

## Patents and Economic Activity: The Need to Develop Prediction Methods for Patent Applications

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Rec date: August 25, 2014; Acc date: August 27, 2014; Pub date: August 31, 2014

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Since the decade of the 1980's the literature on economic development began paying attention to the cases of countries which were industrialized after the first industrial revolution. One of the most relevant aspects analyzed has been the role of technology as a factor which promotes or delays the process of catching up with technology leaders [1]. As result of this interest, new and more adequate indicators were identified to provide a coherent explanation for technological activities and their relationship with economic efficiency. Although the earliest studies focused on analyzing the activities of research and development (R&D), recently the focus of analysis has shifted to another type of variables, more oriented towards the processes of innovation and the gathering of knowledge and capabilities, in which patents provide relevant information [2].

The first studies developed by Schmookler demonstrate that technical inventions have an economic cause and that a country's level of inventive activity is influenced by the number of workers with technical qualification, the industrial inputs and the Gross Domestic Product (GDP) among other variables. Some years later, this author analyzed the percentage of patents used commercially and identified the effect of patents on the income from products which compete with each other and the change in Gross Domestic Product caused by imitations [3]. Continuing along this line of studies, other authors found evidence which suggests that an increase in the number of patents in a country is directly related with an increase in spending on R&D [4], and the existence of a delay of approximately one year between the implementation of R&D expenditure and the patent application produced as a result [5].

On the basis of these evidences, the use of the information contained in the patents has undergone more than significant change and, actually, it is almost impossible to find studies on the technological capabilities of any organization without using patents as indicator of reference. Along this line, it is possible to summarize the following focus of interest:

To know if efforts in R&D have a positive impact on a company's stock of knowledge. Assuming the hypothesis that knowledge gathered depreciates over time, causing the contribution by R&D to decrease in value, some authors used patent applications as one possible indicator of the added value of the knowledge produced over a period of time.

To compare the impact of the value of protecting patents with spending on R&D, suggesting that patents have a limited but important impact on these expenditures. The method calculated the "rates of subsidies equivalent" to the patents dividing their estimated value by the company's spending on R&D to produce those patents. The rates calculated are equal to the subsidies which the companies would need to maintain R&D at its current level, if there were no

patent. Another methodology used is known as the "patent premium", that is define as the difference between the value of innovation before and after having been patented, and therefore its value may be positive or negative.

To estimate the interest of firms in using patents as a signal to attract financial investors, and therefore patents become a decisive factor in the value of firms. In fact, capital markets use patent applications by firms as indicators of their inventive activities, and normally they assume that patents have a correlation with the ability of firms to innovative. However, they also associate it with other characteristics that are more difficult to observe, such as intellectual capital [6].

Finally, though there is little empirical evidence regarding this topic in the literature, patents also seems to constitute a key factor allowing newly created companies to attract venture capital. Venture capital investors consider that patents with a high value are one of the most important factors when reaching investment decisions, especially in the early stages. Within this context, newly created based technology firms have real incentives to file for patents, which could explain why, in an empirical study carried out in the American semi-conductor industry, newly created companies displayed a greater propensity towards patenting than did other companies [7].

Without a doubt, and based on these evidences, patents constitute an excellent indicator to analyze technological change. And for this reason, studying the predictions of patent applications has recently become a field of interest, in particular on the part of the main national and supranational intellectual property entities, such as the United States Office of Patents and Trademarks (USPTO), the Japanese Patent Office (JPO), the European Patent Office (EPO) and the World Intellectual Property Organization (WIPO). This interest also results from the need which these organizations have to effectively design their business strategies and plan their resources, with the support of sophisticated models which allow them to provide information in advance on developments in technological change. As an example, the USPTO uses three different models for annual prediction of patent applications: the Naive model, the ARIMA model and the econometric model; and the EPO uses two specific prediction models: one linear model based on time series methods, and another model based on regression methods.

Amongst the advantages offered by the use of different patent application prediction models we can highlight the following [8]:

Support for the strategic planning of national entities which design R&D and innovation policies through the identification of advanced indicators associated with the series of patent applications.

Rationalization of the operating structure of national patent offices and increase in the quality of the service offered to clients (firms, universities, public research centers, etc).

Decrease in costs, thanks to the optimization of processes, which makes it possible to reduce potential bottlenecks in patent application registration operations.

Improvement in the coordination with the national patent offices of other countries. In this sense, it is interesting to emphasize the joint efforts of the USPTO, the JPO and the EPO to share predictions produced using different methodologies and establish optimal coordination mechanisms among the methodologies used in the former Trilateral Statistical Working Group (TSWG) which has by now been expanded to be an IP5 Statistics Working Group, that also includes the Korean Intellectual Property Office (KIPO) and the State Intellectual Property Office of China (SIPO).

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