THE EFFECTS OF INTELLECTUAL PROPERTY RIGHTS – IPRS ON KOREA'S EXPORT TECHNOLOGY PRODUCTS

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ABSTRACT

This study investigates the impact of intellectual property rights enforcement on Korea's technological exports to 158 partner countries during 2010–2022. Using a gravity model and GMM estimation, the findings reveal a significant positive effect of IPR on exports across all technology levels. Specifically, a one-unit increase in the IPR index of importing countries leads to a 0.407% rise in high-tech exports, a 0.157% increase in medium-tech exports, and a 0.096% increase in low-tech exports. These results highlight the pivotal role of strong IPR regimes in promoting Korea's technological export growth, particularly in innovation-intensive industries. This underscores the critical role of robust IPR regimes in protecting innovation, reducing imitation risks, and fostering trade in innovation-intensive sectors. High-tech industries, which heavily rely on intellectual property protection to safeguard R&D investments, benefit the most from stringent intellectual property rights enforcement. Medium- and low-tech exports also gain from intellectual property rights by reducing competition from counterfeit or low-quality products and ensuring a fair market environment. These findings highlight the importance of engaging with IPR-compliant markets to maximize Korea's technological export potential and strengthen its competitive advantage in global high-tech trade.

TÁC ĐỘNG CỦA QUYỀN SỞ HỮU TRÍ TUỆ – IPRS ĐẾN SẢN PHẨM CÔNG NGHỆ XUẤT KHẨU CỦA HÀN QUỐC

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TỪ KHÓA

Quyền sở hữu trí tuệ
Hàn Quốc
Xuất khẩu hàng công nghệ
Mô hình trọng lực
GMM

TÓM TẮT

Nghiên cứu này điều tra tác động của việc thực thi quyền sở hữu trí tuệ đối với hoạt động xuất khẩu công nghệ của Hàn Quốc sang 158 quốc gia đối tác trong giai đoạn 2010–2022. Sử dụng mô hình trọng lực và ước tính GMM, các phát hiện cho thấy tác động tích cực đáng kể của IPR đối với xuất khẩu ở các nhóm công nghệ thấp, công nghệ trung bình và công nghệ cao, với tác động mạnh nhất được quan sát thấy đối với xuất khẩu công nghệ cao. Điều này nhấn mạnh vai trò quan trọng của các cơ chế bảo vệ quyền sở hữu trí tuệ mạnh mẽ trong việc bảo vệ sự đổi mới, giảm rủi ro bắt chước và thúc đẩy thương mại trong các lĩnh vực đòi hỏi nhiều đổi mới. Các ngành công nghệ cao, vốn phụ thuộc nhiều vào việc bảo vệ quyền sở hữu trí tuệ để bảo vệ các khoản đầu tư vào R&D, được hưởng lợi nhiều nhất từ việc thực thi nghiêm ngặt quyền sở hữu trí tuệ. Xuất khẩu công nghệ trung bình và thấp cũng thu được lợi ích từ IPR bằng cách giảm sự cạnh tranh từ các sản phẩm giả mạo hoặc chất lượng thấp và đảm bảo môi trường thị trường công bằng. Kết quả của nghiên cứu này nhấn mạnh tầm quan trọng của việc tham gia vào các thị trường tuân thủ IPR để tối đa hóa tiềm năng xuất khẩu công nghệ của Hàn Quốc và tăng cường lợi thế cạnh tranh của nước này trong thương mại công nghệ cao toàn cầu.

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1. Introduction

South Korea has emerged as a global leader in high-technology exports, significantly contributing to its economic growth and international competitiveness. In 2022, South Korea held a 17.7% share of the global semiconductor market, maintaining its position as the second-largest producer worldwide for the tenth consecutive year since 2013. Notably, the country accounted for 60.5% of the global memory semiconductor market, with a 70.5% share in DRAM and 52.6% in NAND sectors [1]. This dominance in the semiconductor industry underscores the strategic importance of high-technology exports in South Korea's overall economic structure, as the sector not only generates significant export revenue but also fosters the development of other industries such as consumer electronics, automotive, and artificial intelligence.

