



Employee Salary Competitiveness and Enterprise Innovation: The Moderating Role of Personnel Structure and Fintech

Wenqi Zhang^(✉)

Department of Finance, Hohai University, Nanjing, China
zwq18360863797@163.com

Abstract. Based on social comparison theory, this paper explores the impact of employee salary competitiveness on enterprise innovation. Taking the data of A-share listed companies from 2010 to 2020 as a research sample, the empirical results show that employee salary competitiveness is significantly positively correlated with enterprise innovation, that is, the stronger the employee salary competitiveness, the stronger the enterprise innovation capability. Further research finds that the positive correlation between the two is more significant in the sample enterprises with higher quality of human capital. In addition, financial technology and digital economy has continuously spawned new financial service models in recent years. The empirical results show that in regions with a low level of financial technology development, the impact of employee salary competitiveness on enterprise innovation is more significant.

Keywords: employee salary competitiveness · enterprise innovation · personnel structure · fintech

1 Introduction

Since the 21st century, the world has entered the VUCA era. With the rapid development of Internet + technology in recent years, whether for the macroeconomic environment or the microscopic business environment, “Volatility”, “Uncertainty”, “Complexity”, “Ambiguity” are important features that cannot be ignored. All industries are difficult, but innovators win. Especially in the context of increasing uncertainty in the current world economic situation and China’s entry into a period of internal and external constraints on the transformation of growth drivers, innovation-driven connotative growth has become an important starting point for high-quality economic development [1]. For enterprises, flexible innovation based on changes in the market environment is the key to their sustainable operation and eternal vitality.

People are the basic part of the economic system, the main body of production and innovation, and the most dynamic factor of production. Therefore, the importance of employees to enterprise innovation activities is self-evident. Although there is still a lack of research on employee topics in academic circles [2], it is worth noting that in recent years, research results related to employee motivation have gradually increased

[3, 4]. This also reflects that the theoretical and practical circles are paying more and more attention to the improvement of employees' willingness to innovate and the stimulation of employees' enthusiasm for innovation. Among many innovation incentive factors, the relationship between employee salary and enterprise innovation has always been the focus of research [5]. According to the composition of employee salary, existing research mainly explores its impact on enterprise innovation from the aspects of monetary salary, equity incentives, and employee stock ownership. The research results show that salary mechanism can improve enterprise innovation performance by alleviating the principal-agent problem [6, 7]. Among them, monetary salary incentive is the most common incentive method [8], and has an irreplaceable key position in the field of enterprise governance. At present, the innovative incentive effect of monetary salary has attracted extensive attention from scholars at home and abroad [9]. Based on relevant research conclusions, the effect of salary incentives comes from absolute salary and relative salary [10]. This paper further introduces the concept of employee salary competitiveness to measure the matching degree between enterprise profitability and employee salary. Compared with the general relative salary index, this index can more comprehensively consider the pay gap caused by the difference in profitability between different companies. Therefore, this research will be based on the definition of the concept of employee salary competitiveness, and deeply explore its role in enterprise innovation.

This paper takes A-share listed companies from 2010 to 2020 as a research sample, and after controlling for possible influencing factors such as corporate governance structure and financial status, the empirical results show that the stronger employee salary competitiveness, the stronger enterprise innovation. Moreover, after replacing the core indicator construction method and regression model, the conclusion has not changed and is relatively stable. Subsequently, this paper further analyzes the moderating role of personnel structure and the development of financial technology in the impact mechanism of employee salary competitiveness on enterprise innovation. The research conclusion shows that when the quality of human capital of the enterprise is high, the positive incentive effect of employee salary competitiveness on enterprise innovation is more significant. On the contrary, in companies located in areas with low levels of financial technology development, the positive incentive effect of employee salary competitiveness on enterprise innovation is more significant.

The following structure is arranged as follows: the second part is the research hypothesis; the third part is the research design; the fourth part is the empirical analysis; the fifth part is the further research; the sixth part is the research conclusion.

