INTELLECTUAL PROPERTY RIGHTS AND ECONOMIC GROWTH:

A CASE STUDY OF MIDDLE INCOME DEVELOPING COUNTRIES

By

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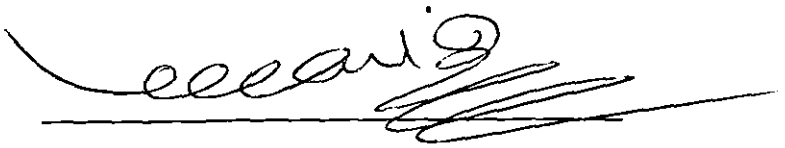
CERTIFICATE OF APPROBATION

We accept the work contained in this dissertation as conforming to the required standard for partial fulfillment of the degree of Master of Philosophy in Economics (MS Economics).



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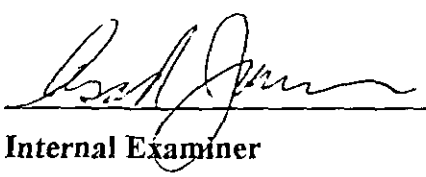

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CONTENTS

List of Abbreviations

BMP	Black Market Premium
BOP	Balance of Payments
CL	Civil Rights
EBRD	European Bank for Reconstruction and Development
EFW	Economic Freedom of the World
FEM	Fixed Effect Model
FDI	Foreign Direct Investment
FIA	Federal Investigation Agency
GDI	Gross Domestic Investment
GDP	Gross Domestic Production
GIs	Geographical Indications
GLS	Generalize Least Square
GNP	Gross National Production
GSP	Generalize System of Preferences
IP	Intellectual Property
IPRs	Intellectual Property Rights
LSDV	Least Square Dummy Variables
MNEs	Multinational Enterprises
OECD	Organization of Economic Cooperation for Development
P	Page
pp	Pages
OLS	Ordinary Least Square

PR	Political Rights
REM	Random Effect Model
R&D	Research and Development
SUR	Seemingly Unrelated Regression
RRI	Returns on Rate of Investment
TFP	Total Factor Productivity
TNCs	Trans National Corporations
TRIPS	Trade Related Intellectual Property Rights
UPOV	Union for the Protection of New Varieties of Plants
WDI	World Development Indicators
WF	World Freedom
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

List of Tables

CHAPTER-1

1. INTRODUCTION

1.1 Intellectual Property Rights

Intellectual property (IP) refers to the creation of mind: inventions, literary and artistic works, and symbols, name, and images used in commerce. Trade Related Intellectual Property Rights (TRIPS) are one of the important agreements of World Trade Organization (WTO). The most significant development of the Uruguay Round of Trade Negotiations (1986-94) was the inclusion of intellectual property rights (IPRs) issue on the agenda of the multilateral trading system. Before the TRIPS agreement, this important topic of Intellectual Property Rights was regulated by Paris Agreement (1863), Berne Convention (1886), Madrid Agreement (1891), Universal Copyright Convention (1952), Rome Convention (1961), Geneva Convention (1971) & IPIC Treaty (1989). [1]

The agreement has seven important components

a) Patents
b) Trade marks
c) Copyrights
d) Geographical indications
e) Industrial designs
f) Layout designs and
g) Basic principles

[1] Bagchi K J, Intellectual Property: Global and Indian Dimensions, Manas, New Delhi 2007, p. 13

The most common forms of intellectual property are briefly defined below[2]

Patent is an exclusive right granted for an invention, which is a product or a process that provides a new way of doing something, or offers a new technical solution to a problem. A patent provides protection to the owner of the patent for his invention. The protection is granted for a limited period, generally for 20 years.

Trademark is a distinctive sign, which identifies certain goods or services as those produced or provided by a specific person or enterprise. Its origin dates back to ancient times, when craftsmen reproduced their signatures, or marks on their artistic or utilitarian products. Over the years these marks evolved into today's system of trademark registration and protection. The system helps the consumers to identify and purchase a product or service, because its nature and quality as indicated by its unique trademark, meets their needs.

Copyright is the body of laws which grants authors, artists and other creators protection for their literary and artistic creation, which are generally referred to as " works" a closely associated field of right related to copyright is "related rights", which provides rights similar or identical to those of copyright, although sometimes more limited and of shorter duration. The beneficiaries of related rights are:

- Performers (such as actors and musicians) in their performances.
- Producers of sound recordings (for example, cassette recording and compact discs) in their recordings.
- Broadcasting organizations in their radio and television programs.

[2] Idris Kamil, Intellectual Property: A Power Tool for Economic Growth, WIPO, p. 18.

Works covered by copyright include, but are not limited to: novels, poems, plays, reference works, newspapers, computer programs, databases, films, musical compositions, choreography, paintings, drawings, photographs, sculpture, architecture, advertisements, maps, technical drawings and artistic & scientific literature.

Geographical indication is a sign used on goods that have a specific geographical origin and possess qualities or a reputation that are due to that place of origin. Most commonly, a geographical indication consists of the name of the place of origin of the goods. Agricultural products typically have qualities that derive from their place of production and are influenced by specific local geographical factors, such as climate and soil. Whether a sign functions as a geographical indication is a matter of national law and consumer perception. Geographical indications may be used for a wide variety of agricultural products, such as, "Tuscany" for olive oil produced in a specific area of Italy, or "Roquefort" for cheese produced in this region of France.

The use of geographical indications is not limited to agricultural products. They may also highlight specific qualities of a product which are due to human factors that can be found in the place of origin of the products, such as specific manufacturing skills and traditions. That place of origin may be a village or town, a region or a country. An example for the latter is "Switzerland" of "Swiss", which is perceived as a geographical indication in many countries for products that are made in Switzerland and, in particular, for watches.

Industrial design is the ornamental or aesthetic aspect of an article. The design may consist of three dimensional features, such as the shape or surface of an article, or of two–dimensional features, such as patterns, lines or color.

Industrial designs are applied to a wide variety of products of industry and handicraft: from technical and medical instruments to watches, jewelry, and other luxury items; from house wares and electrical appliances to vehicles and architectural structures; from textile designs to leisure goods.

1.2 Technological progress and economic growth

What is the role of above-mentioned Intellectual Property Rights (IPRs) in the process of economic growth? How far these rights are related to the technological progress? Does the legal protection of IPRs positively contribute towards economic growth? Under what conditions IPRs protection may negatively affect the process of growth? In order to answer these or similar questions we have to look how economists have understood the relationship between technological progress and economic growth.

Under classical studies, capital was considered to be an important factor in economic growth. Neoclassical economist Robert Solow investigated about the determinants of US Gross Domestic Product (GDP) by considering data from 1909 to 1949 and showed that the growth in capital stock contributed to less than 20 percent of the growth of GDP per person employed, and argued that the growth in labor and capital explained only half of the growth in total GDP. He concluded that the remaining unexplained portion of growth, which came to be known as the Solow residual resulted from technological progress. Later on Edward Denision also supported these findings. He concluded that between 1929 and 1957, 40 percent of the increase in per capita income in

the US was due to the "advance of knowledge". He emphasized the role of technological improvements, and considered it a key factor leading to economic growth. However, he considered no role for economic policy to determine the technological status of the economy. That is why he failed to define from where technology was coming from.

In 1980s new growth theory (also known as endogenous growth theory) considered technological progress as an endogenous factor, which could be influenced by public policy through the protection of intellectual property, taxation, maintenance of law and order, fiscal and monetary measures. After the failure of Solow model for less developed countries, Paul Romer introduced his model assuming monopolistic competitive environment and suggested that R&D activities and the accumulation of human capital through education and training play important role in generating long term growth in per capita income. To take advantage of technological progress Romer postulated that technological progress in industry requires concerted, profit oriented activity that yields two distinct components: (a) specific technical features embodied in products that can be patented and produced, excluding rival firms from the same activity, (b) the knowledge that those features were essentially for the public good.

Romer concluded that for countries to promote growth, their economic policies should:

- Encourage investment in new research, as opposed to encouraging investment in physical capital accumulation
- Subsidize the accumulation of total human capital, as the higher the level of human capital a country possesses, the higher will be its productivity.

Now if we look at the patents granted in two blocks of countries one with high GDP growth rate in Japan, South Korea, Singapore, Hong Kong, Malaysia, Turkey and China and the other with low GDP growth rate in Pakistan, Bangladesh, India, Indonesia, Sri

Lanka, Iran and Nepal. China achieved highest average growth rate of the patent granted (36.95%) followed by, South Korea (26.2%) Singapore (22.5%), Hong Kong (16.4%) and Japan (4.9%). Due to limited data available for countries in group two we cannot exactly find the average percentage growth rate but it shows that their growth rate for granting patents are quite low. Therefore, it ultimately affects the innovations, FDI, International Trade, R&D and lastly the economic growth in these countries.[3]

Economic growth depends a lot on international competitiveness of the economy, of industry and of business. It is believed that such competitiveness is driven by knowledge-based technological progress, which depends on an appropriate intellectual property system. It is one of the cornerstones of modern economic policy at the national level and catalyst for development. Intellectual property is increasingly being recognized the world over as an important commercial asset and a driving force for technological innovation and progress. Strong and effective intellectual property protection is a crucial factor in facilitating technology transfer as well as in attracting foreign direct investment in certain sectors of the economy that are vital for economic development.

According to the advocates of stronger IPR regimes followings are some of the benefits, which will accrue to the economies concerned:

1. Stronger IPRs have a positive impact on a nation's level of exports and increases the probability of investments undertaken by multinational firms.
2. Improvements in IPRs increase a country's attractiveness for foreign investment specifically those sectors that rely most heavily on IP rights.

[3] World Development Indicator 2005

3. Multinational firms have demonstrated to respond to changes in IPR regimes by significantly increasing technology transfer to reforming countries.
4. Intellectual property rights also affect the innovation rate and innovation affects economic growth and it is the key driver in future global economy. [4]
5. Moreover, there is no indication that payments of royalties have hindered the growth of any nation including Singapore, Ireland, and South Korea.

