Digital Economy's Impact on Employment and the Role of Market Competition-The Impact of Digital Economy on Employment——Based on the Perspective of Market Competition

Leyan Chen

School of Business, Soochow University, Suzhou, 215021, China

2312406025@stu.suda.edu.cn

Abstract. While profoundly reshaping production methods, digital economy exerts a multi-faceted influence on aggregate labor demand. Utilizing panel data spanning 31 Chinese provinces from 2012 to 2022, this paper constructs a two-way fixed effect model and a threshold regression model of market competition to evaluate the digital economy's different impact on regional employment magnitude and also focuses on the heterogeneity of industrial structure and economic development level. The research results show that: First, digital advancement substantially expands regional workforce capacity, with the long-term net job-creation dividend dominating the market. Second, market competition imposes a single-threshold constraint; its employment-stimulating potential is markedly amplified only after competitive intensity transcends a distinct structural tipping point. Third, the employment-generation capacity exhibits pronounced discrepancies across varying industrial architectures and economic development tiers. This paper provides new empirical evidence for understanding the conditional dependence and regional differences of the employment effect of the digital economy, and provides theoretical support for the formulation of differentiated employment policies.

Keywords: Digital Economy, Employment Scale, Market Competition, Threshold Model.

1. Introduction

Digitalization and employment stabilization have become dual imperatives deciding current national development strategies. China has institutionalized its digital economy with the sector's total output reaching 50.2 trillion yuan in 2022, which is a nominal growth of 10.3% year-on-year, consistently exceeding GDP growth for eleven successive years. Digital activities now constitute over 40% of national economic output, functioning as the primary accelerant of high-quality growth. The 20th National Congress of the Communist Party of China further codified this trajectory, mandating accelerated digital-industrial integration, the cultivation of globally competitive digital clusters, and the reinforcement of employment-first governance frameworks. These directives collectively aim to advance labor markets toward both breadth of coverage and elevation of quality. Against this backdrop, examining how digital economic expansion influences aggregate employment scale—while identifying the mediating function of market competition—holds considerable theoretical and practical value. Understanding this nexus is essential for policymakers seeking to reconcile growth-oriented digital strategies with inclusive, sustainable employment outcomes..

Digital empowerment is an important path for employment creation, and the optimization of employment structure requires solid digital technology as support. To realize the common development of the digital economy and employment, we must give play to the role of data elements, actively promote the construction of digital infrastructure, promote the transformation of production methods through digital transformation, and stimulate employment creation potential through market competition. In order to better promote employment under the background of the rapid development of the digital economy, this paper intends to study the impact of the digital economy on employment scale, as well as the threshold effect and regional heterogeneity of market competition, and conduct empirical analysis.

2. Literature Review

Anchored in data as its core productive input and propelled by digital technologies, the digital economy has fundamentally restructured labor market dynamics. Academic literature examining this domain has primarily addressed three dimensions: overall workforce volume, occupational and sectoral composition, and the intrinsic quality of employment outcomes.

First, the impact of the digital economy on employment total is a dual process with both creation effect and substitution effect. From a short-term and partial perspective, the application of digital technologies (such as artificial intelligence and industrial robots) will replace some regular and repetitive labor positions, leading to technological unemployment and structural unemployment [1]. However, from a long-term and overall perspective, existing studies generally believe that the employment creation effect of the digital economy is greater than its substitution effect [2]. The digital economy significantly enhances the employment absorption capacity of the economy by spawning new business forms and models (such as platform economy and gig economy) and a large number of digital new occupations. The newly created jobs can offset the destruction effect of technology on traditional jobs in the long run, thus exerting a stable and even expanding positive effect on the total employment scale [3,4]. Evidence at the micro enterprise level shows that although digital transformation may squeeze low-skilled labor in the process, it ultimately increases the labor income share of enterprises by optimizing the human capital structure, which indirectly confirms its net creation effect [5].

