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The Impact of Deepening IPR Protection in Host Countries on China's High-tech Product Exports under FTAs

-- Based on China's Bilateral Trade Data with 34 Countries from 2012-2020

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Abstract

This paper conducts an empirical study on the impact of IPR protection in exporting host countries on China's High-tech products based on an extended gravity model, which generally finds that the strengthening of IPR protection in host countries will not have a negative impact on China's High-tech product exports during 2012-2020. The host countries are divided according to income levels, and it is found that the responses of China's High-tech product exports to the strengthening of IPR protection in host countries are different according to different economy levels, but overall they all play a positive role in China's High-tech product exports.

Keywords

IPR; High Technology Products; Exports; Ftas.

1. Introduction

With the level of technological innovation increasing worldwide, countries are paying more and more attention to protecting intellectual property rights (as of here referred to as "IPR"). From various international IPR protection conventions to the signing of the Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS) under the framework of WTO, and later to many free trade agreements that provide higher, broader, and more effective TRIPS PLUS provisions compared to the TRIPS Agreement, international IPR protection has been continuously enhanced. The Trans-Pacific Partnership Agreement (TPP), which was officially signed on February 4, 2016, represents the highest level of FTA agreement in the world to date, and the IPR provisions in it have greatly surpassed the strength of IPR protection under TRIPS, making it one of the most controversial provisions. Along with the increasing intensity of international IPR protection, trade disputes caused by IPR barriers have become increasingly intense. Developed countries use the IPR system as a trade protection tool to prevent other countries' products from entering their markets, which undoubtedly poses a significant challenge to developing countries with relatively backward technology, including China, threatening the export of China's High-tech products.

Therefore, in the current international context of deepening IPR barriers, IPR protection has become a focal point for Chinese enterprises to participate in international competition. It is of practical significance to study the impact of IPR protection in host countries on China's exports of High-tech products.

2. Review of the Literature

In the existing research literature on the relationship between IPR protection and trade, scholars generally agree that the IPR protection regime in the export destination country affects

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the export decisions of firms in the exporting country and thus bilateral trade. Chin and Grossman argue that strengthening the level of IPR protection in the South can stimulate technological innovation in Northern countries and thus increase welfare in the North, while imitation costs increase, and welfare suffers in the South [1]. Maskus and Penubarti suggest that IPR protection in export destination countries has two opposite effects on bilateral trade, the "market expansion effect" and the "market power effect," and that the specific direction of trade effects depends on which of the two effects is stronger [2-3]. Ivus found four offsetting trade effects of enhanced IPR protection in the South: the "market power effect," the "market expansion effect," the "market dilution effect," and the "terms of trade effect." Ivus further finds that this effect can be categorized as a "product variety effect," a "product quantity effect," and a "product price effect" [4]. The direction of the impact of IPR protection on trade is uncertain [5].

In terms of empirical studies, scholars have mainly explored the impact of IPR protection on trade based on the "market expansion effect" and the "market power effect." Smith classifies export destination countries according to the strength of the imitation threat [6]. The results of Rafiquzzaman's study show that increased IPR protection has a positive expansionary effect on Canadian exports and that this expansionary effect is more pronounced in high-income countries [7]. The results of Shin, Lee, and Park's study show that IPR protection in export target markets discourages exports from developing countries that are less advanced in technological innovation [8]. In addition, some scholars found that the impact of IPR protection on trade varies with the trade industry. Fink and Primo Braga conducted a study using cross-sectional data for 89 countries in 1989 for High-technology and non-fuel industries and found that the market expansion effect plays a dominant role in trade in non-fuel industries. However, the increase in IPR protection shows a non-significant inverse relationship with High-technology trade-in industries [9]. Awokuse and Yin's study of China's import trade finds that increasing China's patent protection can boost import trade, especially for knowledge-intensive products [10]. Examining China's import trade from 1991–2005, Changlin Yu finds that enhanced IPR protection significantly boosts China's import trade in technology-intensive industries, with the market expansion effect being more pronounced when the exporting country is a high-income country [11].

