PART I

The Broad Environment for Intellectual Property Protection beyond Borders

1

The International Intellectual Property System from an Economist's Perspective

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ABSTRACT

The globalized system of protection for intellectual property rights continues to evolve, from the TRIPS Agreement and WIPO treaties to modern regulation-based preferential trade agreements. All these mechanisms require substantive strengthening of intellectual property (IP) rights, particularly in emerging and developing countries. This chapter surveys evidence on how these policy reforms have affected key economic variables, ranging from early studies of growth, research and development, and innovation to new research on trade, foreign investment, and production and knowledge networks. The evidence regarding growth and innovation does not paint a clear picture, largely due to difficulties in measurement and estimation. Considerably more research, especially at the microeconomic levels, is needed to understand the channels through which innovation is encouraged or discouraged. Recent work on how detailed trade flows and firms react to rigorous and globalized protection has unearthed numerous subtleties in the microeconomics of IP, trade, and technology transfer. This research is becoming highly granular. For example, the status of patent rules in importing countries affects the decisions of foreign firms to patent and export to those locations. Another point is that preferential trade agreements with "TRIPS-Plus" IP standards tend to expand the export of detailed, patent-sensitive goods to external countries. Patent laws also influence the development of global innovation networks.

TABLE OF CONTENTS

A. INTRODUCTION

The modern international intellectual property (IP) system has been under continuous construction since the inception, in 1995, of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) at the World Trade Organization (WTO). As one of the foundational accords establishing the WTO, TRIPS requires all member countries to meet its minimum IP standards, which are considerably more comprehensive and prescriptive than those involved in prior international agreements. TRIPS obligations are enforceable under the WTO system of settling disputes. In essence, the agreement set a policy benchmark that greatly internationalized the protection of IP rights (IPRs) as its requirements were implemented over the succeeding years.[1]

Twenty-seven years later, the IP system has achieved even greater globalization through additional norm-setting in treaties of the World Intellectual Property Organization (WIPO); bilateral investment treaties among nations; and – especially – the many bilateral, regional, and "mega-regional" preferential trade agreements (PTAs) that feature elevated "TRIPS-Plus" protective standards. Prominent among the last category are the recently renegotiated North American Free Trade Agreement, the Comprehensive and Progressive Agreement for Trans-Pacific

[1] For extensive descriptions and analysis, see, among many treatments, Deere (2008), UNCTAD (2005), WIPO (2004), and Maskus (2012).

Partnership, and the Comprehensive Economic and Trade Agreement between the European Union and Canada. Together, such initiatives have considerably extended the scope of international IP protection, both in terms of coverage and substantive standards as well as with regard to enforcement requirements. They have also established a complex system of rules that are simultaneously overlapping and potentially fragmented across countries. Broadly put, the majority of poor countries are bound minimally by TRIPS, with which they sometimes struggle to comply, but remain outside the elevated system constructed via PTAs among developed and key emerging countries.

Policy reforms on this vast scale must inevitably have important economic impacts, and searching for those impacts through extensive data analysis has become a large sub-specialization within economics. Research in this area is challenging for several reasons.

First, IPRs – including patents, copyrights, trademarks, trade secrets, and numerous variations on those themes – are themselves complex policy interventions that may generate cross-cutting incentive and disincentive effects. Their purpose is to address information problems and market failures that operate both statically and dynamically. In this inherently distorted environment, policies that may enhance innovation in one set of socioeconomic circumstances can diminish competition in another. Consequently, even the manner in which a research question is framed depends on specific national and temporal conditions.

Second, IPRs are (usually) national regulations facing all forms of economic activities and sectors, unlike product-specific or sectoral taxes, subsidies, and tariffs. Cutting specific taxes directly reduces costs and would almost inevitably expand the taxed activity – such as output, trade, and investment. In contrast, increased patent scope or copyright duration has differential effects across countries and industries, with those effects being highly dependent on local conditions such as the endowments of skills, depth of financial markets, and efficacy of the judicial system. In that context, it is challenging to make theory-based accurate predictions about how national, let alone global, IP reforms may affect measurable economic activity.

Third, data limitations are endemic in this area, particularly across countries at different levels of economic development. For example, we would like to know how IP reforms affect innovation incentives and outcomes. Patent statistics offer an obvious outcome measure, but simply counting patent applications or grants fails to recognize their considerable heterogeneity, while much innovation in poor countries is not patented. Investments in research and development (R&D) are the corresponding input measure, but such data rarely exist beyond the developed and key emerging economies. Moreover, innovation should be measured at the microeconomic or firm level, and such datasets remain scarce, although they are gradually increasing in scope and availability. Little wonder, then, that much of the empirical research on incentive effects has centered on international trade, for

which data are comprehensive and reasonably consistent internationally. But even that solution runs into its own research problems, such as the technical difficulty of detecting microeconomic impacts from national reforms that happen sporadically. Beyond that, the data limitations become severe: how do we consistently and appropriately measure competition, prices, and markups, as well as entry and exit across countries?

