ROLES OF INTELLECTUAL PROPERTY IN DEVELOPING COUNTRIES - CASE STUDY OF PATENTS ANALYSIS IN CHINA

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Abstract

Patent area is one among the intellectual property right areas, China issued different and numerous patents during the eighteen years ago. China is a country which issued domestically and no locally the most number of patents but patents distribution in China is unequal in provinces, autonomous regions and municipalities' cities of China. This study investigates the roles of issuing many numbers of patents in economic development of China. Gravity model and endogenous growth model are applied in analyzing data. With gravity model, we use the balanced panel data with fixed effects estimation in analyzing the roles of foreign patents in economic development of China. Those two panel data techniques are selected through Hausman test. With time series data set and endogenous growth model, through R-squared test, pooled OLS regression model or linear regression model is the best estimation in investigating the positive impacts of patents in provinces, cities and regions economic development; in studying the roles of foreign patent on economic the development of China (national level). This study uses STATA as its analysis tool. The patent protection is considered as a very important variable in economic development of China's autonomous regions, municipalities and provinces since granted patent numbers define autonomous regions, municipalities and Provinces' GDP with the perfect significant statistical possibility value of zero% and with increase of 7%. In China's autonomous regions, municipalities and Provinces, the number of patent protections is the main intellectual property right protection and it is very important due to its positive influence on the expansion of China's economy in autonomous regions, municipalities and Provinces.

Keywords: Granted Patents, Economic Growth, Intellectual Property Right, Export Flows, Import Flows

1. INTRODUCTION

Governments rise in the size of economy which is measured by the Gross Domestic Product (GDP). Exports affect positively an economic growth but imports have negative effects on economic growth. The government must maintain trade policy which is defined as the agreement and regulations that direct exports to and imports from others countries [1]. In different countries, GDP is affected by different factors and the net exports are among of GDP components. If exports are less than imports automatically the country has the trade deficit. Intellectual property right protected/enhanced by basic policy plays a big role in a country's economy development so the management intellectual property rights is crucial and basic policy in ameliorating economic activities as well as encouraging the creativity or innovation in all economic sectors in the world and its system plays a significant role in encouraging the evolution in science and technology, inspiring the culture and developing the economy of country [2]. The researchers showed that the IPR protection has positive significant effects on R&D activities and they argued that stronger protection of IPR encourages the modernization and technological progress results a positive impact on productivity and economic growth [3]. WIPO [4] confirmed that China persists moving ahead in innovation. It was the overall GII ranking of 22nd and it demonstrated strong patent applications, global R&D companies, research talent in business enterprise, and other IP-related variables [4],[5]. This study used granted patent applications as one of kind of intellectual property to get its impacts on economic growth of China. In this research work, the researcher assumes that when a business man or women get that granted patents, she or he uses them immediately as the right on their innovation and invention, and then at the following stage they produce new goods and services on either local or international markets which influences positively gross domestic products of countries.

This articles is very important to developing countries especially the ones with low income level, in showing their decision and policy makers how the granted patents influence the economic growth, which enhances the learning of the relationship between intellectual property rights and foreign direct investment inflows, economic openness through the investigation based on data from regions/provinces of PRC.

China as an emerging country has objective of changing its economy from a manufacturing based economy to knowledge based economy. This transition is from "Made in China'' to "Invented in China'' [6]. This objective will be achieved through strength intellectual property protection rights. The developing countries trade more with the developed countries [7] while geographic distance between trading partners negatively affects trade volume values [8] the same as foreign patents due to costs of transactions and information of both patenting and trading activities [9]. There are different kinds of intellectual property rights such as trade mark, copyright, patent, trade secrets, and geographical indications [10], but this paper considers only patent protection. Among patents protections, we can generally cite domestic and foreign or abroad patents protections but China's patents are divided into three categories such as utility model, design and invention patents. In fact, China issued many and different categories of Patents to resident and to nonresident or to domestic , different place and foreign countries, Patents distributions are different or not the same, that is why this research investigates what are the roles of those patents especially in China's economy and generally in developing countries economic development. The case study of China was chosen because it is considered to be the fastest growing country among the developing countries' economy and its patent application is very strong. At the end of this research, we expect to get the answer for the following questions:

- What relationship that exists between China's autonomous regions, municipalities and Provinces GDP and number of patents granted in corresponding autonomous regions, municipality cities and Provinces?
- What relationship that exists between number of granted patents and export and import flow values of China's autonomous regions, municipalities and Provinces?

