

# Government support and the development of new quality productivity: a text mining analysis based on the provincial government work report

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**Abstract.** The new quality productivity is an important driving force to push forward the Chinese modernization in our country, based on the text mining of 510 provincial government work reports from 2011 to 2023, this paper estimates the government's support for the development of new-quality productivity, and carries out the principal component analysis by constructing the index system of the development of new-quality productivity, this paper measures the development level of new quality productivity and empirically tests the mechanism of government support on the development of new quality productivity with panel data model. The empirical results show that government support has a positive effect on the performance of new qualitative productivity at the 5% significance level. Based on the research conclusion, the paper proposes that government agencies should understand the actual demand of new quality productivity development, strengthen the implementation of supply-side reform, focus on long-term development, and create a good innovation environment.

**Keywords:** New qualitative productivity, Government work report, Text mining, principal component analysis, and Random effect model.

## 1. Introduction

China's economy experienced a period of high growth, averaging 9.9% , after the reform and opening-up policy and until 2012, during which the demographic dividend and the acceleration of industrialization brought about a sustained supply of labour and capital accumulation Reform dividends and accelerated urbanization have increased the efficiency of resource allocation. It is estimated that between 1978 and 2012, capital accumulation, total labour force, human capital and total factor productivity increased by 4.1, 1.1 and 3.7 percentage points respectively. Subsequently, the demographic dividend contraction, slowing industrialization, urbanization, anti-globalization, China's economic growth rate shift. Between 2013 and 2019, GDP grew at an average annual rate of 7.0%, with capital accumulation, total labour force, human capital and total factor productivity pulling up by 4.4, 0, 0.5 and 2.0 percentage points respectively, total factor productivity has also fallen.

The new quality productivity has expanded on the traditional productivity, emphasizing innovation as the leading factor, and characterized by high technology, high efficiency and high quality, at the same time, the allocation of factors of production and deep industrial transformation are required. For the new quality productivity, its basic elements have not changed in essence, but, due to the development of science and technology, the form and characteristics of these elements have changed. For example, due to the development of artificial intelligence and the application of big data, artificial intelligence liberates part of human labor, becomes the externalization of part of human labor, and is a highly talented tool for human beings, a part of human mental and physical labor. Due to the



application of high-tech labor materials in the labor process, the labor objects from the original natural entities gradually rely on abstract data or new energy materials. Because of the development of society and the progress of productive forces, high-tech means of labor and new forms of labor objects need high-quality personnel as the main factor of productive forces to use and process them, the basic elements of the new quality productivity are thus determined. At the same time its original needs not only to meet the needs of survival, but also on the basis of the pursuit of high quality. Scientific and technological means come into the field of vision of development needs. In the Society of high-speed development of science and technology, workers should not only break through themselves, but also realize the transition needs of the highest ideal of people's all-round and free development.

## **2. Theoretical analysis and research hypotheses**

### **2.1. Theoretical analysis**

New-quality productivity is not just about “New” but also about “Quality”. In terms of “New”, (Sheng Chaoxun, 2024) refers to new industries, new technologies, new products and new forms of business, as well as new workers, new objects of labor and new means of labor, and it will involve new fields as one of the key characteristics of the new qualitative productivity [1] . In terms of “Quality”, it emphasizes high-quality development. On the road of our country's modernization, high-quality development is the fundamental path and inherent requirement of building socialism (Wang Zhidong, 2024) [2] . But its foothold is in the productivity, therefore requests the factor optimization combination transition, simultaneously the total factor productivity need to get the huge promotion (Chen Huiling, Tao Wenzhao, 2024) . If we want to optimize the allocation of production factors and move closer to the future industries and high-tech clusters, we need not only to rely on market mechanisms to regulate them, it also requires the control and promotion of government policies (Wang Huahua, 2024) [3] . For disruptive innovation, we are committed to transform it into a new quality of productivity, in practice, for innovative research, to find the application of the scene, policy support and the corresponding adaptation (Fang Xiaoxia, Li Xiaohua, 2024) [4] . In terms of productivity improvement, the government policies of urban agglomerations have an important influence and impetus on the productivity of enterprises, thus indirectly promoting the development of new quality productivity (Wang Ting, Wang Kebin, Yang Xiaoyi, 2024) [5] . As a new factor of production, big data can be applied to various fields, including national governance and government policy-making. Based on open data, for the Digital Economy Policy, the provincial government policy documents have horizontal and vertical synergy to it (Chen Mei, Zhao Ziyou, 2024) [6] , that is to say, it has an important impact on the development of digital economy. At the same time, industrial agglomeration in the field of digital economy has a significant positive effect on the development of new quality productivity (Luo Shuang, Xiao Yun, 2024) [7] .

