LUND UNIVERSITY
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Master in Economic Development

The Potential of Intellectual Property Rights for Economic Development
A Case Study on India

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Abstract:
Intellectual Property Rights' systems have not yet been admitted as policy instruments favouring economic performance of developing countries, and Intellectual Property itself has not been recognised as an economic asset as yet. While there is strong argument that robust IPR system fosters economic growth and development, suspicions of this argument still hold up in the national and international debate. This paper questions whether or not strengthening and enforcing Intellectual Property Rights regimes will positively affect the economic growth and development of developing countries, through attracting more foreign direct investments, increasing exports and encouraging innovation. A case study on India's economy is performed using a time series panel data for the period 2000-2015.
Key words: Intellectual Property Rights – Economic Growth – Developing countries - India – Time Series Analysis – Cointegration – VECM – Granger Causality

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Abbreviations

IPR	Intellectual Property Rights
IP	Intellectual Property
WIPO	World Intellectual Property Organization
WTO	World Trade Organization
TRIPS	Trade-related Aspects of Intellectual Property Rights Agreement
FDI	Foreign Direct Investment
R&D	Research and Development
MNC	Multinational Companies
NIE	Newly Industrialized Economy
GATT	General Agreement on Tariffs and Trade
ADF	Augmented Dickey Fuller test
EG	Engle Granger Method
IRF	Impulsive Regressive Function

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1. Introduction

Technology and knowledge have played a vital role in the economic growth of world developed economies as well as emerging ones. Intellectual Property (commonly referred to as IP), despite being clearly identified in most countries, has not yet been recognized as an economic asset for most of the developing countries. There have been extraordinary changes in international systems of intellectual property law and policy over the last 20 years, as a result of their intersection with economic growth indicators, mainly: foreign trade, foreign direct investments and innovation.

Economies of globalization: the increase of cross border economic cooperation and integration, the exchanges of goods, services, capital and knowledge construct the main reasons for the structural changes in all economies, together with the emergence of innovation as a tradable economic asset. Securing intellectual Property Rights (hereafter; IPRs) has been seen as a policy instrument with wide-ranging ramifications on economic activity. the question of whether it, together with powerful financial institutions and productive industries, will have a positive potential for the development process on a local or an international level is controversially complex and based on many variables.

Stronger systems for protecting IP could either enhance or limit economic growth in the short run in theory. Nevertheless, there is an emerging concept nowadays that efficient IP valuation and management in a manner that encourages innovation and competition with incentives, has a great potential to lead to economic development in the long run. Economic development, generally defined as an improvement of general economic and social well being resulting from economic growth, which in this paper is explained as per an increase of Trade, Foreign Direct Investments and Innovation of an economy.

There have been a lot of arguments at all levels; governmental, civil and private sectors, on the role of IPR in fostering innovation, catalyzing technology and contributing to economic growth, especially in developing and least developed countries. The effectiveness of IPR enforcement is still debatable, and such effectiveness will have to depend on the special circumstances present in each country.

1.1 Research Problem

This paper is constructed on three pillars. First the paper will state, through the available literature and empirical studies, the arguments regarding how tightening IPR systems could improve or retard economic development. Second, the paper will extract and study the case of India as a developing economy that has applied a reasonable IP system[1] for a considerably long time. Third, the paper will overview the the recommendations and suggested methods by which international organizations and developing countries might wish to complement in order to maximize the benefits of emerging and enhancing IP regimes.

In the rest of this chapter, the paper will start with the definition of the IPRs and some of its different measures mainly: patents, trademarks, copyrights and trade secrets. Moreover, the IPR international governance, with regards to the international organizations working on enforcing, encouraging and synchronizing IPR systems in the world, which are World Intellectual Property Rights Organization with its TRIPS agreement, and the World Trade organization. Afterwards, IPR with regards to economic growth and development will be discussed from the aspect of the IPR capacity to increase foreign trade, attract more foreign direct investments and encourage expenditure on research and development. Following a brief background on the issue of intellectual property rights, the paper will summarize and highlight the most relevant literature put forth by a wide range of economists and researchers supporting different arguments about the positive and/or negative impact with regards to each indicator will also be illustrated. Then through applying a quantitative research method, this paper will thoroughly study the case of India using time panel data, to identify if there is a relation between the IPR tools and three indicators of economic development[2]: R&D, Trade and FDI. Summary and recommendations based on the whole study performed will also be identified at the end of the paper.

[1] As explained in Chapter 6

[2] Economic development in this paper refers to the improvement in economic conditions as a result of economic growth, as explained in section 1.3.3

1.2 Aim, Research Scope and Limitations

While there is strong argument that robust IPR system fosters economic growth and development, suspicions of this argument still holds up in the national and international debate. Developed countries issue study after study indicating that strong IPR systems are macro-economically beneficial, while developing countries are worried about their micro-economic details and special circumstances.

The overall aim of this study is to consider how tightening IPR could influence, retard or have no effect on economic activity and growth. This study moreover aspires to answer this question of whether there is a real relationship between IPR enforcement and economic growth in developing countries, using India as a case study. Using statistical analysis, the case study tries to answer whether or not tightening IP rights has helped India through promoting innovation, increasing exports and attracting FDIs.

A limitation in the paper is that the paper assumes that most developing countries share certain common characteristics, and that economic growth will behave the same way with regard to IP protection, innovation, exports and FDI. Another limitation is that India has only started applying IPRs as per the international standards very recently (2005), which lead to a small number of observations.

It is worth noting that the issue of Intellectual Property Rights and its effect on economic activity is still an emerging field of research: the concept of IPR protection is still not very popular and deeply rooted in most of the developing countries' social and economic as yet. It is also worth noting that the primary finding in most of the previous studies is that development is a complex process and that IPR could have a range of impacts, which will also have to depend on the characteristics of products, markets and institutions in different countries.

1.3 Intellectual Property Rights

Intellectual Property; IP, a term that has acquired wide usage in the world today, can be defined as "creations of the mind: inventions; literary and artistic works; and symbols, names and images used in commerce" (WIPO, 2004 p.2). Like any other property rights, IPRs allow creators, or owners of patents, trademarks or copyrighted works to benefit from their creation, allowing their holder to exercise a monopoly on them for a specified period (WIPO, 2004). Clearly outlined in the Universal Declaration of Human Rights, Article 27[3], these rights were officially recognized in the Paris Convention for the Protection of Industrial Property (1883), then Berne Convention for the Protection of Literary and Artistic Works (1886); but it was not until the the late 20th century that they became embraced by the international community.

Intellectual property rights are meant to reward creativity thus fueling the progress of humankind (WIPO, 2004), where the exclusive rights given are generally subject to a number of limitations and exceptions, aimed at reaching the balance between the legitimate interests of right holders and of users. Divided into two categories, Industrial Property that includes Patents, trademarks, industrial designs and geographical indications; and Copyright that includes literary work such as films, novels and artistic works (WIPO, 2004). The two main objectives of applying IPRs are (1) maximizing the interest of a particular country, industry or individual, and (2) encouraging and utilizing humankind's innovative abilities to improve human conditions (WIPO, 2004).

Ever since IPRs have been recognized, there has been a controversy about enforcing the IPR laws, as it is seen by many that it could generate abuses of market power or monopolistic behavior and thus preventing the reach of such creations to the developing and least developed countries (Braga et al, 2000). Though such concerns could be valid, the IPR encouragers debate that if IPRs are enforced with special conditions and circumstances, their benefits would so much outweigh their costs, and they will actually help improve the economic conditions of developing countries by striking the right balance between the interest of innovators and public interest. However, suspicions will still hold up till there are enough proofs and positive

[3] Article 27 of the Universal Declaration of Human Rights speaks about the right to participate in the cultural life of the community, and to share in scientific advancement and its benefits, as well as the right to the protection of the moral and material interests resulting from authorship of scientific, literary or artistic productions.

experiences of developing countries that have applied stronger IPR systems (Kumar, 2003).

1.3.1 IPR Measures

As per the World Intellectual Property Rights Organization, Intellectual property is divided into two categories:

(a) Industrial Property:

Patents: exclusive rights granted for an invention; a product that provides a new way of doing something or of solving a problem. A patent provides the patent owner with protection for their inventions, as a material and social reward and in order to encourage innovative practices.

Trademark: a distinctive sign identifying certain goods or services provided by an individual or a company. Unique trademarks have evolved in order to help consumers identify and purchase a product or service as per its special characteristics and quality. The period of protection of different IPR measures varies, but a trademark can be renewed infinitely.

Industrial Design: can be defined as the ornamental or aesthetic aspects of an article. Industrial designs are what makes an industrial product attractive and appealing, thus adding to its commercial value and marketability.

Geographical Indication: a significance that certain goods have a specific geographical origin. It usually consists of the name of the place of the origin of the product.

(b) Copyrights:

laws that grant authors, artists, painter, photographers and other creators a sort of protection for their works. The creators of such works are protected by copyright; they and their heirs have certain rights under copyright laws.

1.3.2 IPR Governance[4]

The institutional environment of IPR has developed due to the tendency and need to internationalize IPR systems of different countries. There is a number of international intergovernmental organizations that work on fostering governmental cooperation in the different areas of intellectual property, as well a number of non-governmental, non-profit organizations, lobbying organizations and think tanks, either working and campaigning for either encouraging or discouraging IPR systems' strengthening. International economic relations and activities raised the need to have specialized organizations and treaties concerned IPR; availing strong incentives particularly among immerging economies encouraging them to adjust their patent systems to meet national requirements and international standards for a better IPRS system, and meanwhile celebrating and protecting the existing strong IPR systems in the developed countries.

In this paper, two international organizations will be mentioned several; times:

1) The World Intellectual Property Rights Organization (WIPO):

Established in 1967 to encourage creative activity and promote the protection of intellectual property, the World Intellectual Property Rights organization is one of the specialized agencies of the United Nations. However, the origins of WIPO are said to be going back to 1883 and 1886, with the adoption of the Paris Convention and the Berne Convention respectively. WIPO now has 189 member states, and its headquarters lies in Geneva (WIPO, 2004).

2) The World Trade Organization (WTO) and its Agreement on Trade Related aspects of Intellectual Property Rights (TRIPS) agreement:

One of the youngest organizations, the World Trade Organization came to life in 1995 as a successor to the General Agreement on Tariffs and Trade (GATT) established in the wake of the Second World War. From an international trade perspective, many argue that the WTO is now the

[4] Governance here is used as an umbrella term for international institutions coordinating economic and social activities, with management hierarchies and markets as two main polar type of institutions.

center-piece of the international trade and economic cooperation governance institution. Came into force in with the WTO in 1995, as part of outcome multilateral Uruguay Round, the Agreement on Trade Related aspects of Intellectual Property Rights (TRIPS) establishes the minimum standards of protection for a wide variety of intellectual property that aim to facilitate and promote trade in goods and services. A room has been left intentionally for maneuvering so that each government can adapt its domestic IP laws and policies to safeguard important national interests. (WTO, 2015). TRIPS negotiators argue that shortcomings and inconsistencies in IPR systems can distort trade and impede benefits of globalizations. The Developing countries meanwhile have been discussing the significant impact this agreement might have on their economic development and questioning whether this would encourage economic growth in their countries.