This article is organized as follows introduction, related works, research methodology, results and findings, conclusions and recommendations.

2. RELATED WORKS

In the past centuries, different researchers have been theoretically and empirically examining the relationship between the economy of developing countries and the intellectual property protection. Patents are valuable and legal certificate for invention to get it the creator must to follow the rules and regulations [11]. The intellectual property right protection is very vital in economy of developing countries. Since many years ago, an individual or organization invented new technology, techniques and new tools, they granted their ownership rights for their new idea [12]. Different researchers such as Lai and Qiu [13] compared and estimated the North and the South the impacts on economic welfare of an international agreement to harmonize countries' IPR standards, and they was assuming that the North has a greater capacity for innovation and a greater demand for innovative products [13], Grossman and Lai in their study of Intellectual Property and International Protection they argued that a government has to protect intellectual property if it is open to trade with different countries at each economic level and a level of patent protection that make the most of global economic welfare, and it should be accomplished through combinations of different level patent protection of countries [14]. Park and Lippold [31] examined whether stronger IPRs in developing countries promote technology transfer through international licensing. The international trade in developing countries is very important in allowing them to have high value added products or goods through importation that are not produced locally but which are necessary for economic development. On exportation side, exports is very crucial in developing countries in allowing them to transform underutilized its surplus labor and nature resources into foreign currencies exchange as results they get payment means for imports to maintain their economic growth. Previous researchers empirically confirmed that trade is very important in improving the economic growth of country [15] [16]. In World there are two categories of trade regimes but we put the emphasis on an Open trade regimes that may perhaps reveal a stronger connection between innovation and intellectual property right protection. The open trade regime involves that domestic firms are further probable to get in rivalry or competition from non-local manufacturers that use the most modern technology together within their fabrication procedures and in their yields.

3. RESEARCH METHODOLOGY

This research work empirically analyzes the roles of intellectual property in China's economy China through Foreign and domestic granted patent applicants. To assess or study the positive effects of intellectual property right in China's economy, the endogenous model is applied. Previous works examined the association between economic growth by sample of gross domestic product and the production of Patents through times series dynamic equilibrium rapport analysis method [17] [18]. Ginarte and Park [19] argued that IPR protection influences economic growth through motivating the increasing of human capital inputs such as development and research factors. They confirm that the benefits gained from patent protection by an open economy are different from the one gained by a closed economy. They stated that an open economy gain more benefits than a closed economy. They made IPRs index but their indexes are updated until 1995; the researcher cannot use their IPRs index in this research since this research covers the period of 1998 to 2015.

This research work applies the economic growth endogenous model in analyzing the impacts of intellectual property rights

$$\ln GDP_{CNt} = B_0 + B_1 \ln IPR_{CNt} + B_2 \ln IPR_{CNt} + B_3 \ln Controls_{CNt} + E_{CNt} \tag{1}$$

where *CN* means China, *T* means time (Year), GDP_{CNt} is Annual Gross Domestic Products of China, IPR_{CNt} is total of granted patents of both non-residents and residents per year of China, FDI_{CNt} is Foreign Direct Investment inflows as a share of GDP of China, $Controls_{cnt}$ is human capital, government expenditure, and freedom degree of economy of China and ln means Natural Logarithm. The above linear equation (Eq.(1)) helps us to learn effects of the three types of granted patents on Gross Domestic Products of China. Usually gravity model is model which is used in different research works but related on international trade. The Gravity model is from physics formula. The gravity model history has been started from traditional gravity model within the international trade through Newton's law of gravitation. The Eq.(2) is the tradition gravity model [20].

$$T_{ij} = G \frac{M_i^{B_1} M_j^{B_2}}{D_{ij}^{B_3}} \simeq T_{ij} D_{ij}^{B_3} = M_i^{B_1} M_j^{B_2}$$

$$M_i = G \frac{T_{ij}^{B_1} D_{ij}^{B_3}}{M_j^{B_2}} \tag{2}$$

where, T_{ij} is yearly total granted patents from country *i* to other country, *G* is the gravitational constant, the constant *G* is approximately equal to 6.674×10^{-11} Nm^{2}kg^{-2}. M_i is Gross Domestic Products of country *i*, M_j is Gross Domestic Products of country *j*, D_{ij} is the distance between country *i* and country *j*.

