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Digital Paradox: Platform Economy and High-Quality Economic Development—New Evidence from Provincial Panel Data in China

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Abstract: Based on provincial panel data of China from 2011 to 2019, this paper discusses the influence and mechanism of the platform economy on the high-quality development of regional economies. It is found that the platform economy has an inverted U-shaped impact on the high-quality development of regional economies. On the left side of the inverted U-shaped inflection point, the platform economy plays a significant role in promoting high-quality economic development; on the right side of the inflection point, the platform economy has an obvious inhibitory effect on high-quality economic development. Statistical analysis showed that 85% of the observations fell on the left side of the inflection point, indicating that China's platform economy as a whole is in the early stages of development. From the strong and weak grouping test of the degree of government intervention, it was found that the platform economy only has an inverted U-shaped effect on the high-quality development of the areas with weak intervention. From the point of view of the coefficient, the platform economy has a greater promoting effect on the high-quality development of the areas with strong intervention. From the grouping test of the quality of the market system, it was found that the inverted U-shaped curve is steeper in the areas with higher institutional quality, indicating that, in the early stage of development, the platform economy has a greater promoting effect on the high-quality development of areas with perfect institutions. In addition, the analysis of regional heterogeneity showed that, in the early stage of development, the promoting effect of the platform economy on the high-quality development of the northeastern and western regions is more significant. After exceeding the threshold, the platform economy has an inhibitory effect on the high-quality development of all regions. The mechanism test shows that technology, talent, and capital in the initial stage of development can all play a positive regulatory role; after exceeding the threshold, platform economic monopoly may restrain high-quality economic development by hindering technological progress and causing a mismatch of labor–capital elements and resources.

Keywords: platform economy; high-quality development; resource allocation; digital paradox

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1. Introduction

The Fifth Plenary session of the 19th CPC Central Committee further stressed that, in order to promote high-quality development as the theme of economic and social development during the 14th five-year plan period, we must put the quality of development in a more prominent position and strive to improve the quality and efficiency of development. At the same time, the new round of scientific and technological revolution and industrial reform represented by the digital economy are reconstructing the global innovation map and reshaping the global economic structure, which is a historical opportunity for China to promote high-quality development. Developing the digital economy vigorously, promoting digital industrialization and industrial digitization, accelerating innovative breakthroughs

in new-generation information and communication technologies, such as 5G, Internet of Things, cloud computing, big data, and artificial intelligence, and promoting the deep integration of the digital economy and the real economy will help to transform and upgrade traditional industries and promote the upgrading of the industrial foundation and modernization of the industrial chain, and are the strategic choices and key support for constructing a new development pattern to achieve high-quality development.

China's economic development is in a new normal period of transformation from an investment-driven, high-speed growth model to an innovation-driven, high-quality development model. In the face of multiple pressures, such as the impact of the epidemic, the global economic downturn, and the lack of effective demand, the platform economy represented by the Internet, cloud computing, and big data has played an inestimable role. According to the report of the China Academy of Information and Communications, the added value of China's digital economy increased from 9.5 trillion yuan in 2011 to 39.2 trillion yuan in 2020, accounting for 38.6 percent of GDP from 20.3 percent. Under the superimposed influence of the impact of the epidemic and the global economic downturn in 2020, China's digital economy still maintained a trend of vigorous development, with a scale of 392 trillion yuan, of which the scale of digital industrialization reached 7.5 trillion yuan, accounting for 19.1 percent of the digital economy and 7.3 percent of GDP. The scale of industrial digitization reached 31.7 trillion yuan, accounting for 80.9 percent of the digital economy and 31.2 percent of GDP. The platform economy, which is based on data as the factor of production and driven by intelligence, will become a new engine and provide key momentum for the high-quality development of China's economy. Therefore, it is of great practical significance to explore the relationship between the platform economy and high-quality development to effectively release the new momentum of the platform economy to achieve high-quality economic development.

The possible contributions and innovations of this paper are as follows: first, the existing research on the platform economy and high-quality development is mainly focused on theoretical analysis, and empirical analysis is mostly based on linear discussion. Different from the existing research, this paper comprehensively measures the high-quality development index based on the new development concept and comprehensively discusses the nonlinear relationship between the platform economy and high-quality development and its underlying mechanism, which makes up for the research gap of this topic and enriches the relevant research theory. Second, this paper takes the allocation of factor resources as mechanism variables to construct a theoretical analysis framework to explore the adjustment mechanism between platform economy and high-quality economic development, which provides a new insight for a deeper understanding of the role of the platform economy in high-quality development. Third, based on the "double-edged sword" characteristics of the platform economy, this paper discusses the heterogeneity of the impact of the platform economy on high-quality economic development in multiple dimensions and can evaluate the conditionality and effectiveness of platform economic development more comprehensively than previous studies. It provides detailed evidence for supporting and guiding the healthy development of the platform economy.

2. Literature Review

Previous studies have been carried out from both theoretical and empirical aspects: theoretical studies believe that the platform economy, represented by big data, the Internet, and artificial intelligence, mainly affects the high-quality development of the economy from micro and macro dimensions. Microscopically, digital technology is widely used in various fields, and the application scenarios are constantly being expanded and enriched, promoting the innovation and development of technology, business, and models in different fields, and creating an economic environment with economies of scale and scope. On this basis, new economic forms, such as the sharing economy and platform economy, are being produced to better match supply and demand, form a more perfect price mechanism, and improve the efficiency of economic operation as a whole [1–3]. Macroscopically, the

platform economy promotes high-quality economic development mainly by improving the efficiency of resource allocation and total factor productivity [4,5]. Empirical research shows that the platform economy can improve entrepreneurial activity [6], technology utilization efficiency [7], and other paths to promote the high-quality development of regional economies. However, a small number of scholars have found that there are risks and problems in the development of the platform economy [8,9]. For example, excessive use of artificial intelligence may lead to a mismatch between capital and labor factors [10], inappropriate competition [11], and disorderly development of the platform economy, leading to technological risks and market monopolies [12], and other problems are not conducive to the healthy development of the economy. The platform economy has gradually become an important part of today's social and economic development, but there is a lack of empirical research to comprehensively evaluate the relationship between the platform economy and high-quality economic development. The only relevant literature focused on how artificial intelligence affects economic and social transformation [13], economic growth and sustainable development [11,14,15], total factor productivity and employment [16], and the impact of the platform economy on economic growth and income equity [17,18] and other high-quality development sub-topics. By combing the existing literature, we found that the effect of the platform economy on high-quality economic development may not just be a simple linear relationship. Some scholars have discussed the threshold effect of the platform economy on high-quality development [17]. However, it does not give its non-linear mechanism, nor does it evaluate the regional differences in the current high-quality development level of regional economies in China.

According to the summary, the existing research has the following shortcomings: first, from the perspective of the platform economy paradox, it is rare to explore the nonlinear relationship between the platform economy and regional high-quality development. As far as the actual platform economy is concerned, some platform organizations use digital technology to carry out price monopolies; market monopolies destroy the market order and are not conducive to the healthy development of the national economy [12,19]. The existing research is not enough to fully assess the economic effects of the platform economy. Second, the existing literature on the relationship between the platform economy and high-quality development only focuses on related sub-topics, such as artificial intelligence and employment [20,21], ICT, and economic growth [22]. A few studies tried to combine the platform economy with economic growth [23]. However, it is not very good to measure the platform economy and solve endogenous problems. Third, there is still a lot of room for discussion of the relationship and mechanism between the platform economy and high-quality development. Therefore, this paper attempts to explore the non-linear relationship between the platform economy and high-quality development level and its mechanism on the basis of the comprehensive measurement of the platform economy and high-quality development level. The questions to be answered in this paper are as follows: Is there a non-linear impact of the platform economy on high-quality economic development? If so, what is the mechanism behind it? What is the non-linear relationship between the two and is it affected by the location and the degree of marketization? In order to answer the above questions, we need to analyze the regional characteristics on the basis of combing the relevant theories. This paper selects 30 provinces in China as research samples, and empirically tests the influence and mechanism of the platform economy on high-quality development.

