

# ***How the Political Background of Listed Companies Affects Corporate Digital Innovation***

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**Abstract:** Using data of A-share listed companies in China from 2013 to 2022, this paper examines the effect of listed companies' political background on corporate digital innovation by empirical tests. The findings show that the political background of listed companies significantly promotes corporate innovation activities. Further tests reveal that the above promotion effect is more prominent in non-state-owned enterprises, enterprises with a high level of digital financial inclusion, and high-tech enterprises. Meanwhile, when the intensity of R&D investment is higher, the positive effect of political background in promoting digital innovation is more obvious. In addition, we also find through mechanism analysis that the political background of listed companies affects corporate digital innovation through three channels: enhancing the enterprises' ability to obtain resources, improving the level of risk-taking and creating a corporate innovation culture. The findings of this paper provide new references for rationally utilizing the government-business relationship to promote China's development from a "digital power" to a "digital superpower".

**Keywords:** political background of listed companies, digital innovation, political connection

## **1. Introduction**

In 2021, HNA Group bankrupted and reorganized. Many of its senior executives came from the aviation management system. With the help of political resources, HNA Group obtained a large number of overseas investment licenses and bank loans. But as regulations tightened, HNA's capital chain eventually broke. In recent years, China has strengthened the supervision of such phenomenon.

In 2022, the number of patents authorized for inventions in China's core digital economy industries reached 335,000, up 17.5% from 2021. In addition, enterprises have been the main force of digital innovation. As digital technologies such as big data and AI have made breakthroughs, enterprises centered on these technologies are leaping toward the mid-to-high end of the global industrial chain. However, in the underlying field, many core technologies still face the risk of "necking". Thus, there are both opportunities and challenges for Chinese enterprises in digital innovation. To date, there is still a gap in the study that explores the relationship between the political background and digital innovation. Listed companies can utilize their political background to obtain more innovation resources, but the maintenance of political connections also raises their external cost and affects its motivation to innovate. Digital transformation is regarded as a core driver of economic growth now. Its relationship with political background needs to be studied urgently.

So, does the political background of listed companies have a positive or negative impact on digital innovation? Using the data of A-share listed companies from 2013 to 2022, this paper examines the

effect of political background on digital innovation by empirical tests. The findings show that the political background of listed companies significantly promotes corporate innovation activities. Specifically, the higher of political hierarchy of listed companies, the more digital innovation activities they have. Further tests reveal that the above effect is more prominent in non-SOEs, high-tech enterprises and enterprises with a high level of digital financial inclusion. Meanwhile, when the R&D investment is higher, the positive effect of political background is more obvious. This paper also find through mechanism analysis that the political background of listed companies affects digital innovation behavior through three channels: enhancing the ability of enterprises to obtain resources, improving the level of corporate risk-taking and creating a corporate innovation culture. This is of great theoretical and practical significance for the rational use of government-business relationships.

The contribution of this paper is reflected in three aspects. First, while existing research on corporate innovation is mostly based on market and technology, this paper reveals the mechanism from the informal institutional factor of political background. This research perspective breaks through the tradition, which expands the theoretical boundaries of the influence factors of corporate digital innovation. Second, while much of the existing literature on the impact of political background focuses on financial performance or traditional technological innovation, the high-risk nature of digital innovation may change the role of political background. This paper tests the facilitating role of listed companies' political background on corporate digital innovation at a quantitative level, which makes the research paradigm of political background more complete, and deepens the theory of government-business relationship. Third, from a practical point of view, the findings of this paper provide guidance for optimizing policies and serve as a strategic reference for enterprises. Based on the role of political background in the conclusions, relevant measures can be formulated to optimize support or strengthen regulation. Firms can use the findings to balance political resources and market capabilities, or explore other ways to access innovation resources. In addition, the political background may signal a firm's potential for digital innovation, informing investors' decision.