The opponents have criticized the process of technology transfer as extremely detrimental to the development process in developing countries, because the IPRs system primarily benefit the owners of intellectual property from developed countries, which includes huge transaction costs and licensing fees. Therefore, according to their opinions the enforcement of Intellectual Property Rights in developing countries will result in:

1. Loss of jobs
2. Increasing prices of products due to monopoly created through IPRs
3. Reducing access to technology needed for development
4. Compelling companies to pay for licenses or royalties on the products that they produce.

1.3 Objectives of the study

The positive and negative points of Intellectual Property Rights (IPRs) have been mentioned. It is important to note that IPRs is going to occupy a central role in the economic growth of a country.

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4 Like IPR, the level of innovation is difficult to measure but a number of factors, including R&D spending, human capital stock, and the level of capital goods from developed countries have been demonstrated to relate positively to innovation.

With the above cited background, this study aims at examining the role of intellectual property rights in economic growth of developing countries. In other worlds, this study attempts to find out the contribution of economic and political institutions towards economic growth. This study considers technological progress as an important factor of endogenous growth theory and links it with the enforcement of IPRs.

This study considers up to date intellectual property rights experiences for developing countries. To the best of my knowledge, previous studies have only examined the IPRs regime for different periods of the developed (host) countries and partially some studies have touched this issue for the world economies, which includes both the developed (host) and developing (recipients) countries. During the last decade, more importance has been given to the role of IPRs in the economic growth process.

To understand the process of economic growth, this study identifies direct determinants (i.e. inflation, population, trade, human capital, capital and money markets, savings, economic freedoms and institutions, political freedoms and institutions, and resources) and indirect determinants (values, culture, religion, and geography) of economic growth, but it will mainly focuses on direct determinants.

Given the brief introduction of the problem stated earlier, this study addresses the problem of IPRs and economic growth in middle-income countries including Pakistan and aims to achieve following objectives:

- To find out the role of Intellectual Property Rights (IPRs) in the economic growth of the middle income developing countries.

- To find out the role of human capital (education) in the economic growth of the middle income developing countries.
- To find out the role of institutions in the economic growth of the middle income developing countries.
- To ascertain whether stronger IPR regime will benefit the developing economies.
- To assess the impact of stronger IPR regime on bilateral or multilateral trade.
- To derive policy implications from the empirical results of the study.

1.4 Hypothesis and methodology of investigation

This study considers null-hypothesis (Ho), i.e. the enforcement of Intellectual Property Rights (IPRs) does not affect economic growth in middle income developing countries and alternative hypothesis (H1), i.e. enforcement of IPRs does affect economic growth in middle income developing countries. If the sign of IPR variable in the growth equation becomes negative, then alternative hypothesis is accepted and vice versa.

For this study, I employed Pooled Least Square estimation technique (fixed and random) using a cross sectional unbalanced design for the period 1960 to 2005 and balanced design for 1970-2005. The reason for this time period is that it contains a sizeable amount of data available for a large cross section of countries. A long time period also reduces the effects of business cycles in my analysis.

For the study, I selected ten middle income developing countries[5] of Asia including Pakistan, Bangladesh, India, China, Turkey, Malaysia, Indonesia, Sri Lanka,

[5] According to the classification of World Bank (2006) countries having US $ 906-$11,115 as GNI per capita are included in the middle income developing countries.

Iran, and Nepal. This particular sample was chosen due to the availability of data for each of the variables used in this study and keeping in view the importance of these countries for the study.

The general equation used in my study is:

$$GROW_{it} = \beta_1 + \beta_2 INITGDP_{it} + \beta_3 GDI_{it} + \beta_4 POPGROW_{it} + \beta_5 SYR15_{it} + \beta_6 TRADEGDP_{it} + \beta_7 INFLATION_{it} + \beta_8 IPR_{it} + \beta_9 EFW_{it} + \beta_{10} WF_{it} + U_i + V_{tt}$$

Where *GROW* is the average growth rate of GDP per capita for country *i* in period *t*, INITGDP is the (logged) level of per capita GDP at the beginning of each five year period, GDI is the average (logged) level of gross domestic investment, POPGROW is the average growth rate of population, SYR15 is the average years of secondary education for people over 15 at the beginning of each five year period, TRADEPGDP is the average ratio of imports plus exports to GDP[6], INFLATION is the average rate of inflation[7], IPR is our measure of patent protection; to measure the institutional effects economic freedom of the world (EFW), World Freedom (Political rights (PR) and Civil Liberty rights) are included. Ui and Vt are the country and time specific fixed effects.

My dataset includes 10 middle income developing countries and nine sub-periods, i.e. 1960-64, 1965-69, 1970-74, 1975-79, 1980-1984, 1985-89, 1990-1994, 1995-1999, and 2000-2005 for unbalanced data and seven sub periods, i.e. 1970-74, 1975-79, 1980-1984, 1985-89, 1990-1994, 1995-1999, and 2000-2005 for balanced data. The data on growth rates, population growth, investment, trade, and inflation was taken from World

[6] Included to capture the potential benefits of trade openness
[7] typically included to measure the economic instability

Bank's *World Development Indicators* (2006), secondary school education from Barro and Lee (2000). Ginarte and Park (1997) IPR index, Gwartney and Lawson's data set was used to measure the Economic Freedom of the World (EFW) and political and civil liberty rights index developed by Freedom House, a non-profit NGO.

1.5 Organization of the work

Chapter 1 of this study includes definition of key terms, problem and purpose statements as well as methodology and data description. Chapter 2 deals with the linkages of IPRs to economic growth. Chapter 3 discusses data description and econometric techniques to measure the protection of intellectual property rights. Chapter 4 covers empirical estimations and results. Chapter 5 concludes the study with recommendations.

CHAPTER-2

2. LINKAGES OF IPRS TO ECONOMIC GROWTH

In the theory of Mercantalism (1500 -1750) economic growth was considered as a result of accumulation of gold and silver. It led to the forced trade, high tariffs were erected, exploitation of resources and ultimately it led to the monopoly power. The "Dutch East India Company" and the "British East India Company" were examples of such state granted trade monopolies. It faced a lot of criticism but the most important was from the Physiocrats (1750-1800). According to them economic growth solely derived from agriculture. Later on Adam Smith in his "Wealth of Nations" elaborated that growth mainly depends on three factors, i.e. Land (T), Labor (L) and Capital (K). Land could be acquired by conquest, or efficiently utilization of land through technological progress. Labor productivity depends on more efficient utilization of other factors of production. Thus, he favored increasing returns resulting from growing specialization. Lastly, capital depends on continuing investment by the capitalists.

2.1 Process of economic growth

Economic growth theories and models have been presented in order to describe the way why some countries developed and other remain underdeveloped. In other words some countries became rich and others remain and became poor. In the prospects of economic growth two schools of thought have been thoroughly discussed below.

2.1.1 Classical theories

Classical economists believed that capital and technological progress contribute to the economic growth. According to Adam Smith improved technology would lead to increased labor productivity (division of labor accelerate invention and hence

technological progress). Despite the belief that technological progress contribute to increased productivity, classical economists like Ricardo and Malthus were of the opinion that increased population would decrease the labor productivity which is known as law of diminishing returns in economic literature.

2.1.2 Neoclassical theories

To look at the role of technology in the growth process of the economy, the neoclassical theories are grouped into two groups of theories, known as exogenous and endogenous growth theories.

2.1.2.1 Exogenous growth theory:

In this approach technological change substantially contributes to increased output without any change to the input of labor and capital in the production process. In other words technological progress leads to increased output while using the same amount of labor and capital.

Exogenous growth theorists like Robert Solow and Swan (1956) recognized that productivity depends on saving rate, population growth, and technological progress. Solow added technology to the production function equation, however in his model technology works exogenously. The major weakness to the Solow's model is by keeping technology outside of the equation (Zipfel 2004).

The important implication of Solow's model is convergence property. Barro (2001) drives the neoclassical model from the concept of diminishing returns to the role

of capital (technology). Economies that have less capital per worker relative to their long run capital per worker tend to have higher rates of return and higher growth rates. The convergence is conditional because the steady-state levels of capital and output per worker depend in the neoclassical model on the propensity to save, the growth rate of population, and the position of the production function characteristics that may vary across the countries. Further cross country factors are for example government policies with respect to levels of consumption spending, protection of property rights, and distortions of domestic and international markets.

The criticism on the neoclassical model is that it leaves technology growth as exogenous factor. It did not have adequate explanatory power to account for output and to predict growth. Therefore, economists were in search of more refined ways to account for economic output and growth over time.

2.1.2.2 Endogenous growth theory:

According to this approach internal factors of production originate economic growth within the system. Endogenous growth theory specifically focuses on education, on the job training, and development of new technologies.

The development of endogenous growth models focused on improvement in the productivity that can be linked to faster pace of innovation and extra investment in human capital. Endogenous growth theorists stress the need for government and private sector institutions and markets which nurture innovation, and provide incentives for individuals to be inventive.

Main points of the endogenous growth theory are as follows:

1. Rate of technological progress should not be taken as given in a growth model – appropriate government policies can permanently raise a country's growth rate particularly if they lead to a higher level of competition in markets and a higher rate of innovation.