In order to minimize high difference and high number of some variables such as yearly GDP (US dollars), Exports values, imports values, Foreign direct investment inflows, and government expenditures, we need to use natural logarithm (ln) in the above equation (Eq.(2)) and we add more variable since in Eq.(2) we have only GDP of two countries and distance between that countries (country *i* and country *j*). We assume that GDP should be influenced by innovation, export flow values, import flow values and degree of economy freedom of country then we apply natural logarithm product and quotient rules [21], we get the following equation:

$$\ln M_{CN} = B_0 + B_1 \ln T_{CNk} + B_2 \ln Ex_{CNk} + B_3 \ln Imp_{CNk} + B_4 \ln D_{CNk} + B_5 \ln M_k + B_6 Openess_{CN} + e_{CNk} \tag{3}$$

where, CN means China and k is any country which is granted the number of Patents by China, TCN_k is the total yearly granted patents applications from abroad (country k) to China. MCN is the proxy of GDP (Gross Domestic Product) of China and M_k is GDP of China's granted patent partner, D_{CNk} represents the distance between China and granted patents partners, Imp_{CNk} is import flow values between China and its granted patents holders, ln EX_{CNk} is export flow values between China and its granted patents holder, $Openess_{CN}$ is freedom degree of China's economy. M_k is Gross Domestic Product of a country which is granted patents by China, and e_{CNk} is error term, B_0 is constant and from B_1 to B_6 are the coefficients.

The Eq.(3) is used in the effects of foreign granted patents on economic growth of China and also learn others variables which influence the China's rapid increase of economic growth but the researcher needs also to empirically learn the factors which influence the presence of high number of patents in China. For this situation, we apply the gravity model with yearly number of granted patents to country k as dependent variable and the equation changes as follows:

$$\ln T_{CNk} = B_0 + B_1 \ln M_{CN} + B_2 \ln Ex_{CNk} + B_3 \ln lmp_{CNk}$$
$$- B_4 \ln D_{CNk} + B_5 \ln M_k + B_6 Openess_{CN} + e_{CNk} \quad (4)$$

With this Eq.(4) and its results will help in investigation of the factors which influence outside countries to come in China and apply for Patents but we have to investigate also on the roles of granting different patents to foreign countries in that time, China's GDP will be the dependent variable but with the variables and data.

In Eq.(4), CN stands for China, T_{CNk} is the total of yearly granted patents applications from abroad (country k) to China. M_{CN} is the proxy of GDP (Gross Domestic Product) of China and M_k is GDP of China's granted, D_{CNk} Presents the distance between China and granted patents partners, Imp_{CNK} is import flow values between China and its granted patents holders, Ex_{CNK} is export flow values between China and its granted patents holder, $Openess_{CN}$ is freedom degree of China's economy, M_k is Gross Domestic Product of a country which is granted patents by China, e_{CNk} is an error term, B_0 is a constant and B_1 to B_6 are the coefficients.

This research work examines the relationship between China's autonomous regions, municipalities and provinces gross domestic products and the number of granted patents in corresponding region with Eq.(5):

$$\ln M_{regionCN} = B_0 + B_1 \ln T_{regionCN} + B_2 \ln Ex_{regionCN}$$
$$+ B_3 \ln lmp_{regionCN} - B_4 Openess_{regionCN} \quad (5)$$
$$+ e_{regionCN}$$

where $region$ is China's Provinces, Cities and Autonomous regions, CN means China, $T_{regionCN}$ is the total of yearly granted patent applications from China's province, $M_{regionCN}$ is the proxy of GDP (Gross Domestic Product) of China's provinces, Cities and regions and $Imp_{regionCN}$ is import flow values from province, cities and regions of China, $Ex_{regionCN}$ is exports values exported by province of China, $Openess_{regionCN}$ is freedom degree of China's provinces, cities and regions economy, $e_{regionCN}$ is error term, and B_0 to B_4 are variable coefficients.

