Economics & Business Management
ISSN Print: 3079-5214
ISSN Online: 3079-5222
https://doi.org/10.63313/EBM.9092

# Digital Transformation and Enterprise Labor Employment: Incentivizing or Suppressing ?

**Ziyi Fan**
Anhui University of Finance and Economics, Bengbu 233030, China
Email: 3202300348@aufe.edu.cn

**How to cite this paper:** Fan, Z. Y. (2025). Digital Transformation and Enterprise Labor Employment: Incentivizing or Suppressing? Economics & Business Management,2(3),111-125. ISSN Print: 3079-5214; ISSN Online: 3079-5222.
https://doi.org/10.63313/EBM.9092
**Published: 2025-08-27**



## Abstract

In the context of accelerated digital economic development, digital trans-for-mation has not only become a core driver for organizational restructuring and business model innovation in enterprises, but also profoundly influenced labor market reforms, serving as a crucial approach to achieving stable employment goals. Using the establishment of National Big Data Comprehensive Pilot Zones as a natural experiment, this study employs the difference-in-differences method to demonstrate that these zones significantly enhance corporate em-ployment levels. Mechanism tests reveal that these zones boost employment scale through three pathways: improving production efficiency, reducing op-erational costs, and enhancing business performance. Expanding the research framework to examine how National Big Data Comprehensive Pilot Zones affect productivity, the study finds that such zones improve factor allocation, promote specialized division of labor, and optimize human capital to enhance production efficiency. Heterogeneity tests indicate that the employ-ment-promoting effects are more pronounced in pilot zones with stronger internal controls, those located in Northeast China, northern coastal regions, and the middle reaches of the Yangtze River, as well as non-technology-intensive enterprises. This research not only deepens our understanding of how National Big Data Comprehensive Pilot Zones empower corporate employment, but also holds significant practical implications for advancing and refining industrial policies aimed at stabilizing employment.

## Keywords

Digital transformation; National Big Data Comprehensive Pilot Zone; Employment

## 1. Introduction

Employment, as the cornerstone of people's livelihoods, serves as both the foundation for individual survival and the source of corporate innovation. It acts as a vital link between sustainable economic development and social stability, impacting not only the survival and growth opportunities of millions of families but also profoundly influencing industrial transformation efficiency. This strategic pivot drives high-quality development and contributes to building a global community with a shared future for mankind. Currently, facing external challenges such as slowing

global economic growth and geopolitical conflicts, domestic economic uncertainties have intensified, affecting China's job market and creating severe employment pressures [1]. Against this backdrop, the report from the 20th National Congress of the Communist Party of China has elevated the "employment-first strategy" to the core of socioeconomic development, emphasizing institutional innovations to achieve higher-quality and more adequate employment. The rapid development of the digital economy provides a key solution to address employment issues. According to the "China Digital Economy Development Research Report (2024)" by the China Academy of Information and Communications Technology (CAICT), over the past decade, digital investments in secondary and tertiary industries have contributed 5.9 and 12.6 percentage points more to labor productivity growth than traditional inputs, respectively. The digital economy has become a vital engine for driving economic growth, promoting industrial transformation, and stimulating employment and entrepreneurship vitality. It not only creates job opportunities and diverse career paths in emerging sectors but also expands labor market absorption capacity [2], thereby achieving high-quality employment. However, while digital technology advances rapidly, it may also exert disruptive impacts on the job market [3]. The technological preferences inherent in progress have led to reduced demand for low-skilled workers [2]. Moreover, as capital deepens, the substitution of human labor by capital has become increasingly pronounced [4]. Therefore, driving corporate digital transformation to achieve the goal of "stable employment" is a topic worthy of in-depth discussion.

With the booming development of the digital economy, digital technologies are penetrating all sectors of economic and social development with unprecedented depth and breadth. Data has emerged as a new and crucial production factor, profoundly impacting traditional corporate production models and resource allocation, particularly in labor management [5]. The "14th Five-Year Plan for Digital Economy Development" explicitly identifies the digital economy as the core engine driving industrial upgrading. By establishing an efficient data element market system, it aims to fully unlock the value dividends of data elements and expand employment opportunities in the digital economy. However, it's noteworthy that while the data economy creates significant value for the job market through its flexible and adaptable nature [2], it also brings structural labor challenges such as a large aging workforce and substantial educational disparities between urban and rural areas. These factors make it difficult for the labor market to adequately meet the demand for highly skilled professionals required by industrial digitization and intelligent transformation [6]. Whether enterprises can seize opportunities brought by data elements to transition from "demographic dividend" to "human capital dividend" will profoundly influence their future development. Therefore, accelerating research on optimizing corporate labor capital to achieve high-quality employment goals holds immense significance.

