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Working Paper No 2013/36| December 2013

The Correlation between the Level of Patent Protection and International Trade

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Abstract
Intellectual outputs are available on a non-exclusive basis and are non-rivalrous in use. Therefore, it is difficult for producers of intellectual outputs to appropriate the returns on their investments and cover the costs without intellectual property rights (IPRs). In addition, the market for intellectual outputs would fail, or would deliver an inefficient output supply, without IPRs. Intellectual outputs are traded in both domestic and foreign markets and hence risks of imitation exist at home and abroad. Hence, the trade to regions with weak IPRs might be weak. Importantly, weak IPRs lead to less innovation and production, which decreases export potential. This paper reviews the existing theoretical and empirical evidence on the effects of IPRs on international trade and delivers a number of important insights. First, economic theory is ambiguous in terms of the effects of IPRs: on the one hand, the market expansion effect predicts a positive relationship between stronger IPRs and exports; on the other hand, the market power effect predicts a negative relationship between the stronger IPRs and exports. Second, empirical evidence reveals a positive association between stronger IPRs (patent rights) and exports. This is especially the case for large developing countries with significant capacities for imitation. Third, stronger IPRs have differential effects across industries. Fourth, the impact of intellectual property on international trade depends on the local market demand, the economic sector, the structure of trade barriers, the specific intellectual property rights measured, a country's innovative potential (such as its adaptive capacity), the educational level of its workforce, the structure and funding of research and development (R&D), the quality of infrastructure, government policies and regulations, the market structure, the management of assets and the institutions involved. Thus, there are complex interactions that should be considered between absorptive capacities, intellectual property rights and trade. Finally, the paper argues that intellectual property rights are an important part of international trade agreements and will remain important in the future.

Research for this paper was funded by the Swiss National Science Foundation under a grant to the National Centre of Competence in Research on Trade Regulation, based at the World Trade Institute of the University of Bern, Switzerland.

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Contents

Tables

1. Introduction

The increase in international trade and international trade agreements as well as the growth of knowledge as a tradable asset have increased the importance of intellectual property rights (IPRs) in international trade over the past two decades. Countries that export knowledge-intensive goods have put pressure on other countries to change their existing IPR-related policies, laws and enforcement procedures. The argument put forward is that the countries under pressure will also benefit economically from the changes through the improved export performance of recipient firms as well as the accelerated transfer of technology between countries. The consistency of global trade and IPRs can be attributed to the successful negotiation of the agreement on the Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization (WTO). Subsequently, IPR standards and enforcement obligations were included in many regional and bilateral trade agreements (TRIPS-plus) which required the trading partner to implement stronger measures to protect IPRs than provided by the rules of the TRIPS Agreement, for example in plurilateral arrangements such as the Anti-Counterfeiting Trade Agreement (ACTA) involving 40 countries. The major emphasis of the TRIPS Agreement is the gain that developing countries will derive from strengthening their IPRs regimes. Indeed, access for the developing countries to the latest technologies via trade can increase with stronger IPRs. Developing countries have limited domestic technology and their domestic research and development (R&D) sector is underdeveloped. Therefore, foreign technology is important for their economic development. Obviously, intellectual property laws and regimes can attract foreign technologies to developing countries. However, although stronger IPRs can increase the exports of foreign firms by reducing the domestic imitation of new technologies, foreign firms might prefer to exert monopoly power under stronger IPRs and increase the prices of new technology goods. Therefore, whether global IPRs reforms will increase or decrease international trade is an empirical question.

This paper analyses the effects of the stronger IPRs on international trade by reviewing theoretical and empirical economic studies. Although the theoretical effect of stronger IPRs on international trade is ambiguous, empirical studies have shown that, overall, stronger IPRs (mainly patent rights, most of the data available for empirical studies relates to patent rights) have a positive effect on trade. This finding has important implications, since policies that aim to strengthen IPRs will benefit both exporting and importing countries, including the developing countries. Thus, the enhancement of IPRs could substantially increase imports of

technology-intensive goods that can have significant technological spill-over effects. This is especially the case for large developing countries with significant capacities for imitation, since almost all empirical studies have found a positive association between IPRs (patent rights) and international trade for large developing countries with significant capacities for imitation.

This paper is set out as follows: Section 2 discusses the global governance of international trade and IPRs; Section 3 analyses the economic theory and provides empirical evidence of the effects of IPRs on international trade; and Section 4 provides the conclusions.