2 Research Hypothesis

Individual innovation behavior refers to the novel and potentially valuable ideas or products created by individuals in the process of work, as well as new methods and new processes for solving problems [11], and is an important part of enterprise innovation [12]. In recent years, with the increasingly fierce market competition, how to improve the innovation ability of employees and stimulate the vitality of enterprises has become a key issue for managers.

According to social justice theory (equity theory) [13], people tend to gain a fair perception of income by comparing the salary they get with those ones for the same type of work, and this perception of fairness through social comparison will in turn affect employees' satisfaction with income distribution. Especially when the external salary competitiveness of employees is weak, the external sense of unfairness of employees will increase, and it may even lead to employee absenteeism or resignation [14], which will have a negative impact on the stability of the enterprise and the enthusiasm of employees. If employees perceive internal and external fairness, they will have higher salary satisfaction, thereby stimulating their innovation input and the transformation of innovation resources [15]. In addition, social exchange theory believes that salary is the return mechanism given by the enterprise to employees, which reflects the organization's affirmation of employees to a certain extent, so it has the most direct and effective incentive effect on employees' behavior [16]. When being paid a higher salary, that is, when the employee's salary is more competitive, employees will perceive the company's recognition of themselves. According to the principle of reciprocity, employees will tend to work harder and create value to give back to the company's resources. In the process of enterprise R&D and innovation, the challenging pressure brought by this organizational identity will also give employees stronger innovation momentum, stimulate their spirit of exploration and adventure, and make them inclined to show innovative behaviors, thereby promoting enterprise innovation.

On the one hand, employee salary competitiveness can reflect the level of the average salary of enterprise employees, and on the other hand, it can also reflect the matching relationship between corporate profits and employee salary. If the company can continuously improve the salary system, improve the reward mechanism, and allocate the salary to the employees in line with the profitability of the company according to the actual operating conditions, it is more likely to enhance the employees' sense of organizational belonging and identity. When this two-way salary mechanism is established, employees will also be more deeply aware of the inseparability of personal development and enterprise development, thus supporting them to more actively create and innovate value in the process of work, so as to better serve the development of the enterprise.

To sum up, this paper puts forward the following hypothesis: employee salary competitiveness positively affects enterprise innovation.

3 Research Design

3.1 Sample Selection and Data Sources

This paper selects all A-share listed companies from 2010 to 2020 as research samples, and processes the data as follows: (1) Exclude the samples of financial listed companies such as banks, securities, and insurance; (2) Exclude listed companies that were specially treated by ST, *ST, etc. during the observation period; (3) Exclude companies that were PT and delisted during the observation period; (4) Exclude samples with missing data for main variables; (5) In order to exclude the influence of extreme values, all continuous variables are Winsorized at the level of 1% before and after. The innovation patent application data of listed companies used in this paper comes from China Research Data

Platform (CNRDS), and other data are from Cathay Pacific Database (CSMAR). The data processing software used is EXCEL2019 and STATA16.0.

3.2 Variable Design

(1) Dependent variable: Enterprise innovation

In the existing literature, the innovation measurement of enterprises mainly adopts innovation input and patent output. Regarding innovation input, most of the existing literature regards R&D investment and number of R&D personnel as the most important innovation investment of enterprises [17, 18]. However, some studies have shown that R&D and innovation activities are characterized by high risks and unclear benefits [19–21], which means that it is difficult to transform the actual results of innovation investment. Using innovation investment to measure enterprise innovation may overestimate the innovation ability of enterprises [22]. Therefore, compared with innovation input, patent output can reflect innovation ability more intuitively. For patent output, there are mainly three measurement methods in the existing literature: (1) the number of enterprise patent applications [23, 24]; (2) the number of enterprise patent grants [25]; and (3) the number of enterprise patent citations [26]. The number of enterprise patent applications reflects the utilization efficiency of the innovation resources invested by it, and can better reflect the innovation capability of the enterprise [27]. It is worth noting that, according to the “Patent Law of the People’s Republic of China”, patents are divided into invention patents, utility model patents and design patents. Among them, non-invention patents (including utility models and designs) have relatively low technical difficulty and low gold content, and the number of applications cannot well reflect the quality of innovation output [28]. Therefore, this paper uses the number of invention patent applications with the most stringent review standards and the highest technical content to measure enterprise innovation (Patent) [29]. Considering that the number of annual invention patent applications of many sample companies is 0, in order to overcome the bias of patent data, this paper performs 99th percentile (Winsorize) on the number of invention patents, and then adds 1 to it and takes the logarithm.

