

The Impact of Digital Economy on Employment Structure: A Perspective on Government Spending

Qiyang Wu

*School of Economics and Finance, Huaqiao University, Quanzhou, China
1614962996@qq.com*

Abstract: The progression of the digital economy not only promotes the refinement of labor employment frameworks but also creates higher-quality job opportunities, elevates workers' skill proficiency, and accelerates industrial transformation and high-caliber economic development. This research investigates the interplay between the digital economy and employment structure using provincial panel data from China (2013-2022) and a panel threshold model. The results demonstrate that digital economic growth positively contributes to employment structure optimization. When government spending surpasses a specific threshold, the digital economy's impact on employment structure displays a nonlinear pattern with escalating marginal returns. Furthermore, the influence of digital economic development on employment structure varies regionally. Consequently, it is crucial to build a robust digital infrastructure system, implement precise policies driven by government expenditure efficiency, and cultivate cross-regional collaboration mechanisms for digital resource allocation.

Keywords: Digital Economy, Employment Structure, Government Expenditure

1. Introduction

The digital economy, alongside the green economy, is reshaping the global future, with China positioning it as a key driver of economic growth. Fueled by innovation, policy, and market demand, it has been elevated to a national priority. In 2023, China's digital economy hit 53.9 trillion yuan, contributing 42.8% to GDP and 66.45% to its growth. Digital industry revenue surged to 31.7 trillion yuan in the first 11 months of 2024, up 5.4% year-on-year. The 20th CPC National Congress stressed accelerating digital economy development, fostering its integration with the real economy, and building globally competitive digital clusters. It also emphasized an employment-first strategy to ensure high-quality jobs. The report highlights the digital economy's role in driving high-quality development through digital industrialization and industrial digitalization, fostering a modern industrial system. It also underscores its impact on creating new job forms and improving employment quality. This study explores the link between digital economy development and labor employment, offering empirical insights to optimize employment structures.

2. Literature review

2.1. Research on the effects of the digital economy on employment structure

Existing literature has explored the impact of the digital economy on employment structure from both macro and micro perspectives. Most studies suggest that the digital economy promotes the optimization of labor employment structure, with its influence continuously strengthening. In the current job market, the development of the digital economy has given rise to numerous emerging industries, such as internet services, e-commerce, fintech, smart manufacturing, big data analytics, and virtual reality, creating a significant number of high-skill, high-value-added jobs. The rise of digital work models has enhanced flexibility and reduced labor costs for enterprises, facilitating talent mobility and optimal allocation [1]. At the macro level, some scholars have examined the impact of the digital economy on the income gap between urban and rural residents and its mechanisms. At the middle level, studies have explored its effects on enterprise technological advancement, economies of scale, industrial agglomeration, high-quality development of manufacturing in the Yellow River Basin, and mechanisms of industrial synergy.

While certain studies contend that the digital economy does not facilitate the enhancement of labor employment structures, this perspective is rooted in specific challenges. From a technological standpoint, the accelerated pace of digital innovation necessitates significant corporate investments in research, development, and equipment modernization. This often results in a cautious approach to human capital expenditure, leading to reduced recruitment for general technical and basic operational positions. For example, the adoption of automated systems in traditional manufacturing has displaced manual roles such as assembly and quality control, leaving low-skilled workers vulnerable to job loss and difficulties in transitioning to new opportunities, thereby impeding employment structure optimization.

Additionally, regional disparities further complicate the issue. The expansion of the digital economy is heavily dependent on advanced infrastructure and a skilled workforce. Developed regions, benefiting from strong financial capabilities and abundant talent, can rapidly build digital ecosystems and attract high-value industries. Conversely, less-developed areas, hindered by insufficient infrastructure and limited connectivity, face challenges in attracting relevant industries and skilled professionals, widening regional employment imbalances. This uneven growth not only fails to improve the overall employment structure but also perpetuates traditional, homogeneous employment patterns in certain regions [2].