1.4 Intellectual Property Rights for Economic Development

The economization and commercialization of IP is debated to have a significant stimulus to economic growth; IP is now considered by many as a potential valuable asset to be transformed into tradable economic commodity. Developed countries and the Intergovernmental Organizations argue that an IPR strong system have a causative potential towards to a country's efforts to attract Foreign Direct Investments (FDIs) as well as to promote innovation and increase a country's exports. IPR cheerers are encouraging public awareness of the developing countries on the role of tightened IPR systems in order to create a broad understanding and eagerness for compliance to be able to harness its economic - besides the legal and social benefits.

The three arguments that have been made so far in this regards would be summarized as follows: (1) increased and tightened IPR system will benefit developing countries and foster their economic growth by encouraging domestic innovation and expenditure on R&D, attracting and foreign direct investments (FDIs) and encouraging the country's trade through increasing its exports, or that (2) increased and tightened IPRs will harm developing countries because developing countries are only net consumers of the available domestic products resulting from the imitation based technology sectors originally established by developed countries, or the most agreed upon that (3) increased and tightened IPR generates a variety of positive and negative impacts on the economic development in developing countries, based on particular circumstances present in each individual country. Many believe that up till date, there has not been yet sufficient strong empirical evidence to support any of the three arguments stated and that evidence is not clear as we like, although many important studies have shed light on those questions.

Economic growth in this paper refers to the increase of the real per capita income of a country over a period of time; a country is deemed to record economic growth when there is a measurable increase in the amount of goods and services produced in that country. And hence, R&D, exports (trade) and FDIs are introduced as vital agents for economic growth. Such economic growth within the long term lead to improvement of the economic and social aspects of a developing country, leading to economic growth in the long term.

1) <u>IPR and Innovation</u>

It is argued that IPR systems play a vital role in encouraging and facilitating the process of taking innovative technology to the market place, and that it plays a major role in enhancing competitiveness of technology-based enterprises, whether such enterprises are commercializing new or improved products or providing service on the basis of a new or improved technology. Innovation is usually measured through the expenditure of an economy on R&D. Technology innovation costs a lot, and it need to be financed through mass R&D expenditure. Some argue that in the absence of patents, companies would never take the risk of investing time and money in R&D as any technological breakthrough would soon be copied, and the exclusivity of such breakthroughs would diminish. And since local businesses in developing economies have limited resources for sustainable R&D programs as compared to the local business in the developed ones, thus they rely more on imitation; reverse engineering, dismantling and incremental modification rather than innovation or invention. However, many economists argue that stronger IPR systems can encourage a country's expenditure on R&D; public as well as private, and thus increase its innovativeness. Domestic innovation could thus be one source of long-term growth encouraged by IPRs, which also positively affects the other indicators we are measuring; exports and inward FDIs, which also involve technology transfer, thus more innovation.

2) IPR and FDI

FDI is a necessity in developing countries, because those countries do not have the capacity or the sufficient capital and expertise to establish mega businesses and create mass jobs on their own, besides encouraging technology transfer, enabling the developing countries to start creating patentable products themselves and availing them to the global market, and to improve existing technology and adapt it best to their situation and needs hence, contributing to helping the local economy by bringing expertise, revenues and confidence to the developing economy. Meanwhile, transitional MNCs often look to developing countries for their expansion plans in order to maximize their revenues either by reducing labour costs, to reduce transportation costs, to be closer to resource inputs or sometimes to be in a more supportive governmental environment.

It has been argued by developed countries and the TRIPS cheerers that strengthening IPR systems will increase the inward FDIs in the developing

countries, because the MNCs would not want to transfer their technology innovations and trade secrets into an economy with absent or low enforceable IPR systems where their IP can not be protected. Thus local patent systems become important tools for attracting those FDIs, and countries with strong enforceable IPR systems will stand out in the global market place.

Others argue that strengthening IPR systems does not automatically increase the volume of FDI going to countries thus will not insure greater attractiveness of a country competing to attract investments, and that MNCs usually have more considerations than IPR systems, such as labour and human capital, investment climate, economic, political and other considerations such as taxation laws, and foreign investment laws in general.

3) IPR and Trade

International trade nowadays involves an increasingly diverse range of products in which ideas and knowledge play an important role. Empirical studies of the IPRs-trade relationship started only in the mid 1990s with the emergence of the WTO. Globalization of trade has revealed the differences between IPR national regulations, and it is now being argued by developed countries and IP Intergovernmental institutions' representatives that strengthening IPR systems is vital if a country wants to adopt an export extensive strategy and open up new export opportunities. Through developing advantageous market position in export markets and identifying the appropriate export market distribution channels, a country can resort to a strong IPR in order to protect its products' designs, brand images, confidential business information and strengthen their position in the export market competition. It has also been argued that exporters usually realize the importance of IPR once its too late; after their product or brand has been copied and developed in the markets they export to, or if they themselves have been found infringing another IPRs which could be a costly mistake. However, it is also worth noting that the decision to export heavily has its attendant challenges; since it involves a considerable financial, managerial and production decisions that could be risky.

1.5 Outline of Intellectual Property in India[5]

India has been among of the fastest growing and largest economies in the world in the recent years; it has even scored the highest GDP growth rate in 2015 of 7.6% (World Bank, 2016). Being the sixth largest in the world as per the GDP, India is classified as a newly industrialized country (NIE) and it is one of the G20 economies (World Bank, 2016). Despite having an average growth rate of 7% in the last decade, India is still largely one of the poorest countries (World Bank, 2016). The growth achieved in India has come mainly from the service and manufacturing sectors, and due to the high domestic consumer demand, especially from the middle class population. The long-term growth prospective of the Indian economy is positive due to its young population, potentials to attract FDIs, high consumption rates and big market (World Bank, 2016).

Creativity and innovation have been a constant in growth and development of the Indian Economy. Many features of that can be observed through he evolution of the Indian film and music industry, the contribution of the Indian pharmaceutical sector in enabling access to affordable medicines globally, the presence of a strong competitive software industry as well as the Indian popular practices such as Ayurveda and Yoga. While India has always been a rich society with innovative and creative works, much of the IP created remains unprotected both on account of lack of awareness and complexity of the IPR system.

India has robust IP laws and enforcement that it has inherited from its colonial times[6], and it has recently joined the countries that have adopted stronger IPR protection after joining the WTO and signing the TRIPS agreement for reasons mainly as of boosting economic growth and bilateral and international trade relations with developed economies as well as its local financial institutions.

According to the statistical data provided by the Indian government for the period 2000-2015, there seems to be a rise[7] in the total number of IPR measures filed domestically and abroad. There is also a noticeable steady growth in the economy, which results in an improvement in income among Indians; thus it might be seen as offering encouraging incentives to individuals and companies to invest more in creating innovative products.

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[5] India Development Update, World bank Report, June 2016 India Development Report, June 2016
[6] As seen in details in chapter 6
[7] Check table (1) and graph (1) in chapter 6

2. Research Questions

The research questions of this paper can be summarized and outlined as follows:

1. What is the effect of strengthening the IP systems on the economic development of developing countries? How does it impact on FDI, Innovation and Exports?
   (a) Is is a positive effect?
   (b) Is it a negative effect?
2. To what degree did strengthening the IP systems in India benefit its economic growth and development in the period 2000-2015t?
   (a) What was the effect on Innovation?
   (b) What was the effect on FDI?
   (c) What was the effect on Exports?

3. Background

3.1 Historical Background

Throughout history, societies have deemed intellectual creations; for example: technological inventions, artistic and literary works, business secrets, trademarks, as a legitimate private property of the creators. Standards and enforcement of intellectual property rights date much older than the international organizations; the WIPO and WTO, and the international trade agreements and even the Universal Declaration of Human Rights. Some historians date IPRs to Renaissance Italy, as far back as the eleventh century as the when skilled craftsmen were making and exporting world famous glass products in Venice (Long, 1991). Others date IPRs to 18th century when the copyright law began to take its modern form to avoid piracy and foster artistic and literary production, the Statute of Anne in England is the main example in this regards (Durdik, 1994).

Later came the Paris Convention 1883 on the Protection of Industrial Property Rights, then the Berne Convention 1886 on the Protection of Literary and Artistic Works, reaching to the Madrid Agreement 1891 for the International Registration of Marks. All those steps led afterwards, the establishment of the WIPO by virtue of the WIPO Convention in 1967, as a specialized agency governing IPRs which then became under the umbrella of the United Nations System in 1974 (WIPO, 2004). And, after the 2nd World War, the Uruguay round of negotiations paved the road for the establishment of the WTO in 1995, as the largest trade organization in the world, and its TRIPS agreement was introduced IP law into the international trading system. Thus, we can conclude that the IPR protection property at an international level can be roughly divided into three periods: a territorial period with an absence of an international protection, an international period commenced with Paris Convention, and a global period at a multilateral level with the international institutions governing IPR (Drahos, 1997).

The nineteenth century brought a lot of changes to the economic world which relate on one hand to international economic cooperation, and on the other hand to innovation and information and communication technology (ICT). Yet, numerous countries still remain in the buyers/imitators position rather than the producer/innovator one, and their calls for applying and strengthening IPR systems have got louder, ever since the

establishment of the WTO and its TRIPS agreement. As globalization continues to shape the world, an increasing interest by policymakers, academics, businesses and civil society organizations in analyzing the potential economic impact of IPRs continues to force itself into the scene. Intellectual Property is argued to be an avenue for economic development through wealth creation, however, the enforcement of IPR is not an end in itself but rather a means. Moreover, the effectiveness of such approach depends on the enforcement of these rights with a view and a plan towards achieving economic growth and development.

There is a significant diversity in the control of IPR across nations. Developed nations are in control of the future changing, cutting edge technologies in all areas of life; telecommunications, ICT, machinery, pharmaceuticals, space, clear energy and much more, and they are willing to share their intellectual property assets in exchange for oil, money, or even political reasons. They are therefore striving to protect their technological achievements and intellectual assets by establishing and celebrating stronger IP systems. It was on that basis that it has become mandatory for member states of the World Trade Organization (WTO) to have at least reasonable IP systems; if a country wishes to become a member it needs to sign and comply to the Trade Related Aspects of Intellectual Property Rights agreement, which to date is the most important and comprehensive multilateral agreement on IP rights protection.

On the other hand, developing countries are adopting economic and socio-political reforms, strategies and policies towards reaching better economic statuses aiming at engaging into the international economic systems, or aiming at maximizing their benefits through IP systems, or adopting them in such ways that are economically beneficial for them. The domestic benefits of strengthening IPR systems are not yet clearly identified, however, the limited empirical evidence and the experiences of a number of countries are used as as the basis of economic studies.

3.2 Literature Review

The literature on IPR has rapidly been expanding in the field of economic growth and development, since the Uruguay rounds and the establishment of the WTO with its TRIPS agreement. Such literature is mostly devoted to the impact of IPR in industrial economics, however, their direct relevance to the concerns of developing countries are not yet very clearly addressed in most of the available works. Enforcement of IPR has been a subject of academic and policy debate for many years; many raise doubts on the such welfare gains from IPR protection for the developing countries and others conclude that the link between IPRs and long-term economic growth remains poorly understood, and is likely to remain controversial in the short run scope (World Bank, 2001). Available economic evidence is still "fragmented and somewhat contradictory, in part because many of the concepts involved are not easily measured" (Maskus, 2001, p.458), despite the presence of a growing body of literature suggesting that stronger IPRs could increase economic growth and promote beneficial technical change if these property rights are structured in a way that encourages dynamic competition (Maskus & Penubarti, 1995).

