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Research on the Impact of Intellectual Property Protection on China's High Quality Economic Development

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***Abstract*—*In order to give full play to the role of the intellectual property protection system in promoting the high-quality development of China's economy and seize the high ground for future development, China has implemented the strategy of strengthening intellectual property rights. This paper selects 282 prefecture-level cities in China from 2011 to 2020 as a sample and uses a linear regression model to analyse the impact of intellectual property protection on China's high-quality economic development. It is found that IPR protection has a significant contribution to China's high quality economic development and the results still hold after replacing variables. The heterogeneity analysis shows that the impact of IPR protection on China's high-quality economic development is more significant in the central and western regions, which has important implications for promoting China's high-quality economic development.*

Keywords*—*intellectual property protection; quality economic development; linear regression model

I. INTRODUCTION

Against the background of China's economy shifting from a stage of high growth to a stage of high quality development, how to achieve high quality economic development has become a hot topic of concern. China's intellectual property right (IPR) protection has made progress in recent years, but there are still shortcomings compared to developed countries. In order to seize the high ground for future development, regions can promote high-quality regional economic development by strengthening IPR protection. As an institutional guarantee for high-quality economic development, IPR protection has an important role to play in high-quality economic development. Can the intensity of IPR protection in China promote high-quality economic development? Studying the impact effect of IPR protection on China's high-quality economic development is important in promoting the coordination and improvement of the intensity of IPR protection and the level of economic development between regions is conducive to the overall improvement of China's regional high-quality economic development and the achievement of sustainable, healthy and stable economic development.

Based on data from 282 prefecture-level cities in China from 2011 to 2020, this paper uses a linear regression model to analyse the impact of IPR protection on the high-quality development of the Chinese economy. The paper is expected to contribute in two aspects: first, it measures the level of China's high-quality economic development from the new development concept, enriching the relevant literature and revealing the economic effects of IPR protection on China's high-quality economic development. Second, it enriches the empirical findings on the impact of IPR protection on China's high-quality economic development based on the city dimension, and further explores the regional heterogeneity of IPR protection on high-quality economic development, providing new perspectives for subsequent research.

II. THEORETICAL ANALYSIS

The implementation of an intellectual property protection system is one of the important tools for promoting quality economic development. At a macro level, sound IP protection continuously enriches society's knowledge resources by promoting the production, dissemination and application of knowledge (Sweet and Maggio, 2015). It stimulates technological innovation and improves overall productivity, which provides the institutional basis and motivational support for high-quality economic development, and is also conducive to the transformation of the economy into an innovation-led and knowledge-intensive one.

Intellectual property protection helps to stimulate innovation. IP protection increases the value and stability of a firm's technological achievements and reduces risk, making it easier for firms to obtain financing support from investors, banks, government and other institutions and other resources such as technical experts, suppliers, customers, etc. The inflow of capital and resources promotes the emergence of innovative firms as a whole, which in turn drives technological innovation (Lin et al, 2023).

Intellectual property protection helps drive agricultural quality and efficiency and industrial structure optimisation, narrowing the gap between urban and rural areas, thus achieving urban-rural and industrial coordination. The protection of intellectual property rights protects geographical indications and trademarks, which establishes a stable link between the demand and supply sides of agricultural products and facilitates the formation of great advantages for special agricultural products and the industrialisation of leisure agriculture, which brings business opportunities for the development of small towns and surrounding rural areas (Yan, 2018). It is also conducive to the coordinated development of urban and rural areas. Intellectual property protection effectively promotes coordinated industrial development by

helping industrial clusters to upgrade their value chains and attract foreign investment.

Intellectual property protection helps accelerate the opening up of domestic industries to the outside world and promotes the free flow of technology, products, services and elements such as capital, which is conducive to improving China's overall level of openness and competitiveness. Intellectual property protection promotes openness by attracting high-tech foreign investment. A sound intellectual property protection system is one of the important factors in attracting high-tech foreign investment. When choosing countries and regions for investment, foreign enterprises will consider whether the local intellectual property environment can protect their core technologies and trade secrets, and a favourable intellectual property environment can attract more high-tech and high value-added foreign direct investment, thereby increasing the level of opening up (Huang and Chen, 2021).

Intellectual property protection facilitates the development of resource-efficient and environment-friendly industries and promotes the low-carbon transformation of industries, which provides important support for achieving sustainable development and building an ecological civilisation. Intellectual property protection promotes sustainable development by encouraging green technological innovation. Intellectual property protection provides economic incentives for green technological innovation, encouraging enterprises and individuals to invest large amounts of resources in developing new energy, energy conservation and environmental protection and other green technologies, promoting the transformation of the economy towards low carbon and environmental protection, which is conducive to environmental protection and ecological construction (Li and Wu, 2022).

