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Intellectual property rights protection, trade, and GVC participation – an empirical analysis based on South Korean data

Jeong-ho Yoo and Rajae El Ayboud
Pukyong National University, Busan, South Korea

Abstract

Purpose – This paper explores the impact of South Korea's partner countries' intellectual property rights protection (IPRP) level on South Korea's trade dynamics and its GVC participation.
Design/methodology/approach – Through a literature review and an empirical analysis based on two models, the paper studies first the impact of Korea's partner countries' IPRP on South Korea's trade, then investigates the impact of South Korea's imports from countries having high, medium and low IPRP levels on its exports to third countries.
Findings – Imports from countries with high IPRP appeared to facilitate Korea's technology transfer and enhance its GVC participation, thereby boosting South Korea's export growth to third countries with varying IPRP levels. Conversely, imports from countries with medium IPRP drive exports only to third countries with low IPRP, but still contributing to South Korea's GVC participation.
Originality/value – This research sheds light on South Korea's strategic adaptation to global trade dynamics, especially with partner countries having varying levels of IPRP. Also, this paper has a particular focus on the effect that IPRP can have on countries' GVC participation.

Keywords IPR protection, GVC participation, Manufacturing products, Technology spillover, Gravity model
Paper type Research paper

1. Introduction

In today's globalized world, Intellectual Property Rights (IPR) protection has become a critical issue for nations engaged in international trade. These rights, including patents, copyrights, and trademarks, are essential for fostering innovation and driving economic growth. Countries globally are intensifying efforts to safeguard their IPR to gain competitive advantages and stimulate economic development. Recent trade tensions, particularly between the U.S. and China, have underscored the importance of IPR protection in maintaining fair and competitive trade practices. Numerous studies, such as those by Maskus (2000) and Park and Ginarte (1997), demonstrate that strong IPR protection fosters innovation, facilitates technology transfer, and promotes economic growth by reducing the risk of imitation and encouraging foreign direct investment. Also, recent research by Doanh *et al*. (2022) further highlights how IPR protection can influence trade by enhancing market power and driving market expansion in global trade.

This paper is a collaborative work. Both authors contributed jointly to the theoretical framework, drawing conclusions and implications, and drafting the manuscript. Jeong-ho Yoo provided guidance and supervision for the empirical analysis and played a key role in structuring the manuscript. Rajae El Ayboud led the development of the research model, collected and analyzed the data, performed the regression analysis and contributed significantly to the refinement of the manuscript.

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However, despite a growing body of literature on the relationship between IPR protection and trade, many studies have focused on large economies or regions, while smaller but technologically advanced countries like South Korea have been overlooked. South Korea, with a technological capability score of 80.1% and an IPR protection level of 6.9 in 2020 (Property Rights Alliance, 2023), presents a compelling case for studying how IPR frameworks influence trade. Despite its advanced innovation capacity, the specific role of IPR protection in shaping South Korea's trade dynamics has received less detailed studies. This paper seeks to address this gap by investigating how South Korea's partner countries' IPRP affects Korea's trade relationships.

While existing studies have explored IPR's effect on trade more broadly (Doanh and Heo, 2007; Yoon and Nguyen, 2012), this paper goes further by analyzing the role of IPR in determining South Korea's preferences for trading with certain partners and its participation in global value chains (GVCs). By categorizing partner countries based on their IPR protection levels, we aim to better understand which countries South Korea prefers to engage with and how IPR levels shape these decisions. This study focuses on South Korea's unique trade environment and contributes fresh insights into how IPR protection shapes trade dynamics in an increasingly interconnected global economy. Our empirical analysis not only examines trade volume but also explores the impact of IPR protection on South Korea's involvement in GVCs, as suggested by recent research on market power and expansion effects (Doanh *et al*., 2022).

In this context, the structure of the paper is as follows: first, we review existing literature on IPR protection and trade, followed by a discussion of IPR's role in GVC participation. Second, we develop a theoretical framework for our study, incorporating relevant data and models. Third, we present the results of our empirical analysis to explore how IPR protection in partner countries impacts Korea's trade and GVC participation.

2. Literature review

Several studies explored the links between IPR protection, international trade, and the Global Value Chain. Firstly, we will examine previous research papers about IPRP's impact on trade and innovation. Secondly, we will assess its effect on countries' GVC participation.

2.1 IPR protection and trade

Scholars have explored the intricate link between IPR protection and international trade, highlighting both positive and negative outcomes. Early studies by Chin and Grossman (1988), Deardoff (1992), and Helpman (1993) established that stronger IPR protection in developed countries fosters innovation and reduces imitation risks in trade with developing nations. Lai and Qiu (2003) and Grossman and Lai (2004) further argued that higher IPR protection benefits global innovation, especially as economies develop.

The market expansion and market power effects of IPR protection are central themes in this literature. Maskus and Penubarti (1995) found that stronger IPR regimes promote exports, particularly of high-tech products, from OECD countries to developing markets. Smith (1999) added that stronger patent protection can boost exports in markets with high imitation threats, but may limit trade by enhancing monopoly power in markets with lower imitation risks. Research on multinational corporations reinforces the positive relationship between IPR protection and trade. Doanh *et al*. (2022) showed that strong IPR regimes reduce the intellectual property risks, encourage exports, foreign direct investment (FDI), and R&D investments. Yoon and Nguyen (2012) found similar results in South Korea, where stronger IPR protection boosted exports in knowledge-intensive sectors. However, the positive impacts of IPR protection are not universal. Auriol *et al.* (2019, 2023) argued that stricter IPR regimes in developing countries can hinder innovation by limiting imitation and reverse engineering, which are essential for early-stage industrial growth. This creates a trade-off between

accessing foreign markets through strong IPR protections and encouraging local innovation through relaxed rules.