On one hand, a first observation is that literature supporting strengthening and enforcing IPR systems is particularly developed either by developed countries, or constructed under the umbrella of international organizations governing IPRs and international trade. Advocates of IP argue that industrial progress is a crucial and indispensable factor in the development of society, and that technological inventions are necessary for society's progress, thus promotion of such innovations by giving exclusive rights is the cheapest initiative (for example: World Bank, 1999, 2001, Maskus & Penubarti, 1995; Maskus, 2000, 2001; Mascus & Fink, 2005; Prakash et al. 2010; Chen & Puttitanun, 2005; Chang, 2001; Falvey et al. 2006).

Praising the TRIPS, Dutta and Sharma (2008) point out that with an increasing trade and economic integration between countries, the differences of local IPR systems and laws become a source of tension in international economic relations, whereas the TRIPS is an attempt to narrow those gaps and relieve those tensions. Maskus (2001) indicates that "stronger intellectual property rights, if properly structured, can increase economic growth and encourage technological development" (p.57). Prakash et al (2010) also argue that for developing countries and least developed countries, enforcing

IPR systems can be a mechanism through which income for scientists and researchers will be generated, providing an incentive to innovate, attract investment and advanced technology, benefit from knowledge sharing and thereby generate wealth. At the same time, Diwan and Rodrik (1991) assure that if a developing country has special technological needs not present in other countries, such as drugs to fight country specific diseases, it has a stronger incentive to protect foreign intellectual property.

Moreover, the positive effects of stronger IPRs on trade and exports have been generally confirmed empirically by a number of studies (for example Ferrantino, 1993; Mascus & Penubarti, 1995; Mascus & Lahouel, 2000; Smith, 2001). Researchers have used various economic indicators to infer the effect of modifying IP to positively affect economic measures, resulting in strengthening economies and the international economic system as a whole, but mainly focused on trade, innovation and FDI. In a study covering 110 countries for the the period 1960-90, Park and Ginarte (1997) study how IPRs affect growth and investment and concluded that no direct relation between patent strength and growth could be identified despite the presence of a strong and positive impact of patent rights on physical investment and R&D spending, which in turn raised growth rates. Gould and Gruban (1996) also find a significant positive effect of the strength of patent protection systems on the economic growth of 79 countries. Rapp and Rozek (1990) study the relationship between the strength of IPR systems and the inflows of FDIs and GDP in general, and find a statistically strong positive one, but with no indication of causality and they conclude that countries had better adopt stronger IPR system as their economy reaches a developed level. Similarly, Branstetter and Saggi (2011) and Park (2008) suggest that strengthening IPRs will bring about increased inflow of FDIs and technology transfer into developing countries, which in turn will spur domestic innovation. Consequently, and with a panel of data for 64 developing countries, Chen and Puttitanun (2005) also confirm a positive impact of IPRs on innovations in developing countries and the presence of a U-shaped relationship between IPRs and economic development. Maskus et.al (1995, 2000, 2001) concludes that IPR protection regimes, together with a set of collateral policies and transparent regulation, are likely to have considerable positive potentials towards long-term economic growth and technological innovations among developing countries.

While on the other hand, various previous researchers have argued that if anyone has to benefit from tight IPR systems, it will not be the developing countries (for example: Braga et al. 2000, Kumar, 1996, 2003; Lesser et al. 1999). This is largely since tightening IPRs systems will make developed countries' innovators more powerful at the expense of their counterparts in developing countries, and this power will give the firms located in developed countries a stronger capability to arbitrarily increase prices in the developing countries in other to maximize profit (Cannady, 2004; Saint-Paul, 2008; Qiu & Lai, 2004; Borota, 2012; Hossain, & Lasker, 2010).

Critics of IPR frequently argue that developed countries and NIEs did not adopt strict IPR laws until after their economies were well advanced. In other words, that stronger IPR have long been associated with higher per capita GDP (Lesser et al, 1999), and that weak IPRs protect the poor in their countries against the high prices associated with stronger IPR regimes of developed countries (Primo et al. 2000). Grossman and Helpman (1991) hint that innovation is always likely to takes place in developed countries while imitation occurs in developing countries. Kumar (2003) suggests that strengthening IPR regimes is going to negatively impact the economies of poorer countries by "shocking an important contributor of growth that has been variously described as imitative duplication, reverse engineering or knowledge spill-overs from abroad" (p.222). Rushing and Thompson (1996) argue that the universally imposed patent protection are not sufficiently likely to positively contribute to growth in developing countries, and in another study, (1999), they add that patent protection could positively contribute to economic growth of countries that are already wealthy and developed.

In a survey of theoretical and empirical studies, Mazzoleni and Nelson (1998) explain that "there is reason for concern that the present movement towards stronger patent protection may hinder rather than stimulate technological and economic progress" (p.273). Dubey (1996) reveals that the GATT treaty is unequal, and that IPRs lead to anti-competition and anti-liberalization, and goes against the spirit of globalisation and global economic integration. Ferrantino (1993) reasons that MNEs even prefer FDIs over licencing in the case of weak IPR systems in developing countries, since internalized foreign production helps firms to maintain direct control over their property assets. It is useful to note that merely increasing IPR laws and enforcement will not by itself bring FDI into a developing country (Lee & Mansfield,

1996). Moreover, as for technology transfer, Twinomukunzi (1982) indicates that MNES usually have more considerations while making FDI decisions other than IPR systems, such as investment climate, economic and political circumstances, taxation and investment laws. Braga et al., (2000) explain that "most developing countries have not relied on IPR protection as a major mechanism to foster innovation" and that "developing countries have traditionally preferred rapid dissemination of knowledge at the expense of the protection of IPRs of foreigners." (p.1). They also added that the potential of IPR for economic development across different countries depends on "the amount of resources countries devotes to creating intellectual assets" (i.e. R&D) and "the amount of protected knowledge and information used in production and consumption" (p.12). Adams (2011) analyses the relationship between economic development and IPRs protection in 34 Sub-Saharan Africa countries using a panel data of four different time periods, and the results obtained indicate that strengthening IPRs have a negative effect on economic growth. Kanwar and Evenson (2003) work with time series data obtained for 32 countries between the periods 1981 and 1990 confirmed that strengthening IPRs protection has significant positive impact on R&D expenditure. The World Bank (1999, p.34) admits that stronger IPR systems may "adversely affect follow on innovations in developing as well as industrial countries, that draw on inventions whose patents have not yet expired," and that there is a concern that they might actually obstacle the "overall pace of innovation" (p.34).

Having examined the impact of IPRs protection on economic growth using a panel data of 80 developed and developing countries over the periods 1975-1994, Falvey et al. (2006) conclude that the relationship between IPRs protection and economic growth is ambiguous and has varying effect on country specific characteristics, and that this effect can be positively and significantly related to economic growth for low-income and high-income countries but not for middle-income countries. They also suggest that IPRs protection promotes innovation in high-income countries, and encourages technology or FDI inflow into low income countries but that low income countries suffer losses as a result of reduction in the gains they would have enjoyed from imitation.

In this context, it is useful to confirm that the impact of IPR on the economy generally, and on FDI, R&D and trade specifically, depends on unique circumstances, as well as on the IPRs measures themselves, among other variables. Additional

influencing factors include each country's special economic and political circumstances, its innovative potential and adaptive capacity, the educational level of its human resources and other factors.

The above review of literature suggests that the evidence of the role of IPRs as a determinant of economic growth for developing countries is still not strong, and remains unproven and under-researched. Maskus (2001) concluded that "developing nations face an important challenge reconciling intellectual property protection with the global push for more open, procompetitive trade", and that this issue is "empirical in nature" and "considerably more research needs to be done to understand the complexity involved" (pp.456:458). The World Bank is also aware that "interests in encouraging low-cost imitation dominate policy until countries move into a middle-income range with domestic inventive and absorptive capabilities" and that "only at high income levels do patent rights become strongly protective" (World Bank, 2001p.132). Curtis (2012) summarizes his study on IPR and trade that "Economics can also help establish causality where it exists, as well as patterns of probability. There are no absolutes in economics; the question is not whether domestic or international legal obligations are being met, but whether the benefits to the individual creator/innovator and ultimately to society outweigh the costs to society in terms of potentially higher costs, lower output, less innovation and creativity, or reduced/delayed access by users because of the exclusive intellectual property monopoly rights granted by government" (p.4)

But at least, developing countries could focus on becoming "the promoters of a transitional innovation system" in which applying stronger IPR systems was not the end in itself but rather the means of "generating more scientific and technological innovations, and foster the exchange between innovators at work on common technologies." (Maskus & Reichman, 2004p.311)

To sum up the, the relationship between IPRs and economic development is suggested by almost all the literature reviewed to be complex, with no theoretical prediction and empirical evidence as yet on the effect protection on growth. Besides, that "the complexities of development and IPRs could combine to generate a variety of positive and negative effects" whereas "the challenge for governments is to strike an appropriate balance that promotes rigorous but fair dynamic competition" (Maskus, 2001p.459).

But there are some generic conclusions that were made by most of the literature. Firstly, IPR systems are likely to impact economic growth more effectively in open economies; those ones that are open to international trade and investment. The hopes rise here that foreign competition aroused by MNEs would push domestic firms to invest in new technology and higher product quality (Gould & Gruben, 1996). Secondly, there exists a mutual relation between IPR and other IPR and economic variables, particularly FDIs, Trade and R&D. These processes yet have to take firm hold in developing countries, as it is still debated to be not always favourable for them, though, agreed to be positive on developed ones, and they appear to become more mature and cumulative as countries grow richer. Moreover, while IPR systems affect FDI, Trade and R&D, the of FDI, Trade and R&D also determine how strong or weak the IPR will be. (Park & Ginarte, 1997; Borensztein et al., 1998). But most importantly, IPR systems would be effective and powerful if establishing and enforcing them is also is accompanied by other economic policies and sound administrative practices; baring into consideration (Braga et al. 2000). Finally, IPRs are only economically useful where new innovations are allowed to be brought freely to the national and international marketplace; thus, “countries should reduce barriers to the commercialization of new knowledge within their national innovation systems” (Mascus & Lahouel, 2000p.604).

4. Data Source

This paper counts on both primary and secondary qualitative and quantitative types of data. Primary data for the is be obtained from organizations such as the World Bank, WIPO and WTO websites. Secondary sources of data used are the academic journals, empirical studies, theses, country reports and development policy documents. This research also seeks to reach primary information from Indian government websites, mainly: www.ipindia.nic.in and www.dipp.nic.in

Data used in case study analysis on India is obtained as follows:

IP measures: numbers of the sealed patents, designs and trademarks is obtained from the Annual Reports of Office of Controller General of Patents, Designs and Trademarks[8]. Those numbers are aggregated and used in the analysis as one variable under the name of "IP Measures".

GDP, FDI and Exports: Data obtained from the data bank of World Bank for the years 2000-2015 as measured in USD.

R&D is available as a percentage of GDP on the World Bank data bank, so this percentage is used to calculate the value of the GDP by the following formula:

R&D = Percentage*GDP

The logged value of the previous data is used in the analysis, in order that the values are more behaved and to explain the values in terms of percentages, if a relation is found between them.