2. There are potential increasing returns from higher levels of capital investment.

3. Private investment in R&D is the central source of technological progress.

4. Protection of property rights and patents can provide the incentive to engage in R&D.

5. Investment in human capital (education and training of the workforce) is an essential ingredient of growth.

2.1.2.2.1 Extensions in endogenous growth theory and IPRs

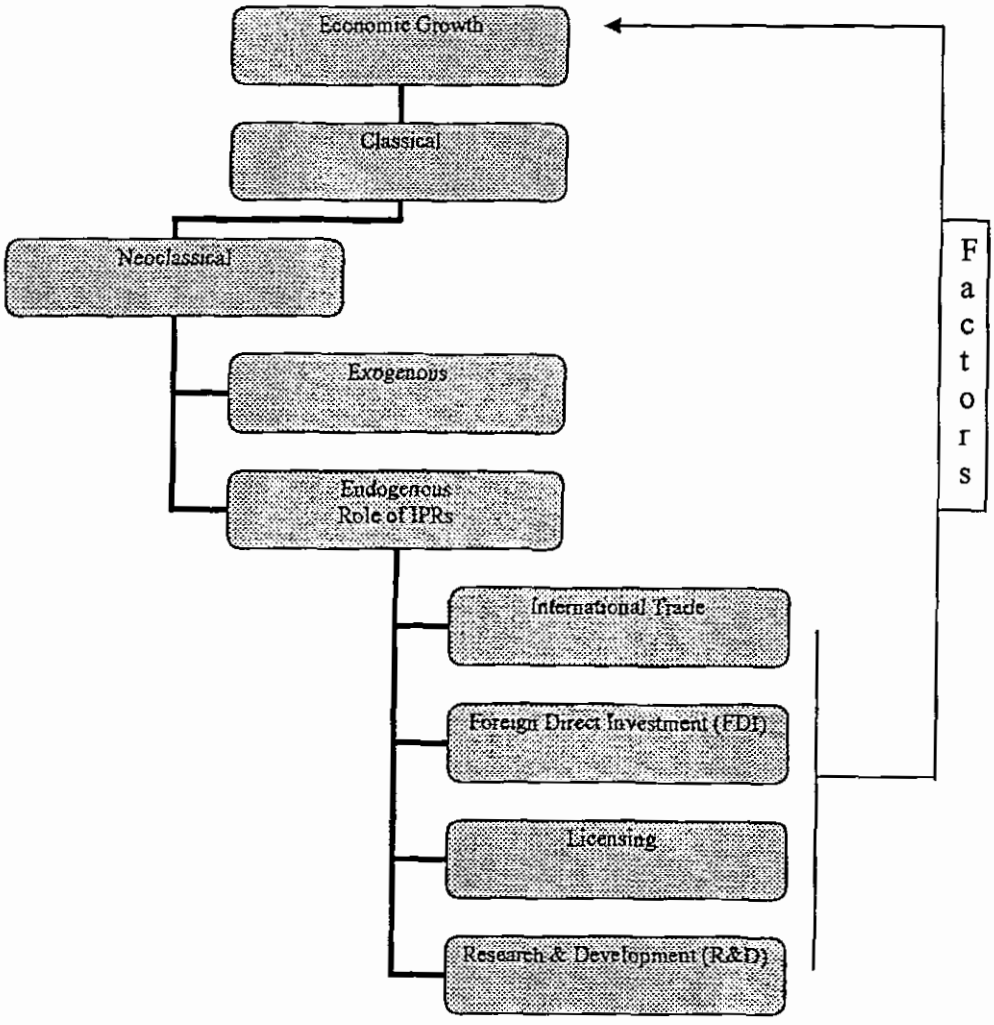
According to the concept of Paul Romer (1986) positive, long run growth rates can be achieved without assuming exogenous technical change through technology growth as the outcome of competitive firms that invests in knowledge generation. Many authors have tested Romer's findings. Important modifications and re-interpretations have included the role of human capital and imperfect competition and misuse of intellectual property. Imperfect competition implies that welfare may be suboptimal. Would a social planner prefer more or less resources devoted to innovation? In general, the social benefit of an innovation cannot be fully captured by a monopolist implying too little private investment in innovation.

Lucas (1988), Rebelo (1991), and Barro (1995) were of the views that neoclassical model can be broadened from physical capital to include human capital in

the forms of education, experience, and health. Gary Becker (1990) defines human capital as, "embodied knowledge and skills..." According to him "economic development depends on advances in technological and scientific knowledge, therefore development presumably depends on the accumulation of human capital". Human capital affects economic growth in two ways (Rogers 2003). First, if human capital (H) is a factor of production, i.e. Y=f (A, K, H, L); changes in H will be correlated with changes in Y (income growth). Workers with higher levels of education or skills are more productive than simple laborers. Second, the level of human capital may affect the rate of accumulation of other factors. Human capital measurement is a difficult task. A number of studies used average years of schooling to measure human capital (Barro & Lee 1996, 2001). Benhabib and Spiegel (1994) find that changes in schooling capital are uncorrelated to growth. However, they find that changes in schooling capital are related to technological growth.

Barro and Sala-i-Martin (1995) conducted a survey of the literature and determined that the most basic model tends to include a measure of education, the ratio of government consumption to Gross Domestic Product (GDP), the black-market premium, political instability, and the growth rate of the terms of trade. They account for potential endogeneity by lagging these variables. Barro and Sala-i-Martin considered measure of political stability as a way to control the decline in property right protection, but never attempted to include a property rights variable. They also maintained the separation of male and female schooling rates.

Intellectual property rights (IPRs) have been widely recognized as a growth enhancing factor for the global economies as a whole. IPRs regime can influence the growth process through domestic and external sector of an economy. This study is primarily concerned with the effects of IPRs regime through external sector. Through different channels IPRs can promote economic growth in the recipient countries.



2.1.2.2.1.1 IPRs and international trade

Intellectual Property Rights (IPRs) affect international trade flows when knowledge intensive goods move across national boundaries.[8] Schiffel and Kitti (1978) explain foreign patenting activity in the United States (recipient country) by applicants from Canada, France, West Germany, Japan, Netherlands, Sweden, Switzerland and the United Kingdom. The independent variables considered are exports to the US by countries to which the foreign applicants belong to and patents taken by the residents in the same set of countries, or domestic patents. The period covered by this study is 1965-74 for all countries except the Netherlands in which case the period is 1965-73. The domestic patents variable is positive and significant for Switzerland, and negative and significant for the Netherlands. For all other countries, it is not significant. The exports variable is positive and significant for all countries except for the Netherlands.

The study by Bosworth (1980) proceeds on some what similar lines. He explains foreign patenting by the United States (host country) in 50 countries for the year 1974. The explanatory variables are gross domestic product and gross domestic product per capita of the 50 countries in which inventors belonging to the US have obtained patents as also exports and foreign investment originating in the United States to each of the above mentioned countries. The log-linear results show that all the independent variables are positive and significant but only exports and foreign direct investment variables are significant at one percent level of significance.

[8] Intellectual Property and Development, World Bank (2005) p.19

Ferrantino (1993) in his empirical investigation on the link between IPRs and international transactions by using gravity model[9] recognizes that trade, FDI, and licensing are simultaneously determined. Ferrantino's result indicates a weak association between IPRs and US exports (chemical and allied products, non electrical machinery, electric and electronic equipment, and transportation equipment). No influence of IPRs on sales by overseas affiliates, and a significantly negative effect with respect to intra firm trade is identified. He interprets these findings that U.S. Transnational Corporations (TNCs) prefer to maintain production within the United States and engage in intra firm trade rather than risk the loss by locating production in countries that have weak IPRs.

Maskus and Konan (1994) use gravity model to estimate the effect of IPRs protection on bilateral trade. They regress the index developed by Rapp and Rozek (1990) along with several other development related variables on the residual of the gravity flow estimation. But it produces only valid estimates, if these variables were uncorrelated with the independent variables of the gravity estimation. This is clearly not the case as both GDP and population are included in the gravity model. Hence, it is not clear to what extent Maskus and Konan's finding of a positive IPRs trade link is reliable.

Maskus & Penubarti (1995) use gravity model to estimate the effects of patent protection on international trade flows. Their results indicate that higher levels of protection have a positive impact on bilateral manufacturing imports into both small and large developing economies. They collected data for the Organization for Economic Cooperation and Development (OECD) countries for manufacturing industries. They

[9] Mathematical form of gravity model is $F = G\, m_1\, m_2 / d^2$ It shows direct relationship of the economic growth to the GDP of the respective countries and inverse relationship to their respective distance. It's based on Newton's Law of Gravitation.

observed that in developing economies with significant imitative capabilities stronger property rights increase trade flows through the expansion of market size. For the lower income developing countries the effect will be low. These results are confirmed by Primo Braga and Fink (1997).

Fink and Braga (1999) use gravity model of bilateral trade flows and estimate the effects of increased protection on cross-section countries. They took two aggregates; total non-fuel trade and high technology trade. They used fine tuned index of IPRs developed by Park and Ginarte (1996). Result suggested a positive link between IPRs protection and trade flows for the total non-fuel trade aggregate. However, IPRs are not found to be significant for high technology trade flows. The implications of tighter IPRs on economic welfare are highly complex. The trade flows in response to tighter IPRs is not a sufficient condition to draw conclusion regarding economic welfare. Both static and dynamic effects need to be considered. From a static or partial equilibrium point of view, the host country is likely to gain from tighter protection due to increased monopoly profits from the sale of its goods abroad. In contrast the static effects on the welfare of the destination country are likely to be negative. The dynamic mechanism will benefit both the trading economies by assuming that social returns on these innovations exceed private returns.

Rafiquzzaman (2002) conducted a study for Canadian manufacturing exports, whether national differences in patent rights affect trade from Canadian cities to different countries. He mentioned large number of theoretical studies[10] in which the effect of stronger patent rights on trade is not determined, because the trade volumes

[10] Including Flam and Helpman 1987; Schwartz 1991; Taylor 1993, 1994; Maskus and Eby-Konan 1994; Smith 1999

simultaneously rise and fall through the market expansion effect and the market power effect. In his empirical study using gravity model of bilateral trade he found that patent rights are important determinant of Canadian exports. The result suggests that in the case of countries where the threat of imitation is high (i.e. countries with weak patent laws and strong imitation abilities) stronger patent protection results in greater Canadian exports through market expansion effect. Similarly the countries where the threat of imitation is low (strong patent laws and weak imitation abilities) stronger patent protection results in lower Canadian exports, due to market power effect.