3. Theoretical Analysis and Research Hypotheses

High-quality development is development that can well meet the growing needs of people for a better life, and embodies the new development concept of "innovation, coordination, green, openness, and sharing" [24]. The platform economy and sharing economy spawned by the platform economy not only break through physical time and space constraints and realize the real-time development of large-scale supply and demand activities, but also help to reduce production operation costs and transaction costs. It has

not only become an important carrier to promote resource integration and value creation in the development of the platform economy [25], but also represents a new way of resource allocation with an emphasis on matching and connection. It has effectively solved the problems of high-quality economic development, such as the contradiction between the supply and demand of factor resources, space limitation of economic activities, efficiency, and fairness, etc. [22]. This paper holds that the platform economy can create conditions for high-quality economic development by improving the efficiency of resource allocation of talent, capital, and technology.

In terms of the allocation of technological elements, many scholars have proved that the digital economy can promote the improvement of total factor productivity and economic growth [26–28]. Platform enterprise productivity is a comprehensive function of enterprise technology upgrading, management mode improvement, product quality improvement, and enterprise structure upgrading. We believe that any realistic productivity is actually total factor productivity, and there is a positive correlation between technological innovation and enterprise total factor productivity. The higher the level of technological innovation, the higher the efficiency of technological factor resource allocation. Therefore, this paper focuses on the use of total factor productivity representation as a kind of technological progress brought about by the platform economy. We believe that the platform economy affects technological innovation from the following four aspects: first, the platform economy has the characteristics of versatility and high permeability, and the integration of the platform economy and real economy expands from the field of consumption to the field of production. It accelerates the new trend of the integration of production and consumption and the integration of industrial collaborative innovation, promotes the application and upgrading of new technologies in traditional industries, and accelerates the networking and intellectualization of traditional industries [29,30]. Second, platform technology is widely used in various economic and social fields, giving birth to a large number of emerging intelligent industries with a high technical level and production efficiency, such as network offices, the sharing economy, intelligent manufacturing, and so on. The increasing proportion of knowledge-intensive industries helps to promote the optimization and upgrading of the industrial structure and the improvement of production efficiency [31]. Third, in the process of deepening the integration of the platform economy and the traditional industry, it has effectively improved the original leading technology of the traditional industry and reshaped the traditional production organization mode [32]. Through the intelligent transformation of procurement, production, circulation, and other links, optimize the business process, effectively improve the production efficiency and profitability of enterprises, and then contribute to the technological innovation of enterprises [33]. Fourth, the platform economy is conducive to the birth of economies of scale and knowledge agglomeration, while the effects of economies of scale and agglomeration can promote technological innovation through technology spillover, labor costs, intermediate goods sharing, cooperation, and exchange among enterprises, reducing production costs and other aspects [34]. Therefore, we believe that the platform economy can affect high-quality economic development by improving the allocation level of technical elements.

Secondly, in terms of the allocation of talent elements, the integration of the platform economy and different industries and fields will help to give birth to new industries, new business types, and new models, on the basis of which a shared economy and a platform economy will be formed to better match supply and demand and form a more perfect price mechanism. In addition, through platform organization, enterprises improve the efficiency of information searching, break the information asymmetry barrier between the supply and demand of human resources, reduce the market transaction cost, and improve the efficiency of economic operation [35]. The platform economy is a new economic form based on information technology and data as elements. In the era of the platform economy, talents are the core elements of digital innovation. In the process of platform economy agglomeration, the infrastructure is more perfect, the policy environment is more favorable, the attraction to investment is enhanced, and more and more high-quality enterprises

are attracted. With the expansion of the industrial agglomeration around the digital industry, the spatial agglomeration of digital technology, talents, and capital is conducive to the flow of new knowledge and technology between enterprises and industries, and provides intellectual and dynamic support for the innovation and development of regional economies [30]. When the saving of transaction costs further expands the scope of the market and promotes the development of division of labor, enterprises can carry out division of labor and cooperation on a global scale, and quickly adjust the industrial chain and match better partners according to changes in demand so as to improve the efficiency of resource allocation and promote high-quality economic development [33].

Finally, in the allocation of capital elements. The platform economy accelerates the flow of resources. Under the condition of market competition, the mechanism of survival of the fittest helps to optimize the allocation of resources and improve the efficiency of capital utilization. The development of digital industrialization helps to promote the formation of a wider integration of the digital economy and real economy. In the environment of economies of scale and economies of scope, the reduction of production and transaction costs attracts more factors of production. In particular, the free flow of capital factors between industries and regions is more rapid, which helps to optimize the efficiency of spatial capital allocation and improve the rate of return on capital and labor productivity [36,37], and promote the high-quality development of regional economies. In addition, due to information asymmetry, capital utilization efficiency and market efficiency are reduced. The platform organization makes use of its strong data advantages to provide online evaluation, comparison, and feedback systems, which saves search costs and negotiation costs for consumers to choose goods, reduces the information asymmetry between buyers and sellers, and improves market competition and capital utilization efficiency [38]. Therefore, the rapid development of the digital economy breaks down the distance barriers between regions, improves the degree of competition between regions and industries, and improves the efficiency of capital factor resource allocation, which is conducive to high-quality economic development.

The above analysis shows that technology, human resources, capital, and other factor resources play a positive role in regulating the relationship between the platform economy and high-quality development. However, due to psychological reactions and behavioral inertia, under certain conditions, once the economic advantage of the platform appears and reaches a certain extent, there will be a monopoly situation of "the stronger is stronger". Therefore, when the platform economy exceeds a certain threshold, it may have a negative impact and reduce the efficiency of factor resource allocation, because, when the market is monopolized by several large platform organizations, the free flow of technology, manpower, and capital may be disturbed by monopoly behavior. For example, in the past two years, some large Internet giants in China have been involved in platform monopoly events to varying degrees. Therefore, there is a double-edged sword effect in the platform economy, such as unreasonable guidance and standardization, which is ultimately not conducive to the high-quality development of the socialist market economy [12].

To sum up, the platform economy is a double-edged sword, which plays a positive role in promoting high-quality economic development at the initial stage of development, but, without reasonable supervision and guidance, the negative externalities brought about by the later development of the platform economy exceed its positive externalities, which will hinder the high-quality development of the economy. Based on the above analysis, this paper puts forward the following assumptions.

Hypothesis 1 (H1). *The platform economy has an inverted U-shaped impact on the high-quality development of regional economy. Specifically, on the left side of the inflection point, the platform economy promotes high-quality economic development, while, on the right side of the inflection point, the platform economy suppresses high-quality economic development.*

Hypothesis 2 (H2). *The platform economy mainly affects the high-quality development of regional economies through labor, capital, and technology.*

4. Model Settings, Variables, and Data Sources

4.1. Model Setting

4.1.1. Benchmark Model

Through the analysis of Williamson's inverted U-shaped theory, we found that he applied Kuznets's inverted U-shaped hypothesis of income distribution to regional economic development, and put forward the inverted U-shaped theory of regional economic differences. Ref. [39] Based on this, we analyzed the possible inverted U-shaped influence of the platform economy on regional high-quality development. The nonlinear regression model of this paper is constructed by drawing lessons from the econometric analysis methods of some international well-known scholars [40–43] to construct the following nonlinear econometric models.

$$\ln hquality_{it} = \alpha_0 + \alpha_1 platform_{it} + \alpha_2 platform_{it}^{\ 2} + \alpha_c X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

In model (1), $lnhqualitiy_{it}$ indicates that the high-quality economic development level of region i in t period takes the natural logarithm; $Platform_{it}$ is the comprehensive index of platform economic development of region i in t period; vector X_{it} represents a series of control variables; μ_i represents the fixed effect of region i not changing with time; λ_t represents the fixed effect of time; and ε_{it} represents the term of random disturbance.