[8] from their website of report: www.ipindia.nic.in

5. Research Method

The research questions will be addressed with a quantitative method approach. Quantitative research method is the examination of a given phenomena through investigation and analysis of specific quantitative attributes with the aim of understanding the relationship between the attributes and the phenomena (Hunter & Leahey, 2008). Quantitative research therefore, entails the collection of numerical data and subjecting to analysis using one or more statistical tools (Spring et al. 2013).

The quantitative research design will be needful for the study as to analyze the relationship between innovation, FDI, trade and IP protection. Based on a case study on India, primary time series panel data for the years 2000-2015 will be studied and analyzed to reach the paper findings. The questions to be answered are with regards to the behavior of GDP, FDI, Trade and R&D in stands with the local IP protection system adopted. This analysis will be done using an IPR index of the summation of the other IPR measures available.

Ideally it is important to use a sample size that will yield a sampling error that is as small as possible, and the sample size is usually inversely proportional to the sampling error that is the larger the sample size the smaller the sampling error, such as nonresponse biases or nontruthful responses (Albright et al. 2003). However, due to some factors as the availability of primary data and the recency of the topic, the sample size is not big enough as wished to be.

6. Case Study on India

6.1 Applying IPR System in India

India is a member of World Intellectual Property Organization since 1975, and a member of the World Trade Organization since 1995. Unlike many other emerging counties, the Indians enjoyed a longer transition period of ten years before they were required to introduce the product patents in order to become fully compliant to the TRIPS Agreement, because they had already had a patent regime previously. Hence, as a contractual obligation towards the TRIPS, and a consideration to the possibility and potentials of IPR as a growth enhancer and enabler, and with an objective of building a reliable IPR system, India has been taking a number of steps that include human resources development, procedural improvement which included efficient IT enabled processing and administrative functioning, all under an umbrella of the legislative steps.

The transformation of India's patent laws was a three-stage process clear in the amending process of the Patents Act of 1970. First, the Patents Amendments Act of 1999 which allowed inventors to file patent applications for products invented after 1995. Second, the Patents Act of 2002 further amended the 1970 Act by providing the TRIPs-required twenty-year patent term. Last, India finally put product patent protection into full effect as of January 1, 2005. India is also putting efforts to place the necessary jurisdiction, infrastructure, computerization, database upgrading and avail the adequate technical manpower in order to deal with the new system.

It is worth noting that India had inherited Patent and Design Act 1911 from its colonial times. Besides, that the Patents Act, 1970 was marked by many as a landmark in the Indian industrial development, with its basic philosophy to encourage inventions and secure that those inventions are protected, because it is believed to have provided the reasonable balance between adequate and effective protection of patents on the one hand and technology development, public interest on the other hand. For example, quantitative studies by Basant and Fikkert (1996), Kumar and Saqib (1996), have shown that the innovative activity of Indian domestic enterprises was encouraged by the Patent act 1970. Sheehe (2009) has used panel data from India for 1989 to 2005 to examine whether or not the signing of the TRIPs positively affected innovation and technology transfer in the country, and has concluded that strong evidence that the post-

TRIPs era is associated with increased expenditure on R&D and patent applications by domestic firms in India. Moreover, qualitative studies by Lanjouw and Cockburn (2000) using the results of interviews with industry and government representatives about measures of R&D find some limited evidence of an increase in the 1980s, which later on increased after the 1990s. However, it is also important to note that some other economists argue that large foreign firms were not in favour of Patent act 1970; and that Indian firms wished for greater access to patented know-hows and products (for example: Desai, 1980).

India and many other developing countries were opposing the inclusion of patent and intellectual property rights in the WTO accord during the first three years of the Uruguay round of trade negotiations; they had previously viewed the GATT to be a tool by which developed countries would impose strong obstacles to hinder developing countries from entering western markets. They were worried about the negative effect a stronger IPR system could have on the innovative activity in many fields; especially technological and medical business, by shocking the knowledge spillovers and implications and affecting the availability to the mass underprivileged population.

But then, in order to join the open international economy and join the race of globalization, and as per the TRIPS compliance standards, India is supposed to have fine-tuned its IPR regime as per its developmental requirements and market system.

It is believed by many policy makers that strengthening the IPR system is substantial for India's economic growth and development process. Hence, India's national improved IPR policy is a reflection of the ongoing process of marketing India's IP regime globally. The improvements are aspired to result in making India more attractive to FDIs, earning more through exports and encouraging R&D. Policy makers even go further that the TRIPs and WTO would be responsible for attracting the entry of MNEs into India in large numbers and for improving trading relations between India and many developed countries.

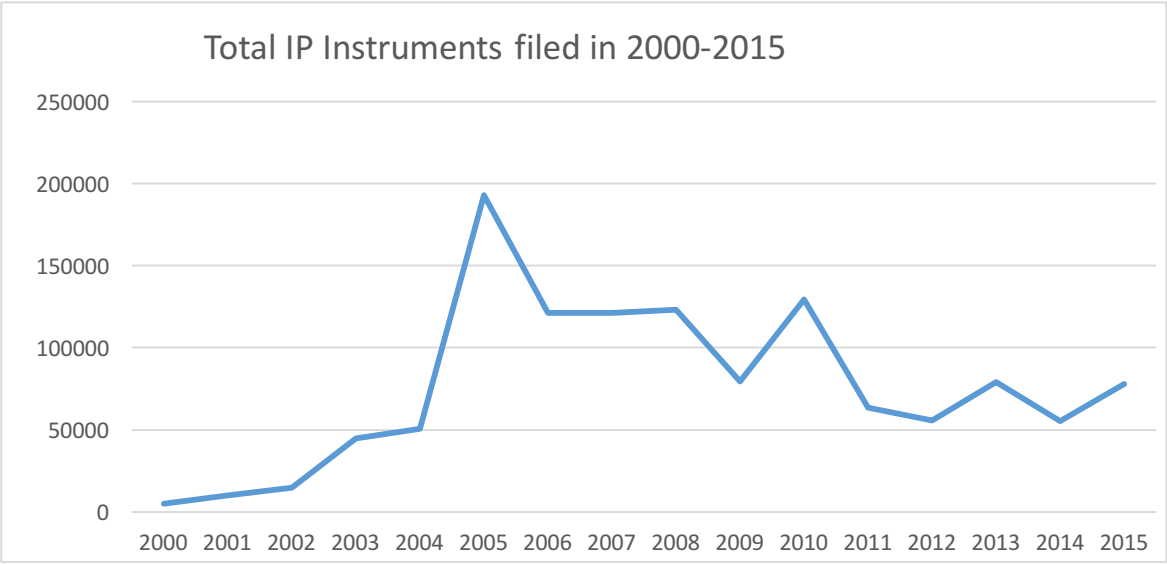
6.2 Data of IPR in India

Below are the statistics of the filed IP measures in India; the patents, trademarks and industrial designs, during the period **2000-2015**:

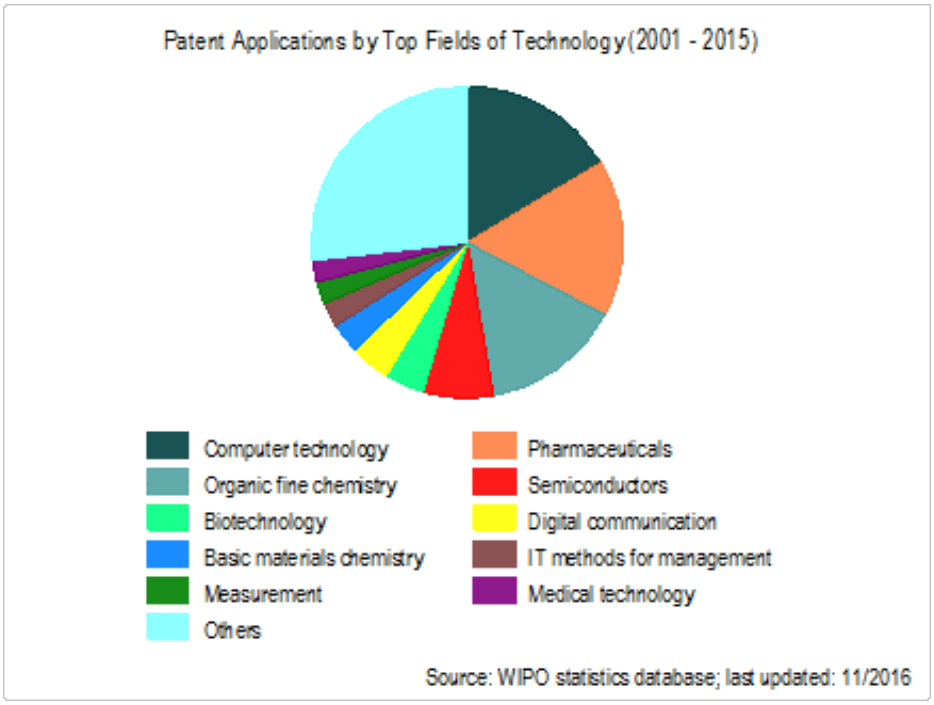
(1)

Year	Patent Granted	Trademarks Registered	Designs Registered
2000	1318	1318	2430
2001	1591	6204	2426
2002	1379	11190	2364
2003	2469	39762	2547
2004	1911	45015	3728
2005	4320	184325	4175
2006	7539	109361	4250
2007	15261	100857	4928
2008	16061	102257	4772
2009	6168	67490	6025
2010	7509	115472	6590
2011	4381	51735	7252
2012	4126	44361	7178
2013	4226	67,876	7147
2014	5978	41583	7904
2015	6326	65045	6590

Table (1) Filed Patents, Trademarks and Designs in India during the period (2000-2015), Source: Annual Reports of Office of Controller General of Patents, Designs and Trademarks : www.ipindia.nic.in)



Graph (1): Total filed and sealed IPR instruments in the period (2000-2015). Data collected from : www.ipindia.nic.in and graph developed by self.



Graph (2)Pie Chart of Patent Applications by top fields of Technology (2001-2015).
Source: WIPO statistics database

By observing the previous figures and graphs, we get to observe that:

(a) The number of sealed patents, trademarks and industrial designs is on a fluctuating increasing trend during the period 2000-2015.

(b) As per graph (1), the sum of patents, trademarks and designs peaked in 2005, the year when India became fully compliant to the TRIPS agreement, probably as a result of having a huge backlog previously, then it fell back to a more stable though still increasing trend. It fell back in 2008, probably having been affected by the financial crisis of 2008-2009, increased in 2010, then fell back again to be more of a steady stable trend.

(c) IPRs are granted in many different fields, with a heavier weight of pharmaceutical, computer technology and organic fine chemistry fields more than the other fields, as seen in graph (2).

6.3 Aim of Case Study

A time series panel data for the period (2000-2015) is used to examine whether strengthening IPR Indian system has also led to the increase of FDIs, exports and expenditure on R&D, thus led to the enhancement of the economic variables of the Indian economy and the economic growth as a result. The question that this paper is trying to answer is whether strengthening IPR systems in India also has a positive/negative and/or causality effect on the FDI, R&D and trade, and thus affecting the economic growth of India.