2. Global Governance of International Trade and Intellectual Property Rights

2. 1. Regulation of International Trade

The composition, the means of delivery, the institutions and the rules that govern international trade have changed substantially over time. Today, trading 'in bits and pieces' takes place more than the export and import of finished goods and services, suggesting the fragmentation of the production, distribution and development of goods and services. This increasingly fragmented activity is regulated by the national and international regulatory framework. The WTO, which governs international trade, evolved from the General Agreement on Tariffs and Trade (GATT) in 1995, and has political (in the form of negotiations), legislative and judicial power (the mandatory dispute settlement system). However, some legitimate cross-border commercial activities are not covered by the WTO – some are regulated, for instance, by the Organisation for Economic Co-operation and Development (OECD) codes of conduct or guidelines. Moreover, some cross-border activity remains outside negotiated international trade rules, depending on private contract law or on widely accepted norms of expected behaviour – the 'socialization' effect (Curtis, 2012). In addition, 30 countries are not members of WTO.

IPRs in trade first came into effect on 1 January 1995, both in the North American Free Trade Agreement (NAFTA) and in the multilateral Uruguay Round in the form of the TRIPS Agreement. These two agreements detail the intellectual property standards and enforcement mechanisms that member governments have to adopt domestically as legal obligations in trade. These IPRs-related rules, regulations and enforcement procedures had also to be harmonized at the international level. However, the TRIPS Agreement does not require

compliance with the provisions of the Rome Convention and also does not incorporate the provisions of the Berne Convention on moral rights. The major challange of the TRIPS Agreement is to strengthen the intellectual property regimes in developing countries.

2. 2. Regulation of Intellectual Property Rights

The IPRs-related standards and enforcement procedures date back much further. The Paris Convention on the Protection of Industrial Property (1883) was the first international procedure to include patents on industrial innovations. The Berne Convention for the Protection of Literary and Artistic Works (1886) dealt with copyright and the Madrid Agreement Concerning the International Registration of Marks (1891) covered trademarks.

These three agreements became part of a larger umbrella organization, the *Bureaux Internationaux Réunis pour la Protection de la Propriété Intellectuelle* (BIRPI) in 1893 and later, after World War II, this became the World Intellectual Property Organization (WIPO). The WIPO (and BIRPI before it) focus on intellectual property standards; however, the enforcement provisions in WIPO are non-existent for all practical purposes. Although the principle of non-discrimination between domestic and foreign goods and services is an important part of international intellectual property conventions, international trade concerns are not central issues for the ongoing operation of WIPO (Curtis, 2012). Therefore, the TRIPS and the TRIPS-plus Agremeents are the main agreements on trade-related IPRs and most studies of them have investigated the effects of these agreements on international trade. Additionally, the TRIPS Agreement concerns the promotion of technology transfer, particularly to the least developed countries.

3. Economic Theory and Evidence on Intellectual Property Rights and International Trade

The legal approach to IPRs deals with the property aspects of such rights, whereas the economic approach mainly focuses on the policy aspects. The economic approach to IPRs investigates, theoretically or quantitatively, the potential gains and losses that result from policy changes, and it tries to establish causality where it exists. Economists are not interested in whether domestic or international legal obligations are being met, but in whether the benefits to the individual creator/innovator and to society outweigh the costs. The costs of IPRs can take the form of lower output, lower trade, less innovation and creativity, or reduced or delayed access by users.

3. 1. Intellectual Property Rights and International Trade: The Theory

Despite the body of literature studying the relationship between IPRs and international trade in the 1990s and 2000s, this relationship remains theoretically ambiguous.[1] Imposing intellectual property standards which reduce the volume of trade is seen to inhibit trade and to be anti-competitive. Therefore, some economists oppose the insertion of intellectual property standards and procedures into trade agreements and argue that these agreements tilt the balance of advantage towards producers and creators, and away from consumers, particularly consumers in poorer countries. They also claim that strengthening IPRs could hurt firms' learning-by-imitating strategies, reduce technology diffusion and transfer to the developing countries through reverse engineering, reduce legal trade in imitative technologies and products, and worsen consumers' welfare. Moreover, they argue that the United States (US) and other developed countries have a competitive strength in patent-intensive sectors such as pharmaceuticals, plastics, computers, scientific instruments, music recordings and videos, and other creation-intensive goods, and that strengthening patent rights will only benefit these countries (Maskus and Eby-Konan, 1994). In addition, the monopoly profits related to patent rights may acrrue largely to foreign firms rather than domestic firms, therefore IPRs may reduce the expected welfare gains for the home country. On the other hand, some economists favour strong IPRs and argue that weak or non-existent intellectual property standards reduce the incentives for firms to innovate and the possibility of more access to foreign technological innovations; they can act like a non-tariff trade barrier resulting in less international trade and technology transfer than would otherwise be the case.[2] For instance, weakly enforced IPRs can cause domestic firms to copy foreign products, thereby replacing imports with home production. Moreover, the proponents of covering intellectual property in trade agreements argue that if there are strong intellectual property laws and practices in one country they must not be weaker in other countries (Curtis, 2012). In addition, they claim that the dynamic benefits of IPRs, such as greater product variety and more global exports and growth, might outweigh consumer losses from monopoly pricing. Therefore, there are two main arguments concerning stronger IPRs that we theoretically summarize in the following paragraphs.