From a comprehensive perspective, most scholars' studies have examined how the strengthening of IPR protection in developing countries at the level of technological imitation will affect developed countries' exports to developed countries. At the same time, there are few studies on the impact of strengthening foreign IPR protection on developing countries' exports. The relevant domestic literature mainly concerns the impact of strengthening IPR protection in the home market on domestic import and export trade. Studies on the impact of IPR protection in host countries on China's import and export trade are few in number. For developing country exporters, the strengthening of IPR protection in the host country market will increase the production cost of their products at the imitation level, resulting in a decrease in exports. Therefore, it is of practical significance to study the impact of IPR protection in host countries on China's exports of High-tech products.

3. Model Setting and Data Description

3.1. Model Setting

In this paper, we follow the research model of Song Weiliang (2016) and classify the gravitational equation as

$$LnX_{ijt} = K_0 + K_1 lnGDP_{ijt} + K_2 lnPOP_{ijt} + K_3 lnD_{ij} + K_4 T_{jt} + K_5 lnIPR_{jt} + K_6 LT_{it} + K_7 HC_{it} + \theta_{ijt}$$

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where the explanatory variable X_{ijt} denotes the export value of high technology products from country i (China) to country j in period t. The explanatory variables GDP_{it} and GDP_{jt} are the real GDP of country i (China) and the importing country j and are proxy variables for the level of economic development of the two trading parties. D_{ij} represents the geographical distance between the two countries ; POP_{it} and POP_{jt} represent the population sizes of the two trading parties in period t. T_{jt} is the average import tariff rate (%) of importing country j in year t; IPR_{jt} is the intellectual property protection index of the importing country. HC_{it} denotes the stock of human capital in China in period t, representing China's absorptive capacity for technology. LT_{it} denotes the technological innovation capacity of China's High-tech industry, represented by the share of R&D expenditure in main business income (%). θ_{ijt} is the model error term, representing other factors that would affect China's exports of High-technology products that are not considered in the model.

3.2. Data Description and Descriptive Statistics

(1) Exports of high technology products (X_{ijt}). The export data of High-tech products in this paper are obtained from the trade data of SITC (REV.3) five-digit code of UN COMTRADE, and the scope of product statistics refers to the division of High-tech industries in China's Statistical Classification of High-tech Industries Catalogue, including pharmaceutical manufacturing, aerospace manufacturing, electronic and communication equipment manufacturing, electronic computer and office equipment manufacturing, and medical equipment and instrumentation manufacturing. For the consideration of data completeness and representativeness, this paper selects 34 countries with which China has close trade relations as research samples, and the names of specific sample countries are shown in Table 1.

Table 1. Name and classification of sample countries

High-income country	Upper middle-income countries	Lower middle-income or low-income countries
United States (USA)	Poland (POL)	India (IND)
Japan (JPN)	Hungary (HUN)	Indonesia (IDN)
Korea (KOR)	Chile (CHL)	Morocco (MAR)
Germany (DEU)	Russia (RUS)	Philippines (PHL)
Australia (AUS)	Brazil (BRA)	Thailand (THA)
Singapore (SGP)	Mexico (MEX)	Ukraine (UKR)
Netherlands (NLD)	Malaysia (MYS)	Pakistan (PAK)
United Kingdom (GBR)	Argentina (ABG)	Vietnam (VNM)
France (FRA)	South Africa (ZAF)	Nigeria (NGA)
Italy (ITA)	Colombia (COL)	Egypt (EGY)
Canada (CAN)	Peru (PER)	
Spain (ESP)	Venezuela (VEN)	

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(2) Intellectual property protection index (IPR_{jt}). Scholars' quantitative methods on IPR protection usually use the G-P index measured every five years, but the G-P index contains fewer years and country data within the sample interval, and its measurement method only examines the level of IPR protection legislation in a country. Therefore, this paper adopts the IPR index from the Global Competition Report published by the Global Innovation Policy Center (GIPC) to represent the intensity of IPR protection in the sample countries over the years.