### **2.2. Study assumptions**

In order to study the impact of government support on the development of new qualitative productivity, this paper first constructs a theoretical framework of the impact of government support on the development of new qualitative productivity Then, by means of text mining, we measure the index of “The government supports the development of new qualitative productivity”, then construct the index system of the development level of new qualitative productivity, and use the principal component analysis to give weight to it, finally, the panel data model is used to verify the impact of government support on the development of new qualitative productivity and to test its robustness.

Through financial subsidies, tax incentives and other measures to lower the threshold for new-quality productivity market entry, while encouraging technological innovation, to create a level playing field in the market environment, as well as promoting the integration of new-quality productivity and traditional industries, these measures not only ease the financial pressure of enterprises, but also enhance their technological level and market competitiveness, thus the new quality of the productive

forces for the development of a strong driving force to achieve a sustainable and healthy economic and social development. Based on this, a hypothesis, H<sub>1</sub>.

H<sub>1</sub>: Government support for new qualitative productivity has a positive effect on the development of new qualitative productivity. 2.3 The indicator measure of “Government support for the development of new-quality productivity”

### 2.3. The index measure of "The government supports the development of new quality productivity"

The government work report is an important legal document reflecting the development of local government governance. This paper selects the provincial government work report as the Research Foundation, and extracts the corresponding statistical data with the help of the text analysis technology, usually in the official website of the people's government under the “Provincial government”, “Government affairs open” or “Information open” and other columns to find.

A variable for measuring government support. We manually collected the original government work reports of 31 Chinese provinces (excluding Hong Kong, Macao and Taiwan) from 2002 to 2023. Then Select 31 provinces' government work reports from 2011 to 2023 for word segmentation and then explain the method of text analysis, using the research of Liu et al. (2020) for reference to measure government support, for the content of the collected government work report, we use the JIE B a library in Python to segment the text, and finally build a custom retrieval dictionary through several screening checks, python was used to count the word frequency of the text, and the statistical results were analyzed [8].

The core problem of the text mining of the above-mentioned government work report is to select the “Key words” that can measure the government's support for the development of new qualitative productivity and to determine the number of word frequency that can limit the total number of entries. First, we identified 8 core terms related to neo-qualitative productivity by screening them. Next, in order to increase the representativeness and comprehensiveness of text mining to the development and application of government support for new qualitative productivity, we add the relevant high-frequency synonyms of the original eight core terms, together with the core terms, they are used as retrieval terms for text mining of new qualitative productivity. The results of representative retrieval terms are shown in Table 1.

**Table 1.** An overview of representative retrieval terms.

Core terms	High frequency synonyms
High Technology	New quality productivity, block chain, industrial internet, intelligent manufacturing, artificial intelligence, 5G, R & D investment, core technology, high-tech Enterprises, information technology, technology transfer
High-quality development	Innovation-driven, structural optimization, Smart city, green development, industrial upgrading, sustainable development, talent training, new urbanization, scientific development, sustainable development
Scientific and technological innovation	Technological Innovation, innovation base, key core technology, innovation capability, intellectual property, basic research, scientific and technological talents, transformation of scientific and technological achievements, frontier technology
New Energy	New materials, new energy vehicles, renewable energy, nuclear power, photovoltaic power generation, smart grid
Strategic Emerging Industries	Industrial upgrading, industrial transformation, future industry, independent innovation demonstration zone, high-end equipment manufacturing, information technology, big data, cloud computing, Internet of things
Innovation-driven	Innovation Development, innovation capacity, innovation ecology, innovation system, innovation platform, independent innovation, coordinated innovation, Innovation Entrepreneurship, innovation talents, innovation resources, innovation guidance, innovation service
Digital economy	Digital industrialization, industry digitization, digital transformation, data resources, Industrial Internet, e-commerce
New forms of business	New Model, Internet + , new economy, telemedicine, sharing economy, agricultural modernization, high efficiency and high efficiency

