

Title: Intellectual Property Rights, Social Values and Economic Performance: An Econometric Analysis

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Abstract:

The era of globalization is often believed to be also the era of Global Standard Institutions (GSI). This enthusiasm to homogenize the international policy space, however, is often at odds with the conjectures made by the scholars on institutions, which suggests that transfer of institutions across societies are burdened with problems of incompatibilities with existing, formal, informal institutions and social values. These social values are historically and culturally shaped and constrained or enabled and constitute formal institutions. At the same time, scholars from evolutionary economics present a complex relationship between economic performance and informal institutions, formal as well as informal. Intellectual Property Rights is perhaps the most talked about GSI, which have received unmatched policy attention and push for homogenisation in the post-WTO era. However, diversity still exists in this institution across countries. This study is an attempt to understand the dynamic two way relationship between the institution of IPR, related social values and economic performance using the framework of simultaneous equation system. We find that historical and political contingencies crucially shape the institution of IPR. IPR has complex non-linear impact on various parameters of economic performance.

Introduction

Over the last few decades the literature on institution experienced an interesting turn when North(1995, 2003, 1994; 360) introduced two forms of institutions – formal and informal. Surprisingly, scholars have argued that underlying informal norms play much of the enabling or constraining role (Helmke and Levitsky 2004) and the constitutive role (Cooter 1997, Chang and Evans 2005, Chang 2007). John and Storr (2011), Aoki (2007) and Chang and Evans (2005),

have identified that formal institutions can function only if complementary (informal) institutions are in place.

Comparative institutional analysis has emerged as a methodology which goes beyond single institutional analysis (Cole 2013, Morgan et al 2010). The major argument of CIA are a. *endogenous growth* of institutions (North 2005, p. 77, Boettke and Fink (2011) and institution change (North 1990; Greif 1998) b. institutions (both formal and informal) do not work in isolation but are interconnected (ibid, 2-4) and c. focus on historical contingencies, which shape ideas, practices and institutions and d. the nuanced relation between institutions and economic performance (Acemoglu and Robinson 2013).

It may not be an overstatement that we are living in the era of harmonization of institutions, where to harmonize one has to become a part of Global Standard Institutions is becoming a norm (Chang 2011). This policy enthusiasm is often at odds with the conjectures of a wide body of literature on institutions, which suggests that transfer of institutions across societies are burdened with problems of incompatibilities with existing social values of a society (Hodgson 2015, McAdams 2015). Intellectual Property Rights is one such institution (policy initiative) which has received major attention in the negotiations of the World Trade Organization (WTO).

The regime of IPR is a good example of homogenization of policy space across countries through the mechanisms of TRIPS. However, despite the efforts¹ to homogenize, the uniformity of IPR across countries has remained a far cry. Homogenization of Intellectual Property Rights (IPR) as a tool to promote and protect the private rights of an innovator and thereby promote innovation has not gone unnoticed. There have been numerous debates over the merits of global homogenization wherein in large measure about the desirability of achieving such uniformity in property rights enforcement has been viewed through lens of skepticism. There also has been various modification and revision in the policy resulting from the various conflicts in interest of societies across the globe. The regular efforts taken by the TRIPS regime or even the TRIPS-PLUS regime to regulate the implementation of patent system, has failed to even out the differences. The Intellectual Property Rights Index (IPRI) published through various years very well depicts the diversity in strength of IPR throughout the countries. According to the IPRI

¹ Special 301 reports published by TRIPS keep countries on watch list and priority watch list so that they make their IP environment TRIPS compliant.

report 2016, for sample of 128 countries, on the scale of 10, the mean value of IPR has been 5.33, where the minimum value is 1.68 and the maximum value is 8.63. The standard deviation for the same is 1.66. Also recently WTO after weeks of negotiation in 2015 extended a waiver to LDCs by permitting them to avoid applying and enforcing IP rights on pharmaceutical products till 2033².

Studies on IPR have however not addressed and considered various informal institutions and social values may obstruct homogenization of the policy regarding IPR. For long scholars have employed Ordinary Least Square methods to explore the relationships between institutional characteristics, economic performances and policies and have assumed them to be unidirectional (Shlifer and Vishney 1997, Glaeser and Schlifer 2002, Acemoglu et al 2004, Graff 2005, La Porta et al 1996, 1999, 2008) with causality running from institutions to economic performance. These studies have been criticized for avoiding the endogeneity problem. This paper adopts Simultaneous equation system perspective, banking on the literature on institutions and plausible two way causality among IPR, social values and economic performance. We obtain social value data from World Value Survey, data for IPR from IPRI Report and data on innovation from Global Innovation Index.

The paper has been divided into six sections. The II section discusses Institutions and and the inter-linkages between institutions and economic performance. In the III section we discuss IPR as an institution. Here we also try to highlight the various justifications of IPR being treated as property and the debates surrounding IPR. The section IV, data and methodology gives details on the data, model and method of analysis. Section V we discuss the results and finding and then we conclude in section VI.

Section II: Inter-linkages among formal, Informal institutions and Economic Performance

² For example countries like Bangladesh and Zambia.

Institutions have been defined by North (1995, 2003, 1994; 360) as “the humanly devised constraints that structure human interaction. They are made up of formal constraints (e.g., rules, laws, constitutions), informal constraints (e.g., norms of behavior, conventions, self-imposed codes of conduct, social values³), and their enforcement characteristics. Together they define the incentive structure of societies, and, specifically, economies.” They are formulated with aim to reduce uncertainty and minimize transaction costs. North (2005) tried to identify the plausible causes for success and failure of economics. And it was through his study he could identify difference in institutions as a factor differentiating one country from another in terms of economic performance (see North and Thomas 1973, North 2005).

Chang and Evans (2005) view institution not just as enabling and constraining, but also as *constitutive*. The authors argue that we may continue to behave under certain sets of institutions, and eventually we then tend to internalize the values embodied in those institutions and thus our values change. As Chang and Evans (2005) discuss that people tend to internalize the values embodied in an institution and thus values may change with time. Chang (2007) highlights that individuals being born with predetermined ‘preferences’, institutions are just instruments for advancing the sectional interests (for instance economic development) in groups that are politically organized enough to initiate changes in institutions in a way that suits their interest⁴. We here identify the causality running from informal to formal institution. Djelic (2010) argues that the idea of institutions is deeply embedded and constitutive of actors and their interest and it is impossible therefore to examine institution as a dis-embedded, strategic and agency attempting to gain competitive advantage. We identify values and preferences and interests as important component for this study of ours.

Interesting argument has been posed by Aoki (2007) who suggests that institutions may co-exist in a manner that they compete, accommodate, complement and substitute for each other. Moreover studies carried out by Zweynert (2007; 2009) propose that for an institution to be successful it should have complementing informal institutions in place. The complementarity of institutions between both formal and informal or formal and formal or even informal and

³ Thogerson and Olander (2002) have defined values as desirable institutional goals, varying in importance, that serve as guiding principles in the life of a person or other social entity. It is obvious from this definition that values are assumed to motivate actions – giving it direction and emotional intensity.

