# Digital Economy and Government Public Service Quality - Experience and Evidence from China

Jiachuan Lu

lujc@s.hrbcu.edu.cn

Harbin University of Commerce, School of Finance and Public Administration, Heilongjiang province Harbin 150028, China

**Abstract.** This paper utilizing data from 30 provinces in China (excluding Tibet) spanning from 2012 to 2021, empirically examines the impact of the digital economy on the quality of government public services. The empirical results remain valid even after various robustness tests.The research finds that: (1) The advancement of the digital economy greatly enhances the quality of public services provided by the government. (2) The results of the heterogeneity analysis reveals that the influence of the digital economy on the quality of government public services is region-dependent, showing a more significant improvement in the eastern region. The following policy recommendations are proposed: (1) Foster the robust growth of the digital economy and enhance the quality of public services. (2) Enhancing cooperation in basic public services and optimizing spatial layout. (3) Digital Crisis Management.

**Keywords:** Digital Economy; Government Public Service; Digital Management

## 1 Introduction

In the global context, the rapid evolution of digitalization and information and communication technologies has profoundly impacted social structures and individual behaviors, marking the entry of the world into the digital era[1]. Innovation and development in the digital age are inseparable from the digital economy. Digital economy become an important component of global economic growth. It not only changes the operational models of traditional industries but also gives rise to new industries and service forms. The quality of public services is a foundational condition for rapid social progress[2], and local governments, as key providers of public services, play a decisive role in enhancing their quality[3].In the digital economy era, the methods of public services are managed is evolving, with an extensive application of digital management in the government service. Against this backdrop, this study utilizes data from 30 Chinese provinces (Tibet excluded) over decade from 2012 to 2021 to conduct an empirical analysis of how the digital economy affects the quality of government public services. The unique contributions of this paper include: (1) Addressing the previously unexplored area of how the digital economy impacts the quality of government public services, thereby providing additional theoretical groundwork that is crucial for future enhancements in public service quality and has profound practical implications. (2) Based on the research conclusions, it proposes paths for improving government public service construction for policymakers to reference, providing theoretical support for subsequent policy formulation.

BDEDM 2024, January 12-14, Ningbo, People's Republic of China

DOI 10.4108/eai.12-1-2024.2347217

## 2 Research hypothesis

The influence of the digital economy on the quality of public services can be summarized in the following aspects:

1. Efficiency Enhancement: Big data analytics can automate and optimize public service processes, reducing human errors and enhancing the speed and accuracy of services[4]. This leads to more efficient resource allocation, ensuring resources are directed where they are most needed based on data analysis.

2. Improvement in Service Quality: The digital economy, by analyzing user data, enables public services to offer more personalized services, better meeting the individual needs of citizens[5]. Digital technologies encourage innovation, allowing public service institutions to provide new modes of service, such as telemedicine and online education[6].

3. Increased Inclusiveness: Digital platforms can extend the reach of public services to wider areas, especially remote regions, thereby narrowing the urban-rural gap[7]. With digital means, the cost of providing public services can be reduced, making them more affordable and accessible to a larger number of people[8].

Based on this, the paper proposes the research hypothesis $H_1$: The digital economy has a significant incentive effect on improving the quality of government public services.

## 3 Research design

### 3.1 Baseline regression model specification

This paper use a two-way fixed effects model to measure the impact of the digital economy on the quality of government public services, with the empirical model specified as follows:

$$\mathrm{Gpsq}_{it} = \alpha_0 + \alpha_1 \mathrm{Dige}_{it} + \alpha_n \sum_{j=1}^{5} \mathrm{controls}_{it}^{j} + \delta_i + \mu_t + \varepsilon_{it} \quad (1)$$

$Gpsq_{it}$ represents the quality of government public services, $Dige_{it}$ represents the digital economy index, $\sum controls_{it}$ represents a series of control variables, $\delta_i$and $\mu_t$represents the fixed effects of province and time, respectively. $\varepsilon_{it}$ represent a random disturbance term.