## **2. Theoretical analysis and research hypotheses**

### **2.1. Key drivers of corporate digital innovation**

Enterprise digital innovation refers to enterprises use digital technology to innovate products, services, processes, business models, etc. with the deep integration with traditional production factors, in order to gain sustainable competitive advantages. As the level of digital innovation in China's listed enterprises shows an upward trend, academic research in this field has become increasingly in-depth. From the external perspective of enterprises, Hu Zengxi and Ma Shuzhong found that an increase in the level of market integration can significantly promote the quality and quantity of corporate digital innovation based on the national unified large market[1]. Chen Xiao et al. found that there is a facilitating effect of digital inclusive finance on digital innovation[2]. From the internal perspective, Wang Xincheng and Li Yuan find that firms that have a CIO have a greater likelihood of implementing digital innovation and better digital innovation performance; and that the business background of CEO can significantly enhance the facilitating effect of CIOs on digital innovations [3].

### **2.2. The influence effect of political background of listed companies**

In recent years, academic research on the influence of political background of listed companies can be categorized into macroscopic and microscopic aspects. Macroscopic perspective is mainly based on the government subsidy. Pan Yue et al. found that private firms with political background can obtain more government subsidies when firms are in financial difficulties, but this effect is not significant for state-owned enterprises [4]. Chen Wei et al. found that in addition to the CEO and the

chairman of the board, the political background of other executives also affects the firm's access to government support policies [5]. And the greater the number of executives with a government background, the stronger the government support the company receives. At the microscopic level, Cai Di et al. argue argued that political background can help private enterprises obtain resources such as funding and human capital, ensuring that they benefit from technological innovation, thereby positively influencing their technological innovation activities [6].

### **2.3. Political background and corporate digital innovation: theoretical hypotheses**

Synthesizing the research results in related fields, this paper argues that the political background of listed companies may affect corporate digital innovation through the following three channels.

First, the political background of listed companies can enhance their interactions with government to obtain more resources. Corporate executives who have worked in the system have a high degree of policy sensitivity. They are often able to take timely measures to respond to changes in government policy and the call of the country. So it is easier for them to seek help from the government-related departments [7]. The government also tends to be more willing to support these firms because they can serve the government's economic objectives. Specifically, political background makes it easier for firms to access low-cost capital, technology, talent, and other key resources. These resources can be used to invest in digitization equipment, R&D activities, and innovation projects, driving the implementation of digital innovation in the firm.

Secondly, the political background of listed companies can provide more security for enterprises, enhancing the corporate risk-bearing capacity. Enterprise innovation activities often have a long-term and uncertain cycle, which not only raises the financial risk faced by the enterprise, but also causes moral hazard between the enterprise and investors [8]. Political connection, on the other hand, are regarded as “political insurance”. It can provide implicit guarantees for enterprises and reduce the consequences of corporate innovation failures. Thus, by increasing risk-taking capacity, political background can promote active investment and breakthroughs in digital innovation of listed firms.

Finally, the political background also plays an important role in the creation of innovative culture. On the one hand, political resources provide a material foundation for the cultivation of an innovative culture. On the other hand, companies with political background respond more actively to national policies and form a policy-driven open innovation culture. This kind of culture usually focuses on high-risk innovation attempts and failures toleration. If an enterprise's willingness to innovate is stronger and its attitude towards innovation is more open, the innovation orientation of that enterprise is also likely to be stronger [9]. It can be seen that the enterprise through the support of political resources, enhancing its innovation awareness and forming an innovative organization atmosphere. It gives employees more confidence and motivation in digital transformation.

Synthesizing the above analysis, this paper puts forward the following hypotheses:

H1: The political background of listed companies is conducive to promoting corporate digital innovation.

H2: Listed companies utilize their political background to promote digital innovation through three channels: obtaining more resources, improving risk-taking and creating an innovation culture.