Additionally, the third-country effect (Doanh *et al*., 2022) complicates the relationship between IPR protection and trade flows, as firms may use intermediary countries with strong IPR regimes to mitigate risks in weaker regions. Overall, while IPR protection promotes innovation, FDI, and exports, particularly in developed countries, it may stifle innovation in developing nations by restricting imitation.

2.2 IPR protection and global value chain

The impact of IPR protection on GVC participation presents both opportunities and challenges. Durand and Milberg (2020) warn that strong IPR regimes may lead to intellectual monopolies, consolidating market power within GVCs and limiting smaller firms' and developing countries' participation, exacerbating global inequalities. Similarly, Fagerberg and Godinho (2004) argue that stringent IPR protections prevent imitation and reverse engineering, crucial for industrial development in developing nations, leading to dependence on foreign technologies and constraining local innovation.

On the other hand, Branstetter and Saggi (2006) argue that strong IPR regimes facilitate technology transfer by reassuring multinational firms that their intellectual property is protected, encouraging them to share innovations within GVCs. However, this often favors developed countries, deepening global inequalities. Recent studies support these findings, such as Yang *et al*. (2020), who show that suitable IPR protection can help developing countries upgrade their GVC status if aligned with the country's phase of economic development. Moreover, Maskus and Penubarti (1995) found that stronger IPR protections attract FDI, fostering industrial growth and technology transfer, but benefits are uneven, with larger firms in developed nations reaping most of the rewards. Fink *et al*. (2005) highlight that while IPR regimes promote innovation diffusion within GVCs, overly stringent protections can hinder knowledge sharing, limiting developing countries' ability to move up the value chain.

In summary, while IPR protection can enhance innovation and technology transfer within GVCs, it may also lead to market concentration, the exclusion of smaller firms, and dependence on foreign technologies in developing countries. To maximize GVC benefits, a balance between innovation incentives and inclusive participation is essential.

Based on the results of these studies, two hypotheses can be formulated. First, IPR protection has a positive effect on developed countries' trade by increasing FDI and promoting innovation, but it may have a negative effect on developing countries by limiting their ability to imitate and reproduce traded products. Second, IPR protection can stimulate innovation and technology transfer within GVCs, opening new opportunities for countries with high IPR protection to increase their participation in these global networks. However, challenges related to market concentration and exclusion must be carefully managed to ensure more equitable participation.

3. Data and methodology

3.1 Data

This paper delves into South Korea's trade ties with 104 partner countries. The selection of these partners ensures a wide representation, facilitating a general understanding of Korea's global trade dynamics. Unlike previous studies focusing on national or continental levels, this research meticulously examines trade data at a regional level within Korea. It analyzes the trade of 104 countries with 17 Korean regions, providing detailed insights into intra-country trade dynamics. These trade statistics are sourced from "KITA," Korea's trade database managed by the Korea International Trade Association.

The study spans a decade, covering the years from 2009 to 2019. The rationale for selecting this period is tied to the availability of intellectual property rights protection (IPRP) data. The IPRP index for many of the studied partner countries was limited to this period, making it the most appropriate period to ensure data completeness and accuracy across all countries in the analysis. The dataset comprises over 17,300 observations, which enhances the statistical robustness of the findings and enables a detailed exploration of the factors influencing Korea's international trade relationships. This comprehensive dataset, combining partner countries, a decade-long study period, a focused regional approach, and a substantial observation count, forms the foundation for the empirical analysis undertaken in this research.

The main independent variable in this study is intellectual property rights protection (IPRP) level, measured on a scale of 0–9. The IPRP index is sourced from "The International Property Rights Index (IPRI)," which assesses legal, political, and intellectual property rights protection indexes. In our study, we will focus on the intellectual property rights index score, that reflects each country's perception of the IPRP level, including patent, copyright, and trademark protection. Population data by region is included as an independent variable to account for regional variations in population size and density. This data is sourced from the Korean Statistical Information Service (KOSIS). Finally, partner countries' GDP data is extracted from the World Bank database. The descriptive statistical analysis (Table 1) of our data can be summarized as follows.

Based on UN Comtrade data and IPRI statistics data, between 2009 and 2019, South Korea's top trade partners (Figure 1) included a mix of countries with varying levels of IPRP. The top five export destinations were China, USA, Japan, Singapore, and India, with total exports reaching over 1 billion dollars for China, 684 million dollars for the USA, 331 million dollars for Japan, 182 million dollars for Singapore, and 137 million dollars for India. Analysis of the IPRP index during this period shows that South Korea exported significantly to countries with strong IPRP, such as the USA, Japan, and Singapore (IPRP ranging from 7.8 to 8.8). However, major export destinations also included countries with a low IPRP level, like China, with an IPRP index varying between 4.4 and 6 during this period.

On the import side, South Korea's main partners were China, Japan, USA, Saudi Arabia, and Australia, with total imports exceeding 950 million dollars from China, 608 million dollars from Japan, 500 million dollars from the USA, 280 million dollars from Saudi Arabia, and 218 million dollars from Australia. The IPRP analysis for these countries showed a similar trend, as South Korea imported significantly from both low IPRP countries like China and strong IPRP countries such as Japan, USA, and Australia, indicating a diverse trade network in terms of intellectual property rights protection.

