



# Government Digital subsidies, Digital Innovation and High-quality Enterprise Development

Wenqian Cao<sup>\*</sup>; Shuo Ma<sup>a</sup>; Pengcheng Wang<sup>b</sup>; Songqiang Wu<sup>c</sup>

School of Economics and Management, Nanjing University of Technology, Nanjing China

<sup>\*</sup>Caowq7727@163.com; <sup>a</sup>mashuo6666@163.com;

<sup>b</sup>wpch2022@njtech.edu.cn; <sup>c</sup>wsq9271@126.com

**Abstract.** In the context of digital economy, the government promotes the digital transformation of enterprises by providing special subsidies, so as to empower the high-quality development of enterprises. Based on the data of listed enterprises related to the digital economy from 2001 to 2021, this paper innovatively examines the impact of government digital subsidies on the high-quality development of enterprises from the perspective of digital innovation by using text analysis and other methods. The research results show that government digital subsidies can achieve high-quality development of enterprises by positively promoting digital innovation. The above research results enrich the research on the implementation effect of special government subsidies, provide evidence support for the theoretical mechanism of digital technology enabling the development of the real economy, and also provide practical enlightenment for Chinese enterprises to achieve digital transformation and promote the high-quality development of enterprises.

**Keywords:** government digital subsidy, digital innovation, high-quality development of enterprises

## 1 Introduction

The report of the 20th National Congress of the Communist Party of China stressed that high-quality development is the primary task of comprehensively building a modern socialist country. China's economy is facing a transition from high-speed growth to high-quality development. Improving total factor productivity is not only a key way to achieve high-quality development, but also one of the core indicators to test high-quality development (Wu C.Q., et al.,2022)<sup>[1]</sup>. In the era of digital economy, accelerating digital technology innovation is an inevitable requirement to promote the high-quality development of digital economy.

Research and development subsidies play an important role in the various means by which the state encourages enterprises to innovate. With the increasing intensity of various tax incentives, financing support and other policies, the ways in which the government supports enterprises to carry out scientific and technological innovation are also

more diversified. However, whether government subsidies play a positive role in promoting the development of enterprises or crowd out the effect is still controversial. In order to obtain subsidies, some enterprises adopt the innovation strategy of "heavy quantity, light quality", mainly carrying out strategic innovation to pursue more patent quantity, rather than substantive innovation to improve quality (Yan J.B., et al.,2023)<sup>[2]</sup>. In the context of digital economy, in order to facilitate the digital transformation of enterprises and encourage enterprises to carry out digital technology innovation, the government has introduced various subsidies, tax incentives and other policies, but whether it can achieve high-quality development of enterprises through promoting digital innovation remains to be verified. Based on this, this paper takes the digital core industry as the research object and explores the impact of various digital subsidies introduced by the government on the high-quality development of enterprises under the background of digital economy from the perspective of digital innovation.

## 2 Theoretical Analysis and Research Hypothesis

Digital transformation is an ongoing and complex organizational effort that plays a critical role in both competitiveness and sustainability (Mahboub and Sadok, 2023)<sup>[3]</sup>. As one of the important means to promote the digital transformation of enterprises, government subsidies have a different impact on enterprise performance and the transmission mechanism behind it. On the one hand, government subsidies can directly provide funds for enterprises, alleviate the financing constraints faced by enterprises, make up for part of the innovation costs of enterprises, and release the advantage signal of technological research and development of enterprises to the outside world to attract more venture capital. On the other hand, government subsidies may distort the incentive effect of R&D subsidies, and may even cause moral hazard and adverse selection problems, leading enterprises to prefer strategic innovation.

At present, due to the strong spillover of innovative knowledge, and the security of data and technology needs to be improved, enterprises cannot immediately obtain the corresponding economic returns from the market, which seriously dampened the enthusiasm of enterprises. Therefore, the government usually provides various kinds of subsidies to form a positive incentive effect on enterprises to achieve the goal of promoting high-quality economic growth. Studies have shown that government research and subsidies can promote high-quality development of enterprises. Such subsidy measures have played a significant role in improving the innovation performance and business performance of enterprises, thus promoting the high-quality development of enterprises. Through financial subsidies, enterprises get financial support and the economic burden can be reduced. This allows enterprises to carry out technological research and development innovation with more confidence. At the same time, the injection of subsidy funds also improves the production efficiency of enterprises and further promotes high-quality economic growth(Tang M., et al.,2023)<sup>[4]</sup>. In view of this, this paper proposes the following hypothesis:

Hypothesis 1: There is a positive correlation between government digital subsidies and high-quality development of enterprises.