The deep integration of digital technology with the real economy has become a crucial driving force for economic transformation, and its economic impacts are increasingly drawing attention from scholars both domestically and internationally. Existing research reveals that the digital economy exerts dual effects on employment [8]. On one hand, digital technology may trigger labor substitution effects, leading to reductions in routine or repetitive jobs due to technological progress [9,10]. On the other hand, digital technology can also drive employment growth through creation effects. These effects manifest in two key aspects: First, the application of digital technology prompts enterprises to increase capital investment in advanced equipment (such as machinery), thereby stimulating demand for high-skilled positions related to digitization [11]; Second, the scale effect induced by cost reduction and efficiency improvement through digital technology drives increased labor demand [12,13]. Therefore, the net impact of digital technology on employment depends on the dynamic balance between its "creation effect" and "substitution effect," with the relative strength of these effects requiring further theoretical and empirical verification. Industrial policies typically generate welfare and economic effects [14], but does the implementation of national big data comprehensive pilot zone policies also produce such effects? While existing scholarship has comprehensively analyzed the economic impacts of big data comprehensive pilot zones, demonstrating their capacity to drive corporate digital transformation [15], innovation [16], and improvements in total factor productivity [17], relatively few studies have examined the welfare effects of big data policies—particularly regarding employment, income distribution, and social benefits [5,11]. Against the backdrop of intensifying employment pressures, a critical question emerges: Can government-established big data pilot zones stimulate job creation by empowering enterprises through data-driven elements? What specific pathways exist for this impact? Under what conditions would these effects become more pronounced? These remain crucial research questions requiring further exploration.

Based on the above analysis, this study plans to select A-share listed companies from 2011 to 2020 as research samples, using the establishment of National Big Data Comprehensive Pilot Zones as an exogenous shock. The study employs the difference-in-differences method to thoroughly explore the impact of these zones on employment scale in enterprises. The findings reveal that ①Big Data Pilot Zones significantly boost corporate employment growth. ②The implementation of these policies stimulates job creation through improved production efficiency, reduced costs, and enhanced business performance. ③Heterogeneity analysis indicates that the policy more effectively promotes employment increases in Northeast China, northern coastal regions, the middle reaches of the Yangtze River, and enterprises with stronger internal controls or non-technology-intensive operations. This paper makes three key contributions: First, it expands research on the relationship between corporate employment and National Big Data Pilot Zones, particularly in as-

sessing employment effectiveness under digital transformation policies from a national governance perspective. Second, it extends mechanism testing by identifying three pathways through which these zones improve production efficiency—optimizing factor allocation, promoting specialized division of labor, and enhancing human capital—thereby enriching existing literature. Third, by treating the establishment of National Big Data Pilot Zones as an exogenous shock, it effectively addresses endogeneity issues and precisely identifies the causal effects of digital transformation policies on employment.

## 2. Ttheoretical Analysis

The net impact of technological progress on employment depends on the dynamic game between 'destructive effects' and 'creative effects'[3]: the former reduces low-skilled jobs due to efficiency improvements and skill preferences, while the latter stimulates consumption, expands production, and related industries through price, income, and technology diffusion effects, thereby creating new employment. Therefore, the ultimate impact of big data technology on corporate employment is uncertain.

1. The direct effect of the establishment of big data comprehensive pilot zone on employment

The establishment of the National Big Data Comprehensive Experimental Zone is based on the theory of capital-skill complementarity. By combining digital technology with production activities, it promotes capital deepening and directly creates a large number of high-skilled talent job demands. Digital technology has given rise to new industries such as the platform economy and the sharing economy, giving rise to emerging professions such as delivery riders and cross-border e-commerce. The infrastructure construction of the experimental zone, including network upgrades and data center construction, has generated a large demand for technical maintenance personnel. Specialized policy support has attracted relevant enterprises to gather, significantly enhancing the regional employment creation capacity.Based on this analysis, Hypothesis 1 is proposed:

H1: The establishment of the National Big Data Comprehensive Pilot Zone will directly promote enterprise employment

