Do Technology Transfer and IPR Spur Domestic Innovation?: An International Panel Data Analysis

Demir, Caner

Kirklareli University, Department of Economics

15 December 2016

DO TECHNOLOGY TRANSFER AND IPR SPUR DOMESTIC INNOVATION?: AN INTERNATIONAL PANEL DATA ANALYSIS ♠

Caner DEMİR
Kırklareli University,
Department of Economics
Kırklareli – TURKEY
caner.demir@klu.edu.tr

ABSTRACT

The study investigates whether raising technology transfer and strengthening the intellectual property rights (IPR) regime trigger domestic innovation by employing a panel data analysis for 58 developed and developing countries in the 1960-2010 period. Since theoretical and empirical literature has proved that innovation and technology were the prominent drivers of development process, analyzing the determinants of these factors have become crucial. Due to the globalization process, knowledge spreads faster than any other social and economic indicators; which makes the interactions between the types of knowledge more important. Thus, the study analyzes the impacts of foreign patents (as a proxy for technology transfer) and IPR on domestic innovation. According to the empirical analysis, it is found that technology transfer triggers domestic innovation both in developed and developing world. Contrary, it is also found that intellectual property protection is a detrimental factor for domestic innovation in mid income group while it bears fruit in high income group.

Keywords: *Innovation, technology transfer, intellectual property rights, patents.*

JEL Codes: *O31, O34.*

♠ This paper has been already published in an open-access journal. Thus, please cite this article as follows;
- Demir, Caner, (2016); "Do Technology Transfer and IPR Spur Domestic Innovation?: An International Panel Data Analysis", **Journal of Knowledge Management, Economics and Information Technology**, Vol. 6, Issue 6, ISSN: 2247-7756.

1. INTRODUCTION

Today's economy considerably makes progress by using knowledge and technology. This fact refers to the importance of knowledge and the necessity of investigating the sub-factors that affect the production of knowledge and technology. Within this scope, the study focuses on two important determinants of the production of knowledge and technology; and examines the effects of IPR and technology transfer on domestic innovation by operating with various samples.

Since the mid 1980's and 1990's, many economic models have considered technology as an endogenous factor (i.e. Romer, 1990) and assumed that the accumulation of the technology strongly depends on the stock of the knowledge. According to this fact we may suggest that any knowledge available now to be used is an important source for future innovation. Thus, for a national economy or – in a micro framework – for an innovator firm, either domestic or transferred knowledge from abroad are considered as the potential knowledge stock to develop new ideas. Because of domestic knowledge stock is already scarce and does not lead to a technological accumulation in developing countries, the potential impact of the transferred knowledge has become even more important in those countries. In this framework, *the first hypothesis of this study is that technology transfer has a positive impact on domestic innovation*.

In our age, it is not that easy to reach and use an existing idea. Intellectual property rights (IPR), which give a right of retention to the inventor of the idea, make it difficult to build the new ideas on the existing knowledge stock. However, there is a controversy on the impact of IPR. Some arguments and even empirical evidences suggest that IPR encourages the creation of new ideas while some others assert that it hinders bunching the ideas together. Especially the leading international institutions force countries to implement stronger IPR policies. So, – in the light of the suggestions of the mainstream global policy on IPR *our second hypothesis is that IPR protection has a positive impact on domestic innovation*.

Although the practices of IPR are based on the 15th century, its main economic impacts have emerged during and post industrial revolution periods. Since then, the mainstream perspective on IPR claims that the protection of knowledge constitutes an incentive mechanism for potential inventors. The same view also asserts that without such a protection system no one will go into the effort of any innovation process (WIPO, 2011: 5). However, one should consider that IPR system gives monopoly rights to the parties which may obstruct the knowledge spillover mechanism, despite its encouragement function. Moreover, the negative impact might overweigh the positive one in different economic and structural environment. This rationale constitutes an important key point for testing our second hypothesis.

Due to the heterogeneity within the global economy, each country might be influenced differently by transferred technology and IPR protection in the practice. Since many developing countries which do not have any sufficient infrastructure for innovation and could innovate only products with low value-added while developed countries utilize effectively functioning innovation mechanisms. Due to above mentioned facts, developing countries need time to establish the essential infrastructure for managing an innovation process which depends mostly on executing a learning-by-doing process by transferring technology from foreign countries.

