Article

Regional Trade Agreements with Patent Provisions and US Imports of Intermediate Goods from Developing Countries in High-IP Industries

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Abstract

Patent-related provisions have become increasingly common in regional trade agreements (RTAs). This paper studies how patent clauses included in RTAs affect the international organization of production, to be specific, foreign outsourcing and insourcing from overseas, especially in manufacturing industries with high intellectual property (IP) intensity. The analysis finds that after developing countries in the sample signed PTAs containing patent-related clauses with developed countries, US companies increase foreign outsourcing of intermediate goods from these developing countries, but there is no change in US intra-firm imports of intermediate goods from related-parties in those countries.

This implies that RTAs with patent-related clauses are effective in expanding foreign outsourcing of the US companies, because such RTAs could decrease risks related to international transactions of patents and technologies. On the other hand, for multinational companies that have already controlled the risks related to external market transactions of patents and technologies through internalization, such RTAs may not affect the intra-firm imports of multinational companies.

Key words: Patent; RTAs; Developing countries; High-IP industries

1．Introduction

With the gradual segmentation of global production, offshoring has become a prominent strategy through which developed countries source intermediate goods from foreign countries. There are two basic forms of offshoring, performing an activity in a firm's own over-

seas subsidiary and contracting out an activity to a foreign vendor. The first form takes place within the boundaries of multinational firms (MNFs), while the second form occurs through arm's-length contracts. In this context, global trade in intermediate goods has become increasingly frequent because parts and components cross borders multiple times before the final product is completed. For example, by 2006, trade in intermediate goods had already accounted for more than half of total global trade (OECD, 2010). Meanwhile, it is argued when developed countries import intermediate goods from developing country suppliers, technology transfer may occur for the reason that the knowledge about improvements in production technology including adjustments in machinery settings, and advice on packaging and instruction materials can be transmitted from developed to developing countries (Pack and Saggi, 2001).

However, which organizational form is preferred remains a question worthy of further investigation. In the theoretical model of Antràs and Helpman (2004), equilibria are characterized by firms with varying productivity levels selecting distinct ownership structures and supplier locations. Subsequently, Antràs and Helpman (2008) examine how variations in the quality of contracting institutions influence the relative dominance of these organizational structures and it is shown that outsourcing is promoted when there are improvements in the contractibility of an input provided by the final-good producer (headquarters), while integration is encouraged when improving the contractibility of an input provided by a supplier. Especially, an improvement in the contractibility of headquarter services in South, for example, a manufacturer providing a supplier with a production equipment with clear value and specific functions, which can be written into a contract and be monitored to usage, increases the share of Northern firms that outsource there.

Better contractibility can come from the improved quality of institutions, which is increasingly reflected in trade agreements. Before the 1990s, regional trade agreements (RTAs) primarily focused on tariff reductions, but more and more recent RTAs include a set of provisions that go beyond tariff issues, such as intellectual property rights (IPR) protection provisions, which is associated with improving the contractibility of headquarter services (Osnago et al., 2019)[1].

Meanwhile, an increasing number of developing countries have signed intellectual property (IP)-related RTAs with developed countries, such like Vietnam-US free trade agreement, Japan-Thailand Economic Partnership Agreement, and so on. These RTAs compel developing countries to enforce stricter IPR protection. Whether strengthening IPR protection in developing countries impacts the outsourcing decisions of developed countries is therefore an issue worth exploring. Several studies have inspected this question, but different findings are found. On the one hand, it is suggested that strengthened IPR reduces the relative advantage of integration, thus, increasing the share of outsourcing (Ivus et al., 2017). On the other hand, based on the assumption that knowledge spillovers can be larger

under vertical integration than that under outsourcing, it is found that strengthening IPR protection in developing countries enhances intra-firm imports compared to imports from independent suppliers（Biancini and Bombarda, 2021）.

