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Social progress and international patent collaboration

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ABSTRACT

This study focuses on how international patent collaboration (IPC) influences social development at the country level. Although researchers have traditionally stressed the effects of IPC on countries' technological development, there are indications that it can also have important social effects. In this context, this paper provides an empirical evaluation of the influence of different types of patents (i.e., patents invented abroad and patents invented in the focal country by foreign researchers) on the Social Progress Index. Using panel data on a sample of 35 OECD countries over the period 2009–2016, the results support the conclusion that different types of IPC may have different implications for countries' social development. The findings also show that patents invented abroad have a positive influence on those aspects of social progress related to personal rights, freedom and choice, tolerance and advanced education, more than on basic human needs. Overall, this paper is relevant for policy making with regard to the type of IPC that is most beneficial in terms of social impact.

1. Introduction

Social progress, understood as "*the capacity of a society to meet the basic human needs of its citizens, establish the building blocks that allow citizens and communities to enhance and sustain the quality of their lives, and create the conditions for all individuals to reach their full potential*" (Social Progress Imperative, 2016, p. 10), is a priority in public policies. Many initiatives aim to foster social progress, although some are more efficient than others. Studies have shown that in the era of the global economy, technological innovation is one of the essential factors in a country's economic growth and competitiveness (Cohen, 2010; Hall et al., 2014). In this context, international patent collaboration or IPC (i.e., agreements among agents in different countries to jointly develop technological innovations) has become a common phenomenon, receiving increasing attention from scholars in a variety of fields (Belderbos et al., 2014; Giuliani et al., 2016; Montobbio and Sterzi, 2013; Nepelski and De Prato, 2015a, 2015b).

Knowledge spillovers from such collaboration are essential to improving creativity, efficiency and productivity, enhancing a country's ability to develop technological innovations (Lee and Bozeman, 2005; Mariani, 2004). Moreover, this collaboration contributes to the implementation of such innovations by promoting the dissemination of knowledge and technology via expanded social networks (Hertzum, 2008; Lim and Park, 2010; Yin et al., 2006). Given these potential advantages for countries' technological development, public and private investment efforts are increasingly aimed at encouraging international collaboration initiatives.

Although traditionally it has been emphasized that international collaboration has significant impact at a technological level, some scholars have started to note that these transboundary initiatives can also have implications for the social aspects of a country's development (Jiang et al., 2017; Noailly and Ryfisch, 2015). For instance, some recent studies suggest that international technological collaboration can help fulfill basic human needs, enhance access to fundamental knowledge, improve health systems, increase income levels, foster the use of environment-friendly technologies, expand personal freedom and choice, or help generate tolerance and an advanced educational environment (Giuliani et al., 2016; Montobbio and Sterzi, 2013; Noailly and Ryfisch, 2015). The main driver in all these cases has been found to be the new knowledge created and the newly acquired knowledge, skills and capabilities of the human capital.

Beyond these initial findings, however, not much is known about the social effects of IPC. Thus, this study aims to advance understanding of this phenomenon by examining a particular type of international collaboration and its implications for a country's social progress. To analyze social progress, the study provides a holistic, objective, transparent, outcome-based measure of a country's wellbeing that is independent of economic indicators. Examining IPC is particularly relevant for several reasons. First, IPC tends to imply closer and longer-term relationships between partners than other forms of collaboration (Breschi and Lissoni, 2009; Singh, 2005). Second, it usually entails intensive transfer of both implicit and explicit knowledge between the partners (Montobbio and Sterzi, 2013). Finally, the effect of patents on society is more instantaneous than that of other technological inputs

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because it implies an explicit knowledge that can be used immediately (Awokuse and Yin, 2010).

Additionally, a critical argument made in this study is that the social implications of IPC could differ depending on the type of collaboration. Thus, two types of IPC have been considered. The first, Patents Invented Abroad, aims to reflect the knowledge acquired by the researcher abroad, the spillovers generated by the collaboration and the knowledge associated with the patent. The second variable is Patents Invented by Foreigner, which aims to reflect the spillovers foreign researchers generate in a focal country and the knowledge transfer that stems from the collaboration.

The paper argues that these two types of IPC entail different types of human capital mobility (i.e., incoming versus outgoing) and can therefore be of varying benefit to the focal country's social development (Artuc et al., 2015; Leger, 2005; Singh, 2005). The characteristics of the key participants — in terms of their education, work and entrepreneurial experience, and social relations — thus become a major source of credibility and legitimacy (De Cleyn et al., 2011; Packalen, 2007; Reagans and Zuckerman, 2001).

The study contributes to previous literature by showing that IPC may have important social implications. Moreover, the two types of IPC were explored in order to assess its influence in depth and to determine those public policies that are more advisable in terms of social progress and IPC. The two types differ depending on the kind of human capital mobility the collaboration entails (incoming vs outgoing). Overall, it was found that outgoing mobility (patents invented abroad) has a positive and significant influence on social progress.