[1] See Flam and Helpman (1987), Horstmann and Maskusen (1987), Brown (1991), Deardorff (1992), Helpman (1993), Taylor (1993), Maskus and Eby-Konan (1994) and Maskus and Penubarti (1994, 1995).

[2] However, as Maskus and Eby-Konan (1994) argue, weak IPRs can expand trade through domestic piracy of foreign trademarks. However, this would increase the exports of lower-quality imitations that would displace the sales of 'legitimate' products.

3. 1. 1. Arguments that Support Stronger Intellectual Property Rights – Market Expansion Effect

Firms with stronger IPRs gain *ownership advantages* in foreign markets through recourse to legal action against the violation of their assets or products. The *market expansion effect* increases the demand curve facing firms. Therefore, stronger IPRs increase trade to foreign markets by reducing the costs associated with preventing a loss of technology. Thus, by giving ownership advantages, strengthening the IPRs can positively affect trade (Maskus and Penubarti, 1995), especially when the destination country has strong imitative abilities (Smith, 2001).

Differences between national IPRs regimes can act like non-tariff trade barriers (Primo Braga and Fink, 1997). Under these conditions, exporting firms face additional costs, since they must engage in activities designed to inhibit local imitation. Therefore, international harmonization of IPRs regimes can reduce the transaction costs (Taylor, 1993).

3. 1. 2. Arguments against Stronger Intellectual Property Rights – Market Power Effect

The *market power effect* occurs when strong IPRs reduce bilateral exchange by ensuring a temporary monopoly over the protected knowledge. The market power effect reduces the elasticity of demand facing foreign firms and therefore they reduce the export of the patentable product to the market with stronger IPRs. Hence, firms with strong patent rights in foreign markets can exercise their market power by restricting quantity and increasing the unit price of bilateral exchange to that market (Maskus and Penubarti, 1995; Fink and Primo Braga, 2004). Smith (2001) also found a negative relationship between the strength of IPRs and bilateral flows, suggesting that the market power effect operates under weak technical absorptive capacities. Firms in these circumstances reduce the quantity supplied and increase the prices of the protected products.

In addition, under strong IPRs, firms may choose to serve foreign markets by foreign direct investment (FDI) or by licensing their intellectual products rather than directly exporting to them. In this case, there can be a negative correlation between trade flows and strengthened intellectual property protection (Fink and Primo Braga, 2004). Moreover, the trademarks may be better appropriated by FDI than exports, since trademarks protect reputation and are a 'firm-specific asset' (Horstmann and Markusen, 1987).

3. 2. Intellectual Property Rights and International Trade: The Empirical Evidence

The empirical literature on the effects of IPRs on trade has found that there is a significant positive effect. However, this effect depends on the local market demand, the economic sector, the structure of trade barriers, the specific IPRs measure, a country's innovative potential (such as its adaptive capacity), the educational level of its workforce, the structure and funding of R&D, the management of assets and the institutions involved (Maskus, 2012). However, it is possible that strengthening IPRs and the associated technology transfer can also have an effect on the evaluation of local innovative capacity of developing countries. Indeed, Park and Lippoldt (2008) show that IPRs measures had an effect on R&D and patenting by residents and non-residents in developing countries. This suggests a complex relationship between absorptive capacity, IPRs and trade.

The empirical evidence is based on the two strands of research: first, the examination of the impact of IPRs on trade flows from the perspective of developed countries and, second, investigation of the issue from the perspective of developing countries.

3. 2. 1. The Measures of Intellectual Property Rights Protection

IPRs protection is calculated by objective and subjective measures. The Ginarte-Park (GP) index[3] or the Rapp-Rozek index are commonly used in the studies of the effects of IPRs on international trade and are objective measures.