### 3.2 Variable description

Dependent Variable: Government Public Service Quality (*Gpsq*). In order to obtain a more comprehensive evaluation of government public service quality, this article integrates macro public service government investment indicators and micro public satisfaction indicators, draws on existing research, and based on the basic public services provided by local governments, constructs five secondary indicators including public education, medical and health, public transportation, social security, ecological environment, etc. The government public service quality measurement system for ten tertiary indicators is shown in Table1. To eliminate subjective bias in weighting, this article initially applies range standardization to transform the chosen indicators into a non-dimensional form. Subsequently, it employs the entropy method to establish the weights of each indicator and computes the *Gpsq* score for the digital economy across 30 provinces.

**Table 1.** Government Public Service Quality Measurement System and Indicator Weight.

| Level 1 | Level 2 | Level 3 Indexes | Arribute | Indicator Weight |
|---|---|---|---|---|
| Government Public Service Quality | Public Education | People's Average Education Years | + | 0.061544 |
| | | per Capita Owning Public Library Collections | + | 0.199108 |
| | Hygienism Care | per 10000 People Beds in Medical Institutions | + | 0.066763 |
| | | per 10000 People Owning Practicing Assistant Physicians | + | 0.067744 |
| | Public Transportation | per 10000 People Owning Public Transport Vehicles | + | 0.065682 |
| | | per 10000 People Owning Public Toliet | + | 0.077817 |
| | Social Security | Livehood Financial Expenditure Proportion | + | 0.028508 |
| | | Urbanization Rate | + | 0.066567 |
| | Ecological Environment | Forest Coverage Rate | + | 0.111693 |
| | | Carbon Emission Intensity | + | 0.254569 |

Explanatory Variable: Digital Economy (*Dige*).Up to now, there is no consensus in the academic world on a standardized approach to measure the digital economy. Referencing on exists research, this study develops an evaluative framework for the digital economy, which includes three key areas. For the evaluation process, the entropy method is used, as detailed in Table 2.

**Table2.** Indicators and Weightings for the Digital Economy Evaluation System.

| Level 1 | Level 2 | Level 3 | Attribute | Indicator Definition | Indicator Weight |
|---|---|---|---|---|---|
| Digital Economy | Digital Infrastructure | Mobile phone penetration | + | per 100 people Owning Mobile Phones | 0.090793 |
| | | Degree of information transfer | + | Fiber optic cable density（km/km$^2$） | 0.072622 |
| | | Degree of network coverage | + | IPV4 number（pcs） | 0.131172 |
| | | Internet broadband infrastructure | + | Internet Broadband Access Port Density（pcs/km$^2$） | 0.071660 |
| | Digital Industrialization | Internet-related practitioners | + | Information Transmission, Software and Information Technology Services Urban Employment/Urban Employment | 0.196884 |
| | | Internet-related outputs | + | Total telecommunications operations/year-end resident population | 0.041966 |
| | | Information technology service levels | + | Information Technology Services Revenue (10,000) | 0.068739 |

| | | | | |
|---|---|---|---|---|
| Industrial Digitalization | The level of e-commerce development | + | E-commerce sales (100 million) | 0.103 806 |
| | Level of Electronic Manufacturing Development | + | Electronic Information Manufacturing Revenue（10,000） | 0.037 850 |
| | The degree of Enterprise Digitalization | + | Number of Electronic Information Manufacturing Enterprises（pcs） | 0.069 594 |
| | Software and Information Technology Services | + | Software Revenue（10,000） | 0.055 340 |
| | Digital Inclusion Financial Index | + | Peking University Digital Financial Inclusion Index | 0.059 568 |

Control Variables: This study selection of control variables primarily focusing on aspects such as resident population (*pop*), industrial structure *(struc*), foreign direct investment (*FDI*), government intervention (*gov*), and innovation degree (*inov*). Five variables were chosen to minimize the potential mediating role between the digital economy and the public services quality.

$$\sum_{i=1}^{5} controls_{it}^{j} = \beta_1 Pop_{it} + \beta_2 Struc_{it} + \beta_3 FDI_{it} + \beta_4 Gov_{it} + \beta_5 Inov_{it} \quad (2)$$

The names, symbols, and meanings of each variable are provided in Table 3.