Within this scope, the study exhibits empirical evidences by employing panel data analysis which covers twenty high-income, nineteen mid-income and nineteen low-income countries. Now, before making the quantitative analysis let us give a brief literature survey.

2. LITERATURE REVIEW

The previous theoretical and empirical studies indicate that the existing knowledge stock is an important determinant of innovation. However, technology transfer is an important source of domestic innovation according the current literature and the political views of international institutions. Indeed, the more technology and knowledge flow from abroad the more domestic innovation rise.

Taylor (1993) and Taylor (1994) have stressed that in a North-South based global framework, southern region which imports technology from abroad should provide the necessary conditions for northern innovators such as IPR protection. Otherwise, the global innovation rate will reduce, the transfer of technology will decline and correspondingly the further innovation possibilities for the South will fall.

In a dynamic general equilibrium analysis, Lai (1998) has reported that if technology transfer comes to the South via FDI, stronger IPR protection in the South may raise domestic innovation in this region. However, if technology transfer comes through imitation, the opposite effects will emerge. According to the inferences of Lai (1998) it might be suggested that countries transferring technology through FDI may attract the potential FDI inflows from the North by strengthening their IPR system. Similarly, Naghavi (2007) has stated that developing countries should strategically implement stronger intellectual property right regimes to induce multinational companies (MNCs) of developed countries. In such a policy regime, MNCs will tend to less R&D intensive industries of developing countries through FDI and enhance domestic innovation.

The indicators for domestic innovation, technology transfer and IPR protection are proxied by different variables. Although most of the early empirical studies in the economic growth and innovation literature have used R&D investments and expenditures as a proxy of domestic innovation (i.e. Park, 1999; Kanwar and Evenson, 2003; Park, 2005 etc.), many others have used residential patent applications and patent application to US Patent Office (i.e. Lerner, 2002; Chen and Puttinanum, 2005; Schneider, 2005; Branstetter et al., 2006; Allred and Park 2007 etc.). To proxy technology transfer, either trade indicators (i.e. Maskus and Penubarti, 1995; Fink and Braga, 1999; Co, 2004 etc.), foreign direct investment inflows (i.e. Lee and Mansfield, 1996; Mayer and Pfister, 2001 etc.), or non-residential patent applications (i.e. Lerner, 2002; Branstetter et al., 2006; Allred and Park, 2007 etc.) are employed. However, as might be expected, the hardest difficulty has been on measuring the strength of IPR protection which changed by the type of the implemented policies. The early empirical studies generally overcome this problem by using Rapp-Rozek Index (Rapp and Rozek, 1990). As an example, Gould and Gruben (1996) found that stronger IPR protection leads to higher economic growth rates based on a dataset of 79 countries for the 1960-1988 period by using the RRI. Openness has also a positive impact on innovation in close economies. By using the same index, the RRI, Thompson and Rushing (1996) and Thompson and Rushing (1999) stressed that the growth effect of IPR protections exists only in countries which already achieved a certain level of development. In other words, IPR protections might have some positive effects on economic growth; but the possible benefit depends on the level of technological infrastructure and the capacity of physical and human capital.

However, the Ginarte-Park Index (Ginarte and Park, 1997; and as the updated version Park, 2008) has come into prominence due to its measurement method, being updated in every five years by maintaining the relative position of countries. The Ginarte-Park Index varies between zero and five; consisting of five sub-categories. The subcategories are as follows; the coverage of intellectual property, the membership status in international treaties, the duration of protection, the enforcement mechanisms and the restrictions on patent rights (Park, 2008). Walter Park, the co-author of the first publication on the index and the current updater, has updated the index in his 2008 paper and still has been updating the index in every five years.[1] To remunerate the two founders of the index, it will be called as the Ginarte-Park Index in the study. The subcategories and components of the index are shown in appendix.