The protection of intellectual property rights (IPR) plays a crucial role in sustaining and enhancing South Korea's high-tech export performance. Robust IPR frameworks are essential for fostering innovation, attracting foreign direct investment (FDI), and facilitating technology transfer. By safeguarding intellectual property, IPR regimes encourage companies to invest in research and development (R&D), which is a cornerstone of South Korea’s competitive advantage in high-tech sectors [2]. Research indicated that strong IPR protection correlates with increased high-tech exports, as it assures investors and firms of the security of their innovations [3]. For instance, research indicates that countries with stringent IPR enforcement experience higher levels of FDI in technology-intensive industries, which in turn boosts export performance [4]-[6]. Furthermore, the enforcement of IPR not only protects existing technologies but also incentivizes the creation of new ones, enabling South Korea to sustain its technological edge in global markets [7], [8]. South Korea’s experience highlights how strategic IPR frameworks can transform innovation into a driver of global competitiveness, particularly in dynamic and high-value-added industries.

However, the relationship between IPRs protection and high-tech exports is complex. While strong IPR regimes can enhance exports by protecting proprietary technologies, they may also pose challenges for developing countries attempting to enter high-tech markets. For example, stringent IPR enforcement can limit the diffusion of technology and increase the cost of access to critical technologies for emerging economies. In the context of South Korea, which has transitioned from a developing to a developed economy, understanding this dynamic is vital. As a country that has benefited from technology transfer in the past, particularly during a period of less stringent IPR regulations [9]-[11], and now leads in technological innovation, South Korea’s perspective on balancing the benefits and challenges of IPR enforcement is particularly relevant [7].

Despite South Korea's advancements, there is a need for comprehensive studies focusing on how IPR protection in partner countries affects its high-tech exports. The degree of IPR enforcement in importing countries can influence trade flows by shaping market conditions, such as reducing the prevalence of counterfeit goods and ensuring fair competition for South Korean exporters [11], [12]. Given the global competition and the rapid pace of technological innovation, it is imperative to analyze how varying levels of IPR enforcement influence South Korea's export performance across different technological sectors [12].

This study aims to fill this gap by examining the impact of IPR protection on South Korea's exports of low-tech, medium-tech, and high-tech products to 157 partner countries between 2010 and 2022. By employing a comprehensive dataset and robust econometric methods, this research seeks to provide nuanced insights into how IPR enforcement influences trade dynamics in the technological domain. The findings are expected to inform policymakers and business leaders on strategies to enhance South Korea's high-tech export competitiveness in the global market. Additionally, the research will contribute to the broader understanding of how IPR regimes interact with technological exports in the context of advanced economies, offering valuable lessons for other nations aspiring to lead in high-tech industries.

2. Hypothesis development

2.1. Gravity model

The gravity model of international trade, introduced by Tinbergen [13], posits that trade flows between countries are positively influenced by their economic size (GDP) and negatively affected by distance [14]. This research follows Yusufu, et al. [15] to use gravity model.

According to international economic theory, GDP plays a crucial role in driving exports, particularly for high-technology goods. A country with a large GDP typically has a more developed economy, characterized by robust production capabilities fueled by substantial investments in research and development, modern infrastructure, and a highly skilled labor force [16]. This enables the development of advanced, high-value-added technological products, thereby enhancing competitiveness in global markets. A large GDP also reflects a sizable domestic market, allowing high-tech firms to test, refine, and scale their products to achieve economies of scale [17]. On the other hand, the GDP of the importing country also affects the export of high-technology goods, as it indicates purchasing power and the ability to adopt new technologies [18]. Thus, GDP serves as both a determinant of the exporting country's production capacity and a driver of demand from importing countries, forming a complex yet fundamental relationship in the trade of high-technology goods.