4.1.2. Regulation Mechanism Model

In order to identify the role of labor, capital, and technology in the mechanism between the platform economy and regional high-quality development, this paper follows the econometric model (2).

$$\begin{gathered} \ln hquality_{it} = \beta_0 + \beta_1 platform_{it} + \beta_2 platform_{it}^{\ 2} + \beta_3 ROA_{it} \\ +\beta_4 platform_{it} \times ROA_{it} + \beta_5 platform_{it}^{\ 2} \times ROA_{it} + \alpha_c X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \end{gathered} \quad (2)$$

In model (2), $lnhqualitiy_{it}$ indicates that the high-quality economic development level of region i in t period takes the natural logarithm; $Platform_{it}$ is the comprehensive index of digital economic development of region i in t period; and ROA_{it} characterizes the resource allocation of elements, including labor, capital, and technology. This paper focuses on the positive or negative and significance of coefficients β_4 and β_5 of the interactive term. The meaning of the other variables is consistent with that of model (1).

4.2. Variable Measure and Explanation

4.2.1. High-Quality Economic Development

Most of the existing studies used total factor productivity as a measure of high-quality economic development, but, as an evaluation index of high-quality development, it obviously cannot meet the needs of research. Accurately grasping the connotation of high-quality development is the key to the scientific construction of a high-quality development index system. Previous studies have shown that high-quality development is development that can well meet the growing needs of people for a better life, and the development that embodies the new development concept of "innovation, coordination, green, openness, and sharing" [44,45]. On the basis of existing research, based on the new development concept, this paper constructs a comprehensive evaluation index system of high-quality economic development from five indicators: innovation, coordination, sustainability, openness, and sharing. On this basis, the principal component analysis method was used to measure the comprehensive index of regional high-quality development, which was recorded as hquality. The specific measurement index system is shown in Table 1.

Table 1. Comprehensive measurement index system of high-quality development of regional economies.

First-Level Index	Secondary Index	Third-Level Index	Fourth-Level Index	Index Calculation	Attribute
Innovate	Innovation investment	Innovation investment intensity	Proportion of investment in scientific research	Internal expenditure on scientific research/provincial GDP	+
			Proportion of investment of scientific research personnel	Total number of researchers at that time/total number of employees at the end of the provincial year	+
		Innovation stock	Human capital level	Number of college students per 10,000 people	+
	Innovation output	Number of patents	Number of patents per capita	Number of patents granted per capita in the province	+
		Technical turnover	Proportion of turnover in technology market	Technical market turnover/provincial GDP	+
	Innovation efficiency	Resource allocation efficiency	Capital productivity	Provincial GDP/investment in fixed assets of the whole society	+
			Labor productivity	The total number of employees at the end of the year in each province of GDP.	+
			Energy productivity	GDP/10,000 tons of standard coal in each province	+
			Land productivity	Total grain output/total area of cultivated land in the province	+
		Market efficiency	Pluralism of economic subjects	Proportion of fixed assets investment in non-state-owned economy	+
				Industrial output value/gross industrial output value of non-state-owned enterprises	+
			Government code of conduct	Amount of capital in the general budget of local finance/investment in fixed assets of the whole society	−
				Government consumption expenditure/total social consumption	−

Table 1. *Cont.*

First-Level Index	Secondary Index	Third-Level Index	Fourth-Level Index	Index Calculation	Attribute
			Factor market development	Financial sector value added/provincial GDP	+
				Number of individual employees/total number of employees at the end of the provincial year	+
Coordination	Regional coordination	Per capita GDP ratio	Percentage of per capita GDP in each province	Per capita GDP of each province/per capita GDP of the whole country	+
		Regional consumption level	Proportion of consumption level of residents in each province	Regional resident consumption/national average consumption level	+
	Urban–rural coordination	Income level	Urban–rural income ratio	Per capita income of urban residents/per capita income of rural residents	Moderate
		Consumption gap between urban and rural areas	Comparison of consumption level between urban and rural areas	Per capita consumption of urban residents/per capita consumption of rural residents	Moderate
	Industrial coordination	Adjustment of industrial structure	Rationalization of industrial structure	Reciprocal of Theil index	+
		Upgrading of industrial structure	Advanced industrial structure	Output value of tertiary industry/secondary industry	+
Sustainable	Steady development	Output stability	Growth rate of total output	Provincial GDP growth rate	+
		Price steadiness	Producer price index	Ex-factory price index of industrial producers	−
			Consumer price index	Consumer price index	−
		Stable employment	Labor supply fluctuation	Registered urban unemployment rate	−
	Green development	Green environmental protection	Forest coverage	Forest coverage	+
			Nature reserve coverage	Area of nature reserve/area under its jurisdiction	+
			Green coverage rate in built-up areas	Green coverage rate in built-up area	+

Table 1. *Cont.*

First-Level Index	Secondary Index	Third-Level Index	Fourth-Level Index	Index Calculation	Attribute
		Pollution reduction	Unit GDP emission	SO_2 emissions/provincial GDP	−
			Unit GDP wastewater discharge	Total wastewater discharge/provincial GDP	−
			Unit GDP solid waste discharge	General industrial solid waste production/provincial GDP	−
		Environmental regulation	Intensity of environmental pollution control	Investment in environmental pollution control/provincial GDP	+
Open up	Foreign trade opening	Degree of dependence on foreign trade	Proportion of total import and export	Total import and export/provincial GDP	+
	Opening up of foreign investment	Degree of dependence on foreign capital	Ratio of foreign direct investment	FDI/provincial GDP	+
		Foreign direct investment	Proportion of foreign direct investment	OFDI/provincial GDP	+
Share	Income	Income distribution	Average capital of on-duty staff and workers	Per capita disposable income	+
	Consumption	Consumption expenditure	Per capita consumption expenditure	Per capita consumption expenditure	+
	Health	Hygiene and health	Medical and health level	Number of beds in health institutions per 10,000 people	+
				Health technicians per 10,000 people	+
	Education	Educational support	Investment in education	Education expenditure/provincial fiscal expenditure	+
	Leisure	Leisure welfare	Residents' tourism expenditure	Engel coefficient of resident tourism	+

4.2.2. Comprehensive Index of the Platform Economy

There are few literatures on the measurement of the platform economy, and the measurement methods are constantly improving. We referred to the practices of Zhao Tao, Huang Qunhui, and other scholars [6,46]. According to the availability of relevant data at the inter-provincial level, on the basis of taking the development of the Internet as the core measure, and adding indicators, such as platform economic business application and digital inclusive finance, the comprehensive development level of the platform economy is measured from four aspects. The specific contents include: the number of domain names of 10,000 people, the number of web pages, the number of websites, the number of undergraduates and above, the number of mobile Internet users, Internet access ports, Internet penetration, mobile phone penetration, fixed phone penetration, software technology sales revenue, e-commerce sales, e-commerce procurement, the number of e-commerce enterprises, and digital-inclusive financial development index. Principal component analysis (Principal Component Analysis, PCA) is used to measure the comprehensive development index of the platform economy, which is recorded as digital. The specific measurement index system is shown in Table 2.

Table 2. Comprehensive index system of the platform economy.

	First-Level Index	Secondary Index	Index Meaning	
Comprehensive index of platform economic development	Platform technology infrastructure	Number of domain names with ten thousand people (person/ten thousand)	Describe the distribution of domain names in each province	+
		Number of web pages (unit)	Describe the basic situation of web page information resources in each province	+
		Number of websites (10,000)	Describe the basic situation of website construction in each province	+
		Number of undergraduates or above (10,000)	Describe the level of human capital in each province	+
		Number of mobile Internet users (10,000)	Describe the basic situation of platform users in each province	+
		Internet access ports (10,000)	Describe the development of Internet infrastructure	+
	Internet information resources	Internet penetration rate	Depict the present situation of the development of Internet information resources in various provinces	+
		Mobile phone penetration rate	Depict the use of platform resources of users in each province	+
		Fixed-line telephone penetration rate	Depict the use of household platform resources in each province	+
	Platform business application	Sales revenue of software technology (ten thousand)	Reflect the development level of upstream and downstream platform industry	+
		E-commerce sales (10,000)	Reflect the prosperity of e-commerce	+
		E-commerce purchase amount (10,000)	Reflect the degree of development of various e-commerce applications	+
		Number of e-commerce enterprises (10,000)	Reflect the development degree of enterprise digitalization	+
	Digital finance	Digital-inclusive Financial Development Index	Measure the development of digital economy in the financial field	+

Note: The data come from provincial statistical yearbooks and statistical bulletins, China Statistical Yearbook, China Internet Development Statistical report, and China Science and Technology Statistical Yearbook.

