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Empowerment or Disempowerment: The Employment-Stabilizing Effect of Digital Transformation in Private Enterprises

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ABSTRACT

Employment is the foundation of people's livelihood and a crucial driver of economic growth. Against the backdrop of intensified economic downturn and deep integration of digital technologies, private enterprises, as the "main force" supporting over 80% of urban employment, face a pivotal challenge: whether their digital transformation can solidify the "employment reservoir." Based on data from China's A-share listed companies between 2013 and 2023, this study empirically examines the impact of digital transformation on employment scale in private enterprises and its underlying mechanisms. The findings reveal that digital transformation expands employment scale in private enterprises, with this effect being more pronounced in firms with higher education levels, mid-to-high-skilled labor, and those located in larger cities. Mechanism analysis demonstrates that digital transformation drives employment expansion by broadening business scale and enhancing productivity. Specifically, digital technologies extend market boundaries and business complexity, leading to increased demand for various types of labor. Simultaneously, efficiency gains from technological applications also structurally facilitate the reallocation of labor resources, thereby driving overall employment growth. The research conclusions provide empirical evidence for comprehensively assessing the actual impact of digital transformation on employment markets in China's private enterprises. They also offer policy insights into balancing employment stability and labor structure optimization while advancing the development of the digital economy.

KEYWORDS

Digital transformation; Stable employment; private enterprise; Employment scale

1. INTRODUCTION

Employment underpins people's livelihoods and serves as a vital engine for economic growth. Since the 18th National Congress of the Communist Party of China, the Party Central Committee and the State Council have consistently prioritized employment. Stabilizing employment ranks first among the tasks to ensure stability on six key fronts, acting as a crucial measure to safeguard people's well-being and advance high-quality economic development. Its core objectives are to maintain overall employment stability, preserve jobs, and foster fuller and higher-quality employment. In May 2024, during the 14th collective study session of the Political Bureau of the CPC Central Committee, General Secretary Xi Jinping explicitly emphasized that fuller and higher-quality employment should be set as a priority goal for economic and social development. It is essential to enhance the capacity of economic growth to generate employment opportunities, continuously create more high-quality

jobs, charting the course and providing fundamental guidelines for employment work in the new era. At the national level, a series of policy documents including the Circular on Further Strengthening Policy Support for Employment Stabilization have been issued successively. These policies focus on supporting enterprises to retain staff, incentivizing firms to expand recruitment, and reinforcing policy supply and safeguards for enterprises' employment stabilization efforts.

From the perspective of enterprise ownership, private enterprises constitute the largest group of employers in the labor market. They absorb more than 80 percent of urban employment and contribute over 90 percent of newly added jobs, serving as the core pillar and key focal point for implementing the employment stabilization strategy and stabilizing the overall employment landscape (Zhao & Tian, 2024) [1]. Guided by national macroeconomic policies and driven by market demand, private enterprises ought to take proactive responsibility and consolidate their role as a "reservoir" and "stabilizer" of employment. On the one hand, they should advance industrial upgrading and innovative development to boost job creation capacity and expand employment scale. On the other hand, they need to adapt to shifts in labor market demand, optimize staffing structures, improve the matching between workers and vacancies, and effectively resolve the structural contradiction of the coexistence of labor shortages and employment difficulties. By sustaining business operations, expanding job openings and lifting employment quality, private enterprises can continuously inject vitality into the labor market and offer solid support for ensuring people's livelihoods and stabilizing economic and social development.

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For individual firms, digital transformation represents a core strategic engine for cultivating new quality productive forces, reconstructing value chains and leading new economic forms (Zhang et al., 2025) [2]. Existing literature has examined the impacts of digital transformation on capital market performance (Wu et al., 2021) [3], corporate total factor productivity (Guo et al., 2024) [4], corporate carbon emission reduction (Lü & Wei, 2025) [5], firm performance (Hu et al., 2024) [6], and innovation output (Li & Li, 2024) [7]. Nevertheless, relatively few studies have explored how digital transformation affects employment scale within private enterprises.

