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The Impact of Intellectual Property Rights Protection on Innovation in developing countries: a Panel Data Investigation

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Abstract

In this paper, we try to analyze the relation between IPR reforms and innovation by looking for factors through which intellectual protection could affect innovation in developing countries using a Poisson and Negative binomial model. We pay particular attention to the impact of the investment on innovation and tried to capture the non-linear behavior of IPR protection. The results demonstrated the existence of nonlinearities between IPR and innovation taking the form of an inverted U-shaped Curve indicating that intellectual reform affects differently the developing countries. For the less developing ones, the expected positive effect of IPR reform on innovation could be expected through "the signal effect" of relatively better institutions, property protection, and law enforcement. While for the developing countries with higher income per-capita and important capacities of absorption and more developed National System of innovation the effect is expected to be negative. The main cause is that the rising cost of imitation and the legal constraint would hinder seriously the capacities of emerging countries in inventing around and then decrease the adaptative innovations in this group of countries.

Keywords: Intellectual Property Rights, Innovation, Absorptive capacities, National System of Innovation

1. Introduction

Modern economies are increasingly concerned by absorption, production, dissemination and protection of new knowledge which is cumulative and complex process. The Scientific knowledge production is then taking a larger importance in modern economies. Jalles (2010) noted that adoption of new ideas is essential to economic growth. This accumulated stock is transformed in new services and products and grant a suitable rate of economic growth. So it appears that the factors defining the prosperity of nations are less the initial natural resources but the capacities of these countries of absorbing and generating new knowledge and transforming it in innovation. In this context, the knowledge based economies has emerged as a necessary new economic organization granting a continual flow of new knowledge transformed in new technologies and commercialized throughout the world. The globalization process characterized by a liberalization of trade and capital flows has assisted the dynamics of knowledge economies. In the same time, it comes into interest the necessity of protecting the knowledge produced to grant a return on R&D investment. While patent protection is not the only mean of appropriability, the Northern firms pointed out the centrality of the protection of the generated knowledge. As consequence, intellectual Property Rights has taken a considerable importance in industrial policy for developing and developed countries. Its impact concerned as well the process of innovation, economic growth and technology transfer.

As innovation took an increasing importance in the process of economics development as underlined by Romer (1994), it becomes increasingly important to investigate the relation between the tendency toward standardization of IPR protection and its impact on developing countries especially since the implementation of IPR protection. The intellectual property rights (IPR's) refers to patents, copyright and trademark that differ in their scope and application. Copyrights and patents ensure the innovator temporary monopoly power allowing the production of goods using new ideas. In fact, TRIP's agreement was established by the World Trade Organization (WTO) in 1995. Its purpose was the protection of intellectual property rights of inventors in active manner which allows promoting innovation, knowledge dissemination and technology transfer conducting to higher level of social andeconomic welfare as noted in Art.7 of the agreement. Its covers a large scope of appropriation's means as the patent, trademarks, commercial design and trade secret.

During the Uruguay Round in which the agreement was negotiated, discussions opposed two sides: the Northern countries endowed with the larger capacity and outcomes of innovation which have as objective strengthening IPR protection to grant a return on R&D investment and the southern countries who considered it suspiciously since they expected harmful impact on their respective economies through limiting knowledge access and technology transfer. In order to convince the developing countries, the importance of technology transfer was indicated clearly in the agreement and a compulsory license was adopted allowing countries under special conditions to use patent after payment.

In fact, the endogenous growth theory demonstrated thatthe free imitation and the reverse engineering form and important means of learning and acquisition of new technologies. Historically, countries like United States and Japan relied heavily on reverse engineering to absorb foreign technologies stemming from other countries. From this perspective, the central question which we are concerned about is the effect of IPR reform on the innovation in the developing countries.Particularly, we would analyze how the rising cost of imitation and the legal constraint linked to PR reform would affect innovation in the developing countries.

