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Intellectual Property Rights and Economic Growth: Evidence from A Cross-Country Data of Developing Countries

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Abstract
The paper uses a new cross-country data to test whether strong intellectual property rights protection (IPR's) has a positive effect on economic growth for a sample of developing countries during the post TRIP's period.We Control for a set of economic and policy variables as the level of economic development, investment, political stability, openness and geographic location. We focus on the correlation between IPR's and economic growth. Using IVE to address endogeneity, we find that IPR protection is positively correlated with economic growth and this finding is robust to various estimations techniques confirming the previous results of Gould and Gruben (1996).
Keywords: Intellectual Property Rights, economic development, economic growth, utility patent.

1. Introduction

Protection of intellectual property right is an important issue with economic and policy implications related to economic growth and innovation in developed and developing countries. Romer (1986) formalized the relation between technological innovation and growth, and demonstrated that research and development is the main engine of economic progress. An increasing interest was devoted to the mechanisms through which technological progress affects production and organizations.

TRIP's agreement was implemented by the World Trade Organization (WTO) in 1995. It covers a large filed as patent, trademarks, commercial design, and trade secret. This agreement was complementary to previous agreements like Paris convention. TRIPS provide a period of 20 years of monopoly use of invention after which it belongs to the public field. The discussion of intellectual property rights (IPR) protection was conducted under the World Trade organization supervision. During the Uruguay Round discussions was opposing two sides: on the one hand, the developed countries on other hand, developing countries. On the one side, the Northern countries with the most important share of innovative activities have intention to raise protection of intellectual property rights to grant return on R&D investment. On the other side the Southern countries considered the fact of strengthening protection harmful to their economies since it restrains imitation and technology transfer. To resolve this conflict, developed countries were called to grant technology transfer to developing countries in order to enhance their technological capacities. At the same time a restriction on property rights was established (the compulsory license) allowing government to use patent after payment when there is an important necessity.

The TRIPS Agreement enacted in the Uruguay Round during 1994 established minimum standard for protection. The objective was to reward innovators and to restrain imitation and copying which were considered as source of rental losses for developed countries. The idea was developed by suggesting a system close to harmonization of IPR protection. Patent protection gives a rental rights to whose holds innovation in order to earn royalties. Countries which have signed the TRIP's agreement have to adopt enforcement measures preventing national and international transactions in counterfeit goods.

2. Literature Review

Mazzeloni and Nelson (1998) indicates the existence of four different theories about patent protection. Firstly, the theory of patent motivation which explains that anticipation of patent provides motivation for inventors. Secondly, the theory of induced commercialization which demonstrates that patent system provides the investment used for development and commercialization of new product. Thirdly, the disclosure theory which considers that patent forms a reward for individual efforts or investment in R&D activities. Fourthly, the theory of exploration which explains that patent allows exploration of broad possibilities and opens the road for new inventions.

Patent provides assurance of rewarding when invention is commercialised. Firms could easily support the cost of going to the markets capital when expecting a return on innovation which allows recovering the initial investment. In opposite, when the firm does not enjoy of patent protection, it would be little incitation to invest in R&D activities. Some studies indicate that patent was not the only means uses by firms to protect their products, in fact they could use secrecy which protect technology processes. In other circumstances, without patent protection, the first mover position could grant a large profits for new product. A patent does not necessarily generate more innovation but are required to ensure disclosure of information and dissemination of

information included in innovations. Inventors expect to have return on innovation when selling their products on the market.

Gould and Gruben (1996) analysed the direct relationship between growth rate and IPR protection controlling for other factors. They conducted their study using cross-sectional data over the period 1960-1988. Using OLS estimation, they find that IPR has a positive but not significant coefficient. They remarked the possibility of measurement errors since the index of patent contains subjective judgment. To solve this problem they used the instrumental variable technique. They concluded at the existence of significantly positive relation between IPR protection and economic growth. Ginarte and Park (1997) studied the indirect effect of IPR on growth through the impact which exerts on physical, human and R&D capital accumulation. They used a cross country data over the period 1960-1990. They concluded that IPR protection influences the capital accumulation which in turn affects growth. In this line, Thompson and Rusching (1999) studied the indirect effect if IPR on growth. They used a cross –sectional data from 1975 to 1990 in assessing the influence of IPR protection on the total factor productivity which in turn affects growth. They find a significant positive relation between IPR and factor productivity for countries for which the GDP per capita in 1985 is above 4000 dollars.