Year	IP	FDI	GDP	Trade	R&D
2000	5066	3584217307	4.76609E+11	60878396866	3545733802
2001	10221	5128093562	4.93954E+11	60963525504	3572424703
2002	14933	5208967106	5.23968E+11	73452725999	3736732796
2003	44778	3681984671	6.18356E+11	90838365704	4371099952
2004	50654	5429250990	7.21585E+11	1.26648E+11	5367508521
2005	192820	7269407226	8.34215E+11	1.60838E+11	6760809643
2006	121150	20029119267	9.49117E+11	1.99974E+11	7566548632
2007	121046	25227740887	1.20107E+12	2.52325E+11	9498076768
2008	123090	43406277076	1.18691E+12	2.88043E+11	9982891503
2009	79683	35581372930	1.3239E+12	2.72938E+11	10840196069
2010	129571	27396885034	1.65656E+12	3.74237E+11	13205782246
2011	63368	36498654598	1.82299E+12	4.47384E+11	14989348834
2012	55665	23995685014	1.82812E+12	4.48401E+11	
2013	79249	28153031270	1.85724E+12	4.7218E+11	
2014	55465	34576643694	2.03353E+12	4.6833E+11	
2015	77961	44009492130	2.08884E+12	4.16787E+11	

Table (2) Data used in the Case Study performed on India. IPR statistics obtained from www.ipindia.nic.in (summation of the previous table), while FDI, Trade, GDP and R&D Complied from the World Bank Data Bank.

Data used is the table and graph show that there is an increasing trend in the all variables under question.

Graph (3) Source: Data of Table (2), graph developed by self

6.4 Data Analysis and Model Identification

- The logged value of the previous data is used in the analysis, in order that the values are more behaved and to explain the values in terms of percentages, if a relation is found between them.
- In order to use this data for our analysis, we needed to perform the following steps:

6.4.1 Checking for Unit Root:

A time series Y_t is Stationary if for all values and all time periods, it is true that the mean is constant, the variance is constant, and the covariance depends on s not t as follows:

$$E(y_t) = \mu \qquad var(y_t) = \sigma^2 \quad cov(y_t, y_{t+s}) = cov(y_t, y_{t-s})$$

1) The data was inspected graphically, and the inspection showed that the data was stationary or stationary with a trend[9]. It was clear from the graphs that stationarity exists.
2) In order to further test for stationarity, the Augmented Dickey Fuller test was carried out. We used the ADF instead of the Dickey Fuller test, as The Dickey Fuller test can suffer from auto-correlated errors. It is important to add lagged differenced terms to the ADF test equation in order to allow for the possibility that the error term could be correlated. Using the testing down approach, we wanted to reach a parsimonious equation that of the dependent variables. result that the

   H_0: Variable is not stationary, got unit root
   H_1: Variable is stationary, no unit root

   However, the results of the ADF method show that the variables are not stationary by the testing down approach starting from the 5th lag. From the test performed, the decision is to accept H_0 for the IP, FDI, GDP, EXPORTS and R&D variables with 95% confidence level. Table available in the annex. Besides from the graphical inspection and tests above, we conclude that our data has unit root, and it is not stationary. We could not reach our parsimonious equations our variables at I(0).[10]

[9] Graphs of inspection available in the annex (1)
[10] Results of ADF in Annex (2)

6.4.2 Treating Unit Root

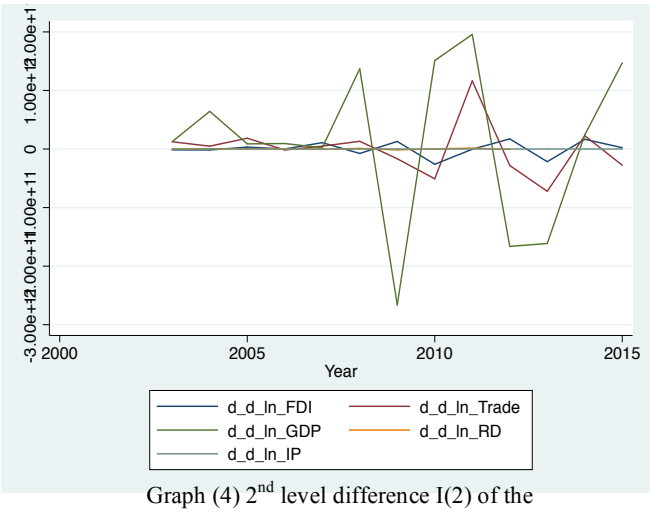
Since ADF test showed that stationarity still existed in the 1st difference, the 2nd difference is taken for our logged variables. **Parsimonious levels are reached at the 2nd differences:**

Variable	lags	specification	statistic	critical	obs	conc
D_d_ln_IP	3	No trend no constant	-4.705	-3.000	9	Reject H_0
d_d_ln_FDI	1	Trend and constant	-3.682	-3.600	11	Reject H_0
D_d_ln_GDP	2	Trend and constant	-3.784	-3.600	10	Reject H_0
d_d_ln_Trade	1	trend no constant	-4.849	-3.600	11	Reject H_0
D_d_ln_RD	1	Trend no constant	-3.433	-3.000	11	Reject H_0

Table (3) Parsimonious levels reached at 2nd difference of the variables, re-inspected graphically and through Augmented Dickey Fuller test, other non stationary variables in the annex.

6.4.3 Engle Grange Method Procedure

We know that if we run regression model with non stationary variables, the regression model will be spurious. However, the could exist a tendency for some economic time series to move together establishing long term relationship among trending variable (Engle & Granger, 1987). Such a process is called co-integrating, if a linear combination of the components is stationary (Engle & Granger, 1987); thus two or more series are said to be co-integrated if there exists a linear combination of them and they are integrated on the same level. Aiming at identifying if there is a long or short term or a short term relation between our variables, Engle-Granger method is used. The conditions for using this method is that (a) the variables should be non stationary at level I(0), and that (b) the variables should be stationary at the same level



Graph (4) 2nd level difference I(2) of the non stationary variables, that has become stationary after differencing. To be checked for co-integration

of difference. Since the variables stationary at I(2), we will perform the Engle-Granger test as follows:

H_0: Unit Root of Residuals
H_1: No Unit Root of residuals

Having regressed the variables, and having checked the stationarity of the residuals through using the ADF test, we get to the test statistic value = -3.745. By comparing this statistic to the Engle Granger critical value; |-3.624| > |-2.76|, and since our test statistic > critical value Therefore, we can reject the null hypothesis of the unit root, and accept the alternative hypothesis that there is stationarity in the residuals, thus conclude that the residuals are stationary, which shows that our model is not spurious. This also means that our variables are cointegrated, and that there is a long term relationship between our variables, and we can perform a regression model for our variables. [11] Since our variables are cointegrated, we can regress them though they are not stationary. However, it is worth noting that However, it is worth noting that there has been some criticism for the Engle Granger method. Hargreaves (1994) argued that large samples are needed to be able to get accurate or near accurate results, in addition that it can only detect maximum one cointegration relationship. But since we only want to detect the presence or not of a long term equilibrium relationship between the variables, and since Engle Granger method is more popular for the risk of Type 2 error[12], it could be helpful for us to depend on it in our test for cointegration.

[11] ADF test results for stationarity of residuals in annex (3)
[12] Type (2) Error defined as power of the test error, meaning the probability to reject a false null hypothesis. There was an effect but the test could not capture it since it didn't reject the null hypothesis

6.4.4 Model Identification

Model (1) To answer the research question whether IP measures affect FDIs, a regression analysis is performed of the logged FDI variable on logged the Intellectual Property Rights variable where the dependent variable is the FDI and the independent variable is the IP, and E_t is the white noise error term:

$$\mathbf{FDI_t = B_1 + B_2IP_t + E_t}$$ [13]

From the results we get, we get that the probability of the whole model, and of $\mathbf{B_2}$ is more than 5%, thus not significant.

Model (1.1) Vector Error Correction: We use the differenced variables that proved to be stationary at I(2), and U_{t-1} is the lagged residual of model 1. It is also the error correction term that guides the variables of the system to restore equilibrium. The coefficient B_5 tells us at what rate it corrects the previous period disequilibrium of the system. If B_5 is significant and with a negative sign, this validates that there is a long run equilibrium relationship between our variables.

$$\mathbf{d\_d\_ FDI_t = B_3 + B_4d\_d\_IP + B_5U_{t-1}}$$ [14]

a) Long Run Causality: CE1 (Error Correction term = -0.117272) is not significant (though negative) because its probability is more than 5%, therefore there is no long run causality running from IP to FDI.
b) Short Run Causality: Probability of the lag of IP is not significant, thus it can not explain a short run causality towards FDI

Thus we can conclude that there is no short term or long term causality relation between IP and FDI. IP does not cause FDI in the short run or the long run.

Model (2): To answer the research question whether IP measures affects Trade, a regression analysis is performed of the logged Trade variable on logged the IP variable where the dependent variable is the Trade and the independent variable is the IP, and F_t is the white noise error term:

$$\mathbf{TRADE_t = B_6 + B_7IP_t + F_t}$$ [15]

[13] Variables just for simplicity are renamed as FDI and IP, but the variables used are the logged variables. Results available in the annex (5).
[14] Id
[15] Id

From the results we get, we get that the probability of the whole model, and of $\mathbf{B_7}$ is more than 5%, thus not significant.

Model (2.1) Vector Error Correction: We use the differenced variables that proved to be stationary at I(2), and R_{t-1} is the lagged residual of model 2.

$$\mathbf{d\_d\_TRADE_t = B_8 + B_9 d\_d\_IP + B_{10} R_{t-1}}$$ [16]

a) Long Run Causality: CE1 (Error Correction term = -0.2937045) is not significant (though negative) because the probability is more than 5%, therefore there is no long run causality running from IP to Trade.
b) Short Run Causality: Probability of the lags of IP is not significant as they are more than 5%, thus it can not explain a short run causality towards Trade

Thus we can conclude that there is no short term or long term causality relation between IP and Trade. IP does not cause Trade in the short run or the long run.

Model (3): To answer the research question whether IP measures affects R&D, a regression analysis is performed of the logged R&D variable on logged the IP variable where the dependent variable is the R&D and the independent variable is the IP, and J_t is the white noise error term:

$$\mathbf{RD_t = B_{11} + B_{12} IP_t + J_t}$$ [17]

From the results we get, we get that the probability of the whole model and of $\mathbf{B_{12}}$ is more than 5%, thus not significant.

Model (3.1) Vector Error Correction: We use the differenced variables that proved to be stationary at I(2), and G_{t-1} is the lagged residual of model 3

$$\mathbf{d\_d\_RD_t = B_{13} + B_{14} d\_d\_IP + B_{15} G_{t-1}}$$ [18]

a) Long Run Causality: CE1 (Error Correction term = -0.3285628) is not significant (though negative) because the probability is more than 5%, therefore there is no long run causality running from IP to R&D.
b) Short Run Causality: Probability of the lags of IP is not significant as they are more than 5%, thus it can not explain a short run causality towards R&D

Thus we can conclude that there is no short term or long term causality relation between IP and R&D. IP does not cause R&D in the short run or the long run.

[16] Results of Model in Annex (5)
[17] Id
[18] Id

Model (4): To answer the research question whether IP measures GDP in general, a regression analysis is performed of the logged GDP variable on logged the IP variable where the dependent variable is the GDP and the independent variable is the IP, and Q_t is the white noise error term:

$$\mathbf{GDP_t = B_{16} + B_{17}IP_t + Q_t}$$ [19]

From the results we get, we get that the **probability of the whole model** and of B_{17} is more than 5%, thus not significant.