Domestic and international research on the relationship between digital transformation and firm-level employment scale mainly falls into three strands. The first view holds that digital transformation expands employment scale (Han & He, 2023; Lai & Philip, 2024) [8, 9]. Digital technologies reshape traditional consumption patterns, help enterprises cut costs, improve operational efficiency and product quality, lower prices of goods and services, stimulate expansion in consumer demand, and thereby generate more jobs.

The second perspective highlights the displacement effect of digital transformation on employment (Acemoglu, 2018; Wang & Dong, 2020) [10, 11]. For one thing, artificial intelligence can replicate and even surpass human cognitive capabilities across an increasingly broad and deep range of

scenarios. It can accomplish increasingly complex and diverse tasks and break through human physical and cognitive boundaries, greatly accelerating the replacement of traditional human labor by digital technologies. For another, although innovative activities may temporarily raise demand for high-skilled workers and related production factors in the short run, they exert adverse impacts on certain labor groups in the long term, particularly low- and medium-skilled workers (Wei et al., 2020) [12].

The third viewpoint stresses that digitalization has given rise to the phenomenon of job polarization (Hui & Zhu, 2021; Li et al., 2021) [13, 14]. At its core, technological progress—notably breakthroughs in artificial intelligence, automation and big data analytics—does not exert uniform impacts on all occupations. Instead, it triggers substantial differentiation in labor demand, forming a distinct dumbbell-shaped structure. On the one hand, market demand for high-end technical talents has surged sharply (Chen & Zhao, 2021) [15]. On the other hand, technologies are increasingly capable of substituting routine, procedural and codifiable tasks, leading to a marked contraction in demand for positions involving such basic and repetitive work.

2. THE ORETICAL ANALYSIS AND RESEARCH HYPOTHESES

Digital transformation refers to a dynamic process in which enterprises actively adopt digital technologies including artificial intelligence, big data, cloud computing and the Internet of Things to systematically promote in-depth transformation and integrated innovation in strategic concepts, production procedures, organizational forms and value creation modes. It aims to cut operational costs, improve efficiency, optimize resource allocation, stimulate innovation vitality, advance iterative upgrading of products and services, and enhance user experience. Ultimately, enterprises can build core competitiveness for the digital era and strengthen the fundamental driving force for boosting development resilience (Yin et al., 2025; Xu et al., 2024) [16, 17]. Such improved resilience constitutes a vital micro foundation for private enterprises to withstand external shocks and stabilize jobs.

2.1. The Impact of Digital Transformation on Employment Stabilization of Private Enterprises

As an internal driving force facilitating efficiency reform and competitiveness improvement for private enterprises, digital transformation helps them stabilize employment. Firstly, through digital transformation, private enterprises implement digital marketing, digital management, digital services, digital operation and digital collaboration across all operational links. This enhances their market competitiveness by reducing comprehensive operating costs and improving product quality as well as service experience (Ni & Liu, 2021) [18]. Although digital transformation generates a displacement effect on some low-complexity, routine jobs, its creation effect will significantly outweigh the displacement effect in the long run and expand corporate employment scale (Fang et al., 2022) [19].

The underlying reason lies in the fact that digital transformation raises corporate operational efficiency and resource allocation efficiency, and lowers service and product prices (Zheng et al., 2025) [20]. Furthermore, it alleviates the previous problem of information asymmetry, helps the labor force acquire high-level skills, empowers the labor market, thereby boosting firms' labor demand and eventually yielding a positive net employment growth effect (Zhao et al., 2020) [21].

Meanwhile, the continuous improvement of big data information platforms greatly enhances the informatization level of the labor market. Massive and accurate data on job supply and demand substantially enriches workers' access to employment information. Improved information flow efficiency removes the temporal and spatial constraints of traditional offline recruitment and expands the breadth and depth of employment channels. Supported by data analysis, enterprises can identify consumer demands and market trends, collect, integrate and conduct in-depth analysis of data on

customer behaviors, operational procedures and market dynamics. This effectively addresses fragmented, delayed and distorted information, strengthens market sensitivity as well as capabilities for precision marketing and customer retention, and further drives the growth of corporate labor demand (Tao et al., 2021) [22].