Schneider (2005) analyzed the effect of IPR on innovation which was proxied by the number of patent filings in US. She finds a positive effect of IPR on patent in developed countries, while for developed countries IPR has a negative or insignificant effect on innovation when controlling for other variable like infrastructure and FDI. Falvey at al (2006) studied the impact of IPR protection on growth using a threshold regression analysis over a panel composed of 80 countries between 1975 and 1994. The Research focused on the role of openness and the level of economic development measured by initial GDP. They find that the impact of IPR on growth varies at different level of income per capita and that this effect is positive under a certain level and above other threshold level. Between the two limits IPR protection has not any statistically significant effect on economic growth.

Concerning developed countries, raising IPR protection stimulates innovation by encouraging inventions and granting return on R&D investment. For middle income countries engaged in the catching up process IPR protection decreases the ability of the country to imitate and absorb the new technology by raising the cost of reverse engineering which will be reflected by a negative effect on growth. Concerning the low income countries, high IPR protection stimulates FDI flow and technology transfer which would have a positive effect on growth and income level.

Patents are accorded for inventions which are considered new, non-obvious and have industrial application. The duration of protection is 20 years and concern product and processes. Patent protection requires a disclosure of technical information and details in that way which allows its replication. Utility model are minor innovations concerning tools and components in optical, mechanical and electronic industries. Utility model is simply to acquire but does not grant strong protection as do patent.

The cost of innovation rises with higher intellectual property standard as consequence of higher price of technological input. The R&D in developing countries is oriented toward imitative and adaptative rather than radical innovation, hence the relative low quality of new products don't compensate the reduced competition. Grossman and Lai (2004) established a linkage between the market size, the level of IPR and innovation. They show that the weaker are innovative capacities and the smallest is the market size, the lower is the optimal IPR level. Eicher and Penalosa (2008) confirmed this linkage between the size of the market, IPR protection and innovation. They demonstrated that IPR stimulates innovation and growth unless the market reaches some size otherwise IPR protection would have a negative effect on growth. As generally, developing countries have small size markets and low innovative capacities, the balance between benefits of IPR protection and marginal cost occurs at low IPR level comparatively to developed countries. Consequently, innovation activity of southern countries would be negatively affected if the specific character of the imitative and incremental innovation has not been taken into account and the IPR protection level is established above the one suitable.

Patent protection affect market in two ways firstly through the market power by enhancing the monopoly power of firms secondly via the market diffusion effect by enabling firms to rise their market's share when imitative capacities of competitors is reduced. Stronger patent limit the ability of the southern's firm to imitate northern product, in other side by exploiting their market power, patent holders could slower technology transfer of new technologies to the south. Ginarte and Park (1997) pointed out that the optimal level of patent protection corresponds to one which establishes equilibrium between dynamic benefits and protection's costs.

Kanwar and Lai (2001) analyzed the impact of intellectual property rights (IPR) on economic growth and welfare using an expanding-variety type model of R&D. Kwan and Lai (2003) demonstrate that when taking into account a transitional dynamics there exist a limited optimal degree of IPR protection. They calibrate their model using US data to evaluate the impact of optimal IPR on welfare. They looked to explain factors responsible from deviation of R&D from the optimal level specifically knowledge spillovers and creative destruction.

Lai (1998) when assessing the relation between economic growth and IPR finds that when FDI is the major channel of technology transfer and there is high rate of protection than the rate of innovation rises in the North

and the South. Kwan and Lai (2003) finds that tightening IPR protection would have as consequence an immediate fall in consumption and a rising of the R&D expenses in the R&D sector. In the next period, consumption would rises as a result of more investment in R&D which has as consequence faster innovation and growth. Kwan and Lai (2003) show that tradeoff between actual consumption and future consumption implies the existence of an optimal IPR that maximizes the utility of the representative agent. Extension realized by the authors, assume that the rate of imitation is dependent of accumulation of knowledge of past imitations. Strengthening IPR has a positive effect on innovation by stimulating R&D activities while imitation reduces R&D activities. IPR protection was modelized as the part of imitation rate that could be impacted by the government policies. The collection of means of industrial policies used is composed from length and breadth of patent, protection of trademarks, copyrights and trade secrets. In consequence, IPR policies form a component of anti-trust policy.

Kim and al. (2011) remarked that patent protection has a marginal impact on R&D while petty patent has a positive effect on R&D activities. They noted that in china at 1984 with the first patent law utility models counted for the two thirds of the total patents

4. Data and Methodology

In this paper we propose to examine whether IPRs exerts a positive impact on economic growth across countries. We assess the exogenous contribution of IPR on economic growth by instrumenting for IPR's using a set of instruments. Our main question is whether IPR's protection is positively correlated with economic growth 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 economic growth.