R&D investment intensity reflects the importance that firms attach to innovation activities. First, high R&D-investment firms may transform political resources into digital innovations more efficiently, avoiding the disadvantage of resource mismatch in low R&D-investment firms. Second, sufficient R&D capital investment can solve corporate financing problem and improve their risk resistance. In addition, the investment in R&D personnel of high R&D-input enterprises is usually at a higher level, which helps them accumulate their own knowledge reserves [10]. Finally, high R&D-investment enterprises have the material foundation such as R&D equipment and intangible resources

such as social connections necessary for innovation activities, forming a technological synergy effect. Based on this, this paper proposes hypothesis 3:

H3: When the intensity of R&D investment of listed companies is higher, the positive contribution of their political background to corporate digital innovation is more significant.

### 3. Research design

#### 3.1. Sample selection and data sources

In this paper, Chinese A-share listed companies from 2013 to 2022 are selected as the initial research sample. In order to ensure the accuracy and scientificity of the research data, the selected samples are processed as follows: the samples of financial and real estate companies are excluded; the samples of ST and PT are excluded; and the samples with missing data of major variables are excluded. Finally, 20,399 observations were obtained. Among them, the patent data are derived from IncoPat; the government subsidy data are derived from CNRDS; and the rest of the listed companies' financial data are derived from CSMAR database. In order to exclude the influence of outliers, all continuous variables of the model have been winsorized at the 1% level.

#### 3.2. Variable definition and measurement

##### 3.2.1. Corporate digital innovation (*DigInov*)

This paper adopts the number of digital invention patent applications filed by enterprises in the current year to portray their digital innovation. By referencing the *Statistical Classification of the Digital Economy and Its Core Industries* and the *Correspondence Table of International Patent Classification (IPC) and National Economic Industry Classification*, the four-digit national economic industry codes corresponding to the IPC numbers of the patents is matched with digital technology fields to determine whether a patent qualifies as a digital technology patent.

##### 3.2.2. Political background of listed companies (*politic*)

The traditional method only distinguishes listed companies according to whether they have political background or not. This research method does not take into account the intensity of political background. Given the prevalence of political background among Chinese publicly listed companies, simply considering its presence or absence cannot portray the extent of political influence comprehensively[4]. Therefore, this paper collected the relevant data of each listed company listed on the domestic stock exchange, i.e., the biographies of all directors, CEOs, and all other executives (with the word “chief” in the title) displayed on the Sina Finance website. In this paper, the administrative level is categorized into five levels: national, provincial, departmental, county and township. When an executive has held multiple administrative positions, the highest level is taken. It is believed that only executive backgrounds at the division level and above will play a role, at which time the *Politic* is taken to be 1, otherwise it is taken to be 0.

##### 3.2.3. Control variables

With reference to the existing literature, this paper introduces control variables: (1) Firm Size (*Size*) is defined as natural logarithm of annual total assets; (2) Return On Total Assets (*ROA*) is defined as the percentage of net profit to total assets; (3) Leverage Ratio (*Lev*) is defined as the ratio of total liabilities at the end of the year to total assets at the end of the year; (4) Cashflow Ratio (*Cashflow*) is defined as the proportion of net cash flow from operating activities to total assets; (5) Tobin's Q Value (*TobinQ*) is defined as (Market value of outstanding shares + number of non-outstanding shares

× net assets per share + book value of liabilities)/Total assets; (6) Shareholding Concentration (*Top3*) is defined as shareholding ratio of top three shareholders of listed companies; (7) Duality (*Dual*) is assigned a value of 1 if the chairman and the general manager of the publicly listed company are the same person; otherwise, it is assigned a value of 0; (8) Firm Age (*Age*) is defined as the natural logarithm of the difference between the current year and the company's listing year plus one. In addition, this paper introduces industry (*Ind*) and year (*Year*) fixed effects.

### 3.3. Model building

In order to test the impact of listed companies' political background on corporate digital innovation, this paper constructs the following model:

$$DigInov_{i,t} = \beta_0 + \beta_1 Politic_{i,t} + \Sigma \beta_k Controls_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where the explained variable  $DigInov_{i,t}$  denote the level of digital innovation of listed firms *i* in year *t* and the core explanatory variables  $Politic_{i,t}$  denote the political background of listed firms *i* in year *t*.  $Controls_{i,t}$  is the control variables,  $\beta_0$  is the intercept term, and  $\varepsilon_{i,t}$  is the random error term. If the hypothesis is valid, the expected result is that the regression coefficient of *Politic* is significantly positive, indicating that it is positively related to corporate digital innovation.