3.2 Methodology

The analysis consists of two parts, aiming to understand the intricate relationships between Intellectual Property Rights (IPR) protection, international trade, and GVC participation.

The first part examines the impact of IPRP on export dynamics, analyzing how partner countries' IPRP strength influences Korea's exports. Additionally, it investigates the effect of

Table 1. Descriptive statistics

	N	Mean	Sd	Median	Min	Max
EXP (1000 USD)	17,324	266,137	1,484,899	13,071	0	60,113,280
IMP (1000 USD)	17,324	260,530	1,517,181	3,231	0	39,759,630
IPR	17,324	5.610	1.690	5.390	1.770	9.100
GDP (100,000 USD)	17,324	682570.2	1,995,934	163988.6	31771.981	21,380,980
POP (number of people)	17,324	3,048,513	3,141,044	1,903,914	113,117	13,239,670

Source(s): The authors

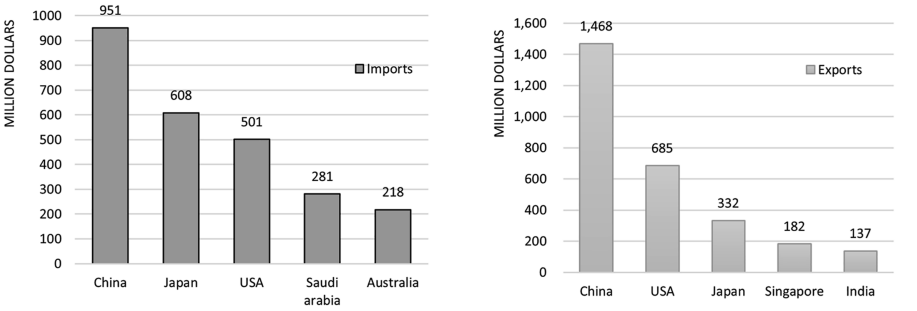

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Figure 1. Trade value of Korea's main export and import partners between 2009 and 2019

imports from countries with strong IPRP on Korea's exports. Building on these insights, the second part assesses the impact of imports from countries with varying IPRP levels on Korea's GVC participation. Specifically, it explores how imports from countries with different IPRP levels affect Korea's exports to third countries, unraveling nuanced trade relationship dynamics and technological capabilities.

This research adopts a panel data approach, utilizing the Gravity Model to capture complex variable interactions. Panel data enables dynamic analysis over the period from 2009 to 2019, providing a robust foundation for examining trade pattern changes. The Gravity Model is chosen for its effectiveness in modeling bilateral trade relationships. By structuring the analysis in two steps and employing the panel data Gravity Model, the research aims to unravel multifaceted relationships between IPRP, international trade, and GVC participation, contributing to a comprehensive understanding of Korea's global economic position.

3.2.1 Impact of IPRP on trade. In this section, we will explore how partner countries' IPRP affects Korea's exports using the gravity model. This model, based on factors like economic size and trade costs, predicts trade patterns between countries. Developed from theories like monopolistic competition, factor-proportions, and Ricardo's trade theory, the gravity model has evolved over time (Bergstrand, 1985; Deardoff, 1998; Eaton and Kortum, 2002). Anderson and van Wincoop (2003) extended it for empirical analysis, incorporating multilateral trade barriers. This extension has become widely used in studying the effects of international trade policies.

This study employs a gravity model for analysis. The price of products P_i, and supply Q_i are fixed, which allows the GDP of a country to be calculated as $Y_i = P_i Q_i$, and the expenditure as $B_i = v_i Y_i$, where v_i is the relationship between output and expenditure. When $v_i > 1$, indicates a trade deficit where expenditure exceeds output, $0 < v_i < 1$, denotes for trade surplus.

Initially derived through demand equations, the gravity model can be represented by a CES utility function (1). Where $\sigma > 1$ representing the elasticity of substitution and x_{ij} is the consumption of products supplied from country i to j. α_j is an exogenous CES preference parameter.

$$U_j = \left\{ \sum_j \alpha_j^{\frac{1-\sigma}{\sigma}} x_{ij}^{\frac{\sigma-1}{\sigma}} \right\}^{\frac{\sigma}{\sigma-1}} \tag{1}$$

The budget constraint can be expressed as function (2) where p_{ij} is the price of products imported from the country i to j, and B_j means the consumption of the imported products. The price can also be expressed as $p_{ij} = p_i t_{ij}$, where $(t_{ij} \geq 1)$ means trade barriers.

$$B_j = \sum_i p_{ij} x_{ij} \tag{2}$$

Based on that the budget constraint equation can be expressed as follows $B_j = \sum_i p_i t_{ij} x_{ij}$. Using the Lagrangian for Equations (1) and (2), the following equation (3) can be derived, where x_{ij} means the flow of trade from country i to j.

$$x_{ij} = \left[\frac{\left(\alpha_i p_i t_{ij}\right)^{(1-\sigma)}}{\sum_i \left(\alpha_i p_i t_{ij}\right)^{(1-\sigma)}} \right] E_j \tag{3}$$

The total trade from country i to j is expressed as follows:

$$Y_i = \sum_j x_{ij} \tag{4}$$

By substituting equation (3) into equation (4), the following equation (5) is derived.