Second, the most profound impact of the digital economy on employment lies in the systematic reshaping of the employment structure, driving profound changes in labor in terms of skills, industries and forms. First, the digital economy leads to the upgrading of the skill structure of employment. The upgrading of production technology brought by enterprise digital transformation leads to strong demand for high-skilled labor, while accelerating the substitution of medium and low-skilled labor, so as to optimize the human capital structure and realize the transformation of value creation mode [5, 6]. This promotes the overall employment structure to evolve towards "high-skilled" [7]. Empirical research on industrial intelligence shows that it significantly reduces the employment share of stylized tasks in the manufacturing industry, while increasing the employment share of knowledge and technology-intensive service industries (such as producer services), promoting the upgrading of industrial employment structure [8]. Second, the digital economy drives the adjustment of the industrial structure of employment. The impact of the development of the digital economy on the employment structure presents a dynamic "positive U-shaped" feature. In the initial stage of development, it may temporarily reduce employment in the secondary industry, but with the deepening and penetration of digital transformation, it will ultimately promote the employment structure to adjust towards "manufacturing" and "high-tech" [7]. Within the service industry, the digital economy significantly promotes the expansion of employment scale including producer services and consumer services [1]. Finally, the digital economy promotes the diversification of employment forms. Digital platforms have greatly lowered the threshold for entrepreneurship and employment, and have significantly promoted non-agricultural employment, especially employed informal employment and entrepreneurial activities [2, 4]. By alleviating the constraints of individual entrepreneurs in terms of financial resources and social relationship resources, it makes employment forms more flexible and the entrepreneurship process more convenient, thus enriching the ecology of the labor market [4].

Third, the impact of the digital economy on employment quality and workers' rights and interests presents a complex duality, producing differentiated consequences for different groups. On the one hand, the digital economy has an improving effect on employment quality. The optimization of employment structure itself is an important part of high-quality employment, and can further promote the improvement of labor remuneration and labor protection [3]. The development of the digital economy has a positive impact on the overall employment quality by improving labor productivity and reducing transaction costs, and through this intermediary, stimulates the structural transformation of the labor force to new employment models [2]. On the other hand, the digital economy also brings

new challenges and differentiation. The primary problem is skill premium and income right squeeze. The development of the digital economy significantly squeezes the relative income rights of medium and low-skilled workers, and its development dividends are more inclined to high-skilled groups with higher education levels [4, 5, 6]. Although some studies point out that the digital economy may improve the relative welfare level of medium and low-skilled workers by improving the efficiency of the legal system and the quality of government supervision [6], against the background of declining demographic dividends, the substitution effect of digital technology on low-skilled workers is far stronger than the positive effect brought by labor shortage, leading to the weakening of their rights and interests [6]. Secondly, within the flexible employment market, the development of the digital economy intensifies the polarization of income. Research shows that top workers in the digital flexible employment market gain higher income competitiveness, while bottom flexible workers suffer greater wage penalties, exacerbating income inequality [2].

Furthermore, the employment situation under the development of China's digital economy has obvious differences. Studies have found that under the influence of different regional development levels, individual endowments and industry characteristics, the digital economy has different impacts on employment. Compared with central and eastern provinces, the labor force in western provinces faces greater challenges in adapting to the transformation of the employment structure of the digital economy [1, 8]. In technology-intensive industries and non-state-owned enterprises, the employment creation and income enhancement effects of the digital economy are more significant [5].

To address the literature gap regarding market competition's role in the digital-employment nexus, this study develops a threshold regression framework. By integrating the digital economy, employment scale, and competitive intensity into a unified matrix, it offers a comprehensive econometric analysis.

3. Theoretical Mechanism and Research Hypotheses

The digital economy’s distinct techno-economic traits—namely network effects, scale economies, and pervasive permeability—dynamically balance labor creation and substitution. By reshaping labor market structures, analyzing digitalization's impact on employment magnitude and market competition's regulatory role holds vital theoretical and practical value for achieving robust, high-quality employment stabilization.