Model (4.1) Vector Error Correction: We use the differenced variables that proved to be stationary at I(2), and H_{t-1} is the lagged residual of model 4.

$$\mathbf{d\_d\_GDP = B_{18} + B_{19}d\_d\_IP + B_{20}H_{t-1}}$$ [20]

a) Long Run Causality: CE1 (Error Correction term = -1.369829) is not significant (though negative) because the probability is more than 5%, therefore there is no long run causality running from IP to R&D.

b) Short Run Causality: Probability of the lags of IP is not significant as they are more than 5%, thus it can not explain a short run causality towards GDP

Thus we can conclude that there is no short term or long term causality relation between IP and GDP. IP does not cause GDP in the short run or the long run.

Summary of the findings:

- No relationship could be identified between the IP variables and each of the FDI, Trade, R&D or GDP variables in models 1,2,3,4. The values of B_1, B_6, B_{11} and B_{15} were insignificant, so we failed to reject the null hypothesis that B=0 for all of them
- No short term or long term causality could be identified in the regressed models after applying the Vector Error Correction Model approach, as seen in Model 1.1, 2.1, 3.1 and 4.1 because the values of alpha and beta of the model were insignificant.

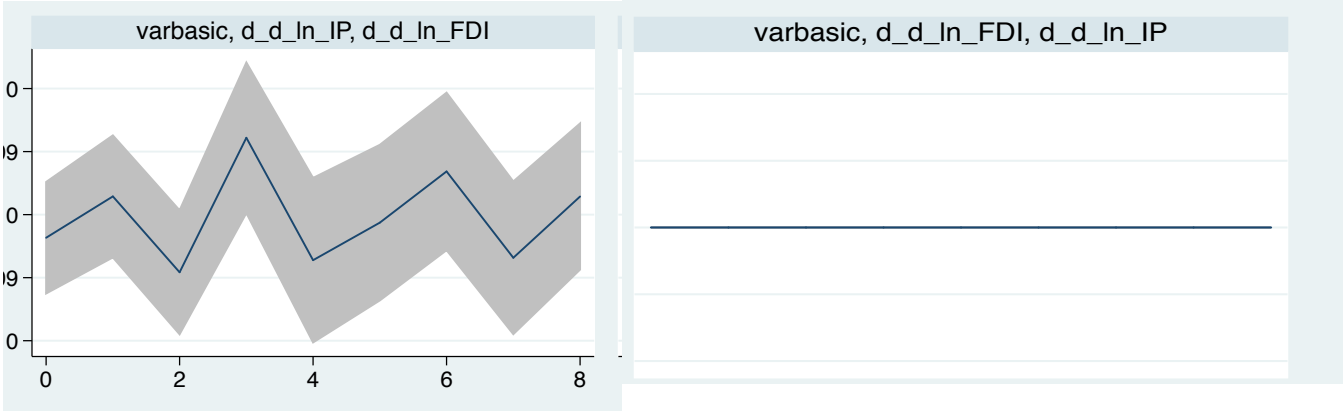
[19] Results of the model in Annex (5)
[20] Id

6.4.5 Impulsive Response Function and Granger Causality

Checking for the impulse response of a one unit change in each of the variables with a 95% confidence interval. The results are estimated in the graphs and tables below:

H0: X does not Granger-cause Y
H1: X Granger-causes Y

FDI and IP



Graph (5) Impulsive Response Function for the FDI and IP variables

A shock to the IP variable will result in an effect that is significantly different from zero a negative effect on the FDI in the beginning, then it will change to be positive then negative and so on.

A shock in the FDI variable will result in no effect on the IP variable

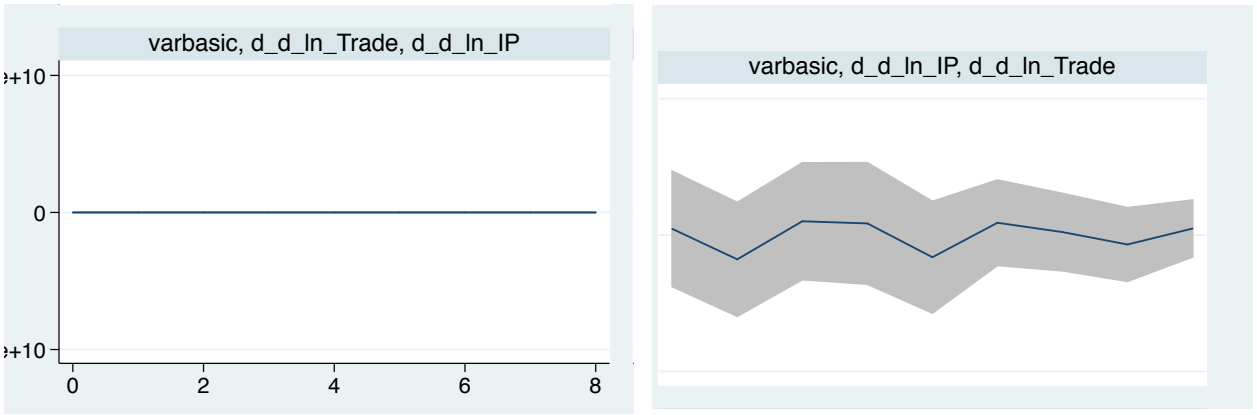
Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
d_d_ln_IP	d_d_ln_FDI	**1.1998**	**2**	**0.549**
d_d_ln_IP	ALL	**1.1998**	**2**	**0.549**
d_d_ln_FDI	d_d_ln_IP	**7.3355**	**2**	**0.026**
d_d_ln_FDI	ALL	**7.3355**	**2**	**0.026**

Table (4) Granger Causality Wald Test results for FDI and IP

We fail to reject the null hypothesis since our p values are greater than the significance value of 5%

Trade and IP



Graph (6) Impulsive Response Function for the Trade and IP variables

A shock in the FDI variable will result in no effect on the Trade variable

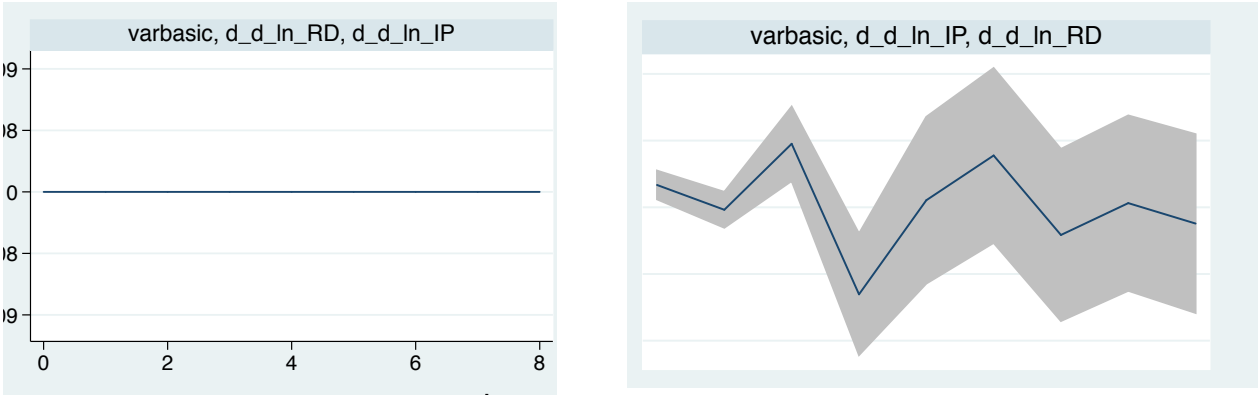
A shock to the IP variable will result in an effect that is significantly different from zero, and it has a negative effect on the Trade

Equation	Excluded	chi2	df	Prob > chi2
d_d_ln_IP	d_d_ln_Trade	**1.293**	**2**	**0.524**
d_d_ln_IP	ALL	**1.293**	**2**	**0.524**
d_d_ln_Trade	d_d_ln_IP	**.77916**	**2**	**0.677**
d_d_ln_Trade	ALL	**.77916**	**2**	**0.677**

Table (5) Granger Causality Wald Test results for Trade and IP

We fail to reject the null hypothesis since our p values are greater than the significance value of 5%

R&D and IP



Graph (7) Impulsive Response Function for the R&D and IP variables

A shock in the R&D variable will result in no effect on the IP variable

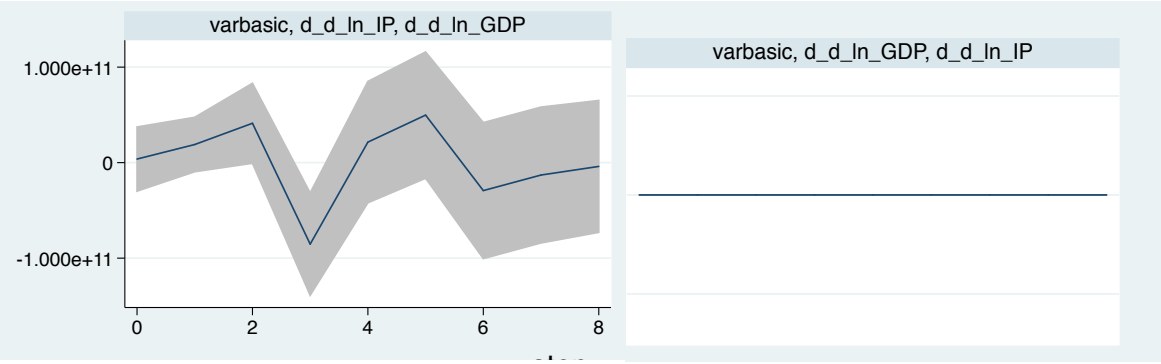
A shock to the IP variable will result in an effect that is significantly different from zero, starts as a negative effect on the R&D in the beginning, then it changes to be positive then negative and so on.

Equation	Excluded	chi2	df	Prob > chi2
d_d_ln_IP	d_d_ln_RD	.35789	2	0.836
d_d_ln_IP	ALL	.35789	2	0.836
d_d_ln_RD	d_d_ln_IP	80.672	2	0.000
d_d_ln_RD	ALL	80.672	2	0.000

Table (6) Granger Causality Wald Test results for R&D and IP

We fail to reject the null hypothesis that IP granger causes R&D since our p values are greater than the significance value of 5%. However, we can reject the null hypothesis and accept the alternative hypothesis that the R&D granger causes IP since the p value is smaller than 5%.

GDP and IP



Graph (8) Impulsive Response Function for the GDP and IP variables

A shock to the IP variable will result in an effect that is significantly different from zero a negative effect on the GDP in the beginning, then it will change to be positive then negative and so on.