Nair-Reichert and Duncan (2003) examine to what extent the host country's policy environment matter for stronger affective IPRs protection. They consider US panel data for multinational enterprises (MNE's) by using simultaneous equation. The variables taken are per capita income, population, distance between the trading partners and distortionary factor (intellectual property rights). The result show that host country's policy environment does matter. They reconfirm the results of other studies that patent protection increases local subsidiaries sales and reduce licenses. Regarding the direct involvement of MNE's the stronger patent protection leads to reduce local sales and increases licensing.

Fink (2005) evaluates the effect of IPRs protection on German firm's exports and FDI decision. Four manufacturing industries (chemicals, non-electrical machinery, electrical engineering, and transportation equipment) were considered for 30 countries for which the data were available. He pooled the four industries into one regression with industry specific intercepts. The estimated result without Park and Ginarte index, most

gravity variables have the expected signs and are statistically significant except the border dummy, which is statistically not significant, and independent relationship between German total exports and FDI stocks were observed. When Park and Ginarte index is included the estimated coefficients shows nearly significantly positive effect in the export equation but is close to zero and not significant in the FDI stock equation. Overall, the German data confirm the positive link between IPRs and total exports, but no influence of direct investment stock of German firms in foreign countries.

Braga and Fink (2005) in the international trade perspective recognize that the welfare impact of stronger protection depends on the structure of the economies. In a small country with limited production and innovation capabilities higher protection may improve welfare as long as they permit access to products that would otherwise not be available. In a country with greater production capabilities (possibilities for imitation), but limited innovative capacity (measured by its R&D), higher standards of protection will likely displace local producers, raise prices, and transfer rent from local consumers and producers to foreign titleholders, resulting in a negative welfare impact. Finally, if the small country has both well developed production and innovative capabilities (East Asian) the result will be indeterminate.

The net impact of trade flows depends on the market power of the titleholder and market expansion. The net trade results depend on which effect dominates. If the market power effect is more substantial than the market expansion effect, trade flows may decrease. If the opposite occurs, strengthened IPR protection will lead to trade expansion.

2.1.2.2.1.2 IPRs and foreign direct investment

Foreign direct investment (FDI) and licensing have been given importance in economic growth process by economists. FDI and licensing flows provide access to the technological and managerial assets of foreign multinational enterprises.

Empirical findings of the relationship between IPRs and FDI are of diverse nature in developing countries. Helpman (1993) using a dynamic model shows that a strengthening of IPR in developing countries will lower the inflow of FDI from developed countries. He suggested that not IPR, rather other factors such as market competition is important component for FDI profitability.

Kondo (1995) used data on US outward FDI and found that there is no evidence supporting the hypothesis that FDI is affected by patent protection.

Lee & Mansfield (1996) in his empirical study show the relationship between IPR and US foreign direct investment. Some observers believe that weak IPR regime in developing countries may lower the investment of multinational corporations in developing countries or they will invest only in wholly owned subsidiaries (not joint ventures with local partners) or they will transfer only older technology. But there is little evidence in this regard. Lee & Mansfield took random sample of 100 US firms in six manufacturing industries, i.e. chemicals, transportation equipments, electrical equipments, machinery, food and metals. They collected data from US Commerce Department regarding U.S direct foreign investment in the manufacturing industries. The result shows that the country system of IPR protection influences the volume and composition of US direct investment. Countries with weak protection may have certain legal, social, and economic structures that tend to discourage FDI.

Seyoum (1996) examined the relationship between IPR and FDI and analyzed whether a governments can attract FDI more effectively through macroeconomic policy, or strengthening of IPR. Using cross section time series data set for 27 randomly selected countries for 1975-90 results of the sample are separated for the least developed, emerging and developed economies. For less developed countries policy factors (market size, pubic investment, external debt and exchange rate stability) explain 21 percent and IPR factor 13 percent of the variation in FDI flows. For the emerging economies policy factors account for 28 percent while IPR factor 43 percent of the FDI flow variation. For the developed economies enforcement is the most important concern.

W. Lesser (1999) examined the relationship between IPR, FDI and Imports. He was of the view that increase in trade particularly through FDI will enhance economic growth. FDI inflows were considered as dependent variable along with important explanatory variable like FDI inward stock, risk, openness, degree of industrialization. The cross section data included for 44 countries. He found that stronger IPR increases both FDI and imports. The results indicated that a one point increase in the IPR score will increase FDI by $1.5 billion and imports by $8.9 billion. Among others factors the level of industrialization is important factor, e.g. less industrialized countries can expect modest affect of IPR strength on FDI and imports.

You and Katayama (2005) findings indicate that there is no clear link between stronger patent rights and FDI. In their empirical study for Japanese firms in China they collected the data obtained from questionnaires. They found that there is at best a weak association between countries decision to join IPR protection agreement and their decision to pursue open policies with regard to trade or FDI.

Maskus (2005) discuss the role of intellectual property rights in encouraging foreign direct investment and technology transfer. Actually the FDI depend on the level of technology (lower, medium and high based technology) based in the recipient countries. Investment in lower technology goods and services, such as textiles and apparel, electronic assembly, distribution, and hotels, depend relatively little on the strength of IPRs and much on input costs and market opportunities. The message he derived shows us that the strengthening of IPRs can be an effective tool for inward FDI, but other factors like market liberalization and deregulation, technology development policies and competition regimes should be recognized.

Javorcik (2005) in his empirical evidence indicating that the extent of IPR protection in a host country affects the composition of the foreign direct investment (FDI) it receives. He used Probit Model[11] for the determinants of estimates. The dependent variable takes the value of one, if firm i has invested in country c, and zero, if a firm has not undertaken FDI in country c. Firm specific dummy variables di are included to control for unobserved firm characteristics. Country specific explanatory variables Xc (i.e. IPR index, GDP per capita, population, progress in reform, corporate income tax, legal effectiveness, corruption, privatization and openness) are included in the model. The findings show that a weak IPR regime deters foreign investment in high technology sectors, where intellectual property play an important role. Secondly, it focuses FDI projects from manufacturing to distribution, because setting up a production plant is more

[11] A Probit Model is an econometric model in which the dependent variable yi can only be one or zero, and the continuous independent variable xi are estimated in:
Pr(yi=1)=F(xi'b)

costly than setting up distribution chain, it needs advance reform process, advance privatization process.

The overall results suggest that further research is needed to investigate the links between IPR and FDI.

2.1.2.2.1.3 IPRs and licensing

Yang & Maskus (1998) consider licensing as an important form of technological transfer. Whereas FDI is an indirect channel of technology trade, licensing is a direct mechanism for technology transfer, which had been ignored in the literature of economists. Rent sharing is one of the important components observed in licensing contracts. The license rents are used to deter imitation. Yang & Maskus used reduce form of econometric equation relating to the volume of US international licensing to an index of patent strength, real GDP per capita, and index of openness, population, secondary school enrollment rate. They applied this model to 26 technology recipient countries over three years 1985, 1990, and 1995. They concluded that under stronger IPR regimes it is difficult for the licensee to imitate the licensors product.

Fink (2005) in his empirical study shows, how strong IPRs affects German cross-border receipts from patents, inventions, and processing in six manufacturing industries (chemical and oil processing, metal production and processing, electronic and data processing equipment, precision and optical engineering, and food and kindred products). For each manufacturing industry 24 countries were listed according to the availability of the data. On the basis of gravity model the results are significant except the coefficient on geographic distance and on the border dummy. The technology flows can better be

explained with cultural distance-result shows positive and significant for language dummy-than cultural proximity. It is found that German receipts for patents, inventions, and processing are positively related to the degree of IPRs protection. But the result is more prominent in chemical and oil processing industries.

Yang and Maskus (2005) studied the relationship between intellectual property rights system and the decision to license technology. They used pooled regression techniques to the available panel data. The dependent variable is the ratio of the volume of unaffiliated license fees to trade volume between the United States and the bilateral partner. The independent variables include IPR index in the recipient country and square of IPR index, openness to trade and investment, total labor endowment, ratio of skilled labor to total labor, and real GDP. The results are based on their fixed as well as random effect specifications, although they prefer fixed effect specification. 1) US receipts of unaffiliated royalties and license fees rise with stronger IPRs in the technology recipient country. 2) The ratio of US receipts of unaffiliated royalties and license fees to US exports is also higher with stronger IPR protection. 3) IPRs have less significant effects on US receipts of affiliated royalties and license fees. 4) US receipts of both affiliated and unaffiliated royalties and license fees are higher, if the technology recipient country has a higher per capita GDP level and has greater labor endowment. 5) There is weak evidence that openness to trade encourages export trade in relation to licensing.

2.1.2.2.1.4 IPRs and research and development

A large empirical literature has estimated the rate of return to R&D at the firm and industry levels. This literature found the social rates of return to R&D substantially higher than the private rates of return. These rates of return inform us how important R&D is for growth. Endogenous growth theorists emphasize that profit seeking firm generate technology through R&D and innovation[12]. R&D expenditures lead to innovation and ultimately improving the number of patent applications.

Soete (1981) explains patenting behavior of foreign applicants from 17 OECD countries in France, West Germany, Japan, the United Kingdom and the United States. The dependent variable is the patents granted averaged for the years 1976-78 and the independent variable is the R&D expenditures of the business enterprise sector for the year 1975. The interesting feature of this study is that domestic R&D expenditure undertaken by each of the 17 countries was used to explain foreign patenting activity in that country. The log linear results of regression between foreign patent per capita and business enterprise R&D per capita show that the relation between them is positive and significant for all the countries.

Bosworth (1984) explain UK patenting activity abroad. He uses cross section data for 50 countries for the year 1974. The explanatory variables are GDP, GDP per capita, exports of UK to the countries concerned and size of operations of multinational enterprises (proxied by the number of UK subsidiaries in each country). The log-linear regression shows that all the independent variables are positive and significant.