The Rapp-Rozek index (Rapp and Rozek, 1990) considers only the presence or absence of particular characteristics of patent laws such as working requirements, compulsory licences and product patents for pharmaceuticals and only for the year 1984. The scale ranges from zero to five, the latter indicating full conformity with the minimum standards.

The Ginarte-Park (GP) index (Ginarte and Park, 1997, updated by Park, 2008) aggregates the elements of patent law into five categories: duration of protection, coverage, membership of international treaties, legal enforcement mechanisms and limitations on patent breadth. The index varies between zero and five. Maskus (2012) has showed that the GP index measure increased by over 100%, particularly for lower-middle and middle-income countries (e.g. China, India, Egypt, Turkey, Thailand and Brazil) after the TRIPS agreement. However, both

[3] The Ginarte-Park index of the strength of patent protection covers 110 countries over the period 1960–1990, now extended to 2005 (Park, 2008).

indices suffer from several problems. First, they are based on written laws, but do not consider whether the laws are enforced; second, the systematic differences in the strength of IPR protection across countries are not clear. For example, it is not clear whether a country with a higher demand for technology will also have stronger IPR protection, and whether this country will import more technology than other countries with a lower demand for technology and weaker IPR protection (Arora, 2009). Park (2005) included patent enforcement effectiveness reports for the period 1990–2000 in his new index. However, this index also suffers from limitations, as the reports are based on the views of the US firms and might be biased, and because the construction of quantitative indices depends on the authors' subjective interpretations of the characteristics of complaints.

The Global Competitive Report (GCR) compiled by the World Economic Forum presents the subjective index of IPRs protection. For this purpose, executives of multinational businesses operating in particular countries are asked the following question:

> *How would you rate intellectual property protection, including anti-counterfeiting measures in your country*?

Responses are on a scale from 1, *very weak*, to 7, *very strong*. However, this index also suffers from problems since one respondent's view might differ from another's with respect to weak protection, the expectations of businesses operating in one country may differ from the firms operating in another, and the questions in the index vary over time, so that it is impossible to directly compare the indices over a period of time. However, this index still has an advantage since executives are asked to consider the actual state of enforcement against counterfeiting. Maskus (2012) showed again that scores for this index increased for India, China, Turkey and Brazil after the TRIPS Agreement.

Table 1 shows the trends of the GP and GCR[4] measures of IPRs over the years in order to see if they match each other. This is important, because both the measures of IPRs (GP or GCR) and trade might go up, even if the two are not really related to each other. However, the data

[4] The country coverage as well as the questions posed in the GCR change over time. In order to overcome this problem Maskus (2012) computes an index for each country relative to the US and tracks this ratio. Indeed, as Table 1 shows, the changes in the GCR index over the years are consistent with changes in the GP index.

shows that both measures of IPRs (GP and GCR) increase over the years, therefore the relationship between IPRs and trade is not spurious.

Table 1: Changes in the GP and GCR Indices

	GP Index					GCR Index		
Countries	**1990**	**1995**	**2000**	**2005**	**% Rise**	**1995**	**2008**	**% Rise**
India	1.03	1.23	2.27	3.76	265	0.49	0.67	36
China	1.33	2.12	3.09	4.08	207	0.41	0.74	83
Brazil	1.28	1.48	3.59	3.59	181	0.43	0.56	30
Mexico	1.36	3.14	3.68	3.88	186	0.68	0.59	−12
S. Korea	3.69	3.89	4.13	4.33	17	0.65	0.78	19
Taiwan	1.26	3.17	3.29	3.74	198	0.77	0.93	20
Singapore	2.04	3.88	4.01	4.21	106	0.95	1.15	21
Israel	2.94	3.14	4.13	4.13	40	0.87	0.74	−15
Hungary	2.28	4.04	4.04	4.50	97	0.58	0.72	24
Portugal	1.67	3.35	4.01	4.38	163	0.75	0.87	14
Jordan	0.74	1.08	3.03	3.43	363	0.51	1.13	70
USA	4.68	4.88	4.88	4.88	4	–	–	–

Source: Maskus (2012). Reproduced with the kind permission of the publisher.

In a recent paper, Maskus and Yang (2013) multiplied the GP index by the Fraser Institute's index of the effectiveness of the legal system in order to capture both legal patent rules and the overall enforcement of property rights. They found that IPRs had a strong impact on the volume and pattern of manufacturing exports.