Most challenging, however, is the essential difficulty of assigning causality from IP reforms to, first, these microeconomic factors and, second, macroeconomic concepts such as economic growth, sectoral reallocation, and inequality. All of these are critical issues about which we have little solid information and need more research. The primary reason causality is so difficult to detect is that there are many complex confounding factors that must be accounted for, not least the fact that IP policy may be endogenous to those changes. It is evident that IP policy exists and evolves in a milieu of other conditions that affect technological and cultural change and which is itself often path-dependent.[2]

Despite these problems, economists have made progress in studying particular questions and improving our understanding of how the evolving IP system influences economic outcomes, particularly at the microeconomic and sectoral levels. Research also has shed light on the ways in which such effects are conditional upon other economic factors. This chapter is a progress report on this research, with an emphasis on the most recent and current studies in international trade, investment, and strategic IP use. The international focus reflects my comparative advantage in studying trade, foreign investment, and technology transfer, the areas of my own inquiry. In fact, however, these areas have attracted the most research attention by empirical economists largely because of the relatively thick data sets and the likelihood that IP will leave detectable traces in trade flows. For completeness, I supplement the review with comments on important recent findings in the areas of innovation and pricing. The final portion of the chapter sets out useful directions in which this research agenda should move.

Readers may wonder about the suitability of a chapter that reviews economic analyses of the effects of IP reforms and related policies in a volume centered on the theme of public international law of IPR. One reason for this inclusion is that legal scholars in this area sometimes make strong claims based largely on intuition or common sense, without reference to available evidence. It is important, therefore, to bring to the attention of those scholars the many complex factors that matter for the economic outcomes of international IP reforms. A second reason is to alert policymakers to the impacts, both wanted and unwanted, of changing the global IP system. Sometimes the consequences are as intended, but often they are not; furthermore, indirect effects can be dominant. The studies analyzed here should

[2] See Odagiri et al. (2010).

therefore inform future deliberations about IP regulation and international IP treaties.

B. COMMENTS ON IP REFORMS, INNOVATION, AND ECONOMIC GROWTH

Implicit in the discussion above is the idea that it is next to impossible to make credible claims that global IP reforms in the post-TRIPS era have materially affected international investments in R&D, invention, or literary and artistic creativity. The investment variables, if measured (poorly) at the national or broad sectoral levels, are macroeconomic; they vary primarily with the business cycle, expectations, taxes and subsidies, education, competition, and a host of other socioeconomic conditions. For example, real business expenditure on R&D among OECD countries showed no clear upward trend break after TRIPS implementation and only recently returned to shares of gross domestic product (GDP) that existed prior to the 2009–2010 financial crisis.[3] Neither can strong assertions about effects on aggregate economic growth be supported by rigorous empirical research in the presence of compounding factors across countries. Moreover, IP standards and enforcement, even in this time of effective harmonization, remain sufficiently endogenous to economic conditions that identifying aggregate causal effects is challenging. The protection of IP is a regulatory incentive that is presumably important in some contexts. However, finding its traces in aggregate data has not been achieved satisfactorily, in my view.

I. *Growth Regressions*

Despite these limitations, it is worth reviewing a few recent studies in order to highlight some conclusions that are intriguing and could support further debate and research. Consider first how patent laws interact with real GDP growth. Falvey et al. (2006) studied this question using a panel of eighty countries over discrete five-year periods between 1975 and 1994, the pre-TRIPS period. The authors noted the standard arguments that the innovation gains from stronger patent rights – in terms of both new products and technology diffusion – could be offset by higher imitation costs and reduced static competition. These impacts should vary among countries at different levels of economic development and technological capabilities. The authors estimated a standard growth equation in which average real growth in GDP per capita, for each country and within each period, was regressed on several variables: initial GDP per capita, gross domestic investment, population growth, degree of secondary education in the economy, ratio of exports to GDP, average inflation rates, a measure of IP protection, and country- and time-specific fixed

[3] See WIPO (2019).

effects. The IP variable was the widely used Ginarte–Park (GP) index, which essentially counts the number of patent provisions in each country's national laws (Ginarte and Park, 1997).