H1: GDP of exporting countries impacts positively on Korea's technological product export

H2: GDP of importing countries impacts positively on Korea's technological product export

Geographical distance significantly affects technological product exports by increasing transaction costs, complicating logistics, and reducing market accessibility. While high value-to-weight ratios mitigate transport costs for such goods, complex logistics and time sensitivity crucial for products with short lifecycles amplify distance-related challenges [19], [20]. Proximity facilitates collaboration in global value chains, boosting efficiency in production and assembly [21]. Additionally, greater distances often imply cultural and institutional differences, complicating trust-building and adaptation to technical standards [22].

H3. Geographical distance impacts negatively on Korea's technological product export

Language plays a crucial role in technological product export by influencing communication, knowledge transfer, and market accessibility. Shared language reduces transaction costs, improves collaboration, and minimizes misunderstandings in the exchange of technical information, which is vital for technology-intensive products [23]. Additionally, adapting technological product to local languages in interfaces, manuals, and marketing materials is often necessary to ensure consumer acceptance, though it increases export costs when linguistic differences are significant. Language also fosters trust and long-term partnerships, which are essential in technology sectors requiring sustained cooperation. While the global use of English as a lingua franca and advancements in translation technologies have reduced some barriers, linguistic differences still affect trade flows, particularly in markets with low English proficiency [24].

H4. Common language impacts positively on Korea's technological product export

2.2. The effects of intellectual property rights

Enhanced IPR protection in importing countries has significant implications for high-tech exports, presenting both market power and market expansion effects. Stronger IPR protection can confer monopoly power to exporting countries by restricting imitation and enabling firms to set higher prices for their products. This exclusivity reduces export volumes while allowing firms to capture greater value per unit, a dynamic highlighted in studies of trade patterns under stringent IPR regimes [6], [25], [26]. Conversely, stricter IPR enforcement in importing countries reduces domestic production of imitated goods, necessitating increased imports to meet local demand. This market expansion effect leads to a rise in trade flows as imports compensate for the decline in local supply [27], [28]. These opposing outcomes underline the complexity of IPR

enforcement, with its overall trade impact shaped by factors such as the technological capacity of the importing country and the structure of global supply chains [3].

H4. IPR may impacts positively or negatively on Korea's technological product export

3. Materials and Methods

3.1. Model of estimation

This study applies the gravity model to analyze the factors influencing Korea's technology exports to 157 partner countries during the period 2010–2022. The gravity model is widely used in international economics, especially for analyzing trade flows between countries. The model is specified in a log-log form to ensure linearity and facilitate the interpretation of regression coefficients. The research model is defined as follows:

$$lnTech_{ij,t} = \beta_0 + \beta_1 lnTech_{ij,t-1} + \beta_2 \ln G_{ij,t} + \beta_3 lnR_{ij,t} + \beta_4 lnS_{ij,t} + \beta_5 lnDIST_{ij} + \beta_6 Language_{ij} + \beta_7 IPR_{j,t} + \varepsilon_{ij,t} \quad (1)$$

Where: ln is the natural logarithm of a variable, i is Korea, j denotes the importing (partner) country in the dataset, which includes 158 countries.

- Tech: is the value of Korea's technology exports to a partner country
- $Tech_{t-1}$: is the lagged value of Korea's technology exports to the same partner country from the previous year
- G: is the average of Gross Domestic Product (GDP) of Korea and the partner country, representing their economic size
- R: is the GDP per capital differences between Korea and the partner country
- S: is the similarity GDP between Korea and the partner country
- DIST: is the geographical distance between Korea and the partner country, capturing trade-related transportation costs and barriers
- Language: A dummy variable indicating whether Korea and the partner country share a common language (1 if yes, 0 otherwise)
- IPR: is the Intellectual Property Rights (IPR) index of the partner country, representing the strength of IPR enforcement.