This paper aims to examine whether the US increases the offshoring of high-IP manufacturing industries to developing countries after these countries sign RTAs with patent protection provisions. Specifically, this study identifies 19 developing countries that implemented an RTA with patent clauses at a certain point in time during the period of 2000-2011 with developed countries and total offshoring of US firms is decomposed into related and non-related parties offshoring. The empirical analysis finds that RTA-induced patent reforms exert a positive effect on US offshore outsourcing from non-related parties in developing countries in high-IP sectors, but no impact on US imports from related parties in these countries. This finding is in line with part of assumptions from Antràs and Helpman（2008）.
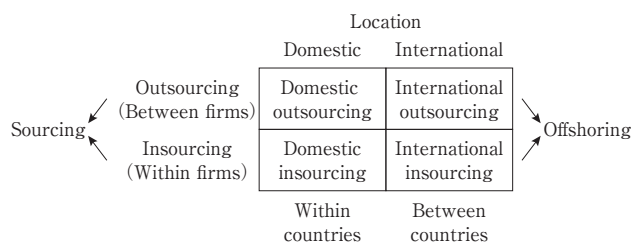
The rest of this paper is organised as follows. Section 2 presents existing literature to analyse how IPR provisions in trade agreements are related to the international organization of production. Section 3 describes data sources and methodology used. Then, the empirical analysis and main findings are presented in section 4. Section 5 concludes.

2．Literature Review

2.1　Offshoring and Offshore Outsourcing

Offshoring occurs when commercial enterprises or governments opt to procure intermediate goods or services from abroad, which were previously sourced domestically. The practice of offshoring mainly started in the 1960s, when U. S. firms in the consumer electronics industry relocated their manufacturing plants to low-cost destinations such as Japan and other parts of Asia（Wilkinson et al., 2001; Kotabe et al., 2008; Pisani and Ricart, 2016）. Offshoring refers to the relocation of jobs and processes to a foreign country, regardless of whether the provider is external or affiliated with the firm, whereas outsourcing includes job relocations exclusively to external providers both domestically and internationally. Therefore, the term offshore outsourcing simultaneously meets both the characteristics of offshoring and outsourcing, which refers to the relocation of jobs or business processes to an external provider located in another country（Olsen, K. B., 2006）.

The extensive theoretical literature on a firm's decision to either produce in-house or outsource through market contracts has its origins in Coase（1937）. His theory, known as transaction cost economics（TCE）, suggests that firms should choose to produce goods internally if the costs associated with conducting transactions in the market are higher. Conversely, if the transaction costs are lower, firms are more inclined to procure goods exter-

Table 1　The illustration of offshoring and offshore outsourcing

Location

	Domestic	International	
Outsourcing (Between firms)	Domestic outsourcing	International outsourcing	Offshoring
Insourcing (Within firms)	Domestic insourcing	International insourcing	
	Within countries	Between countries	

Sourcing

Note: Some parts are changed by author.
Source: Olsen, K. B.（2006）.

nally. Subsequent studies have expanded this framework. For example, the incomplete contract theory suggests that contracts between firms are inherently incomplete due to the uncertainty and complexity of future events. Because it is impossible to foresee all contingencies, firms must rely on mechanisms like trust, reputation, and relationship-specific investments to manage contractual relationships（Hart and Moore, 1990; Williamson, 1985）.

More recently, Antràs and Helpman（2004）study the self-selection of firms into different sourcing modes. Their model predicts that the most productive firms sourcing from an affiliate party abroad by engaging in FDI. Less productive firms trade at arm's length. This theoretical result is driven by the plausible assumption that the affiliate set-up cost associated with FDI is greater than the unaffiliated supplier search cost related to foreign outsourcing. Baes on this model, Antràs and Helpman（2008）describe that the effect of institutional improvements on the structure of offshoring hinges on whether these improvements disproportionately enhance the contractibility of a specific input.

2.2　IP-Related Trade Agreements and Offshoring Strategies

Since the Agreement on Trade-Related Aspects of Intellectual Property（TRIPS）came into force in 1995, the requirements for protecting IPR have been present in bilateral and multilateral preferential trade agreements（PTAs）[2]（Maskus and Ridley, 2021）. The impact of IP-related trade agreements on the organization of production in developed countries has been examined at both the theoretical and empirical levels. The model of Antràs and Helpman（2008）combines firm heterogeneity and contractual incompleteness to systematically explain firms' organizational choices in the global production chain, which provides a theoretical foundation for understanding the structure of global supply chains and international trade. In this paper, it is proposed that in high headquarter intensity sectors, an improvement in the contractibility of headquarter services in South increases the share of firms offshoring there and specifically increases the share of firms that outsource in South. Following this model, Osnago et al.（2019）provide a simplified model to illustrate different effects of PTAs provisions that improve contractibility of components and headquarter services separately and they empirically find provisions that improve the contractibility of

headquarter services, such like IPR clauses are associated with a decrease in the share of firms engaging in FDI. However, Canals et al.（2023）find that IP-related PTAs increase US offshoring to several developing countries in IP-intensive industries compared to non-IP-intensive industries, especially by FDI.