2. The establishment of big data pilot zones increases labor demand by increasing enterprise productivity

Enhanced labor productivity drives workforce demand growth, thereby increasing employment. Moreover, digital technology serves as a complementary labor tool, effectively reducing inefficient repetitive tasks and improving worker efficiency. Secondly, information theory demonstrates that precise data reduces managerial decision-making errors . By promoting corporate digital transformation [15], these zones integrate digital technologies with enterprises. Through big data analytics, they minimize consumer information noise, create accurate customer profiles, and

precisely capture market demands, enabling flexible production, minimizing decision-making errors, and enhancing operational efficiency. Finally, specialized division of labor remains a crucial pathway to improve enterprise productivity. Digital transformation reduces inter-enterprise coordination costs, enabling specialized division of labor that allows companies to focus on deep mining of user data and grasping key nodes in industrial chains, thereby boosting productivity. Thirdly, pilot zones attract high-quality talents through generous talent policies and institutional support. For instance, Guizhou Province offers preferential policies for core technical personnel in big data enterprises, including household registration, medical care, and children's education. These policies directly reduce information search, migration, and settlement costs associated with labor mobility, eliminating barriers to talent flow and attracting high-end professionals. The advanced human capital significantly enhances enterprises' resource allocation capabilities. High-skilled human capital demonstrates stronger knowledge absorption and application abilities. Furthermore, by attracting top-tier talent to pilot zones, enterprises gain access to cutting-edge technologies and management models, optimizing production processes and enhancing efficiency. Additionally, the technological innovation and absorption capabilities of high-caliber human capital accelerate technology diffusion and commercialization, driving progress while improving resource utilization efficiency for cost reduction and efficiency enhancement. Based on this analysis, Hypothesis 2 is proposed:

H2: The establishment of the National Big Data Comprehensive Pilot Zone will improve the production efficiency of enterprises and promote the employment of enterprises

3. The establishment of data pilot zones increases labor demand by reducing enterprise costs

The establishment of big data comprehensive pilot zones creates favorable conditions for enterprises to expand production and workforce employment through reduced internal control costs and external transaction costs, including market access and capital provision. Regarding external transaction costs: First, by integrating digital technologies into production structures, enterprises effectively break down information barriers with external stakeholders, expand market boundaries, and significantly reduce search-matching costs. Simultaneously, the reduced cost of obtaining employment information facilitates efficient labor matching across regions, thereby increasing employment opportunities for enterprises in these zones. Second, digital platforms help enterprises broaden market reach, identify high-quality partners, mitigate supplier default risks, and minimize production costs caused by incomplete contracts. In terms of internal control costs, digital transformation primarily reduces coordination expenses. By embedding technologies like blockchain into operational frameworks, real-time data monitoring enables transparent management processes, facilitates instant cross-departmental information sharing, and

lowers interdepartmental coordination costs for production adjustments and sales strategy changes [7]. This enhances management efficiency and profitability, driving corporate expansion and labor demand growth. Based on this analysis, Hypothesis 3 is proposed:

H3: The establishment of the National Big Data Comprehensive Pilot Zone will promote employment by reducing production costs

4. The establishment of data pilot zones increases labor demand through profit effects

Expanding consumer market scale serves as a crucial strategy for boosting corporate employment. Big Data Comprehensive Pilot Zones enhance business performance through digital-driven differentiation strategies. Increased corporate revenues drive production expansion, which in turn stimulates employment demand. Specifically, digital technologies' capabilities in data capture and analysis have significantly reduced upstream/downstream data acquisition costs while improving information processing efficiency. By leveraging big data analytics, companies can precisely identify consumer characteristics to meet personalized needs. Furthermore, through real-time communication via online platforms and mini-programs, businesses can incorporate consumer feedback directly into product design cycles, creating a virtuous cycle of demand insight, product optimization, and market expansion. This ultimately enhances customer retention, market share, and operational performance. Based on this analysis, Hypothesis 4 is proposed:

H4: The establishment of the National Big Data Comprehensive Pilot Zone promotes enterprise employment through profit effect

## 3. Empirical Research

### 3.1. Model Specification

Using a double difference model, enterprises within the experimental zonea re treated as the treatment group, while those outside the zone are used as the control group. The net effect of establishing the National Big Data Comprehensive Experimental Zone on the scale of enterprise employment i s empirically evaluated:

$$Labor_{it} = \alpha + \beta DID_{jt} + CV_{it} + \sum Firm + \sum Year + \varepsilon_{ijt} \quad (1)$$

In equation (1), indices i, j, and t represent enterprises, cities, and years respectively. $Labor_{it}$,denotes the number of employees employed by enterprise i in year t; $DID_{jt}$,is a dummy variable indicating whether city j was designated as a Big Data Pilot Zone in 2015 or 2016 (value 1 if yes, 0 otherwise); $\varepsilon_{ijt}$represents random disturbance terms;$CV_{it}$controls for potential employment influencing factors. The model also controls for firm fixed effects and annual fixed effects. Notably, $\beta$ reflects the average policy effect of national big data pilot zone policies on enterprise employment. This study employs city-level clustered robust stand-

ard errors in benchmark regression analysis.