Table 2. Expected direction of influence of variables on China's exports of High-technology products

variable	Expected symbols	Description of expectations
$lnGDP_{ijt}$	+	The larger the Chinese economy, the higher the production capacity, and the higher the level of economic development of the importing country, the higher the consumption capacity
$lnPOP_{ijt}$	+	The size of the labour force affects productivity, and the size of the population represents the size of the market and the size of the market demand in the importing country
lnD_{ijt}	-	Geographical distance determines the transportation costs of China's High-technology exports
T_{jt}	-	Import tariffs in importing countries as an impediment to trade
HC_{it}	+	The better the human capital, the better China's ability to absorb and develop new technologies
LT_{it}	+	Technological innovation can improve productivity and product quality
$lnIPR_{jt}$	?	The increased level of IPR protection in importing countries inhibits their imitation of China's self-developed High-tech products, which is conducive to the increase of China's exports. However, at the same time, the risk of infringement of China's High-tech products is increased, and infringement fines or the introduction of technology will raise production costs, thus weakening China's exports

Table 3. Descriptive statistics for each variable

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	max
totalvalue	306	6.227e+09	1.039e+10	1.152e+08	8.658e+10
lngdp	306	27.33	1.196	25.34	30.56
lnpopulation	306	17.97	1.040	15.49	21.05
lndist	306	8.880	0.680	6.863	9.867
LT	306	1.821	0.632	1.160	2.700
taxrate	306	7.590	4.262	0	19.10
lngdpi	306	29.88	0.166	29.60	30.10
lnppli	306	21.04	0.0125	21.02	21.06
lnipr	306	2.894	0.492	1.963	3.884
hc	306	1.979	0.168	1.770	2.330
country	306	17.50	9.827	1	34

(3) The stock of human capital (HC_{it}) and technological innovation capacity (LT_{it}). Scholars at home and abroad usually use education variables to measure the stock of human capital. Referring to Yan Pengfei and Wang Bing, this paper adopts the ratio of the number of university students to the total population to measure the level of human capital in China [12]. The data

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source is the China Statistical Yearbook 2012–2020 published by the China Bureau of Statistics. Moreover, the statistics on technological innovation capability can be obtained from the relevant indexes in the China High Technology Industry Statistical Yearbook. This paper uses the index of the proportion of R&D expenditure to primary business income to measure the level of technological innovation in China's High-tech industry.

(4) Remaining variables. GDP and population data for China and each country are obtained from the World Bank Development Indicators Database (WDI), and some missing data are supplemented by the UNCTAD database, where GDP data are 2010 GDP in constant U.S. dollars. T_{jt} (%) from WTO and UNCTAD databases, geographical distance D_{ij} Data are from the French Centre for International Economic Studies (CEPII).