2.2. Research on the mechanisms of the digital Economy's impact on employment structure

Existing research has extensively analyzed the pathways and mechanisms by which the digital economy shapes labor employment structures from multiple angles.

A primary focus is the employment generation effect. The digital economy boosts societal productivity, stimulating job creation through heightened output and demand. Simultaneously, it promotes flexible employment models like gig work and crowdsourcing, providing workers with greater autonomy and adaptability. Another critical aspect is the employment displacement effect, which underscores the dual nature of technological advancement. While innovation diminishes the value and lifespan of certain jobs, potentially reducing labor demand, it also escalates human capital costs, compressing corporate profits and discouraging market entry and job creation. Industrial transformation further plays a pivotal role. The digital economy reduces employment in primary and secondary sectors while increasing the share of workers in tertiary industries, particularly in high-end and productive services, thereby advancing employment structure sophistication [3]. However, this transition exacerbates income inequality, especially between high- and low-skilled workers. Low-

skilled individuals in traditional industries often struggle to transition, facing limited reemployment prospects, which can lead to income loss or unemployment. Regional disparities also significantly influence outcomes. The digital economy's growth varies markedly across regions. Eastern developed areas, with strong industrial bases and innovation capabilities, exhibit higher digital economy contributions to GDP, while central and western regions lag behind. This imbalance not only affects regional employment opportunities but also drives large-scale labor migration from less-developed to developed areas, intensifying employment structure disparities. Moreover, regional differences in education levels and skill sets impact adaptability to the digital economy, further shaping employment structure dynamics [4].

In conclusion, existing research has explored the digital economy's impact on labor employment structures through mechanisms such as job creation, displacement, industrial restructuring, skill shifts, public-private sector dynamics, occupational mobility, income effects, and regional disparities. These studies provide a solid theoretical and empirical foundation for addressing employment challenges in the digital era. However, the interplay between the digital economy, employment structure, and government expenditure remains underexplored. Building on prior work, this paper integrates government expenditure into the analytical framework, allowing for the coexistence and interaction of policy, employment, and digitalization within a unified model. Using panel threshold models, it examines the differential impacts of the digital economy on employment structure under varying levels of government expenditure.

3. Theoretical model and research hypotheses

Digital technology, as a skill-biased innovation, tends to replace routine, low-skill jobs while increasing demand for high-skill labor, creating complementary roles in the digital economy. From a human capital perspective, this shift not only reshapes skill requirements in the labor market but also drives reforms in education and vocational training to meet emerging job demands. These changes are expected to significantly influence employment structures in the long term. Based on this, Hypothesis 1 is proposed:

H1: Higher levels of digital economic development optimize employment structures.

Government investments in digital infrastructure, such as 5G networks and data centers, lay the groundwork for digital economic growth and foster the creation of new roles like data analysts, AI engineers, and cloud architects. Endogenous growth theory suggests that such investments exhibit a threshold effect. Once a critical network coverage density is achieved, technological spillovers accelerate, further boosting digital economic expansion. Additionally, synergistic policies in infrastructure, education, and regulation can amplify their collective impact, driving industrial upgrading and employment structure optimization. This leads to Hypothesis 2:

H2: Beyond a certain level of government expenditure, the impact of digital economic development on employment structures becomes increasingly nonlinear.

Regional disparities in resources, infrastructure, and government spending result in uneven digital economic growth and varying employment structure adjustments. Resource-based theory highlights regions with stronger foundations—such as advanced infrastructure, robust R&D funding, and higher human capital—experience more significant digital economic development and employment optimization. In contrast, less developed regions, constrained by weaker infrastructure and limited digital talent, see smaller improvements, potentially widening regional employment gaps. Thus, Hypothesis 3 is proposed:

H3: The effect of digital economic development on employment structures varies across regions.