[12] See Institute for Fiscal Studies, Briefing Notes No.12

Coe and Helpman (1993) found for Organization for Economic Cooperation and Development (OECD) countries that increased levels of research and development (R&D) had very strong positive effects on productivity growth. They calculated measures of total factor productivity (TFP) for each of the countries in their sample and then regressed cumulative domestic R&D expenditure and a weighted measure of foreign R&D expenditure on TFP. Coe and Helpman found that there is a close link between productivity and R&D expenditure. They suggest that much of the variation in TFP can be accounted by technology, which is in turn improved by R&D that IPRs could stimulate.

Eaton and Kortum (1996) explain the flow of patent applications among 19 OECD countries for the year 1988. The explanatory variables are human capital (average years of schooling), imports of one country from another country relative to one's GNP, the ratio of R&D scientists and engineers to total labor force, relative productivity of one country to the concerned country. The log linear equation explaining ratio of patent applications and total labor force shows that human capital, intensity of R&D scientists and engineer's employment and relative productivities are positive and significant, while import intensity is not significant. This equation also contains four variables to account for strength of the patent system. They find that while countries providing strong patent protection attract more foreign patents, patent strength and domestic patents are not so related.

C. Lin (2002) try to explain whether Northern optimal R&D subsidy rate inversely respond to Southern intellectual property right protection. The simulation results indicate that R&D subsidy rate depend on the elasticity of demand for innovative

products. If the demand is more elastic, a tightening of Southern intellectual property protection is found to induce the North to increase the optimal subsidy rate. Conversely, if the demand is less elastic, a tightening of Southern intellectual property protection is found to invite the North to decrease the optimal subsidy rate. He further added that the rate of product innovation is endogenously determined by profit-driven research inputs, but the rate of product imitation is parameterized by Southern intellectual property standards. Regarding the welfare implications, the findings shows that Southern welfare declines, but Northern welfare rises at the steady state, as long as the Southern IPR protection is strengthened. The overall results show that welfare maximization requires a regime of Southern IPR protection that is neither as stringent as the North favors nor as lax as the South prefers.

Kanwar and Evenson (2003) estimated the random effect model (GLS) for 30 countries with due consideration given to the fixed effect model by considering the countries specific variables R&D investment, patent protection, etc. from 1981 to 1995. They linked the economic growth with innovation and innovation with stronger protection of IPR. Two important characteristics of innovations ought to be kept in mind. First, innovations are non-rival goods (use of particular innovation by a producer does not prevent other entrepreneurs from using it). Second, innovations are partially non-excludable goods (innovators are often unable to prevent others without due authorization). It is not the IPRs that hurt the economies, but their proper implementation failure. The lack of incentive structure can be a significant mitigating factor for technological change even when other constraints such as internal funds, availability of skills and trade orientation may not be binding.

2.1.2.2.1.5 IPRs and economic growth

Economic historians considered protection of IPRs as an indicator to the Western growth. Efficient property rights equate private and social rates of return, thereby providing incentives for economic actors (individuals and firms) to engage in socially constructive behavior. The fear of high prices depends on how competition, price regulations and cost of innovations work. Competitive markets permit sellers not to charge more than competitive prices and earn competitive returns. In other words dynamic competition keeps prices down and produces a stream of new products that compete with existing products in price and quality.

According to Rapp and Rozek (1990) economic development is a complex process, economist associate it with successful developmental efforts. Economic growth requires increase in productivity, increase in productivity requires increase in technological innovation and it requires the efficient protection of IPRs. Rapp & Rozek developed scale for IPR range from zero to five, zero means no patent protection law and five mean full enforcement of patent protection law.

Gould and Gruben (1996) regress the average growth of real GDP per capita on the IPR and a number of standard explanatory variables, including initial GDP per capita, the investment to GDP ratio, the secondary school enrolment ratio and initial levels of literacy. They find that stronger IPR protection has a positive impact on growth, which is marginally statistically significant. Gould and Gruben then go on to examine the relationship between IPR protection and growth in open versus closed economies. Openness is measured using three variables. The first two are the Black Market Premium

(BMP)[13] and distortions in real exchange rates. Countries with high BMPs and high real exchange rate distortions tend to be highly distorted and inward orientated. The third measure is a composite index of a country's trade regime developed by Gould and Ruffin (1993) comprising a number of existing trade orientation indices as well as a country's BMP, real exchange rate distortions and the ratio of import taxes to imports. Each of these are interacted with the IPR and included in the growth regression. Gould and Gruben conclude that IPR protection has a slightly larger effect on growth in more open economies.

Thompson and Rushing (1996) conduct a similar exercise by regressing the average growth of real GDP per capita between 1970 and 1985 on the ratio of investment to GDP, the secondary school enrolment ratio, population growth, initial GDP per capita and the IPR for 112 countries. While they find a positive relationship between the IPR and growth, it is statistically not significant. They then go on to consider whether IPR protection may have an impact upon a country's growth rate, once the country has reached a certain (but unknown) level of development, as measured by initial GDP per capita. For this they employ threshold regression techniques finding a threshold at an initial level of GDP of $3,400 (in 1980 dollars). For countries below this value there is no significant relationship between IPR protection and growth, but above this level the relationship is positive and significant.

Thompson and Rushing (1999) extend their analysis to a system of three equations. They consider three dependent variables, i.e. growth rate of real GDP per capita, ratio of total factor productivity (TFP) between 1971 and 1990 and IPR. The system is estimated using Seemingly Unrelated Regression (SUR) techniques for 55

[13] The percentage differential between the black market and the official exchange rate

developed and developing countries. They split their sample into two sub samples depending on the initial level of GDP per capita. It is found that increases in TFP have a positive and significant impact on GDP growth. The IPR index is found to have an insignificant impact on TFP for the full sample of countries, but a positive and significant impact for the richest sub sample. The results suggest that in the most developed countries stronger IPR protection impacts upon growth by enhancing TFP.

De Soto (1990, 2000) argues that property rights are particularly important economic institution because of their role as an engine of economic growth. Property rights include: ownership of resources, including titles and deeds, intellectual property rights, including patents, copyrights, and trademarks and independent and impartial legal systems. Continuous economic growth through innovation, human capital formation, and lower transaction costs is conditional on the existence of enforceable property rights. The divergence between the developed and developing countries for the last 100 years is the difference in formal private property protection between developed and developing counties. In developing countries assets cannot be turned into productive capital, it cannot be traded outside, can not be used as collateral for a loan, and can not be used as a share against investment. But developed countries have security to private property. He suggests that countries with unsecured property rights have lower than optimal technology growth because they face higher interest rates, because they have no collateral and are at high risk, they face higher costs of borrowing, and they face greater costs of financial intermediation.

According to Maskus (2000) the Intellectual Property Rights System (IPRS) has a positive impact on the economic growth. But it may initially harm the development process by raising the cost of imitation and permitting monopolistic behavior. The potential gains and losses depend on the competitive structure of the markets and efficiency of the business regulations. The limited evidence available suggests that the relationship is positive but it depends on other factors like strengthening of human capital, skill acquisition, promoting flexibility in enterprise organization, ensuring a strong degree of competition on domestic markets, and developing a transparent, non-discriminatory, and effective competition regime.

Josh Lerner (2002) examined the determinants of the strength of intellectual property rights protection in 60 nations over a 150 years period. It is critical to understand the interaction between the patents and other technology policy tools including trade secret law and government subsidies. Institutional feature is more important for IPR regime.

Lewer & Saenz (2004) on the basis of theoretical and empirical analysis supported the role of IPRs in the development process. Their linear econometric study for 101 countries from 1990 to 2002 provides evidence for a positive and significant relationship between property rights and economic growth. They use fixed effect panel data to the variables, i.e. real gross domestic product, growth of labor force, growth of real capital, growth of real international trade, proxy for human capital, IPR index[14], and their results are supportive of the hypothesis that countries, whose citizens have secure and legal property rights, tend to grow faster than countries with weaker property rights.

[14] Gwartney & Lawson's 2004

Claessens et al came to the conclusion that firms in the markets with weak property rights tend to invest more in fixed assets relative to intangible assets including intellectual property rights in the form of patents, trademarks, or copyrights. The paper found that weak protection inhibits growth by encouraging firms to allocate resources inefficiently and limiting access to external financing by decreasing foreign direct investment. The paper did not include a single transition economy[15] in its sample and it failed to test the differences between developed and developing countries. Moreover, the paper did not control the changes in intellectual property rights protection within countries during the time period. Despite the fact that they examined growth rates in the 1980s, most of their property protection variables were measured in the 1990s.

Melisa Ginsberg (2005) found for transition economies that stronger IPR affect the growth rate of these economies. Ginsberg used pooled OLS estimation technique to the panel data from 1994 to 2004. High degree of protection correlated with increased revenues in areas such as petroleum, chemical, and plastic manufacturing. According to the European Bank for Reconstruction and Development (EBRD) growth in transition economies mainly comes from 1) recovery from the recession during transition 2) structural change including entrepreneurial structure and establishment of new firms 3) labor skills 4) investment and technological advancement. Pooled OLS estimation of Ginsberg combines the above factors with standard growth regressions like IPR, education, saving, life expectancy, achievements of certain reforms in transition process. To control the possibility of endogeneity she considered the lag of IPR.

[15] Transition economies, by using the classification of Rostow, are those which are still not entered in the stage of take off.

Maskus et al (2005) in their paper "Intellectual Property Rights (IPRs) and Economic Development in China" were of the view that the relationship between the IPRs and economic development is complex. The factors which stimulate economic growth are stimulation of invention and innovation, market deepening (i.e. establishing marketing and distribution networks that support expansion and scale economies), quality assurance, domestic and international diffusion of knowledge, composition of global research and development. The factors which limits economic development are administrative cost, shifting resources out of infringing activities, monopoly pricing, higher imitation costs. Most importantly IPRs need to be introduced into markets in which other competitive processes, such as firm entry, labor flexibility, distribution systems, and international trade are strong. However, they favor the global consensus that stronger IPRs increases economic growth and improve economic development processes, if they are properly structured. These results were based on the interviews conducted in Hong Kong, Taipei, Shanghai, and Beijing in 1997 and again in Shanghai and Beijing in 1998. The 58 interviewed persons were categorized into managers of enterprises, officials from public agencies, scholars from universities, and officials from other organizations.