⁴ We would discuss interests and its impacts on policymaking comprehensively in our next chapter.

informal is an important factor for an institution to serve its function. This follows from the argument that Institutions are socially and culturally embedded (they are shaped by the local culture and values) (Grief and Laitin, 2004; Roland, 2004; Jong, 2011). The success of an institution can be attributed to its success of being able to combine the exogenously transferred institution with domestic ones. The formal and the informal can complement each other, coexisting in a given system and mutually enhancing each other's institutional performance (Deeg, 2005; Helmke and Levitsky, 2004; Aoki, 2001). Deeg (2005) suggests institutions may complement each other by exhibiting supplementarity (each making up for the deficiency of other) or synergy (this embodies mutually reinforcing effects of compatible incentive structures). The success and failure of the imported institutions may depend on the adaptability of the already existing system which reflect the common cultural heritage (Zweynert, 2009). For instance Chang (2007) argues that no institution performs only one function and that there are several institutions within a society which serve the same function⁵. He takes the case of property rights and argues that they alone cannot encourage investment, but can do so along with other financial institutions, labor institutions and the welfare state.

Due to dependence on informal institutions, formal institutions are often called socially and culturally embedded (Grief and Laitin, 2004; Roland, 2004; Jong, 2011) which slows the changes in formal institutions and makes it path dependent. Reasons for inertia of informal institutions are often located in individual cognitive structures, which creates mental models'. The 'mental models', according to North (1986), are 'local' to an individual's particular environment. Denzau and North (1994) argue that individuals with common cultural background, language and experience will share a reasonably convergent mental model, ideologies and institutions as compared to individuals with different cultural background and experiences. Dimaggio (1997) notes that culture enters everyday life through the interaction of environmental cues and mental structures (see also Mantzavinos et al. 2004; Searle 2005). The mental constructs of the players, and the inherited cultural grooming guides individual's perception and choice (North, 1993). Grief (1994, 1989) also identify that cultural beliefs determine the societal organization since strategic interactions occur within a 'specific social and

⁵ Chang (2007) gives example of democracy as a form of institution which might enable functions of contract enforcement, respect for private property, maintain price stability.

historical context'. According to the author diverse cultural beliefs can make way for differential economic behavior. For Greif, beliefs, norms, and organizations are as much a part of institutions as Northern rules. O'Neill (1998: 48) suggests that individuals have 'local knowledge' which helps them make preference about what would augment their well being. The author further argues that this local knowledge is 'practical knowledge' which differentiates them from others who do not have it. Bengelsdijk and Klasing (2016) point out that factors such as ethnicity, language, religion and genetic diversity are important drivers behind the variations in political values observed across individuals within the same society.

Norms are the informal rules that function to preserve the values of the society and collective (Parson 1951). Preferences are individual value assignment to act after calculating the cost and benefit of that action (Cooter 2006). Preference change can be triggered by economic change (Schubert and Chai 2012) and that preference change can lead to social movements (Sanderson 2006) and change in economic and social institutions. It would not be an overstatement to argue that these preferences back up interests and economic profit may motivate a change in interest and thereby also preference. Economic and political interests are most common interests of human life (Sanderson 2006) and that the function of interest is to motivate learning and experience (Silvia 2008). We now understand social values, vis a vis informal institutions are important for a formal institution to survive.

Though not numerous studies have explored the role of interests as a crucial motivator for determining trade policies, Rho and Tomz (2012) in their paper, discuss the debate of protectionist verses free trade by developing new industry-specific measures of protectionism and using them to test the theories that have attempted to analyze economic roots of individual preferences⁶. The next they test the New-New Trade (NNT) theory which emphasizes that the economy is composed of 'heterogeneous firms', which fall into different levels of productivity. The theory proposes that most highly productive firms benefit from free trade whereas less

⁶ According to Cooter (2006) preferences describe what a person wants. Preferences include wishes, values, desires, inclinations, attitudes, ends, goals and objectives. A person who prefers to obey a law is willing to give up something to perform his legal obligation. According to the author in such a scenario where a law is introduced, preferences are intrinsic, not an instrument for securing something else of value. Author suggests that a person who is indifferent towards obeying or disobeying a law on the contrary is unwilling to give up anything to perform his legal obligation. A person who is indifferent to a legal obligation however, takes a purely instrumental approach towards obedience – he obeys only when doing so secures something else he values.

productive firms do better with protectionism. It also strongly hypothesizes that an individual's desire to protect their own industry is inversely related to the individual's firm's productivity. However, the study by these authors does not validate this theory as they could find no relationship between the productivity of a respondent's firm and his or her desire for protection. In this case too the results contradict the theory as the individual's who work at profitable firms are actually more protectionist as compared to the individual's from less profit making firms. We observe that, this paper raises serious concern about role of interest as been perceived by the economists and the lack of empirical evidences supporting the theories.

Englebert (2000) has stated that 'efficient' economic growth is the function of formal institutions if it is embedded in informal institutions of norms and social relations having historical roots. The interplay between formal rules and informal constraints, define and shape (over a period) the nature of institutions of a country. Bhaduri and Chandra (2008) provide us a case study of relationship between informal institutions and policy making in Japan. The authors argue that the informal institutions which are ingrained in formal policies very well illustrate the case of social embeddedness. The policies reflecting social values are hierarchy adherence, long term planning, the philosophy of incremental improvements and orientation towards miniaturization. Zweynert (2006; 2009) discusses the failure of reforms in Russia due to differences in ideological and social values. He attributes the failure to the fact of overlooking the domestic institutions prevailing in that country. To bring out the contrast to Russia's case, the author discusses the case of Central Europe (Germany) where the success of importing institution reflected the compatibility with the domestic institutions.

Section III: Intellectual Property Rights

A most common form of institution we encounter today is the institution of property rights. The significant interests that property rights serve are economic ones: without property rights, individuals cannot participate in a market economy (Hettinger, 1989; Resnik, 2003). However, with recent advances and commodification of knowledge, the world saw the emergence of

Intellectual property rights, which is currently being regulated by Trade Related Aspects of Intellectual Property Rights (TRIPS), World Trade Organization (WTO). Lately property rights have begun to extend ‘governmental protection of private innovation and creativity’ (Magic, 2003). It is seen as an owner’s right to use a good or asset for consumption and/or income generation (Besley and Ghatak, 2009). The key parameters from the above definitions are – government protection, private innovation and creativity, owner’s right and income generation, which give the flavor of Intellectual Property Rights (IPR) regime. Patent⁷, copyrights⁸, geographical indications⁹, trademarks¹⁰ and industrial designs¹¹ are some of the common form of protection under the IPRs. The most general form of protection of ideas known today is the patents.

In contrast, to the property rights that were mostly transferred to countries through the colonization process, intellectual property rights saw its seeds being sowed in this phase itself. As Drahos (1995) points out, India, adopted its patent law of 1911, in the model of the UK patent law 1854. Similarly, Malay States, North Borneo and Sarawak, the Copyright Act, 1930 was modeled on the UK Copyright Act, 1911. In the case of Philippines the Spanish patent law was functional in that country till the time it was a Spanish colony, but as soon as it was taken over by US in 1898, the US patent law became functional. The linkage between IP and trade regime, forged in the 1980s made way for globalization of the IP norms. As most of it began through the multilateral or bilateral trade agreements. The parties in the agreements are expected to implement more extensive IPR to raise the standards of their bilateral or multilateral agreements¹². Also have Bhaduri et al (2015) while arguing for strong physical property rights augment the strength of IPR, discuss the case of socialist countries in recent past have past have

⁷ a set of exclusive rights granted by a sovereign state to an inventor or their assignee for a limited period of time in exchange for the public disclosure of an invention.