4.2.3. Mechanism Variable

According to theoretical analysis, the impact of the platform economy on high-quality economic development may be realized through the allocation of technology, talent, and capital. Therefore, in order to test the role of the mechanism of technology, talent, and capital allocation, this article refers to Zhu Xi'an's practice [47]. The location quotient index was selected to measure the provincial scientific research personnel agglomeration index and scientific research capital agglomeration index to characterize the talent factor resource allocation level (talent) and the capital factor resource allocation level (capital). Data Envelopment Analysis (DEA) was used to calculate the total factor productivity of each region to characterize the level of technical factor resource allocation (tfp). About the calculation of DEA, the measurement process of provincial total factor productivity in China is relatively mature. The author draws lessons from the practices of scholars such as Zhang Jun Shan Haojie [8,48], mainly selecting the DEA-Malmquist index method to measure total factor productivity.

$$LQ_i = \frac{e_i / \sum_{i=1}^{n} e_i}{E_i / \sum_{i=1}^{n} E_i} \tag{3}$$

$$LQ_i = \frac{q_i / \sum_{i=1}^{n} q_i}{Q_i / \sum_{i=1}^{n} Q_i} \tag{4}$$

In Formulas (3) and (4), LQ_i represents the entropy of industrial location, q_i and e_i denote an area for the total output value of the industry i and number of employed persons, respectively; and summation formula $\sum_{i=1}^{n} e_i$ and $\sum_{i=1}^{n} q_i$ represent the total output value and employment of all industries in the country. This paper selects the formula (3) to calculate the allocation level of capital factor resources and talent factor resources in i region.

4.2.4. Control Variable

This paper chooses the following control variables: human capital level (edur), represented by the ratio of the number of students in higher education to the total population of each province. High-quality development is driven by innovation, and human capital is one of the key factors affecting innovation, so the high-quality economic development of each province is inseparable from regional human resources, and controlling the level of human capital is helpful to strip off this influencing factor. The level of financial development (finance) is characterized by the ratio of the balance of deposits and loans of financial institutions to the GDP of each province. The higher the level of financial development, the more perfect the credit system, the more conducive to support the development of local governments, industries, and enterprises, and then affect regional economic development; the level of financial development is directly related to all aspects of high-quality development. The level of economic development (pgdp) is characterized by the per capita GDP. Because the per capita GDP reflects the overall living standards of a region, the higher the per capita GDP, the more qualified the region is to pursue a high quality of life. The level of material capital (finvest) is characterized by the amount of fixed assets investment in the current year. The miracle of China's "economic growth" in the past few decades is inseparable from fixed-asset investment, although China's economic growth momentum has gradually shifted from investment-driven to innovation-driven; however, at present, fixed-asset investment is still an important means to promote employment-driven regional economic growth.

4.3. Data Sources and Processing Instructions

This paper takes 30 provinces and regions of China, except Hong Kong, Macao, Taiwan, and Tibet, from 2011 to 2019 as the research object. Since the digital inclusive financial index jointly compiled by the Digital Finance Research Center of Peking University and Ant Financial Services Group began in 2011, because it is an important part of the platform economy, in order to build a comprehensive platform economic development index, this paper measures the platform economic development index and high-quality development level of 30 provinces and regions from 2011 to 2019. The original data in the provincial data came from China Statistical Yearbook, China Labor Statistical Yearbook, China Science and Technology Statistical Yearbook, China Industrial Statistical Yearbook, China fixed assets Investment Statistical Yearbook, China Energy Statistical Yearbook, China Environmental Yearbook, China Internet Development Statistical report, as well as the statistical yearbooks of 30 provinces and the National Bureau of Statistics.

4.4. Descriptive Statistics

Table 3 reports the descriptive statistical results of the main variables in this paper. The results show that the average value of economic high quality development index (hquality) is 3621.211. The maximum value is 1.0×10^4. The minimum value is 1627.952, and the standard deviation is 1427.287. In the absence of the natural logarithm, it can be seen that there is a wide gap in the quality of development among the provinces. In addition, the value of 3347.991 in the 50% quantile is less than the average, indicating that the quality of development in China as a whole is on the low side. The average platform economic development level (digital) is 0.210. The standard deviation is 0.197. The maximum is 0.867, the minimum is 0.031, and the 50% quartile is 0.142, which also shows the uneven development of regional platform economy and the overall low level of platform economic development. From the perspective of control variables, there are obvious differences in the level of human capital, financial development, economic development, and material capital in different regions.

Table 3. Descriptive statistics of variables.

Variables	Mean	p50	sd	Min	Max	N
hquality	3621.211	3347.991	1427.287	1627.952	1.0×10^4	270
digital	0.210	0.142	0.197	0.031	0.867	270
Digital2	0.083	0.020	0.155	0.001	0.752	270
edur	0.019	0.019	0.005	0.008	0.035	270
finance	3.331	3.071	1.070	1.688	7.552	270
pgdp	5.198	4.376	2.657	1.619	16.45	270
finvest	18000	14000	13000	1436	59000	270
tfp	0.963	0.957	0.113	0.538	1.459	270
talent	18.28	3.218	48.02	0.660	324.7	270
capital	0.012	0.010	0.009	0.002	0.063	270

5. Empirical Analysis

5.1. Benchmark Estimation

Table 4 reports mainly the results of nonlinear estimates of the impact of the platform economy on high-quality economic development. As a comparative analysis, column (1) reports the results of linear regression of the platform economy to high-quality economic development, and the results show that the core explanatory variables are not significant. Columns (2) to (5) report the progressive regression results, which show that the platform economy has varying degrees of deviation in the estimation of high-quality economic development due to the influence of time, individuals, and other interference factors. Column (5) reports the estimated results after adding all control variables, controlling time, and individual effects, which is also the benchmark estimation result of this paper.

Table 4. Platform economy and high-quality economic development.

Variables	Lnhquality				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
digital	0.080	1.497 **	1.186 *	−1.186 ***	0.337 ***
	(1.31)	(2.53)	(1.96)	(−3.67)	(2.89)
digital2		−0.694	−1.197	0.738	−0.389 ***
		(−0.94)	(−1.18)	(1.23)	(−3.53)
edur	10.33 **		36.81 ***	9.781 **	10.01 **
	(2.48)		(3.84)	(2.23)	(2.45)
finance	−0.0364		0.257 ***	0.190 ***	−0.0334
	(−1.25)		(6.58)	(8.35)	(−1.18)
pgdp	−0.0254 ***			0.0946 ***	−0.0248 ***
	(−3.47)			(7.76)	(−3.33)
finvest	6.68×10^{-7}			1.13×10^{-5} ***	4.23×10^{-7}
	(0.58)			(6.27)	(0.36)
Time fixed	YES	NO	NO	NO	YES
Province fixed	YES	NO	NO	NO	YES
Constant	7.673 ***	7.872 ***	6.405 ***	6.802 ***	7.650 ***
	(57.44)	(121.76)	(32.67)	(63.75)	(59.06)
Observations	270	270	270	270	270
R-squared	0.986	0.283	0.536	0.824	0.987

Note: the t value is in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

As can be seen from the results of the report in column (5), the coefficient of the core explanatory variable platform economy (digital) is significantly positive at the 1% statistical level, and the coefficient of the platform economy square (digital2) is significantly negative at the 1% statistical level, indicating that the platform economy has an inverted U-shaped impact on high-quality economic development. Most studies only considered the positive promoting effect of digital technology [3,28], ignoring the double-edged sword effect of the platform economy. Before reaching the extreme point (digital < 0.4329), the platform economy has an obvious promoting effect on the high-quality development of the economy. At present, 85% of the observations are to the left of the extreme point, mainly in the central and western regions. When the extreme point is exceeded (digital > 0.4329), the platform economy has an obvious hindrance effect on the development of high-quality economy. At present, 15% of the observations are located to the right of the extreme point, and the observations are mainly concentrated in Beijing, Shanghai, Jiangsu, Zhejiang, and Guangdong. According to the theoretical analysis, the development of the platform economy has exceeded a certain level. Without government guidance and supervision, platform enterprises may monopolize by virtue of their own technological and information advantages, which is not conducive to the development of the real economy and is not conducive to the high-quality development of the economy.