$$Y_j = \sum_j \left[\frac{\left(\alpha_i p_i t_{ij}\right)^{(1-\sigma)}}{\sum_i \left(\alpha_i p_i t_{ij}\right)^{(1-\sigma)}} \right] E_j \tag{5}$$

Excluding the countries j, this can be extended to the whole countries $\left(Y = \sum_i Y_i\right)$, and by rearranging both sides for Equation (5) for Y, this equation is derived:

$$\left(a_i p_i\right)^{1-\sigma} = \frac{\frac{Y_i}{Y}}{\sum_j \frac{t_{ij}^{(1-\sigma)}}{\sum_i \left(\alpha_{ij} p_i t_{ij}\right)^{(1-\sigma)}} \frac{E_j}{Y}} \tag{6}$$

Anderson and van Wincoop (2003) have shown that the right-hand denominator of equation (6) can be replaced by $\pi_i^{(1-\sigma)}$:

$$\left(a_i p_i\right)^{1-\sigma} = \frac{Y_i}{Y} \frac{1}{\pi_i^{(1-\sigma)}} \tag{7}$$

By substituting Equation (7) from Equation (3), the following equation is derived.

$$x_{ij} = \frac{Y_i}{Y} \left[\frac{t_{ij}^{(1-\sigma)}}{\pi_i^{(1-\sigma)} \sum_i \left(\alpha_i p_i t_{ij}\right)^{(1-\sigma)}} \right] E_j \tag{8}$$

Equation (8) is the gravity model to be used in this study, and by adding the items that are the subject of this study, the following final model can be expressed as follows.

$$x_{ij}^k = \frac{Y_i^k E_j^k}{Y} \left[\frac{t_{ij}^{\left(1-\sigma^k\right)}}{\pi_i^{k(1-\sigma^k)} \sum_i \left(\alpha_i^k p_i^k t_{ij}^k\right)^{(1-\sigma^k)}} \right] \tag{9}$$

Y_i^k represents the total production amount of k goods produced in country j, and E_j^k represents the total consumption of k goods in country j. t_{ij}^k refers to trade costs, and in this study,

population, GDP, and IPRP level of partner countries were included as variables. Finally, Feenstra (2003) showed that Y_i^k, $\pi_i^{k(1-\sigma^k)}$, and E_j^k can be replaced by the fixed effects, so that, this study includes the fixed effects of exporting country, importing country, and year in the model.

The gravity equation (10) employed in the study integrates various variables, including trade openness, population, and IPRP level. The impact of IPRP on import flows is captured through the coefficients β3 and β4, representing direct and interactive effects, respectively.

$$EXP_{ijt} = \alpha + \beta_1 IPR_{jt} + \beta_2 \log\left(\frac{TR_{ijt}}{GDP_{jt}}\right) + \beta_3 \log(POP_{it}) + \beta_4 IPR_{jt} * \log(IMP_{ijt}) + t_i + \delta_j + \eta_t + \varepsilon_{ijt} \quad (10)$$

EXP_{ijt} represents South Korea's exports from region i to country j in year t. The ratio $\log((TR_{ijt})/GDP_{jt})$ that represents South Korea's trade openness ratio. It is the value of trade [1] by GDP, measuring the openness of a country to international trade. Also, our model introduces $\log(POP_{it})$ represents the population of each Korean region by year. In this paper we focus on studying the impact of IPRP on exports, so we added our main independent variable IPR_{jt} that measures the partner countries' IPRP level. IPR_{jt} is an index in which the value varies from 0 to 9. We expect that the partner countries' IPRP will have a positive impact on exports because of the technology transfer. This aligns with findings from previous papers, such as Branstetter *et al*. (2006), that have empirically demonstrated that stronger IPRP can foster international technology transfer. Also, we added the interaction term $IPR_{jt} * \log(IMP_{ijt})$ to examine how imports from partner countries with strong IPRP impact South Korea's exports, allowing us to capture the potential negative effects of stringent IPR regimes on export opportunities. Finally, the terms t_i, δ_j, η_t and ε_{ijt} refers respectively to the region, country, year fixed effect, and the error term.

To assess the relationship between the response and predictor variables, we employed generalized linear modeling (GLM), which extends traditional linear regression by allowing for non-normal error distributions and non-linear relationships. Given the issue of overdispersion in the data, we used the quasi-Poisson model to avoid potential bias. One common challenge in trade-flow analysis is the presence of zero trade values, which can distort estimates (Van Bergeijk and Brakman, 2010). To address this, we added a small constant to retain all observations, as removing zero-value data could introduce bias if the zeros are non-random (Afman and Maurel, 2010). The quasi-Poisson model also helps address both zero trade flows and heteroskedasticity, avoiding the biases of log-linear gravity models. To check the robustness of our results, we incorporated country, region, and year fixed effects to control for multilateral resistance, following Baier and Bergstrand (2009), accounting for unobserved heterogeneity. Additionally, to manage the heterogeneity among partner countries based on their IPR protection levels, we grouped countries into three categories: high IPRP, medium IPRP, and low IPRP, allowing us to better capture how different IPR protection levels influence trade flows.