The employment ramifications of the digital economy are fundamentally rooted in its distinct techno-economic attributes. During embryonic development, substantial capital expenditures required for infrastructure deployment and initial technological adoption yield negligible labor market dividends. However, once digitalization crosses a critical maturity threshold, network externalities and Metcalfe’s law materialize. Expanding user bases on digital platforms optimize labor supply-and-demand matching efficiencies, accelerating the proliferation of novel business paradigms and emerging occupations [10]. Concurrently, returns to scale manifest as enterprises cater to vast consumer segments at near-zero marginal costs. This mechanism aggregates previously unviable niche demands into substantial market volumes, spawning highly fragmented, diverse, and decentralized workforce opportunities [11]. Furthermore, the pervasive permeability of digital technologies enables deep cross-sectoral integration, driving structural labor reallocation across diverse industries [12]. Consequently, the digital-employment nexus mirrors Schumpeterian "creative destruction." While digital ecosystems catalyze pioneering business models and substantial job creation, automation and artificial intelligence displace standardized, routine-task labor, heightening technological unemployment risks [2]. Over a long-term horizon, the compounding forces of network effects and scale economies enable this structural creation effect to surpass the substitution effect. Based on these systemic dynamics, this paper formulates Hypothesis 1.

H1: The development of the digital economy has a significant positive promoting effect on regional employment scale.

The intensity of market competition is a key moderating variable that determines the balance between the above creation and substitution forces. From the perspective of skill-biased technological progress theory, the wide application of digital technology leads to a sharp increase in enterprises' demand for high-skilled labor, while exerting substitution pressure on medium and low-skilled labor. In a highly competitive market environment, survival pressure forces enterprises to adopt digital technology more actively, which may accelerate labor substitution in the short term, but a competitive market also provides the optimal soil for the germination and diffusion of new business forms [13]. Low entry barriers and free factor mobility make the employment creation potential more fully released. Moreover, competition ensures the flexibility of resource allocation, enabling labor to transfer from declining sectors to emerging sectors more quickly [14], thus strengthening the long-term net employment growth effect. On the contrary, in an environment with insufficient market competition, incumbent enterprises lack motivation for digital transformation and may use market power to squeeze workers' income and employment opportunities, thus weakening the employment promoting effect of the digital economy. This means that market competition has a non-linear moderating effect on the employment effect of the digital economy. Therefore, this paper proposes Hypothesis 2.

H2: The capacity of the digital economy to expand employment size is governed by a non-linear threshold mechanism dictated by market competition. Specifically, the employment-stimulating dividends of digital advancement are only markedly amplified once the intensity of market competition surpasses a critical point.

The employment implications of digital economic expansion exhibit pronounced heterogeneity across geographic and structural dimensions. Variations in factor endowments, infrastructural capacity, and developmental maturity across Chinese regions have collectively produced an uneven spatial distribution of digital economy growth, consequently yielding divergent magnitudes of labor market impact [15]. Regions with a high degree of advanced industrial structure have a large proportion of modern service industries and high-tech industries; while in regions dominated by traditional industries, digital transformation is more manifested as machines replacing labor. From the perspective of economic development level, underdeveloped regions lack traditional employment positions, and new business forms spawned by digital technology can fill employment gaps more effectively, while developed regions have high labor costs, enterprises have more motivation to replace labor with digital technology, their industrial structure is relatively mature, and the marginal employment pulling space of the digital economy is limited [7]. Therefore, the impact of the digital economy on employment scale presents heterogeneity due to different levels of industrial structure and economic development. This paper proposes Hypothesis 3.

H3: The impact of the digital economy on employment scale presents heterogeneity in industrial structure and economic development level.

4. Model Construction and Variable Description

4.1. Model Construction

To test the direct effect of the digital economy on regional employment scale, this study first constructs a two-way fixed effects panel model for benchmark regression, as shown in Equation (1):

$$Emp_{it} = \alpha_0 + \alpha_1 Digeco_{it} + \beta Controls_{it} + \omega_t + \lambda_i + \varepsilon_{it} \quad (1)$$

Here, i and t denote cross-sectional provinces and chronological years, respectively. The dependent variable, capturing the workforce magnitude, is denoted by Emp_{it}, while $Digeco_{it}$ serves as the primary regressor of interest, quantifying the advancement of the digital economy. To account for potential confounding factors, a vector of control variables, $Controls_{it}$, is incorporated into the model. Furthermore, ω_t and λ_i are specified as province- and time-specific fixed effects; the former absorbs time-invariant regional idiosyncrasies, whereas the latter partials out macroeconomic shocks and shared temporal trends. Finally, ε_{it} captures the idiosyncratic error term.