Falvey et al (2006) in his empirical estimation for 79 countries estimated the impact of IPR protection on economic growth of a country by using threshold regression analysis. Other variables including IPR in his study are, initial GDP to measure the convergence of the developing countries towards the developed countries, trade openness, and human capital. Their result shows that from theoretical point of view the strengthening of IPR regime shows ambiguous results for economic growth. It's reflecting the varieties of channels through which technology can be acquired. The effect

of IPR protection on growth depends upon the level of development. IPR protection is positively and significantly related to growth for low and high income countries, but not for middle income countries. They favored the argument that IPR protection encourages innovation in high income countries and technology flows to low income countries.

CHAPTER-3

3. MEASUREMENT OF IPRS PROTECTION

Measurement of IPR protection has been a critical issue for international business, scholars and practitioners. Different authors have measured it in different ways. A number of studies have attempted to measure IPR protection cross-nationally.

Rapp and Rozek's (1990's) attempted to quantify IPR protection in some form. They used patent laws as a proxy for IPR protection. They measured the strength of 159 countries patent laws on a zero to five scale, where zero represents a country with no patent laws and five represents a country having laws consistent with the standards established by the US Chamber of Commerce Intellectual Property Task Force. The Rapp and Rozek's 0-5 measure is presented in Table 1.

Table 1

RAPP AND ROZEK SCALE FOR INTELLECTUAL PROPERTY RIGHTS/PATENT PROTECTION	
Scale Score	**Description**
0	No intellectual property protection laws
1	Inadequate protection laws; no law prohibiting piracy
2	Seriously flawed laws
3	Flaws in laws, some enforcement laws
4	Generally good laws
5	Protection and enforcement laws fully consistent with minimum standards proposed by the U.S. Chamber of Commerce
Source: Rapp & Rozek, 1990 Appendix 4.	

Seyoum (1996) also used the US Chamber of Commerce's minimum standard for his criteria. However, his 0-3 scales of IPR protection components were constructed from survey sent to IPR practitioners. Seyoum constructed four variables (i.e. patents, copyrights, trademarks and trade secrets) for his analysis.

Shrewood (1997) proposed a third measure of IPR protection that combined personal knowledge and experience with professional interviews. The protection scores range from 0-103 and were developed for eighteen countries.

Table 2

SHERWOOD'S EIGHT INTELLECTUAL PROPERTY RIGHTS COMPONENTS	
Description	**Assigned Points**
Enforceability	25
Administration	10
Substantive Laws	
Copyright	12
Patents	17
Trademarks	9
Trade Secrets	15
Life Forms	6
Treaties	6
Total	100
Public Commitment	3
Total Possible Points Added	*103*
Source: Sherwood, 1997, 265	

The enforceability (25points in coding scheme) were further sub-categorized into eight separate areas of interest, namely judicial independence (up to 12 points), quality of judges (up to 10 points), lack of legal tools for enforcement (up to 10 points), judicial knowledge of intellectual property concepts (up to 7 points), reliability of prosecutors, police, and customs official (up to 6 points), civil and criminal sections (up to 6 points), delay in enforcement proceedings (up to 4 points), and lack of transparency for final decisions (up to 2 points). All of the above calculation is based on interview and the author's experience. The countries were categorized by summing up all the possible points in a range of 103.

3.1 ISSUES OF MEASUREMENT

First conceptual issue is, which IPR laws must be examined to measure economic growth? Using patents as a proxy for all IPR may overlook this issue. Second conceptual issue relates to the enforcement of the laws. Rapp and Rozek and Seyoum don not include a component for enforcement in their study and finally, in the analysis of Rapp and Rozek method of differentiation is missing for example between "inadequate" laws and "seriously flawed" laws or between "generally good laws" and laws that are "fully consistent" with the minimum standard. In Seyoum's study it is unclear, on which criteria the raw data were reduced to a 0-103 scale. Sherwood's procedure is based on his experience. There exist no set rules while judging how many points to subtract for judicial independence, etc.

Ginarte and Park (1997) constructed IPR index for 110 countries in the sample having data range from 1960 to 2005. Five categories of the patent laws were examined:

1) extent of coverage, 2) membership in international patent agreements, 3) provisions for loss of protection, 4) enforcement mechanisms, and 5) duration of protection.

Table 3

(1) Coverage	**Yes**	**No**
Patentability of pharmaceuticals	1	0
Patentability of chemicals	1	0
Patentability of food	1	0
Patentability of plant and animal varieties	1	0
Patentability of surgical products	1	0
Patentability of microorganisms	1	0
Patentability of utility models	1	0
(2) Membership in international treaties	**Yes**	**No**
Paris convention and revisions	1	0
Patent cooperation treaty	1	0
Protection of new varieties (UPOV)	1	0
(3) Loss of protection measures against losses	**Yes**	**No**
Working requirements	1	0
Compulsory licensing	1	0
Revocation of patents	1	0
(4) Enforcement	**Yes**	**No**
Preliminary injunctions	1	0
Contributory infringement	1	0
Burden of proof reversal	1	0
(5) Duration	**Value**	
Application-base standard		
$X \geq 20$ years	1	
$0 \leq x < 20$	x/20	
Grant-based standard		
$X \geq 17$ years	1	
$0 \leq x < 17$	x/17	
Source: Ginarte and Park (1997)		

It ranges in values from zero to five. Higher values of the index indicate stronger levels of protection. This IPR index differs from the previous IPR indices on the following grounds:

Firstly, it provides information for more countries and periods than other studies. Secondly, broader categories of the patent system are considered, particularly the treatment of foreigners. Thirdly, previous studies exhibit little variability across countries; one cannot distinguish the levels of patent protection between the USA and Denmark since both have the same value. But this measures of patent rights exhibit greater variability across countries. Therefore, I have used IPR index of Ginarte and Park in my study.

Moreover, I used Barro and Lee's "International Data on Educational Attainment". Their research has been used in many studies. Education is the one of the important components to measure human capital. Barro (2000) states, "Human capital, particularly that attained through education, has been emphasized as a critical determinant of economic growth". Education also allows the creation and use of technology, which facilitates more efficient use of labor and physical capital. Educational measurements are quite widespread and the method of the data collection is well-known and recognized.

Gwartney and Lawson's data set is used to measure the Economic Freedom of the World (EFW). This dataset covers size of government, legal structure and security of property rights, access to sound money, freedom to exchange with foreigners, and regulation of credit, labor, and business.

Freedom in the World Report data is used to measure the political rights score, which consist of electoral process, political pluralism and participation, the functioning of the government, and a few additional questions depending on the government type. The civil liberties score is derived from the variables of freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy and individual rights. "PR" stands for "Political Rights" and "CL" stands for "Civil Liberties". Political Rights and Civil Liberties are measured on a one to seven scale, with one representing the highest degree of freedom and seven the lowest. I used both of the dataset to find out its impact on economic growth in the presence of IPR index. Countries whose combined average ratings for Political Rights and for Civil Liberties fell between 1.0 and 2.5 are designed "Free"; between 3.0 and 5.0 are "Partly Free" and those between 5.5 and 7.0 are "Not Free".

Gross capital formation (formerly gross domestic investment) consists of outlays in additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress".

Population growth (annual %) is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship-except for refugees not

permanently settled in the country of asylum, who are generally considered part of the population of the country of origin.

In addition, ratio of imports plus exports to GDP is included to measure trade openness and it is said that countries which are more open to the rest of the world are better positioned to absorb the rapid technological advances of leading nations. Initial GDP of a country is included to measure the convergence of the developing countries.

3.2. SPECIFICATION OF THE MODELS

3.2.1 The Fixed Effects Approach

Pooled Least Square estimation technique is based on the following assumptions about intercept, the slope coefficients, and the error term.[16]

- The intercept and slope coefficients are constant across time and space and the error term captures differences over time and individuals (countries). This simplest approach disregards the space and time dimensions of the pooled data and just estimates the usual OLS regression.
- Slope coefficients are constant but the intercept varies across individuals in the Fixed Effects or Least –Square Dummy Variable Regression Model. The fixed effect is due to the fact that although the intercept may differ across individuals, each individual intercept does not vary over time; it means that it is time invariant. To allow for the (fixed effect) intercept to vary between the individuals, least-squares dummy variable (LSDV) model will be used. This is the case, if a researcher wants explicit intercept values for each country. The time dummies

[16] Gujrati.D (2003) Basic Econometrics, fourth edition. McGraw-Hill/Irwin. New York, p. 641

will be used to capture the time effect such as technological change, changes in the government's regulatory and tax policies and external effects such as wars or other conflicts.

- Slope coefficients are constant but the intercept varies over individuals as well as time, when the previously mentioned two techniques (LSDV, Time dummies) are combined into one regression.
- All coefficients vary across individuals. It means that the intercepts and the slope coefficients are different for all individual.