3.2.2 Impact of IPRP on trade with third countries (GVC participation). To study the impact of IPRP on trade with third countries, we will use equation (11).

$$T\_EXP_{ijt} = \alpha + \beta_1 \log\left(IMP_{ijt}\right)_L + \beta_2 \log\left(\frac{TR_{ijt}}{GDP_{jt}}\right)_L + \beta_3 \log\left(POP_{it}\right)_L + t_i + \delta_j + \eta_t + \varepsilon_{ijt} \quad (11)$$

The dependent variable T_EXP_{ijt} represents the third country's exports, calculated as the total exports of region i in year t minus the exports from region i to country j in year t. The independent variables are $\log\left(IMP_{ijt}\right)_L$ presents South Korea's imports from partner countries,

$\log\left(\frac{TR_{ijt}}{GDPjt}\right)_L$ represents South Korea's trade openness ratio, and $\log(POP_{it})_L$ represents the population of each Korean region by year. In this equation we classify partner countries j by the level of IPRP, which is mentioned as L next to each variable. We classified countries into three levels of IPRP. Countries with an IPRP index such that $1.7 \leq IPRP < 4.3$ are classified as low IPRP. Countries with $4.3 \leq IPRP < 6.8$ are classified as medium IPRP. Finally, countries with $6.8 \leq IPRP \leq 9$ are classified as high IPRP. And we do the same thing for third countries to study the effect of imports from each partner country's IPRP level on exports to each level of third countries. In other words, we will study imports from which level of IPRP encourage exports to which level of IPRP in third countries. The fixed effects (t_i, δ_j, η_t) address region-specific, country-specific, and time-specific factors. The error term ε_{ijt} accounts for unobservable influences on TFP_{it}. Employing this equation allows the study to discern how the IPRP and magnitude of trade interactions, collectively contribute in increasing South Korea's GVC participation over the studied period.

The model of our study is summarized in Figure 2.

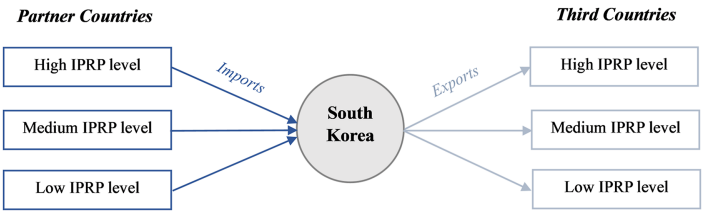
4. Results and discussion

The results in Table 2 shows that South Korea's exports are positively influenced by the trade openness of her partner countries and the population size. Additionally, stronger IPR protection (IPRP) in partner countries is associated with a 0.097 increase in South Korea's exports to those countries, suggesting that South Korea prefers exporting to markets with robust IPRP, which fosters innovation and safeguards proprietary technologies (Maskus, 2000).

However, the interaction term between the IPRP of the partner countries and South Korea's imports from them, reveals a negative impact on South Korea's exports to the same markets. This may be due to technology leakage, where South Korea imports advanced technology from these countries, incorporates it into its own products, and then attempts to export similar products. Countries with high IPR protection are unlikely to accept these exports, as they may perceive them as competing products that have benefited from the imported technology and will instead seek to strengthen their own industries by sourcing from other countries.

In this sense, strong IPR protection in these partner countries acts as a trade barrier, preventing South Korean exports of similar technologies (Helpman, 1993; Grossman and Lai, 2004). Despite this, the negative interaction points to opportunities for technology spillovers. South Korea can leverage imported technologies from partner countries with strong IPRP to enhance its own production capabilities, expanding its participation in global value chains (GVCs) and increasing exports to third-party markets where IPR barriers are less restrictive (Branstetter and Saggi, 2006; Fink *et al.*, 2005).

To analyze the impact of IPRP on GVC participation, we will classify countries by IPRP level and study the impact of Korea's imports from each level on its exports to the rest of the countries, regardless of their IPRP level, as shown in Table 3. The results revealed that



Source(s): The authors

Figure 2. Model

Table 2. Regression results of the effect of IPRP on exports

Dependent variable: EXP_{ijt}	Model 1	Model 2
$Log(IMP_{ijt})$	0.556^{***} (0.008)	0.021^{***} (0.007)
$Log((TRADE_{ijt})/GDP_{jt})$	0.225^{***} (0.012)	0.887^{***} (0.005)
$Log(POP_{it})$	1.693^{***} (0.440)	0.856^{***} (0.123)
IPR_{jt}	0.022^{**} (0.009)	0.097^{***} (0.022)
IPRjt x $log(IMP_{ijt})$	–	-0.039^{***} (0.001)
Constant	-16.612^{**} (6.642)	7.860^{***} (1.917)
Region FE	Y	Y
Country FE	N	Y
Year FE	N	Y
Observations	17,324	17,324

Note(s): [a]Standard error in parentheses
[b]$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$
Source(s): The authors

Table 3. The effect of imports from countries with different IPRP levels on GVC participation

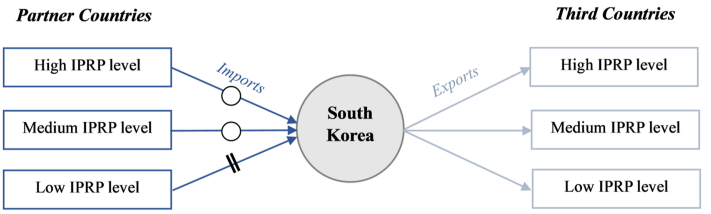
Dependent variable: 3rd country exports (T_EXP_{ijt})			
Partner countries' IPRP level	High IPRP	Medium IPRP	Low IPRP
$Log(IMP_{ijt})$	0.018^{***} (0.004)	0.002^{*} (0.001)	0.001 (0.001)
$Log((TRADE_{ijt})/GDP_{jt})$	0.044^{***} (0.005)	0.023^{***} (0.002)	0.012^{***} (0.003)
$Log(POP_{it})$	1.502^{***} (0.089)	1.730^{***} (0.064)	1.532^{***} (0.095)
Constant	-6.908^{***} (1.423)	-9.805^{***} (0.965)	-6.242^{***} (1.346)
Observations	4,321	8,658	4,345