## 4. Empirical results and analysis

### 4.1. Descriptive statistics

The results of descriptive statistics for variables are shown in Table 1. The mean value of *Politic* is 0.588, and the standard deviation is 0.492. It indicates that 58.8% of listed companies in the sample data have a political background, which indirectly reveals the close relationship between government and enterprises in China. The mean value of *DigInov* is 0.968, the maximum value is 25.400 and the minimum value is 0. It means that there is a big difference in the level of digital innovation among different listed companies, and the digital innovation of most enterprises are still at a low level.

Table 1: Descriptive statistics for key variables

| Variable        | Obs   | Mean   | SD    | Min    | Median | Max    |
|-----------------|-------|--------|-------|--------|--------|--------|
| <i>DigInov</i>  | 20399 | 0.968  | 3.304 | 0.000  | 0.000  | 25.400 |
| <i>Politic</i>  | 20399 | 0.588  | 0.492 | 0.000  | 1.000  | 1.000  |
| <i>Size</i>     | 20399 | 22.094 | 1.213 | 20.064 | 21.898 | 25.968 |
| <i>ROA</i>      | 20399 | 0.043  | 0.058 | -0.194 | 0.043  | 0.190  |
| <i>Lev</i>      | 20399 | 0.386  | 0.190 | 0.060  | 0.376  | 0.854  |
| <i>Cashflow</i> | 20399 | 0.051  | 0.064 | -0.124 | 0.049  | 0.231  |
| <i>TobinQ</i>   | 20399 | 2.055  | 1.175 | 0.864  | 1.685  | 7.341  |
| <i>Top3</i>     | 20399 | 0.491  | 0.148 | 0.187  | 0.485  | 0.849  |
| <i>Dual</i>     | 20399 | 0.339  | 0.473 | 0.000  | 0.000  | 1.000  |
| <i>Age</i>      | 20399 | 1.814  | 0.918 | 0.000  | 1.946  | 3.296  |

### 4.2. Regression results

#### 4.2.1. Total effect

Table 2 reports the regression results between political background and digital innovation of listed companies. The table adds core explanatory variable in column (1), adds control variables in column

(2), and controls for industry and year fixed effects in column (3). From the results, the regression coefficient of listed companies' political background (*Politic*) on digital innovation (*DigInov*) is 0.1638, which is significant at 1% level. This indicates that the greater the intensity of political background that a listed company have, the higher its level of digital innovation. Hypothesis 1 holds.

#### 4.2.2. Moderating effect of R&D investment intensity

Choosing the ratio of R&D investment to enterprise operating income to portray the intensity of enterprise R&D investment, this paper introduces the index of firms' R&D investment intensity (*R&D*) on the basis of model (1) and sets the interaction term *Politic*  $\times$  *R&D*. The regression coefficient of the interaction term in column (4) of Table 2 is 4.4074, which is significant at 1% level. This indicates that the positive effect of political background on digital innovation is more prominent when listed firms invest more in R&D. *R&D* exerts a significant positive moderating effect. Hypothesis 3 is valid.