## 2.4. Measurement of the development level of new qualitative productivity

In this paper, Wang et al. (2024) for reference to the development of the level of neo-qualitative productivity index system [9], the above indicators reflect the development of our country's neo-qualitative productivity status quo, it also reflects the future trend and development potential of new quality productivity, and provides a scientific and complete evaluation framework for the development of new quality productivity.

By means of principal component analysis (PCA), the development level of new qualitative productivity in 31 provinces of our country is evaluated, the requirement of data distribution is not strict [10].

The extracted three principal components correspond to the three dimensions of the development level index system of the new qualitative productivity mentioned above, i. e., the criterion worker, the object of labor and the means of production, the main index of principal component 1 covers the two dimensions of labor and means of production, while principal component 2 mainly covers the index information of the dimension of labor object. The results are shown in Table 2.

**Table 2.** Main indicators and weights covered by the principal components.

Name	Cumulative variance interpretation rate (%)	Key indicators	Identification	Weight (%)
Principal component 1	46.764	X1, X2, X3, X4, X6, X7, X13, X14, X15, X19, X20, X21, X22, X23, X24, X25, X26	$F_1$	65.789
Principal component 2	63.864	X 8, X 9, x 10, X 11, x 12, X 17, X 18, X 27	$F_2$	24.056
Principal component 3	71.082	X 5, X 16	$F_3$	10.155

## 3. Study design

### 3.1. Variable selection

#### 3.1.1. Explained variables

The level of development of new-quality productivity. Based on the above, we construct the Comprehensive Evaluation Index System of the development level of new quality productivity, and Boil 27 indexes into three principal components by principal component analysis, the three principal components were normalized by the factor weight score coefficient, and the new quality productivity comprehensive index was obtained as a measure of the development level of new quality productivity. The formula of principal component normalization is as follows:

$$F = \sum_{i=1}^n w_i \times x_i \quad (1)$$

Among them,  $F$  is the New Quality Productive Force Comprehensive Index,  $w_i$  is the first Linear Combination Coefficient,  $x_i$  is the first Core Explanatory Variable, and  $n$  is the total number of Explanatory variables.

#### 3.1.2. Core explanatory variables

The government supports the development of new quality productivity (SUP), which is measured by the word frequency of the provincial government work report after text mining. A total of 24,254 words were recorded in 31 provinces (excluding Hong Kong, Macao and Taiwan). In order to ensure the consistency of the data, in the process of building the model, we use only the word frequency data of 30 provinces (excluding Hong Kong, Macao, Taiwan, and Xizang) for the government work reports, with a total of 22,430 word frequencies, and standardize the data using the averaging method.

### 3.1.3. Control variables

Depth of international cooperation and exchange, measured by provincial foreign investment (ITN); contribution rate of social capital, measured by fintech index (FIN) and digital inclusive finance index (NFN); degree of market competition, it is measured by software revenue as a percentage of GDP (INC), information technology services revenue as a percentage of GDP (ISC), and e-commerce transaction activity as a percentage of enterprises (EET). In order to reduce the sample loss, the missing data of foreign investment in 2021-2022 were filled with the least square model. The above data sources for the provincial statistical yearbook, the official website of the Provincial Statistical Bureau, Statistical Bulletin, we use the mean method to standardize their processing.

In order to observe the smoothness of the data series, we analyzed the statistical characteristics of the selected variables. The descriptive statistics of the variables are shown in table 3.