Finally, digital transformation enhances private enterprises' supply chain collaboration and market adaptability, and improves their capacity to cope with changes in the external environment and uncertain risks. Centered on big data analytics, artificial intelligence-based decision-making, IoT perception and cloud computing, digital transformation of private enterprises can drive business model innovation and the expansion of business boundaries. It enables in-depth coordination between internal procedures and external ecosystems, opens new channels for value creation, fosters new business forms, new scenarios and new occupations, and injects new momentum into employment stabilization for private enterprises (Zhang et al., 2023) [23]. Accordingly, this paper proposes Hypothesis 1:

H1: Digital transformation can expand the employment scale of private enterprises.

2.2. The Mediating Role of Productivity

Digital transformation expands the employment scale of private enterprises by increasing productivity. Digital transformation integrates information, computation and communication via combinations of digital technologies, embedding big data, the Internet of Things, cloud computing, artificial intelligence, blockchain and other technologies into corporate operation and management (Tobias & Pooyan, 2020) [24]. In the process of digital transformation, enterprises integrate digital technologies into the real economy, lift operational efficiency and value creation rate, and continuously drive productivity growth (Luo et al., 2023) [25]. Productivity growth raises employment through two channels. On the one hand, after traditional industries adopt digital technologies, error rates in production processes drop markedly, operational conditions become more stable, unit output costs decline, prices of goods and services fall, and market demand is further stimulated. Firms therefore expand production and increase labor demand (Bai & Zhang, 2021) [26]. On the other hand, digitalization breaks temporal and spatial barriers; remote collaboration and real-time information sharing become commonplace, and the efficiency of cross-industry and cross-field resource restructuring rises, pushing up labor productivity. New models such as online education, telemedicine and unmanned retail emerge against this backdrop. They inject vitality into traditional industries, generate flexible and diversified new jobs, and facilitate dynamic optimization of labor structure (Qi & Xiao, 2020) [27]. With rising innovation efficiency and penetration of digital technologies, corporate productivity keeps growing and eventually translates into expanding labor demand. On this basis, Hypothesis 2a is put forward:

H2a: Digital transformation expands the employment scale of private enterprises by boosting productivity.

2.3. The Mediating Role of Business Scale

Digital transformation expands the employment scale of private enterprises by enlarging business scale. First of all, relying on big data and artificial intelligence, enterprises can capture demand fluctuations in real time, intelligently regulate inventory and dynamically update business strategies, which not only cuts operating costs but also eliminates risks caused by market information lags. Secondly, digital transformation promotes integrated development across all industries (Yang & Jiang, 2021) [28].

Digital transformation breaks internal departmental barriers and external ecological boundaries of enterprises, accelerates information flow in supplier management, customer services and cross-departmental cooperation, reduces internal and external transaction costs and optimizes resource

allocation. The application of digital technologies gives rise to cross-border products and services that accurately match diversified consumer needs. Meanwhile, private enterprises share information and make joint decisions with upstream and downstream partners via digital platforms, accelerating full-chain coordination and enabling agile responses to market volatility.

Expanded business scale contributes to larger corporate employment scale. To match higher output, enterprises need to increase input of production factors in all links, including labor, which pushes up labor demand and creates more jobs (Acemoglu & Restrepo, 2020) [29]. In addition, funds saved through cost reduction can be invested in new business development or technological upgrading, further accelerating business expansion and generating new employment opportunities. Therefore, this paper proposes Hypothesis 2b:

H2b: Digital transformation expands the employment scale of private enterprises by enlarging business scale.

3. RESEARCH DESIGN

3.1. Sample Selection and Data Sources

The sample of this paper consists of micro firm-level data of private listed companies on the A-share market from 2013 to 2023. Corporate financial data are obtained from the China Stock Market & Accounting Research (CSMAR) Database, while data on employees' occupations, job types and educational backgrounds are sourced from the Wind Database. Annual reports of listed companies are collected and sorted in batches from official websites of the Shanghai Stock Exchange and Shenzhen Stock Exchange. Macroeconomic data and indicators adopted in this paper are derived from successive editions of the China Statistical Yearbook, China Labor Statistical Yearbook, China Industrial Statistical Yearbook, and China Economic Census Yearbook (2008).