### 3.2. Data sources and processing

1. Data Sample

To examine the impact of the National Big Data Comprehensive Pilot Zone on corporate employment, this study selected A-share listed companies from the Shanghai and Shenzhen stock exchanges as initial samples during the five-year period before and after the zone's establishment (2011-2020). Following Shen Kunrong et al. (2024)[11], we conducted the following data screening and processing: ① eliminating companies with total assets below total liabilities; ②excluding financial industry firms; ③removing ST-listed enterprises; ④applying 1% capping to continuous variables. The final dataset comprises 15,340 annual observations from 1,538 companies, with panel data primarily sourced from CSMAR and Wind databases. To mitigate outliers, all continuous variables were censored at the 1% level.

2. Definition of main variables

（1）Explained Variable

The number of employees employed by enterprises. Referring to Shen Kunrong et al. (2024)[11], the natural logarithm of the total number of employees in listed companies is used as an agent variable to measure the labor force employed by enterprises.

（2）Explanatory Variable

The Big Data Pilot Zone (DID) policy framework. Through manual collection of policy documents from national big data comprehensive pilot zones, this study identified the approved regional designations. The research ultimately established eight major national-level big data pilot zones: The first batch in 2015 exclusively included Guizhou Province, while the second batch selected in 2016 encompassed regions such as the Beijing-Tianjin-Hebei region, Pearl River Delta, Shanghai, Henan Province, Chongqing Municipality, Shenyang City, and Inner Mongolia Autonomous Region.

（3）Controlled Variable

Following the selection of control variables by Shen Kunrong et al. (2024)[11], the analysis is structured as follows: (1) Corporate-level controls include: Debt-to-asset ratio (Leverage), firm age (Age), Return on Assets (ROA), and fixed asset investment (Capital), expressed as logarithmic net fixed assets; Operating cash flow (Cash), measured as operating net cash flow to total assets; and Growth capability, gauged by revenue growth rate. (2) Urban-level controls comprise: Prefecture-level city GDP (GDP), measured as logarithmic regional GDP; Urban population (Pop), measured as logarithmic average urban population; Secondary industry structure (Second), represented by the proportion of secondary industry in regional GDP; and Tertiary industry structure (Third), indicated by the ratio of tertiary industry to regional GDP.

# 4. Empirical Analysis

## 4.1. Descriptive Statistics

As shown in Table 1, the average number of employees of listed companies in China is 7.91, which is larger than the median of 7.86, and the standard deviation is 1.27. This indicates that there are large individual differences in employment scale of listed companies in China. Other variables are within normal ranges without extreme values.

**Table 1.** Descriptive statistics of variables

| （1）<br>Variable Name | （2）<br>Num | （3）<br>Mean | （4）<br>Median | （5）<br>Sd | （6）<br>Min | （7）<br>Max |
|---|---|---|---|---|---|---|
| Labor | 15396 | 7.910 | 7.860 | 1.270 | 4.650 | 11.29 |
| DID | 15747 | 0.160 | 0 | 0.360 | 0 | 1 |
| Lev | 15747 | 0.440 | 0.440 | 0.210 | 0.050 | 0.980 |
| Age | 15747 | 2.880 | 2.920 | 0.340 | 1.790 | 3.560 |
| Roa | 15747 | 0.030 | 0.030 | 0.070 | -0.360 | 0.200 |
| cash | 15747 | 0.040 | 0.040 | 0.070 | -0.190 | 0.240 |
| Growth | 15555 | 0.170 | 0.100 | 0.490 | -0.640 | 3.810 |
| Capital | 15747 | 20.44 | 20.39 | 1.840 | 0 | 27.32 |
| Second | 15707 | 41.87 | 44.40 | 9.410 | 15.80 | 59 |
| Third | 15707 | 51.79 | 49.76 | 11.93 | 29.70 | 83.90 |
| GDP | 15707 | 10.47 | 10.49 | 0.720 | 6.410 | 11.62 |
| Pop | 15707 | 8.560 | 8.700 | 0.670 | 5.740 | 9.440 |

## 4.2. Results of benchmark regression

Table 2 presents the empirical results of Hypothesis 1. Column (1) shows th at, at the 5% significance level, the coefficient for the Big Data Comprehensiv e Pilot Zone (DID) reaches 0.072, indicating that the establishment of suchzo nes significantly boosts workforce employment growth in enterprises. Column (2) further demonstrates that after controlling for firm-level and urban varia bles, the regression coefficient remains statistically significant. These findings conclusively support Hypothesis 1: National-level Big Data Comprehensive Pilo t Zone policies substantially accelerate employment expansion in enterprises.