**Table 3.** Descriptive statistics for variables.

Variable type	Variable name	Variable Indicator	Variable symbols	Sample size	Mean	Standard deviation	Maximum	Minimum
Interpreted variable	The level of development of new-quality productivity	Composite index of new-quality productivity	F	330	0.987	0.977	9.678	0.294
Core explanatory variables	The government supports the development of new-quality productive forces	Frequency of new quality productivity-related words in government work reports	Report	330	59.712	23.553	139	0.000
	Depth of international cooperation and exchanges	Foreign Investment	ITN	330	84.578	79.283	357.579	0.045
Control variables	Level of contribution of social funds	Fintech index	Fin	330	0.191	0.122	0.611	0.005
		Digital Financial Inclusion Index	Nnn	330	263.339	94.780	486.010	61.470
	Market competition	Software revenue as a percentage of GDP	Inc.	330	0.049	0.070	0.541	0.000
		Revenue from information technology services as a proportion of GDP	ISC	330	0.033	0.055	0.541	0.000
		Proportion of enterprises engaged in e-commerce transactions	Eet	330	0.082	0.042	0.274	-0.016

### 3.2. Model design and result analysis

#### 3.2.1. Panel data model results analysis

Panel data models generally include fixed effect model, mixed estimation model and random effect model. The development level of new quality productivity is taken as the explanatory variable, and the government's support to the development of new quality productivity is taken as the explanatory variable. The amount of foreign investment, fintech index, digital inclusive financial index, the proportion of software business income to GDP, the proportion of information technology service income to GDP, and the proportion of e-commerce enterprises were used as control variables. Ordinary least squares model, namely mixed estimate model, fixed effect model and random effect model, is used to study the influence of government support on the development level of new quality productivity, the regression results are shown in table 4.

**Table 4.** ols, Re, FE regression results.

Variables	Traditional OLS	Random effects regression (RE)	Fixed-effect regression (FE)
Frequency of new quality productivity-related words in government work reports	0.008 * * (0.214)	0.008 * * (0.075)	0.057 * (0.075)
Foreign investment in the province	0.125 (0.058)	0.711 (0.062)	0.610 (0.068)
Fintech index	0.001 * * * (0.068)	0.027 * * (0.073)	0.095 * (0.065)
Digital Financial Inclusion Index	0.304 (0.096)	0.080 * (0.101)	0.040 * * (0.092)
Software revenue as a percentage of GDP	0.001 * * * (0.057)	0.147 (0.235)	0.000 * * * (0.078)
Revenue from information technology services as a proportion of GDP	0.000 * * * (0.044)	0.111 (0.148)	0.001 * * * (0.041)
Proportion of enterprises engaged in e-commerce transactions	0.575 (0.072)	0.527 (0.117)	0.076 * (0.075)
Const	0.290 (0.101)	0.531 (0.126)	0.068 * (0.121)
Sample size	330	330	330
Fit	0.786	0.761	0.738

Note: \* \* \* , \* \* , \* represent 1% , 5% , 10% significance levels respectively

Next, an F-test was performed, and the result of the f-statistic had a p-value of 0.000.0.01, meaning that the original hypothesis was rejected at the 1% significance level, thus negating the results of the OLS regression model. The Hausmann test showed that the P value was 1, that is, the original hypothesis could not be rejected and the RE model was better. The Breusch-pagan test was used for the selection comparison of the RE model and the POOL model. A P value less than 0.05 means that the RE model is better. Therefore, the fixed effects model (RE) was chosen for the regression analysis of the empirical results. Specific test results are shown in table 5.

**Table 5.** F tests Breusch-Pagan test with Hausman test results.

Type of validation	Statistics	P	Conclusion
F test	6.042	0.000 * * *	Fe model
Breusch-pagan test	38.929	0.000 * * *	RE model
Hausman test	- 139100.397	1.000	RE model

Note: \* \* \* , \* \* , \* represent 1% , 5% , 10% significance levels respectively

From the perspective of explanatory variables, the degree of government support for the development of new qualitative productivity has a positive effect at the 5% significance level. Therefore, the government should actively support the development of new-quality productivity, improve the policy of training talents, encourage the innovation of science and technology products, and then improve the development level of new-quality productivity. Table 5 shows that for every unit increase in government support for the development of new qualitative productivity, the new qualitative productivity will increase by 0.008 units. Both the traditional OLS regression and the fixed-effect and random-effect regression show that the government's support for the development of new qualitative productivity has a positive effect on the development of new qualitative productivity, but the positive guidance and promotion effect is relatively weak.