⁸ aimed for the protection of literary and creative work. Example – poems, paintings etc.

⁹ a name or sign used on certain products which corresponds to a specific geographical location or origin, Geographical Indications are generally traditional products, produced by rural communities over generations, that have gained a reputation on the markets for their specific qualities

¹⁰ a distinctive sign or indicator used by an individual, business organization, or other legal entity to identify for consumers that the products or services on or with which the trademark appears originate from a unique source, designated for a specific market, and to distinguish its products or services from those of other entities.

¹¹ right that protects the visual design of objects that are not purely utilitarian. An industrial design consists of the creation of a shape, configuration or composition of pattern or color, or combination of pattern and color in three dimensional form containing aesthetic value

¹² Article 1.1, TRIPS

weaker forms of physical property rights and the countries with history of British colonialism, have stronger forms of physical property rights, at place. (Correa 2002) argues that Though property rights have historically evolved and varied across countries over time, IP is quite a recent activity and is somehow not socially or culturally embedded. Countries have used IP tools strategically to boost their economy where they use weaker forms IP protection with a deliberate aim of promoting the development of the domestic industries. Similarly, some countries strengthened patent protection as the industries developed, or until they were forced by other partners in trade agreements. The author also argues that the challenge developing countries face today is effective integration of development policies¹³ industrial into IP policies.

Intellectual property has emerged as a major issue of our global society. Intellectual property is no doubt most important aspect of globalization, especially as the world moves toward a knowledge economy (Stiglitz, 2008). The transformation of knowledge into a commodity a 'global public good' (Stiglitz, 1999a; 1999b) introduced a debate over appropriate means to protect it (Machlup and Penrose 1950; Machlup1958). Knowledge can be distinguished from other forms commodities which drive the economy today. At first, knowledge is non-rivalrous in use which means once produced, there is no marginal cost in another individual making use of the knowledge (Machlup and Penrose, 1950, Stiglitz, 1999b). The second characteristic of knowledge is its inherent non-exclusivity (Stiglitz, 1999b), which means that once knowledge is produced and disseminated, it is impossible to appropriate it for private consumption. The intangible characteristic of knowledge distinguishes it from ownership of any tangible goods or private property.

The most discussed form of intellectual property protection known today is patent. A patent signifies the right to secure and enforce power over an invention for a specific duration within which the patent holder has the supreme right to use his invention. As Machlup and Penrose (1950) suggest that for security of industrial progress it is important to share the new inventions. In the absence of the right granted by patents an inventor might keep secret an invention. Sagoff (1986) points out that individual welfare is the goal of public policy choices, which is intrinsically valuable. The most discussed approach for IP has been the Libertarian approach, which has been discussed, where, Locke argues that a form of property is justified for a human

¹³ Policies which deal with industrial development, public health, food security, education, etc

being on the basis of labour he has put to that object. Machlup and Penrose (1950) argue that property should provide exclusivity and enforcement of this exclusivity through patented invention is the only appropriate way for society to recognize this property right. According to Machlup (1958), rights over IP is justified as long as it secures an invention from misappropriation. The criteria for gaining rights over an invention according to the author is utility, novelty and flash of genius associated with the invention. The author argues that according to the “natural law” thesis property rights over idea is the natural extension of property rights over fruits of labour. Hettinger (1989) argues that if a person uses his intelligence, effort and perseverance to produce an object that object ought to belong to that person and not to anyone else.

However, over time, the utilitarian approach has also become popular. The basic argument it proposes is that Intellectual property rights should be used in such a manner so as to promote progress and usefulness of new ideas. Article 1.8 of the US constitution gives congress power “to promote the progress of science and useful arts...” and congress used this power to pass patents and copyright acts in 1790 (Kingston, 2005). Although John Stuart Mill had defined ‘utility’ in terms of happiness, other utilitarian have equated ‘utility’ with satisfaction of ‘preference’ (Hettinger, 1989). From a utilitarian perspective, IP rights maximize social utility by providing authors and inventors with incentives and rewards, which encourage development of science, technology, industry and the arts (Resnik 2003, Moore and Hemma 2014, Fragerberg et al 2004).. Understandably, a support for the utilitarian view of IPR would mean presence of social values that recognizes utility of novelty and new technology for societal progress, and justifies non-revelation of innovative ideas without compensation in the form of IP rights. According to Resnik (2003) Marxists raise an important issue here on the just distribution of both ‘benefit and burden’ to the society and how IP can be a tool for propagating this idea.

So far we found that values of – autonomy (a sense of self respect), privacy, utility, justice and self expression (a reflection of person’s unique knowledge, creativity skills and genius) form the ground of granting rights to a person for his creation as key values in the underpinning of IP. However, people can generate new ideas and share with the society voluntarily as well without bothering about extrinsic rewards (Bhaduri and Kumar 2011). Such intrinsic motivations to generate and share new ideas would mean presence of autonomy or non-materialistic “joy of

creation”. Quite often, such acts are regarded as “pro-social acts” inspired by duty to the commons. The case of grassroot innovators in India shows that in the presence of such non-materialistic motivations, social preference for (and the awareness of) intellectual property rights remains less. Here, although autonomy is important, it does not get translated into demand for IP because either it is not well appreciated that IPR-awarded technologies will be fruitful for the concerned society, and/or they do not think incentives in the form of IP protection is essential for dissemination of new knowledge.

The skepticism about IPR might be an outcome of the way IPR laws operates these days. To many, IPR today has become a tool of big corporations to elongate their monopoly, which stifles new ideas and obstructs access due to increased price. It has long been argued that IPR propagates social values which are individualistic in nature. (Machlup 1958, Stiglitz 2008, Kingston 2005, Noble 1977). Martin (1995) takes up Marxian perspective and argues that IP rights lead to social injustices, such as exploitation of poor countries and poor people¹⁴ by slowing down innovation and inhibiting technological progress. Patents can also discourage generation of new ideas¹⁵ by giving large patent generated corporations an unequal power to defend their rights in the court. Often small new entrants have found it immensely costly to fight infringement suits leading to their withdrawal from the market.

The motto of the TRIPS agreement is to help close the gap in technology between the developed and developing and least developed countries (Stiglitz, 1999a, 2008). Organizations face trouble in the transfer of the tacit knowledge that is usually embedded in the staffs of organization from which technology is being leased. Such knowledge can be the core of the organization’s competitive advantage or the core competency. Stiglitz (1999a) argues that knowledge is best acquired by ‘active involvement’ of learner and not by ‘passive memorization’. The author argues that the knowledge based transformation of developing countries is being done by

¹⁴ Martin (1995) argues that companies may take out a patent, or buy someone else's patent, in order to inhibit others from utilizing the ideas. He gives example of telephones. From its beginning in 1875, the US company AT&T collected patents in order to ensure its monopoly on telephones which slowed down the introduction of radio for some 20 years. In a similar fashion, General Electric used control of patents to retard the introduction of fluorescent lights, which were a threat to its market of incandescent lights.