3.2. Variable Definitions

3.2.1. Dependent Variable

Employment scale of private enterprises (employ). Following Han and He (2023) [8], this variable is measured by the number of employees in private enterprises. To mitigate the bias of outliers on empirical results and better reflect the changing trend of employment size, the natural logarithm of the number of corporate employees is adopted.

3.2.2. Independent Variable

Digital transformation (dig). Referring to the methodology proposed by Wu et al. (2021) [3], textual analysis is employed to measure corporate digital transformation. First, Python is used to crawl annual reports of A-share listed firms over 2013–2023. A dictionary of digital terminology is constructed and imported into the Jieba segmentation library in Python. The frequency of keywords covering five categories—artificial intelligence, blockchain, cloud computing, big data, and digital technology application—is counted, as illustrated in Figure 1. Finally, to address the right-skewed distribution of such word-frequency data, the total word frequency is logarithmically transformed to construct the final indicator measuring the level of corporate digital transformation.

3.2.3. Mediating Variables

The mediating variables in this study are business scale (business) and productivity (tfp). Business scale is measured by the natural logarithm of corporate operating revenue. Productivity is represented by firm-level total factor productivity (TFP), which is estimated via the OLS approach in this paper.

3.2.4. Control Variables

Firm-level and city-level factors may both affect corporate employment scale. Following existing studies (Yan & He, 2025; Zhao et al., 2024) [30, 31], control variables are selected at the firm and regional levels. Firm-level control variables include firm size (size), firm age (age), ownership concentration (top), corporate growth (growth), and asset-liability ratio (lev). Regional control variables cover economic development level (gdp), secondary industry structure (struct1), tertiary industry structure (struct2), and average wage level (salary).

Table 1. Variable Definitions

Variable Name	Variable Symbol	Definition
Employment scale of private enterprises	employ	Natural logarithm of the number of employees in private enterprises
Digital transformation	dig	Indicator constructed based on the frequency of digital terminology in corporate annual reports
Business scale	business	Natural logarithm of corporate operating revenue
Productivity	tfp	Firm-level total factor productivity
Firm size	size	Natural logarithm of corporate total assets
Firm age	age	Natural logarithm of the years since firm establishment
Ownership concentration	top	Ratio of the shareholdings of the largest shareholder to total share capital
Corporate growth	growth	Ratio of fixed assets
Asset-liability ratio	lev	Ratio of total liabilities to total assets
Economic development level	gdp	Natural logarithm of provincial per capita GDP
Secondary industry structure	struct1	Proportion of secondary industry value-added in provincial GDP
Tertiary industry structure	struct2	Proportion of tertiary industry value-added in provincial GDP
Average wage level	salary	Natural logarithm of the average wage of employees in the province

3.3. Model Specification

To examine the impact of digital transformation on the employment scale of private enterprises, this paper constructs the following baseline regression model:

$$\text{employ}_{it} = \alpha_0 + \alpha_1 \text{dig}_{\text{it}} + X_{it} + \omega_i + \eta_i + \mu_{it}$$

Where subscripts i and t denote firm and year, respectively. $\text{employ}_{\text{it}}$ represents the employment scale of firm i in year t; dig_{it} denotes the digital transformation level of firm i in year t. X_{it} stands for a set of control variables; ω_i is the firm fixed effect; η_i refers to the year fixed effect, and μ_{it} is the random error term. The coefficient α_1 is the core parameter of interest. If α_1 is significantly positive, it can be inferred that digital transformation expands the employment scale of private enterprises, which is consistent with the theoretical expectation of this study.

4. EMPIRICAL RESULTS ANALYSIS

4.1. Descriptive Statistics

Table 2 reports the descriptive statistics of the main variables in this paper. As shown in Table 2, the mean value of employment scale of private enterprises (employ) is 7.4838, with a standard deviation of 1.101. Its minimum value is 4.94 and maximum value is 10.49, indicating evident disparities in employment size across different firms. The mean value of digital transformation (dig) equals 1.7349, the standard deviation is 1.462, the minimum value is 0 and the maximum value reaches 5.30. This result suggests that most private enterprises have launched digital transformation initiatives, yet the extent of digital transformation varies substantially among firms. The descriptive statistics of the remaining variables are broadly consistent with those documented in relevant existing literature.