To understand this lets consider the following model:[17]

$$Y_{it} = a_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \text{———} \beta_k X_{kit} + U_{it}$$

This can be rewritten in a matrix notation as:

$$Y = D\alpha + X\beta' + ц$$

$$Y = \begin{bmatrix} y1 \\ y2 \\ \bullet \\ \bullet \\ yn \end{bmatrix} \qquad D = \begin{pmatrix} iT & 0 & 0 \\ 0 & iT & 0 \\ 0 & 0 & iT \end{pmatrix}$$

[17] D. Asteriou (2005) Applied Econometrics, Palgrave Macmillan, p.370

$$X = \begin{pmatrix} x_{11} & x_{12} & x_{1k} \\ x_{21} & x_{22} & x_{2k} \\ x_{N1} & x_{N2} & x_{Nk} \end{pmatrix} \qquad a = \begin{bmatrix} a1 \\ a2 \\ . \\ . \\ aN \end{bmatrix}, \beta = \begin{bmatrix} b1 \\ b2 \\ . \\ . \\ bN \end{bmatrix}$$

Before assessing the validity of the fixed effects method, this study check whether fixed effects (i.e. different constant for each group) should include in the model. To do this the standard F- statistic is used to check fixed effects against the simple common constant OLS method.

$$H_0: a_1 = a_2 = \text{-----} = a_N$$

The F statistic is:

$F = (R^2_{FE} - R^2_{CC})/ (N-1)$, whole divided by $(1- R^2_{FE})/ (NT-N-k) \sim F (N-1, NT-N-k)$

Where R^2_{FE} is the coefficient of determination of the fixed effects model and R^2_{CC} is the coefficient of determination of the common constant model. If F-Statistic is bigger than the F-critical, then the study will reject the null hypothesis.

Fixed effects approach has following problems:

- It ignores all explanatory variables that don't vary over time. It means that it does not allow using other dummies in the model. This is not useful, when it is required to consider such dummies.
- It considers large number of degrees of freedom, which is a major cost.

- It makes it very hard for any slowly changing explanatory variables to be included in the model, because they will be highly collinear with the effects.

3.2.2 The Random Effects Approach

The fixed effect or LSDV modeling can be expensive in terms of degrees of freedom, if we have several cross-sectional units. Dummy variables in fact represent a lack of knowledge about the true model. The proponents of random effects model suggest using the disturbance term U_{it} in order to capture the true effect.

Instead of treating β_{1i} as fixed, now assume that it is a random variable with a mean value of β_1 (no subscript here) and the intercept value for an individual country can be expressed as:

$$\beta_{1i} = \beta_1 + \lambda_i \qquad i = 1, 2, 3, \text{---------}, N$$

Composite error term ϵ_{it} consists of two components, λ_i which is the cross sectional or individual specific error component and U_{it}, which is the combined time series and cross-sectional error components.

$$\epsilon_{it} = \lambda_i + U_{it}$$

The random effects model therefore takes the following form:

$$Y_{it} = (\alpha + \lambda_i) + \beta_1 X_{1it} + \beta_2 X_{2it} + \text{———} + \beta_k X_{kit} + U_{it}$$

$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \text{———} + \beta_k X_{kit} + (\lambda_i + U_{it})$$

Obvious disadvantage of the random effects approach is that one should make specific assumptions[18] about the distribution of the random component. If the unobserved group-specific effects are correlated with the explanatory variables, then the estimates will be biased and inconsistent. In my study the index of IPRs is likely correlated with the individual effects caused by institutional and cultural factors.

3.2.3 Fixed Effects versus Random Effects Model[19]

The fixed effects model assumes that each country differs in its intercept term, whereas the random effects model assumes that each country differs in its error term. Usually, when the panel is balanced (i.e. it contains all existing cross-sectional data), one might expect that the fixed effects model will work better. In other cases, where the sample contains limited observations of the existing cross-sectional units, the random effects model might be more appropriate.

The usefulness of Fixed Effect Model (FEM) and Random Effect Model (REM) depends upon the assumptions one makes about the possible correlation between cross-sectional specific error components λ_i and the X's regressors.

If assumption is λ_i and X's are uncorrelated, REM may be appropriate. Whereas if λ_i and X's are correlated the FEM may be appropriate. These are the two fundamental differences in the two approaches. Some other observations are in order to choose between the two methods.

[18] Country specific effects are uncorrelated with the exogenous variables included in the model.
[19] Gujrati.D (2003) Basic Econometrics, Fourth edition. McGraw-Hill/Irwin. New York, P. 650

- If the number of time series data (T) is large and the number of cross-section units (N) is small, Fixed Effect Model (FEM) may be preferable.
- When the number of time series data (T) is small and the number of cross-section units (N) is large, then due to the non-random sampling of cross-sectional units, FEM is appropriate otherwise REM is appropriate.
- If the individual error component λ_i and one or more regressors are correlated, then the REM estimators are biased, whereas those obtained from FEM are unbiased.
- If the number of cross-sectional units (N) is large and the number of time series data (T) is small, and if the assumptions underlying REM hold, then REM estimators are more efficient than FEM estimators.

In order to further investigate about whether fixed effects model or random effects model is more useful, so called Hausman[20] test is used.

However, this study does not consider Hausman Test, because contradictions may arise, when one makes an assumption for fixed effect and the result of Hausman Test favors random effect and vise versa. Therefore, this study takes both the assumptions for fixed as well as for random effects as explained earlier and calculated both the effects instead of relying on only one.

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[20] This test considers *null hypothesis* Ho: Random effects model coefficients are consistent and efficient, and alternative hypothesis H_1: Random effects are inconsistent.

$H = (\hat{\beta}^{FE} - \hat{\beta}^{RE})' [\text{Var}(\hat{\beta}^{FE}) - \text{Var}(\hat{\beta}^{RE})]^{-1} (\hat{\beta}^{FE} - \hat{\beta}^{RE}) \sim X^2(k)$

If the value of the Hausman statistic is high, then the difference between the estimates is significant, it rejects the null hypothesis and the random effects model is inconsistent. In contrast low value of the statistic implies that the random effects estimator is more appropriate.

3.2.4 One-way or two-way error components[21]

One way error components means, it includes individual effect and random effect.

$\epsilon_{it} = \lambda_i + U_{it}$

Where λ_i is individual effect and U_{it} is random error.

Two way error components means, it includes individual effect, random effect and time effect.

$\epsilon_{it} = \lambda_i + U_t + U_{it}$

Where λi is individual effect and U_{it} is random error and U_t is the time effect.

The two way error components can not be applied to unbalanced data, and the one way error components is applicable to both balanced and unbalance data. This study used one way error components. The one way error components is applied to the unbalanced data from 1960-2005. Similarly, to capture the appropriate results, one way error components is applied to the balanced data from 1970-2005. The balanced data shows more significant results for the study.

[21] See W. Green, Applied Econometrics (2003) Fifth Edition, Class note of Dr. Eitzaz

CHAPTER-4

4. EMPIRICAL ESIMATION AND RESULTS

4.1 Analysis of the results

The Pooled Least Square (Unbalanced and Balanced), Fixed Effect and Random Effect Models are used to estimate equation (A) and the results are presented in Table 4, 5, 6 and 7 at the end of this chapter. Since there is no significant difference in the results of the above mentioned models, therefore the results have been interpreted in a combined manner. The preliminary results show that coefficients of most of the standard explanatory variables caries the expected sign and are statistically significant.

This study finds that for the middle income developing countries with the strengthening of IPR regime, the real GDP per capita growth declines. The coefficient associated with IPR indicates that with a one unit increase (more strengthening) in the IPR index, the real GDP per capita growth declines by 0.48 %. It means that the empirical results do not support positive relationship between IPR and economic development for middle income developing countries. Thus, the result of this study supports the findings of Rod Falvey et al (2006). The impact of IPR protection on growth depends upon the level of development of a country, as reflected in its ability to imitate and innovate. In low-income countries low level of education, human and physical capital, expenditure on R&D, etc. does not favor imitation or innovation. In these countries more likely strong IPR protection encourages imports and inward FDI that subsequently encourage growth. Moreover, the low income countries can also reap the

broad benefits of freer trade[22] without sacrificing growth in order to meet the accompanying TRIPs obligations, because the TRIPs agreement imposes minimum standards of IPR protection on low income countries. However, in middle-income countries imitation can be an important source of technological development and growth. These countries are at the transitional stage of their economic development and the cost of innovation is higher than the cost of imitation. In these countries enforcement of stronger IPR protection would affect domestic industry that heavily relies on imitated technologies. The middle-income countries are not engage in innovative activities to a larger extent, but substantially relying on imitative activities in order to achieve economies of scale, and the IPRs protection in these countries may reduce the overall level of imitation, innovation and social welfare. The lack of a positive relationship between IPR protection and growth in these countries is likely to reflect two opposing forces. The positive impact of IPR protection on growth that works indirectly through trade and FDI is being offset by a negative impact of slowing down of knowledge diffusion and discouragement of imitation. In the developed countries stronger IPR protection stimulate acquisition and dissemination of knowledge, encourage innovation by allowing innovators to accrue benefit from their inventions and the innovation subsequently stimulate growth. The reasons are that these countries have already achieved a higher level of economies of scale, physical and human capital, and expenditure on R&D.

[22] Including grace period, technical assistance and opportunity to explore and utilize the TRIPs flexibilities to build up their economies.

Human capital, which is defined as average years of education, carries the expected sign but it is insignificant. The findings show that with one unit increase in the average years of education index, the real GDP per capita growth will increase by 0.11%. Educational attainment indicates more skilled and more productive workers. One reason for this insignificant relationship may be the level and distribution of educational attainment. Secondly, in these countries large number of population is in the age group of 15 to 25 and to reap this demographic dividend, it will take some time.

Economic Freedom of the World (EFW), which covers security of private property rights, rule of law, legal structure, monetary and fiscal policy, has a significant impact on the economic growth of the middle-income developing countries. In this regard the results are highly significant. If there is one unit increase in the EFW index the real GDP per capita growth rate will increase by 0.86%. The empirical analysis favors the positive role of institutions in the economic growth process by judicial efficiency, low level of corruption, effective bureaucracy and protected property rights.

Population growth affects economic growth in a complex way. In case of developed economies its impact appears to be positive as determined by their absorption capacity. However, in developing countries, population growth leads to less capital per worker decreasing per worker output and consumption. This study has also found that increase in the population growth lower the economic growth of the middle-income developing countries. The coefficient of the population indicates that as a result of 1 % increase in the population growth, the real GDP per capita growth decreases by 0.70 %.

