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Analyzing the Impact of Intellectual Property Laws on Innovation

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ABSTRACT: A long theoretical literature has analyzed optimal patent policy design, yet there is very little empirical evidence on a key parameter needed to apply these models in practice: the relationship between patent strength and research investments. In recent decades, intellectual property rights (IPR) and their macroeconomic effects have attracted considerable attention from both policymakers and academics. The results demonstrate the existence of non linear relationships between IPRs and technological innovation which the form is an inverted U shaped curve, It's shown that innovations in emerging countries increase in it is IPRs by looking for the factor of human capital and economic development who play an indirect role in increasing the impact of IPR on innovation. I then summarize the findings of two recent studies that have made progress in starting to overcome these empirical challenges by combining new data sets measuring biomedical research investments with novel sources of variation in the effective intellectual property protection provided to different inventions. Despite a substantial theoretical and empirical literature, evidence regarding the impact of IPR protection on innovation and economic growth is mixed. In this study we conduct a literature review and meta-analysis of the topic, and find that IPR have an overall positive effect on innovation and growth. I discuss the relevance of both studies for patent policy and discuss directions for future research.

KEYWORDS: intellectual property rights (IPR), technological innovation, non linear relationships, Trade-Related Intellectual Property Rights (TRIPS), patent policy.

I.INTRODUCTION

Among the various driver of modern economic growth has been the distinctive role played by technological innovation. Of the different factors stimulant innovation, none has received as much attention as intellectual property protection. IPR protection could help to stimulate creativity and risk-taking against counterfeiting and imitation. So, constantly innovating will be the condition for sustainable economic growth. In recent years, technological innovation has progressed, giving a central role to the protection of intellectual property rights, which have an important role in the emergence and resolution of international economic conflicts. This evolution led to the Agreement on the aspects of Trade-Related Intellectual Property Rights (TRIPS) which was concluded during the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) in 1994. In the same goals, the TRIPS Agreement describes an objective of extending the rigor of IPR protection. The study of the relationship between IPR and innovation has become a major topic in economic research. The impact of intellectual property rights on innovation may have the potential for a positive or negative result; therefore, the rate of innovation may vary positively or negatively. This impact leads to non-linear relationships between IPRs and innovation. In other words, the IPR system may have a different impact on innovation with the existence of certain thresholds. Academics and policymakers have long recognized that—in the absence of government intervention—competitive markets may provide too little incentive for research investments in new technologies. If a market failure arises due to the public good nature of ideas, then there exists the potential for government intervention to improve welfare. In theory, many different policy instruments could be used to address this market failure. In practice, perhaps the most widely used policy lever both historically and globally has been intellectual property rights such as the patent system. Intellectual property rights aim to increase private research investments in new technologies by allowing inventors to capture a higher share of the social returns to their inventions.

II. LITERATURE REVIEW

Huirong Chen (2023) In this study, we analyze the cultivation problems, such as lack of personnel training links, professional teachers' lack of relevant knowledge, simple course assessment methods, students' weak application ability of professional knowledge and so on, of intellectual property awareness training in current application-oriented universities from teaching teachers, school curriculum offering, assessment and so on. Then, based on specialized courses, combined with general courses of intellectual property, and by means of practice, strategies are proposed to stimulate students' innovative thinking and improve their ability of intellectual property extraction and writing, so as to provide some references for the cultivation of students' innovative ability and improvement of their awareness of intellectual property.

Jun Zhao (2023) For the seed industry to gain a foothold in the fierce market competition and achieve breakthroughs in technology, products and markets, the most important thing is to bring into play the unique value of intellectual property. The use of IPR search and analysis can be effectively informed of the real competitive environment, understand the development of technology, layout, gap vulnerability and other information, providing legal risk analysis, technological innovation guidance, cooperation ecological construction, M&A financing assistance and other aspects of value for domestic seeds to achieve leapfrog development. IPR operation in the seed industry has both the general functions of general IPR operation and the special features of the seed industry such as strong regulation and object restrictions, etc. **Yujiao Tang (2022)** The punitive damages system originated in the United Kingdom and has been widely developed in the United States. In view of the serious problem of intentional and repeated infringement of intellectual property rights in China, the Civil Code and relevant laws in the field of intellectual property rights have fully introduced a punitive compensation system. Through learning and drawing on the experience of the application of punitive damages for extraterritorial intellectual property rights, we hope to provide a reference for China's judicial practice. Through comparative law research, it is clear that the principle of prudence and modesty, reasonableness and proportionality of intellectual property punitive damages in China should be followed.

Tran Thi Hai Van (2022) The study explores the model of spin-off businesses originating from research and training institutions as a new solution to improve the commercialization of intellectual property in universities in the country we are now. From the challenges brought by the spin-off business model, the article, with the method of analyzing and synthesizing the results from related studies, offers suggestions for useful solutions to promote the formation of the business model business model starting from exploiting intellectual property at universities.