The analysis of the relationship between the dependent variable and its independent variables is done through regression

models. In running regression model, this research uses Hausman test for choosing the suitable estimations between fixed effect estimation and random effects estimation, otherwise the probability value and R^2 help researcher to choose the appropriate regression models. This research work uses STATA program as its analysis tools in data analysis and drawing figures.

Table.1. Roles of Granted Patents on Economic Growth of China Econometric model

Analysis of effects	Cases	Econometric model	Dependent variable	Data set
Domestic Patents on economic development of China	Granted patent effects on China's provinces	Endogenous Growth Model (linear regression model)	Region's GDP	Time series
	Aggregate domestic patents on economic growth	Endogenous Growth model (linear regression model)	China's GDP	Time series
Foreign Patents Effects on Economic Development of China	Foreign granted patents on China's economic growth	Gravity model (fixed effects estimation)	China's GDP	Panel data
	Aggregate foreign granted patents on economic development of China	Endogenous Growth model (linear regression model)	China's GDP	Time series

The sample size for domestic granted patent is from 31 China's regions, provinces, and municipalities which are chosen from their lists without any critical. China's provinces used here are 22 provinces which are Anhui, Fujian, Gansu, Guangdong, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangsu, Jiangxi, Jilin, Liaoning, Qinghai, Shaanxi, shading, Shanxi, Sichuan, Yunnan and Zhejiang, and 4 municipalities are Beijing, Chongqing, Shanghai, and Tianjin and 5 autonomous regions which are Guangxi, Inner Mongolia, Ningxia, Tibet and Xinjiang. Within foreign granted patents analysis, this research considers the first 30 countries which have the most total number of granted patents during the period of eighteen years (1998-2015). Those selected countries are Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Great Britain or United Kingdom, India, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Republic of Korea, Russian Federation, Singapore, Spain, Sweden, Luxembourg, South Africa, Malaysia Switzerland, United States of America, and Virgin Islands. In studying the most important kinds of granted patents, this research is using as China's three kinds of patents for the period of eighteen years as the sample size.

In General, intellectual property protection has different kinds, according to Besen and Raskind [22] there exist old and new forms of intellectual property protection, in the old forms there are as patents, copyrights, trade secrets, design rights and trademarks types while in new types there are as database rights and breeding rights. However, the one kind of intellectual property protection form which is patents is generally considered

like the mainly representative as well as key intellectual property rights [23]. A patent refers to as a lawful document that is established to a creator or an inventor by office which has in its charge of patents in order to protect the new technology or knowledge.
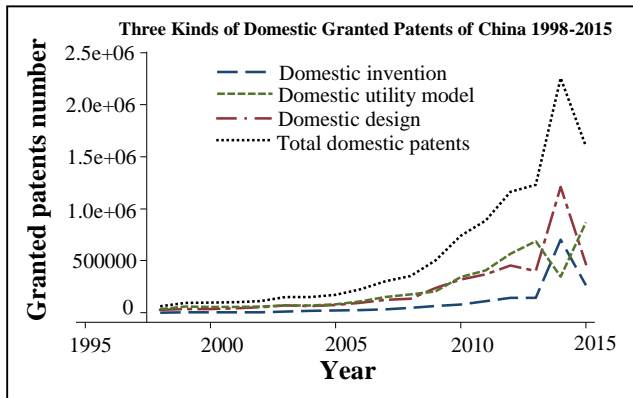

Fig.1. Three kinds of Domestic Granted Patents (1998-2015)

4. PATENT LICENSING IN CHINA

PRC has experienced rapid increase in the number of both applied and granted patents from the Patent Act promulgation in 1985 [24]. Patent protection is very important intellectual property right kind. In PRC, according to State Intellectual Property Office of the People's Republic of China industrial property rights are in three kinds such as trademark, patent and copyright, and there are three types of Patents which are invention, utility model and design patents [25]. Each kind is divided into two parts which are one part is from abroad or outside of China is foreign patents and second part is the one which is applied by local Population, enterprise and local industries is Domestic Patents.