Although many studies have discussed the impact of IPR protection in trade agreements on offshoring models, the effect of specific types of IP, such as patents, has been less explored. Considering patents are particularly crucial for manufacturing industries with High-IP intensity, this paper, referring to the theoretical proposition of the model built by Osnago et al.（2019）, estimates the effect of enforcing a patent-related PTA in developing countries on US importing intermediate goods from these countries through offshoring in manufacturing industries with high-IP intensity, which are generally characterised by high headquarter service.

3．Data description and methodology

3.1 Data description

In this paper, developing countries that have signed RTAs containing patent protection clauses with developed countries are selected, but only the production organization strategies of US, excluding other developed countries, are considered. There are two reasons for that. Firstly, it is argued IPR regulations in a PTA must also be extended to WTO member countries outside of the PTA based on most-favoured nation and national treatment principles（Canals et al., 2023; Maskus and Ridley, 2021）. Therefore, although US is not a direct party to an agreement, it is still affected by patent-related RTAs signed by developing countries with other developed countries. Secondly, US has provided detailed data on imports from related and unrelated parties located in other countries separately.

To capture the decisions of US companies regarding imports from related or unrelated parties, this study uses a dataset built by Antràs and Chor（2013）who mapped NAICS industry codes to six-digit Input-Output（IO）2002 industries by using a correspondence from the Bureau of Economic Analysis（BEA）. The advantage of using this database is that the IO2002 classification can isolate the intermediate input component of import flows, which eliminates possible confounding effects of intermediate input and finished goods imports. The data on US imports from non-related parties and related parties between 2000 and 2011 at the exporting country-year level is taken to measure US MNFs' decision on foreign outsource and insourcing from developing countries.

The information about the level of patent protection in RTAs signed between developing and developed countries comes from the World Trade Organization（WTO）and the World Bank. The WTO RTAs database provides detailed information on all RTAs to date. The

Deep Trade Agreements database from the World Bank provides detailed information on patent-related provisions[3] in most RTAs. In this paper, nineteen developing countries are selected during the examination period.

The classification of high-IP manufacturing industries is from Canals et al. (2023), which is based on the survey of "Research and Development Funding Expenditures" conducted by the National Science Foundation. They used one of the questions in the Intellectual Property and Technology Transfer regarding the importance of six types of IPR protection. And using the percentage of firms within each industry that consider patent protection either "somewhat important" or "very important", they sorted industries into two groups: a high-IP and a low-IP intensity group. The high-IP group includes eight industries which are computer and electronic products, chemicals, electrical equipment, miscellaneous manufacturing, machinery, petroleum and coal products, transportation equipment, and plastics and rubber products.

3.2 Empirical specification

The baseline regression is:

$$LnIm_{ct} = \beta_0 + \beta_1 Patent_{ct} + \beta_2 RL_{ct} + \beta_3 LnGDPper_{ct} + \beta_4 LnTrade_{ct}$$
$$+ \beta_5 MHTex_{ct} + \mu_c + \gamma_t + \varepsilon_{ct} \tag{1}$$

where $LnIm_{ct}$ includes two components, Imnon and Imre, which represent US imports intermediate inputs from non-related parties and related parties respectively in a country c and a given year t and which take the logarithmic form. $Patent_{ct}$ is a quantified variable at the country-year level, which indicates the number of patent-related provisions in a RTA signed by a developing country c with a developed partner, entering into force in year t. To be specific, before the RTA enters into force, this variable takes the value of zero; after the RTA comes into effect, the variable takes the value of the number of patent-related provisions contained in that RTA. Compared to a general dummy variable, this quantitative variable can, to some extent, measure the level of patent protection in different RTAs.

Other control variables about exporting countries' characteristics are also considered. For instance, RL_{ct} represents rule of law of each exporting country from the Worldwide Governance Indicator database. Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. The value varies from -2.5 to 2.5. As emphasized by Hu and Png (2013), including this institutional control helps to account for potential differences in sample countries' ability to enforce legal rights, possibly including IPR.