In their basic estimation, Falvey et al. (2006) found no impact of IP protection on economic growth, which is unsurprising in light of the problems discussed above. Instead, they argued that if there were such a relationship, it would likely depend on threshold effects in how IP protection interacts with initial GDP per capita. In fact, they found evidence of two thresholds. In countries with real per-capita incomes below $671 (in 2005 prices) and those with incomes above $10,289, a rise in patent rights significantly increased GDP per capita across the time periods. Countries in the middle-income ranges experienced no effect, positive or negative. It should be noted that the estimated effects, while significant, were economically small. The authors interpreted their findings to mean that poor countries can achieve income growth through the ability of IPRs to attract foreign investment and new products from abroad, whereas rich countries gain from increased technological innovation. In contrast, the middle economies see any inward diffusion benefits offset by lower domestic imitation and competition.[4]

While these results are intriguing, as is the absence of any negative effect of IP on growth, the study exemplifies the econometric difficulties in aggregate growth estimation. No attempt was made to control for endogenous changes in the GP index, while simple fixed effects were insufficient to control for other factors that could drive these results. In short, the paper does not reliably demonstrate a causal effect. Moreover, the approach sheds no light on what precise economic mechanisms could drive the varying growth impacts, if in fact they exist.[5]

Hu and Png (2013) offered a better design by studying panels of about fifty manufacturing industries across about seventy countries, in five-year periods from 1981 to 2000, thereby bringing in a disaggregated sectoral focus and a period overlapping the early TRIPS era. Their basic specification regressed the growth in real value added at the sector–country level on several variables: initial value added, an interaction between sectoral patent intensity and national patent rights, and country and industry fixed effects. Their measure of "effective patent rights" was the product of the GP index and a national measure of contract enforcement, the Fraser Institute's index of legal systems and property rights. The logic is that GP fails to incorporate IP enforcement and interacting it with the Fraser index – assuming it applies *mutatis mutandis* to patents – should better capture the effective scope of

[4] This finding is reminiscent of the U-shaped relationship between GDP per capita and patent rights first noted in Maskus and Penubarti (1995).

[5] See also Gold et al. (2019), in which economic growth was regressed on an extended index of IP protection. In the authors' basic specification the relationship was positive and significant, but they found additional results that seem inconsistent with an IP–growth connection. For example, they found limited evidence of increased usage of IP rights after reforms, which raises questions about how policy changes actually flow through to growth.

protection. Industry-level measures of patent intensity were taken from US data and assumed to be constant across countries. The variable of interest was the interaction term: it should be that manufacturing industries with higher patent intensity grow faster than other industries in countries with strong patent rights.[6]

This expectation was born out in the study. The coefficient of the interaction variable was positive for all periods but statistically significant only for 1991–1995 and 1996–2000. Moreover, the size of this coefficient grew over time, offering some suggestion that in the TRIPS era, we may be seeing stronger manufacturing growth effects. Using 1990 figures, Hu and Png (2013) computed that a one-standard-deviation increase in effective patent rights (roughly, the difference between the regimes in Turkey and Singapore) would raise value-added growth by 0.75 percentage points, a large effect in the context of an average growth rate of around three percentage points. This effect was strongest for the most economically advanced countries. The results withstood a battery of robustness tests.

The study is noteworthy largely for its focus on detailed industries and the finding that if patent rights matter for output growth, that is true mainly for high-patent sectors and developed economies. However, the paper can be criticized for not dealing adequately with endogeneity, and it does not permit inferences about overall economic growth effects beyond manufacturing.

A more nuanced approach was taken by Kim et al. (2012). They studied the thorny question of whether different forms of technology protection, specifically invention patents versus utility models, have different effects on innovation and economic growth in developed and developing economies. For this purpose, they specified a "knowledge production function" in which the stock of knowledge (cumulated ideas) depends on the number of patents registered at the US Patent and Trademark Office (USPTO), which in turn depends on legal rights to protect the patents. The production function was specified as a growth equation, in which increases in per-capita income in each nation depend on lagged knowledge and IP applications, along with physical and human capital stocks, population growth, and fixed effects. This function was estimated together with an equation for patenting – itself a function of lagged patents, R&D spending, and a productivity term. The latter equation was augmented by a dummy variable indicating which countries had a utility model law in place, which enabled investigating whether the existence of such laws spurred patenting; that is, whether protecting utility models encouraged patentable invention. The authors demonstrated that the existence of a utility model regime was due primarily to each country's colonial origins rather than current economic factors that would generate sample selection bias, so that inclusion of the binary

[6] This is an example of the approach pioneered by Rajan and Zingales (1998) in their study of financial markets and growth. It is now widely used in international studies of innovation, contract enforcement, and related elements.

variable would not suffer from endogeneity problems. This careful relation between theory and estimation marks the study by Kim et al. (2012) as particularly credible.