To further test the impact of the digital economy on employment under different levels of market competition, the following threshold effect model is constructed. Among them, $I(\cdot)$ is an indicator function, which takes the value of 1 when the condition in parentheses is satisfied, otherwise 0; γ is the threshold value, dividing the sample into different market competition level intervals. By comparing the estimated coefficients of the digital economy in different intervals, the moderating effect of market competition on the employment effect of the digital economy can be identified.

$$Emp_{it} = \alpha_0 + \alpha_1 Digeco_{it} * I(MarCom_{it} \le \gamma_1) + \alpha_2 Digeco_{it} * I(\gamma_1 < MarCom_{it} \le \gamma_2) + \alpha_3 Digeco_{it} * I(MarCom_{it} > \gamma_3) + \beta Controls_{it} + \omega_t + \lambda_i + \varepsilon_{it} \quad (2)$$

4.2. Variable Definition

4.2.1. Explained Variable

Employment scale (*Emp*) is the core explained variable in the empirical analysis of this paper. Regarding the measurement of regional employment scale, existing studies mostly adopt the number of employed persons in urban units or the total number of employed persons in the whole society. This paper selects the natural logarithm of the number of employed persons in urban units (ten million people) to measure the employment scale of each province. This indicator covers the number of employed persons in urban units of state-owned, collective and other economic types, which can comprehensively reflect the total employment in the labor market of each region.

4.2.2. Core Explanatory Variable

The core explanatory variable is the digital economy level (*Digeco*). Following the scholarly consensus, which synthesizes composite metrics across digital infrastructure, digital industrialization, and sectoral digitization, this study applies the entropy weight method to evaluate regional digital maturity. To ensure an unbiased, granular depiction of provincial digital landscapes, the constructed index integrates diverse benchmarks: broadband and mobile subscribers, the workforce share in information and software services, total telecom volume, and the digital financial inclusion index.

4.2.3. Threshold Variable: Market Competition

The moderating variable is market competition (*MarCom*). Referring to existing studies, this paper uses the proportion of the number of regional enterprises in GDP to measure it [16]. This indicator reflects the number of enterprises per unit of economic output. A larger value means more intensive competition subjects in the market and a higher degree of competition.

4.2.4. Mediating Variables

This paper examines the mediating mechanism of the digital economy affecting employment scale from the perspectives of human capital accumulation and innovation output. The proportion of employees in the information software industry (%) is used to measure the human capital structure (*Hum*). Innovation vitality (*Innov*) adopts the level of patent authorization (pieces per ten thousand people) as the measurement indicator. The number of patent authorizations directly reflects the regional innovation output capacity and technological activity, and is a commonly used indicator to measure regional innovation performance. The natural logarithm is taken in the regression.

4.2.5. Control Variables

The paper also incorporates a set of control variables, encompassing expenditure on educational development, the extent of external economic openness, and the intensity of governmental involvement in economic affairs. Precise operational definitions for each variable are presented in the Table 1.

Table 1. Variable Description

Variable Type	Variable Name	Symbol	Measurement Method
Control Variable	Education Investment	EduExp	Per capita education expenditure (ten thousand yuan)
	Degree of Opening to the Outside World	Open	FDI (hundred billion US dollars)
	Degree of Government Intervention	Gov	General public budget expenditure/GDP (%)

4.3. Data Source and Descriptive Statistics of Variables

This paper uses panel data spanning 2012 to 2022, encompassing all 31 provincial-level administrative units across China's mainland. Data are sourced from the respective provincial statistical yearbooks, with intermittent gaps addressed through linear interpolation techniques. Descriptive statistics summarizing the aforementioned variables are reported in Table 2.

Table 2. Descriptive Statistics of Variables (N=310)

Variable	Mean	Std. Dev.	Min	Max
Emp	-0.877	0.882	-3.474	0.747
DigEco	0.238	0.178	0.032	0.992
MarCom	0.385	0.189	0.000	1.060
Innov	15.23	17.323	0.341	92.819
Hum	0.021	0.018	0.008	0.135
Gov	0.240	0.180	0.083	1.232
EduExp	0.241	0.106	0.115	0.870
Open	2.968	5.832	0.013	56.704

5. Empirical Results Analysis

5.1. Analysis of Benchmark Regression Results

Table 3 presents the baseline regression estimates examining how digital economic advancement shapes aggregate labor market scale at the regional level, fixing province and year effects. Column (1) only includes *Digeco*, with a significant coefficient of 0.627, indicating a positive correlation between the digital economy and employment scale. Columns (2) through (4) progressively augment the baseline with additional covariates. The significant coefficient of *Digeco* in fully-specified model in Column (4) is 0.488, verifying that the positive promoting effect. Hypothesis 1 is established. At the same time, education investment and degree of opening to the outside world are significantly positive, while the degree of government intervention is always significantly negative, indicating that education investment and degree of opening to the outside world can promote the expansion of employment scale, while the degree of government intervention inhibits employment scale. This may be because excessive government expenditure crowds out private investment and market vitality, or the structure of fiscal expenditure is biased towards non-productive fields.