In order to further verify the inverted U-shaped relationship between platform economy development and high-quality development, the inverted U-shaped relationship test was further carried out by using the UTEST command. The results show that the slope of the relationship between the platform economy and high-quality development is first positive (0.3131) and then negative (−0.3380). The extreme point of the platform economic development index is 0.4329, which is just within the 95% Fieller range (0.0988, 0.57480). The overall p-value test is still significant at the 1% statistical level (pause 0.00428), so it rejects the original hypothesis that there is no inverted U-shaped relationship between the independent variables and dependent variables. The above results support the inverted U-shaped relationship between the platform economy and high-quality development, so hypothesis H1 of this paper has been verified.

The estimated results of the control variables in Table 4 show that there is a positive correlation between the human capital level (edur) and high-quality economic development, and it is significant at the 5% statistical level. It shows that the level of human capital has a significant promoting effect on high-quality economic development, so expanding the

scale of higher education and improving the level of human capital are conducive to the high-quality development of regional economies. The coefficient of economic development level (pgdp) is significantly negative, which is different from expectations. The possible reason is that the per capita GDP only reflects the quantity of regional economic growth, but does not reflect the quality of economic growth. In reality, China's economic "growth miracle" has brought a rapid increase in per capita GDP, but it also brings problems such as environmental pollution, a gap between urban and rural areas, unfair distribution, and so on, which is not conducive to high-quality economic development. The coefficient values of the material capital level (finvest) and financial development level (finance) are not statistically significant.

5.2. Robust Estimation

5.2.1. Test of Alternative Estimation Method

Although the fixed effect model is good at solving the endogenous problem that the individual within the region does not fluctuate with time, based on the consideration of robustness, this paper uses the generalized moment estimation method (GMM) to solve the possible endogenous problems, and the specific estimation results are shown in Table 5. The estimated results of the system generalized moment estimation (sys-gmm) and differential generalized moment estimation (diff-gmm) are reported in Table 5. The estimated results show that the coefficient values of the platform economy (digital) are significantly positive at the 5% statistical level, and the coefficient values of the platform economy square (digital2) are significantly negative above the 10% statistical level. According to the AR2 value of the high-order autoregressive test, there is no high-order autocorrelation and it passes the exogenous Hansen test of tool variables. This shows that the impact of the platform economy on high-quality economic development has the effect of "Going too far is as bad as not going far enough". In addition, considering that provinces and regions are excluded from the sample, and the estimated sample is a restricted subset of the population sample, this paper chooses the restricted dependent variable method (xttobit) for re-estimation, and the estimated results are shown in Table 5. The estimated results show that the inverted U-shaped impact of the platform economy on high-quality development does not change with the change of the estimation method, which verifies the robustness of the benchmark estimation results in this paper.

5.2.2. Change Variable Measure

In the process of measuring variables by principal component analysis, eigenvalue decomposition requires that the transformed matrix must be a square matrix, and in the case of non-Gaussian distribution, the principal component obtained by principal component analysis may not be optimal. Therefore, in order to make up for the limitations of the measurement method, refer to Chen Jinghua's approach [45]. In this paper, the entropy method is used to calculate the comprehensive index of high quality development Retest as a dependent variable. In addition, this article uses the digitization degree index jointly compiled by the Digital Finance Research Center of Peking University and Ant Financial Services Group (digidegree). Robust estimation by replacing the comprehensive index of the platform economy. The estimated results of the replacement dependent variables are shown in column (1) of Table 6, the platform coefficient is significantly positive, and the digital2 coefficient is significantly negative, indicating that the platform economy has an inverted U-shaped impact on high-quality development.

Table 5. Test of alternative estimation methods.

Variables	Lnhquality		
	Sys-gmm	**Diff-gmm**	**Xttobit**
digital	3.083 **	4.980 **	0.385 ***
	(2.53)	(2.47)	(3.25)
digital2	−2.870 **	−4.668 *	−0.372 **
	(−2.29)	(−1.65)	(−2.48)
edur	0.790	−7.808	12.55 ***
	(0.15)	(−0.49)	(5.28)
finance	0.0809 **	−0.123	−0.0124
	(1.99)	(−1.59)	(−0.92)
pgdp	−0.00174	−0.121	−0.0178 ***
	(−0.07)	(−1.09)	(−3.87)
finvest	-9.02×10^{-6}	-9.92×10^{-6}	2.14×10^{-7}
	(−1.53)	(−0.56)	(0.42)
Time fixed	Yes	Yes	Yes
Province fixed	Yes	Yes	Yes
Constant	−199.3 ***	-	7.511 ***
	(−4.91)		(83.20)
AR2	$p = 0.167$	$p = 0.543$	-
Hansen	$p = 0.212$	$p = 0.212$	-
Observations	270	240	270

Note: the t value is in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6. Changing the variable measure and considering missing variables test.

Variables	Replace Dependent Variable	Replace Independent Variable	Resolve Missing Variables
	(1) Lnhqualitys	**(2) Lnhquality**	**(3) Lnhquality**
digital	0.118 *		0.303 ***
	(1.92)		(2.95)
digital2	−0.150 *		−0.378 ***
	(−1.73)		(−3.55)
digidegree		0.301 ***	
		(2.80)	
digidegree^2		−0.0314 ***	
		(−2.77)	
edur	4.029 ***	12.06 ***	10.87 ***
	(3.01)	(3.29)	(2.76)
finance	−0.00206	−0.0642 **	−0.0491
	(−0.24)	(−2.53)	(−1.64)
pgdp	0.00601*	−0.0294 ***	−0.0270 ***
	(1.81)	(−4.06)	(−3.90)
finvest	-5.23×10^{-7}	5.12×10^{-7}	4.77×10^{-7}
	(−0.95)	(0.42)	(0.49)
lnfdi			0.0114
			(1.59)
rd			−0.510 ***
			(−6.42)
Time fixed	YES	YES	YES
Province fixed	YES	YES	YES
Constant	−0.696	−219.5 ***	7.716 ***
	(−0.14)	(−18.80)	(54.69)
Observations	270	270	270
R-squared	0.217	0.972	0.988

Note: the t value is in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Column (2) in Table 6 uses the digitization degree index (digidegree) to replace the independent variable for estimation. The results show that the platform economy still has a significant "Inverted U" effect on the high-quality economic development after changing the independent variable or dependent variable.

5.2.3. Consider Missing Variables

Based on the consideration of omitted variables, provincial scientific research investment intensity (rd) and foreign investment (lnfdi) control variables are added to the model for estimation. The intensity of scientific research investment is characterized by the ratio of the internal scientific research expenditure of each province to the financial income of each province at the end of the year, and the amount of foreign direct investment at the end of the year is characterized by the natural logarithm. The estimated results are shown in column (3) of Table 6, which shows that, after adding possible missing variables, the impact of the platform economy on high-quality development is still consistent with the basic estimates, indicating that there is no serious problem of missing variables. It shows that the benchmark estimation result of this paper is robust.