3. 3. Evidence from the Perspective of Developed Countries

The studies that have utilized aggregated trade data have in general found that the strength of importing countries' intellectual property regimes affects the exports of developed countries positively and significantly.[5]

[5] Only Ferrantino (1993) found weak evidence of the relationship between the US export patterns (arm's-length trade) and national membership of IPRs treaties. However, their measure of IPRs, which was the national

Maskus and Penubarti (1995) using a dataset of 22 developed countries and 55 developing countries from Africa, Latin America and the Middle East, based on 1984 data and the Rapp-Rozek index found that increasing IPRs had a positive impact on bilateral imports. Thus, the market expansion effect dominates the market power effect and higher levels of patent protection have a positive impact on the manufacturing exports of OECD nations to developing countries. However, the effect was stronger for the group of large developing countries such as Mexico, Turkey, Korea, Brazil and Argentina – where most of the trade disputes occur – than for small developing countries such as Ecuador. They also found that the pharmaceuticals sector in particular, which is sensitive to patent rights, showed a positive impact of patents on trade flows, indicating the importance of sectoral differences for the impact of IPRs on trade.

Primo Braga and Fink (1997) investigated the impact of the strength of IPRs, as measured by the Rapp-Rozek index, on arm's-length trade, intra-trade and establishment trade for US companies by utilizing bilateral data for US exports from 1989 covering 35 developed or developing countries. They found that market expansion dominated market power effects.

In a more recent paper, Ivus (2010) investigated the growth of bilateral high-technology (patent-intensive) exports from 24 OECD countries to 55 developing countries in the pre-TRIPS (1962–1994) and post-TRIPS (1994–2000) periods. She found that reforms of the IPRs had a positive impact on the high-technology exports to the countries with reformed IPRs such that high-technology exports to these countries grew faster than low-technology exports after 1994.

3. 3. 1. The Endogeneity Issue

The obvious difficulty in estimating the effect of patent rights on trade is that there is potential endogeneity of patent rights to trade flows. This problem is generally corrected by adopting an instrumental-variables approach which chooses instrumental variables that are correlated with patent rights but uncorrelated with unobserved errors in the trade variables. The colonial or historical origin of a country's legal system is chosen as an instrument in the empirical

memberships of international intellectual property conventions, might be an inaccurate measure of the effective strength of local laws.

studies. Income levels, trade policy measures, exchange rates, FDI, factors productivity and technological progress are the control variables that are used in the estimations.

3. 4. The Importance of the Technical Absorptive Capacity for the Effects of Intellectual Property Rights on Trade

Empirical research has also been done on the relationship between the strength of IPRs and trade flows according to the level of development of countries and their imitative abilities. Smith (1999) investigated the effects of the strength of national IPRs on US exports to countries, grouped by threat of imitation. For this purpose, she analysed the two-digit Standard International Trade Classification (SITC) of sectoral manufacturing exports of US states to 96 countries in 1992. The Rapp-Rozek and GP indexes were used to measure the strength of IPRs. The countries were classified into four groups according to their ability to imitate products. The first group consisted of industrial countries with strong technological capabilities (a competitive threat through imitation) and with strong patent rights. For this group, market expansion dominated market power. The second group of countries had both weak patent rights and weak imitative capacities. In this group of countries, market power dominated the market expansion; therefore, the patent strength negatively and significantly affected the US export volumes. The third group consisted of industrializing economies with weak patents but which posed effective threats, such as China, Turkey and Venezuela. For this group of countries, stronger patents led to higher import volumes, thus the market expansion effect dominated. The final group consisted of countries with strong patent rights but weak imitative abilities. The market power effect dominated among this group of countries. Thus, weak patent rights inhibited US exports, but only for countries that posed a strong threat of imitation. These countries were emerging economies, and countries that the US placed substantial pressure on to raise IPR standards. However, the market power effect was evident for exports to countries posing a weak threat of imitation.

Rafiquzzaman (2002) analysed the relationship between IPRs for the exports of 10 Canadian provinces to 76 countries and showed that exports increased with the improvement in IPRs, independent of the degree of development of the importing country. His findings also were consistent with Smith (1999) that the importing country's type of imitative threat was significant for Canadian exports. Thus, stronger patent laws induced more Canadian exports to countries posing a strong threat of imitation (the market expansion effect) and reduced exports to those markets posing a weak threat of imitation (the market power effect).

Al-Mawali (2005) found that the interaction between IPRs and imitation abilities was important for determining bilateral intra-industry trade flows.