4. Empirical Results

4.1. Total Sample Estimates

Table 4. Baseline regression results

VARIABLES	OLS	RE	FE		
			(1)	(2)	(3)
lnipr	3.693e+09*	2.226e+09*	5.857e+08*	-1.669e+09	5.857e+08
	(1.71)	(0.66)	(0.14)	(-0.40)	(0.12)
lngdp	3.286e+09***	5.052e+09***	2.125e+10***	2.247e+10***	2.125e+10**
	(4.28)	(3.03)	(3.83)	(3.92)	(2.50)
lnpopulation	1.156e+09	-6.733e+08	-3.085e+10**	-3.229e+10**	-3.085e+10*
	(1.37)	(-0.34)	(-2.09)	(-2.11)	(-1.93)
LT	-5.261e+09**	-3.557e+09**	-1.579e+10***	-4.506e+09***	-1.579e+10***
	(-2.29)	(-2.50)	(-4.67)	(-2.94)	(-3.58)
taxrate	-8.972e+07	2.235e+08	6.137e+08	4.751e+08	6.137e+08
	(-0.57)	(0.71)	(1.31)	(0.98)	(1.25)
lngdpi	-1.332e+11*	2.890e+10***	3.875e+10	-1.335e+11***	3.875e+10***
	(-1.67)	(5.14)	(0.54)	(-3.03)	(3.09)
lnppli	2.282e+12**		2.547e+11	2.242e+12***	2.547e+11
	(2.05)		(0.28)	(3.64)	(1.08)
hc	-1.899e+10**	-1.312e+10**	-7.957e+09	-1.442e+10**	-7.957e+09
	(-2.30)	(-2.45)	(-1.30)	(-2.48)	(-1.26)
lndist	-3.904e+09***	-4.173e+09**			
	(-5.31)	(-2.11)			
Constant	-4.409e+13**	-9.217e+11***	-6.496e+12	-4.318e+13***	-6.496e+12
	(-2.09)	(-5.64)	(-0.38)	(-3.70)	(-1.35)
Observations	306	306	306	306	306
R-squared	0.402		0.297	0.231	0.297
Year fixed effects	No	No	Yes	No	Yes
National fixed effects	No	No	No	Yes	Yes

t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

The regressions are first performed on the overall sample, and for the analysis of panel data, the three commonly used methods are mixed data ordinary least squares (pooled OLS), random effects model (RE), and fixed effects model (FE). The results of estimating the regressions using different methods are shown in Table 3, where columns (1) and (2) show the pooled OLS and RE estimation results, while the other three columns show the estimation results after

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controlling for year fixed effects, country fixed effects, and double fixed year and country effects, respectively.

According to the estimation results, the impact coefficients of the core explanatory variables IPR are all positive, and the overall impact of IPR protection in the host country on China's exports of High-technology products is positive. However, the overall impact coefficient is not significant, which may be caused by the small sample size, or the trade protection of the host country is a minor imitation threat to China's exports of High-tech products, and its increase in the intensity of IPR protection will not cause a significant impact on exports.

4.2. Sub-sample Regressions based on Country Differences

For further analysis, this paper divides the sample countries into three groups based on their economic development levels: high-income countries, upper middle-income countries, and lower middle-income or low-income countries, and performs group regressions. The results are shown in Table 4. $lnIPR_{jt}$'s impact coefficients are positive among different groups, but the degree varies, which confirms that the sensitivity of China's exports of High-technology products to IPR protection in the export destination countries varies with the different levels of economic development of the host countries. In general agreement with the overall regression results, IPR protection in the group of high-income countries, middle- and high-income countries, and middle- and low-income or low-income countries all have a positive effect on China's exports of High-technology products at the 5% level of significance.

Table 5. Estimated results based on trade country groupings

	High-income country	Upper middle-income countries	Lower middle-income or low-income countries
VARIABLES	y	y	y
lnipr	1.681e+10**	1.938e+09**	9.154e+09**
	(1.77)	(1.82)	(2.32)
lngdp	2.551e+10***	5.458e+08	1.305e+09
	(2.83)	(0.56)	(0.99)
lnpopulation	-1.736e+10*	7.500e+08	9.857e+08
	(-1.83)	(0.87)	(0.70)
lndist	-8.690e+09***	-2.249e+09***	-7.369e+09***
	(-4.02)	(-4.25)	(-5.60)
LT	-1.479e+10**	-1.588e+09	-4.048e+09
	(-2.62)	(-1.58)	(-1.42)
taxrate	-8.315e+07	94989463.701	4.528e+08**
	(-0.10)	(0.87)	(2.11)
lngdpi	-2.203e+11	-5.467e+10	-1.405e+11
	(-1.21)	(-1.57)	(-1.49)
lnppli	3.934e+12	9.090e+11*	2.319e+12*
	(1.54)	(1.87)	(1.77)
hc	-4.311e+10**	-6.485e+09*	-2.200e+10**
	(-2.17)	(-1.77)	(-2.14)
Constant	-7.649e+13	-1.749e+13*	-4.456e+13*
	(-1.59)	(-1.90)	(-1.80)
Observations	108	108	81
R-squared	0.487	0.466	0.495