$GDPper_{ct}$ represents GDP per capital, which comes from the World Economic Outlook database from the International Monetary Fund. In addition, GDP deflators between 2000

Table 2　Descriptive Statistics

Variables	(1) N	(2) mean	(3) sd	(4) min	(5) max
Imnon	228	$5.838e+08$	$1.413e+09$	$22,134$	$6.450e+09$
Imre	228	$1.239e+09$	$3.626e+09$	$2,183$	$2.111e+10$
Patent	228	1.408	1.821	0	6
RL	228	-0.223	0.585	-1.122	1.263
GDPper	223	2,995	2,121	401.6	10,319
Trade	228	77.31	34.11	18.83	192.1
MHTex	216	30.39	18.59	3.660	76.44

and 2011 for developing countries in the sample are also taken from this database for adjusting all dollar-related variables to constant dollar valuation at 2000 prices. $Trade_{ct}$ represents trade openness of a country c in year t, which is defined as total international trade (including exports and imports) over GDP. This variable helps to separate the impact of trade liberalization. $MHTex_{ct}$ is about the proportion of high and medium-tech product exports in total exports of aa developing country in year t in the sample, which can, to some extent, reflect the technological level of the exporting country. The data is from World Development Indicators of the World Bank. Table 2 presents summary statistics for all variables.

3.3　Empirical analysis

Table 3 and Table 4 show correlation coefficient matrixes of all variables. The correlation coefficients between all variables do not exceed 0.6, indicating that there is no strong correlation among them. Therefore, regression analysis can be further conducted. The basic regression results are presented in Table 5 and Table 6.

Table 5 provides the regression results of the impact of patent protection on US imports from non-related parties. From column (1), it is found that without other control variables, the coefficient of patent is positive at the 5% significance level. After adding other control variables, the coefficient of the patent variable is still positive, but the significance level decreases to the 10%. Both results are in line with the theoretical assumption of Antràs and Helpman (2008). That is US firms increase outsourcing from developing countries in high headquarter intensity sectors after they enhance patent protection levels as a way to ensure the security of headquarter service, to some extent. In addition, other control variables, RL, LnGDPper, LnTrade and MHTex, show positive signs, but not significant, as shown in column (2).

In order to verify whether patent provisions have a transferable effect between two organizational forms, importing from related party is further considered in Table 6. Negative signs are shown in column (1) and (2), but without any significance. That implies develop-

Table 3 The correlation coefficient matrix of all variables (US imports from non-related parties)

Variables	LnImnon	Patent	RL	LnGDPper	LnTrade	MHTex
LnImnon	1.000					
Patent	0.177***	1.000				
RL	0.379***	−0.045	1.000			
LnGDPper	0.162**	0.105	0.532***	1.000		
LnTrade	0.283***	0.153**	0.200***	0.055	1.000	
MHTex	0.531***	0.189***	0.415***	0.350***	0.588***	1.000

Note: ***$p<0.01$, **$p<0.05$, *$p<0.1$.

Table 4 The correlation coefficient matrix of all variables (US imports from related parties)

Variables	LnImre	Patent	RL	LnGDPper	LnTrade	MHTex
LnImre	1.000					
Patent	0.269***	1.000				
RL	0.305***	−0.045	1.000			
LnGDPper	−0.017	0.105	0.532***	1.000		
LnTrade	0.382***	0.153**	0.200***	0.055	1.000	
Mhexport	0.512***	0.189***	0.415***	0.350***	0.588***	1.000

Note: ***$p<0.01$, **$p<0.05$, *$p<0.1$.

Table 5 The effect of patent provisions on US imports from non-related parties

Variables	(1) LnImnon	(2) LnImnon
Patent	0.079** (2.05)	0.078* (1.90)
RL		0.052 (0.15)
LnGDPper		0.137 (0.39)
LnTrade		0.036 (0.09)
MHTex		0.012 (1.53)
Constant	17.717*** (127.08)	16.311*** (4.85)
Observations	228	211
R-squared	0.145	0.154
Number of Exporter	19	18
Exporter FE	YES	YES
Year FE	YES	YES

Note: T-statistics in parentheses, ***$p<0.01$, **$p<0.05$, *$p<0.1$. The decrease in the number of exporting countries in column (2) is due to missing values of the MH-Tex variable for the Dominican Republic.