Table 3. Benchmark Regression Results

VARIABLES	(1)	(2)	(3)	(4)
DigEco	0.627*	0.461*	0.499**	0.488***
	(0.323)	(0.250)	(0.187)	(0.173)
Gov		-0.244***	-0.147**	-0.155***
		(0.074)	(0.059)	(0.056)
EduExp			1.281***	1.269***
			(0.144)	(0.121)
Open				0.003***
				(0.001)
Constant	-0.998***	-1.359***	-1.432***	-1.443***
	(0.072)	(0.139)	(0.103)	(0.098)
Time and Province Fixed		Yes		
N	310	310	310	310
R^2	0.205	0.307	0.534	0.559

Note: The values in parentheses are robust standard errors; * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level. The same applies to the following tables.

5.2. Robustness Test

To further verify the reliability of the benchmark regression results, this paper adopts three methods: excluding samples from special years, municipalities directly under control, and tailing

processing for robustness test. First, the COVID-19 pandemic in 2020 exerted a huge exogenous shock on the labor market. To avoid model estimation bias caused by data from this special year, this paper excludes the 2020 sample and re-regresses. Second, the four municipalities differ greatly from other provinces. Finally, tailing processing is performed on all continuous variables at the 1% and 99% quantiles to eliminate the influence of extreme outliers. Based on above three tests in Table 4, the positive promoting effect of the digital economy on regional employment scale remains significant, collectively affirming that the baseline empirical estimates reported herein demonstrate considerable stability and reliability.

Table 4. Robustness Test Results

VARIABLES	(1) Excluding 2020	(2) Excluding Municipalities	(3) Tailing Processing
DigEco	0.436**	0.457**	0.572***
	(0.175)	(0.222)	(0.206)
Gov	-0.160***	-0.208***	-0.146**
	(0.053)	(0.063)	(0.057)
EduExp	1.280***	1.249***	1.294***
	(0.129)	(0.149)	(0.131)
Open	0.003***	0.003***	0.003*
	(0.001)	(0.001)	(0.002)
Constant	-1.441***	-1.498***	-1.452***
	(0.094)	(0.096)	(0.097)
Time and Province Fixed		Yes	
N	279	270	310
R^2	0.560	0.575	0.535

5.3. Threshold Effect Analysis

Based on the threshold existence test results in Table 5, only single threshold model is correct and the threshold value is 0.459. Furthermore, according to the regression results in Table 6, when market competition degree is greater than 0.459, the coefficient increases significantly to 0.576. This may be because sufficient market competition not only forces enterprises to continuously innovate to maintain advantages and create new jobs by using digital technology, but also lowers the threshold for entrepreneurship, enabling new employment forms such as sharing economy and gig economy to spread rapidly. At the same time, a fully competitive labor market is conducive to the rapid transfer of labor from traditional sectors to emerging sectors, thus strengthening the employment creation effect of digital economy. Hence, Hypothesis 2 is established.

Table 5. Threshold Existence Test

Threshold Variable	Number of Thresholds	Threshold Value	F-statistic	P-value	BS Times	Critical Value		
						1%	5%	10%
Marcom	Single Threshold	0.459	67.95	0.007	300	35.892	42.345	57.248
	Double Threshold	0.741	15.09	0.400	300	26.711	34.649	48.195
	Triple Threshold	0.422	11.78	0.673	300	42.056	57.973	110.370

Table 6. Threshold Regression Results

Variable	Threshold Value	$I(MarCom_{it} \leq \gamma_1)$	$I(MarCom_{it} > \gamma_1)$	Number of Periods	Number of Provinces
Marcom	0.459	0.092(0.113)	0.576***(0.126)	10	31

