rapid industrialization and its huge potential to generate significant demands for technologies. The present study proposes reconsidering patent systems of these PFROs, in light of new insights on patent filing motives, which holds policy implications in these emerging nations of modern economy.

This study is structured as follows: We begin with the discussion on importance of PFROs and their role in National Innovation Systems (NIS). Second, we provide a background literature on patenting of innovations and the use of patents as a proxy for measuring technological innovations. This is followed by a discussion on patenting in PFROs. We start our analysis with some descriptive statistics followed by validation of proposed hypotheses using Ordered Probit Models. Patent filing behavior in PFROs is examined by analyzing the motives driving patent filing of its PFROs. Finally, Negative Binomial Regression Models are constructed to explain whether these patent filing motives impact patent portfolios in PFROs.

2. PFROs and their role in NIS

Research sector plays a fundamental role in modern economies (Lare' do and Mustar, 2004). In Schumpeterian environments where technological innovations hold pivotal importance, R&D would carry high weightage for firms seeking competitive advantage. Firms, with limited R&D support and expertise, increasingly seek external scientific knowledge support (Wang and Guan, 2010), generated mainly by PFROs (Narin et al., 1997). This seems, particularly, relevant for emerging economies like India where 70–80% of the R&D expenditure is spent by government sources in comparison to 20–25% by private sector.

A growing number of studies, in the recent past, has investigated and stressed upon the importance of public funded scientific research and emphasized on their importance in building National innovation systems that drive economic growth (Henderson et al., 1998; Caballero and Jaffe, 1993; Romer, 1986, 1990; Nelson, 1993; Lundvall, 1988; Hu and Mathews, 2005; McMillan et al., 2000; Guena and Nesta, 2006; Etzkowitz and Leydesdorff, 2000). However, theoretical literature contends mainly on developed economies, with very little focus on emerging economies where public research appears to egress equally as an important element to support economic catch-up (Mazzoleni and Nelson, 2007).

Hu and Mathews (2008) argue that public funded research plays a vital role in developing national innovative capacity of Asian latecomer countries. Several Asian emerging economies have attempted at pushing their economy towards knowledge based economy by raising investment in building their science and technology capacity. They have evolved from merely supporting technological development in manufacturing industries to strengthening the role of PFROs in development of knowledge based economy (Asgari and Wong, 2007; Kostoff et al., 2007; Lee, 2007; Lundvall et al., 2006; Nagano, 2006; Wong et al., 2010; Wonglimpiyarat, 2007; Zhou and Leydesdorff, 2006).

3. Patenting innovations

Patents are unique and supposed to be highly visible method of technology transfer (Henderson et al., 1998; Archibugi, 1992; Basberg, 1987; Boitani and Ciciotti, 1992; Trajtenberg, 1990). Researchers believe that easy patent accessibility allows for a more comprehensive analysis in comparison to surveys or case study work (Henderson et al., 1998). Patents have long been used as a well-grounded proxy for measuring technological innovations in the literature on Innovations (Schmookler, 1966; Soete and Wyatt, 1983; Griliches, 1990; Trajtenberg, 1990; Dosi et al., 1990; Eaton and Kortum, 1996, 1999; Kortum, 1997; Kanwar and Evenson, 2003; Furman et al., 2002; Hagedoorn and Clodt, 2003).

Furman et al. (2002) used patent data to evaluate sources of differences among countries in production of visible innovative output. Using 'National Innovative Capacity' framework, which they defined as the ability of a country to produce and commercialize a flow of new-to-the-world technologies over the long term, the study focused on 17 OECD countries. This framework was later extended to some Asian countries by Hu and Mathews (2005). These studies acknowledge the sources bias associated with using patent data which they believe to overcome by using 'international patents' – USPTO patent filings in their case. Several studies have utilized patent data to trace international knowledge flow (Jaffe and Trajtenberg, 2002; Hu and Jaffe, 2003), experiences of specific institutions (Furman et al., 2002), innovations of an individual country (Trajtenberg, 1990).

Despite the fact that patent system is generally defended, at least partly, on the basis that patents provide a fairly good, although not perfect, representation of innovation activity (Acs et al., 2002), disagreement to this common notion is also reported in the literature. Several researchers argue that only certain types of innovations can be measured (Arundel and Kabla, 1998; Griliches, 1990; Mansfield, 1986). While some patents are granted for trivial discoveries, many important innovations may not be patented or patentable (Griliches, 1990; OECD, 2009). It is widely accepted that patents can, enormously, vary in terms of value and importance, simple patent counts are, therefore, unlikely able to capture innovative output (Trajtenberg, 1990; Jaffe and Trajtenberg, 2002; Hu and Mathews, 2005). Patent citation rates have been used by some (Jaffe et al., 1993; Trajtenberg, 1990; Maurseth and Verspagen, 2002; Alcacer and Gittelman, 2006) as an alternative; this creates a truncation problem – difference in citations between older and new patents (Jaffe and Trajtenberg, 2002; Hu and Mathews, 2005). Furthermore, not all technologies from scientific research need to be patented in order to reach the markets (So et al., 2008).

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