**Table 2.** Big Data Pilot Zone and Enterprise Employment: Benchmark Results

| | Labor | |
|---|---|---|
| | (1) | (2) |
| DID | 0.072** | 0.079** |
| | (0.028) | (0.034) |
| Control Variable | No | Yes |
| Enterprise Fixed Effects | Yes | Yes |
| Fixed effects by year | Yes | Yes |
| R2 | 0.884 | 0.916 |
| Sample Capacity | 15340 | 15153 |

## 4.3. Heterogeneity analysis

(1) Factor intensity classification. Building upon the industrial categorization framework by Dong Yiyu and Guo Zeguang (2021)[25], we classify labor-intensive and capital-intensive enterprises into non-technology-intensive categories. As evidenced in Tables 3(1)-(2), the establishment of national big data comprehensive pilot zones significantly boosts employment in labor-and capital-intensive sectors, while showing no notable effect on technology-intensive enterprises.

(2) Internal Control Environment. Using the data set released by the "Dibo China Listed Companies Internal Control Index", we selected the comprehensive internal control index as a proxy variable for internal control quality. By calculating the median for each industry year, companies with internal control quality exceeding the median were classified as having good internal control, while others were deemed to have poor internal control. As shown in columns (3) and (4) of Table 3, companies with relatively better internal controls exhibited significantly positive estimated coefficients for core explanatory variables, whereas those with weaker internal controls showed no significant effect. This indicates that internal control serves as a crucial factor in enhancing employment through policies implemented by national big data comprehensive pilot zones.

**Table 3.** Heterogeneity analysis

| | Skill-intensive | Not technology intensive | Internal control is good | Internal controls are weak |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| DID | 0.058 | 0.086** | 0.090** | 0.077 |
| | (0.039) | (0.041) | (0.043) | (0.055) |
| Control Variable | Yes | Yes | Yes | Yes |
| Enterprise Fixed Effects | Yes | Yes | Yes | Yes |
| Fixed effects by year | Yes | Yes | Yes | Yes |
| R2 | 0.933 | 0.917 | 0.937 | 0.894 |
| Sample Capacity | 6483 | 8092 | 7586 | 7406 |

## 4.4. Mechanism Analysis

(1) By enhancing production efficiency, the National Big Data Comprehensive Pilot Zone significantly boosts corporate employment.Productivity (Total Factor Productivity, TFP is measured using Total Factor Productivity (TFP) to reflect efficiency gains, as proposed by Chen Lin et al. (2024)[26]. Specialization is assessed through a modified value-added method, following Yuan Chun et al. (2021)[27]. Human capital structure optimization employs Rade (Research and Development Personnel Ration, as outlined in Ji Yunyang et al. (2023)[28]. Table 4(1) – (3) presents statistical results: productivity coefficients are significantly positive at the 1% level, human capital structure coefficients at the 10% level, and specialization coefficients at the 5% level. These findings confirm that the National Big Data Comprehensive Pilot Zone enhances corporate productivity through digital transformation-driven specialization and human capital optimization, ultimately increasing marginal output efficiency. This supports Hypothesis H2 outlined earlier.

(2) By reducing production costs, enterprises can enhance employment opportunities. To analyze internal control costs, this study adopts Huang Bo et al. (2023)[29] methodology, using the ratio of administrative expenses to characterize internal control costs. As shown in Table 4(5), the Big Data Comprehensive Pilot Zone policy significantly reduces corporate internal control costs at the 10% significance level. Regarding external transaction costs, we reference Wang Fei and Li Yue's (2024)[30] approach of measuring asset specificity through fixed assets' proportion of total assets. High asset specificity makes it difficult to repurpose specialized assets during external market transactions, leading to increased transaction costs for partners in negotiations and contract execution to ensure effective utilization. Consequently, excessive asset specificity results in higher external transaction costs. Table 4(4) reveals that the data comprehensive pilot zone policy reduces corporate asset specificity at the 1% significance level. By lowering both internal and external costs, enterprises gain favorable conditions for scaling production and expanding workforcesize, validating Hypothesis H3 presented earlier.

(3) By boosting operating profits, enterprises can enhance employment opportunities. As theoretical analysis indicates, the establishment of National Big Data Comprehensive Pilot Zones enables companies to adopt differentiated and personalized production models, thereby driving profit growth. Ample capital supply facilitates corporate expansion and production scale upgrades, which in turn stimulates labor demand. To validate this mechanism, we directly examine the impact of these pilot zones on business performance. Following Wang Xianbin and Chen Chunxiu's (2023)[14] methodology using operating revenue (logarithmic of main business income) as a proxy, the results in Table 4(6) demonstrate that the policy significantly contributes to corporate performance at the 1% significance level. This finding conclusively supports Hypothesis H4 proposed earlier.

