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ENDOGENOUS INNOVATION, OUTWARD-BOUND INTERNATIONAL PATENTING AND NATIONAL ECONOMIC DEVELOPMENT

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Abstract. In this paper we argue that countries whose residents exhibit a relatively high proclivity for obtaining foreign patent protection for endogenous inventions are likely to enjoy relatively high levels of wealth per person, and that the exploitation by home-country residents of the intellectual property systems of foreign countries for the commercialization of endogenous technology is an important factor for national economic development.

Keywords: intellectual property, outward-bound international patenting, economic development.

Intellectual Property and Global Innovation. The idea that intellectual property is an important factor in global innovation is now widely accepted in the academic literature [1–20]; and the majority of the pertinent published research portrays IP generally as supporting rather than inhibiting global innovation.

A sub-theme in this literature is that *international* patenting may be especially important for internationally-oriented innovation and trade in R&D intensive goods and services [1, 11, 21–27].

The Emergence of Outward-bound International Patenting. Most recently a formal distinction has been made in the internationally oriented patent literature between “Mode One” patenting (domestic patenting), “Mode Two” patenting (inward-bound international patenting), and “Mode Three” patenting (outward-bound international patenting), with the argument that Mode Three patenting is of great significance for economic development [27]. This paper reports the results of research that builds on Willoughby’s pioneering research in this field by exploring the differences between wealthy (developed) countries, emerging (mid-tier, developing) countries and poor (less developed) countries, in the changes over times in their relative levels of Mode One patenting and Mode Three patenting.

To conduct our investigations we collected data on both Mode One and Mode Three patent applications, together with data on national wealth (Gross Domestic Product per Capita), over a period of 18 years from 2000 onwards for all countries for which suitable data were available (148 countries). For each country we then calculated the total number of Mode Three patent applications as a proportion of all patent applications filed by residents of that country for each year of the time period covered by our data set. We divided the countries in our data set in to four groups, based upon their relative per capita levels of wealth, according to the standard classification system employed by the World Bank – namely, High Income, Upper-middle Income, Lower-middle Income and Low Income – and then calculated the aggregate changes in levels of Mode One patenting from 2000 to 2017. The results are shown in the following table.

Changes in the Volume of Outward-bound International Patent Applications as a Percentage of All Patent Applications, 2000 to 2017

Country Group	Mode-Three, % in 2000	Mode-Three, % in 2017
All countries (excluding China)	35	51
All countries (including China)	35	32
High income countries	36	52
Upper-middle income Countries	5	5
Lower-middle income countries	7	40

The proportion of worldwide patent applications in our data set accounted for by outward-bound foreign patent applications (excluding China) increased substantially over the eighteen years, from just over a third at the turn of the Millennium to just over a half by 2017. We calculated the global aggregate both with and without China because China is an outlier that has an extraordinary effect on the overall results. China's patent office received a record total of 1.38 million patent applications in 2017, more than double the number of applications received by the next most prominent patent office, the USPTO [28, p. 11]. While China was the source of substantial foreign (Mode Three) patent applications, accounting for over 60,000 in 2017, the vast majority (90.2%) of Chinese patent applications in that year were domestic (Mode One) applications [29].

The emphasis on Mode Three patenting was most prominent within the high-income group, accounting for over half of all patent applications in that group by 2017. The results for the two "middle" income groups present an intriguing contrast. The upper-middle income countries exhibited a very low emphasis on Mode Three patenting in 2000, a situation that remained unchanged 18 years later. Remarkably, however, the lower-middle income countries demonstrated a dramatic increase in their emphasis on Mode Three patenting, from 7% at the beginning of the period to 40% at the end of the period. The results for the low-income group were not plotted due to small numbers and missing data.

Notwithstanding the anomalous impact of China on the global aggregate it is fair to say that outward-bound international patenting Mode has clearly been growing in prominence worldwide during the last couple of decades, and hence deserves greater study as a phenomenon.

How Important is Outward-bound International Patenting? To test the ostensible importance of Mode Three patenting for economic development we calculated the correlation between domestic patent applications (Mode One patenting) and Gross Domestic Product (GDP) per capita, and between foreign patent applications (Mode Three patenting) and GDP per capita for all countries in our data set, at two points in time, namely 2000 and 2016. We found that at both points in time there was a statistically significant positive relationship between the level of patenting per person in each county and its level of wealth (measured as

GDP per capita). This relationship held true for both domestic (Mode One) patenting and foreign (Mode Three) patenting. However, the correlation between per capita patenting and GDP was stronger for Mode Three patenting ($R^2 = 0.67$ in 2000, and $R^2 = 0.69$ in 2016) than for Mode One patenting ($R^2 = 0.57$ in 2000 and in 2016). Thus, it apparently takes a relatively larger step in domestic patenting than it does in foreign patenting for a country to achieve a given step-up in GDP.

In short, there appears to be a positive relationship between the level of a country's level of outward-bound international patenting and its level of economic development, and the nature of that relationship appears to vary a great deal between different groups of countries according to their relative levels of wealth.

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