1. Literature Review

1.1 Intellectual Property Rights and Innovation

Investigating the relation between strengthening IPR's and innovation Helpman (1993) argue that higher rate of protection rises the rate of innovation in the short run but decreases this rate in the long run the welfare of consumer in the south decreases also. He concludes that the impact of rising IPR protection is negative on the south since the static effect generated by the rising product prices hurt them negatively. Diwan and Rodrik (1991) demonstrate that stronger patent protection in the South gives to the North greater incentive to innovate and to introduce adapted technology to the South which would enhance economic welfare. Mazzeloni and Nelson (1998) considered more carefully the impact of broadening and strengthening. They considered that in some industrial field, more stringent policy could generate more inventions, disseminate knowledge induce a higher flows of innovations while in otherindustrial fields more stringent patent generates higher costs than the expected social profits and could hinder sensibly innovation by limiting the motivation to invest in R&D.

Using a general equilibrium model, Lai (1998) demonstrated that more stringent intellectual property protection would increase the innovation rate if coupled with higher flow offoreign direct investment to the south. He noted that theexpected reduction of imitation in the south would encourage Northern firms to invest in the South and in consequence the cost of innovation in the north would not rise. Simultaneously,the higher rate of profit of innovators would encourage them to invest more in R&D activity leading to higher rate of innovation in the North. In other hand, Glass and Saggi (1999b) introduced a cost of adaptation for the multinationals firms and their costs of production are higher of the Southern's production cost. They considered that more stringent intellectual property protection would lead to higher imitation costs and more workers used in imitation activities, this situation lead to less workers available (in absence of unemployment) lower rate of multinationalisation. In the North, more workers are use in the production industries and less available for R&D activities. The cost of innovation is more important which would have as consequence lower rate of innovation in the North. In the same vein, Mondal and Gupta (2008) used a general equilibrium model to investigate the effect of more stringent IPR's policy on the North innovation and South unemployment. They demonstrated that higher rate of intellectual protection affect negatively innovation in the North while it is impact on unemployment depends of wage differential.

In fact, the impact of intellectual property rights (IPR's) would be varying with regard of the national innovative system of the country and specifically the capacity of the country learning absorbing new technology resulting from spillover. At the micro level, Dutta and Sharma (2008) underlined the fact that industries in their dependence to innovation and in consequence in their willingness to perform R&D activities. They find that the expenditure in R&D activities increased in firms with higher propensity to innovate and their international patenting activity increases sensibly. Chen and Puttitanum (2005) studied the impact of intellectual property rights on innovation employing a panel data of 64 developing countries. They find that IPRs impacts positively innovation and that IPRs is decreasing in the early stage of economic and increasing later. They confirmed the presence of a U-schaped curve between IPRs and the level of economic development. In the same line, Dinopoulos and Segerstrom (2010) developed a North-South trade model to investigate the relation of IPR on developing countries. Allred and Park (2007) argued that the impact of IPR's on innovation is nonlinear and depend of the initial level of patent protection and the level of economic development. They showed that more stringent patent protection affects negatively domestic patent filing and insignificantly R&D activity and foreign patent filing. Kanwar and Evenson (2009) argued that lower level of technologies in the developing countries imply the existence of narrow and poor quality goods in consequence they are incited to allow for low level of IPR protection through cheap imitation of imported products. Many countries like India, at the first stage of their development allowed only patenting process and drugs firms synthesized the same molecule discovered with different process. When their technological base becomes more important countries adopt a more stringent IPR policy. In consequence, countries are expected to switch of IPR regime when the level of economic development rises. Furukawa (2010) developed an endogenous growth model to study the interaction between intellectual property rights and innovation he finds a non-linear relation drawing an inverted shaped curve. This relation would emerged from the interaction between the learning and the R&D process.