t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

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Although countries have different levels of economic development and possess different IPR protection mechanisms and technology levels, in general, the high trade protection of IPR does not have a significant negative impact on China's exports of High-tech products. Since China's High-technology products exported to foreign countries for years have already had significant capacity enhancement in terms of IPR protection awareness and measures, most enterprises can realize the impending IPR protection crisis and possible protection measures by host countries in advance. Thus they can avoid the impact of IPR's trade protection enhancement on Chinese High-technology manufacturers.

4.3. Sub-sample Regression based on Time Differences

The Trans-Pacific Partnership (TPP), signed in 2016, represents the highest level of FTA agreement in the world to date, with IPR provisions that far exceed the strength of IPR protection under TRIPS, making it one of the most controversial provisions. Thus, by dividing the data into two groups, 2012–2015, and 2016–2020, it is possible to measure whether the signing of the TPP has an impact on China's export trade due to more robust IPR protection in importing countries. However, the regressions are not significant enough to conclude a correlation.

Table 6. Results of year-based grouping estimates

	(1)	(2)
VARIABLES	y	y
lnipr	3.407e+09	3.682e+09
	(1.08)	(1.33)
lngdp	3.749e+09***	2.738e+09***
	(3.24)	(2.94)
lnpopulation	1.261e+09	1.003e+09
	(1.01)	(0.95)
lndist	-5.253e+09***	-2.215e+09**
	(-4.79)	(-2.48)
LT	-4.541e+10*	1.615e+10
	(-1.95)	(1.17)
taxrate	-4.060e+07	-1.894e+08
	(-0.18)	(-0.94)
lngdpi	4.539e+10	4.799e+10
	(0.30)	(0.26)
lnppli	4.685e+12**	
	(2.20)	
hc	-9.598e+10**	-6.399e+10
	(-2.08)	(-0.22)
Constant	-9.976e+13**	-1.405e+12
	(-2.25)	(-0.29)
Observations	170	136
R-squared	0.419	0.424

t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5. Summary and Reflections

This paper empirically investigates the relationship between the level of IPR protection in host countries and China's exports of High-technology products using sample data for the period

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2012–2020. It was found that the control variables in the traditional gravity model are primarily consistent with theoretical expectations. However, the variables of human capital stock and innovation capability do not promote the export of High-technology products, possibly because the quality of China's technological innovation is not high enough to enhance the export competitiveness of China's High-technology products, or possibly because the technological innovation variables in this paper are not selected to represent China's innovation capability. In addition, for the overall sample regression, more robust IPR protection in host countries does not significantly benefit China's exports of High-technology products. Grouping host countries according to their income levels, the empirical evidence shows that the impact of enhanced IPR protection in host countries on China's exports of High-technology products varies with their economic sophistication, but there is no overall negative impact. Therefore, internationally, China should actively participate in the process of formulating new rules for international trade and investment, strengthen its discourse and establish its IPR protection system. At the same time, it should strengthen its technological innovation efforts at home and cultivate innovative enterprises as well as increase investment in education, cultivate innovative and high-quality talents, and improve the quality of human capital.

This paper has the following limitations which require urgent revision: 1. Too little data on bilateral trade of countries are selected, leading to bias in the regression results. 2. Instrumental variables are not used for stability testing, which should be further improved in the subsequent study. 3. The calculation method of HC and LT indicators used to measure innovation capacity may be too simple, and better indicators or measurement methods should be found.

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