¹⁵ . Ben-Bessen and Meurer (2008) show that small inventors generate substantially less value out of a patent compared to large corporates. Surprisingly, new ideas are often generated in small firms and at individual levels, who cannot translate these ideas into a substantial intellectual property capital. Lanjoiuw and Shankermen (2001) show how infringement threats by large firms prevent entry of small firms with new patented ideas in the market. In case of India’s grass-root innovators also, the innovators have often found it extremely difficult to exploit their Intellectual property through large-scale commercialization.

‘conditioning where the best practices are being forced on the country. Such a conditioning undermines people’s incentive to develop their own capacity and snatches away their opportunity to use their intelligence. True development, on the other hand aims at transforming societies which involves in its core the idea of ‘changing the thought process of people’. Such change and transformation of societies raise serious questions about respecting the unique identities and prized values of these societies

Nelson and Winter (1977) argue that purposive acts of investment are an important part of innovation process the process. They argue that two factors influence the allocation of effort first are those actors that influence the demand for or pay-off from innovation, and second factors that influence the difficulty or cost of innovation. Also the author emphasis that R & D-strategies can be dichotomized into two. - ‘demand pull’ and capability push. They further argue that when applied, demand-pull is more likely to result in a commercially successful project than a strategy of capabilities-push.

Even in the case pharmaceuticals there is a demand pull yet these needs have not met because of lack of capability push. At present global epidemic like AIDS has drawn great deal of attention. Gewertz and Amado (2004) have taken up the case of HIV AIDS drug AZT. Not only does it bring forward the economic aspect surrounding the production and distribution of anti HIV medication AZT, it also highlights the ethical factor surrounding it. According to the authors both Robert Nozick and John Rawls hold different opinion about responsibility of the state to protect and redistribute various liberties and rights. Where on one hand utilitarians such as Nozick held that IP can be justified as property right in so far as they promote social utility by providing the authors and investors with incentives so as to encourage the development of science and technology, arts and industry, on the other hand egalitarian thinker Rawls held that “distribution” of benefits of IP is important (Resnik 2003). The development of the TRIPS protocol as well as international economic sanctions rendered against nations like India and Brazil who have provided compulsory licenses¹⁶ for generic anti HIV medication which indicates a policy of proving IPR over health concerns (Gewert and Amado 2004). Hence here Nozick’s

¹⁶ It is provision under TRIPS, WTO, for patents: when the authorities license companies or individuals other than the patent owner to use the rights of the patent — to make, use, sell or import a product under patent (i.e. a patented product or a product made by a patented process) — without the permission of the patent owner.

justification of patent monopolies appears inhuman and dogged, and the Rawls argument fits well as far as it is concerned for health and wellbeing of the society. Protecting new knowledge and exploiting it further leads to the generation of new knowledge. However, a protectionist approach where firms attempt to monopolize their inventions leads to slowing down the pace of innovation.

Moreover, Furukawa (2007) suggests that innovation and IPR have an inverted U-shaped relation. Too strong protection obstructs innovation and the resulting economic growth. Under a too strong IPR, the innovator may lose interest in creating new technology and focus only on exploiting the existing ones. With the advent of biomedical research and its privatization, the field has become susceptible to the emergence of a patent thicket¹⁷. This issue was soon termed in property rights theory as tragedy of “anti-commons”, which resulted in a significant drag on innovation (Stiglitz, 2008). Heller and Eisenberg (1998) argue that the privatization of biomedical research has led to proliferation of intellectual property rights upstream which would stifle life saving innovation further downstream in the course of research and product development. The upstream research in the biomedical area supported by private funds, carried out in a private institution or privately appropriated through patents, trade secrecy or agreements that restrict the use of material or data. Thereby private rights over commons create obstacles to its full public use and development and thereby preventing competition.

In the section, our major intentions have been to analyze the intellectual property rights in institutional framework: where formal and informal institutions interact and shape each other. While in the above passages we did learn that values (which represent informal institutions) such as individual autonomy, future orientation towards technology and competition are key driving values motivating factors for innovators to innovate. However, these values have often not been taken up study in the context of intellectual property rights.

Section IV: Data and Methodology

¹⁷ In a patent thicket the existence of many overlapping patent claims begins to block the pathways to market and choke out commercialization—both by causing uncertainty about freedom to operate and by imposing multiple transaction costs—such that even owners of dominant patents cannot themselves be certain of reaching market unhindered.

Econometric cross-country research is not uncommon in institution literature¹⁸. Glaeser and Shlifer (2002) and Graff (2005) have studied different legal (common and civil Law) systems and the security of property rights in these countries. La Porta et al (1996, 1999, 2008) have also studied the effect of different legal systems on formal institutions (political and financial institutions). Shlifer and Vishney (1997) recognize the impact of institution on financial investments in the countries. Acemoglu (2003) and Acemoglu et al (2004) have studied the differences in the different legal systems (formal institution) and their treated formal institutions in isolation (by carrying out a one-way causality) where institutions in some way affect the economic performances of the countries studied. Also no study has been carried so far to highlight the underlined role of informal institutions on formal institutions and economic performance.

Data

The study relies mostly on secondary data. Since we intend to look into dynamics of three different categories of aspect surrounding IPR – economic determinants, social values and historical and political contingencies, we collect data from different sources.

Intellectual Property rights -

The 2016 International Property Rights Index provides us data for 128 countries. It makes detailed study of 10 variables, which are divided into the three main components: Legal and Political Environment, Physical Property Rights, and Intellectual Property Rights. Legal and Political Environment (LP) comprised of Judicial Independence, Rule of Law, Political Stability and Control of Corruption. Intellectual Property Rights (IPR) comprised of parameters such as Protection of Intellectual Property Rights, Patent Protection and Copyright Piracy. Protection of Intellectual Property Rights entails opinion survey outcomes reflecting a nation's protection of intellectual property Expert participants in each country were asked to rate their nation's IP protection as "weak and not enforced" to "strong and enforced." The second component Patent Protection reflects

¹⁸ Cross Sectional econometric study has received criticisms from Authors like Chang (2007) Chang (2010) and Chang and Evans (2005).

the strength of a country's patent laws based on five extensive criteria: coverage, membership in international treaties, restrictions on patent rights, enforcement, and duration of protection. The third component Copyright Piracy captures the level of piracy in the IP sector is an important indicator of the effectiveness of intellectual property rights enforcement in a country.

a. Social values

We collect our data for social values from World Value survey. We collected longitudinal data for the value variables. Given that social values change at a much slower pace, we argue that longitudinal data provides us data which covers more number of countries across the waves of survey. The three relevant values surrounding IPR as discussed in previous section are – autonomy, future orientation towards technology and competition. We discuss these variables in brief.