Digital innovation offers companies new opportunities to increase the value created for customers through new products and services (Åström et al. 2022)<sup>[5]</sup>, but faces externalities and resource constraints due to its high-risk, high-input and positive externalities. Government subsidies, as the direct capital supply of the government, can make up for the insufficient return on innovation caused by imitative innovation and free-riding, subsidize innovation losses, reduce innovation risks, directly reduce the fixed cost of innovation, ease the constraint of innovation resources, and enable enterprises to actively invest in innovation activities, so as to achieve high-quality development. Even if the enterprise is motivated by the strategic acquisition of subsidies, after obtaining government subsidies, in order to cope with the government inspection and acceptance mechanism, the enterprise will actively carry out digital innovation activities, thus promoting the high-quality development of the enterprise. Based on this, this paper proposes:

Hypothesis 2: Government digital subsidies promote the high-quality development of enterprises by positively influencing their digital innovation

### 3 Method

#### 3.1 Sample

Based on the scope of digital economy determined in the Statistical Classification of Digital Economy and Its Core Industries (2021) issued by the National Bureau of Statistics in May 2021, and based on operability and data availability, this paper selects core enterprises of digital economy. That is, Chinese A-share listed companies in four industries, namely computer communication and other electronic equipment manufacturing industry, telecommunications, radio and television and satellite transmission services, Internet and related services, software and information technology service industry, are taken as samples, and the sample panel data from 2001 to 2021 are removed from St-class enterprise samples, deleted from missing key variable samples and performed tail reduction processing. Finally, 5935 valid sample data were obtained.

#### 3.2 Measures

**High quality development of enterprises.** Enterprise total factor productivity (TFP) is a comprehensive productivity that covers the changes of various internal factors required by enterprise development. Therefore, this paper adopts enterprise total factor productivity (TFP) as an indicator of high-quality development of enterprises, and adopts the OP method proposed by Olley and Pakes (1996) to estimate enterprise total factor productivity. At the same time, LP method is used to re-measure the total factor productivity of enterprises to test the reliability of the results.

**Government digital subsidies.** Based on the method proposed by Sun W.Z. et al. (2023)<sup>[6]</sup>, this paper manually selects keywords related to digital innovation through the name of government subsidies, including: digital, Internet, data, network, wisdom, intelligence, cloud computing, electronic information, etc. Based on the above keywords, within the listed company's annual report, the amount of digital subsidies received by

the enterprise is selected and +1 is selected for the natural logarithm (i.e., the total amount of digital subsidies +1 is selected for the natural logarithm).

**Enterprise digital innovation.** This paper draws on the statistical methods of existing studies and analyzes the contents of patent application documents according to the keywords of digital technology, so as to calculate the number of digital patent applications of listed companies in each year to measure the digital innovation of enterprises.

**Control variables.** Indicators such as firm age, growth, financial leverag, liquidity ratio, net profit, board size and cashflow are selected as control variables.

### 3.3 Descriptive statistics

Table 1 reports the descriptive statistical results of the study variables. The results show that the difference between the maximum and minimum values is significant, whether it is the number of government digital subsidies each year, the logarithmic result of the amount, or the number of digital innovations.

**Table 1.** Descriptive statistics

Variable	N	Mean	Sd	Min	Max
Subsidy	5935	0.369166	0.4826196	0	1
Subsidy_num	5935	1.218366	2.802179	0	36
Subsidy_value	5935	5.382402	7.166485	0	21.47482
Digital innovation	5935	30.1112	166.9368	0	4902
TFP_op	5935	6.382604	0.814498	3.425656	10.80464
TFP_lp	5935	8.097418	0.9774272	4.371799	12.71257
Firm age	5935	2.744039	0.4062271	1.098612	3.610918
Growth	5935	0.2053232	0.4184634	-0.6696326	4.024214
Financial leverage	5935	0.3657763	0.1859625	0.0274426	0.9078884
Liquidity ratio	5935	3.025081	3.110256	0.2361502	30.57504
Netprofit	5935	0.0631744	0.1999332	-1.980436	0.5491831
Board size	5935	2.098852	0.2176624	1.098612	2.833213
Cashflow	5935	0.0429708	0.0657758	-0.2139342	0.2825168

## 4 Results

In this paper, Stata was used to conduct baseline regression analysis robustness test and mechanism test on 5935 sample data after controlling other influencing factors and fixed effects. The results are as follows.