While investigating the impacts of technology transfer or patent protection on economies, estimating their impacts on the total production may not be the best identification. The whole production of an economy (i.e. GDP) consists of many different factors and determinants. Instead of GDP, examining the impacts of technology transfer and patent protection on technological production (i.e. innovation and patenting activities) might give more considerable results. To clarify this proposition, Park (1999) reveals that IPR protection do not directly affect economic growth while it affects physical investments and R&D investments by using the GPI index. Similarly, Kanwar and Evenson (2003) and Kanwar and Evenson (2009) found that IPR protection significantly affects technological change and R&D investment in their panel data analysis for the 1981-1990 period.

For countries that are still in the *technologically developing* stage, technology transfer may most likely affect their learning-by-doing process, technological improvement and thereby their development process. So that, it might be claimed that either developed or developing countries might benefit from transferred technology. The empirical consistency of the claim is going to be tested in the next section. Also, the benefits derived from stronger IPR policies might depend on the development level of countries. Chen and Puttinanum (2005) suggest that domestic innovation in developing countries is raised by the increased IPR protection in a panel data analysis including sixty-four developing countries for the period 1975-2000. As in the inferences of Thompson and Rushing (1996) and Thompson and Rushing (1999), the effects of IPR depend on the development level of the countries as their technological abilities differ. The role of development level was also emphasized by Schneider (2005) who analyzed nineteen developed and twenty-eight developing countries for the period 1970-1990. The results of the study show that even though the innovation effects of IPR protections are more significant in developed countries, in most of the developing country regressions of the study, the sign of IPR protection is negative. It is also found that the positive effects of high-technology imports for domestic innovation are similar for both country groups. Similarly, Falvey et al. (2006) found that IPR protection has a positive significant effect on economic growth for low and high income countries; not for the mid-income countries based on a dataset consisting of seventy-nine countries. However, Hudson and Minea (2013) suggest that the effect of IPR protection on innovation is more complex than it is described in the previous literature based on an analysis for sixty-two developing and developed countries for the period 1980-2009. They have stated that the relationship under question involves some non-linearity which depends on the level of IPR protection and initial GDP per capita.

Some researchers dwelled upon opennes and set up relations with IPR protections. Gancia and Bonfiglioli (2008) emphasize the role of openness as in Gould and Gruben

[1] The last update has been given with a coverage of 1960-2010 period.

(1996). In a panel data analysis of fifty-three countries for the period 1965-1990, they concluded that IPR protections are most beneficial in open countries. In addition, integration with countries that have weak IPR protection, may reduce the global economic growth rate.

3. EMPIRICAL ANALYSIS

The aim of the empirical analysis is to test the two hypotheses which have been given in the introduction. Hence, the varying effects of technology transfer and IPR protection on domestic innovation are analyzed. The effects of the non-residential patent applications (as a proxy for technology transfer) and IPR Index on residential patent applications (as a proxy for domestic innovation) is going to be analyzed by employing panel data estimation technique.

The patent production function is defined as below;

$$P_D = (IPR, P_{F,(t-1)}, H, X_j) \tag{1}$$

where IPR, P_D, P_F, H and X_j represent intellectual property rights, domestic patents, foreign patents, human capital index and any other control variables respectively. The number of foreign patents (patent applications by non-residents) stands as a proxy for technology transfer from abroad. It assumed that the induced technology in the past may affect the innovation of the present. This is why the lagged value of the foreign patents is used. Also the research and development (R&D) expenditures could be used in the analysis as a potential determinant of domestic innovation. But due to the data limitations for the R&D data, this variable is excluded. Thus, the reduced form for the estimation is as follows;

$$lnP_{D\,it} = \propto_0 + \propto_1 lnP_{F\,i(t-1)} + \propto_2 lnH_{it} + \propto_3 lnIPR_{it} + \sum \gamma_j X_{jit} + \varepsilon_{it} \tag{2}$$

The (X_{jit}) term in the equation stands for the control variables. Due to the strong correlation between domestic patents and foreign patents in the equation (2) the endogeneity problem may arise. To prevent the possible endogeneity problem in the estimations, the instrumental variable estimator (IV, two stage panel data analysis) method has been employed[2]. Correspondingly, the foreign patents variable –which stands for the technology transfer from abroad – has been instrumented in the equation (2). The Wooldridge test statistic is used to investigate the presence of the first order autocorrelation. The model is estimated by two-step Instrumental Variable (IV) estimation with GMM option. Various lagged values of the instrumental variable are used as instrumental variables for the two-step IV GMM estimations.