Table 2. Descriptive Statistics

VarName	Obs	Mean	SD	Min	Median	Max
employ	21947	7.4838	1.101	4.94	7.41	10.49
dig	21947	1.7349	1.462	0.00	1.61	5.30
size	21947	22.0136	1.075	19.97	21.88	25.31
lev	21947	0.3928	0.193	0.05	0.38	0.88
growth	21947	0.1629	0.386	-0.56	0.10	2.23
top	21947	30.5302	13.338	8.00	28.91	68.06
age	21947	2.9733	0.294	2.20	3.00	3.58
gdp	21947	11.3647	0.423	10.40	11.39	12.21
struct1	21947	0.3935	0.085	0.15	0.41	0.52
struct2	21947	0.5504	0.103	0.40	0.53	0.85
salary	21947	11.7047	0.474	10.65	11.68	13.08
tfp	21947	10.4263	1.088	8.16	10.33	13.61
business	21947	12.0904	1.254	9.43	11.99	15.68

4.2. Direct Effect Test

Table 3 presents the regression results regarding the impact of digital transformation on the employment scale of private enterprises. Column (1) only includes the core explanatory variable; Column (2) further incorporates firm-level control variables; Column (3) additionally introduces regional-level control variables. The results show that all regression coefficients of digital transformation on private enterprises' employment scale are significantly positive at the 1% statistical level.

Taking Column (3) to interpret the economic implication: the regression coefficient of digital transformation is 0.025, which indicates that a 1% increase in the level of corporate digital transformation in the current year leads to a 0.025% growth in the employment scale of private enterprises. The above evidence demonstrates that digital transformation significantly expands the employment absorption capacity of private enterprises. Accordingly, H1 is verified.

Table 3. Baseline Regression Results

	(1)	(2)	(3)
	employ	employ	employ
dig	0.074***	0.018***	0.025***
	(13.33)	(4.35)	(6.87)
Time fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
N	21947	21947	21947
R^2	0.0158	0.4399	0.5646

Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The same applies to subsequent tables.

4.3. Robustness Tests

(1) Replacing the core explanatory variable. To verify whether the measurement of the core explanatory variable distorts the baseline regression results, this study follows Zhao et al. (2021) [32] and reconstructs the digital transformation index via textual analysis and expert scoring. The re-estimated results of Model (1) are presented in Column (1) of Table 4. The coefficient of the core explanatory variable remains significantly positive at the 1% level, which confirms the robustness of the baseline findings.

(2) Controlling for provincial fixed effects. Provincial heterogeneity such as distinctive local economic characteristics and divergent timing/intensity of provincial policy implementation may shape labor demand of private enterprises. These provincial-level unobservable factors are hard to incorporate into conventional regression specifications, which may trigger spurious correlation and biased estimates caused by omitted variable bias. To eliminate this concern, this paper extends the baseline model by adding provincial fixed effects to absorb unmeasured provincial shocks. Column (2) of Table 4 reports the corresponding results. The coefficient of digital transformation is still significantly positive at the 1% significance level, supporting the robustness of our baseline conclusion.

(3) Alternative model specification. The number of corporate employees exhibits obvious left censoring. To mitigate bias induced by inappropriate model selection, we replace the two-way fixed effects model with a left-censored Tobit model and re-estimate Model (1). The results are shown in Column (3) of Table 4. The coefficient on dig stays significantly positive at the 1% level, further validating the robustness of our results.

(4) Excluding special samples. The COVID-19 pandemic exerted an abrupt and severe shock on firms and labor markets, which may confound the causal relationship between digital transformation and employment. To address this issue, we restrict our sample to pre-pandemic observations for re-estimation, as illustrated in Column (4) of Table 4. The core coefficient remains significantly positive at the 1% level, which again demonstrates the reliability of our empirical findings.