1.2 Absorptive Capacity and Cumulativeness Effect

Cohen and Levinthal (1990) remarked that accumulation of knowledge for firms allows assimilation and exploitation of new knowledge. The cumulative character of absorptive capacity permits to efficiently accumulate knowledge in the next period and allows to fix what is the useful knowledge for the next period. In consequence, the accumulation of absorptive capacity permits to understand and choose accurately the technology that would lead to more technological advance. The cumulative character of absorptive capacity implies that when a firm would invest in R&D it would be able to assimilate and use new information. In other side, the firms of developing countries could be confronted to the "lockout" effect. Firstly, if the firm does not develop its absorptive capacity than it would not be able to assimilate and exploit new information and to detect new opportunities linked to technological change. Secondly, the lack of initial investment in absorptive capacity would lead to more costly R&D activity which would curtail the assimilation and eventual development of technology. Cohen and Levinthal (1990) applied the concept of "lockout" to the micro-level but it could be extended to the macro-level and countries with initial low level in R&D activities could be found in the "lockout" situation. Cohen and Levinthal (1990) highlighted the "non-invented-syndrome" which is consequence of low initial level of investment of R&D activities leading to assimilation of knowledge generated in the environment. The cumulative characteristic of absorptive capacity leads to chronic lack in the technological capacities and especially the firm can not detect the technological opportunities and finds itself in "lockout situation".The concept of "self-reinforcing behavior" explains the persistence over time of some firms behavior. Particularly when firms neglect R&D activities they may fail to absorb external technology and this behavior would be self-sustained leading to the "lockout" situation.

2. Methodology and Data

In this paper we propose to examine whether IPRs exerts a positive impact on innovation across countries. Our main question is whether IPR's protection is positively correlated with innovation controlling for a set of variables like economic development, inflation, political stability and government spending. We focus precisely on the impact and magnitude of IPR's protection on innovation and paying particular attention to the possible non-linear relation between intellectual property and innovation.

2.1 Sample and Data

In the first part a sample of 60 developing countries is used over the 20-years period of 1985-2004 (inclusive). The choice of this period was motivated by the purpose of evaluating the direct effect of TRIP's Agreement on the potential innovation of the set of developing countries.

2.2 Model's Hypothesis

Two hypothesis are evaluated:
H_0: Intellectual Property rights reform has a positive effect on innovation in developing countries;
H_1: Intellectual Property Right reform by limiting the possibility of free imitation has a negative effect on innovation in developing countries.

2.3 Empirical Estimation

Using a panel data set composed of 60 developing countries we assess whether IPR protection has a significant impact upon innovation in our sample. The dependent variable is the average patent number, we use as explanatory variables, measure of intellectual property rights index and the ratio of investment to GDP.

2.4 The model

The Poisson model used here is a count model such that the probability of the event happening is determined by a Poisson distribution and the mean of distribution is defined by a set of exogenous variables. The Poisson random model is the following:

$$Pr(Pit)= \exp(-\lambda_{it})\lambda_{it}^{pit} / p_{it}\,! \qquad (1)$$

The model estimated is the following:

$$E(p_{it}/X_{it})=\lambda_{it} = \exp(\alpha_{it} + \beta_1 IPR_{it}+ \beta_2 IPR^2_{it} + \beta_3 Z_{it}) \qquad (2)$$

$$\ln (pit) = \alpha_{it} + \beta_1 IPR_{it}+ \beta_2 IPR^2_{it} + \beta_3 Z_{it} \qquad (3)$$

Where p_{it} is the number of patent filled at the term of the period, as p_{it} is a positive integer, Greene (2001) recommends utilisation of Count model as the Negative binomial method for the panel model. IPR_{it} is the intellectual property right index. The used index was developed by Park (2005). Finally, Z_{it} is formed by a set of control variables. The Poisson model is characterised by the equality between the mean and variance in consequence:

$$E(p_{it}/X_{it,}\ \beta)=Var(p_{it}/X_{it,}\ \beta)= \lambda it \quad (4)$$

The Negbin model is a more general specification than the Poisson model allowing for differences between variances between countries. As noted by Chadha (2009) the advantage of the Negbin model is the possibility of handling a large number of zeros existing in the data set. The conditional variance of the Negbin model is given by:

$$Var(p_{it}/X_{it})= \lambda_{it} + \alpha g(\lambda_{it}) \quad (5)$$

Where α is an unknown parameter while the function g (λ_{it}) is known taking the form $g(\lambda_{it})= \lambda^2_{it}$ or $g(\lambda_{it)=}\ \lambda_{it.}$ The ratio of the variance to the mean is given by:

$$Var(p_{it}/X_{it})/\ E(p_{it}/X_{it,}\ \beta)= 1+\alpha\ E(p_{it}/X_{it,}\ \beta) \quad (6)$$