3.2. Method of estimation

In this study, the author employs the two-step Generalized Method of Moments (GMM) approach [29] to evaluate the impact of various factors on technology exports. Compared to methods such as Ordinary Least Squares (OLS) and the Fixed Effect Model (FEM), the two-step GMM method is regarded as more robust for dynamic panel data analysis due to its ability to address complex econometric issues. GMM effectively mitigates endogeneity by utilizing lagged values as internal instruments, thereby reducing bias and improving reliability [30]. Notably, the system GMM combines the difference and level equations, enhancing efficiency compared to the traditional difference GMM approach [29]. Additionally, the author conducts Hansen Test and AR(2) assessments to ensure the model's accuracy and address the limitations of alternative methods [31], [32].

3.3. Source of data

The study includes Korea and 157 partner countries, covering the period from 2010 to 2022. The author utilizes data from multiple credible sources to ensure the reliability and validity of the analysis. Export data were obtained from the World Integrated Trade Solution (WITS) database. Variables such as logG, logR, and logS were computed using gross domestic product (GDP) and population data sourced from the World Bank Open Data platform. Information on IPR was derived from the Economic Freedom of the World: 2024 Annual Report. Data on geographical

distance and shared language were extracted from the Centre d'Études Prospectives et d'Informations Internationales (CEPII) database.

Table 1. *Summary of statistic*

Variable	Obs	Mean	Std. dev.	Min	Max
$lnTech_{ij,t}$	1,963	12.060	2.742	0.824	18.633
$lnLowTech_{ij,t}$	1,953	9.841	3.011	-2.919	16.205
$lnMediumTech_{ij,t}$	1,959	11.495	2.831	-2.313	17.759
$lnHighTech_{ij,t}$	1,957	10.003	2.974	0.498	18.193
$logG_{ij,t}$	1,963	28.534	0.409	28.085	31.170
$logR_{ij,t}$	1,963	1.286	1.003	0.000	4.030
$logS_{ij,t}$	1,963	-2.492	1.415	-6.229	-0.693
$lnDIST_{ij}$	1,963	9.074	0.502	6.765	9.883
$Language_{ij}$	1,963	0.285	0.451	0.000	1.000
$IPR_{j,t}$	1,963	5.508	2.110	0.000	9.670

Table 1 provides a summary of the descriptive statistics for the study variables, offering insights into Korea's technological exports and their determinants. The dependent variables ($lnTech_{ij,t}$, including low-, medium-, and high-tech exports) exhibit wide variability, reflecting significant differences in export values across partner countries. The independent variables capture diverse trade determinants. $logG_{ij,t}$ shows high values with minimal dispersion, indicating relatively large and stable economic sizes. $logR_{ij,t}$ displays moderate variability, suggesting disparities in economic development levels. $logS_{ij,t}$ reflects GDP similarity, has a lower mean and higher variability, highlighting varying degrees of economic resemblance. Geographical distance has a narrow range, emphasizing stable spatial relationships. The binary variable ($Language_{ij}$) indicates that only a minority of partner countries share a common language with Korea. Finally, the IPR index reveals wide variation in IPRs enforcement across partners.

4. Results and Discussion

The results of the AR(2) and Hansen tests in Table 2 confirm the validity and robustness of the models. The AR(2) test shows p-values greater than 0.05 across all models, indicating the absence of second-order autocorrelation in the error terms. This ensures the reliability of the GMM estimation and supports the appropriateness of using dynamic panel data techniques. Similarly, the Hansen test yields p-values above 0.05, confirming that the instruments used are valid and not overidentified. These findings collectively validate the exogeneity of the instruments and the robustness of the estimation results, ensuring the credibility of the conclusions drawn from the analysis.