### 3.2.2. Robustness test

In order to ensure that the conclusions of this paper are not subject to the selection of control variables, on the basis of the original model, the control variables, such as the amount of foreign investment in the province, the index of financial technology, the Index of digital inclusive finance, the proportion of software business income to GDP, and the proportion of information technology service income to GDP, were excluded in turn, as shown in Table 6, the results are still robust.

**Table 6.** Removes regression results for control variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Frequency of new quality productivity-related words in government work reports	0.008 * * (0.075)	0.062 * (0.074)	0.005 * * (0.068)	0.003 * * (0.068)	0.004 * * (0.078)	0.000 * ** (0.091)	0.000 * ** (0.131)
Foreign investment in the province	0.711 (0.062)						
Fintech index	0.027 * * (0.073)	0.083 * (0.065)					
Digital Financial Inclusion Index	0.080 * (0.101)	0.042 * * (0.092)	0.043 * * (0.092)				
Software revenue as a percentage of GDP	0.147 (0.235)	0.000 * ** (0.078)	0.000 * ** (0.076)	0.000 * ** (0.076)			
Revenue from information technology services as a proportion of GDP	0.111 (0.148)	0.001 * ** (0.041)	0.002 * ** (0.041)	0.001 * ** (0.041)	0.000 * ** (0.027)		
Proportion of enterprises engaged in e-commerce transactions	0.527 (0.117)	0.079 * (0.075)	0.095 * (0.075)	0.747 (0.053)	0.158 (0.06)	0.272 (0.196)	
Const	0.531 (0.126)	0.064 * (0.101)	0.108 (0.1)	0.340 (0.094)	0.057 * (0.104)	0.569 (0.251)	0.061 * (0.141)
Sample size	330	330	330	330	330	330	330
Fit	0.761	0.736	0.736	0.727	0.717	0.156	0.085

Note: \*\*\*, \*\*, \* represent 1%, 5%, 10% significance levels respectively

## 4. Conclusions and recommendations

Because the new quality productivity is an important driving force for high quality economic development, and the government's support plays an important role in guiding and promoting the development of the new quality productivity, therefore, it is of great significance to study the impact of government support on the development of new qualitative productivity, but there are few studies on the measurement of these two indicators or the relationship between them. Therefore, we based on the manual collection of 2011-2023 China's 30 provinces 510 government work reports, combined with Python software, the paper measures the government's support for the development of new qualitative productivity, draws word cloud graph and nuclear density graph to show the text features, constructs the index system of the development of new qualitative productivity, and carries on the

principal component analysis, this paper measures the development level of new quality productivity and empirically tests the mechanism of government support on the development of new quality productivity with panel data model. Finally, the paper concludes that the provincial government policy has a positive effect on the development of new quality productivity. At the same time, we put forward the following suggestions for the work of the government:

In the aspect of government policy-making, we suggest that we should pay more attention to supply-side reform and carry it out, so as to provide a good environment for the efficient and high-quality development of new quality productivity. In order to improve the pertinence and adaptability of policies, the government should have a deep understanding of the actual needs of the development of new-quality productive forces, pay attention to the development trends of industries, change the direction of policies at the right time and focus on long-term development, formulate more realistic and targeted policies. At the same time, we should strengthen the interface between policy and market, ensure that policy can guide the flow of market resources to new quality productivity, ensure that new quality productivity has scenario application, and encourage patent transformation. We will encourage all sectors of society to participate in policy formulation and evaluation, and make policies more scientific and democratic. Second, we should lead by innovation. Disruptive, original technological innovation is the most important form of innovation.

According to the degree of policy implementation and realization, the government should establish and improve the policy implementation and supervision mechanism to ensure the effective implementation of the policy. It shall regularly assess the progress of policy implementation and adjust and improve the contents of policies in a timely manner. We should also strengthen the training and management of policy practitioners to improve their implementation and sense of responsibility.

In the optimization of resource allocation, the establishment of a sound resource allocation mechanism to ensure the efficient and rational allocation of capital, technology, talent and other factors to the new quality of productivity. We will invest more in new, high-quality productive forces and make more efficient use of public resources. We will create an enabling environment for innovation, attract and retain talented people, and actively train and develop them.

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