[2] The equations were estimated via the (xtivreg28) module of Schaffer (2012) which is an updated version of the STATA software's instrumental variable for panel data module (xtivreg).

Table 1: The Variables and Data Sources

Variable	Data Source
IPR	Obtained from the current updater of the Ginarte&Park Index, Prof. W. Park. The detailed information on this data will be given in appendix.
Human Capital Index	PWT 8.0 - Index of human capital per person, based on years of schooling
Openness	WDI – Calculated as the share of the sum of export and import in the GDP.
Domestic Patents	WDI – Number of Residential Patent Applications
Foreign Patents	WDI – Number of Non-Residential Patent Applications

Note: All the data is obtained from World Bank's *World Development Indicator (WDI)* database, *Penn World Tables 8.0 (PWT)* and *Prof. Walter Park* for the GPI Index.

Table 1 shows the descriptions and sources of the data. The analysis covers the 1960-2010 period and fifty-eight countries (20 high-income, 19 mid-income, 19 low-income). Since the IPR index data is produced for every five years, all data is averaged into five-year spans. Thus the time dimension of the data is eleven in consequence of this arrangement. Due to data limitations for patent and IPR data it is not possible to involve all developed and developing countries.

Table 2: Sample Statistics

	ALL COUNTRIES			HIGH			MIDDLE			LOW	
Variable	**Mean**	**Std. Dev.**		**Mean**	**Std. Dev.**		**Mean**	**Std. Dev.**		**Mean**	**Std. Dev.**
ln(IPR)	.740	.6011		1.181	.3195		.5826	.587		.447	.579
ln(h)	.776	.279		.9928	.1738		.7516	.230		.577	.255
ln(open)	-.684	.715		-.7822	.6977		-.643	.8605		-.611	.540
ln(Pd)	5.83	2.821		8.11	1.953		5.23	2.483		3.695	1.93
ln(Pf)	6.99	2.08		8.26	1.867		6.86	1.884		5.613	1.53

Table 2 displays sample statistics of the variables used in the analysis. The estimations of the equation (5) are shown on Table 3. Table 3 includes three post-estimation diagnostic test results: the Anderson LR statistic tests whether the chosen instruments are under-identified; the Cragg-Donald F statistic tests whether the chosen instruments are weakly identified; and the Hansen J statistic tests whether the instruments are over-identified or not. All these diagnostic test statistics are significant which mean the chosen instruments are valid.[3]

[3] For more information, you may also see Baum, et. al., (2007).

Table 3: The Effects of Technology Transfer and IPR on Residential Patent Applications: 2-Step IV (GMM) Estimations

Dependent Variable: P_D	*ALL COUNTRIES*	*HIGH INCOME*	*MIDDLE INCOME*	*LOW INCOME*
$P_{F,(t-1)}$	0.394 *** (0.166)	0.114 * (0.064)	0.859 *** (0.177)	0.463 ** (0.198)
IPR	-0.325 * (0.193)	0.944 ** (0.373)	-1.48 *** (0.394)	- 0.057 (0.294)
Openness	0.255 (0.203)	0.521 (0.387)	0.141 (0.335)	0.071 (0.316)
Human Capital	2.28 *** (0.648)	1.44 ** (0.617)	4.66 ** (2.15)	- 0.929 (2.81)
Time Dummies	Yes	Yes	Yes	Yes
Cragg-Donald F statistic	398.16 ^	40.52 ^	52.49 ^	34.22 ^
Anderson LR Statistic	425.45 ***	93.05 ***	105.73 ***	77.94***
Hansen J (P-value)	0.08	0.12	0.57	0.14
Number of Observations	409	153	125	114
Number of Countries	58	20	19	19
F Statistic	10.67 ***	5.00 ***	7.96 ***	5.74 ***

Notes: ***, ** and * symbols imply statistically significance at the level of 1%, 5% and %10 respectively. Heteroscedasticity and Autocorrelation robust standard errors are in parantheses. The null hypothesis of Anderson canonical LR Statistic states that the equation is underidentified. ^ symbol shows that the Cragg-Donald statistic on testing the weak identification problem is in the acceptable range.