**Table 4.** Relationship between policy and mechanism variables in big data comprehensive pilot area

| | Production efficiency | Human capital structure | Division of labor based on specialization | Asset specificity | Internal control costs | Business Performance |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| DID | 0.077*** | 0.561* | 0.021** | -0.013*** | -0.007* | 0.097*** |
| | (0.027) | (0.314) | (0.008) | (0.004) | (0.004) | (0.027) |
| Control Variable | Yes | Yes | Yes | Yes | Yes | Yes |
| Enterprise Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Fixed effects by year | Yes | Yes | Yes | Yes | Yes | Yes |
| R2 | 0.885 | 0.805 | 0.692 | 0.853 | 0.710 | 0.928 |
| Sample Capacity | 15500 | 15500 | 12473 | 15500 | 15500 | 15500 |

## 5. Robustness Test

(1) Parallel Trend Test

We adopt an event analysis approach, replacing the original DID variable with an interaction term of a dummy variable for years before and after policy implementa-

tion with a dummy variable for the treatment group, to test whether the parallel trend assumption is satisfied between the treatment and control groups before policy implementation. The specific formula is as follows:

$$Labor_{it} = \alpha + \sum_{t=-5}^{5} \beta_t Treat_j \times Time_t + CV_{it} + \sum Firm + \sum Year + \varepsilon_{it} \quad (2)$$

The estimation results in Figure 1 show that all interaction terms are not significant before the policy implementation (confidence intervals include 0), indicating that there is no significant difference in employment growth trends between the treatment group and the control group prior to the intervention, satisfying the parallel trend assumption.

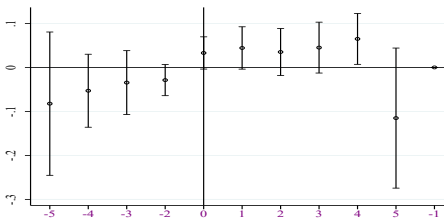

**Figure 1.** Parallel Trend Test

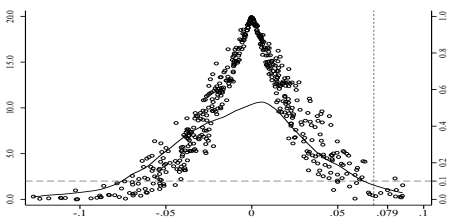

**Figure 2.** Placebo Test

(2) Placebo test

Through 500 random placebo tests, we found that the coefficients of pseudo-policy variables are concentrated near zero and significantly less than the benchmark estimates, with most P-values above 10%, indicating that the results are not coincidental. This confirms that the promotion effect of establishing a big data experimental zone on corporate employment is statistically robust.

(3) Control urban industries

Given that urban-level and industry-specific characteristics may significantly influence employment at the micro-enterprise level, this study incorporates city and industry fixed effects into the benchmark regression model to accurately assess the policy effects of establishing national big data comprehensive pilot zones on corporate employment. As shown in columns (2) to (3) of Table 5, the policy of big data comprehensive pilot zones remains significantly positive for corporate employment at the 1% significance level.

(4) PSM-DID

In order to alleviate the endogeneity problem caused by sample selection bias, this study adopts propensity score matching double difference method (PSM-DID) for control. The results are shown in column (1) of Table 5. The matched estimated results are basically consistent with the benchmark regression, which confirms the robustness of the research conclusions.

(5) Cluster levels change

Given the strong influence of local government policies and economic conditions, the error term may exhibit serial correlation at the city-industry level. To address this, we adopt Shen Kunrong et al.'s (2024)[11] bidirectional clustering method. Furthermore, standard errors are clustered at the enterprise level to control for in-

dividual heterogeneity. Finally, a high-dimensional provincial-level standard error clustering is conducted, with results shown in columns (4) - (6) of Table 5. All core explanatory variables demonstrate statistically significant positive coefficients at the 5% level.

**Table 5.** Robustness test

| | Production efficiency | Human capital structure | Division of labor based on specialization | Asset specificity | Internal control costs | Business Performance |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| DID | 0.077*** | 0.561* | 0.021** | -0.013*** | -0.007* | 0.097*** |
| | (0.027) | (0.314) | (0.008) | (0.004) | (0.004) | (0.027) |
| Control Variable | Yes | Yes | Yes | Yes | Yes | Yes |
| Enterprise Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Fixed effects by year | Yes | Yes | Yes | Yes | Yes | Yes |
| R2 | 0.885 | 0.805 | 0.692 | 0.853 | 0.710 | 0.928 |
| Sample Capacity | 15500 | 15500 | 12473 | 15500 | 15500 | 15500 |