4.1 Sample and data

In the first part a sample of 64 developing countries is used over the 17-years period of 1995-2011 (inclusive).

4.2 Variables

The variable and their definitions used for the cross country-year data base are summarized in the table 1.

4.2.1 Dependent variable

The dependent variable gdpgrowth is the average growth rate of GDP per capita for country i during the period 1995-2011.

4.2.2 Independent variables

The initial level of GDP, InitGDP, is the logged level of per capita GDP at the beginning of the period 1995, Inf is the average rate of inflation, lnipr index is the measure of patent protection, politstab is an index reflecting the political stability over the period, control variables used concern geographical variables.

5. Empirical estimation

Using a cross section data set composed of 60 developing countries we assess whether IPR protection has a significant impact upon growth in our sample. The dependent variable is the average of economic growth and we use as explanatory variable measures intellectual property rights index, the ratio of exports to GDP as measure of openness, the ratio of investment to GDP, index of political stability, and dummies variable controlling for the three groups of countries : Africa, Asia and Latin America countries.

5.1 The model

The model estimated is the following :

$$\mathbf{gdpgrowth_i = \beta_0 + \beta_1 lnInitgdp_i + \beta_2 Invst_i + \beta_3 Oppeness_i + \beta_4 Infl_i + \beta_5 politstab_i + \beta_6 IPRindex_i + \beta_7 Govcon_i + \beta_8 geographic\ dummy + \mu_i, \quad (1)}$$

The index of IPR is from the Report of international property right index 2011. Firstly, we used IPR secondly we used the International Property Rights Index (IPRI) to deal with endogeneity problem.

Table 1.Summary statistics

Variables	Obs	Mean	Std.DEV.	Min	Max
ipr	60	4.60	0.803	2.8	7.3
gdpgrowth	60	4.32	1.95	-1.38	10.30
govCon	55	0.19	0.08	0	0.44
ininitgdp	60	6.78	1.10	4.90	8.90
oppeness	60	0.33	0.19	0.071	1.04
politstab	60	-0.51	0.63	-1.76	0.86
inf	60	9.33	6.06	1.77	33.24

In table 2 we presented the results of estimation of equation (1) using OLS method. We used Park index as a proxy of intellectual property rights strength.

Results from Table 2 show a positive relation between the coefficient of IPR protection proxied by the IPR measure established by Park (2008) and the rate of GDP growth. The coefficient of the initial level of GDP is

significantly negative indicating the presence of sigma-convergence dynamic (i.e countries with lower initial GDP tends to have higher rate of economic growth). In other hand, we has a coefficient of Politic stability is significatively positive which reveals the importance of this factor in the growth process. The coefficient of investment is positive, with the right sign even if it is not significative.

In table 3 we present results of estimation of equation (1). In Column (5), (6), (7) and (8) we show standard OLS regressions output. Several interesting results worth to be pointed out. Firstly, concerning the four equations, the measure of the coefficient initial GDP, lninitgdp, has the expected negative sign and is statistically significant which indicates the presence of a dynamic of convergence of income per capita toward his steady state.

Table 2. Impact of intellectual property rights on growth (dependent variable average yearly per capita GDP 1995-2011)

	(1) OLS	**(2) OLS**	**(3) OLS**	**(4) OLS**
Intercept	8.03***	7.68 ***	8.81***	8.88***
	(5.53)	(5.20)	(5.51)	(5.51)
Lninitgdp	-1.03 ***	-1.02***	-1.13***	-1.07***
	(-4 .16)	(-4.14)	(-4.50)	(-3.93)
Parkindex05	1.09 ***	1.02***	0.97***	0.87***
	(2.48)	(2.32)	(2.23)	(5.51)
Invt		2.11	2.58	3.28
		(1.18)	(1.45)	(1.56)
Politstab			0.64*	0.75*
			(1.69)	(1.79)
Openness				-0.95
				(-0.63)
Prob> F	0.0005	0.0010	0.0008	0.00017
R-squared	0.2365	0.2553	0.2925	0.2979
Adj R-squared	0.2093	0.2147	0.2401	0.2316
Number of obs	59	59	59	59

Notes: t-Statistics in brackets. * Significance at the 10% level. ** Significance at the 5% level. * Significance at the 1% level**