4. Model setting and description of variables

4.1. Research design

To examine the relationship between the digital economy and labor employment structure, this study establishes a regression model as shown in Equation (1). In this model, $empstr_{it}$ represents the employment structure, $digeco_{it}$ denotes the comprehensive index of digital economic development, and X_{it} signifies a set of control variables. Here, i refers to provinces, t indicates the year, α represents the coefficients to be estimated, μ_i accounts for province fixed effects, and ε_i stands for the random error term.

$$\ln(empstr_{it}) = \alpha_0 + \alpha_1 \ln(digeco_{it}) + \theta X_{it} + \mu_i + \varepsilon_i \quad (1)$$

To further explore the impact mechanism of digital economic development under varying levels of government expenditure, a threshold effect model is constructed with government spending as the threshold variable, as shown in Equation (2). Here, $I(\cdot)$ represents an indicator function taking values of 1 or 0, and γ denotes the threshold value to be estimated.

$$\ln(empstr_{it}) = \alpha_0 + \alpha_1 \ln(digeco_{it}) \times I(GOV \leq \gamma_1) + \alpha_2 \ln(digeco_{it}) \times I(GOV > \gamma_1) + \theta X_{it} + \mu_i + \varepsilon_i \quad (2)$$

4.2. Variable selection

In this study, employment structure serves as the dependent variable, defined as the ratio of tertiary industry employment to total employment [5]. The core explanatory variable is the Digital Economy Index (DEI), constructed based on principles of scientific rigor, systematicity, comparability, and feasibility. The DEI measurement system encompasses four dimensions: digital infrastructure, innovation in digital development, industrial digital integration, and the supportive environment for digital growth. These dimensions are further divided into 8 secondary indicators and 18 tertiary indicators, with weights assigned using the entropy method to calculate the provincial-level DEI. The threshold variable is government expenditure (GOV), measured by general fiscal spending. Additionally, a series of control variables are included: (1) average wages of non-private sector employees by region ($avesalary$), (2) foreign direct investment (fdi), measured by the number of foreign-invested enterprises in each region, and (3) cost of living (CH), represented by the ratio of household per capita consumption expenditure to per capita disposable income.

4.3. Data source and descriptive statistics

This study utilizes panel data from 29 Chinese provinces (excluding Tibet, Xinjiang, Hong Kong, Macao, and Taiwan) spanning 2013 to 2022. The data is primarily sourced from the China Statistical Yearbook and provincial statistical yearbooks across various years. Descriptive statistics of the variables are presented in Table 1. As shown in Table 1, the overall development levels of employment structure and the digital economy in China remain relatively low, with minimal disparities among provinces. However, significant gaps exist in per capita wages and foreign investment levels across regions, reflecting differences in economic development and resource foundations, which highlight regional imbalances [6].

Table 1: Descriptive statistics of variables

Variable	Mean	Std Dev	Max	Min
Ln(empstr)	3.727	0.245	3.099	4.42
Ln(digeco)	3.008	0.591	1.59	4.597
avesalary	7.764	2.827	3.83	21.248
Ln(fdi)	4.439	1.283	1.289	7.547
CH	0.71	0.055	0.551	0.894

5. Analysis of empirical results

5.1. Benchmark regression

Prior to conducting the formal regression analysis, this study initially performs a variance inflation factor (VIF) test (as shown in Table 2). The results indicate that the VIF values for all variables are below 10, suggesting the absence of multicollinearity in the model. Subsequently, the research employs Model (1) and progressively incorporates control variables to perform a regression analysis on the relationship between the digital economy and employment structure.

Table 2: Tests for multicollinearity

Variable	VIF	1/VIF
Ln(digeco)	2.29	0.437
avesalary	1.91	0.523
Ln(fdi)	1.88	0.532
CH	1.48	0.677

Table 3 presents the baseline regression results of the digital economy's impact on employment structure. Columns (1) to (5) show the outcomes with control variables incrementally added. Column (1) includes only the digital economy as the core explanatory variable, while Column (2) adds the average wage level of non-private sector employees. Columns (3) to (5) progressively incorporate additional controls. The results indicate that the digital economy's coefficient is significantly positive. Although its effect diminishes with added controls, it consistently passes the 1% significance test, confirming its positive influence on employment structure. A 1% increase in digital economy development boosts regional employment structure by 11.5%, supporting Hypothesis 1. Among control variables, higher average wages in non-private sectors significantly enhance employment structure, while living costs hinder its optimization, with this negative effect being statistically significant [7].