Table 2: Political background and digital innovation in listed companies

| Variable                               | <i>DigInov</i>        |                          |                          |                          |
|----------------------------------------|-----------------------|--------------------------|--------------------------|--------------------------|
|                                        | (1)                   | (2)                      | (3)                      | (4)                      |
| <i>Politic</i>                         | 0.2867***<br>(6.469)  | 0.0971**<br>(2.341)      | 0.1638***<br>(3.810)     | 0.1518***<br>(3.666)     |
| <i>Politic</i> $\times$ <i>R&amp;D</i> |                       |                          |                          | 4.4074***<br>(3.616)     |
| <i>R&amp;D</i>                         |                       |                          |                          | 9.8473***<br>(13.276)    |
| <i>Size</i>                            |                       | 0.9709***<br>(21.421)    | 1.0476***<br>(22.347)    | 1.0096***<br>(21.759)    |
| <i>ROA</i>                             |                       | -0.5745<br>(-1.249)      | -0.1989<br>(-0.445)      | 1.3626***<br>(3.039)     |
| <i>Lev</i>                             |                       | -1.3725***<br>(-9.270)   | -1.1239***<br>(-7.612)   | -0.4898***<br>(-3.326)   |
| <i>Cashflow</i>                        |                       | -0.7653*<br>(-1.779)     | 0.4863<br>(1.118)        | 0.6450<br>(1.503)        |
| <i>TobinQ</i>                          |                       | 0.3078***<br>(12.075)    | 0.2160***<br>(8.067)     | 0.1365***<br>(5.230)     |
| <i>Top3</i>                            |                       | -1.4498***<br>(-7.881)   | -0.4496***<br>(-2.638)   | -0.2431<br>(-1.437)      |
| <i>Dual</i>                            |                       | 0.1570***<br>(3.393)     | 0.0689<br>(1.520)        | 0.0342<br>(0.767)        |
| <i>Age</i>                             |                       | -0.3756***<br>(-9.886)   | -0.2895***<br>(-7.720)   | -0.2221***<br>(-6.072)   |
| <i>Constant</i>                        | 0.7990***<br>(27.831) | -19.2376***<br>(-20.731) | -21.1087***<br>(-21.749) | -21.1605***<br>(-21.832) |
| <i>Ind</i>                             | No                    | No                       | Yes                      | Yes                      |
| <i>Year</i>                            | No                    | No                       | Yes                      | Yes                      |
| <i>N</i>                               | 20399                 | 20399                    | 20399                    | 20399                    |
| <i>Adj-R<sup>2</sup></i>               | 0.0018                | 0.0723                   | 0.1594                   | 0.1719                   |

t statistics in parentheses

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

#### 4.2.3. Mediation effects

The above empirical results have shown that the hypothesis 1 is correct. Then, through what channels does political background play a role? In the following, three influence paths of government subsidies, risk-taking level and corporate innovation culture are tested empirically one by one. Then hypothesis 2 is verified.

Table 3: Mediation effects results

| Variable                 | <i>Subsidy</i>       | <i>Risk</i>          | <i>Innovation</i>    |
|--------------------------|----------------------|----------------------|----------------------|
|                          | (1)                  | (2)                  | (3)                  |
| <i>Politic</i>           | 0.3543***<br>(5.122) | 1.4080***<br>(2.991) | 0.1424***<br>(5.517) |
| <i>Controls</i>          | Yes                  | Yes                  | Yes                  |
| <i>Ind</i>               | Yes                  | Yes                  | Yes                  |
| <i>Year</i>              | Yes                  | Yes                  | Yes                  |
| <i>N</i>                 | 20399                | 20399                | 20399                |
| <i>Adj-R<sup>2</sup></i> | 0.1082               | 0.2134               | 0.3664               |

t statistics in parentheses

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

First, column (1) in Table 3 shows the regression result of *Politic* on *Subsidy*. Government subsidy (*Subsidy*) is a proxy variable for listed companies' access to political resources, which is measured by the proportion of government subsidy to total assets received by the company in the year. The coefficient of *Politic* is significant at 1% level, indicating political background significantly helps firms to obtain more government subsidies. It is consistent with the results of existing academic studies. Currently, there is a multi-dimensional influence mechanism of government subsidies in its mediating role. Directly, government subsidy is equivalent to a direct increase in the cash inflow of enterprises, easing the cashflow constraints, and promoting their digital innovation activities by increasing R&D investment [8]. Indirectly, the government subsidy conveys a policy support signal, enhancing the trust of external investors to the enterprise and reducing their financing cost.