Note(s): [a]Standard error in parentheses
[b]As a dependent variable, 3rd country exports mean exports to all partner countries regardless of their IPR protection level, only independent variables related to partner countries who are grouped by level
[c]The model considers all region, country, and year fixed effects
[d] $^{*}p < 0.1$; $^{**}p$ 0.05; $^{***}p < 0.01$
Source(s): The authors

importing from countries with high IPRP increased exports to third countries regardless of their IPRP level, with a significantly positive effect of 0.018. Also, importing from countries with a medium IPRP level appeared to have a significantly positive impact on exports to third countries, with a coefficient of 0.002. While importing from countries with low IPRP didn't have any impact on South Korea's GVC participation.

Concerning other variables, the results indicate significant positive coefficients for the trade openness $Log((TRADE_{ijt})/GDP_{jt})$ across all levels of IPRP, suggesting that higher trade openness is associated with increased exports to third countries. Additionally, the coefficient for $Log(POP_{it})$ is positive and significant for all IPRP levels, indicating that a larger population in Korean regions is associated with higher exports to third countries. These results can be summarized as shown in Figure 3. Moving to study the imports from high and medium IPRP countries separately and their impact on Korea's exports to third countries by level. Starting with imports from high-IPRP countries.

The findings in Table 4 suggest that importing from countries with high-IPRP leads to positive impacts on exports to third countries across varying levels of IPRP. Which means that imports from countries with high-IPRP increase exports to third countries with high, medium, and low IPRP levels. Remarkably, this positive effect is more pronounced in countries with high and medium levels of IPRP with coefficients of 0.020 and 0.014 successively. These



Source(s): The authors

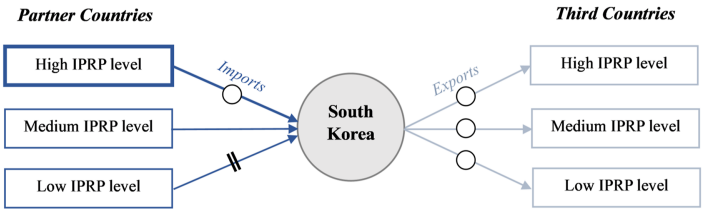
Figure 3. Effect of imports from different IPRP levels on GVC participation

Table 4. The effect of imports from countries with strong IPRP on GVC participation

Dependent variable: 3rd country exports (T_EXP_{ijt})	High IPRP	Medium IPRP	Low IPRP
$Log(IMP_{ijt})_H$	0.020^{***} (0.004)	0.014^{***} (0.005)	0.014^{*} (0.008)
$Log((TRADE_{ijt})/GDP_{jt})_H$	0.038^{***} (0.005)	0.047^{***} (0.006)	0.017^{*} (0.010)
$Log(POP_{it})_H$	0.774^{***} (0.103)	1.789^{***} (0.104)	−0.015 (0.214)
Constant	3.868^{**} (1.552)	-11.246^{***} (1.567)	13.346^{***} (3.223)
Observations	4,345	4,345	4,345

Note(s): [a]Standard error in parentheses
[b]As a dependent variable, 3rd country exports mean exports to partner countries classified by their level of IPR protection, and independent variables related to partner countries are limited to high IPR protection countries
[c]The model considers all region, country, and year fixed effects
[d] $^{*}p < 0.1$; $^{**}p$ 0.05; $^{***}p < 0.01$
Source(s): The authors

results indicate that South Korea's exports benefit from a spillover effect, where technological know-how and innovation disseminate to third countries regardless of their IPRP levels. Similarly to these results, a study by Chen and Puttitanun (2005) illustrated that firms importing from countries with strong IPRP tend to engage in more innovation and technology transfer activities, which subsequently enhance their export competitiveness. The higher positive effect observed in countries with high and medium IPRP underscores the importance of robust intellectual property regimes in facilitating technology diffusion and enhancing export performance. The results of Table 4 are visualized in Figure 4.



Source(s): The authors

Figure 4. Effect of Imports from high-IPRP countries on GVC participation

For the case of imports from countries with Medium-IPRP level and their impact on Korea's exports to third countries, the results are shown in Table 5.

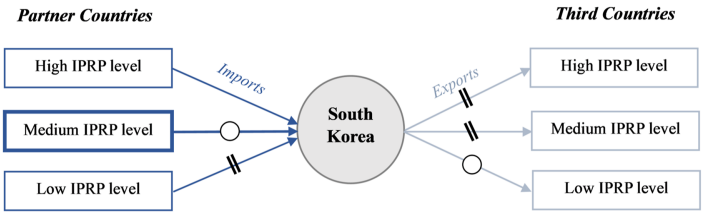
The results in Table 5 suggest that there is a nuanced relationship between the technology spillover, intellectual property rights (IPR) levels, and export dynamics. Importing from countries with a medium IPRP appears to have a single positive significant impact on South Korea's exports, particularly to countries with a low IPRP level, with a significant coefficient of 0.005. This pattern can be interpreted through the lens of technology spillover, wherein the importation of goods or technologies from countries with medium IPRP fosters a conducive environment for knowledge diffusion and technology transfer.