5.2.4. Endogenous Test

The development of the platform economy is conducive to the high-quality development of regional economies, and high-quality development will further promote the development of the platform economy. Therefore, there may be two-way causality; in addition, there may be measurement errors, sample selection, and other problems leading to endogenous problems. For this reason, based on the consideration of data integrity, this paper uses the number of digital circuits in each province in 1998 as the tool variable of the platform economic development index. On the one hand, platform technology is an extension of traditional technology, and the traditional platform infrastructure of each province will affect the use habits of users and the subsequent development and application of platform technology from provincial platform technology to the subsequent development of the platform economy, so as to meet the requirements of relevance. On the other hand, the impact of the number of digital circuits on the current high-quality economic development is ignored to meet exclusiveness. However, because the data of 1998 are only cross-sectional data, they cannot be used directly. With reference to the practice of Nathan Nunn [49], the panel tool variable was constructed by introducing a variable that varied with time. Specifically, the tool variable (instru) was constructed by multiplying the number of Internet domain names of each province and the number of digital circuits in 1998 as the tool variable of the platform economic index of each region. The two-stage least square method (2SLS) was used for estimation. The estimated results are shown in Table 7.

Table 7. Endogenous test.

	(1)	(2)	(3)
Variables	**Second Stage Lnquality**	**First Stage Digital**	**First Stage Digital2**
digital	3.766 *		
	(1.89)		
digital2	−6.344 *		
	(−1.89)		
IV: instru		−0.029	−0.044 *
		(−0.92)	(−1.90)
IV: instru^2		0.002 *	0.002 **
		(2.45)	(2.45)
Control variable	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes
Province fixed	Yes	Yes	Yes
Observations	270	270	270

Note: the t value is in parentheses; ** $p < 0.05$, * $p < 0.1$.

The endogenous test was carried out with reference to the practice of Wang Xianbin [50]. Table 7 shows the results of endogenous estimation. Column (2) and column (3) report the estimation results of the first stage, which show that the coefficient of tool variables (instru) is significant at the 10% and 5% statistical levels, indicating that there is a high correlation between the platform economy and tool variables, and the F value of the first stage is greater than the critical value of 10. There is no need to worry about weak tool variables, and the selection of tool variables is more reasonable. Column (1) reports the results of the second-stage estimates, which showed that, after solving the endogenous problems, the impact of the platform economy on high-quality development still had the effect of Inverted U. The endogenous estimation shows that, except for the change in size, the direction of the core explanatory variable coefficients is consistent with the basic estimation results, indicating that the basic estimation results in this paper are more reliable.

5.3. Heterogeneity Test

5.3.1. Quality of The Market System

The quality of the market system directly affects the market vitality and the degree of competition, thus affecting the speed and quality of regional economic development. The high quality of the system shows that the regional market openness, market order, and degree of freedom are good, which provides a good development environment for the development of the platform economy and contributes to the rapid development of the platform economy. The marketization index is mainly carried out from five aspects: the relationship between the government and the market, the development of the non-state-owned economy, the development of the product market, the development of the factor market, the development of market intermediary organizations, and the environment of the legal system, according to the marketization index report compiled by Wang Xiaolu: "Report on China's Provincial marketization Index (2018)" [39]. In this paper, the marketization index is used to represent the market institutional quality (marindext). Since the sample data lasts until 2019, the marketization index in the last year is calculated by the author by hand. Additionally, the market system quality of the median was the standard for grouping, higher than the median was a higher quality of the system, and lower than the median was a lower quality of the system. The results of the grouped regression are shown in Table 8. The estimated results show that the platform coefficients are significantly positive above the 10% statistical level. The digital2 coefficient is significantly negative when the statistical level is above 10%. We calculated that, when the quality of the market system was low, the total observation value was 146, the economic threshold of the platform was 0.427, and the observation value on the left side of the inflection point was 121, accounting for about 83%. When the quality of the market system was high, the total observation value was 124. the economic threshold of the platform was 0.325, and the observation value on the left side of the inflection point was 99, accounting for 80%. Generally speaking, the observed value on the left side of the inflection point was more than that on the right side of the inflection point.

According to Table 8, it can be seen that, the higher the quality of the market system, the greater the promoting effect of the platform economy on high-quality development. At present, we can improve the degree of marketization and improve the market system and mechanism to further enhance the positive externalities of the platform economy and promote high-quality economic development.

Table 8. Institutional quality and government intervention.

Variables	Lnhquality			
	Quality of the System Is Low	Quality of the System Is High	Weak Government Intervention	Strong Government Intervention
digital	0.351 **	0.566 *	0.458 ***	0.677
	(2.58)	(1.93)	(2.93)	(1.21)
digital2	−0.411 ***	−0.870 *	−0.454 ***	−1.460
	(−3.17)	(−1.83)	(−4.32)	(−0.95)
edur	9.758 **	9.903 *	2.294	5.416
	(2.11)	(1.90)	(0.34)	(1.22)
finance	−0.0335	0.00251	−0.0317	−0.0493 **
	(−0.88)	(0.10)	(−1.29)	(−1.47)
pgdp	−0.0289 **	−0.0143 *	−0.0233 ***	−0.0219
	(−2.44)	(−1.75)	(−2.93)	(−1.23)
finvest	-1.95×10^{-7}	1.37×10^{-6}	4.81×10^{-7}	2.29×10^{-6}
	(-0.09)	(0.89)	(0.39)	(0.74)
Constant	7.673 ***	7.495 ***	7.841 ***	7.602 ***
	(48.20)	(48.34)	(39.80)	(73.79)
Time fixed	Yes	Yes	Yes	Yes
Province fixed	Yes	Yes	Yes	Yes
Observations	146	124	169	101
R-squared	0.983	0.990	0.988	0.991

Note: the t value is in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.3.2. Degree of Government Intervention

The degree of government intervention in the market has always been a hot topic among scholars; the degree of government intervention in different economic types is different, and the effects are also different. As a new type of economy, the initial development of the platform economy is inseparable from the support and guidance of the government; excessive intervention may not be conducive to the rapid development of the platform economy, but unreasonable guidance may lead to market monopoly in the later stage of the development of the platform economy Therefore, it is necessary to test the degree of government intervention in groups. To measure the degree of government intervention (govern), referring to the practice of most scholars, this article adopts the ratio of government general service expenditure to provincial GDP, and divides it into groups according to the median of the degree of government intervention. Higher than the median is regarded as a strong degree of government intervention, and lower than the median is regarded as a weak degree of government intervention. The results of the grouping estimation are shown in Table 8.

The results show that, under the condition of weak government intervention, the platform economy has an inverted U-shaped effect on high-quality development. We calculated that, when the government intervention was low, the total observation value was 169, the economic threshold of the platform was 0.504, and the observation value on the left side of the inflection point was 146, accounting for about 86%. When the government intervention was high, the total observation value was 101, the platform economic threshold was 0.232, and the observation value on the left side of the inflection point was 97, accounting for 96%. This shows that the observed value on the left side of the inflection point was more than that on the right side of the inflection point.

The low government intervention may be due to the low efficiency of government allocation and the utilization rate of expenditure. From the number of observations, more than 80% of the current observations were on the left side of the inflection point, so we focused on the left side of the point of view. On the left side of the inflection point, compared with the areas with stronger government intervention, the promoting effect of the platform economy on the areas with lower government intervention was more significant. However, from the slope point of view, through the derivation of the quadratic function, we can see the steepness of the slope. The slope of the inverted U-shaped curve was minus 2.92 in

areas with strong government intervention and minus 0.908 in areas with weak government intervention. The absolute value shows that the inflection point of the inverted U-shaped curve is steeper on the left and right sides of the inverted U-shaped curve in areas with strong government intervention, but it is not statistically significant. The insignificant reason may be related to the current low utilization rate of overall government expenditure in China, or it may be that the median index is not accurate enough to distinguish the strength of government intervention

5.3.3. Regional Heterogeneity Test

According to the new situation of accelerated economic and social development in China, the country is divided into four major economic regions: the eastern region, the northeast region, the central region, and the western region. Therefore, this paper estimates the regional heterogeneity according to the four major economic regions. To explore whether there are differences in the impact of the platform economy on high-quality development in different regions, Table 9 shows the test results of regional heterogeneity.

Table 9. Results of the regional heterogeneity test.