This study's findings align with and extend prior research on the determinants of technological product exports, highlighting the roles of GDP, geographical distance, and shared language. The lagged dependent variables $lnTech_{ij,t-1}$ and their respective subcategories demonstrate strong persistence in trade flows, with all coefficients being positive and significant. For example, medium-tech exports show the strongest persistence (0.793**), suggesting stable demand and well-established trade relationships in this segment. High-tech (0.225*) and low-tech (0.446**) exports also exhibit significant persistence, indicating that previous trade volumes strongly influence current export performance.

The positive and significant impact of GDP ($logG_{ij,t}$) across all export categories emphasizes the critical role of economic size in driving trade. Larger economies, represented by the average GDP of Korea and its partner countries, foster both production capabilities and demand. The results reveal that low-tech (0.958**) and high-tech exports (0.911**) benefit the most from larger economic sizes. These findings suggest that low-tech exports rely heavily on the purchasing power of larger economies, while high-tech exports are driven by advanced economies with greater adoption of cutting-edge technologies. Medium-tech exports also show a

positive relationship with GDP (0.206**), though the impact is comparatively smaller, reflecting the broader appeal of these products to both developed and developing markets.

Table 2. *The empirical results*

Variables	lnTech	lnMediumTech	lnHighTech	lnLowTech
$lnTech_{ij,t-1}$	0.459*			
	(0.228)			
$lnLowTech_{ij,t-1}$		0.793**		
		(0.064)		
$lnMediumTech_{ij,t-1}$			0.225*	
			(0.096)	
$lnHighTech_{ij,t-1}$				0.446**
				(0.112)
$logG_{ij,t}$	0.604*	0.206*	0.911**	0.958**
	(0.302)	(0.082)	(0.244)	(0.232)
$logR_{ij,t}$	-0.0208	-0.0562	-0.0435	-0.118*
	(0.135)	(0.077)	(0.193)	(0.053)
$logS_{ij,t}$	0.522*	0.242**	0.674**	0.688**
	(0.240)	(0.091)	(0.146)	(0.146)
$lnDIST_{ij}$	-0.413*	-0.195*	-0.396	-0.476**
	(0.205)	(0.093)	(0.203)	(0.120)
$Language_{ij}$	0.139	0.108	0.151	0.270**
	(0.179)	(0.075)	(0.256)	(0.092)
$IPR_{j,t}$	0.285*	0.157**	0.407**	0.096**
	(0.119)	(0.052)	(0.119)	(0.025)
Constant	-7.244	-2.461	-13.970	-16.220**
	(5.594)	(2.144)	(7.242)	(5.115)
No of observation	1812	1812	1812	1812
AR (2) test	0.198	0.139	0.135	0.417
Hansen test	0.318	0.385	0.080	0.409

*Note: * is significantly at 0.05 levels, ** is significantly at 0.01 levels.*
The standard error is in parentheses.

The GDP per capita difference ($logR_{ij,t}$) negatively affects low-tech exports (−0.118*) and is insignificant for medium-tech and high-tech exports. This indicates that greater disparities in GDP per capita may reduce demand for simpler, low-tech products, possibly due to differences in consumer preferences or affordability. For medium- and high-tech exports, the lack of significance suggests that the economic development gap between Korea and its partners does not play a critical role, as these products cater to specialized industries or wealthier segments of partner economies.

The positive and significant coefficients of GDP similarity ($logS_{ij,t}$) across all categories highlight its importance in fostering trade relationships. The strongest effects are observed for high-tech (0.674**) and low-tech exports (0.688**), indicating that countries with similar economic structures tend to have more aligned trade flows. This is particularly relevant for high-tech exports, where shared economic capacities facilitate collaboration in technology-intensive industries.

The negative effect of geographical distance supports findings by Hummels [19], who also confirm that greater distances increase transaction costs and logistical complexities, limiting trade efficiency. Additionally, the challenges of trust-building and compliance with technical standards due to cultural and institutional differences are consistent with Beugelsdijk, et al. [22].

The positive impact of shared language aligns with Egger and Lassmann [23], who emphasize how linguistic similarities reduce transaction costs and enhance communication in technology-intensive sectors. These findings reinforce the continued importance of linguistic and cultural ties in facilitating high-tech trade.

