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When can strong patent regimes boost countries' stocks of inventions and related trade? An analytical model tested in Brazil, Egypt, Nigeria and South Africa in the energy, environment and pharmaceuticals and related sectors

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ABSTRACT

A framework for assessing countries' promptness to strengthen their patent regimes to boost the stock and commercial exchanges of their inventions is developed using an intellectual capital model and a concept map model. It was tested in Brazil, Egypt, Nigeria and South Africa in the energy, environment and pharmaceuticals sectors. Thus far, the findings have shown that stronger patent regimes are very likely to bring the complementary users of inventions together (beacon function), to spur coordination of commercial exchanges for inventions (bargain function) and stimulate further inventions when the core components of the intellectual capital and financial capital have expanded to the point that the coordination of exchanges can gain momentum. Some of the innovation policy implications are discussed in the paper.

1. Introduction

The patent institution has long been used in social systems to facilitate the coordination of exchanges of technical inventions among complementary users (inventors, researchers, technologists, firms, manufacturers, industrialists, other organizations and States), more systematically, from the mercantile, the industrial revolution through to the modern age. To a large extent, this institution has effectively been successful in bringing together various complementary users of inventions (the *beacon* effects), and spurring negotiations among them, resulting in contractual arrangements and commercialization of the said inventions (the *bargain* effect). It bestows upon inventors, limited rights on their inventions, which have successfully passed the universally well-established test of *novelty*, *inventiveness* and *commercial potential*. Patent rights can logically be perceived as a form of reward to inventors' efforts and are aimed at encouraging them to pursue further inventions [4,9,10]. These rights can be sufficient enough incentives to inventors to disclose knowledge to States to gain additional rewards if there are well-established guarantees for compensation in cases in which they are infringed upon. Such compensation could consist of compulsory licensing, revocation of misappropriated patents, fines or other sanctions against a dishonest competitor.

This compensation must be the outcomes of the assessment of three major enforcement criteria including 1) preliminary injunctions, 2) contributory infringement pleadings and 3) burden-of-proof reversal to which a patent holder can make recourse when infringements

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occur. Preliminary injunctions are pre-trial actions that order an accused infringer to cease commercial exploitation of the patented invention during the course of the trial. Contributory infringement is an action that causes or otherwise results in infringements by others. It makes a third party liable if the party is contributing to the infringement. In burden of proof reversals, the onus is put on the accused infringer to prove his/her innocence. Large-scale implementation of these measures can make the patent institution a stimulus for information disclosure - a basis upon which scientific and technological progress as well as innovation can flourish. It can also encourage manufacturers to scale up their operations globally.

Patent rights have also had limited effects on the innovation systems over the past two centuries [2]. They have been misused by certain entities as a defensive tool to gain a monopoly on targeted sectors or impede competition through the propagation of, for example, frivolous patents and dubious patents. This anti-competitive behavior adversely affected and continues to affect the innovation process worldwide. It is worth noting that patent rights are non-rival, non-excludable and geographically constrained. They are limited to the States where they have been granted, except in cases in which national patent laws have been harmonized. They can easily be misappropriated or infringed upon by foreign competitors, especially in the absence of harmonization. Hence, harmonization of the national patent laws is crucial in the contemporary context of global trade that increasingly involves technology-intensive goods [7,8]. Such harmonization is, however, difficult to achieve and has been the cause of many concerns globally, due to the varying levels of economic development and resources and institutional endowments between the developing and the developed. Many of the least developed countries are increasingly concerned that strong governance of the patent institution will impede their capacity to emulate new technologies, which are largely created in the developed world, and to build their endogenous capabilities. On the other hand, developed countries are concerned that trading their technology-intensive goods with countries that have weak patent regimes could result in misappropriation, copying and, ultimately sub-optimal returns on their R&D investments.

The Trade-Related Aspects of Intellectual property (TRIPS) Agreement of the World Trade Organization (WTO) is among the most important multilateral agreements aimed at improving global governance of intellectual properties, including patents. TRIPS recommend some minimum standards that member States of the WTO should follow in order to improve their patent laws and enforcement systems. These standards aimed at improving, among other things, the most important aspects of the patent acts/laws and practices, including the administration of the patent system, scope of patentable inventions and claims, patentable subject matters, examination and litigations procedures, patent duration, provision on compulsory licensing, international patenting, enforcement, revocation of patents (TRIPS, 1994). Until now, the implementation rates of TRIPS vary across countries. Notably, African countries have largely adopted and complied with the Agreement. However, some are still delaying implementation due to concerns that their innovation performances could be adversely affected.

In this paper, an analytical framework is presented for assessing the qualitative effects of strong patent regimes on national capacity to invent and exchange commercially technology-intensive goods. The assessment was carried out in three African countries and expanded to Brazil, to gage whether the proposed approach can be generalized to countries from other regions and across different economic contexts. The measurement of patent strength is based on the Girnate and Park's statutory methodology, which uses an index that averages the following five statutory categories of patent laws [13]:

- Membership in international treaties, including the Cooperation Treaty (PCT) and Protection of New Varieties (UPOV)
- Scope of patentable inventions in the following sectors: pharmaceuticals, chemicals, food, plants and animal varieties, surgical products, microorganisms and utility models
- Restrictions on patents: working requirements, compulsory licensing and revocation of patents
- Duration of protection that is normally 20 years
- Laws enforcement
- Enforcement provisions

Regarding enforcement, the selection criteria are the presence of: a) preliminary injunction measures, b) contributory infringement pleadings and 3) burden-of-proof reversals to which a patent holder can make recourse when infringements occur. A country that has in place these three criteria receives a score of 1. The values of patent strength range between 0 and 5, with 0 corresponding to the weakest and 5, the strongest national patent regime. They strongly depend on the historical status of underlying statutory categories.

The selection of the sectors (energy, environment and pharmaceuticals) was based on their vital role in the economies of the chosen countries. The energy sector is closely related to the environment and climate (change). It is a key driver of the economies of the four countries, which heavily rely of extractive industries, such as oil, gas, minerals and coal processing and largely use, and/or produce energy. Energy production and use are generally associated with adverse impacts on climate and the environment. In addition, the energy sector is very complex, requiring large supplies of new technological systems, increasingly, including those that can increase efficiency and cut down the levels of pollution in its key phases: 1) final consumption (residential, services, agriculture, industry, transport and non-energy use); 2) transformation (power generation and heat, refinery/petrochemicals); and 3) other transformation and fossil-fuel supply. The three groups of technology sectors considered here are generally used to improve efficiency at the appropriate phases and can play instrumental roles in mitigating or adapting to green