This Fig.1 shows three kinds of patents such as domestic invention, design and utility mode patents. Their curves have almost the same shape but in 2014 there was the significant

increase in number of granted domestic design patents, invention patents and decrease of domestic utility mode patent. Li [26] argued that the dissimilar natures of innovation have the various levels of consequences on economic growth of China, and the role of invention patents were lesser by far than the design patents and utility model patents [26]. The above figure compares the increase of domestic granted patents for 1998 to 2015.

5. EMPIRICAL RESULTS AND ANALYSIS

In general economic growth of countries is measured by their Growth Domestic Products which should be diminished or increased by the total of exports and imports values. The gross domestic product, export and import values are all macroeconomic variables [27]. Previous researches about China rapid economic growth argued that China's economic growth is based on allowing knowledge diffusion [28]. New knowledge is crucial in economy of country.

5.1 ROLES OF GRANTED PATENTS IN CHINA'S ECONOMY

5.1.1 Effects of Domestic Granted Patents on China's Provinces or Regions Economic Growth:

The relationship between autonomous regions, municipalities and Provinces economic growth for period of 18 years is analyzed in this section. The regression model uses autonomous regions, municipalities and Provinces' GDP as its dependent variable in order to examine which impacts or influences on the economic growth of those autonomous regions, municipalities and Provinces. The regression model comprises four independent variables go hand by hand with provinces and autonomous regions' economic growth is its dependent variable. The number of observation is $558 = 18 \times 31$, this means that we analyze the data from thirty one autonomous regions, provinces and municipality cities for period of eighteen years. Econometrics model results are summarized in Table.2.

Table.2. Domestic Granted patents and China's Provinces or regions Economic Growth

GDP and Number of Granted Patents in Regions or Provinces of China						
Source	Ss	df	MS	Obs.	558	
Model	953.029685	4	238.257421	$F(4,553)$	8456.67	
Res.	15.5801731	553	0.28173912	Prob > F	0.0000	
total	968.609858	557	1.73897641	R^2	0.9839	
adj.R^2					0.9838	
Root MSE					0.16785	
Lngdp	Coef	Std.Err.	t	$P>\vert t\vert$	[95% conf.	Interval]
Lnpat.	0.070119	0.0114851	6.11	0.000*	0.0475593	0.926788
Ln ex.	0.5596167	0.0143372	39.03	0.000*	0.5314547	0.5877787
Ln im.	0.3335897	0.0113183	29.47	0.000*	0.3113576	0.3558217
Ln op.	0.891408	0.0138974	64.14	0.000*	0.8641098	0.9187063
-cons	2.74879	0.2774772	9.91	0.000*	2.203752	3.293828

Significance level (5%); * Probability value which is significant

Table.3. Total of all Domestic Patents and GDP

Total of Domestic Granted Patents and China's GDP					
Source	Ss	df	MS	Obs.	18
Model	6.38744738	5	1.27748948	$F(5,11)$	441.78
Res.	0.012306755	12	0.001025563	Prob $> F$	0.0000
total	6.39975414	17	0.376456126	R^2	0.9981
Adj.R^2					0.9973
Root MSE					0.03202
Lngdp$_{cn}$	Coef.	Std.Err	t	$P>|t|$	[95%conf.	Interval]
Lntdgp	-0.0028687	0.0201442	-0.14	0.889	-0.0467591	0.0410217
Lnge	0.5502606	0.110724	4.97	0.000*	0.03090138	0.7915074
Lnop	13.81482	3.217962	4.29	0.001*	6.803479	20.82615
Lnh.c.	-0.5206619	0.1830591	-2.84	0.015*	-0.9195134	-0.1218104
Lnfid	0.324661	0.1268054	0.26	0.802	0.3087513	0.2438191
-cons	15.43336	2.464335	6.26	0.000*	10.06403	20.80268