Using their preferred estimation approach, the authors found evidence for the idea that different forms of patent rights are "appropriate" for varying development levels. First, the strength of patent rights (the GP index) had a positive and significant effect on patenting, but only for developed high-income (HI) countries. It had no evident effect on USPTO patent applications from lower-income and middle-income economies. Second, the coefficient for the existence of a utility model law increased future USPTO patent applications, but only in middle-income and lower-income economies. The effect in HI countries was negative but insignificant. In brief, protection of utility models can be an important determinant of the flow of internationally patentable inventions, a novel finding in the literature.

The next question is whether patenting activity raised the per-capita economic growth. Again, Kim et al. (2012) found that the propensity to patent in the USPTO positively affected per-capita growth, but only for HI countries. There was no effect in low-income and middle-income nations. The authors argued that this result reflected the relatively high costs of technology inputs in these countries from increased patenting, which offsets any growth benefit from stronger protection. In contrast, the existence of utility model laws had a positive and significant relationship with economic growth rates in these locations. Thus, policies protecting incremental innovations seem to correlate positively with economic growth in lagging economies. While many observers have argued for this form of tailoring IP policies to suit development needs, this study was the first credible demonstration of the empirical effects on invention and, perhaps, on growth rates.

II. *Innovation*

If stronger patent rights correlate with economic growth, presumably it is because they encourage innovation and technology diffusion. It remains difficult to find such causal links empirically, for reasons discussed above. Again, however, it is useful to review selected recent studies to elicit certain conclusions that seem robust.[7]

Branstetter et al. (2006) analyzed the responses of affiliates of US multinational enterprises (MNEs) to major reforms of patent laws in sixteen countries, most of them developing or emerging, between 1982 and 1999. Their event analysis considered changes in aggregate resident and non-resident patent filings in a six-year window surrounding the dates of reforms. In their econometric model, the patent reforms showed no impact on domestic applications. However, the reforms had a

[7] For a review of earlier econometric studies, see Maskus (2012). There is also important evidence, albeit inconclusive and context-specific, from careful studies of historical innovation episodes, as discussed in Moser (2013).

significant and positive impact on foreign patent applications, both in the short and long run, raising non-resident filings in the average nation by more than 50 percent. These findings reinforced the conventional wisdom, analyzed further in Lerner (2009), that multinational firms are more responsive to increases in patent rights in developing countries than are domestic firms. This point is unsurprising, particularly when one considers that the greatest short-term beneficiaries of domestic patent strengthening are likely to be global firms seeking to deploy their technologies locally.

In an important contribution, Qian (2007) analyzed twenty-six countries that, between 1978 and 2002, implemented laws establishing patent protection for pharmaceutical products; the study examined how that move influenced innovation in the industry. Her primary innovation measure was citation-weighted drug patent applications registered in the USPTO, and the analysis compared matched country pairs that differed in whether they adopted reforms. Various national and industry control variables were included in the regressions. Qian found no significant direct impacts of legal changes on US drug patent applications, even up to ten years later. However, there were important interaction effects: countries with higher educational attainment and per-capita income as well as greater measured market freedom significantly increased such applications post-IP reforms. Qian's results suggest that the innovation impact of IPRs depends heavily on complementary socioeconomic factors. Low-income economies with limited educational attainment and technical skills as well as restricted markets are less likely to motivate more internationally protectable inventions simply by improving their IP regimes. This result is likely relevant to other patent-sensitive sectors as well, but to my knowledge, this question has not yet been studied.

Kyle and McGahan (2012) studied global pharmaceutical innovation in the periods just before and after TRIPS was negotiated. That this new regime would expand innovation incentives, especially in treatments for diseases endemic to poor countries, was a key promise by TRIPS advocates. The authors exploited the fact that TRIPS compliance occurred at different times and across countries with different relative disease burdens. This diversity enabled them to study how global disease-specific R&D investments (measured as Phase I clinical trials) were changed after TRIPS, controlling for the global market in each medicine. They distinguished global diseases (experienced in most countries) from neglected diseases (also experienced in most countries, but of greatest interest in poor regions). In this difference-in-difference (DID) setup, the authors found increases in clinical trials for drugs aimed at both types of disease after TRIPS compliance, but significantly more for drugs aimed at global diseases. They next broke down these impacts into country groups classified by income levels. Here they found no indications of an increase in clinical trials for drugs aimed at neglected diseases after TRIPS compliance was achieved within developing countries. Rather, there were significant increases in R&D spending on illnesses with a large presence in HI countries. Such findings