Inflation rate is also included in the model to measure the economic instability. The results show that it carries the expected negative sign. However, the impact of inflation on the economic growth is controversial. If the inflation increases by one percentage point, it will decrease real GDP per capita by 0.01%.

Gross capital formation or formerly gross domestic investment (GDI) typically increases productivity and GDP growth. When businesses are investing in capital formation as explained earlier, it typically reflects optimism for future growth. The empirical results show that when there is one percentage point increase in the GDI, the real GDP per capita growth rate would increase by 0.11 percent. Perhaps the result is not so significant, because our data pertains to GDI and not to total investment.

Earlier studies have suggested that countries that are more open to the rest of the world are better positioned to absorb the rapid technological advances of leading nations. If the costs of technological imitation are lower than the costs of internally developed innovations, then a poorer country will grow faster than a more developed one. This faster rate of growth will continue so long as that country remains open for capturing new ideas until, at some point, equilibrium is reached and the rate of growth slows. Various theoretical models predict that openness to international trade accelerates productivity and promotes economic growth. The empirical results of this study support this positive relationship. Increasing trade (exports plus imports) as a fraction of GDP by 1 percentage points will increase the real growth rate of GDP per capita by 0.0003 percent, which means trade has marginal impact on economic growth.

Finally, the values of initial GDP at the beginning of each five years were taken to measure the convergence factor. The economic theory says if the value of its initial GDP coefficient is negative, developing countries are converging towards the developed countries. The convergence is supported in this study.

4.2 Econometric Tests

Durbin-Watson d test has been used to check for autocorrelation in time series and cross sectional data. According to its assumptions firstly there should be no missing observations and secondly the regression model should include the intercept term. Due to the presence of missing values in unbalanced panel data from 1960-2005, the D.W d statistic value is not sound. Similarly, the second assumption violates the applicability of Constant Coefficient Method. However, D.W d statistic value can be usefully interpreted for balanced panel data (Fixed and Random effects). The value of D.W Stat for unbalanced data (1960-2005) and balanced data (1970-2005) are 1.87 and 2.11 respectively. As mentioned above D.W Stat is not applicable for unbalanced data. The acceptable (balanced data) value is 2.11, so it is near to standard value of 2, which means no positive and negative autocorrelation.

To check and correct the problem of Heteroscedasticity, White General Hetroscedasticity, White Heteroscedasticity Variance and Standard Error methods are used, respectively. The significance of the White Heteroscedasticity Variance and Standard Error on Weighted Least Square (WLS) is that it does not assume, rather determines variance (6_i^2). The problem of Hetroscedasticity is more common in cross sectional data than in time series data, because it deals with members of cross country

population at a given point of time, such as individual consumers, or their families, firms, industries, or geographical subdivisions (state, country, city etc.). On the other hand time series data can be collected for the same variable over a period of time without having the problem of Heteroscedasticity.

Now if we look at the results obtained after correction for Hetroscedasticity, differences are visible. One of the important variables of the study i.e. average years of education becomes significant and in accordance to the hypothesis average years of education positively affects the real GDP per capita. If average years of education index increases by one percentage point, the real GDP per capita will increase by 0.11 %.

TABLE-4

Pooled Least Square Regression Analysis (1960-2005):
Unbalanced Panel Data (Corrected for Hetroscedasticity)
Fixed Effect Model

Dependent Variable: Real GDP per capita

Variable	Coefficient	Std. Error	t. Statistic	Prob.
C	0.002221	0.017839	-0.124484	0.9010
IPR_?	-0.483843	0.141438	-3.420877	0.0007
SYR15_?	0.110662	0.107564	1.028797	0.3042
EFW_?	0.864858	0.171459	5.044109	0.0000
WF_?	0.117094	0.075099	1.559195	0.1198
POP_?	-0.701890	0.186444	-3.764624	0.0002
INFLATION_?	-0.017523	0.005052	-3.468746	0.0006
GDI_?	0.111662	0.030308	3.684228	0.0003
TRADEGDP_?	0.000394	0.003586	0.109764	0.9127
INITGDP_?	-0.159878	0.186054	-0.859308	0.3907
R-squared	0.80			
D.W Stat.	1.85			
F-statistic	90.75			
Prob. (F-Statistic)	0.000			

TABLE-5

Pooled Least Square Regression Analysis (1960-2005):

Unbalanced Panel Data (Corrected for Hetroscedasticity):

Random Effect Model

Variable	Coefficient	Std. Error	t. Statistic	Prob.
C	-0.001240	0.016433	-0.075457	0.9399
IPR_?	-0.486592	0.136709	-3.559319	0.0004
SYR15_?	0.109707	0.102047	1.075063	0.2830
EFW_?	0.840482	0.162655	5.167257	0.0000
WF_?	0.125136	0.070647	1.771287	0.0773
POP_?	-0.747010	0.178720	- 4.179777	0.0000
INFLATION_?	- 0.017751	0.004994	- 3.554086	0.0004
GDI_?	0.104112	0.028217	3.689731	0.0003
TRADEGDP_?	0.000570	0.003374	0.168906	0.8660
INITGDP_?	-0.119756	0.180988	-0.661681	0.5086

R-squared	0.80
D.W Stat.	1.83
F-statistic	183.77
Prob. (F-Statistic)	0.0000

TABLE-6

Pooled Least Square Regression Analysis (1970-2005):

Balanced Panel Data

Fixed Effect Model

Variable	Coefficient	Std. Error	t. Statistic	Prob.
C	0.001838	0.003457	0.531748	0.5949
IPR_?	-0.758796	0.041031	-18.49336	0.0000
SYR15_?	0.620434	0.031393	19.76329	0.0000
EFW_?	0.695334	0.029450	23.61044	0.0000
WF_?	0.163286	0.017763	9.192325	0.0000
POP_?	0.067184	0.059426	1.130545	0.2583
INFLATION_?	-0.001242	0.000863	-1.439474	0.1501
GDI_?	0.057960	0.009850	5.884082	0.0000
TRADEGDP_?	-0.001418	0.000699	-2.029513	0.0425
INITGDP_?	-0.487639	0.035160	-13.86915	0.0000

R-squared	0.81
D.W Stat.	2.11
F-statistic	856.93
Prob. (F-Statistic)	0.000

TABLE-7

Pooled Least Square Regression Analysis (1970-2005):

Balanced Panel Data

Random Effect Model

Variable	Coefficient	Std. Error	t. Statistic	Prob.
C	0.000086	0.004321	0.019965	0.9841
IPR_?	-0.728613	0.049414	-14.74495	0.0000
SYR15_?	0.522224	0.035898	14.54723	0.0000
EFW_?	0.873635	0.032772	26.65779	0.0000
WF_?	0.283482	0.016220	17.47769	0.0000
POP_?	-0.318773	0.066949	-4.761436	0.0000
INFLATION_?	-0.001722	0.000090	-1.90577	0.0568
GDI_?	0.128304	0.012750	10.06272	0.0000
TRADEGDP_?	-0.002027	0.000808	-2.508464	0.0122
INITGDP_?	-0.600617	0.045568	-13.18082	0.0000

R-squared	0.77
D:W Stat.	2.20
F-statistic	1372.402
Prob. (F-Statistic)	0.0000

CHAPTER-5

5. CONCLUSION AND POLICY IMPLICATIONS

Intellectual Property Rights (IPRs) is now perceived as an important source of economic growth process in developing countries. The developing countries are signatories of WTO, which means that these countries are committed to comply with the Trade Related Intellectual Property Rights (TRIPs) agreement. Therefore they cannot ignore this agreement or otherwise they would be isolated from the world. But the pace of implementation is now important that one should make necessary arrangements to that end, otherwise the developing countries may face repercussions in term of access to the international markets, withdrawal of Generalize System of Preferences (GSP) and foreign investor confidence. Similarly, the problem of counterfeit products, which cause huge annual losses to industries and reduced tax to GDP ratio due to lack of documentation, can be addressed through adequate IPR protection measures.

The empirical result of this study provides evidence that intellectual property system does not necessarily contribute to economic growth process in middle income developing countries including Pakistan. These developing economies are not well prepared to accept this challenge at present stage of economic and infrastructural development. Strong IPR protection measure at this stage may cause inflationary pressure, unemployment and balance of payment (BOP) problem.

Furthermore, the results indicate that other explanatory variables like economic freedom of the world, world freedom (which includes political and civil liberty rights),

trade openness and average years of education affect significantly and positively the process of economic growth in these developing economies.

The important policy implications are:

- An effectively managed intellectual property system is required for the technology based economic development.
- National intellectual property legislation should be updated and refined to keep pace with international developments.
- The role of specialized judiciary courts, police cells, and the Customs and Federal Investigation Agency (FIA) administration could be reconsidered by the developing countries.
- The national and regional IPR offices and their infrastructure should be proactively modernized and computerized.
- Targeted awareness building campaigns by various institutions (including ministries, organizations, and WIPO etc) are necessary to emphasize the role of IPR and economic development.
- IPR should be introduced as a course in the universities and institutions of higher education of developing countries.
- Incentives may be given to encourage inventiveness amongst the national youth.
- R&D base should be strengthened, which will encourage innovative efforts and competitiveness in international trade.
- Interactive links between industry and university, development institutions and research based institutions should be strengthened.

- Like other associations a national inventor's association should be set up with an eminent scientist or inventor as its head, which will help inventors in getting their inventions registered, and in commercializing such inventions.

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AUTHENTICATION OF THE ECONOMETRIC ESTIMATIONS

Date: Wed, 16 Jan 2008 22:02:12 +0500

From: asadzaman@alum.mit.edu

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CC: pervez@janjua.de ; pzjanjua@hotmail.com

Dear Dr. Sherazi

I have had a look at the econometrics that Ghulam Samad has done. It appears to be a competent piece of work making use of the standard techniques of fixed effects versus random effects estimation procedures. Ghulam Samad' writing shows understanding of the issues involved in comparing and evaluating the two (relatively sophisticated) econometric techniques.

With best regards

Asad Zaman