Table 4. Regression Results of Robustness Tests

	Replaced Core Explanatory Variable	Controlling Provincial Fixed Effects	Alternative Model	Excluding Special Samples
	(1)	(2)	(3)	(4)
	employ	employ	employ	employ
digi	1.390***			
	(6.89)			
dig		0.026***	0.133***	0.014***
		(6.97)	(41.40)	(2.79)
Control variables	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Provincial fixed effects	No	Yes	No	No
N	21947	21947	21947	11179
R^2	0.5650	0.5640		0.5618

4.4. Endogeneity Analysis

Direct regression of corporate employment scale and employment structure on digital transformation may suffer from endogeneity bias. Reverse causality and omitted variables can distort the estimation results of the baseline model. To accurately identify the causal relationship between digital transformation and employment, this paper adopts an instrumental variable (IV) approach to mitigate endogeneity concerns.

Following Huang et al. (2019) [33], this paper takes the number of post offices per million residents in each prefecture-level city in 1984 as the instrumental variable (iv) for digital transformation. Regional information infrastructure shapes firms' digital transformation intensity, which satisfies the relevance condition. The historical density of post offices reflects local economic development and consumption levels, and as a legacy communication infrastructure, it proxies residents' historical demand for information services without exerting a direct impact on current corporate employment scale, thus meeting the exogeneity requirement.

Since the 1984 post office density is cross-sectional time-invariant data, we construct the final instrumental variable by interacting the 1984 post office count per million residents with the lagged one-year number of internet users. The regression results are reported in Table 5. In the first-stage regression, the coefficient of the constructed instrumental variable is statistically significant at the 1% level. The Kleibergen-Paap rk LM statistic equals 123.54 with a p-value of 0.000, rejecting the null hypothesis of underidentification. The Kleibergen-Paap rk Wald F statistic far exceeds the critical values of the Stock-Yogo weak instrument test, ruling out the weak instrument problem. Collectively, these tests verify the validity of the instrumental variable and confirm the credibility of the two-stage least squares (2SLS) estimation results.

Table 5. Instrumental Variable Regression Results

Variable Name	First Stage (dig)	Second Stage (employ)
iv	0.000*** (5.87)	
dig		0.370***
		(7.82)
Control variables	Yes	Yes
Time fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
N	18441	18441
Kleibergen-Paap rk LM	123.54 [0.0000]	
Kleibergen-Paap rk Wald F	34.41	

4.5. Heterogeneity Analysis

(1) Heterogeneity by Employees' Educational Attainment. This paper categorizes employees into three groups based on educational background: postgraduate and above, bachelor's or junior college diploma, and high school and below. We further investigate how digital transformation affects employment across groups with different education levels, and the regression results are presented in Table 6.

As shown in Table 6, digital transformation significantly raises labor demand for employees with postgraduate, bachelor's and junior college degrees, while its effect on workers with high school education or less is statistically insignificant. Specifically, deeper digital transformation fuels rising demand for professional talents capable of designing, maintaining and optimizing digital systems, who generally hold higher educational credentials. As discussed earlier, the factor substitution effect lowers the relative wage of both high-educated and low-educated labor. When expanding recruitment, firms exhibit a stronger preference for highly educated workers. Workers with only high school education or below require additional vocational training to upgrade their skills to match new job requirements brought by digitalization. Skill upgrading not only improves individual employability but also lifts the overall competitiveness of the labor market.

The heterogeneous regression results on the employment-stabilizing effect of digital transformation reveal evident stratification by education level. Digital transformation exerts a strongly significant positive impact on workers with bachelor's or junior college degrees, indicating that newly created digital jobs mainly target applied skilled labor and reflecting strong complementarity between technology and human capital. It generates a mild positive effect on postgraduate employees, which implies digitalization drives structural adjustment of high-end positions rather than overall job expansion. The insignificant coefficient for workers with high school education or below suggests low-skilled groups face technological displacement and marginalization risks. This finding demonstrates that digital transformation may widen skill gaps in the labor market, which calls for vocational retraining policies to bridge the digital divide.