The empirical results in Table 2 highlight the significant and positive impact of IPR enforcement ($IPR_{j,t}$) on Korea's technological exports across all categories (low-tech, medium-tech, and high-tech). This finding emphasizes the critical role of robust IPR regimes in facilitating technology trade by protecting proprietary innovations and ensuring fair competition in global markets. Prior studies, such as Chen [27], and Maskus and Yang [28], have similarly emphasized the market expansion effects of IPR enforcement, particularly in sectors that are innovation-intensive and reliant on significant research and development (R&D) investments.

The effect of IPR enforcement is particularly pronounced in the high-tech export category, with a coefficient of 0.407**, the highest among all sectors. This underscores the reliance of high-tech industries on strong intellectual property protection to safeguard cutting-edge technologies and encourage innovation. High-tech products often involve substantial R&D investments, making them vulnerable to imitation and counterfeiting in markets with weak IPR enforcement. Robust IPR regimes provide exporters with the confidence to enter such markets by reducing the risk of intellectual property theft and ensuring a return on their R&D investments [28].

In the medium-tech category, the coefficient for IPR is 0.157**, indicating a moderate yet significant positive effect. Medium-tech exports, which include semi-specialized technologies, benefit from IPR enforcement as it ensures the integrity of intermediate goods and industrial components, critical to maintaining product quality and global value chain efficiency [27]. For low-tech exports, the IPR coefficient is 0.096**, demonstrating a smaller but still significant positive impact. This result suggests that even for simpler products, IPR enforcement reduces the prevalence of counterfeit goods and ensures a level playing field for authentic exports. While the impact is less pronounced compared to high-tech exports, it highlights the broader role of IPR in facilitating trade across all technology levels [28].

The findings collectively suggest that IPR enforcement serves as a key enabler of Korea's technological exports by reducing the risks of imitation, promoting innovation, and fostering trust in international markets. The differential impact of IPR across low-tech, medium-tech, and high-tech categories reflects the varying reliance of these sectors on intellectual property protection. High-tech industries, given their innovation intensity and higher value-added nature, derive the greatest benefit from stringent IPR regimes, followed by medium-tech and low-tech sectors.

These results align with broader findings in trade literature, which highlight that strong IPR regimes in importing countries not only protect innovations but also incentivize firms to expand their exports by ensuring stable and secure market conditions.

However, while IPR enforcement provides a clear advantage for Korea's high-tech exports, it may also create unintended barriers for developing countries. Stringent IPR protection can restrict technology diffusion, making it more challenging for emerging economies to access, adapt, and innovate based on existing technologies. This could potentially slow down global innovation by concentrating technological advancements within developed nations and limiting the spillover effects to late-industrializing economies.

Furthermore, high IPR standards may raise the costs of market entry for firms in developing countries, particularly those that rely on technology licensing or reverse engineering to build their capabilities. As Korea itself transitioned from a developing to a developed economy, it historically benefited from knowledge transfer in periods when IPR enforcement was less stringent. These findings suggest that a balanced approach is needed—one that safeguards innovation while ensuring that knowledge diffusion continues to support global technological progress.

4. Conclusion

This study examines the factors influencing Korea's technological product exports from 2010 to 2022, emphasizing the significant roles of GDP, geographical distance, shared language, and IPR enforcement. The findings confirm that GDP positively influences exports by enhancing

both production capacity in exporting countries and purchasing power in importing countries. In contrast, geographical distance negatively impacts trade efficiency due to increased costs and logistical challenges, while shared language facilitates communication and reduces transaction barriers, particularly in high-tech sectors.

The study also highlights the strong positive effect of IPR enforcement on exports across all technology levels, with the most significant impact observed in high-tech industries. Robust IPR regimes promote innovation, reduce imitation risks, and expand market opportunities, particularly in R&D-intensive sectors. However, strict IPR enforcement can create higher entry barriers for firms in developing economies, limiting technology diffusion and slowing down global innovation.