1. Autonomy

The autonomy variable is constructed using Principal Component Analysis of three variables *Justifiable – abortion*, *Justifiable divorce in* and *How much freedom of choice and control*. **We consider individual autonomy as an important element for motivating an individual to seek for property rights which renders the person individualistic rights.** The responses for this question were in a 10 point scale where, 1 represented never justified and 10 represented always justified. The variable appeared as - *Justifiable – abortion* and *Justifiable divorce in* WVS. The number of observations was 89 and 88 respectively. **The WVS provides us an opportunity to test our assumption of significance of freedom of choice and control for establishing better property rights.** The responses for this variable were in 10 point scale where 1 represented *no freedom of choice and control at all* and 10 represented *a great degree of freedom of choice and control*. The total number of observation are 88. This question appears in WVS as: *How much freedom of choice and control*.

2. Future Orientation towards Technology (FUTECH)

We can assume that developed observe strong property rights so as to maintain their monopoly. We also may assume a country to have negative future orientation for technology could be their historical experiences with the technology. The responses were collected in a three point scale where 1 represented more emphasis on technology as a good thing and 3 represented more emphasis on technology as a bad thing. The question read: *Future changes: more emphasis on technology* in WVS.

3. Competition good or harmful –

it is argued that competition is good as it stimulates people to work hard and develop new ideas. On the other hand it has also been argue that that competition is harmful as it brings out worst in people. The data was collected from world value survey where 1 represented competition is good and 10 represented competition is harmful. The longitudinal data provides us 87 observations.

b. Economic performance

1. GDP PPP Per Capita (GDP) Rank

We take the ranks of countries in terms of their GDP PPP¹⁹ per capita from The International Monetary Fund (IMF) from the year 2014. The variable ranks countries by gross domestic product at purchasing power parity per capita, the value of all final goods and services produced within a country in a given year divided by the average population for the same year. **This variable is used to capture the individual economic condition of countries. the ranks represent the diversity in purchasing power of people across nations.**

2. Non income - Human Development Index (NIHDIR) Rank

The HDI combines in one composite index, indicators of health, education and income and intends to reflect achievements in the most basic human capabilities: living a long life, being knowledgeable and enjoying a decent standard of living. The report comprises of Human Development Index (HDI) value, Life expectancy at birth, Mean years of schooling, Expected years of schooling, Gross national income (GNI) per capita, GNI per capita rank minus HDI rank, Non-income HDI value, HDI rank 2015. In our study we have taken up NIHDIR as a proxy

¹⁹ PPP represents purchasing power parity. PPP percapita represents purchasing power parity of each individual in a country

to understand the development status of a country. This is measured not simply of national income, but also by life expectancy and literacy. Moreover, we take non-income HDI as we already have taken GDP PPP per capita into consideration for our study.

3. Gini Index (World Bank) Ranks

Gini index measures the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a equal distribution. Thus, a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality. Data are based on primary household survey data obtained from government statistical agencies and World Bank country departments. The data was gathered from World Bank, Development Research Group for a range of years.

c. Historical and political contingencies

1. Trade with US (Trade_US) Ranks

US often persuades countries be part of trade treaties, and imposes trade sanctions like Super 301 on the countries with weak IPR (See Bhaduri et al 2015 for detail). Our assumption here is that countries that have trade with US are forced to accept strong form of IPR. We use the variable depicting the export an individual country makes to US to capture this effect. The data for trade with US was collected for the year 2015. This data is compiled and published by the U.S. Census Bureau, Foreign Trade Division. Data for import was taken from the website. We use this variable to control for political-economic comparison of a country to impose stronger form of IPR, even when such an institution varies with their social variables.

2. The Global Innovation index

For the measure of innovation we use data from Global innovation index. We use the data for both innovation input and output separately. The Innovation Input Sub –Index (IISIR): capture elements of the national economy that enable innovative activities. Innovation Output Sub-Index: (IOSIR) Innovation outputs are the results of innovative activities within the economy. Although the Output Sub-Index includes only two pillars, it has the same weight in calculating the overall GII scores as the Input Sub-Index. We hypothesize that innovation output is not much determined by the input but by more political and historical factors (such as colonialism rule of

law. We also take the opportunity to test the hypothesis if IPR strength determines the innovation output or if it is influenced by trade

3. Rule of Law (RLAW)

Rule of law Index that captures perceptions of the extent to which agents have confidence in and abide by the rules of society, in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Scores are standardized. *Source: World Bank, World Governance Indicators, 2013 update. (<http://info.worldbank.org/governance/wgi/index.aspx#home>). Even though the IPRI report takes up rule of law as a component for the variable Legal and Political Stability²⁰ we argue that this variable aptly represents the legal and political environment as well as the enforcement of property rights. We argue that countries ranking high in rule of law will have effective implementation of IPR and would rank high in IPR strength.*

4. Colonialism

To capture the impact of colonialism on intellectual property rights, we use dummy variable for Colonialism (COLONY). Here 1 represents the countries that have been colonized and 0 represents the colonizers. The date for colonies was obtained from Olsson (2004). For some countries, data was also obtained from the website of Central Intelligence Agency (CIA) and Wikipedia (for Syria and Israel). We hypothesize that the countries which were colonized have weaker forms of institution than the colonizers. Hence a country with colonial experience, post independence would have to invest more on realigning the institutions.

Method of analysis

In order to be estimated, the system needs to be identified, as all its equation to be identified. The fulfillment or order and rank condition ensures the identification of the system. An equation is identified if you have enough information to get meaningful estimates of its parameters. An equation is not identified if you don't have enough information to get meaningful estimates of its

²⁰ Besides, it takes other components such as **judicial Independence, Political Stability and Control of Corruption**

parameters. If an equation is not identified, then estimating its parameters is meaningless. This is because the estimates you obtain will have no useful interpretation²¹.

As discussed by various scholars identification is an essential condition to carry out estimation. A simultaneous equation system comprises of M number of endogenous variables, m number of endogenous variables in a given equation. K is number of exogenous variables in the model and k is number of exogenous variables in a given equation. There are two conditions for identifications – the order condition and the rank condition. According to the order condition in order for an equation to be identified, it must exclude at least $(M- 1)$ variables (exogenous or endogenous) appearing in the model. Also, in order for an equation to be identified, it should satisfy the following condition : $K- k \geq m- 1$. The Rank condition is necessary and sufficient for identification. According to this condition an equation is identified in at least one nonzero determinant of order $(M-1)$ $(M-1)$ can be constructed from the coefficients of the variables excluded from that equation but included in other equations in the model.

The best method to analyze two way causality is through simultaneous equation model. Verbeek (2004) suggests that in macro-economics there is a wide range of models consisting of systems of equations that simultaneously determine a number of endogenous variables. Ruxanda and Muraru (2010) suggest that on account of simultaneity that the exogenous variable becomes endogenous. The two way causality between variables using simultaneous equation models have been studied by various scholars. In the area of marketing, Bass (1969) argues that not only is sales influenced by advertising, but advertising is also influenced by sales. Each structural equation explains a part of the system of relations being studied when that part is isolated from the rest of the system. Estimates were developed by 2SLS regression. Lee (1979) applies a simultaneous equation model to study health and wages. They argue that health and wage are jointly dependent. The study highlighted that health is viewed as a capital stock which is determined endogenously a priori. For estimation they use nonlinear least squares procedure and 2SLS.