3. 5. The Effects of Intellectual Property Rights on Trade across Industries

Empirical research on the effects of IPRs on international trade by industry has delivered inconsistent results. Maskus and Penubarti (1995) studied exports by grouping industries into three different categories according to their expected sensitivity to patent laws: high sensitivity (R&D-intensive industries and those industries that have reported significant damage from piracy), low-sensitivity and other industries. The effects of IPRs were larger and more significant for those categorized as low sensitivity industries than for those grouped as high sensitivity industries. This result can be explained by either larger market power effects or the interactions between trade and FDI decisions in highly sensitive industries. Changes in IPRs can motivate the producer to switch between exports and FDI. Thus, IPRs not only affect the volume of FDI and trade, but also the distribution between them as modes of entry. In addition, the patent index Maskus and Penubarti used may have captured other dimensions of the IPR regime (e.g. copyright and trademark protection) which are related to the low patent-sensitivity group. However, they also found evidence that patent strength has a positive impact on trade in the pharmaceuticals sector.

Smith (2001) found that international trade flows, especially in patent-sensitive industries, responded positively to increases in patent rights among middle-income and large developing countries. This indicates a positive market expansion effect for large developing countries with strong imitative abilities.

Smith (2002) analysed the effect of foreign IPRs on US bilateral exports – three highly disaggregated drug industries (biological products, medicinal and botanicals, and pharmaceuticals) – for 105 countries for the period from 1970 to 1990 by utilizing both the GP index and the Rapp-Rozek index. She focused on these particular industries, since they have high fixed costs, but the products can be imitated at relatively low costs. She found that stronger foreign patent rights stimulated market expansion in countries with strong imitative abilities, while the stronger patents rights enhanced the market power in countries with weak imitative abilities. In addition, the market power and market expansion effects were larger in magnitude during the period from 1982 to 1992 than that from 1972 to 1977.

Fink and Promo Braga (2004) found a positive relationship between IPRs and international trade flows for total non-fuel trade for 89 countries in 1989 that differed by industry. The relationship was weak between IPRs and high-technology trade such as in chemicals, electrical and office machinery, and telecommunications apparatus. The authors argued that market expansion effects may encourage firms to service foreign markets through direct investment rather than trade. Firms in rich industrial nations may respond to an increase in patent protection by significantly increasing their level of FDI or licensing as an alternative mode of entry, instead of just increasing international trade. In addition, their study might have suffered from the omission of important explanatory variables such as tariff and non-tariff trade barriers.

Park and Lippoldt (2003) showed that IPRs are important for textiles, drugs and industrial chemicals for both developed and developing countries. In addition, patent rights are effective in the textile imports of the least developed countries, where the threat of imitation of textiles is high. Patent rights affect imports of computer and office equipment modestly in the developed countries, and insignificantly in the developing and least developed nations, as it might be hard to imitate these goods in the least developed countries. In addition, patent rights moderately affect imports of drugs and industrial chemicals in developing countries, but imports into the least developed countries (other than textile imports) are not affected significantly by patent rights. This can be explained by the smaller markets that least developed countries have for these goods.

Smith et al. (2009) examined the effects of copyright policies on bilateral trade in core copyright industries such as literature, music, theatre, film, the media, photography software, visual arts, advertising services and collective management organizations by utilizing a measure of copyrights developed by Park (2005) and Reynolds (2003) for 107 countries for the year 2005. They found that the relative harmonization of copyright policies between countries had a positive effect on bilateral trade in core copyright industries.

In a recent paper Boring (2012) showed that the implementation of the TRIPS Agreement increased US exports of pharmaceuticals to 108 developing or emerging countries in the period from 1995 to 2010. However, although patent protection increase the US exports of pharmaceuticals overall, the impact of patent protection depends on the life-expectancy of

people in the importing countries. Thus, US exports have increased more to countries where the demand for pharmaceutical products is similar to that in developed countries and where people live longer.

3. 6. The Impact of Effective Enforcement of Intellectual Property Rights on International Trade

Maskus and Yang (2013) recently examined the effects of both patent reforms and effective enforcement on industry-level manufacturing exports from 82 countries to the US, using five-yearly data from 1985 to 2005. This was the first study to examine the effects of domestic patent reforms together with effective patent enforcement on export performance. They used the GP index for the measure of patent rights and the Fraser Institute's index for the effectiveness of the legal system. They found that for the whole sample (developed and developing countries) the IPRs after 1995 had a stronger impact on the volume and pattern of manufacturing exports. However, these effects were larger in developed countries than in developing countries. In addition, high-technology exports were more affected by the IPRs than other goods. This study delivered the important finding that stronger patent protection in developing countries will increase the exports of patent-sensitive goods in international markets.