Results in Table 3 show the effects of technology transfer and IPR protection on domestic innovation. The estimation results suggest that the increases in technology transfer (foreign patent applications) significantly raise domestic innovation (domestic patent applications) for all country samples. According to the results, as the number of foreign patent application in the previous period increases by 1%, the number of domestic patent applications today increases by 0.39% in the whole sample, 0.11% in the high-income countries, 0.86% in the mid-income countries and 0.46% in the low-income countries. The coefficients are found significant for all samples. At first sight, we may suggest that technology transfer has a considerably important role on domestic innovation. However, the intensity of the impact varies among countries. Its impact is four times more in the low-income countries and about eight times more in the mid-income countries in proportion to the impact in the high-income group. This evidence is valid for the first hypothesis of the study. The high-income countries are less inclined to exploit the incoming technology from abroad since they are closer to the technological frontier.

Regarding the protection of IPR, the evidences show more diversifying impacts among country groups. Stronger IPR protection has positive impact on domestic innovation in the

high income countries, while the impact is negative in the overall sample and in the middle income countries. There exists no statistically significant impact for the low income countries. The results reveal that the number of domestic patents decreases by 0.33% in the whole sample, increases by 0.94 % in the high income countries but it decreases by around 1.48 % in the middle income countries as the strength of IPR tightens by 1 %. Since the results confirm the second hypothesis for the high-income group but rejects for the mid-income and the whole sample, it is intrigue. These results also justify the studies in the existing literature which have discoursed on the importance of the achieved development level. Indeed, domestic innovation in the developed countries –the high-income group– benefit from stronger IPR policies while developing countries – the mid-income group– are harmed by them.

Openness as one of the control variable is not found significant in any estimated sample. However the other control variable, the human capital index is estimated statistically significant for each sample; except the low-income group. The results show that as the human capital index increases by 1% the number of domestic patents increases by 2.29% in the whole sample, 1.44% in the high-income countries and 4.66% in the mid-income countries. The evidences can be interpreted as more human capital improves innovation performance of countries.

4. CONCLUSION

Since innovation –or new ideas– has been considered as an essential condition for economic growth and development process of today's economies, the sources and drivers of innovation have become more important compared to the past. For most of the developed and upper-middle income countries, we are no more able to explain their economic growth progress only with the fixed capital investment. Many theoretical and empirical studies in the economic growth theory have propounded this fact since the mid-1980s; and implied the importance of research and development expenditures. However, the research and development expenditure may be considered only as the first attempt for innovation and do not guarantee the eventuated new ideas which are the finalized innovation that may advance the economy. So that, this study has focused on domestic innovation and investigated how technology transfer from abroad and intellectual property rights affect the innovation performance of countries.

The study has regarded the transferred technology as a part of the knowledge stock. Thus, with reference to the theoretical literature, it is assumed that the existing knowledge stock determines future innovation and the lagged value of the technology transfer has been used. The results of the study reveal that transferring technology from abroad have positive impacts on domestic innovation both in developed and developing world. Furthermore, the results also show that the intensity of this effect varies among countries. The impact of the transferred technology on domestic innovation is much higher in low-income and middle-income countries as against the high-income countries. This is a very veridical result indeed. Because most of the developed countries are closer to the technological frontier and this makes it difficult for them to exploit the incoming technology from abroad.

The other focal point of the study is on the impacts of intellectual property rights protection. The analysis shows more diversifying results with regard to IPR. It is found that domestic innovation in the high-income countries is positively affected by stronger IPR policies while the middle-income countries are adversely affected. This is an impressive result. Contrary to the international mainstream view on IPR, these protections have not monotype impacts upon countries. Innovation and technological production sectors in

countries that are still in a technologically developing stage are damaged from IPR protection. Besides, for the whole sample which includes all the high, middle and low income countries, the impact of IPR is also estimated negatively. However it is not observed any statistically significant results for the low-income countries.

In consideration of the results obtained in the analysis, we may suggest that transferring technology from abroad is beneficial for any country group even the intensity of this positive impact varies among countries. Implementing stronger IPR policies do not yield positive effects in middle-income countries; but for the high-income countries, the exact opposite effects are observed. The latter effect might be associated with the importance of the development stage. We may assert that countries that are still in the technologically developing stage and that do not have a self-activating innovation mechanism should implement lower protection levels; at least until achieving the next stage.