²¹ Unidentified equation is the equation which does not have enough information to get a meaningful estimate. Exactly identified equation is the one which has just enough information to get a meaningful estimate. Over-identified equation is the equation which has more than enough information to get a meaningful estimate.

Ruxanda and Muraru (2010) have recently used simultaneous equation systems to analyze the relationship between FDI and Economic growth. According to the authors, there exists a two way causality between both, where FDI stimulates economic growth and in turn higher GDP attracts GDP. Their study consisted of a five-equation system which analysed the connection between economic growth and the share of FDI in GDP by using the 3SLS method for its estimation so as to take account of all the information existent in the system. This attempt revealed a bidirectional connection between the variables.

It has been argued that an explanatory variable is correlated with the error term, the OLS estimator is biased and inconsistent. OLS has a smaller variance than the 2SLS. If you compare the OLS and 2SLS standard errors and t-statistics, OLS tends to have smaller standard errors and bigger t-statistics. The 2SLS estimator is consistent regardless of whether or not the error term is correlated with an explanatory variable. 3SLS estimates systems of structural equations where some equations contain endogenous variables among the explanatory variables. Generally, these endogenous variables are the dependent variables of other equations in the system, though not always. The disturbance is correlated with the endogenous variables—violating the assumptions of OLS. Further, because some of the explanatory variables are the dependent variables of other equations in the system, the error terms among the equations are expected to be correlated. 3SLS uses an instrumental-variables approach to produce consistent estimates and generalized least squares (GLS) to account for the correlation structure in the disturbances across the equations Greene (2012, 331–334).

The simplest and the most common method of estimating simultaneous equation or structural equation is the two staged least square (2SLS). According to Zellner and Theil (1962), the two-stage least squares method of estimating a structural equation consists of two steps, the first of which serves to estimate the moment matrix of the reduced-form disturbances and the second to estimate the coefficients of one single structural equation after its jointly dependent variables are "purified" by means of the moment matrix just mentioned. The authors developed a three-stage least squares method, which goes one step further by using the two-stage least squares estimated moment matrix of the structural disturbances to estimate all coefficients of the entire system simultaneously. The mere fact that two-stage least squares is not identical with three-stage least squares imply that the former method is less efficient.

Zellner and Theill (1962) and Bhaduri et al. (2015) discuss a system that can be solved for the jointly dependent variables as

$$y_{\mu} = Y_{\mu} + X_{\mu}\gamma_{\mu} + U_{\mu} = Z_{\mu} + U_{\mu}$$

where, Z is a matrix of Y (the right hand side endogenous) variables and X (the explanatory predetermined) variables in the greek letter ‘ μ ’ th equation : $Z_{\mu} = [Y_{\mu} X_{\mu}]$, where, $E[Z_{\mu} U_{\mu}] = 0$ and $E[U|X] = 0$ and the correlation between the distribution of the equation is: $E[UU'] = \Sigma$

The most common method of estimating a system of simultaneous equation is the two-stage least square (2SLS)²². The 2SLS consists of first obtaining the predicted value of y (\hat{y}) estimating its reduced form equation with OLS, and in the second step, replacing y by \hat{y} in the relevant structural form equation to obtain the OLS estimates of the left hand side endogenous variable. Note, 2SLS estimates may not be efficient when equations are overidentified (because of their inability to use information on all the restrictions) and contemporaneous correlation of error terms is present with \hat{y} .

A “full information” method requires specifying all structural equations and that it is applied to the estimation of all the parameters simultaneously. One such method is Three Staged Least Square (3SLS). 3SLS was developed by Zellner and Theil (1962), which goes one step further by using the two-stage least squares estimated moment matrix of the structural disturbances to estimate all coefficients of the entire system simultaneously, and then apply generalized least square (see Greene, 2003, pp. 402–404; Chow, 1974).

Π ²³ denotes the reduced form for m parameters. If the equation is just identified, then it contains exactly $M - 1$ linear equations for the same number of unknown in coefficients like β . However, if the equation is overidentified then there are more equations than unknown parameters. One can arbitrarily select any $M - 1$ columns of Π to for solve for β of Π . In the second stage, least square is applied to the structural equation using the predicted values of Y_s . The following table shows the correlation between the various endogenous variables in our model (Table 1): Based on our discussions in the previous sections, we specify the model as follows:

²² See Poi (2006) for shortcomings of 2SLS method of estimation.

²³ Π Is referred to as the moment.

The model

$$\text{IPR}_i = \alpha_{0i} + \alpha_{1i}\text{NIHDIR}_i + \alpha_{2i}\text{FUTECH}_i + \alpha_{3i}\text{RLAW}_i + \alpha_{4i}\text{IOSIR}_i + \alpha_{5i}\text{Trade_US}_i + \alpha_{6i}\text{CGH}_i + u_i \quad \text{-----} \quad (1)$$

$$\text{FUTECH}_i = \beta_{0i} + \beta_{1i}\text{IOSIR}_i + \beta_{2i}\text{CGH}_i + v_i \quad \text{-----} \quad (2)$$

$$\text{IOSIR}_i = \gamma_{0i} + \gamma_{1i}\text{IISIR}_i + \gamma_{2i}\text{RLAW}_i + \gamma_{3i}\text{IPR}_i + \gamma_{4i}\text{GDP}_i + \gamma_{5i}\text{Colony}_i + w_i \quad \text{---} \quad (3)$$

$$\text{Trade_US}_i = \delta_{0i} + \delta_{1i}\text{IOSIR}_i + \delta_{2i}\text{IAu}_i + \delta_{3i}\text{IPR}_i + \delta_{4i}\text{GDP}_i + z_i \quad \text{---} \quad (4)$$

$$\text{GDP}_i = \lambda_{0i} + \lambda_{1i}\text{IOSIR}_i + \lambda_{2i}\text{NIHDIR}_i + \lambda_{3i}\text{RLAW}_i + o_i \quad \text{-----} \quad (5)$$

$$\text{IISIR}_i = \theta_{0i} + \theta_{1i}\text{GINI}_i + \theta_{2i}\text{CGH}_i + \theta_{3i}\text{GDP}_i + \theta_{4i}\text{FUTECH}_i + \theta_{5i}\text{IPR}_i + \varepsilon_i \quad \text{---} \quad (6)$$

In the above simultaneous equation system we have 6 equations and 6 jointly determined variables (IPR, FUTECH, IOSIR, Trade_US, GDP and IISIR) and 6 predetermined exogenous variables (RLAW, CGH, GDP, Colony, Autonomy and GINI). Equation (1) is exactly identified and equations (2), (3), (4), (5) and (6) are over identified.

We use three stage least square techniques to use not only the information provided by each equation, but also to include the information available in the entire model. In the presence of contemporaneous correlation, 3SLS gives more efficient estimates than two stage least square, especially in large samples. Note that our sample consists of 67 countries.