3. 7. Evidence from the Perspective of Developing Countries

The empirical evidence from the perspective of developing countries is rather limited.

Liu and Lin (2005) investigated the relationship between IPRs (with the Ginarte-Park index) and the exports of three Taiwanese high-tech industries: semiconductors, information and communication equipment in a consecutive pooled data analysis from 1989 to 2000. They found evidence of both market expansion and market power effects, thus stronger IPR protection increased exports to countries that posed a strong threat of imitation and reduced exports to countries that posed a weak threat of imitation.

Yang and Huang (2009) used longitudinal data for Taiwan's exports to 51 countries during the period from 1997 to 2003 and employed a longitudinal IPRs index surveyed by the World Economic Forum (WEF). They found the market expansion effect prevailed over the market power effect for Taiwan's exports to the developed and developing countries. In addition, this effect was stronger for high-technology exports than for non-high-technology exports.

Plasmans and Tan (2004) investigated the effects of more stringent IPRs in China on China's bilateral trade with the US and Japan using a three-country multiple-goods trade model covering the period from January 2000 to May 2003. They introduced the concept of a patent index ratio, which is the ratio of foreign patent applications to domestic patent applications. This showed that stronger IPRs in China have increased foreign exports to China in high-technology and patent-sensitive industries where China has relatively weak imitation ability. However, stronger IPRs in China negatively affected the low-technology and trademark-sensitive industries where China has a strong imitation ability. These findings suggest that the positive enforcement of IPRs in China in highly patent-sensitive technologies will benefit both foreign IPRs holders, by expanding overseas markets, and China, by importing technology intensive goods.

Similarly, Liu and Lian (2006) studied the impact of domestic patent rights protection on Taiwan's imports from nine exporting countries using the annual data from the period 1989 to 2003 for four high-technology industries (optical, semiconductor, information and communication equipment). They also applied the concept of the patent index ratio suggested by Plasmans and Tan (2004). Strengthening patent protection did indeed increase Taiwan's imports from foreign countries in three of the four high-technology industries. In addition, the enforcement of TRIPS after Taiwan became a member of the WTO in January 2002 had a significant impact on the relationship of domestic IPRs and imports of high-technology products.

Park and Lippoldt (2003) analysed the effects of IPRs on exports from a set of developing and least developed countries. Patent rights did not significantly influence the total exports of these countries. However, pharmaceuticals and computer and office equipment were moderately affected by the IPRs in developing countries.

Awokuse and Yin (2010) found that the strengthening of patent laws in China increased import flows, particularly in knowledge-intensive goods.[6] However, while this market expansion effect holds for import flows from major OECD countries, the effect is weaker for imports from non-OECD countries.

[6] They utilised both aggregated imports and 20 manufacturing product sectors and a panel data set covering 1991–2004.

Yew et al. (2011) investigated the effect of IPRs on China's exports to the Association of Southeast Asian Nations (ASEAN-5) countries (Indonesia, Malaysia, Philippines, Singapore and Thailand) for the period from 1993 to 2006 by employing the IPRs index surveyed by the World Economic Forum (WEF). The results showed that, except for Indonesia, China's exports to the ASEAN-5 countries were negatively affected by the IPRs – the market power effect was stronger.

3. 8. Evidence on the Effects on the Exports of the Reforming Countries

Stronger IPRs in developing countries not only increase exports of the developed countries, but can also improve the ability of firms in developing countries to break into exports markets. Indeed, Yang and Maskus (2009) in a two-country model with a Northern firm and an unaffiliated Southern firm show that strengthening IPRs would enhance technology transfers from the Northern firm through licensing and reduce the Southern firm's marginal production costs (related to the degree of know-how absorbed and also the cost of technology transfer), thereby making the Southern firm more competitive in the international markets and increasing its exports. In addition, the welfare in the Southern country will increase if its firm has high absorptive capacity. Branstetter et al. (2011) provide empirical evidence on this theoretical model by analysing disaggregated US trade statistics. First they construct, for each reforming country, an annual count of initial export episodes for the 1989–1999 period, defined as the number of 10-digit commodities for which recorded US imports from a given country exceed zero for the first time in a given year. They construct another variable in order to analyse the effects of IPR reforms in technology-intensive product categories: electrical machinery, industrial chemicals, other chemicals, professional and scientific equipment and transportation equipment. These disaggregated data show that initial export episodes increase following the IPR reform. In particular, technology-intensive industries respond strongly to reform. In addition, Branstetter et al. (2011) show that US multinational enterprise affiliate activity, as well as industrial activity, increase following the IPR reform. Similarly, Branstetter et al. (2006) found, by analysing detailed firm-level data for the US multinational firms for the sixteen countries over the 1982–1999 period, that the royalty payments for technology transferred to affiliates, affiliate R&D expenditures as well as total levels of foreign patent applications increase at the time of the reforms.