Significance level (5%); *Probability value which is significant

Table.4. China's GDP and Patent Protection

Fixed effects (within) regression			Number of obs = 540			
Group variable: group			number of groups =32			
R^2:within = 0.8483			obs per group: min = 3			
R^2:Between = 0.0384			Avg = 16.9			
R^2:Overall = 0.1599			Max = 18			
corr(u_i,x_b) = -0.9002			$F(6,502) = 467.75$		Prob > F = 0.0000	
Lngdpcn	coef.	Std.Err.	t	$P > |t|$	[95%conf.	Interval]
Ln$G.P$	0.455495	0.027987	16.28	0.000*	0.4005089	0.510481
Lngdp_k	0.4332437	0.0921122	4.70	0.000*	0.2522708	0.6142165
Ln$im._{kcn}$	0.107057	0.0567671	1.89	0.060	-0.044733	0.2185873
Ln$ex._{cnk}$	0.0833476	0.0221739	3.76	0.000*	0.0397825	0.1269126
Ln$op._{cn}$	-0.8393171	0.987065	-0.85	0.396	-2.778604	1.09997
Lnd_{cnk}	0.3071075	1.130134	0.27	0.786	-1.913268	2.527483
_cons	7.584915	10.03256	0.76	0.450	-12.12607	27.2959
sigma_u	1.5620408					
sigma_e	0.32845198					
rho	0.95771005 (fraction of variance due to u_i)					
F-test that all $u_i = 0$ F(31,502) = 46.58 prob > F = 0.0000						

Significance level (5%); * Probability value which is significant

Table.5. Total of All Foreign Patents and GDP

Total of Foreign Granted Patents and China's GDP					
source	Ss	df	MS	Obs.	18
Model	6.3934282	5	1.27868564	F(5,12)	2425.61
Res.	0.006325935	12	0.000527161	$Prob > F$	0.0000
total	6.39975414	7	0.376456126	R^2	0.9990
				Adj.R^2	0.9986
				Root MSE	0.02296
lngdp	coef.	Std.Err	t	$P>|t|$	[95%conf.	Interval]

Ln*tfgp*	0.0643581	0.0195065	3.30	0.006*	0.021857	0.1068592
Ln*ge*	0.3211593	0.0744681	4.31	0.001*	0.1589072	0.4834115
Ln*op*	-7.849832	1.777584	-4.42	0.001*	-11.72285	-3.97681
Ln*h.c.*	-0.668859	0.1269483	-5.27	0.000*	-0.9454557	-0.39226624
Ln*fid*	0.1144012	0.0928513	1.23	0.242	0.0879045	0.3167069
-cons	40.35386	5.085778	7.93	0.000*	29.2729	51.43482

Significance level (5%); *Probability value which is significant

With weak balanced time series for 1998 to 2015 data set of data from 31 China's autonomous regions, municipalities and Provinces. Through R^2 test pooled OLS regression model is the best estimation for this study and with R^2 of 98%, the results (Table.2) shows us that there is perfect positive statistical significant relationship between regions' GDP (Ln*gdp*) and number of granted patents (Ln*pat.*), export flows (Ln ex.), import flows (Ln*im.*), openness (Ln*op.*) and constant variable with probability value of zero% which is less than five%. Usually imports value affects GDP in opposite position with exports value. So China's autonomous regions, municipalities and Provinces economic growth is determined by number of patents. The number of granted patents is considered as rights of intellectual property as consequence, the intellectual property protection is very important to local or domestic places economy of China with the positive effects of 7%. It is not only number of Patents determines local regions economic growth but also the volume of export flows with 55.9% of positive effects, volume of import flows with 33% of positive influence and degree of economy freedom (this equal annual total of import flows plus export flow values over GDP) with positive effects of 89%, degree of freedom in economy of local places in China is influenced by their openness through high percentage and this means that there is competitive effects. In China's autonomous regions, municipalities and Provinces, the number of patent protections is as the main intellectual property right protection and it is very important due to its statistical and perfect positive influence on the economic growth of China's province. Here, we note that patent protection is important in economic development of China's autonomous regions, municipalities and Provinces since granted patent numbers define autonomous regions, municipalities and Provinces' GDP by the perfect statistically significant probability value of 0% and they improve that GDP by increase of 7%. The innovation is very important to GDP of China's autonomous regions, municipalities and Provinces.

5.1.2 *Roles of Aggregated Domestic Granted Patents on Economic Growth:*

This part investigates the roles of domestic granted patents with total or aggregated patents number on economic growth of China. It is argued that the association among technological change, or intellectual property rights and economic growth is unclear [29] [30] [31]. In this case, Chinese intellectual property office granted all kinds of patents to resident people, individuals, as well as for non-residents people. With the same dependent variable (GDP) and total of local, domestic granted patents as independent variable, the researcher runs the additional this regression model, in order to analyze or to study the link between domestic patents and China's economic growth and its results are given in Table.3.