Table 1: Pair wise correlation 1

	IPR	GDP	NIHDIR	RALW	Trade_US	CGH	IAu	FUTECH	Colony	GINI	IOSIR	IISIR
IPR	1.0000											
GDP	0.6822***	1.0000										
NIHDIR	0.6452***	0.8642***	1.0000									
RLAW	0.8255***	0.7534***	0.7544***	1.0000								
Trade_US	0.5459***	0.4853***	0.4875***	0.3725***	1.0000							
CGH	-0.1771	-0.2822**	-0.1817	-0.1605	-0.3275**	1.0000						
IAu	-0.5521***	-0.6027***	-0.7771***	-0.6547***	-0.2392**	0.2238**	1.0000					
FUTECH	-0.3029***	-0.1879	-0.2935***	-0.4310***	-0.1826	0.4182***	0.4493***	1.0000				
Colony	0.2028*	0.4140***	0.5186***	0.3684***	0.1633	-0.1682	-0.4571***	-0.1268	1.0000			
GINI	-0.2251**	-0.4708***	-0.4971***	-0.4062***	-0.0685	0.0340	0.3940***	0.1229	-0.6462***	1.0000		
IOSIR	0.7308***	0.7633***	0.8046***	0.8049**	0.4873***	-0.2864**	-0.7072***	-0.3645***	0.4708***	-0.4446***	1.0000	
IISIR	0.8071***	0.8545***	0.8725***	0.8865***	0.4811***	-0.2571**	-0.7167***	-0.3755***	0.4909***	-0.4097***	0.8658***	1.0000

Note: * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level

Error! No text of specified style in document.: **Three Stage Least square estimates**

	IPRR	FUTECH	IOSIR	Trade_US	GDP	IISIR
NIHDIR	-1.0694***(-3.30)				0.5944***(-5.16)	
IPRR			0.4408(1.44)	0.6597***(-3.07)		1.1295***(-3.00)
FUTECH	-187.6146*(-1.99)					508.3129***(-3.84)
RLAW	-0.4171(-0.89)		0.2730(1.08)		-0.1018(-0.74)	
IOSIR	1.8281***(-2.83)	-0.0015***(-3.18)		-0.7703(-1.81)	0.3056(1.42)	
IISIR			-0.4074(-1.06)			
Trade_US	1.3226***(-5.18)					
CGH	28.6532***(-2.39)	0.0524*(2.17)				-24.5069*(-2.38)
AUTONOMY				5.0531(0.86)		
COLONY			19.1038*(1.96)			
GDP			0.6350***(-2.89)	0.9131*(2.51)		0.8972***(-3.51)
GINI						-0.2622(1.59)
CONSTANTS	118.7029(1.05)	1.2846***(-12.18)	-6.3127(-0.95)	10.0060(0.52)	9.5568*(2.38)	-659.0456***(-2.38)
Chi sq	98.01***	21.46***	171.43***	19.39***	202.92***	38.66***
Total Observation	67	67	67	67	67	67

*denotes significance at 10% level, **denotes significance at 5% level, ***denotes significance at 1% level. Z values are in parenthesis

We then carry out Hausman test which is a general implementation of Hausman's (1978) specification test, which compares an estimator θ_{b1} that is known to be consistent with an estimator θ_{b2} that is efficient under the assumption being tested. The null hypothesis is that the estimator θ_{b2} is indeed an efficient (and consistent) estimator of the true parameters. If this is the case, there should be no systematic difference between the two estimators. However, if there exists a systematic difference in the estimates, then there are reasons to doubt the assumptions on which the efficient estimator is based. For our model, the Hausman test for the similarity between 2SLS and 3SLS is rejected at 10% level. Even though the similarity is rejected, it is only at the 10 percent level. We, consequently, thought we should report the results of both 2SLS and 3 SLS.

Error! No text of specified style in document.: **Comparison of 2SLS and 3 SLS estimation**

		3SLS	2SLS
Dependent variables	Independent variables	Coefficient	Coefficient
IPR			
	NIHDIR	-1.069485*** (-3.30)	-.5732811 (-1.21)
	FUTECH	-187.6146** (-1.99)	-129.6635 (-1.04)
	RLAW	-.4171013 (-0.89)	.2796119 (0.41)
	IOSIR	1.828138*** (2.83)	.7815075 (0.74)
	Trade_US	1.322649*** (5.18)	.8380387* (1.95)
	CGH	28.65327** (2.39)	20.92642 (1.12)
	Cons	118.7029 (1.05)	86.06281 (0.50)

FUTECH			
	IOSIR	-.0015944**** (-3.18)	-.0019265**** (-3.56)
	CGH	.0524846** (2.17)	.0454624* (1.82)
	Cons	1.28466**** (12.18)	1.330524**** (12.11)
IOSIR			
	IISIR	-.4074895 (-1.06)	-.0458595 (-0.10)
	RLAW	.2730699 (1.08)	-.0435367 (-0.15)
	IPR	.4408998 (1.44)	.5548615 (1.59)
	GDP	.6350245**** (2.89)	.3777602 (1.48)
	Colony	19.10383** (1.96)	25.50158** (2.27)
	Cons	-6.312772 (-0.95)	-4.152331 (-0.57)
Trade_US			
	IOSIR	-.7703255* (-1.81)	-.5195642 (-1.15)
	IAu	5.053182 (0.86)	5.399241 (0.84)
	IPR	.6597391**** (3.07)	.5539031** (2.45)
	GDP	.9131152** (2.51)	.7535297** (1.96)
	Cons	10.00603	10.81174

		(0.52)	(0.52)
GDP			
	IOSIR	.3056284 1.42	.0321601 (0.13)
	NIHDIR	.5944091*** (5.16)	.6977778*** (5.55)
	RLAW	-.1018621 (-0.74)	.0386895 (0.25)
	Cons	9.556897** (2.38)	11.15754*** (2.65)
IISIR			
	GINI	-.2622361 (-1.59)	-.251795 (-0.82)
	CGH	-24.50698** (-2.38)	-13.45811 (-0.86)
	GDP	.8972628*** (3.51)	.586186 (1.43)
	FUTECH	508.3129*** (3.84)	325.7885 (1.21)
	IPR	1.129566*** 3.00	1.158594* (1.70)
	Cons	-659.0456*** -3.62	-432.224 (-1.23)

The table 3: comparing the 2sls and 3sls show that the 3sls results capture better results for CGH, GDP, Trade_US, NIHDIR, IOSIR. Therefore, we take up 3SLS to offer a more systemic view. If we compare the 2SLS and 3SLS estimation from table 3, it may be observed that the equation for FUTECH, Trade_US and GDP remain unchanged. In the equation of IISIR, although the sign of each effect are same but more variables are coming out to be in systemic interlinkages of 3SLS. In all other equations direction of affect remain the same but the affect of same (highlighted in

bold in the table) are more pronounced when systemic interlinkages are taken up by 3SLS. In the light of the fact that Hausman test directs us to use 3SLS, we therefore continue to base our analysis through results obtained by 3SLS.

Section V: Results and discussions

From the table 2 we observe that IPR is negatively influenced by NIHDR (significant at 1% level) and FUTECH (significant at 10% level). We also observe that IPR is positively influenced by IOSIR (significant at 1% level), Trade_US (significant at 1% level) and CGH (significant at 5% level). It suggests that countries with lesser non-income human development adopt stronger forms of IPR protection²⁴. We can argue here that NIHDR is not very harmonious with the institution of IPR. We observe that countries with more emphasis on development of technology have weaker IPR protection. However, the countries with better innovation output seem to opt for stronger IPR regime. Also countries receiving more export from US have adopted stronger forms of IPR. Nevertheless we also observe that countries which perceive competition is good tend to have stronger form of protection.