Second, column (2) in Table 3 represents the regression result of *Politic* on *Risk*. The risk-taking level of the enterprise (*Risk*) is measured by the standard deviation of *ROA* from year t-2 to year t adjusted by the annual industry mean. The coefficient of *Politic* is significant at 1% level. It indicates that the political background of listed companies significantly increases the level of corporate risk taking. As mentioned earlier, political background sends corporate compliance and policy responsiveness signal to the outside. It mitigates internal and external R&D risks. As a result, listed firms with high risk-taking levels are more inclined to invest in digital innovation projects with high uncertainty.

Finally, this paper conducts text analysis to count total number of words which reflects the innovation consciousness of executives in the annual reports of listed companies, such as “new products”, “research”, “new technology”, “scientific research”, “innovation”, “independent”, “development”, “patent”, “R&D”. Then this paper uses the proportion of these words to the total number of words in the board report as a quantitative indicator of corporate innovation culture (*Innovation*). Column (3) in Table 3 demonstrates the regression result of *Politic* on *Innovation*. The coefficient is significant at 1% level, indicating that the political background of listed companies significantly promotes the formation of corporate innovation culture. Then, firms can encourage employees to trial and error and promote cross-functional collaboration, thus digital innovation is promoted.

#### 4.2.4. Robustness tests

##### 1. Treatment of Endogeneity

In order to avoid omitting variables, this paper adopts the mean of the ratio of the amount of government subsidies to total assets in the company's city for the current year (*Mean*) as the instrumental variable. Because regions receiving long-term government subsidy benefits may have close government-business relationships, *Mean* is highly correlated with *Politic*. And the early stage of R&D in digital innovation requires a long period, so there is no direct link between government subsidies in a given year and corporate digital invention patent applications in that year. The instrumental variable are regressed using the 2SLS method, and the results are shown in columns (1) and (2) of Table 4. In the first stage, the coefficient of *Mean* are significantly positive at 1% level. In the second stage, the positive correlation of *Politic* is still significant.

##### 2. Alternative Variables for Corporate Digital Innovation

This paper additionally choose firms' digital patent applications in the current year to proxy for corporate digital innovation. Column (3) of Table 4 shows that the regression result of *Politic* is significant at 1% level. It indicates that the main conclusion of this paper is reliable and robust.

##### 3. Introduction of Other Control Variables

In view of the possible impact of corporate management composition and governance mechanism, this paper further introduces two control variables. They are the proportion of independent directors (*Indep*) and the proportion of management shareholding (*Mshare*). As shown in column (4) of Table 4, the regression result of *Politic* is still significant at 1% level.

Table 4: Robustness tests

| Variable                 | IV-2SLS<br>(FIRST)    | IV-2SLS<br>(SECOND)   | Replacement of<br>Explained Variable | Introduction of<br>Other Control<br>Variables |
|--------------------------|-----------------------|-----------------------|--------------------------------------|-----------------------------------------------|
|                          | (1)                   | (2)                   | (3)                                  | (4)                                           |
| <i>Mean</i>              | 8.5819***<br>(1.6271) |                       |                                      |                                               |
| <i>Politic</i>           |                       | 4.8969***<br>(1.5380) | 0.2915***<br>(4.016)                 | 0.1668***<br>(3.880)                          |
| <i>Mshare</i>            |                       |                       |                                      | 0.1236<br>(1.167)                             |
| <i>Indep</i>             |                       |                       |                                      | 0.8810**                                      |
| <i>Controls</i>          | Yes                   | Yes                   | Yes                                  | Yes                                           |
| <i>Ind</i>               | Yes                   | Yes                   | Yes                                  | Yes                                           |
| <i>Year</i>              | Yes                   | Yes                   | Yes                                  | Yes                                           |
| <i>N</i>                 | 20397                 | 20397                 | 20399                                | 20399                                         |
| <i>Adj-R<sup>2</sup></i> | 0.1263                | -0.3903               | 0.2458                               | 0.1596                                        |

t statistics in parentheses

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

## 5. Extensive research

From the previous text, the political background has a significant role in promoting corporate digital innovation. Also government subsidies, corporate risk-taking level and corporate innovation culture play a mediating role. However, the above effects may different among different enterprises.