5.4. Heterogeneity Analysis

First, the sample is divided into high and low groups according to the mean level of industrial development which is manifested by tertiary industry added value to GDP. Only in regions with a high degree of advanced industrial structure, the promoting effect of the digital economy is significantly positive. An industrial structure with developed high-tech service industries and modern service industries can better undertake new business forms and jobs brought by digital technology,

and the transfer of labor from traditional sectors to emerging sectors is smoother, thus strengthening the employment creation effect of the digital economy. On the contrary, in regions dominated by traditional industries, digital transformation is more manifested as machines replacing labor, and the net employment effect is not obvious in the short term. Furthermore, the sample is divided into high and low economic development level groups. It can be seen from Columns (3)-(4) of Table 7 that the promoting effect is more significant in relatively underdeveloped regions. Developed regions have high labor costs, and enterprises have more motivation to replace labor with digital technology, thus weakening the short-term employment creation effect. Their industrial structure is also relatively mature, and the marginal employment pulling space of the digital economy is limited. However, underdeveloped regions lack traditional employment positions, and new business forms spawned by digital technology can fill employment gaps more effectively, thus showing a stronger net employment promoting effect. Thus, Hypothesis 3 is established.

Table 7. Heterogeneity Analysis Results

	Industrial Structure		Economic Development	
VARIABLES	(1) High	(2) Low	(3) High	(4) Low
DigEco	0.633***	0.192	-0.059	0.606***
	(0.183)	(0.192)	(0.395)	(0.205)
Gov	-0.067	-0.178**	-0.106	-0.126
	(0.075)	(0.071)	(0.116)	(0.079)
EduExp	1.211***	1.619***	0.872	1.278***
	(0.128)	(0.462)	(0.790)	(0.133)
Open	0.002***	0.002	0.002	0.003***
	(0.001)	(0.011)	(0.003)	(0.000)
Constant	-1.475***	-1.385***	-0.443	-1.818***
	(0.138)	(0.148)	(0.328)	(0.105)
Time and Province Fixed		Yes		
N	130	180	115	195
R^2	0.660	0.551	0.263	0.670

6. Conclusions and Policy Recommendations

Based on panel data of 31 provinces in China from 2012 to 2022, this paper studies the impact of the digital economy on regional employment scale, and examines the threshold effect of market competition as well as the heterogeneity of industrial structure and economic development level. The following conclusions are drawn.

First, the digital economy serves as a robust driver of regional workforce expansion. Over time, its inherent network externalities and economies of scale generate a job-creation effect. Second, market competition exerts a single-threshold effect on this dynamic. Once competitive intensity transcends a critical inflection point, lowered barriers and factor mobility fully catalyze digital entrepreneurship, accelerating sectoral labor migration. Third, regions with sophisticated industrial compositions seamlessly integrate high-tech digital vocations due to fluid labor mobility. Conversely, in economically lagging regions, digital innovations exhibit a more pronounced marginal employment-creation effect.

Based on these results, this paper puts forward the following suggestions to promote the digital economy to better and fully promote employment. First, sustained investment in digital infrastructure remains foundational. Expanding 5G networks, data centers, and industrial internet connectivity—particularly in inland and western provinces—can narrow persistent regional disparities. Nurturing platform economies and flexible work arrangements, alongside clearer regulatory frameworks for gig-based employment, will broaden institutional support for non-standard workers. Second, cultivating genuinely competitive market conditions is essential for translating digital growth into employment development. Lowering barriers to market entry, dismantling local protectionism, and reducing administrative friction will empower smaller enterprises to participate meaningfully in digital markets. In platform-dominated sectors, strengthened antitrust oversight is needed to prevent

suppressing worker earnings or marginalizing smaller competitors. When competitive intensity crosses a critical threshold, digital technology's job-creation potential makes market environment reform both an economic and employment priority. Third, Eastern coastal provinces should deepen the integration of high-skilled talent pipelines with digital sector demands, focusing on knowledge-intensive services that raise employment quality and value-added per worker. By contrast, central and western regions—still heavily reliant on traditional industries—would benefit more from guided adoption of platform and gig economy models, which can compensate for weaker conventional job absorption capacity and offer more accessible opportunities for rural migrants and lower-skilled workers.

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