4. Conclusions

Policy makers in many countries aim to increase and enhance trade through trade liberalization (Sundaram and Von Arnim, 2009), since trade promotes economic growth, reduces poverty, enhances economic development and innovation, and creates employment opportunities (Krueger, 1997; Greenaway et al., 1997; Edwards, 1998; UNCTAD, 2004; Schneider, 2005).

The TRIPS Agreement and the TRIPS-plus agreements have raised questions about the effect of IPRs on international trade. The main question is how the agreements that aim to reinforce IPRs in developing countries affect trade between developed and developing countries.

The growth of the knowledge-driven economy has raised concerns about how innovation and creativity should best be promoted, and about how the ownership and distribution of IPRs should be protected. IPRs should, on the one hand, ensure that everyone in the globally interconnected world gains access to ever-increasing knowledge within a reasonable period of time and at a reasonable cost; on the other hand, it should also ensure the continuation of innovation and creativity worldwide. Therefore, the balance between the needs of the innovators and creators and the needs of users across international boundaries needs to be established. In addition, the quality of legal institutions within which the IPRs operate matters for the implementation of IPRs regimes.

At the theoretical level, the effect of the stronger patent regime on the international trade is ambiguous: there is a trade-off between the larger effective market size and the enhanced market power effect. The *market expansion effect* shifts the demand curve outwards and induces larger exports, whereas the *market power effect* reduces the elasticity of demand facing the foreign firms, therefore reducing exports. However, empirically, the international harmonization of IPRs (patent rights) encourages exports, especially from emerging industrialized countries. Therefore, we can summarize the results of this study as follows:

- Market expansion creates ownership advantages that allow firms to compete effectively in foreign markets. Therefore, according to the market expansion view, the strengthening of IPRs has a positive effect on international trade, and the international harmonization of IPR regimes can reduce the transaction costs associated with international trade.

- Market power gives foreign firms incentives to increase the price of their products and decrease their exports. Therefore, strengthening IPRs can reduce trade to the benefit of licensing.

- Empirical evidence suggests that IPRs (patent rights) affect trade positively, at least with countries with high technical absorptive capabilities. The empirical evidence supports the market expansion effect of stronger IPR protection in countries which pose a strong threat of imitation. These countries are the main focus of complaints about weak IPRs and strengthening the IPRs of these countries increases the import volumes of high-technology goods that can have an important impact on growth. However, poor countries without the ability to imitate new products do not pose a threat and their weak patent rights are not important for the technology developers. This leads to the market power effect where IPRs have a negative impact on trade.

- Stronger IPRs (patent rights) have differential effects across industries; therefore, a national aggregate index of the strength of patents cannot reflect the differential impacts on industries.

- The international harmonization of IPR regimes may also encourage exports from emerging industrialized countries. However, this harmonization does not seem to have increased exports from other developing countries.

- Further research is needed to understand better the effects of strengthening IPRs on trade in high-, medium- and low-technology industries. Moreover, different types of IPRs (e.g. patents, trademarks, copyrights) will affect industries differently.

- A country-level analysis, especially for the emerging economies, would shed more light on the effects of IPRs on the emerging countries, as well as on other developed and developing countries.

This review of the literature suggests that the impact of intellectual property on international trade depends on the local market demand, the economic sector, the structure of trade barriers,

the specific IPRs measure, the country's innovative potential (such as its adaptive capacity), the educational level of its workforce, the structure and funding of R&D, the management of assets and the institutions involved.

The debate on the effects of IPRs on international trade is ongoing. Although, this is an empirical question and the results depend on the data under investigation, the empirical evidence in general shows that the strength of IPRs (patent rights) is positively associated with international trade. Therefore, agreements such as the WTO TRIPS Agreement, which aim to harmonize protection of IPRs, will be beneficial for international trade.

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