## 6. Conclusion and Countermeasures

This study uses the policy of national big data comprehensive pilot zones as an exogenous shock, selecting a sample of Shanghai and Shenzhen A-share listed companies from 2011 to 2020. Empirical tests using the difference-in-differences method reveal that the establishment of pilot zones significantly promotes employment scale in enterprises, a conclusion that remains valid after undergoing a series of robustness tests. (2) Heterogeneity analysis shows that the big data comprehensive pilot zone policy significantly enhances employment in enterprises with sound internal controls, non-technology-intensive operations, and those located in northeastern China, northern coastal regions, and the middle reaches of the Yangtze River. (3) This paper provides empirical evidence that the digital transformation induced by national big data comprehensive pilot zone policies generates more job creation effects than substitution effects, driving employment growth through improved production efficiency, cost reduction, and enhanced business performance.

Empirical evidence demonstrates that the establishment of national big data comprehensive pilot zones has significantly boosted employment growth in enterprises. Therefore, it is advisable to gradually expand the number of cities included in these pilot programs and lower industry entry barriers, thereby fully leveraging data's positive impact on employment. Simultaneously, promoting industrial digitalization and digital industrialization will enable innovative business models through technological advancements, further invigorating market vitality and driving sustained employment growth.

In terms of mechanism analysis, enhancing production efficiency is a key factor for enterprises to expand production scale and achieve employment growth. The establishment of big data comprehensive pilot zones can improve corporate productivity through optimizing resource allocation, advancing digital transformation, promot-

ing specialized division of labor, and refining human capital structures. First, these pilot zones need to establish robust data platforms to facilitate information sharing between government agencies and public institutions, thereby boosting the effectiveness of other production factors and optimizing resource allocation efficiency. Second, human resources remain crucial for sustainable enterprise development. Policies in national-level big data pilot zones can drive the upgrading of corporate human capital, demonstrating the effectiveness of local governments' talent recruitment and optimization policies. Consequently, regional governments should increase incentives such as subsidies and relocation allowances to attract professionals. Simultaneously, collaborative innovation alliances among government, industry, academia, and research institutions should be strengthened to facilitate the flow of technological and data resources between enterprises, universities, and government bodies, meeting high-quality talent demands. Finally, under the deep integration of digital and real industries, leveraging digital technologies to inject new momentum into the real economy, utilizing big data analytics to enhance decision-making efficiency and deepen specialized division of labor, ultimately elevating overall production efficiency.

Tailored policies for enterprises require targeted solutions. The implementation of policies in the National Big Data Comprehensive Pilot Zone should be categorized and tailored to factors such as internal control levels and industry types, avoiding a "one-size-fits-all" approach. Specifically, for capital-intensive and labor-intensive industries, governments should actively guide them to adopt big data technologies to optimize production processes and enhance efficiency. For enterprises with weaker internal controls, improvements can be achieved through real-time data analysis of production operations and blockchain technology to boost operational transparency, thereby elevating business efficiency.

## References

[1] Mao Qilin & Wang Yueqing. The Employment Effects of ESG: Evidence from Chinese Listed Companies [J]. Economic Research, 2023,58(07):86-103.

[2] Qi Yudong, Liu Cuihua, and Ding Shulei. Digital Economy Development, Employment Structure Optimization, and Job Quality Improvement [J]. Journal of Economic Dynamics, 2020(11):17-35.

[3] Yang Feihu, Zhang Yuwen, and Lü Jiaxuan. The Impact of Digital Economy on China's "Stable Employment" Goal and Relief Measures [J]. Journal of Dongbei University of Finance and Economics, 2021(05):78-85.

[4] Wang Jun, Zhang Yuzhe, Zhang Yibo, et al. The Mechanism and Countermeasures of Employment Impact from New Technological Advancements Such as Artificial Intelligence [J]. Macroeconomic Research, 2017(10):169-181.

[5] Liu Da, Wang Xiaodan, Shi Yutang. The Impact of Data Element Agglomeration on Enterprise Employment: A Dual Perspective Based on Employment Scale and Structure [J]. Journal of Shanxi University of Finance and Economics, 2024,46(04):54-67.

[6] Yin Zhifeng, Cao Aijia, Guo Jiabao, et al. "Research on the Employment Effects of Artificial Intelligence Based on Patent Data: Microeconomic Evidence from Zhongguancun Enterprises [J]. China Industrial Economics, 2023(05):137-154.

[7] Li Xuchao, Zhang Wenyi, and Zhao Jing. Enterprise Digital Transformation, Human Capital Upgrading, and High-Quality Employment [J]. Journal of Beijing Technology and Business University (Social Sciences Edition), 2024,39(03):40-52.

[8] Meng Qi. Digital Economy and High-Quality Employment: Theory and Empirical Analysis [J]. Social Sciences, 2021(02):47-58.