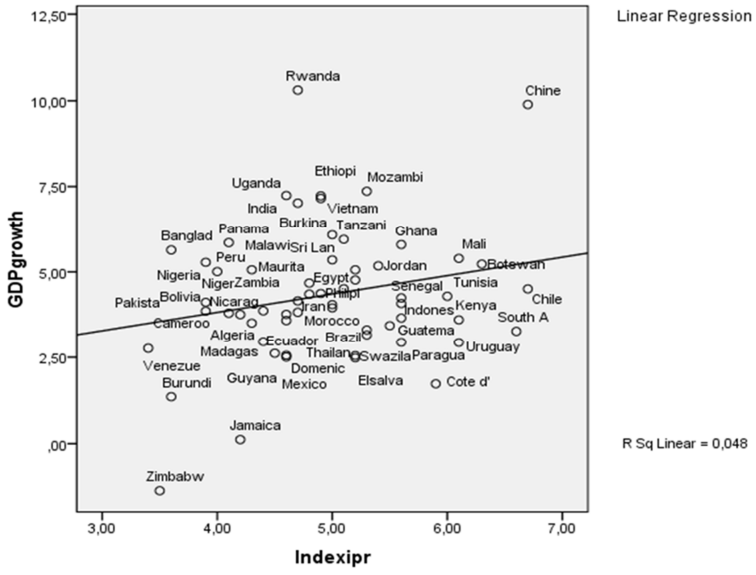
Secondly, the coefficient of the intellectual property right index used is retrieved from International Property Right Index Report (2011) and has a value varying between 0.70 and 0.81 reflecting the positive impact of property protection on economic growth. Inflation was used as indicator of economic stability and the correspondent coefficient was negative but not statistically significant. Concerning equation (8) the value of IPR is 0.84 significatively positive while the coefficient of government spending is significatively negative, this result could be explained by the fact that government spending decreases the investments capacities of the economy which is reflected negatively on growth.

Table 3. Impact of intellectual property rights on growth (dependent variable average yearly per capita GDP 1995-2011)

	(5) OLS	(6) OLS	(7) OLS	(8) OLS
Intercept	6.11***	5.73***	5.64***	6.97***
	(3.63)	(3.41)	(3.32)	(3.56)
Lninitgdp	-.946***	-.958***	-.906***	-.940***
	(-4.53)	(-4.64)	(-4.11)	(-4.26)
IPR	1.041***	1.015***	1.00***	.842***
	(3.61)	(3.55)	(3.49)	(3.03)
Infl	-.0179	-.0214	-.024	
	(-0.50)	(-0.60)	(-0.68)	
Invt		2.60	3.12*	2.79*
		(1.54)	(1.68)	(1.63)
Oppeness			-.896	-1.786
			(-0.70)	(-1.48)
Politstab				.631
				(1.64)
GovCon				-7.52**
				(-2.65)
Asia				.95*
				(1.93)
R-squared	0.31	0.34	0.28	0.48
Adj R-squared	0.27	0.29	0.28	0.41
F-statistic	5.28	7.19	5.80	6.37

Notes: t-Statistics in brackets. * Significance at the 10% level. ** Significance at the 5% level. *** Significance at the 1% level

Figure1. GDP growth and IPR's index



5.2 The measurement error and endogeneity problem

The concept of intellectual property right is approached by the level of patent protection, but as remarked by Gould and Gruben (1996), it requires evaluation and judgement and in consequence, it may be affected by measurement errors. The technical solution used to deal with the measurement errors is the instrumental variable: variable which should be used must be correlated with the variable instrumented for and no correlated with the error term. Many variables were proposed like a membership in the International Property Right Index (IPRI) which gives a measure of property right respect and in consequence of countries in international convention of intellectual property right. These conventions are Paris Convention, Berne Convention, or conventions dealing with Utility models. Utility models, are property rights accorded to the inventors and preventing other from commercially using the invention. It differs from the patent As the majority of the countries used in the sample are members of Paris convention and Berne convention the utility model seemed to be the most convenient for estimation. A dummy variable was constructed taking the value 0 when the country does not protect utility model and 1 when it does.

Table 4 instrumental variable IPRI

Impact of intellectual property rights on growth (IV estimation; dependent variable average yearly per capita GDP 1995-2011)a

	(9) IVE	**(10) IVE**	**(11)IVE**	**(12) IVE**
Intercept	8.90*	9.35*	6.09*	4.94*
	(6.024)	(5.96)	(3.19)	(2.78)
Lninitgdp	-.67*	-.69*	-.83*	-.40***
	(-3.14)	(-3.20)	(-3.93)	(-1.75)
Infl		-.034	-.013	-.017
		(-0.87)	(-0.36)	(-0.47)
IPRI			.81*	.70*
			(2.71)	(2.55)
GovCon				-6.95*
				(-2.30)
R-squared	0.38	0.15	0.25	0.30
Adj R-squared =	0.13	0.12	0.21	0.24
F-statistic	9.83	5.28	6.36	5.38

Notes: t-Statistics in brackets.* Significance at the 10% level. ** Significance at the 5% level. *** Significance at the 1% level.