Thomas Heinz Meitinger (2020) After Corona times companies are more reliant on the optimum usage of their scarce production resources, like financial or human capital. Intellectual property, like patents, must be used as efficiently as possible. In this context, it is required to focus available financial resources on those property rights that yield to the greatest impact. Other patents that protect subject-matter of little or no interest to market participants waste company resources and form negative financial assets. Such subject-matter does not require patents as prohibition rights, since market participants voluntarily choose not to use the invention.

Intellectual property

Intellectual property (IP) is a category of property that includes intangible creations of the human intellect. There are many types of intellectual property, and some countries recognize more than others. The best-known types are patents, copyrights, trademarks, and trade secrets. The modern concept of intellectual property developed in England in the 17th and 18th centuries. The term "intellectual property" began to be used in the 19th century, though it was not until the late 20th century that intellectual property became commonplace in most of the world's legal systems. Supporters of intellectual property laws often describe their main purpose as encouraging the creation of a wide variety of intellectual goods. To achieve this, the law gives people and businesses property rights to certain information and intellectual goods they create, usually for a limited period of time.

International framework

The international governance of IP involves multiple overlapping institutions and forums. There is no overall rule-making body. One of the most important aspects of global IP governance is the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). The TRIPS Agreement sets minimum international standards for IP which every member of the World Trade Organization (WTO) must comply with. A member's non-compliance with the TRIPS

Agreement may be grounds for suit under the WTO's Dispute Settlement Mechanism. Bilateral and multi-lateral agreements often establish IP requirements above the requirements of the TRIPS Agreement.

Identifying Which Technologies Are Covered by Intellectual Property Rights

I construct my data based on the census of human genes (around 30,000 genes). For each gene, I was able to track the timing of when the gene was sequenced by the Human Genome Project by querying an online NIH database to identify the date that gene sequence first appeared in that online database. Because the Bermuda rules—as described in the preceding—required publicly sequenced data to be posted online within 24 hours of sequencing, the date of appearance in this online database is a reasonable proxy for when each gene was sequenced by the publicly funded sequencing effort. The key input enabling the measurement of which genes were covered with Celera's intellectual property was an academic paper by Istrail et al. (2004), which compared Celera's 2001 draft genome with a snapshot of the publicly sequenced data at a given point in time. By combining this cross-sectional comparison with the data described in the preceding on when each gene was sequenced by the publicly funded effort, I am able to identify which genes were "Celera" genes in 2001 and the timing of when each of those genes was resequenced by the Human Genome Project between 2001 and 2003.

Tracing Follow-On Innovation

Measuring the cumulative nature of innovation is quite challenging in most markets. For this investigation, I constructed measures of cumulative innovation based on linkages between genes and phenotypes. For example, the link between the breast cancer (BRCA) gene and breast or ovarian cancer risk represents a genotype-phenotype linkage. For each gene, I collected data on scientific publications documenting evidence for genotype-phenotype linkages from the Online Mendelian Inheritance in Man (OMIM) database, which curates biomedical publications with identifiers for the genes and diseases relevant to each publication. In order to measure commercial development related to each gene, I collected data from GeneTests.org, a voluntary listing of US and international laboratories offering genetic testing. While not comprehensive, over the time period of my study, private firms and academic medical centers had an incentive to list their tests in GeneTests.org as a way of advertising the availability of their tests to both patients and doctors. Together, these linked measures of follow-on innovation provide a window into how genes transition from being the subject of basic scientific research to being incorporated into commercial products that are available to consumers and measure these aspects of follow-on innovation in a relatively precise way.

Intellectual property rights and technology

A description of the fundamental nature of technology, or knowledge, and the strategic behavior of the firms when utilizing these technologies, which are protected by property rights, explain the importance of our industry-level analysis. The difference in the technological composition of specific industries leads to different incentives for protecting intellectual assets through patents, and many scholars have drawn attention to the different patenting activities and motives across industries.

III. RESEARCH METHODOLOGY

The doctrinal method included meticulous study of materials and review of the literature. International treaties and national legislations of various countries in relation to the subject have been the primary source of the work. Thus, the study attempted to use the same data as those of previous studies in the literature to ensure a degree of comparability with regard to the choice and definition of the control variables. The present doctrinal research has been done to ascertain and examine the protection of intellectual property rights of farmers at the international and national levels. This study analyzed a data set of 10 emerging countries from 1985 to 2015. The variables were divided into primary and control groups. The primary group considered innovation and intellectual property rights. With regard to innovation, there are two main methods of measurement: (i) the R&D expenditure and (ii) the number of patents. As the empirical study requires a large time-series dataset that includes the emerging countries, it uses the number of US patents per capita granted to the residents of a given country each year. To avoid selection bias for US innovations, this study follows previous studies of Porter and Stern and excludes the United States from the dataset. The efficacy of Indian law has been examined in the light of the available data and figures including the data provided by the PPV&FR

Authority. Upon the basis of whole of the study certain conclusions have been drawn and suggestions have been proposed.