Intellectual property protection helps to promote shared development. In terms of income levels, IP protection supports content creators, software developers and subjects of technological innovation to receive reasonable remuneration through copyright, patent and trademark rights, which facilitates higher salary levels for knowledge workers and promotes the distribution of income in terms of innovation factors to achieve shared development dividends (Tian et al, 2015). In terms of cultural construction, intellectual property protection provides copyright protection for cultural content such as literary works, artworks, pictures and music, which motivates more cultural and creative talents to engage in content creation and promotes the development and dissemination of cultural industries, which is conducive to promoting excellent culture and meeting the growing cultural needs of the people and realise the sharing of cultural resources (Xie and Zhou, 2021). In terms of social insurance, IPR protection can encourage more enterprises to engage in technological innovation and product innovation, creating and generating new jobs and sources of tax revenue. Stable employment and higher tax revenues provide a source of funding for pension insurance, which is conducive to a sound pension insurance system and increased pension insurance coverage (Fang and Li, 2023). In terms of healthcare, IPR protection encourages pharmaceutical companies to continue to introduce more advanced and effective medical technologies and medicines by encouraging new drug development and new technological innovation (Li, 2023). This has enabled more people to have access to high quality medical resources, especially some of the medical services brought about by high cost drugs and high end medical equipment. This made it possible to share medical care and meet people's growing medical needs.

As an institutional guarantee for high-quality economic development, intellectual property protection plays an important role in promoting innovative, coordinated, sustainable, open and shared development by facilitating the production, dissemination and application of knowledge.

In summary, this paper proposes research hypothesis H1: Intellectual property protection can promote high-quality economic development in China.

III. SAMPLE SELECTION AND STUDY DESIGN

A. Sample selection and data sources

The 282 prefecture-level cities in China from 2011-2020 were selected for this study, and the data were mainly obtained from the judicial case database of Beida Faber, the China City Statistical Yearbook, the China Regional Economic Statistical Yearbook, provincial statistical yearbooks, prefecture-level city statistical yearbooks, the national economic and social development statistical bulletin of each prefecture-level city, the official website of the National Bureau of Statistics, the EPS database, the CEIC database, the Wind Database, CEIC Statistical Database, China Economic and Social Big Data Research Platform and other information. In addition, some of the missing data were filled in using linear interpolation. For indicators involving price factors, such as GDP per capita, this study uses the GDP deflator to convert to the 2003 price level. For indicators in US dollars, the deflator was converted to RMB at the corresponding RMB exchange rate in that year. Finally, to minimise the impact of anomalous data on the study, this study applies a 1% reduction in the upper and lower tails to all continuous variables.

B. Model and variable definitions

In this study, 282 prefecture-level cities were selected and the following linear regression model was set up to explore the impact of IPR protection on China's high-quality economic development.

$$DEVE_{it} = \alpha_0 + \alpha_1 RCA_{it} + \theta X_{it} + \mu_i + \varphi_t + \varepsilon_{it} \quad (1)$$

where $DEVE_{it}$ measures High level of quality economic development (where i and t denote city and year, respectively, hereafter). RCA_{it} measures Strength of IP protection. X_{it} is a set of firm-level control variables. μ_i and φ_t are city and year fixed effects, respectively, and ε_{it} is a random disturbance term.

Explanatory variable: High level of quality economic development

High quality economic development refers to the way and result of economic development, which requires not only

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fast economic development but also high quality economic development. While achieving economic development, it realizes industrial transformation and upgrading, optimizes the allocation of resources, protects the environment, expands openness and achieves social equity through the five major development concepts of innovation, coordination, green, openness and sharing, so as to achieve high quality, efficient and sustainable development (Zhang et al, 2019; Shi et al, 2022).

TABLE 1. Indicator system.