A shock in the FDI variable will result in no effect on the GDP variable

Equation	Excluded	chi2	df	Prob > chi2
d_d_ln_IP	d_d_ln_GDP	**1.2011**	**2**	**0.549**
d_d_ln_IP	ALL	**1.2011**	**2**	**0.549**
d_d_ln_GDP	d_d_ln_IP	**28.786**	**2**	**0.000**
d_d_ln_GDP	ALL	**28.786**	**2**	**0.000**

Table (7) Granger Causality Wald Test results for GDP and IP

We fail to reject the null hypothesis that IP granger causes R&D since our p values are greater than the significance value of 5%. However, we can reject the null hypothesis and accept the alternative hypothesis that the GDP granger causes IP since the p value is smaller than 5%

6.4.6 Checking for Normality of Residuals

H_0: Residuals are not normally distributed
H_1: Residuals are normally distributed

Jarque-Bera test

Equation	chi2	df	Prob > chi2
d_d_ln_IP	1.775	2	0.41164
d_d_ln_FDI	1.115	2	0.57258
d_d_ln_GDP	3.035	2	0.21922
d_d_ln_Trade	0.619	2	0.73364
d_d_ln_RD	2.342	2	0.31007
ALL	8.887	10	0.54285

Skewness test

Equation	Skewness	chi2	df	Prob > chi2
d_d_ln_IP	1.0238	1.398	1	0.23713
d_d_ln_FDI	.34799	0.161	1	0.68781
d_d_ln_GDP	1.4941	2.977	1	0.08448
d_d_ln_Trade	-.26597	0.094	1	0.75875
d_d_ln_RD	-1.2838	2.197	1	0.13824
ALL		6.827	5	0.23379

Kurtosis test

Equation	Kurtosis	chi2	df	Prob > chi2
d_d_ln_IP	4.0643	0.378	1	0.53889
d_d_ln_FDI	1.3085	0.954	1	0.32877
d_d_ln_GDP	2.5802	0.059	1	0.80851
d_d_ln_Trade	1.7448	0.525	1	0.46866
d_d_ln_RD	2.3418	0.144	1	0.70394
ALL		2.060	5	0.84084

Table (8) Checking for normality of residuals, results of Jaque Bera, skewness and kurtosis tests.

For the 3 tests, Jarque Bera, Skewness test and Kurtosis test, we have a P value bigger than 5%, therefore we can not reject null hypothesis, so the residuals are not normally distributed.

Summary and Findings

Using a panel time series data of Indian economic variables: GDP, FDI, Trade and R&D together with the summation of its IPR measures: Patents, Trademarks and Industrial Designs for the period 2000-2015, the following steps were taken:

- Variables were logged, and the logged variables were used in the analysis, so that they are more behaved, and to explain the relationships between them using percentages.
- The time series proved to have unit root when tested using ADF test, thus stationarity was treated by taking second difference of the variables, since first difference was still stationary. Stationarity was confirmed in the I(2) variables using ADF test.
- Engle-Granger method was used to check if the variables are cointegrated, by comparing the t statistic of the residuals to the EG values. The variables were found to be cointegrated.
- Regression analysis was performed to test the relation between IP and other economic variables. But no relationship could be identified between the IP variables and each of the FDI, Trade, R&D or GDP variables in models 1,2,3,4. The values of B_1, B_6, B_{11} and B_{15} were insignificant, so we failed to reject the null hypothesis that B=0 for all of them
- No short term or long term causality could be identified in the regressed models after applying the Vector Error Correction Model approach, as seen in Model 1.1, 2.1, 3.1 and 4.1 because the values of alpha and beta of the model were insignificant.
- IRF was used to check what would happen to the studied economic variables if a shock was introduced to the IP variable, and the results showed that some effects happen on the economic variables, but not vice versa.
- Granger Causality test was used to test if IP granger causes other economic variables, however, the null hypothesis could not be rejected.
- Normality of the residuals was checked, and the null hypothesis was not rejected, meaning that the residuals are not normally distributed.
- From all the previous points we can conclude that no positive, negative or causality relations could be identified between the dependent and independent variables.
- Since the residuals are not normally distributed, we might need to rethink the whole model in future research, and a bigger sample could be used for the analysis, to decrease the sampling error, and to reached unbiased results

Conclusion

There is significant complexity about the relationship between applying and tightening the IPR systems and the economic growth of developing countries; especially when observed through FDIs, Trade and Innovation. Solid evidence of economic pay off as a result of IP protection is not yet sufficiently developed. The ambiguity of this relationship tends to support both optimistic and pessimistic claims about how developing countries will be affected, since none of these claims has been decisively rejected by theoretical or empirical analysis. Thus, strengthening IPR systems may result in expanding growth of economies, but ay also offer no improvement or even retard conditions for development under certain circumstances. On all sides, special cases bound.

However, this opens up new avenues for more research and studies to investigate the economic implications of stronger IPRs systems, especially those enforced and celebrated by international organizations like WIPO and WTO. Besides, comprehensive studies evaluating adequate levels of IPR system in each developing country needs to be carried out, taking into account each nation's special situation, especially its level of development and institutional capacity as well as the social, cultural, humanitarian, political and even constitutional considerations.

We can still reach another conclusion, which is that IPRs provide an important foundation for sophisticated business structures. IPRs are likely to emerge even more in the near future, as it is generally agreed that knowledge and technology have played, and will play the vital role in the economic growth and development of developing countries. Developing countries need to adopt some form of IPR system sooner or later them so that can join the race of globalization and international trade. The most popular challenge they will face resulting from strengthening their IPR systems is the escalation of essential products' prices, but it is also important to look at the subject from another scope and to realize that only under protective umbrella of an effective IPR regime, research and innovation can drive existing technology to higher levels which in turn will improve affordability and efficacy.

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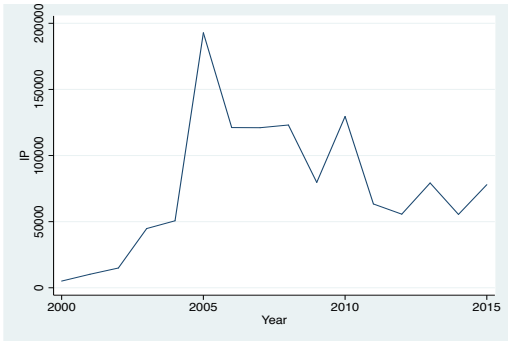
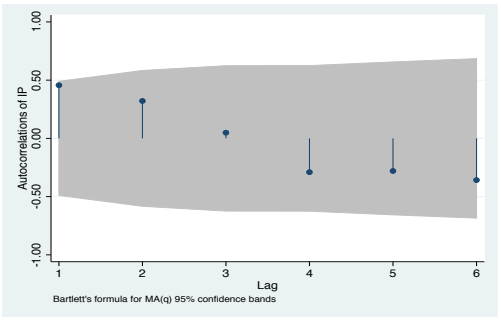
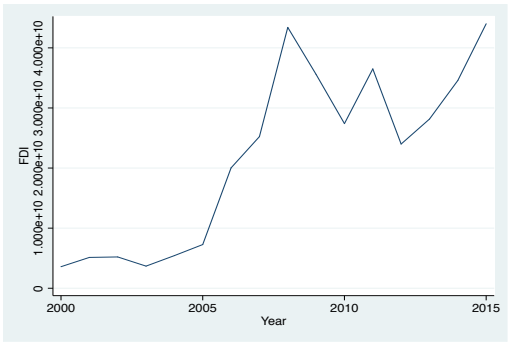
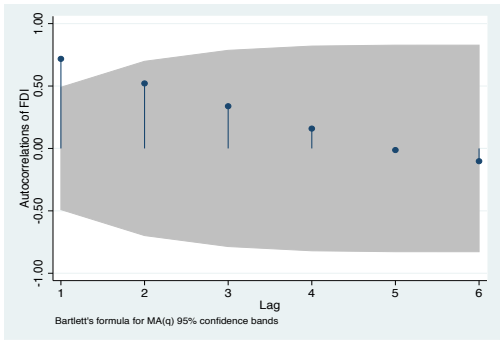
Annex

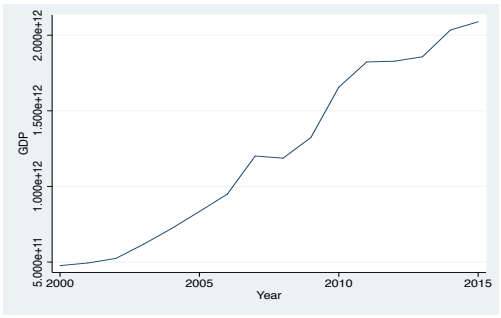
Annex (1): Graphical inspection of variables:

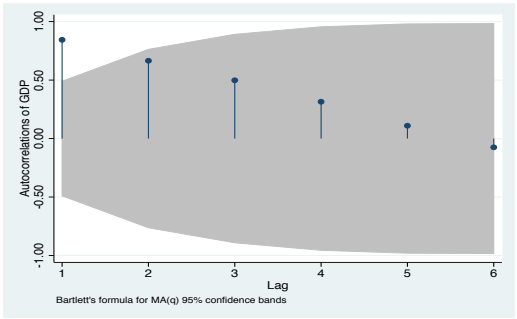


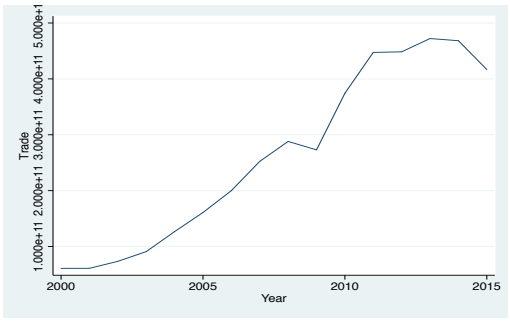


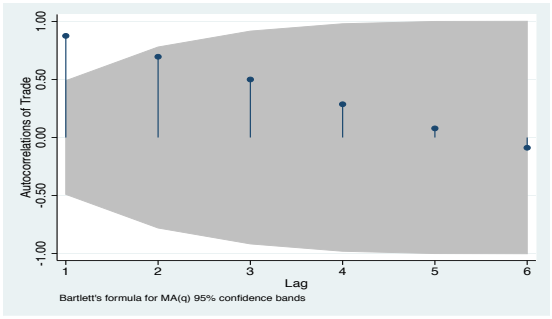


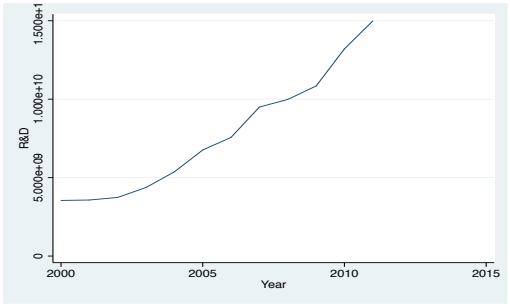


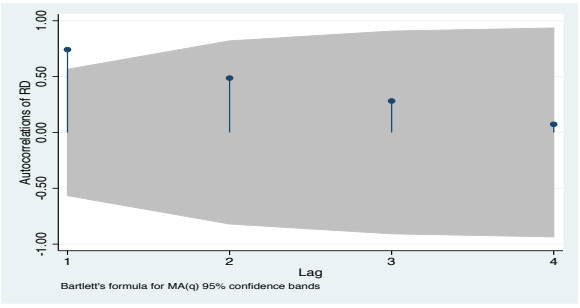












Annex (2)

Comparing statistic with critical values, all variables still appear to be not stationary at I(0)

Variable	**lags**	**specification**	**statistic**	**critical**	**obs**	**conc**
IP	3	Trend and constant	-2.362	-3.600	11	DNR H0
	3	Trend no constant	-2.362	-3.600	11	DNR H0
	3	No trend no constant	-2.622	-3.000	11	DNR H0
FDI	4	Trend and constant	-2.247	-3.600	11	DNR H0
	4	Trend no constant	-2.247	-3.600	11	DNR H0
	4	No trend no constant	-0.858	-3.000	11	DNR H0
GDP	4	Trend and constant	-1.357	-3.600	11	DNR H0
	4	Trend no constant	-1.357	-3.600	11	DNR H0
	4	No trend no constant	-1.087	-3.000	11	DNR H0
EXPORTS	4	Trend and constant	-1.579	-3.600	11	DNR H0
	4	Trend no constant	-1.579	-3.600	11	DNR H0
	4	No trend no constant	-0.903	-3.000	11	DNR H0
R&D	3	Trend and constant	-1.810	-3.600	11	DNR H0
	3	Trend no constant	-1.810	-3.600	11	DNR H0
	3	No trend no constant	1.100	-3.000	11	DNR H0