**Table 3.** Control Variable Descriptions.

| Variable Type | Name | Symbol | Value |
|---|---|---|---|
| Control Variable | Resident Population | *pop* | The total resident population end of the year. |
| | Industrial Structure | *struc* | Ratio of the secondary and tertiary industries |
| | Foreign Direct Investment | *FDI* | FDI/GDP |
| | Government Intervention | *gov* | General financial expenditure/regional gross domestic product(GDP) |
| | Degree of Innovation | *inov* | Degree of Innovation |

### 3.3 Data description

Due to limitations in the National Bureau of Statistics, data for many of the evaluation indicators and variables discussed in this paper are not yet available for 2022. The original data covered in this paper ends in 2021. All the basic indicator data related to the public service and the control variables are sourced from the China National Bureau of Statistics. A descriptive statistical overview of each variable is given in Table 4.

**Table 4.** Descriptive statistics of each variable.

| Variable Type | Symbol | Obs | Mean | Std.Dev | Min | Max |
|---|---|---|---|---|---|---|
| Dependent Variable | *Gpsq* | 300 | 0.273 | 0.0726 | 0.125 | 0.478 |
| Explanatory Variable | *Dige* | 300 | 0.524 | 0.153 | 0.138 | 0.927 |
| | *pop* | 310 | 4483 | 2917 | 315 | 12684 |
| | *struc* | 310 | 9.579 | 1.540 | 4.394 | 12.40 |
| Control Variable | *FDI* | 310 | 0.0177 | 0.0145 | 0.0006 | 0.0796 |
| | *gov* | 310 | 0.280 | 0.192 | 0.107 | 1.334 |
| | *inov* | 310 | 0.501 | 0.0881 | 0.345 | 0.841 |

# 4 Empirical results analysis

## 4.1 Analysis of the baseline regression results

Using the model proposed in this article, the influence of the digital economy on the quality of government public services was assessed. Model (1) represents the results obtained using a two-way fixed effects model without controlling variables.The estimated coefficient for the digital economy is 0.015, which is significantly positive at the 1% level, indicating that the growth of the digital economy has notably improved the quality of public services. Model (2) does not control for time and individual fixed effects, but incorporates a series of control variables.The estimated coefficient for the digital economy increases to 0.042, suggesting that the inclusion of additional control variables enhances the model's explanatory power to some extent. Model (3) is the model equation from formula (1) in this article, incorporating control variables and two-way fixed effects. The estimated coefficient is 0.042, which is significantly positive at the 1% level, and R2 increases to 0.962, indicating that the model's goodness of fit is notably higher than models (1) and (2). This suggests that the two-way fixed effects model selected in this article is highly suitable. Overall, the estimated coefficients for the digital economy (*Dige*) in models (1), (2), and (3) are all significantly positive, preliminarily confirming the hypothesis proposed in this articl. $H_1$: The digital economy has a significant incentive effect on improving the quality of government public services. Table 5 displays the regression results.

**Table 5**. Baseline Regression Results.

| Model | (1) | (2) | (3) |
|---|---|---|---|
| | *Gpsq* | *Gpsq* | *Gpsq* |
| *Dige* | 0.015*** | 0.042*** | 0.042*** |
| | (0.092) | (0.089) | (0.058) |
| *pop* | | -0.032** | -0.031** |
| | | (0.000) | (0.000) |
| *struc* | | 0.005*** | 0.005*** |
| | | (0.004) | (0.003) |
| *FDI* | | -0.038* | -0.038* |
| | | (0.158) | (0.122) |
| *gov* | | 0.017** | 0.017** |

| | | | |
|---|---|---|---|
| | | (0.051) | (0.030) |
| *inov* | | 0.083* | 0.083* |
| | | (0.069) | (0.045) |
| constant | 0.229*** | 0.142** | 0.166** |
| | (0.038) | (0.092) | (0.065) |
| Time FE | Yes | No | Yes |
| Entity FE | Yes | No | Yes |
| N | 300 | 300 | 300 |
| $r^2$ | 0.788 | 0.792 | 0.962 |

### 4.2 Endogeneity problem handling

Drawing from existing research, this paper use the instrumental variable method to tackle endogenous problems. Given the need for digital connectivity among regions in the enhance of the digital economy, and given that mobile phone base stations are a foundational step in China's network interconnectivity, we select the density of mobile phone base stations as our instrumental variable. Table 6 presents the estimation results based on the instrumental variable 2SLS approach.