The results show that after controlling other influencing factors and fixed effects, the coefficient of government digital subsidy amount in column (1) is positive, indicating that government digital subsidy is conducive to the improvement of total factor productivity of enterprises, and then verify hypothesis 1. In this paper, by changing the measurement method of variables, LP method is used to re-measure the total factor productivity of enterprises, and the main effect test is carried out. As can be seen from column (2), the result is still significant, and hypothesis 1 is again verified.

Based on the perspective of digital innovation, this paper explores the path mechanism of high-quality development of enterprises driven by government digital subsidies. As shown in column (3), government digital subsidies promote digital innovation, thereby improving total factor productivity of enterprises and achieving high-quality development of enterprises. Hypothesis 2 is verified. As show in table 2.

**Table 2.** Baseline regression, robustness test and mechanism test

	(1)	(2)	(3)
	<i>TFP_op</i>	<i>TFP_lp</i>	<i>TFP_op</i>
<i>digital innovation</i>			0,001*** (0,000)
<i>subsidy_value</i>	0,003** (0,001)	0,005*** (0,001)	0,003** (0,001)
<i>controls</i>	control	control	control
<i>Constant</i>	4,106*** (0,287)	5,179*** (0,322)	4,154*** (0,286)
<i>N</i>	5,935	5,935	5,935
<i>R</i> <sup>2</sup>	0,489	0,532	0,490

Note: Standard errors in parentheses \*p<0.1, \*\*p<0.05, \*\*\*p< 0.01. Robust standard errors are in brackets

## 5 Conclusion

Using the data of listed companies in China's digital core industry, this paper analyzes the impact of government digital subsidies on the high-quality development of enterprises from the perspective of digital innovation. Empirical evidence shows that government digital subsidies can promote the high-quality development of enterprises by promoting their digital innovation.

Through this study, the following Revelations are brought to enterprises in the digital core industry: First, the government's digital subsidies play a crucial role in stimulating the digital innovation activities of enterprises. Therefore, the government should focus on increasing the investment in digital subsidies, provide adequate financial support, stimulate the enthusiasm and creativity of enterprises, give play to the leading role of digital innovation, and achieve high-quality development of enterprises by promoting their digital technology innovation. Second, after obtaining the special subsidies issued by the government, enterprises should make full use of them to complete digital innovation, accelerate the digital transformation and upgrading of core business links, and achieve high-quality development of enterprises.

## References

1. Wu C.Q.,(2022) Zhang K.X., Zhou X.Y., et al. Digital transformation, competitive strategy selection and high-quality development of enterprises: Evidence based on machine learning and text analysis. *Journal of Economic Management*, 44(04):5-22.
2. Yan J.B., He X.G., Chen Y., et al. (2023) Value Reengineering of troubled Enterprises: Substantive Innovation or Strategic Innovation? *Management Review*, 35(06):92-110.
3. H. Mahboub, H. Sadok (2023) Implementing enterprise digital transformation: A contribution to conceptual framework design. *Nankai Business Review International*, 14, p. 35
4. Tang M., Ye X.G., Ma Y.C. (2023) Effect evaluation of innovation incentive policy on innovation quality of high-tech enterprises: Empirical evidence from Guangdong. *Science and Technology Management Research*, 43(2):75-82.
5. Strm J , Reim W , Parida V (2022) Value creation and value capture for AI business model innovation: a three-phase process framework. *RMS* 16(7):2111–2133.
6. Sun W.Z., Mao N., Lan F., et al. (2023) Policy Empowerment, Digital Ecology and Enterprise Digital Transformation: A Quasi-natural Experiment Based on the National Comprehensive Test Area of Big Data. *China Industrial Economics*, (09): 117-135.

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