Table 3: Regression results

Variable	Ln(empstr)			
	(1)	(2)	(3)	(4)
Ln(digeco)	0.274*** (0.081)	0.126** (0.062)	0.105 (0.067)	0.115* (0.065)
avesalary		0.048*** (0.010)	0.041*** (0.014)	0.029** (0.013)
Ln(fdi)			0.118 (0.105)	0.142 (0.099)
CH				-0.871** (0.465)
Constant	3.139*** (0.366)	3.117*** (0.252)	2.634*** (0.441)	3.181*** (0.619)
Province Fixed			Yes	
R ²	0.151	0.590	0.600	0.624
N			290	

Note: Robust standard errors are in parentheses; ***, **, and * denote significance levels of 1%, 5%, and 10%, respectively, as in the table below.

5.2. Robustness test analysis

To validate the reliability of the research outcomes, this study adopts three distinct approaches for robustness verification. Initially, acknowledging the unique administrative and developmental characteristics of municipalities, the samples from Beijing, Shanghai, Tianjin, and Chongqing are removed for re-evaluation to examine the effect of sample selection on the findings. Subsequently, to address the possible impact of energy consumption on green technology innovation, total energy consumption is incorporated as an additional control variable in the primary model. Lastly, to minimize the influence of potential outliers in the baseline regression, all pertinent variables are winsorized at the 1% and 99% levels, thereby reducing the distortion caused by extreme data points. These tests confirm the consistency of the results, underscoring the robustness of the empirical analysis.

Table 4: Robustness test results

Variable	(1)	(2)	(3)
	Excluding municipality samples	Adding control variable	Winsorizing
Ln(digeco)	0.108**(0.054)	0.118*(0.068)	0.112*(0.064)
CH	-0.922**(0.453)	-0.854**(0.350)	-0.931**(0.456)
Ln(fdi)	-0.008 (0.079)	0.124(0.088)	0.138(0.093)
avesalary	0.053*** (0.009)	0.022*(0.013)	0.030**(0.012)
Energy consumption		0.187**(0.095)	
Constant	3.751*** (0.674)	3.239*** (0.521)	3.251*** (0.605)
Province Fixed		Yes	
R ²	0.729	0.672	0.638
N	250	290	290

5.3. Threshold effect test

This research then investigates the presence of panel threshold effects, specifically analyzing how government expenditure shapes the digital economy's influence on employment structure. Table 5 reveals that when digital economic development serves as the threshold variable, a single threshold effect is statistically significant ($p < 0.05$), while double and triple threshold effects lack significance. Further examination of Table 6 shows that when government spending is below 400.158 billion yuan, the digital economy positively affects employment structure (coefficient = 0.079). Once government expenditure exceeds this threshold, the coefficient rises sharply to 0.127, representing a 60.76% increase. These results underscore the nonlinear relationship between the digital economy and employment structure, demonstrating that beyond a specific expenditure level, the digital economy's positive impact intensifies with increasing marginal returns. Consequently, Hypothesis 2 is confirmed.

Table 5: Results of threshold effect test

Threshold Variable	Model	Threshold	F-value	P-value
GOV	Single	4001.580	49.11	0.0033

Table 6: Threshold effect results

Variable	GOV
$\text{Ln}(\text{digeco}) \times I(\text{GOV} \leq \gamma_1)$	0.079*** (0.028)
$\text{Ln}(\text{digeco}) \times I(\text{GOV} > \gamma_1)$	0.127*** (0.027)
CH	-0.749*** (0.201)
fdi	0.168*** (0.042)
avesalary	0.023*** (0.005)
Constant	2.995*** (0.209)
Threshold value	4001.580
R^2	0.680
N	290