For additional results, the Social Progress Index was disaggregated into three dimensions to test IPC's effect on social progress empirically: Basic Human Needs, Foundations of Wellbeing, and Opportunity. Each dimension has four components, encompassing as many valid aspects of the component as possible. The first dimension, Basic Human Needs, assesses whether a society is able and willing to provide what its citizens require to survive. It encompasses nutrition and basic medical care; water and sanitation; shelter; and personal safety. The second dimension, Foundations of Wellbeing, captures whether a society offers building blocks for its citizens to improve their lives. Are people able to get a basic education and obtain access to information and communications to achieve their full potential? Do they benefit from a modern healthcare system and live in a healthy environment that will ensure a long life? (Social Progress Imperative, 2016). The final dimension, Opportunity, provides information about citizens' freedom and opportunity to make their own choices. Personal rights, personal freedom and choice, an environment of tolerance and inclusion, and access to advanced education all contribute to the level of opportunity in a given society.

The paper is structured as follows: First, it provides the conceptual background for the relationship between IPC and social development. Building on these ideas, it sets out the research hypotheses pertaining to the influence of different types of IPC on social progress. Next, it describes the methodology and results. Finally, it discusses the main conclusions, as well as the study's implications and limitations, and suggests promising avenues for future research.

2. Theoretical framework and hypotheses

2.1. International patent collaboration and social progress

IPC is a technological collaboration that involves two or more countries and whose outcome is a patent. It is widely accepted that, for countries, patent development enables the creation of higher-added-value products and services, which increase productivity and improve living standards (Grossman and Helpman, 1993). New patents and the knowledge associated with them can sometimes improve a country's production systems and make its processes more efficient. In these ways, the new patents and the knowledge derived from IPC have an important effect on social progress (Jiang et al., 2017). However, although patents are a key element in industrialization and allow countries to catch up with others that are more advanced (Fu et al., 2011), many authors show that developing new patents is costly and risky. Thus, industrial agents increasingly opt to work with agents of other countries rather than relying on individual development. Nowadays, such collaboration is an alternative method of patent development, allowing higher efficiency and making a greater impact on society (Fleming et al., 2007). IPC is considered particularly fruitful since it implies that highly qualified personnel and significant resources will be involved, and that strong relationships among agents in partner countries will be developed. (Battistoni et al., 2016; Fernández-Esquinas et al., 2016). These relationships often last for long periods and entail close interpersonal contact, which may continue for years after patent filing (Singh, 2008).

Frequently, IPC has made not only a technological impact but a social one (Hoekman et al., 2005; Jiang et al., 2017; Kirim, 1985; Streeten, 1974). This paper argues that, in general, IPC is relevant for social development because the knowledge acquired from the collaboration can help strengthen relationships between countries with regard to basic human needs (e.g. nutrition and basic medical care, water and sanitation, shelter and personal safety); generate common environmental framework aspects (resulting in similar environmental rules in all countries) (Noailly and Ryfisch, 2015); increase the quality of public health services (new techniques and medicines resulting from patents); generate income (mainly business profits, but also citizens' earnings and public revenues); improve the foundations of wellbeing (access to basic knowledge, information and communications; health and wellness; environmental quality) or increase opportunity by expanding personal rights, personal freedom and choice, tolerance and inclusion, and access to advanced education. Thus, the following hypothesis is put forth:

Hypothesis 1. IPC has a positive impact on a country's social progress.

However, it can be expected that the benefits of IPC for a focal country in terms of social development vary depending on the particular type of collaboration established with the partner country (i.e., whether IPC implies incoming or outgoing mobility of human capital). The study therefore considers two kinds of collaboration: patents invented abroad and patents invented in the focal country by foreigners.

2.2. Patents invented abroad

Patents invented abroad can have an important impact on social development. This type of collaboration implies, for the focal country, outgoing mobility of human capital (Artuc et al., 2015). Research agents sometimes lack the appropriate contextual knowledge in the focal country, so in order to produce new knowledge they move to other countries. This outgoing mobility produces knowledge flow and networks that not only contribute to the production of new patents but also help make countries more socially involved, with more technology dissemination, new relationships in matters of education and health; increased income and improved environmental settings (Artuc et al., 2015; Felsenstein, 2015; Gioli et al., 2016; Montanari, 2012). Thus, patents invented abroad can yield social benefits because they allow the focal country to use and appropriate the patent rents (economic, technological and social benefits), and also to absorb new knowledge, expand access to information, communications and advanced education, enhance personal freedom and choice, strengthen education relationships, improve the health system, increase income, and create new environmental settings (Doern, 1997; Oberthür and Rabitz, 2014).

The driver used is the new knowledge created and its mobility. Moreover, patents invented abroad are especially significant for the focal country because they provide bridges that can lead to agreements in other social areas. This type of collaboration also allows focal countries to enjoy benefits associated with the country hosting its