3. Results and interpretation

The results reported in the Table (1) precisely the 5 column and the table (2) the 10 Column, show the existence of a non-linear relation (an inverted U-Shaped curve) between the innovation and the index of intellectual property. The main result is that for developing countries with low level of intellectual protection, the patent reform would have a positive impact on the number of patent filled in the country while that for countries with higher level of development, strengthening intellectual property right would have a negative impact on innovation. This finding confirm the imitative and adaptative nature in innovation of the intermediate income level countries with absorptive capacities and for which more stringent intellectual property would have a negative impact. This result confirms those of Allred and Park (2007) who find similar conclusions. The second important result is that the innovation depends positively of the level of development of the country. Thirdly, when controlling for the TRIP's year agreement we find that there is a positive impact on innovation.

TABLE I: Estimation of the model using Poisson estimation

	Poisson model				
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
lngdp	2.14*** 0.01	2.30*** 0.015	2.33*** 0.018	1.94*** 0.01	2.16*** 0.02
IPR		-1.179*** 0.013	-0.078** 0.03	0.46*** 0.042	0.66*** 0.042
IPR^2			-0.069*** 0.02	-0.28*** 0.026	-0.15*** 0.027
Inv/GDP				6.74*** 0.097	4.71*** 0.11
IPRdate					-0.54 0.015
Loglikelihood	-8115	-8024	-7927.27	-5606.41	-4982.31
Probchi2	0.00	0.00	0.00	0.00	0.00
Obs	130	129	130	129	129

In the Table **I** was reported the results of estimation using the Poisson model while in table II we reported the estimations' result using the Negative Binomial model.

TABLE II: Estimation of the model using Negbin Estimation

	Negbin	Model			
Variables	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Intercept	-2.26**	-2.35**	-2.51	-1.99*	-2.70**
	(-2.11)	(-1.97)	(-1.96)	(-1.63)	(-2.12)
lngdp	0.49***	0.494***	0.51***	0.44***	0.54***
	(3.19)	(2.76)	(2.76)	(2.62)	(3.09)
IPR		-0.017***	0.11	-0.36**	0.19
		(-0.25)	(0.29)	(-2.07)	(0.49)
IPR^2			-0.1		-0.50*
			(-0.37)		(-1.69)
Inv/GDP				0.69	0.57
				(0.75)	(0.63)
IPR date				0.42***	0.51***
				(2.81)	(3.39)
Loglikelihood	-464	-459	-459	-455	-454
Prob chi2	0.0014	0.067	0.018	0.0004	0.0002
Obs	130	130	129	129	129

4. Conclusion

It is considered that IPR's reform was at the origin a United States firms' request followed by the European ones as consequence of perceived losses due to imitation of original products throughout the world. This claim was adopted by the respective government who looks to reform the intellectual property right system and was subject of the Uruguay negotiations which conducted to TRIP's Agreement.

It stipulates the necessity of harmonization of standards of protection of intellectual property in the world to encourage innovation and prevent imitation, in the same time it was stressed the role of developed countries in technology transferring. The main question in this article concerned the impact of the IPR reform on innovation for developing countries with different level of technology capacities and national system of innovation. We tried to analyze how IPR strengthening affect innovation using a specific counting model namely Poisson and negative binomial ones. In one side we find that the intellectual property protection has a positive impact on the least developing countries since the IPR reform acts as a signaling effect for better governance and rule of law attracting foreign direct investment and encouraging basic innovation. In other side for the middle income countries concerned with the activity of R&D and having an interesting level of absorptive capacities a negative impact on the innovation activity is detected. The negative effect of the rising cost of imitation dominates the positive signaling effect. The innovation of these countries is characterized by his imitative and adaptative aspect which would be affected negatively in the presence of limitation on imitation. The real challenge for those countries is finding a way of using the TRIPS agreement and the legal possibilities which are available to overcome this problem and still developing their technological capacities.

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