South Korean firms may leverage imported technologies or knowledge from these countries, adapting and innovating upon them to enhance their export competitiveness, particularly in markets with low IPRP. This finding underscores the importance of technology diffusion in driving export growth, particularly in environments where regulatory barriers are less stringent. Therefore, while importing from countries with medium IPRP may not directly impact exports to all destinations, it can serve as a catalyst for technological innovation and competitiveness, particularly in markets with lower levels of IPRP. The results of Table 5 concerning the case of imports from countries with medium IPRP can be visualized as shown in Figure 5.

Table 5. The effect of imports from countries with medium-IPRP on GVC participation

Dependent variable: 3rd country exports (T_EXP_{ijt})	High IPRP	Medium IPRP	Low IPRP
$\log(IMP_{ijt})_M$	0.002 (0.001)	0.002 (0.002)	0.005* (0.003)
$\log((TRADE_{ijt})/GDP_{jt})_M$	0.022*** (0.002)	0.022*** (0.003)	0.029*** (0.005)
$\log(POP_{it})_M$	0.947*** (0.073)	2.035*** (0.074)	0.161 (0.155)
Constant	1.244 (1.096)	15.193*** (1.117)	11.011*** (2.329)
Observations	8,658	8,658	8,658

Note(s): [a]Standard error in parentheses
[b]As a dependent variable, 3rd country exports mean exports to partner countries classified by their level of IPR protection, and independent variables related to partner countries are limited to medium IPR protection countries
[c]The model considers all region, country, and year fixed effects
[d] *$p < 0.1$; **p 0.05; ***$p < 0.01$
Source(s): The authors



Source(s): The authors

Figure 5. Effect of imports from medium-IPRP countries on GVC participation

5. Conclusion

This study analyzes the impact of IPR protection in South Korea's partner countries on its exports and Global Value Chain (GVC) participation. The panel dataset used covers 104 countries from 2009 to 2019. Based on our results, the main findings are summarized as follows.

First, the analysis uncovers a nuanced relationship between South Korea's imports and exports in relation to partner countries with strong IPR protection. While importing from these countries benefits South Korea's technological capabilities, it also hinders its direct exports to these same markets due to stringent IPR regulations, which function as trade barriers. This highlights the challenge posed by technology leakage, where South Korea imports advanced technologies but faces barriers when attempting to export similar products to these countries.

Second, despite these barriers, technology spillovers from high-IPRP countries provide opportunities for South Korea to expand its exports to third countries. The results suggest that GVC participation is strengthened as South Korea leverages the imported technology to export to other markets, especially those with lower levels of IPRP that the import country. Notably, imports from countries with high IPRP spur technology transfer, fostering South Korea's exports to third countries with high, medium, and low level of IPRP. Conversely, imports from countries with a medium level of IPRP primarily drive exports only to countries with lower level of IPRP.

The findings of this study have important implications for developing countries with high or medium IPRP like South Korea. These nations should adopt diversified export strategies, targeting markets where IPR barriers are less restrictive, while leveraging technology spillovers from countries with strong IPR protection to enhance their participation in Global Value Chains. Additionally, strengthening domestic innovation capabilities is essential for competing in markets with stringent IPR rules. Developing countries could also benefit from forming strategic alliances with technologically advanced nations to access innovative technologies and reduce the impact of trade barriers. Lastly, advocating for more balanced international IPR regulations, such as through TRIPS, would promote a fairer global trade environment, supporting long-term economic growth and competitiveness.

While this study provides valuable insights, it has some potential limitations. First, the analysis is generalized across manufacturing industries, and sector-specific variations may lead to different responses to IPRP. Second, the study does not fully address the issue of causality, future research could apply methodologies like the Generalized Method of Moments (GMM) to better understand the direction of the relationship between IPRP and trade. Furthermore, expanding the dataset beyond the year 2019 to incorporate the effects of COVID-19 and the effects of US-China trade war. Additionally, exploring the effects of international agreements, such as TRIPS, would offer a more comprehensive view.

Note

1. The value of trade in our paper denotes of the sum up value of imports and exports.

References

Afman, E. and Maurel, M. (2010), "The gravity model in international trade: diplomatic relations and trade reorientation", in *Transition Countries*.

Anderson, J.E. and van Wincoop, E. (2003), "Gravity with gravitas: a solution to the border puzzle", *The American Economic Review*, Vol. 93 No. 1, pp. 170-192, doi: 10.1257/000282803321455214.

Auriol, E., Biancini, S. and Paillacar, R. (2019), "Universal intellectual property rights: too much of a good thing?", *International Journal of Industrial Organization*, Vol. 65, pp. 51-81, doi: 10.1016/j.ijindorg.2019.01.003.

Auriol, E., Biancini, S. and Paillacar, R. (2023), "Intellectual property rights protection and trade: an empirical analysis", *World Development*, Vol. 162, 106072, doi: 10.1016/j.worlddev.2022.106072.

Baier, S.L. and Bergstrand, J.H. (2009), "Bonus vetus OLS: a simple method for approximating international trade-cost effects using the gravity equation", *Journal of International Economics*, Vol. 77 No. 1, pp. 77-85, doi: 10.1016/j.jinteco.2008.10.004.

Bergstrand, J. (1985), "The gravity equation in international trade: some microeconomic foundations and empirical evidence", *The Review of Economics and Statistics*, Vol. 67 No. 3, pp. 474-481, doi: 10.2307/1925976.