**Table 6.** Estimation results of instrumental variables.

| Variable | Government Public Service Quality | |
|---|---|---|
| Model | OLS | 2SLS |
| *Dige* | 0.042*** | 0.143*** |
| | (0.089) | (0.871) |
| control variable | Yes | Yes |
| constant | 0.166** | 0.175*** |
| | (0.065) | (0.554) |
| N | 300 | 300 |
| Kleibergen-Paap rk LM | | 32.135*** |
| | | [0.00] |
| Kleibergen-Paap rk LM Wald F | | 34.196 |
| | | [14.16] |
| $R^2$ | 0.962 | 0.966 |

Notes: Stock-Yogo under 10% significance in []

The initial stage regression outcomes show a great positive correlation at the 1% level between the instrumental variable and the quality of government public services. When addressing endogeneity, it appears that the digital economy more robustly enhances the quality of public services, affirming the validity of hypothesis H1 in this study. The Kleibergen-Paap rk LM statistic is 0, allowing for the rejection of the null hypothesis of non-identifiability at the 1% significance level. Furthermore, the F statistic from the Kleibergen-Paap rk LM Wald F test surpasses the Stock-Yogo critical threshold, demonstrating that, even when considering endogeneity, the digital economy continues to significantly boost public service quality at the 10% significance level.

### 4.3 Robustness test

1. Substitute variables. Re-measure the digital economy and public service quality index using principal component analysis and perform regression analysis[9].

2. Conduct trimming. To eliminate the adverse effects of outliers and non-randomness on the measurement results, this paper performs trimming of the main explanatory variables within ±1%[10]. The results of two robustness tests are consistent with the aforementioned findings.

### 4.4 Regional heterogeneity analysis

To validate the regional variations in the impact of the digital economy on the quality of government public services, this study categorized the sample data into eastern, central, western, and northeastern regions based on the National Bureau of Statistics' regional classification. A two-way fixed effect model was employed for subgroup regression analysis, as presented in Table 7. The coefficients for the western and northeastern regions were not significant.This suggests notable regional disparities in the digital economy's influence on public service quality improvement.

**Table 7.** Regional heterogeneity analysis.

| REGION | Eastern | Central | Western | Northeastern |
|---|---|---|---|---|
| VARIABELS | *Gpsq* | *Gpsq* | *Gpsq* | *Gpsq* |
| *Dige* | 0.026** | -0.020*** | -0.006 | -0.012 |
| | （0.011） | （0.007） | （0.009） | （0.010） |
| constant | 0.161*** | 0.365 | 0.280 | 0.350 |
| | （0.003） | （0.008） | （0.013） | （0.055） |
| control variables | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Entity FE | Yes | Yes | Yes | Yes |
| N | 100 | 60 | 110 | 30 |
| R-squared | 0.957 | 0.953 | 0.951 | 0.951 |

## 5 Conclusions

Drawing on data from 30 provinces in China (excluding Tibet) spanning 2012 to 2021, this study delves into the influence of the digital economy on the quality of government public services through empirical analysis.After addressing potential endogenous issues and undergoing various robustness checks, the obtained results remain consistent.The study reveals the following findings: (1) The digital economy has notably enhanced the quality of government public services in a positive manner. (2) When considering regional heterogeneity, the impact of the digital economy on the quality of government public services differs across regions, with this effect being particularly pronounced in eastern China. In light of these findings, this article offers corresponding policy recommendations：

1. Establishing a digital public service management framework. Enhancing the construction of information and communication infrastructure is the key to promoting the development of the digital economy. The government invests in information and communication technology infrastructure, expands broadband networks, strengthens wireless network signal coverage,

improves network speed, and unblocks key links in urban management, providing the necessary material foundation for the development of the digital economy.Then establish a public service perception and interaction mechanism, and use digital technology to strengthen the interaction between the public and the government. Use integrated government service platforms or mobile applications to provide more convenient and efficient public services for citizens and solve issues of public concern. By combining the progress of the digital economy with improving the quality of public services, a synergistic effect can be achieved, which can produce significant benefits. The government can provide services more effectively, while also providing more convenience for enterprises and citizens, forming a positive feedback mechanism and promoting social and economic growth. Digital public services emphasize universality. In view of the gap in the development of the digital economy in eastern, central and western regions of China, support should be strengthened in the formulation of policies for the central and western regions, providing additional financial assistance, tax incentives or technical support to stimulate the development of the digital economy in these regions and bridge the digital divide, ensuring that every citizen can enjoy quality public services.