In table 4, the results of estimation using IV technique and IPRI as instrument, confirm the previous results of positive and significative impact of IPR on growth. Moreover, the coefficients estimated are near of those already obtained from OLS showing the robustness of these results. In order to check the robustness of our instrument we used another instrument for IPR protection which is protection of utility patent. Weinhold and Reichert (2009) used the Paris convention as instrument but as the majority of countries of the sample were a member of the convention we don't find convenient to use it so we preferred using a dummy variable for utility patent protection.

Table 5 Impact of intellectual property rights on growth (dependent variable average yearly per capita GDP 1995-2011) instrumental variable technique (Instrumentused Utility patent protection)

	(13) IVE	(14) IVE	(15) IVE	(16) IVE
Intercept	9.85***	8.13***	7.62***	7.93***
	(6.42)	(5.37)	(4.99)	(5.09)
Lninitgdp	-.85***	-.42*	-.47*	-.47
	(-3.69)	(-1.66)	(-1.86)	(-1.87)
Utipro	1.04*	.92*	.95*	.92*
	(1.86)	(1.78)	(1.86)	(1.80)
GovCon		-7.24**	-6.14*	-6.05*
		(-2.33)	(-1.95)	(-1.92)
Invt			2.64	2.79*
			(1.56)	(1.64)
Inf				-.037
				(-1.02)
R-squared	0.19	0.24	0.27	0.29
Adj R-squared	0.16	0.19	0.22	0.22
F(2, 57)	6.85	5.46	4.81	4.06

Notes: t-Statistics in brackets.
* Significance at the 10% level. ** Significance at the 5% level. *** Significance at the 1% level.

Through the results of table 5 and 6 it appears that the coefficient of the new instrument is significantly positive for all equations estimated varying between 0.67 and 1.04 indicating a positive effect of IPR on growth in the sample while the coefficient of the initial level of GDP and the government consumption are significantly negative which confirms the previous results. Concerning the results of equation (20) we found a positive impact of IPR, political stability and the market size, proxied by the population on growth.

Table6 Impact of intellectual property rights on growth (dependent variable average yearly per capita GDP 1995-2011) instrumental variable technique

	(17)	(18)	(19)	(20)
Intercept	9.70***	9.49***	7.67***	8.18***
	(5.72)	(5.60)	(3.06)	(5.00)
Lninitgdp	-0.71***	-0.61**	-0.47	-0.44*
	(-2.69)	(-2.25)	(-1.52)	(-1.64)
Utipro	1.047**	.9050*	.87725*	0.866*
	(2.11)	(1.78)	(1.72)	(1.78)
GovCon	-6.05*	-5.57*	-4.92	-5.02*
	(-1.92)	(-1.84)	(-1.59)	(-1.82)
Invst	3.29*	4.30**	4.55**	2.74
	(2.00)	(2.33)	(2.44)	(1.58)
Inf	-.028	-.035	-.037	-.015
	(-0.80)	(-0.98)	(-1.03)	(-0.47)
Politstab	.81**	.92**	.86**	.93***
	(2.24)	(2.48)	(2.29)	(2.75)
Openness		-1.60	-1.56	-.94
		(-1.20)	(-1.18)	(-0.77)
Pop			.354	.002***
			(0.98)	(2.94)
Latin				-.65
				(-1.32)
R-squared	0.35	0.37	0.39	0.51
Adj R-squared	0.27	0.28	0.28	0.41
F(6, 48)	4.50	4.09	3.70	5.23

Notes: t-Statistics in brackets.* Significance at the 10% level. ** Significance at the 5% level. *** Significance at the 1% level.

6. Conclusion

In this paper, we examined the link between intellectual property rights and growth in multi-country sample composed of developing countries. We analysed the relation between economic growth and intellectual property protection. We find that IPR protection is correlated positively with the rate of economic growth. The coefficient estimated lies between 0.67 and 1.04 and this measure is robust to various techniques. We used Instrumental variable to address potential endogeneity biais and the positive relation was confirmed. The negative coefficient of the initialgdp shows the existence of a dynamic of convergence inside the sample. Government consumption has the expected negative sign indicating that it decelerates growth while the politic stability has a positive impact on growth and its coefficient is significantly positive. In other side, the coefficient of oppeness is negative in consequence it is expected to have a negative effect on growth. Finally, we used to study the relation between IPR and growth a cross section data while a temporal dimension would enhance the explanatory power of the model. In consequence, a panel data model would be suitable for futur researchs.

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