To navigate these trade-offs, Korean policymakers should adopt a dual approach. Strengthening engagement with countries that enforce strong IPR protections will maximize high-tech trade. At the same time, promoting technology transfer mechanisms will facilitate responsible knowledge sharing with developing economies. This can be achieved through bilateral agreements, research collaborations, and structured licensing frameworks that protect intellectual property while encouraging technological diffusion.

For exporters, a differentiated market strategy is essential. Firms should prioritize high-tech markets with stringent IPR protections to capitalize on innovation-driven competitive advantages. In emerging markets with weaker IPR frameworks, companies can mitigate risks by implementing tiered licensing agreements, localized joint ventures, and adaptive patent strategies that safeguard their intellectual assets while fostering long-term partnerships. This strategic alignment between policy and industry will not only enhance Korea’s global technological export potential but also ensure a more sustainable and inclusive approach to international trade, balancing innovation protection with economic development.

REFERENCES

[1] N. Liu, "China arrests South Korean chip engineer on espionage charges," 2023. [Online]. Available: https://www.ft.com/content/f6fc898d-9f3b-4aa5-962e-621ba450ddbe. [Accessed Dec. 28, 2024].

[2] O. Ivus, "Do stronger patent rights raise high-tech exports to the developing world?" *Journal of International Economics*, vol. 81, no. 1, pp. 38-47, 2010.

[3] R. Falvey, N. Foster, and D. Greenaway, "Intellectual Property Rights and Economic Growth," *Review of Development Economics*, vol. 10, no. 4, pp. 700-719, 2006.

[4] J.-h. Yoo and R. El Ayboud, "Intellectual property rights protection, trade, and GVC participation – an empirical analysis based on South Korean data," *Journal of International Logistics and Trade*, 2024, doi: 10.1108/JILT-05-2024-0030.

[5] P. Stryszowski and M. Gaudiau, "Technology Transfer and the Economic Implications of the Strengthening of Intellectual Property Rights in Developing Countries," in *OECD Trade Policy Working Papers*, ed: OECD, 2024.

[6] T. O. Awokuse and H. Yin, "Does Stronger Intellectual Property Rights Protection Induce More Bilateral Trade? Evidence from China’s Imports," *World Development*, vol. 38, no. 8, pp. 1094-1104, 2010.

[7] K. Lee and F. Malerba, "Catch-up cycles and changes in industrial leadership:Windows of opportunity and responses of firms and countries in the evolution of sectoral systems," *Research Policy*, vol. 46, no. 2, pp. 338-351, 2017.

[8] S. Kanwar, "Does intellectual property protection spur technological change?" *Oxford Economic Papers*, vol. 55, no. 2, pp. 235-264, 2003.

[9] L. Kim, *Imitation to Innovation: The Dynamics of Korea's Technological Learning*. Boston: Harvard Business School Press, 1997.

[10] A. G. Z. Hu and A. B. Jaffe, "Patent citations and international knowledge flow: the cases of Korea and Taiwan," *International Journal of Industrial Organization*, vol. 21, no. 6, pp. 849-880, 2003.