2. Enhancing cooperation in basic public services and optimizing spatial layout. Establishing an effective cross-regional data sharing platform is pivotal for promoting balanced regional development.From the perspective of regional economics, policy makers need to adopt a multi-level governance framework, encompassing collaborative efforts among local governments, the central government, and non-governmental organizations, to construct a cross-departmental and cross-level government service center. By breaking down information silos, smoothing out data, optimizing resource allocation, and ensuring that all regions can benefit from the rapid development of the digital economy. Furthermore, incorporating emerging digital technologies such as artificial intelligence, the Internet of Things, and big data into public services is crucial for enhancing their quality and efficiency.In the educational sector, personalized learning platforms and virtual classrooms can be utilized to bridge the urban-rural education gap, allowing students nationwide to attend the same class, thus mitigating issues stemming from regional disparities in educational resources.In the healthcare sector, telemedicine and intelligent diagnostic systems can provide better healthcare services to remote areas, enabling remote consultations and surgeries through next-generation information and communication technologies such as 5G. In the transportation domain, intelligent transportation systems can effectively enhance the efficiency and safety of urban traffic management, reducing traffic congestion and boosting citizens' well-being. In the ecological environment, digitalized intelligent detection systems can detect factory emissions in real-time, promptly shutting down enterprises that exceed pollution standards, allowing citizens to enjoy a beautiful living environment.

3. Digital Crisis Management. During natural disasters or public crises, government regulatory bodies can utilize advanced digital technologies to respond swiftly and effectively. By leveraging real-time data analysis, satellite imagery processing, social media monitoring, artificial intelligence, and the Internet of Things, critical information is promptly collected and analyzed. Additionally, social media platforms have emerged as pivotal sources of information and communication channels. The government can disseminate emergency notifications, safety guidelines, and rescue information through these platforms, while simultaneously gathering public feedback and assistance requests. The application of artificial intelligence and machine learning techniques allows for rapid identification of patterns and prediction of risks

from vast amounts of data, playing a crucial role in early warning and disaster mitigation. Digital crisis public relations can enhance the efficiency and precision of resource allocation, reducing the harm caused by disasters to people's lives and property, thereby bolstering the overall resilience and recovery capabilities of society, and subsequently elevating the quality of public services.

## References


[1] Dunleavy, Patrick, and Helen Margetts. "Data science, artificial intelligence and the third wave of digital era governance." Public Policy and Administration (2023): 09520767231198737.

[2] Guo, Bingnan, et al. "Impact of the digital economy on high-quality urban economic development: Evidence from Chinese cities." Economic Modelling 120 (2023): 106194.

[3] Lyu, Yanwei, et al. "How does digital economy affect green total factor productivity? Evidence from China." Science of The Total Environment 857 (2023): 159428.

[4] Limna, Pongsakorn, Tanpat Kraiwanit, and Supaprawat Siripipatthanakul. "The Growing Trend of Digital Economy: A Review Article." International Journal of Computing Sciences Research 7 (2023): 1351-1361.

[5] Leadbeater, Charles. "Personalisation through participation: A new script for public services." Social Work. Routledge, 2023. 236-239.

[6] Farazmand, Ali, ed. Global encyclopedia of public administration, public policy, and governance. Springer Nature, 2023.

[7] Thanh, To Trung. "Effects of digital public services on trades in green goods: does institutional quality matter?." Journal of Innovation & Knowledge 7.1 (2022): 100168.

[8] Chen, Bin , et al. "The disembedded digital economy: Social protection for new economy employment in China." Social Policy & Administration 124(2020).

[9] Hans-Horst, Konkolewsky . "Digital economy and the future of social security." Administration 65(2017).

[10] Faulkner-Gurstein, Rachel , and D. Wyatt . "Platform NHS: Reconfiguring a Public Service in the Age of Digital Capitalism." Science, Technology, & Human Values 48(2021):888 - 908.