[9] YAMI S, M'CHIRGUI Z, SPANO C, et al. Reinventing science and technology entrepreneurship education: The role of human and social capitals[J]. Technological Forecasting and Social Change, 2021,164: 120044.

[10] Zhao Chenyu, Wang Wenchun, and Li Xuesong. How Digital Transformation Affects Total Factor Productivity in Enterprises [J]. Finance & Trade Economics, 2021,42(07):114-129.

[11] Shen Kunrong, Qiao Gang, and Tan Ruipeng. The Establishment of National Big Data Comprehensive Pilot Zones and Employment Growth [J]. China Industrial Economics, 2024(12):5-23.

[12] Wang Chunchao and Nie Yafeng. Research Advances on the Impact of Digital Economy on Employment [J]. Economic Dynamics, 2023(04):134-149.

[13] H. JAMES WILSON P R D A. The jobs that artificial intelligence will create[J]. MIT Sloan Management Review，2017,58(4)： 14-16.

[14] Wang Xianbin and Chen Chunxiu. Key Industrial Policies and Manufacturing Employment [J]. Economic Research, 2023,58(10):34-54.

[15] Sun Weizeng, Mao Ning, Lan Feng, et al. Policy Empowerment, Digital Ecosystems, and Enterprise Digital Transformation—— A Quasi-Natural Experiment Based on National Big Data Comprehensive Pilot Zones [J]. China Industrial Economics, 2023(09):117-135.

[16] Cui Jianjun, Yong Yanlan, and Wang Shaohui. National Big Data Comprehensive Pilot Zone and Corporate Green Technology Innovation [J]. Economic Issues Exploration, 2023(12):37-59.

[17] Qiu Zixun and Zhou Yahong. Analysis of Digital Economy Development and Regional Total Factor Productivity —— Based on National Big Data Comprehensive Pilot Zones [J]. Finance & Economics Research, 2021,47(07):4-17.

[18] Shi Yutang, Wang Xiaodan, Zhou Shitong. Research on Employment Effects of Integration between Digital Economy and Real Economy [J]. Journal of Beijing University of Technology (Social Sciences Edition), 2025,25(01):36-55.

[19] Hu Yongjun and Guan Lening. Exploring the Employment Creation and Substitution Effects of Digital Economy [J]. Reform, 2022(04):42-54.

[20] Su Jian and Chen Yang. Does Technological Progress Reduce Labor Demand? [J]. Open Herald, 2018(03):28-32.

[21] Ye Yongwei, Li Xin, and Liu Guanchun. Digital Transformation and Enterprise Human Capital Upgrading [J]. Financial Research, 2022(12):74-92.

[22] Li Chengming, Zhou Di, Dong Zhiyong. Has the opening of capital markets driven corporate digital transformation? —— Based on quasi-natural experiments and text analysis methods [J]. Statistical Research, 2023,40(08):96-109.

[23] BLACKWELL D. Equivalent Comparisons of Experiments[J]. Annals of Mathematical Statistics, 1953,24(2).

[24] Cai Chunhua, Liu Wei, Jiang Jihai. The Impact of Contextualized Business Models on Value Creation —— A Longitudinal Case Study of Tianhong Co., Ltd.'s Digital Transformation from 2007 to 2018 [J]. Nankai Management Review, 2020,23(03):98-108.

[25] Dong Yiyu and Guo Zeguang. Risk Capital and Technological Innovation —— Based on Factor-Density Industry Differentiation [J]. Finance & Trade Research, 2021,32(08):99-110.

[26] Chen Lin, Gao Yuepeng, Yu Linhui. How is Artificial Intelligence Transforming Corporate Labor Demand? —— Analysis from Big Data of Recruitment Platforms [J]. Management World, 2024,40(06):74-93.

[27] Yuan Chun, Xiao Tusheng, Geng Chunxiao, et al. Digital Transformation and Enterprise Division of Labor: Specialization or Vertical Integration [J]. China Industrial Economics, 2021(09):137-155.

[28] Ji Yunyang, Zhou Xin, and Zhang Qian. Digital Transformation and Enterprise Innovation: An Analysis —— Based on R&D Investment and Efficiency Perspectives [J]. Financial Research, 2023(04):111-129.

[29] Huang Bo, Li Haitong, Liu Junqi, et al. Digital Technology Innovation and High-Quality Development of Chinese Enterprises —— Evidence from Corporate Digital Patents [J]. Economic Research, 2023,58(03):97-115.

[30] Wang Fei & Li Yue. Empowering Total Factor Productivity through Enterprise Digital Transformation: Theoretical Mechanisms and Empirical Evidence [J]. Soft Science, 2024:1-12.