5.4. Heterogeneity analysis

Given the diverse developmental phases across regions, the extent of digital economic advancement and employment frameworks display notable heterogeneity. Utilizing regional categorization approaches from pertinent scholars, this research segments the 29 provincial administrative units into four zones: the East, Central, West, and Northeast. A fixed-effects model was employed to examine Hypothesis 3, with outcomes detailed in Table 6. The analysis reveals that in the East, the digital economic development coefficient stands at 0.161, achieving significance at the 5% level. This indicates that a 1% enhancement in digital economic development correlates with a 16.1% improvement in the employment framework. Conversely, the coefficients for the Central and Western regions lack statistical significance. In the Northeast, the coefficient is -0.142, significant at the 1% level, suggesting that a 1% increase in digital economic development leads to a 14.2% decline in the employment structure. These findings underscore that digital economic development fosters employment structure enhancement in the East, Central, and West, with the East showing the most substantial impact. However, in the Northeast, digital economic expansion negatively affects employment structure optimization, thereby confirming Hypotheses 1 and 3.

Table 7: Heterogeneity analysis

Variable	$\text{Ln}(\text{empstr})$			
	East	Middle	West	Northeast
$\text{Ln}(\text{digeco})$	0.161** (0.080)	0.139 (0.133)	0.048 (0.052)	-0.142*** (0.035)
avesalary	0.007 (0.014)	0.063*** (0.013)	0.072*** (0.018)	0.002 (0.009)
$\text{Ln}(\text{fdi})$	0.351* (0.179)	-0.122 (0.142)	-0.101 (0.150)	0.353*** (0.048)
CH	-0.574 (0.592)	-0.963 (0.722)	-0.910 (0.740)	-0.559*** (0.153)
Constant	1.910* (1.095)	0.000 (0.000)	0.000 (0.000)	2.845*** (0.052)
Province Fixed	Yes			
R^2	0.617	0.734	0.777	0.764
N	100	60	100	30

6. Conclusion and recommendation

6.1. Conclusion

In the era of rapid digitization, the digital economy represents a transformative economic model succeeding agricultural and industrial systems, with data as its central production element. Enterprise digitization, as the micro-level foundation of this economy, drives traditional industries toward intelligence and platform-based models, fundamentally altering labor market dynamics. Investigating how the digital economy can enhance workforce employment structures is a pressing research priority. This study analyzes panel data from Chinese provinces (2013–2022) to explore the relationship between the digital economy and employment structure, drawing the following insights:

First, the digital economy significantly contributes to improving and refining employment frameworks. Second, when government spending surpasses a specific threshold, the effect of digital economic development on employment structures demonstrates a nonlinear pattern with escalating marginal returns. Below this threshold, digital economic development moderately enhances employment structures with statistical significance. Above it, the optimization effect becomes more pronounced, showcasing increasing marginal returns. Third, due to uneven resource allocation and varying regional government priorities, the impact of digital economic development on employment structures exhibits regional heterogeneity. Broadly, in the East, Central, and West, digital economic development optimizes employment structures, with the East showing the most substantial influence. In contrast, the Northeast experiences adverse effects on employment structure optimization from digital economic growth.

6.2. Recommendation

To optimize the employment structure through the development of the digital economy, this paper proposes a three-pronged strategy. First, establish a policy framework integrating dynamic fiscal support, gradient regional compensation, and coordinated factor mobility, supported by a dedicated fund for employment optimization in central and western regions. Additionally, foster technology transfer alliances between eastern and northeastern areas to enhance industrial integration, particularly in intelligent manufacturing and industrial internet applications. Second, accelerate digital literacy and industry-education integration by launching nationwide digital skills training programs and creating a collaborative talent development matrix, supported by joint enterprise-education certification systems. Third, promote industrial digital transformation and dynamic employment adaptation by implementing dual-track monitoring systems for traditional and emerging industries, focusing on high-skilled job clusters in areas like artificial intelligence, and establishing early warning systems and buffer funds to support workforce transitions. These measures aim to ensure a balanced and resilient labor market in the digital era.

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