With the test of R^2 of 0.9981 or 99.8% which allow us to confirm that our model is good shows that total of domestic granted patents do not influence the gross domestic of China with the probability value of 0.88 or 88% which is greater than 5%, this means that each kind of patents has its own influence on GDP. The other variables which are significant with GDP are government expenditures, degree of economic freedom variables are significant at the probability of 0.0001 which is almost equal to zero. Human resources and constant variable are significant to GDP with the probability values of zero (0.000).

5.2 ROLES OF FOREIGN GRANTED PATENTS AND CHINA'S ECONOMIC GROWTH

The following discussion is about the roles of foreign patents to economic growth of developing countries through the analysis of data of China. We investigate these roles through two regression models with the same dependent variable but with different independent variable. The first regression model uses GDP of two patent partner countries and the last regression uses the aggregated foreign patents. The researcher's objective is to study the effects of high patents number in economy.

5.2.1 *Roles of Foreign Patents on Economic Growth:*

Patent license to foreign countries is very important in economic development of countries. We are investigating the effects of number of granted patents from China to different countries of the world. The Table.4 summarizes the econometric model outcomes with fixed effects for 540=18×30 as the number of observation. This means that the researcher runs the regression model for eighteen years and the data from thirty countries and those countries are the countries which applied for more total number of patents from China during that time or period of eighteen years.

With Table.4 and China's foreign granted patents data from 30 countries which were granted the highest total number of patents during the period of 1998-2015, we analyze the factors which influence the China's highest rapid increases of its economic growth. To learn this case, the researcher uses and applies panel data set and gravity model. The analysis is based on balanced panel data set and, fixed effect model which is selected from three panel data estimations (random effect model, fixed effect model and pooled OLS regression model). Pooled OLS regression model is not defined this study due to its low R^2 of only 42%, Hausman test (Table.4) with the null hypothesis: random effects is suitable to present this case, and the alternative hypothesis of fixed effect model is suitable to present this model. Hausman test probability value is significant with zero%; the fixed effects model) is suitable to present the factors which influence China's Gross Domestic Products. Among seven variables used in this fixed effects model, only three variables are

perfect significant with economic growth of China. Those variables are foreign granted patents (Ln*G.Pcnk*), gross domestic products of granted patents holders (Ln*gdpk*) and exports value variable (Ln*ex.cnk*) from China to the trading patterns countries (country *K*) or those countries which were granted most number of patents during our concerned period. When the number of granted patents increases, it improves China's GDP by 45.5%, Gross Domestic Product of granted patents holder increases economic growth of China by 43%, and exports values influence economic growth by the increases of 8%. Openness or degree of freedom of economy (Ln*op.cn*) does not influence the economic growth of China and its coefficients negative sign; it is negative due to its less quantity. Geographic distance between patent holders and China does not influence China's GDP. Patent protection is very important in economic development of China.

5.2.2 *Roles Aggregated Foreign Granted Patents on Economic Growth:*

This case is about the effects of foreign patents number, with the 18 observations number, GDP as the dependent variable and different independent variables including the total of patent categories. Within this case the econometric model has five independent variables excluding constant variable and economic growth of China is its dependent variable. The regression model outcomes are as follows in Table.5.

With the test of R^2 of 0.9990 or 99.9%, regression probability value which is statistically significant, variables as (Ln*gdp*: is proxy of China's Gross Domestic Product, Ln*tfgp*: is aggregated foreign patents, Ln*ge*: is Government expenditures, Ln*op*: is symbolize openness, Ln*h.c.* is Human capital, Ln*fid*: is Foreign Direct Investment, and –cons: which is constant for this regression model) .The regression model results show that the non-resident granted patents (ln*tfgp*) influence positively the economy of China with the probability value of 0.006 or 0.6% which is less than 5% with the effects of 6.4%. There is statistical and perfect positive correlation between foreign granted patents and gross domestic products of China.