### 5.1. Heterogeneity analysis based on the nature of business ownership

SOEs are assigned a value of 1 and non-SOEs are assigned a value of 0. As shown in columns (1)-(2) of Table 5, the coefficient of *Politic* in SOEs fails the test of significance, but it is significant at 1% level in non-SOEs. It indicates that the relationship between *Politic* and *DigInov* is more pronounced in non-SOEs. Because of their natural political ties, SOEs have implicit government credit endorsement, so the marginal utility of their own political background is lower. Non-SOEs, however, usually find it more difficult to obtain bank loans due to their lower credit ratings. Political background can help non-SOEs obtain government subsidies, tax incentives or bank loans.

### 5.2. Heterogeneity analysis based on digital financial inclusion index

When the listed enterprises' digital financial inclusion index is higher than the overall median, the variable enterprise digital financial inclusion index (*Index*) is assigned a value of 1, otherwise it is assigned a value of 0. The data is from the Peking University Digital Financial Inclusion Index. As shown in columns (3)-(4) of Table 5, in high-*Index* firms, the coefficient of *Politic* is significant at 1% level; but it is significant at the 10% level in low-*Index* firms. It means that listed enterprises' political background is more effective in promoting digital innovation with a high degree of digital financial inclusion. Digital financial inclusion itself is highly dependent on policy orientation, and listed enterprises equipped with political background can quickly adjust the direction of innovation.

### 5.3. Heterogeneity analysis based on whether the firm belongs to the high-tech sector

In this paper, it assigns the value of 1 if the listed enterprises belong to high-tech enterprises, otherwise assigns the value of 0. As shown in columns (5)-(6) of Table 5, the coefficient of *Politic* is significant at 1% level in high-tech enterprises; and it is insignificant in non-high-tech enterprises. It means that the role of political background is more obvious in high-tech enterprises. Because high-tech enterprises usually belong to technology-intensive enterprises. Digital innovation of high-tech enterprises often requires the integration of cross-disciplinary technologies. And political background can help listed enterprises share information with universities and research institutes and lower the barriers to cooperation through the government-led industry-university-research cooperation network.

Table 5: Heterogeneity analysis

| Variable                 | State-owned Enterprise | Non-state-owned Enterprise | High Digital Financial Inclusion Index Enterprise | Low Digital Financial Inclusion Index Enterprise | High-tech Enterprise | Non-high-tech Enterprise |
|--------------------------|------------------------|----------------------------|---------------------------------------------------|--------------------------------------------------|----------------------|--------------------------|
|                          | (1)                    | (2)                        | (3)                                               | (4)                                              | (5)                  | (6)                      |
| <i>Politic</i>           | 0.1321<br>(1.111)      | 0.1528***<br>(3.392)       | 0.2455***<br>(3.840)                              | 0.1087*<br>(1.861)                               | 0.1785***<br>(3.528) | 0.0919<br>(1.145)        |
| <i>Controls</i>          | Yes                    | Yes                        | Yes                                               | Yes                                              | Yes                  | Yes                      |
| <i>Ind</i>               | Yes                    | Yes                        | Yes                                               | Yes                                              | Yes                  | Yes                      |
| <i>Year</i>              | Yes                    | Yes                        | Yes                                               | Yes                                              | Yes                  | Yes                      |
| <i>N</i>                 | 5085                   | 15314                      | 10311                                             | 10088                                            | 13952                | 6447                     |
| <i>Adj-R<sup>2</sup></i> | 0.2187                 | 0.1347                     | 0.1730                                            | 0.1487                                           | 0.1447               | 0.1998                   |

t statistics in parentheses

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

## 6. Conclusions and recommendations of the study

This paper conducts an empirical study based on the data of A-share listed companies from 2013 to 2022, analyzing the influence effect and mechanism of listed companies' political background on their digital innovation. The study finds: (1) Political background has a significant positive effect on digital innovation. This suggests that when listed companies have political connection, they are more likely to respond to the national digital transformation strategy reform, applying for digital invention patents; (2) The incentive effect of political background is more pronounced in non-SOEs, enterprises with high digital finance, and high-tech enterprises; (3) According to the mediating effect, the political background influences digital innovation through obtaining more governmental subsidies, improving the level of enterprise risk-taking, and creating a stronger innovation culture; (4) The promotion of digital innovation is more adequate in listed high- R&D enterprises.