Annex (3)

Augmented Dickey Fuller inspection of variables after taking logs of variables and 2nd differences:

Variable	lags	specification	statistic	critical	No. of obs	conc
D_d_ln_IP	4	Trend and constant	-1.420	-3.600	8	DNR H0
	4	No trend no constant	-0.292	-3.000	8	DNR H0

	3	No trend no constant	-4.705	-3.000	9	Reject H0
d_d_ln_ FDI	2	No Trend no constant	-1.565	-3.000	10	DNR H0
	2	Trend and constant	-1.442	-3.600	10	DNR H0
	1	Trend and constant	-3.682	-3.600	11	Reject H0
D_d_ln_ GDP	3	trend and constant	-2.333	-3.600	9	DNR H0
	2	Trend and constant	-3.784	-3.600	10	Reject H0
	4	No trend no constant	-0.562	-3.000	8	DNR H0
d_d_ln_ Trade	3	Trend and constant	-2.310	-3.600	9	DNR H0
	2	Trend and constant	-2.085	-3.600	10	DNR H0
	1	trend no constant	-4.849	-3.600	11	Reject H0
D_d_ln_ RD	2	No trend no constant	-1.402	-3.000	7	DNR H0
	1	Trend no constant	-3.433	-3.000	11	Reject H0
	1	Trend and constant	-3.076	-3.600	8	DNR H0

Annex (4)

Dickey-Fuller test for unit root Number of obs = **11**

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**-3.624**	**-3.750**	**-3.000**	**-2.630**

MacKinnon approximate p-value for Z(t) = **0.0053**

D.res	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
res L1.	**-1.186689**	**.3274606**	**-3.62**	**0.006**	**-1.927457**	**-.4459217**
_cons	**2.48e+09**	**5.56e+09**	**0.45**	**0.665**	**-1.01e+10**	**1.51e+10**

Annex (5)
Model (1) results

Source	SS	df	MS	Number of obs	=	15
				F(1, 13)	=	1.86
Model	3.4875e+20	1	3.4875e+20	Prob > F	=	0.1959
Residual	2.4393e+21	13	1.8764e+20	R-squared	=	0.1251
				Adj R-squared	=	0.0578
Total	2.7881e+21	14	1.9915e+20	Root MSE	=	1.4e+10

ln_FDI	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_IP	95148.15	69792.18	1.36	0.196	-55628.7	245925
_cons	1.31e+10	6.40e+09	2.04	0.062	-7.59e+08	2.69e+10

Model (1.1) results

Vector error-correction model

Sample: 2003 - 2015 — Number of obs = 13
AIC = 74.13695
Log likelihood = -472.8902 — HQIC = 74.05656
Det(Sigma_ml) = 1.35e+29 — SBIC = 74.52807

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_d_FDI	4	9.7e+09	0.5937	13.15348	0.0105
D_d_IP	4	54973.9	0.7376	25.30261	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_d_FDI						
_ce1						
L1.	-.117272	.1266323	-0.93	0.354	-.3654668	.1309227
d_FDI						
LD.	-.4740715	.2313887	-2.05	0.040	-.9275849	-.0205581
d_IP						
LD.	14433.59	68566.03	0.21	0.833	-119953.4	148820.6
_cons	44.1876	2.92e+09	0.00	1.000	-5.72e+09	5.72e+09
D_d_IP						
_ce1						
L1.	1.28e-06	7.16e-07	1.79	0.074	-1.24e-07	2.68e-06
d_FDI						
LD.	-2.35e-06	1.31e-06	-1.79	0.073	-4.91e-06	2.17e-07
d_IP						
LD.	-.2304938	.3879017	-0.59	0.552	-.9907671	.5297796
_cons	11879.43	16514.32	0.72	0.472	-20488.05	44246.9

```
. test ([D_d_FDI]: LD.d_IP)

 ( 1)  [D_d_FDI]LD.d_IP = 0

           chi2(  1) =    0.04
         Prob > chi2 =    0.8333
```

Model (2) Results

Source	SS	df	MS	Number of obs	=	15
				F(1, 13)	=	0.97
Model	2.3955e+22	1	2.3955e+22	Prob > F	=	0.3436
Residual	3.2234e+23	13	2.4795e+22	R-squared	=	0.0692
				Adj R-squared	=	-0.0024
Total	3.4629e+23	14	2.4735e+22	Root MSE	=	1.6e+11

ln_Trade	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_IP	788565.6	802277	0.98	0.344	-944648.4	2521780
_cons	1.93e+11	7.36e+10	2.62	0.021	3.39e+10	3.52e+11

Model (2.2)

Sample: 2003 - 2015 — Number of obs = 13
AIC = 77.27323
Log likelihood = -493.276 — HQIC = 77.19284
Det(Sigma_ml) = 3.11e+30 — SBIC = 77.66435

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_d_Trade	4	5.0e+10	0.1629	1.751413	0.7814
D_d_IP	4	51461.3	0.7701	30.14519	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_d_Trade						
_ce1						
L1.	-.2937045	.3624788	-0.81	0.418	-1.00415	.4167409
d_Trade						
LD.	-.0947424	.4357589	-0.22	0.828	-.9488142	.7593294
d_IP						
LD.	213450.7	264343	0.81	0.419	-304652	731553.4
_cons	185.2858	1.51e+10	0.00	1.000	-2.95e+10	2.95e+10

D_d_IP						
_ce1						
L1.	**-1.12e-06**	**3.76e-07**	**-2.99**	**0.003**	**-1.86e-06**	**-3.88e-07**
d_Trade						
LD.	**4.06e-07**	**4.51e-07**	**0.90**	**0.368**	**-4.79e-07**	**1.29e-06**
d_IP						
LD.	**.0017865**	**.2738704**	**0.01**	**0.995**	**-.5349897**	**.5385627**
_cons	**18633.67**	**15604.66**	**1.19**	**0.232**	**-11950.91**	**49218.25**

```
. test ([D_d_Trade]: L2D.d_IP LD.d_IP) ([D_d_Trade]: LD.d_IP L2D.d_IP)

 ( 1)  [D_d_Trade]L2D.d_IP = 0
 ( 2)  [D_d_Trade]LD.d_IP = 0
 ( 3)  [D_d_Trade]LD.d_IP = 0
 ( 4)  [D_d_Trade]L2D.d_IP = 0
       Constraint 3 dropped
       Constraint 4 dropped

           chi2(  2) =    0.70
         Prob > chi2 =    0.7033
```

Model (3)

Source	SS	df	MS		
				Number of obs	= **12**
				F(1, 10)	= **3.30**
Model	**4.1958e+19**	**1**	**4.1958e+19**	Prob > F	= **0.0993**
Residual	**1.2713e+20**	**10**	**1.2713e+19**	R-squared	= **0.2481**
				Adj R-squared	= **0.1730**
Total	**1.6909e+20**	**11**	**1.5372e+19**	Root MSE	= **3.6e+09**

ln_RD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_IP	**33442.49**	**18408.48**	**1.82**	**0.099**	**-7574.166**	**74459.14**
_cons	**5.12e+09**	**1.79e+09**	**2.86**	**0.017**	**1.13e+09**	**9.11e+09**

Model (3.1)

```
Vector error-correction model

Sample:  2003 - 2011                            Number of obs     =         9
                                                AIC               =   69.26131
Log likelihood = -302.6759                      HQIC              =    68.8357
Det(Sigma_ml)  =  5.58e+26                      SBIC              =   69.45853

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_d_RD                 4     6.8e+08   0.6643   9.893335   0.0423
D_d_IP                 4     62502.7   0.7941   19.28721   0.0007
------------------------------------------------------------------
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_d_RD						
_ce1						
L1.	-.3285628	.3717625	-0.88	0.377	-1.057204	.4000783
d_RD						
LD.	-.0796271	.3565367	-0.22	0.823	-.7784263	.6191721
d_IP						
LD.	-2917.792	4417.184	-0.66	0.509	-11575.31	5739.73
_cons	17.6529	3.82e+08	0.00	1.000	-7.49e+08	7.49e+08
D_d_IP						
_ce1						
L1.	-.0000783	.000034	-2.30	0.021	-.0001448	-.0000117
d_RD						
LD.	.0000637	.0000326	1.95	0.051	-1.63e-07	.0001275
d_IP						
LD.	-.2215645	.403645	-0.55	0.583	-1.012694	.5695652
_cons	-74565.02	34904.92	-2.14	0.033	-142977.4	-6152.627

```
. test ([D_d_RD]: LD.d_IP)

 ( 1)  [D_d_RD]LD.d_IP = 0

           chi2(  1) =    0.44
         Prob > chi2 =    0.5089
```

Model (4)

Source	SS	df	MS	Number of obs	=	15
				F(1, 13)	=	0.90
Model	2.8186e+23	1	2.8186e+23	Prob > F	=	0.3605
Residual	4.0794e+24	13	3.1380e+23	R-squared	=	0.0646
				Adj R-squared	=	-0.0073
Total	4.3613e+24	14	3.1152e+23	Root MSE	=	5.6e+11

ln_GDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ln_IP	2704964	2854093	0.95	0.361	-3460930	8870858
_cons	9.62e+11	2.62e+11	3.67	0.003	3.96e+11	1.53e+12

Model (4.1)

Vector error-correction model

Sample: **2003 - 2015**	Number of obs	=	**13**
	AIC	=	**79.07161**
Log likelihood = **-504.9655**	HQIC	=	**78.99122**
Det(Sigma_ml) = **1.88e+31**	SBIC	=	**79.46273**

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_d_GDP	**4**	**1.0e+11**	**0.5996**	**13.47634**	**0.0092**
D_d_IP	**4**	**70408.5**	**0.5696**	**11.91173**	**0.0180**

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_d_GDP						
_ce1						
L1.	**-1.369829**	**.4227639**	**-3.24**	**0.001**	**-2.198431**	**-.5412272**
d_GDP						
LD.	**.4153883**	**.3050932**	**1.36**	**0.173**	**-.1825834**	**1.01336**
d_IP						
LD.	**49401.91**	**354422.3**	**0.14**	**0.889**	**-645253**	**744056.8**
_cons	**-2206.859**	**2.92e+10**	**-0.00**	**1.000**	**-5.72e+10**	**5.72e+10**
D_d_IP						
_ce1						
L1.	**-3.48e-07**	**2.85e-07**	**-1.22**	**0.221**	**-9.06e-07**	**2.10e-07**
d_GDP						
LD.	**2.25e-07**	**2.06e-07**	**1.09**	**0.274**	**-1.78e-07**	**6.28e-07**
d_IP						
LD.	**-.6236521**	**.2387384**	**-2.61**	**0.009**	**-1.091571**	**-.1557334**
_cons	**-2000.565**	**19648.98**	**-0.10**	**0.919**	**-40511.87**	**36510.74**

. test ([D_d_GDP]: LD.d_IP)

(1) **[D_d_GDP]LD.d_IP = 0**

chi2(1) = **0.02**
Prob > chi2 = **0.8891**