Tier 1 indicators	Secondary indicators	Tertiary indicators
Innovative developments	Innovation Inputs	Investment intensity in science and technology
		Human capital input
	Innovation Outputs	Number of patents granted for inventions
	Innovation Efficiency	Capital productivity
		Labour productivity
		Land productivity
		Total Factor Productivity
Coordinated development	urban and rural Coordination	Urban-rural income ratio
		Urbanisation rate
	Industry Coordination	Industrial Structure
		Rationalisation Index
		Index of Advanced Industrial Structure
Open Development	Economy Open	Foreign trade dependence
	Using Foreign investors	Openness to foreign trade
Sustainable development	Stable Running	Registered urban unemployment rate
		Consumer Price Index
		GDP per capita
		GDP growth rate
	Green Ecology	Greenery coverage in built-up areas
		Harmless disposal rate of domestic waste
		Centralized treatment rate of sewage treatment plants
Shared Development	Income Level	Average wages of employees in employment
	Culture Construction	Education input
		Library holdings per capita
	Society Insurance	Number of urban workers' pension insurance participants per 10,000 population
	Medical Career	Number of health technicians per 10,000 population
		Number of beds in health facilities per 10,000 population

This study is based on the concept of innovative development, environmental protection and openness. Therefore, this study looks at the five dimensions of innovative development, coordinated development, sustainable development, open development and shared development (Chen et al, 2020). The indicator system shown in Table 1 is constructed to measure the level of high-quality development of China's economy, and the entropy value method is used to measure it.

Core explanatory variables: intensity of IP protection

Combining the actual situation in China and the research results of scholars such as Shen Guobing and Huang Xiejun (Dai, 2010; Dai et al, 2015; Shen and Huang, 2019). With reference to the dominant comparative advantage index, 282 prefecture-level cities are used as the research target, and the relative index is used to measure the intensity of IPR protection, the specific formula is shown in (2).

$$RCA_{it} = \frac{IPcrime_{it} / GDP_{it}}{IPcrime_{qt} / GDP_{qt}} \quad (2)$$

Where RCA_{it} measures Strength of IP protection (where i and t denote city and year, respectively, hereafter), with smaller values indicating weaker IPR protection in the city. $IPcrime_{it}$ represents the number of IPR trials. $IPcrime_{qt}$ represent the number of IPR trials in the country in the year t. GDP_{qt} represent GDP in the country in the year t.

Control variables: Including Internet penetration (lnInt); accessibility (lnTran); government behaviour (Gov); financial development (lnFin).

Descriptive statistics for the main variables in this paper are shown in Table 2.

TABLE 2. Descriptive statistics of main variables.

Variables	Observation	Mean	Standard deviation	Minimum	Maximum
DEVE	2820	0.1102	0.0523	0.0443	0.3164
RCA	2820	0.4306	0.6496	0.0000	3.9639
lnInt	2820	6.5007	0.9179	4.4620	8.7258
lnTran	2820	0.7452	0.8601	-1.4405	2.4669
Gov	2820	0.0807	0.0466	0.0116	0.2498
lnFin	2820	0.8345	0.4057	0.0078	1.9097

IV. Empirical Results

A. Baseline regression results

Table 3 shows the regression results on the impact of IPR protection on China's qualitative economic development. Model 1 only considers the intensity of IPR protection, and the results show that the regression coefficient of IPR protection is 0.0369, which is significantly positive at the 1% significance level, indicating that IPR protection can promote high quality economic development.

TABLE 3. Impact of IPR protection on China's high-quality economic development

Variables	Model 1	Model 2	Model 3
RCA	0.0369***	0.0310***	0.0087***
	(0.0013)	(0.0014)	(0.0010)
lnInt			0.0187***
			(0.0010)
lnTran			0.0265***
			(0.0008)
Gov			0.0371***
			(0.0161)
lnFin			0.0287***
			(0.0021)
Constant	0.0943***	0.0858***	-0.0515***
	(0.0011)	(0.0026)	(0.0060)
city	N	Y	Y
year	N	Y	Y
N	2820	2820	2820
R-squared	0.2103	0.2065	0.6582

Note: *, ** and *** indicate significant at the 10%, 5% and 1% significance levels respectively, and standard errors are shown in parentheses.

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Models 2 and 3 include time and city fixed effects, and control variables in turn in the regressions, and the results show that the regression coefficients for IPR protection are 0.0310 and 0.0087 respectively, which both pass the 1% significance test, suggesting that IPR protection can significantly contribute to China's high quality economic development, and therefore hypothesis 1 holds.

B. Robustness tests

While the previous benchmark regression model used equation (2) to measure the intensity of IPR protection, this study uses the number of city patents granted to measure the intensity of IPR protection (Du et al, 2008), the specific formula is as follows:

$$RCA1_{it} = \frac{Patent_{it} / GDP_{it}}{Patent_{qt} / GDP_{qt}} \quad (3)$$

where $RCA1_{it}$ measures Strength of IP protection (where i and t denote city and year, respectively, hereafter). $Patent_{it}$ represents the number of city patents. $Patent_{qt}$ represent the number of city patents in the country in the year t.