6. CONCLUSIONS

With intellectual property rights, people in country are able to demonstrate their competence in creating and inventing new works in the field of technology and culture of their society. When new invention or creation is protected by intellectual property law as a consequence it promotes the commitment of extra assets for more innovation. The intellectual property right promotes also economic growth of countries in supporting new industries creativity as its results is job creation and diminish country an unemployment rate, and improve the value of life in general. To have strong intellectual property system (means the system which is equitable and well-organized) helps developing countries to recognize the roles of intellectual property rights as a mechanism of their economic development and promotion of population culture their community. As a public policy, scientific and technological indicators, intellectual property rights play a vital role in technology communication and economic development. As a new economy, China, as a country of emerging economies, has made remarkable achievements in the cause of intellectual property at the same time.

The main purpose of this research work is empirically to examine the roles and main determinants of patent protections in China. We conclude this research work by checking if the researcher gets answers for all research questions and her research hypothesizes are accepted or rejected. With the theories of economic endogenous model, this research work empirically analyses the relationship between the China's autonomous regions, municipalities and Provinces economic development and the number of granted patents provided in those autonomous regions, municipalities and Provinces. The relationship between the gross domestic of China's autonomous regions, municipalities and Provinces and granted patents is the positive relationship; increase in number of granted patents causes the positive changes in economic development. The China's provinces, cities and regions which grants the greatest number of patents to the investors, creators and innovators also it improves its GDP. The intellectual property right plays the crucial role in increasing and improving the China's autonomous regions, municipalities and Provinces economic development. The intellectual property right has positive impacts on economic growth of China. The relationship between granted patents and exports values from provinces of China is positive but the granted patents are not significant with import values. With the gravity model theory, the most sourcing of Chinese foreign patents applicants are from developed countries. Developed countries get most number of patents from China than other countries of the World. The geographic distance between China and Patent applicant country does not have any impacts on the number of foreign granted patents and also the improvement of China's economy increase the number of patents applicants from abroad. Due to rapid in increase in China's economy, most investors and creators are attracted by that improvement and they apply for licensing patents for their new invention due to improving in infrastructure(roads, hospitals, transportation means) and other facilities which support the new creation, new innovation, new knowledge and new technology. The intellectual property right is one factor which influences positively the rapid increases of China's economic growth. Intellectual property right is very crucial in China economic development.

The relationship exists between the foreign patents applicants' economic growth and number of patents granted to those applicants is positive relationship. The researcher compares the roles of domestic granted patents and foreign granted patents as results to check which is very vital in China's economy, it is realized that the number of foreign granted patents is the one which affects positively the economic growth of China.

7. RECOMMENDATIONS

As granted patents are among factors which have positive influence in Chinese autonomous regions, municipalities and Provinces' economy so those regions should consider the patents or intellectual property right protection as their important element in their economy. China is upper developing country or a country with emerging economy, its rapid increase in economic growth attracts the foreign investors, entrepreneurs from developed countries and they apply for patents which are very important factor to an economic growth of a country.

Due to this research outputs, and according to economic endogenous growth and gravity theories, show that the improvement in intellectual property, increasing export flow values, diminishing the imports of goods and services, and encouraging competitiveness are factors which influence positively the economic development for emerging countries, their influences are started from the economic growth of provincial levels. The effects of intellectual property on economic development are different due to its kinds and their number of applicants. It is recommended that the developing countries with lower level economy should apply some policies in order to improve their economic growth and also to enforce rules and regulations of intellectual property right as it becomes its economic growth factor. The intellectual property right has significant positive influences on economic growth of the protection right holder; the researcher recommends the developing countries to apply for patents in different countries. Developing countries with low level economy Public policy analysts and economists have deeply enhance the appreciative of the multifarious link between innovation and intellectual property protection as well as transmission of technological advances and economic growth of their countries. In addition there is positive association between the intellectual property rights and government expenditures, this means that government of China controls and compensates some costs for intellectual property rights policies. The least countries governments should be more extensive in controlling the whole procedures of production and consumption and strengthen the market system, and encourage creating new innovation, new knowledge and new technology in private sector is very important to the economic development since private sector serves the foreign market and government should establish the foreign trade policy in order to get market expansion in the global market. As government expenditure is among the factors which influence China to be at considerable rank for patents, China's government and policy makers should put effort in improving regions, cities, and provinces that have not sufficiency number of patents in order to encourage innovation in the whole country.

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