Branstetter, L., Fisman, R. and Foley, C.F. (2006), "Do stronger intellectual property rights increase international technology transfer? Empirical evidence from U.S. Firm-level panel data", *Quarterly Journal of Economics*, Vol. 121 No. 1, pp. 321-349, doi: 10.1162/003355306776083482.

Chen, Y. and Puttitanun, T. (2005), "Intellectual property rights and innovation in developing countries", *Journal of Development Economics*, Vol. 78 No. 2, pp. 474-493, doi: 10.1016/j.jdeveco.2004.11.005.

Chin, J. and Grossman, G. (1988), "Intellectual property rights and North-South trade", NBER Working Paper (No. 2769), National Bureau of Economic Research.

Deardoff, A.V. (1992), "Welfare effects of global patent protection", *Economica*, Vol. 59 No. 233, pp. 35-51, doi: 10.2307/2555064.

Deardoff, A. (1998), "Determinants of bilateral trade: does gravity work in a neoclassical world?", *NBER Chapters in: The Regionalization of the World Economy*, pp. 7-32.

Doanh, N.K. and Heo, Y. (2007), "Impacts of intellectual property rights on trade flows in ASEAN countries", *Journal of International and Area Studies*, Vol. 14 No. 1, pp. 1-15.

Doanh, N.K., Gam, N.T. and Heo, Y. (2022), "The impact of intellectual property rights protection on trade: the role of a 'third country' in market power and market expansion effects", *Economic Systems*, Vol. 46 No. 1, 100942, doi: 10.1016/j.ecosys.2022.100942.

Durand, C. and Milberg, W. (2020), "Intellectual monopoly in global value chains", *Review of International Political Economy*, Vol. 27 No. 2, pp. 404-429, doi: 10.1080/09692290.2019.1660703.

Eaton, J. and Kortum, S. (2002), "Technology, geography, and trade", *Econometrica*, Vol. 70 No. 5, pp. 1741-1779, doi: 10.1111/1468-0262.00352.

Fagerberg, J. and Godinho, M.M. (2004), "Innovation and catching-up", *The Oxford Handbook of Innovation*, Oxford University, pp. 514-544.

Feenstra, R.C. (2003), "A homothetic utility function for monopolistic competition models, without constant price elasticity", *Economics Letters*, Vol. 78 No. 1, pp. 79-86.

Fink, C., Javorcik, B.S. and Spatareanu, M. (2005), "Income-related biases in international trade: what do trademark registration data tell us?", *Review of World Economics*, Vol. 141 No. 1, pp. 79-103, doi: 10.1007/s10290-005-0016-x.

Grossman, G. and Lai, E. (2004), "International protection of intellectual property", *The American Economic Review*, Vol. 94 No. 5, pp. 1635-1653, doi: 10.1257/0002828043052312.

Helpman, E. (1993), "Innovation, imitation, and intellectual property rights", *Econometrica*, Vol. 61 No. 6, pp. 1247-1280, doi: 10.2307/2951642.

Lai, E. and Qiu, L. (2003), "The North's intellectual property rights standard for the South?", *Journal of International Economics*, Vol. 59 No. 1, pp. 183-209, doi: 10.1016/s0022-1996(02)00090-9.

Maskus, K.E. (2000), "Intellectual property rights in the global economy", *Peterson Institute for International Economics*.

Maskus, K.E. and Penubarti, M. (1995), "How trade-related are intellectual property rights?", *Journal of International Economics*, Vol. 39 Nos 3-4, pp. 227-248, doi: 10.1016/0022-1996(95)01377-8.

Park, W.G. and Ginarte, J.C. (1997), "Intellectual property rights and economic growth", *Contemporary Economic Policy*, Vol. 15 No. 3, pp. 51-61, doi: 10.1111/j.1465-7287.1997.tb00477.x.

Property Rights Alliance (2023), "International property rights index", available at: https://internationalpropertyrightsindex.org/ (accessed November 2023).

Smith, P. (1999), "Are weak patent rights a barrier to US exports?", *Journal of International Economics*, Vol. 48 No. 1, pp. 151-177, doi: 10.1016/s0022-1996(98)00013-0.

Van Bergeijk, P.A.G. and Brakman, S. (Eds) (2010), *The Gravity Model in International Trade: Advances and Applications*, Cambridge University Press, pp. 355-358.

Yang, G., Zhang, Y. and Yu, X. (2020), "Intellectual property rights and the upgrading of the global value chain status", *Pacific Economic Review*, Vol. 25 No. 2, pp. 185-204, doi: 10.1111/1468-0106.12325.

Yoon, H. and Nguyen, K.D. (2012), "Intellectual property rights, imitative ability and export performance: the Korean experience", *Asian International Studies Review*, Vol. 13 No. 1, pp. 19-41, doi: 10.16934/isr.13.1.201206.19.

Further reading

Jaffe, A.B., Trajtenberg, M. and Fogarty, M.S. (2000), "Knowledge spillovers and patent citations: evidence from a survey of inventors", *The American Economic Review*, Vol. 90 No. 2, pp. 215-218, doi: 10.1257/aer.90.2.215.

Keller, W. (2004), "International technology diffusion", *Journal of Economic Literature*, Vol. 42 No. 3, pp. 752-782, doi: 10.1257/0022051042177685.

Corresponding author

Rajae El Ayboud can be contacted at: rajae.elayboud@gmail.com