REFERENCES

[1]. Allred, Brent and Walter G. Park. 2007. “Patent Rights and Innovative Activities: Evidence from National and Firm-Level Data”, Journal of International Business Studies, Vol. 38 (5), pp.878-900.

[2]. Baum, C.F., Schaffer, M.E., and Stillman, S., (2007), "ivreg28: Stata module for extended instrumental variables/2SLS, GMM and AC/HAC, LIML and k-class regression", http://ideas.repec.org/c/boc/bocode/s425401.html

[3]. Branstetter, L. G., R. Fisman and C. F. Foley, (2006), "Do Stronger Intellectual Property Rights Increase International Technology Transfer? Empirical Evidence from U.S. Firm-Level Panel Data", The Quarterly Journal of Economics, MIT Press, Vol. 121, No. 1, pp.321-349.

[4]. Chen, Yongmin and Thitima Puttitanun, (2005), "Intellectual property rights and innovation in developing countries", Journal of Development Economics, Vol. 78, pp.474-493.

[5]. Co, Catherine, (2004), “Do Patent Regimes Matter?”, Review of International Economics, Vol. 12 (3), pp.359-373.

[6]. Falvey, R., N. Foster and D. Greenaway, (2006), "Intellectual Property Rights and Economic Growth", Review of Development Economics, Vol. 10, No. 4, pp.700-719.

[7]. Fink, Carsten and Carlos A.Primo Braga, (1999), “How Stronger Protection of Intellectual Property Rights Affects International Trade Flows,” Washington, DC: World Bank Working Paper No. 2051.

[8]. Gancia, Gino and Alessandra Bonfiglioli, (2008), "North-South trade and directed technical change", Journal of International Economics, Vol. 76, pp.276-295.

[9]. Ginarte, Juan C. and Walter G. Park, (1997), "Determinants of patent rights: A cross-national study", Research Policy, Vol. 26, pp.283-301.

[10]. Gould, David M. and William C. Gruben, (1996), "The role of intellectual property rights in economic growth", Journal of Development Economics, Vol. 48, pp.323-350.

[11]. Hudson, J. and A. Minea, (2013), "Innovation, Intellectual Property Rights, and Economic Development: A Unified Empirical Investigation", World Development, Vol. 46, pp.66-78.

[12]. Kanwar, Sunil and Robert Evenson, (2003), "Does intellectual property protection spur technology change?", Oxford Economic Papers, Vol. 55, pp.235-264.

[13]. Kanwar, Sunil and Robert Evenson, (2009), "On the strength of intellectual property protection that nations provide", Journal of Development Economics, Vol. 90, pp.50-56.

[14]. Lai, Edwin L.-C., (1998), "International intellectual property rights protection and the rate of product innovation", Journal of Development Economics, Vol. 55, pp.133-153.

[15]. Lee, Jeong-Yeon and Edwin Mansfield, (1996), "Intellectual Property Protection and US Foreign Direct Investment", Review of Economics and Statistics, Vol.78 (2), pp.181-186.

[16]. Lerner, Joshua. 2002. "Patent Protection and Innovation over 150 Years", Cambridge, MA: National Bureau of Economic Research Working Paper No. 8977.

[17]. Maskus, Keith and Mohan Penubarti, (1995), "How Trade-Related Are Intellectual Property Rights?", Journal of International Economics, Vol. 39 (3), pp.227-48.

[18]. Mayer, Thierry and Etienne Pfister, (2001), "Do Stronger Patent Rights Attract Foreign Direct Investment? Evidence from French Multinationals' Location", Région et Développement, Vol. 13, pp.99-122.

[19]. Naghavi, Alireza, (2007), "Strategic Intellectual Property Rights Policy and North-South Technology Transfer", Review of World Economics, Vol. 143, Issue 1, pp.55-78.

[20]. Park, Walter G. and Douglas Lippoldt. 2005. "International Licensing and the Strengthening of Intellectual Property Rights in Developing Countries during the 1990s", OECD Economic Studies Vol. 40(1), 7-48.