IV. RESULTS AND DISCUSSIONS

Prior analyses to EFA of IPRs indicated relevance of this statistical procedure. Measure of sampling adequacy was acceptable (KMO = .62) and Bartlett's Sphericity test gave statistically significant results, $\chi^2(3) = 82.95$, $p < .001$. Considering these results, it is possible to analyse the inter-item correlation matrix. Three methods to determine the number of factors suggested extracting a factor, likewise, the RMSR was equal to .00, indicating a good fit of model. Eigen value of extracted factor was 1.98 and explained 53% of total variability. Finally, factor loadings were greater than.

Table 1: Results from an exploratory factor analysis of IPRs

Code	Item	Factor loading	h^2
IP_1	Number of patents registered by firm.	.46	.21
IP_2	Number of trademarks registered by firm.	.88	.78
IP_3	Number of copyright records.	.78	.61

Notes: N = 102. The extraction method was ULS. Factor loadings above .40 are in italics.

Regarding EFA for IC, this was done in two moments. First EFA obtained acceptable measure of sampling adequacy, KMO = .89, and statistically significant Bartlett's sphericity test, $\chi^2(66) = 839.12$, $p < .001$. Scree test and parallel analysis suggested extraction of 3 factors, while rule of eigenvalues greater than 1 indicated extraction of two factors. EFA was performed with three factors, where two items (CET_2 and CET_3) presented high factor loadings in two factors and the difference between them was less than .10, so they were removed from the measuring instrument.

Table 2: Alpha coefficient, CR and AVE of variables

Variable	nitems	M	SD	α	CR	AVE
Intellectual property rights	3	3.17	4.10	.60	.78	.63
Organisational ambidexterity	6	23.99	4.74	.90	.90	.61
Exploration	2	8.51	1.73	.87	.88	.79
Exploitation	2	9.31	1.32	.84	.85	.74

Notes: M = Mean; SD = standard deviation; α = alpha coefficient; CR = composite reliability; AVE = average variance extracted.

Parameters associated with evaluation of measurement model (reliability analysis, convergent and discriminant validity) were obtained. All factor loadings were greater than .50, except IP_1. Likewise, reliability indices, CR and alpha coefficient (α) exceed the recommended limit of .70 for all variables, except alpha coefficient for IPRs (Table 2).

Table 3: Correlation between the latent factors of IC and IPRs

Variable	IPR	OA	ER	ET
Intellectual property rights	.79	[.23;.61]	[.24; .52]	[.07; .52]
Organizational ambidexterity	.42***	.78	[.49; .90]	[.55; .85]
Exploration (ER)	.38***	.69***	.89	[.50; .76]
Exploitation (ET)	.29*	.70***	.63***	.86

Notes: On diagonal, square roots of AVE. Numbers in brackets represent 95% confidence intervals. * $p < .05$, *** $p < .001$

On the other hand, AVE exceeds value of .50 for all variables, supporting the convergent validity evidence of measurements (Table 3). In all cases, the square roots AVE for each measure exceeded the bivariate correlations of each variable with others, which led to conclude that they have divergent validity (Table 3).

V. CONCLUSION

The present work is an attempt to offer a comprehensive analysis of legal developments for protection of farmers' rights. On the other hand, strategic management of IPR affects exploration of opportunities and dynamic capabilities. IPRs allow trade of knowledge and technology. This, in turn, allows new combinations that lead to innovations. These rights aim to offer recognition and protection to those individuals who are involved in conservation and development of biological resources of a country. An analysis of various legal instruments reveals two major stages through which the issue of farmers' rights protection came to the fore. A long theoretical literature has analyzed optimal patent policy design, yet there is very little empirical evidence on a key empirical parameter needed to apply these models in practice: namely, the relationship between patent strength and research investments. First, the grant of plant breeders' rights (PBR) to the commercial plant breeders under IP regime, which involves technological development in plant breeding technique and second the recognition of role of the farming community in conservation and development of new plant varieties. The response of the world community for the first stage was emergence of the UPOV Convention and the development at the second stage resulted in conclusion of the Convention on Biological Diversity and FAO International Undertaking and Treaty on Plant Genetic Resources for Food and Agriculture. These instruments are based on the scheme of providing protection to commercial plant breeders as well as traditional plant breeders subject to minimum levels of protection guaranteed by the instruments.

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