Based on the above conclusions, this paper puts forward policy recommendations as follows. On the enterprise side, firstly, enterprises should grasp the advantages of their political linkages. The kind of “Acquaintance Society” network in China is characterized as a high reliance on relational capital in the business field. Therefore, listed companies with political background should fully utilize their advantages in access to policy support to promote digital innovation. Second, emphasize the cultivation of an innovation-oriented corporate culture. Enterprises can promote cross-departmental collaboration and strengthen the training of innovative talent so as to inject a constant stream of power for digital innovation. On the government side, firstly, complete the policy framework and provide more precise policy support. The government should optimize resource allocation and make use of political background as an informal institution to introduce preferential policies for digital innovation. In a market-oriented environment, it is essential for government to provide a risk mitigation mechanism to reduce the risks faced by enterprises. It will encourage enterprises to take bolder steps in digital innovation investments. Second, it should strengthen the regulation and review mechanism for resource acquisition, ensure market order and maintain a fair competitive environment.

## References

- [1] Zengxi, H., & Shuzhong, M. *The Impact of Market Integration on Firm Digital Innovation: An Analysis on Digital Innovation Measurement Methods*[J]. *Econ. Res.*,2023,58(06):155-172.
- [2] Xiao, C., Xiaojiao, S., & Guofeng, W. *Digital Inclusive Finance, Digital Innovation, and Economic Growth: Based on the Empirical Investigation of Provincial Panel Data*[J]. *On Economic Problems*,2023,(06):34-40.DOI:10.16011/j.cnki.jjw.2023.06.004.
- [3] Xincheng, W., & Yuan, L. *CIO, CEO and Digital Innovation. Science & Technology Progress and Policy*[J]. *Science & Technology Progress and Policy*,2022,39(13):83-93.
- [4] Yue, P., Yiyi, D., & Caixi, L. *Political Connections and Government Subsidies of Companies in Financial Distress: Empirical Evidence From Chinese ST Listed Companies*[J]. *Nankai business review*,2009,12(05):6-17.
- [5] Wei, C., Shinong, W., & Piaopiao, H. *Political connections, government support, and firm performance: An empirical study based on Chinese listed companies*[J]. *Economist*,2015,(09):48-58.DOI:10.16158/j.cnki.51-1312/f.2015.09.006.
- [6] Di, C., Jianshan, H., & Chunmi, L., et al. *The Impact of Political Connections on Chinese Private Firms' Technical Innovation*[J]. *Economic Review*, ,2014,(02):65-76.DOI:10.19361/j.er.2014.02.006.
- [7] Bing, W., Meng, L., & Wenbing, S. *Leaving Politics for Business: Entrepreneurs' Political Experiences and the Resources Acquisition*[J]. *China Economic Studies*,2018,(06):86-98.DOI:10.19365/j.issn1000-4181.2018.06.08.
- [8] Xin, S., & Shengshi, Z. *Dual Environmental Regulation, Government Subsidy and Enterprise Innovation Output*[J]. *China Popul. Resour. Environ*,2019,29(03):31-39.
- [9] Saiquan, H., Zhengmao, Z., Yue, Q., et al. *The Effect of Firm's Innovative Culture and Strategic Capability on Entrepreneurial Orientation*[J]. *Science Research Management*,2014,35(10):107-113.DOI:10.19571/j.cnki.1000-2995.2014.10.014.
- [10] Wei, L., Duosi, C., & Hongwei, W. *Political Connection and Corporate Technological Innovation Performance: Mediating Effect Based on R&D Investment and Regulating Effect of Degree of Marketization*[J]. *Research on Financial and Economic Issues*,2020,(10):30-37.DOI:10.19654/j.cnki.cjwtyj.2020.10.004.