Table 6. Heterogeneity by Employees' Educational Attainment

	(1)	(2)	(3)
	employ	employ	employ
Postgraduate and Above	0.000*		
	(1.73)		
Bachelor's / Junior College		0.000***	
		(6.06)	
High School and Below			0.403
			(0.84)
Control variables	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
N	21947	21947	21947
R^2	0.5642	0.5738	0.5630

(2) Heterogeneity by Labor Skill Tier

To further examine the differentiated employment impacts of digital transformation across job types, this paper follows the classification standard of Acemoglu and Autor (2011) [34] and divides labor into three tiers: low-skilled labor (non-routine manual tasks such as cleaning and logistics), medium-skilled labor (routine operational work including manufacturing and administrative support), and high-skilled labor (abstract analytical work such as R&D and management). Table 7 reports the corresponding regression outcomes.

The results show that the employment-promoting effect of digital transformation concentrates on medium-skilled and high-skilled workers. Medium- and high-skilled labor enjoys employment expansion dividends due to stronger complementarity with digital technologies (e.g., engineers operating intelligent production systems). In contrast, low-skilled workers fall into a technological isolation trap: they are replaced by automation while lacking access to newly created digital vacancies. Overall, the job creation effect of digital transformation outweighs its displacement effect, leading to a positive net employment effect for private enterprises.

Table 7. Heterogeneity by Labor Skill Tier

	(1)	(2)	(3)
	Low-skilled Labor	Medium-skilled Labor	High-skilled Labor
	employ	employ	employ
dig	0.022	0.020***	0.022***
	(1.35)	(4.56)	(3.14)
Control variables	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
N	894	14667	5280
R^2	0.5589	0.5944	0.5685

5. MECHANISM ANALYSIS

To further identify the transmission channels through which digital transformation affects the employment scale of private enterprises, this paper adopts the mediation identification approach proposed by Jiang Ting to conduct empirical mechanism tests and verify the theoretical hypotheses raised above. The mediation regression models are specified as follows:

$$m_{it} = \beta_0 + \beta_1 \mathrm{dig}_{it} + X_{it} + \omega_i + \eta_i + \mu_{it}$$

Where m_{it} denotes the mediating variable, and all other variables follow the same settings as the baseline regression model. The regression results of mechanism tests are reported in Table 8.

Column (2) of Table 8 presents the estimation results taking total factor productivity as the mediating variable. The coefficient of core explanatory variable dig is significantly positive at the 1% statistical level, which confirms that digital transformation can substantially boost the productivity of private enterprises. Consistent with the theoretical framework, rising productivity triggers a chain reaction including lower product prices, expanded market demand and output growth. This dynamic process facilitates business expansion and generates new business forms, thereby enlarging corporate employment scale. Accordingly, H2a is verified.

Column (3) of Table 8 reports the regression results with business scale as the mediating variable. The coefficient on dig remains significantly positive at the 1% level, demonstrating that digital transformation effectively expands private firms' business scale. As elaborated in the theoretical section, larger business volume generates more job opportunities by increasing workload, deepening labor division and spurring innovative activities, which drives up firms' labor demand. Thus, H2b is validated.

Collectively, the above results fully confirm the dual transmission channels: digital transformation expands the employment scale of private enterprises by lifting firm productivity and enlarging business operation scale.

Table 8. Mediation Effect Analysis

	(1)	(2)	(4)
	employ	tfp	business
dig	0.025***	0.012***	0.013***
	(6.87)	(3.20)	(3.36)
Control variables	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
N	21947	21947	21947
R^2	0.5646	0.5540	0.6006

6. CONCLUSIONS AND POLICY IMPLICATIONS

6.1. Research Conclusions

Since 2020, black swan events have occurred frequently, and the VUCA (Volatile, Uncertain, Complex, Ambiguous) nature of the international environment has intensified sharply. The combination of great-power competition and public health crises triggered a sharp macroeconomic slowdown, imposing widespread operational pressure on enterprises and deteriorating overall employment conditions. Meanwhile, the digital economy is reshaping the employment landscape: it crowds out traditional jobs while generating new labor demand at the same time.