Variables	**Lnhquality**			
	Northeastern China	**Eastern Region**	**Central Region**	**Western Region**
digital	1.456 *	0.291	0.343	1.163 *
	(2.25)	(1.35)	(0.71)	(2.14)
digital2	−3.569 *	−0.335 *	−3.277 *	−3.266 **
	(−2.11)	(−1.76)	(−2.11)	(−2.57)
edur	8.048 **	0.764	5.270	5.034
	(4.59)	(0.07)	(1.12)	(1.73)
financ	−0.0700	−0.0119	−0.106 **	−0.0363
	(−1.05)	(−0.44)	(-3.12)	(−1.06)
pgdp	−0.0469	−0.0211	0.0214	−0.0575 **
	(−1.47)	(−1.64)	(1.32)	(−3.05)
finvest	3.46×10^{-6} ***	-1.42×10^{-6}	2.72×10^{-6} *	3.28×10^{-6}
	(7.52)	(−1.22)	(2.33)	(0.97)
Constant	7.626 ***	8.073 ***	7.546 ***	7.640 ***
	(29.21)	(21.60)	(49.70)	(53.92)
Time fixed	Yes	Yes	Yes	Yes
Province fixed	Yes	Yes	Yes	Yes
Observations	36	90	54	90
R-squared	0.999	0.990	0.997	0.991

Note: the t value is in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

From the estimated results in Table 9, we can see that, in contrast, the effect of the platform economy on the high-quality development of the northeastern and western regions is more obvious. Specifically, compared with the eastern and central regions, the promoting effect of the platform economy on the high-quality development of the northeastern and western regions is more significant; while the impact on the high-quality development of the eastern and central regions is positive, the statistical level is not significant. When the development of the platform economy exceeds the extreme point, it has an inhibitory effect on the high-quality development of the four major economies. Compared with the northeastern, central, and western regions, the inhibitory effect of platform economic development on the high-quality development of the eastern region is the lowest.

As a matter of fact, this is the case in China, where competition in the east is fiercer, the environment is freer, and the regulatory mechanism is also better. From the point of view of the steepness of the curve, the promoting effect of the platform economy on the central and western regions is greater. According to statistics, 85% of the current observations fall on the left side of the inflection point. In other words, the current platform economy is on the rise. From the perspective of the influence coefficient, the promoting effect of the

platform economy on the central and western regions is greater. We think that the possible reason is that the level of high-quality development in the central and western regions is low, and there is plenty of room for growth. Therefore, the promoting effect of the platform economy on underdeveloped areas is relatively greater.

6. Test of Adjustment Mechanism Based on Resource Allocation of Elements

The platform economy is a double-edged sword that plays a positive role in promoting high-quality economic development at the initial stage of development, but without reasonable supervision and guidance, the negative externalities brought about by the later development of the platform economy exceed its positive externalities, which will hinder the high-quality development of the economy. Therefore, according to theoretical analysis, technology, human resources, capital, and other factor resources play a positive role in regulating the relationship between the platform economy and high-quality development. In order to test the regulatory role of the allocation of factor resources in model (2), this paper focuses on the significance of the coefficient of interactive items. The mechanism test results are shown in Table 10.

Table 10. Mechanism test results.

Variables	Lnhquality		
	Technical Elements (1)	Talent Elements (2)	Capital Elements (3)
digital	0.326 ***	0.332 **	0.271 *
	(2.86)	(2.66)	(2.04)
digital2	−0.361 ***	−0.422 ***	−0.225
	(−3.24)	(−3.82)	(−1.12)
tfp	−0.0151		
	(−0.53)		
talent		−0.000159	
		(−0.78)	
capital			1.474
			(0.67)
digitfp	0.732 **		
	(2.08)		
digit^{2}fp	−0.912 **		
	(−2.29)		
digitalent		0.00279 **	
		(2.47)	
digi^{2}talent		−0.00884 **	
		(−2.53)	
digicapital			22.35
			(1.26)
digi^{2}capital			−24.42
			(−1.19)
edur	9.224 **	10.11 **	8.149**
	(2.18)	(2.43)	(2.06)
financ	−0.0402	−0.0334	−0.0291
	(−1.35)	(−1.19)	(−1.06)
pgdp	−0.0263 ***	−0.0274 ***	−0.0172 **
	(−3.45)	(−3.93)	(−2.48)
finvest	4.36×10^{-7}	5.40×10^{-7}	3.14×10^{-7}
	(0.37)	(0.45)	(0.27)
Constant	7.730 ***	7.695 ***	7.667 ***
	(53.52)	(58.38)	(65.47)
Time fixed	Yes	Yes	Yes
Province fixed	Yes	Yes	Yes
Observations	270	270	270
R-squared	0.987	0.987	0.987

Note: the t value is in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

6.1. Resource Allocation of Technical Elements

Column (1) of Table 10 shows the estimated results of the intersection of tfp and the platform economy and its horizontal direction. The estimated results of column (1) show that the platform economy has an inverted U-shaped impact on high-quality economic development, and we focus on the significance of the coefficient of interactive terms. From the interaction between technology factor resource allocation (tfp) and the platform economy (digital), we can see that the coefficient value of digitfp is positive, which is significant at the 5% statistical level. The value of digi2tfp factor is negative, which is significant at the 5% statistical level. This shows that, on the left side of the extreme point, the resource allocation of technological factors plays a positive role in the process of the platform economy, promoting high-quality economic development. On the right side of the critical value, as the development of the platform economy exceeds the extreme point, the resource allocation of technological factors plays a negative role in the inhibitory effect of the platform economy on high-quality economic development.

In order to directly show the regulatory effect of resource allocation, we drew a diagram of the regulatory effect of resource allocation on the platform economy and high-quality development, as shown in Figure 1. As shown in Figure 1, the improvement of the efficiency of resource allocation of technological factors has enhanced the role of the lower level of the platform economy in promoting high-quality economic development, but when the development of the platform economy has reached a certain scale, the slope of the technological factor resource allocation efficiency has gradually changed from positive to negative, indicating that the positive adjustment effect of the technological factor resource allocation efficiency is gradually weakened or even negative. This strengthens the restraining effect of the platform economy on high-quality economic development. Therefore, the resource allocation of technical elements plays a regulatory role in the non-linear relationship.

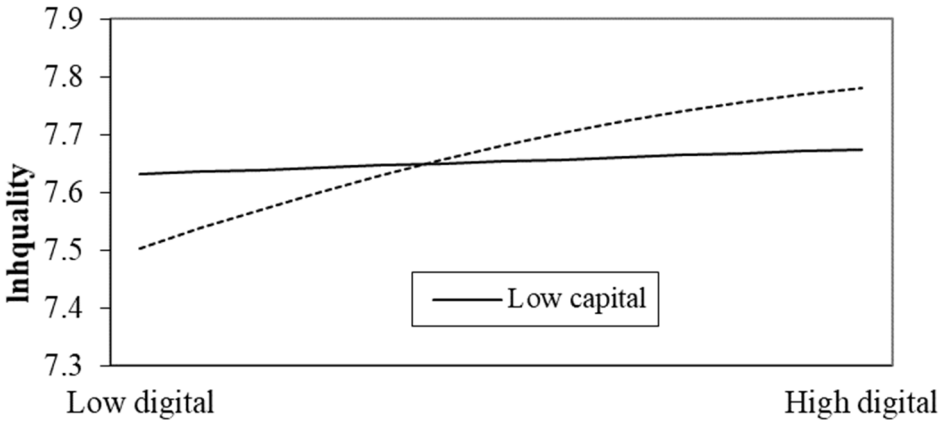

Figure 1. Regulating effect of the resource allocation of technical elements.