From the equation of FUTECH, we observe that IOSIR weakly and negatively influence FUTECH (significant at 1% level) and CGH influences FUTECH weakly yet positively (significant at 5% level). This signifies countries with higher innovation output appear to have lower emphasis on future development of technology. On the other hand, the countries which perceive competition is good are pushing for future development of technology.

In the equation of IOSIR, we observe that IISIR and IPR do not emerge as determinant of IOSIR. Nevertheless, we observe, IOSIR is positively influenced by GDP (significant at 1% level) and COLONY (significant at 10% level). We observe that countries with higher GDP appear to have better innovation output. Also, the countries with history of colonization do not fare well in terms of innovation output. This result also signifies that the colonizers are having better innovation output. This confirms our hypothesis that countries post independence have to make more efforts to realign their institutions according to their both formal and informal institutions.

²⁴ NIHDR has also been studied by Bhaduri et al (2015). In their model HDINI does not emerge as significant determinant of IPR protection. The authors have however treated HDINI as an endogenous variable where IPR negatively influences HDINI. In our equation system we have used NIHDR only as an exogenous variable.

Such countries also have to make huge investments in social capital and infrastructure development. Hence, find that innovation output is more determined by historical institutions. We can argue that investment into innovation, like the institution of IPR is quite recent phenomenon. On the contrary factors like colonial experience and GDP are more embedded into the culture of the society across countries.

In the equation of Trade_US, Trade_US is positively influenced by IPR (significant at 1% level) and GDP (significant at 5% level). We observe that countries with stronger IPR protection have better export from US and also that countries with better economic growth have better trade relations with US. Also GDP (significant at 10% level) positively influences Trade_US. We observe that countries which rank high in GDP are engaged in more trade with US.

In the equation of GDP we observe NIHDR influences GDP positively (significant at 1% level). However, we also observe that IOSIR and RLAW do not emerge to be significant determinant of GDP (economic growth). Hence, we can argue that strength of non-income part of human development level does determine better economic performance.

In the IISIR next equation we observe that CGH negatively influence IISIR (5% level). IISIR is positively influence by GDP, FUTECH, and IPR (all significant at 1% level). We also observe that countries perceiving competition is good are actually are weaker in innovation input. This is in contradiction to the discussion in the discussion above, which stated that the countries with perception that competition is good and are emphasizing more on development of technology.

Here we observe that countries emphasizing more on technology development are investing more on innovation. The countries ranking higher in GDP are better in innovation input. Also countries with stronger IPR have better innovation input.

From the model we observe interesting results on significance of history and social values (in form of social values and history of colonization) and politics (trade with US) on the institution of IPR. Ironically we observe that Innovation output is not determined by innovation input and IPR. We also observe two way causality between IPR and Trade_US. When TRIPS argues for stronger IPR to facilitate import, imports are influenced by the economic status (market and purchasing power) of the country.

We observe from the model that perception of competition plays a determining role in the strength of intellectual property rights and Innovation input. This social value also influences other social value capturing for future orientation towards technology. We also observe that the

future orientation towards technology in turn influences both IPR and innovation input. We observe both direct negative effect of preference for competition on investment on innovation. Whereas we observe positive indirect affect (by influencing future orientation towards technology) of value of competition on investment on innovation. We also do observe weak negative influence of innovation output on future orientation towards technology. Thomas R DeGregory (1996) discusses the anti-technology bias as elitist and the resurgence of a romantic notion of 'superior lifeways' of 'living lightly on the land and in harmony with nature'. DeGregory discusses the evidence arising from environmental and organic agriculture movement. The author argues that cultures are unique in the ways they assemble their complex of technologies. The author argues that though many countries seek technological transfer from other countries, there are some countries have stigma attached in borrowing western technologies. The authors argue that many of these cultures have experienced periods of 'technological dominance'. DeGregory gives example of northern Europe which borrowed technology from Asia and North East. He argues that in the process of colonization, the Europeans adopted a notion of unique capability for science and technology. Consequently some of these beliefs got transferred to the colonies, which also accepted being non-technology as a virtue.

Innovation activity as has been captured by the model is nothing much to do with IPR protection. Though innovation is determined by strength of IP protection. But this factor is jointly determined by the economic status (GDP as well as income inequality) of the country which also represents the purchasing power/ demand or pull for technology. This may also signify that countries with higher income inequality would push for more investment in innovation so as to reduce the gap between have and have nots. Also it is very well captured that history and political institutions represented by history of colonization, embedded in the social values of competition and future orientation towards technology determine the output. In the case of countries which have been colonized, the general infrastructure or the innovation capability may be missing, there by creating dilemma between demand pull and capability push. However, we do observe a negative relation between innovation input and innovation output. We can argue that the countries with higher innovation input are not getting desired innovation output. As discussed previously, it is possible that lack of domestic institution capability, market appropriation, informal economy may cause in failure of achieving desired innovation output.

Section VI: Conclusion

The econometric analysis finds complex relationship between economic performance and the institution of IPR. Stronger IPR promotes investment in innovation, but does not have any impact on innovation outputs. GDP also augments innovation input. Higher level of human development promotes GDP. GDP, however, does not seem to be important for IPR, while countries with lower level of human development are found to have stronger forms of IPR.

Quite surprisingly the findings indicate that innovation output is shaped more by overall income, and historical contingencies than current level of input to innovation. Our analysis also confirms complementarity between the various informal institutions and related formal institutions. What it perhaps shows is developing innovation capacity is a long term process and certain economies, have had a historical advantages in this field, perhaps due to presence of better overall institutional framework for innovation (e.g. better educational infrastructure, skill sets, and other forms of complimentary institutions). Interestingly, the study identifies that the countries ranking high in economic growth are investing more in innovation activities and develop innovation capacities. Hence, the level of economic performance may determine the innovation activities of the country. In terms of social values, higher preference for new technology is found to augment innovative capacity. The results from our study highlight that the countries ranking high in terms of export to US will be those countries which have better economic performance. We observe two way causality between trade with US and strength of IPR, thereby, confirming the argument that countries experience pressure to strengthen their IPR, if these countries wish to have better trade relations with IPR. The thesis highlights the role of informal institutions, politics and history in deciding the path formal institution of IPR would take. This result also highlights that higher exports to the US is done by countries which have stronger IPR at place.

Interestingly, however, we find that the countries which have higher social preference for new technology are the countries which have weaker IPR protection. This finding is in conflict with the premise that that stronger IPR are liked by communities having higher preference for new technologies. What we find is rather a confirmation that people become satiated with technologies, and they cease to prefer further technological developments. Alternatively, our results perhaps indicate that the reasons behind strengthening of IPRs perhaps are not necessarily

supported by a social preference for technological advancement. Possibly, other interests have played a greater role in strengthening the IPR in these countries. Dealing with such questions requires one to go deeper into the contestation of various social values in the making of the institutions of IPR.

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