[11] L. G. Branstetter, R. Fisman, and C. F. Foley, "Do Stronger Intellectual Property Rights Increase International Technology Transfer? Empirical Evidence from U. S. Firm-Level Panel Data," *The Quarterly Journal of Economics*, vol. 121, no. 1, pp. 321-349, 2006.
[12] B. B. Allred and W. G. Park, "Patent rights and innovative activity: evidence from national and firm-level data," *Journal of International Business Studies*, vol. 38, no. 6, pp. 878-900, 2007.
[13] J. Tinbergen, *Shaping the World Economy: Suggestions for an International Economic Policy*. New York: Twentieth Century Fund, 1962.
[14] M. Porto, "The Gravity Model of Trade," in *Using R for Trade Policy Analysis*, (SpringerBriefs in Economics, 2020, ch. Chapter 4, pp. 65-81.
[15] G. Yusufu, G. Aximu, and S. Seyiti, "How does the communication infrastructure quality of the countries along the "Belt and Road" effect the equipment export of China?" *Heliyon*, vol. 9, no. 8, p. e19017, Aug 2023.
[16] G. M. Grossman and E. Helpman, "Quality Ladders in the Theory of Growth," *The Review of Economic Studies*, vol. 58, no. 1, pp. 43-61, 1991.
[17] S. Lall, "The Technological Structure and Performance of Developing Country Manufactured Exports, 1985-98," *Oxford Development Studies*, vol. 28, no. 3, pp. 337-369, 2010.
[18] B. Xu and E. P. Chiang, "Trade, Patents and International Technology Diffusion," *The Journal of International Trade & Economic Development*, vol. 14, no. 1, pp. 115-135, 2005.
[19] D. Hummels, "Transportation Costs and International Trade in the Second Era of Globalization," *Journal of Economic Perspectives*, vol. 21, no. 3, pp. 131-154, 2007.
[20] C. L. Evans and J. Harrigan, "Distance, Time, and Specialization: Lean Retailing in General Equilibrium," *American Economic Review*, vol. 95, no. 1, pp. 292-313, 2005.
[21] R. Baldwin and J. Lopez-Gonzalez, "Supply-chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses," *The World Economy*, vol. 38, no. 11, pp. 1682-1721, 2014.
[22] S. Beugelsdijk, A. Slangen, R. Maseland, and M. Onrust, "The impact of home–host cultural distance on foreign affiliate sales: The moderating role of cultural variation within host countries," *Journal of Business Research*, vol. 67, no. 8, pp. 1638-1646, 2014.
[23] P. H. Egger and A. Lassmann, "The language effect in international trade: A meta-analysis," *Economics Letters*, vol. 116, no. 2, pp. 221-224, 2012.
[24] W. K. Hutchinson, "Does Ease of Communication Increase Trade? Commonality of Language and Bilateral Trade," *Scottish Journal of Political Economy*, vol. 49, no. 5, pp. 544-556, 2003.
[25] S. Vishwasrao, "Intellectual property rights and the mode of technology transfer," *Journal of Development Economics*, vol. 44, no. 2, pp. 381-402, 1994.
[26] P. J. Smith, "Patent Rights and Trade: Analysis of Biological Products, Medicinals and Botanicals, and Pharmaceuticals," *American Journal of Agricultural Economics*, vol. 84, no. 2, pp. 495-512, 2002.
[27] W. Chen, "Do stronger intellectual property rights lead to more R&D-intensive imports?" *The Journal of International Trade & Economic Development*, vol. 26, no. 7, pp. 865-883, 2017.
[28] K. E. Maskus and L. Yang, "Domestic patent rights, access to technologies and the structure of exports," *Canadian Journal of Economics/Revue canadienne d'économique*, vol. 51, no. 2, pp. 483-509, 2018.
[29] R. Blundell and S. Bond, "Initial conditions and moment restrictions in dynamic panel data models," *Journal of Econometrics*, vol. 87, no. 1, pp. 115-143, 1998.
[30] M. Arellano and O. Bover, "Another look at the instrumental variable estimation of error-components models," *Journal of Econometrics*, vol. 68, no. 1, pp. 29-51, 1995.
[31] D. Roodman, "A Note on the Theme of Too Many Instruments," *Oxford Bulletin of Economics and Statistics*, vol. 71, no. 1, pp. 135-158, 2009.
[32] H. Khan, L. Weili, and I. Khan, "Institutional quality, financial development and the influence of environmental factors on carbon emissions: evidence from a global perspective," *Environ Sci Pollut Res Int*, vol. 29, no. 9, pp. 13356-13368, Feb. 2022.