6.2. Allocation of Talent Elements and Resources

The estimated results of column (2) in Table 10 show that the coefficient of the interaction term (digitalent) is significantly positive. The value of the digi2talent coefficient is significantly negative, indicating that, on the left side of the extreme point, the allocation of human resources positively adjusts the positive correlation between the platform economy and high-quality development. On the right side of the extreme point, talent elements negatively regulate the negative correlation between the platform economy and high-quality development. In order to intuitively show the regulatory role of talent factor resource allocation, we drew a diagram of the regulatory effect of talent factor resource allocation on the relationship between the platform economy and high-quality economic development, as shown in Figure 2. As shown in Figure 2, the improvement of the allocation of human resources enhanced the promotion of the lower level of the platform economy to high-quality

development. When the development of the platform economy has exceeded the extreme point, the improvement of the allocation of human resources has obviously strengthened the negative impact of the platform economy on high-quality development. Therefore, the resource allocation of talent elements plays a regulatory role in the non-linear relationship.

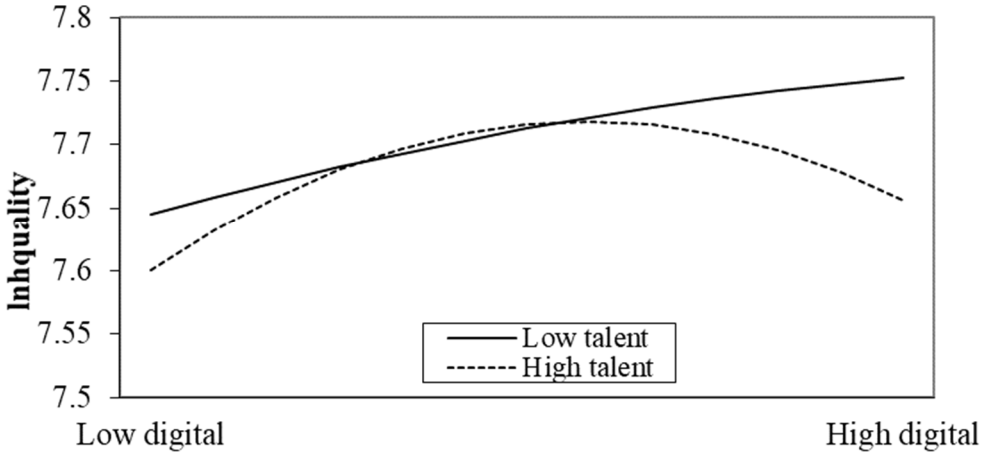

Figure 2. Regulating effect of the resource allocation of talent elements.

6.3. Capital Factor Resource Allocation

The interactive items in column (3) in Table 10 show that the value of the digicapital coefficient is positive and the value of capital coefficient is negative, but it is not significant at the statistical level. In order to directly see the regulatory role of capital factor resource allocation, we drew a diagram of the regulatory effect of capital factor resource allocation on the relationship between the platform economy and high-quality development. As shown in Figure 3, the improvement of capital factor resource allocation enhances the promotion of the low-level platform economy to high-quality development, but when the development of the platform economy exceeds the extreme point, it shows that the regulating effect of capital is not obvious.

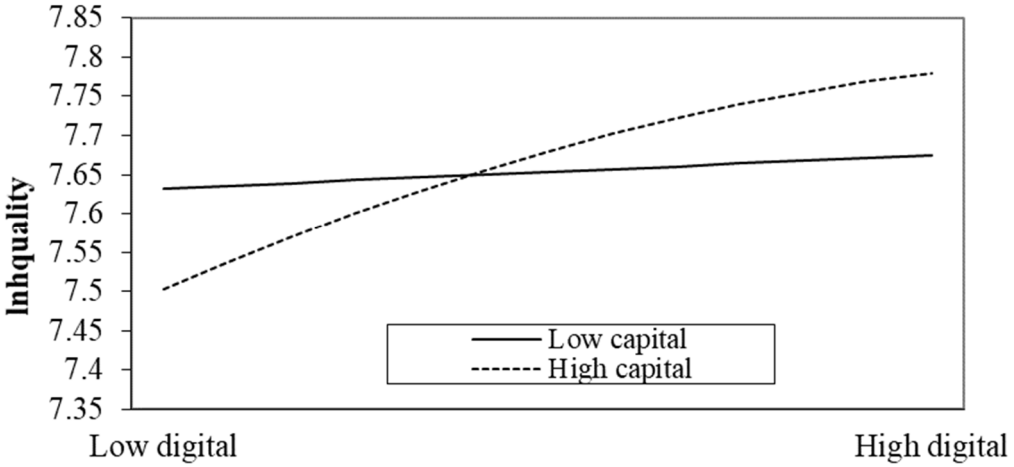

Figure 3. Regulating effect of the resource allocation of capital elements.

7. Conclusions and Revelations

This paper empirically analyzes the influence and mechanism of the platform economy on high-quality economic development by using Chinese provincial panel data.

The conclusions are as follows: first, the platform economy has an inverted U-shaped influence on the high-quality economic development. On the left side of the inverted U-shaped inflection point, the platform economy has an obvious promoting effect on the

regional high-quality development. On the right side of the inflection point, the platform economy has an inhibitory effect on the regional high-quality development. Second, compared with areas with stronger government intervention, the platform economy has a more significant inverted U-shaped effect on high-quality development in areas with weaker intervention. Compared with areas with a higher-quality market system, the promotion effect of the platform economy on high-quality development in areas with lower institutional quality is more obvious on the left side of the inflection point and the inhibitory effect on the right side of the inflection point. Compared with the eastern and central regions, on the left side of the inflection point, the platform economy plays a greater role in promoting the high-quality development of the northeastern and western regions, while, on the right side of the inflection point, the platform economy has an inhibitory effect on the high-quality development of each region. Third, the agglomeration of factors plays a regulatory role between the platform economy and high-quality development, in which talent and technology elements play a positive regulatory role on the left side of the inflection point and a negative regulatory role on the right side of the inflection point; meanwhile, capital elements only play a positive regulatory role, and the negative regulatory role is not significant.

According to the research conclusions, several policy implications are obtained: first of all, according to the statistical analysis, 85% of the observations fell on the left side of the inverted U shape, indicating that the overall development of China's platform economy is in its infancy. Vigorously developing the platform economy will help to promote the high-quality development of the regional economy. Therefore, the government will promote the construction of platform infrastructure, especially by accelerating the application of technology in the fields of big data, artificial intelligence, 5G, and the Internet of things, further promote the integration of the platform economy with the real economy, and speed up the in-depth development of platform technology, making the platform organization innovation vitality and potential continue to burst out, and providing new momentum for achieving high-quality economic development. Secondly, attach importance to regional coordinated development, according to regional resource endowment, improve the resource utilization rate of regional technology, talent, and capital advantages, and vigorously develop the platform economy and scope economy to make full use of agglomeration advantages to promote regional high-quality development. At the same time, the government needs to pay attention to the economic support and guidance of the platform, especially in the areas where the degree of government intervention is weak, to strengthen the reasonable guidance and supervision of the platform economy. In the eastern region, there is a high degree of market and there is a great possibility of monopoly risk. Therefore, it is necessary to strengthen the supervision of largescale platform organizations in the east, and to encourage and support the platform economy in the central and western regions and underdeveloped areas. The government should appropriately relax the market access threshold for platform enterprises and release the economic vitality of platform enterprises in backward areas. Finally, improve the supervision and management system and mechanism of platform enterprises, provide an institutional guarantee for the healthy development of the platform economy, make full use of the agglomeration advantage of the platform economy to promote high-quality economic development, and attach importance to the double-edged sword effect of the platform economy.

The article also has the following shortcomings: first, compared with the existing research, the comprehensive index of the platform economy has made great progress, but, with the continuous extension and development of digital technology in recent years, the connotation of the platform economy is becoming richer. This study is mainly based on the Internet-based comprehensive index, and index diversification is still lacking. Second, from the actual situation in China, the study found that 15% of the sample observations, such as Guangdong, Beijing, Shanghai, and other areas, fell on the right side of the inverted U shape, which does not mean that the development of the platform economy in this region should be stagnated or restrained across the board, because there is still an imbalance in the

development between prefecture-level cities and counties; however, the provincial panel data cannot capture these details very well. This is also an important direction for the author to study in the next step.

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