Against this backdrop, private enterprises act as the primary vehicle for employment absorption and boast flexible institutional conditions for digital upgrading. Accordingly, unlocking their job creation potential via digital transformation has become a core approach to retaining and expanding jobs. To unpack the profound impacts of digital technologies on employment structure, this study assembles micro data of A-share private listed firms in China spanning 2013 to 2023, constructs multi-dimensional indicators to measure corporate digital transformation, and systematically identifies the

transmission channels and boundary conditions of digital transformation's effect on private enterprises' employment scale. The empirical results yield three key findings:

First, digital transformation significantly expands the employment scale of private enterprises, and this positive effect survives a battery of robustness tests.Second, mechanism tests verify that digital transformation enlarges private firms' employment capacity through two parallel channels: boosting total factor productivity and expanding business scale.Third, heterogeneous effects show that the employment-promoting gains of digitalization accrue disproportionately to workers with higher educational attainment, and digital transformation substantially raises the share of medium- and high-skilled positions.This paper provides micro-level empirical evidence for balancing the development of the digital economy and labor market stability.

6.2. Policy Implications

Drawing on the above findings, targeted policy recommendations are put forward to advance private enterprises' digital transformation and fully leverage its employment-stabilizing effects:

(1) Launch targeted support policies for digital transformation to unlock private firms' employment absorption capacity

Compared with state-owned enterprises, private firms face disadvantages in accessing resources and information. Amid the current economic downturn and shrinking job supply, private enterprises are confronted with unprecedented employment challenges. This study confirms that digital transformation can effectively expand their employment scale. To amplify this effect, differentiated supporting policies tailored to private enterprises should be formulated.First, scale up fiscal and financial support for private firms' digital upgrading, improve supporting policies and infrastructure, and cut the cost of technological renovation. Priority should be given to subsidizing the adoption of intelligent manufacturing equipment, data management systems and digital marketing platforms, enabling firms to generate more jobs through business expansion.Second, streamline administrative approval procedures for digital economy sectors, and encourage firms to develop new business forms such as cross-border e-commerce, intelligent manufacturing services and platform economy powered by digital technologies, which inject new momentum into employment retention and expansion. Policy implementation should coordinate digital investment and job creation to guarantee that technological dividends translate into sustained labor demand.

(2) Target the dual employment-promoting mechanisms to drive job growth via productivity gains and business expansion

The results confirm that digital transformation lifts private enterprises' employment scale through two complementary channels: higher productivity and larger business volume. Targeted measures should be implemented around these two mechanisms:On the one hand, incentivize private firms to adopt digital technologies including artificial intelligence and industrial internet to optimize production workflows and management modes, lift total factor productivity, reduce unit output costs and strengthen market competitiveness, laying an efficiency foundation for sustained employment absorption.On the other hand, support firms to expand domestic and overseas markets through digital marketing platforms, cross-border e-commerce and collaborative supply chain systems to drive continuous business growth, which directly creates a wide range of production, technical and operational vacancies. Governments can jointly foster a virtuous cycle of "efficiency expansion – business growth – employment growth" by offering subsidies for core technological renovation, building public service platforms for production capacity matching and broadening market access for digital industries, ensuring digital transformation translates into tangible employment growth for private enterprises.

(3) Establish a tiered digital skill training system to mitigate job polarization

Heterogeneity analysis reveals that the employment benefits of digital transformation mainly favor highly educated workers and push up the proportion of medium- and high-skilled jobs. Therefore, a precise skill development system must be built to adapt to structural shifts in the labor market:For medium- and high-skilled workers, a tripartite digital talent cultivation mechanism linking governments, universities and enterprises should be established. Universities shall expand course offerings in cutting-edge technologies such as artificial intelligence and big data analytics, while tax incentives shall motivate firms to provide on-the-job digital skill training.For low-skilled laborers, a digital literacy campaign shall be rolled out, delivering specialized training on automated equipment operation and digital platform usage to improve their ability to transition into medium-skilled roles. Meanwhile, lifelong digital learning accounts with training subsidies should be launched to alleviate structural skill mismatches induced by digital transformation.

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