Looking at Models 1-3 in Table 4, it can be seen that the regression coefficients for the intensity of IPR protection calculated using the number of patents granted in the city are all significantly positive at the 1% significance level, indicating that IPR protection can effectively contribute to high-quality regional economic development. After introducing the control variables, the economic significance of the coefficient $RCA1_{it}$ shows that, controlling for other factors, a 1% increase in the intensity of IP protection will increase the level of quality economic development by 0.0264%, a slight increase compared to the original benchmark results. Therefore, it is concluded that the increase in the intensity of IP protection measured using patent grant volume effectively contributes to high quality economic development, i.e. the benchmark regression results are robust.

TABLE 4. Regression estimation results for replacement variables.

Variables	Model 1	Model 2	Model 3
RCA1	0.0645***	0.0707***	0.0264***
	(0.0016)	(0.0021)	(0.0018)
lnInt			0.0162***
			(0.0010)
lnTran			0.0249***
			(0.0008)
Gov			0.0388***
			(0.0157)
lnFin			0.0266***
			(0.0021)
Constant	0.0742***	0.0619***	-0.0437***
	(0.0012)	(0.0025)	(0.0058)
city	N	Y	Y
year	N	Y	Y
N	2820	2820	2820
R-squared	0.3757	0.3427	0.6767

Note: *, ** and *** indicate significant at the 10%, 5% and 1% significance levels respectively, and standard errors are shown in parentheses.

C. Heterogeneity analysis

In order to investigate whether there is regional heterogeneity in the impact of IPR protection on high-quality economic development, the 282 prefecture-level cities were divided into three regions: East, Central and West, and the results are shown in Table 5. Looking at the coefficient of RCA, it is clear that there is significant regional heterogeneity in the impact of IPR protection on high-quality economic development. Specifically, the impact of IPR protection on high-quality economic development in the eastern region is not significant, mainly because the eastern region has a relatively mature economy and a more complete industrial structure, and its high-quality economic development is less dependent on IPR protection and more dependent on factors such as the introduction of talents. In the central and western regions, the protection of intellectual property rights has a significant impact on high-quality economic development, and the impact of intellectual property protection on high-quality economic development is stronger in the western region.

TABLE 5. Estimated results of the impact of IPR protection on quality economic development in different regions.

Variables	East	Central	Western
RCA	0.0020	0.0050***	0.0090***
	(0.0016)	(0.0012)	(0.0029)
lnInt	0.0290***	0.0176***	0.0069***
	(0.0026)	(0.0015)	(0.0016)
lnTran	0.0342***	0.0274***	0.0205***
	(0.0024)	(0.0011)	(0.0011)
Gov	0.2726***	-0.1137***	-0.1027***
	(0.0361)	(0.0226)	(0.0225)
lnFin	0.0570***	0.0214***	0.0273***
	(0.0053)	(0.0029)	(0.0034)
Constant	-0.1407***	-0.0318***	0.0179***
	(0.0159)	(0.0085)	(0.0084)
city	Y	Y	Y
year	Y	Y	Y
N	1000	990	0.6094
R-squared	0.7089	0.7020	0.0557

V. CONCLUSIONS AND POLICY RECOMMENDATIONS

This study uses panel data from 282 prefecture-level cities in China from 2011 to 2020 as the research sample to construct a benchmark regression model to analyse the impact of IPR protection on China's high-quality economic development and to analyse the regional heterogeneity of its impact. The results found that there is a significant contribution of IPR protection to China's high-quality economic development, and this finding remains robust to substitution variables. The heterogeneity analysis found that the central and western regions enjoyed greater dividends from IPR protection.

Combining the findings of the study, this paper puts forward the following policy recommendations. China should accelerate the process of high-quality development of China's economy driven by IPR protection by adhering to the strategy of a strong IPR country and implementing differentiated IPR protection policies. The government should adhere to the strategy of a strong IPR nation, adhere to the unified leadership of the Party Central Committee, and realise collaborative IPR protection in which the government performs its duties, judicial protection + administrative enforcement, market players regulate their behaviour, industry organisations strictly supervise, and society as a whole works

together to safeguard, so as to drive high-quality economic development more effectively. At the same time, the government should start by strengthening IPR protection in the central and western regions, while playing a leading role in IPR protection in the eastern regions to promote a balanced development of IPR protection across the country.

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