[21]. Park, Walter G., (1999), "Impact of the International Patent System on Productivity and Technology Diffusion", "Competitive Strategies for International Property Protection" içinde, Fraser Institute, Vancouver, B. C., pp. 47-72.

[22]. Park, Walter G., (2008), "International patent protection: 1960–2005", Research Policy, 37, pp.761–766.

[23]. Rapp, Richard T. and Richard P. Rozek, (1990), "Benefits and costs of intellectual property protection in developing countries", Working paper no. 3, National Economic Research Associates.

[24]. Romer, Paul M. (1990), "Endogenous Technological Change", Journal of Political Economy, Vol. 98, October, part II, pp.71-102.

[25]. Schaffer, M.E., (2012), "xtivreg28: Stata module to perform extended IV/2SLS, GMM and AC/HAC, LIML and k-class regression for panel data models.", http://ideas.repec.org/c/boc/bocode/s456501.html

[26]. Schneider, Patricia Higino, (2005), "International trade, economic growth and intellactual property rights: A panel data study of developed and developing countries", Journal of Development Economics, Vol. 78, pp.529-547.

[27]. Taylor, M. Scott, (1993), "TRIPs, Trade and Technology Transfer", Canadian Journal of Economics, Vol. 26, Issue 3, pp.625-637.

[28]. Taylor, M. Scott, (1994), "Trips, Trade, and Growth", International Economic Review, Vol. 35, No. 2, pp.361-381.

[29]. Thompson, M. A. and F. W. Rushing, (1996), "An Empirical Analysis of the Impact of Patent Protection on Economic Growth", Journal of Economic Development, Vol. 21, No. 2, pp.61-79.

[30]. Thompson, M. A. and F. W. Rushing, (1996), "An Empirical Analysis of the Impact of Patent Protection on Economic Growth: An Extension", Journal of Economic Development, Vol. 24, No. 1, pp.67-76.

[31]. WIPO, (2011), "What is Intellectual Property?", WIPO Publication No: 450-E.

APPENDIX:

Table A1. Country List

High	***Middle***	***Low***
Australia	Argentina	Bangladesh
Austria	Brazil	Bolivia
Belgium	Colombia	Egypt, Arab Rep.
Canada	Ecuador	El Salvador
Denmark	Iran, Islamic Rep.	Guatemala
Finland	Ireland	Honduras
France	Jamaica	India
Germany	Jordan	Indonesia
Italy	Korea, Rep.	Kenya
Japan	Malaysia	Morocco
Luxembourg	Mexico	Pakistan
Netherlands	Panama	Paraguay
New Zealand	Peru	Philippines
Norway	Singapore	Sri Lanka
Portugal	South Africa	Syrian Arab Republic
Spain	Thailand	Ukraine
Sweden	Tunisia	Vietnam
Switzerland	Turkey	Zambia
United Kingdom	Venezuela, RB	Zimbabwe
United States		

Table A2: The Subcategories and Components of Ginarte-Park Index

1. Coverage	**Available**	**Not Available**
Patentability of pharmaceuticals	1/8	0
Patentability of chemicals	1/8	0
Patentability of food	1/8	0
Patentability of surgical products	1/8	0
Patentability of microorganisms	1/8	0
Patentability of utility models	1/8	0
Patentability of software	1/8	0
Patentability of plant and animal varieties	1/8	0
2. Membership in international treaties	**Signatory**	**Not Signatory**
Paris convention and revisions	1/5	0
Patent cooperation treaty	1/5	0
Protection of new varieties (UPOV)	1/5	0
Budapest treaty (microorganism deposits)	1/5	0
Trade-related intellectual property rights (TRIPS)	1/5	0
3. Duration of protection	**Full**	**Partial**
	1	$0 < f < 1$ *
* where *f* is the duration of protection as a fraction of 20 years from the date of application or 17 years from the date of grant (for grant-based patent systems).		
4. Enforcement mechanisms	**Available**	**Not available**
Preliminary (pre-trial) injunctions	1/3	0
Contributory infringement	1/3	0
Burden of proof reversal	1/3	0
5. Restrictions on patent rights	**Yes**	**No**
Working requirements	1/3	0
Compulsory licensing	1/3	0
Revocation of patents	1/3	0

Source: Park (2008)