Table 6 The effect of patent provisions on US imports from related parties

Variables	(1) LnImre	(2) LnImre
Patent	−0.041 (−0.58)	−0.010 (−0.15)
RL		1.005* (1.75)
LnGDPper		−0.596 (−0.99)
LnTrade		1.507** (2.11)
MHTex		−0.010 (−0.74)
Constant	16.305*** (64.73)	14.892** (2.60)
Observations	228	211
R-squared	0.168	0.209
Number of Exporter	19	18
Exporter FE	YES	YES
Year FE	YES	YES

Note: T-statistics in parentheses, ***p<0.01, **p<0.05, *p<0.1. The decrease in the number of exporting countries in column（2）is due to missing values of the MH-Tex variable for the Dominican Republic.

ing countries joining in RTAs containing patent protection clauses do not encourage US importing from related party in these countries, which is different from the finding of Canals et al.（2023）, that is, IP-related PTAs reinforce the advantage of vertical integration, especially in IP-intensive industries. There may several reasons for this result. First, this paper uses different developing countries as a sample. Second, this paper considers the effect of patent clauses instead of general IPR provisions. In addition, Maskus（2000）highlights that for high-tech goods, the benefits of IPR protection are often overshadowed by the firms' preference for in-house production or FDI to maintain control over proprietary technology. In such industries, the trade of intermediate goods is less dependent on IPR protection than on factors like technological expertise and supply chain dynamics.

4．Conclusion

Globalization―the intensification of structural interdependence within the global economy ―has been a prominent topic on development policy during the past few decades. A significant aspect of the ongoing globalization process is product fragmentation, which refers to the cross-border distribution of component production and assembly within vertically integrated manufacturing processes.

The decisions of firms to produce abroad and their decisions on the mode of foreign pro-

duction has aroused the research interest of scholars. Recently, foreign outsourcing is becoming an increasingly common strategy, apart from FDI. However, in the absence of complete and enforceable contracts, this generally leads to a holdup problem. Although a firm can own subsidiaries, which allows it to avoid holdup, this has the disadvantage of leading to agent shirking or lack of effort. The advantage of foreign outsourcing, where the agent owns the capital, is more high-powered incentives to the agent. Thus, the FDI-foreign outsourcing decision involves a trade-off between high-powered incentives and the risk of holdup.

This paper enriches the literature that examine the effect of PTAs-induced IPR provisions signed by developing countries on the organizational structure of US firms from specific perspectives of RTA and patent clauses. The main finding is that developing countries signing RTA-induced patent clauses encourages the US to import intermediate inputs from unrelated parties in high-IP industries within these countries but has no effect on US imports of intermediate inputs from related parties in these countries. In short, RTAs with patens clauses are effective in protecting IP when US companies import intermediate goods on a contract basis from unrelated companies in developing countries, which is why US imports of intermediate goods from developing countries have increased. However, the effectiveness of RTAs with patent clauses is not considered to be as significant for intra-firm imports from related partners in developing countries because intellectual property can be protected by internal discipline to some extent. Future work can analyse the additional effects of patent reforms on domestic innovation, such as productivity enhancements, patents filed abroad, and so on.

Notes

1) In this context, manufacturers may feel secure disclosing machine parameters, design drawings, and other related information to suppliers.

2) PTAs are usually limited to providing preferential access for certain products or sectors. They do not generally aim for full trade liberalization or deep integration like RTAs. RTAs is a specific type of PTAs.

3) Patent-related provisions in the Deep Trade Agreements database include the following fourteen items: requires patents be made available along the lines of the three-step test; requires patent be made available for new uses of a known product; requires patent be made available for new methods of a known product; requires patent be made available for new processes of a known product; stipulates grace period for info in public disclosures that should be disregarded when considering patent application; establishes a set of permissible exclusions from patentability; stipulates permissible reasons for patent revocation; stipulates rules governing patent filings; requires that a patent applicant be given opportunity to make amendments, corrections and observations; requires publication of information concerning pending patent applications; requires patent term adjustment be given for unreasonable delays by granting authority; requires a period of sui generis protection for patents; includes rules governing patent linkage; and requires cooperation to enhance mutual utilization of search and examination re-

sults for patent applications.

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Appendix

Patent-Related RTAs in the Sample (2000–2011)

Agreement	Year
Albania-EFTA	2010
Egypt-EFTA	2007
Thailand-Japan	2007
Viet Nam-Japan	2009
Malaysia-Japan	2006
Costa Rica-US	2006
EI Salvador-US	2006
Nicaragua-US	2006
Jordan-US	2001
Morocco-US	2006
Oman-US	2009
Peru-US	2009
Chile-US	2004
Guatemala-US	2006
Honduras-US	2006
Lebanon-EFTA	2007
North Macedonia-EFTA	2002
Dominican Republic-Central American Free Trade Agreement (CAFTA)	2006
Tunisia-EFTA	2005