(2) Independent variable: Employee salary competitiveness

According to social comparison theory [11], the strength of employee salary competitiveness, that is, employees’ perception of salary fairness based on industry horizontal comparisons, will affect employees’ salary satisfaction, and thus have an impact on corporate stability and corporate innovation. Referring to the research method of Zhang et al. [30], this paper quantifies employee salary competitiveness based on the relative comparison between corporate profitability and overall salary level. The specific calculation method is to rank the profitability of the company and the average salary of employees in the same year and industry (the stronger the ability, the higher the salary, and the smaller the ranking value). Then, match the industry ranking of the profitability of each company with the industry ranking of the average salary of employees, calculate the difference between the two, and standardize the number of companies in their industry. If the profitability of the enterprise is weak, it is in a disadvantaged position in

the industry, and its employee salary industry ranking is in a relative advantage, then the value of the calculated index is large, and the employee salary competitiveness is strong.

(3) Control variables

In order to overcome the endogeneity problem caused by missing variables as much as possible, this paper refers to the practices of Chang et al. and Li et al., and introduces commonly used control variables at the micro-level of enterprises. Including: enterprise size (Size), asset-liability ratio (Lev), capital expenditure ratio (CapEx), fixed asset ratio (PPE), enterprise age (Age), the largest shareholder's shareholding ratio (Top1), Tobin's Q value (TobinQ), book-to-market ratio (BM). In addition, this paper sets up industry dummy variables (Ind) and year dummy variables (year). The measurement method of each variable is shown in Table 1.

3.3 Model Settings

Build the following estimation model:

$$Patent_{i,t} = \alpha + \beta_i Competence_{i,t-1} + \sum \varphi CV + \sum Year + \sum Ind + \epsilon \quad (1)$$

In regression Eq. (1), the dependent variable is enterprise innovation (Patent), the independent variable is employee salary competitiveness (Competence1, Competence2); the control variables (CV) include the aforementioned control variables; ϵ is the random error term of the model. In the regression, this paper also carries out the following treatments: (1) According to the research results of Kong et al., the transformation of innovation results takes a certain period of time, so in the process of empirical research, all independent variables are processed with a lag of one period; (2) In order to absorb the relevant fixed effects, this paper follows the most typical "two-way fixed effect model (controlling the "time-industry" dummy variable)" for testing.

4 Empirical Analysis

4.1 Descriptive Statistics

Table 2 lists the descriptive statistics for the main variables. As can be seen from the table, the mean of the number of enterprise invention patent applications is 1.064, and the standard deviation is 1.237, indicating that the number of patent applications of the sample enterprises is quite different, that is, the innovation ability is relatively different. The maximum value of employee salary competitiveness (taking the Competence1 indicator as an example) is 0.99 and the minimum value is -0.99, indicating that there is still a large difference in the matching degree between the profitability of the sample enterprises and the employee salary. The descriptive statistical results of other control variables are consistent with those of previous related studies, indicating that the overall sample is representative to a certain extent.

Table 1. Definition of main variables (self-drawing)

Variable name	Variable symbol	Variable definitions
enterprise innovation	Patent	The natural logarithm of the number of invention patents applied for in the year plus 1
employee salary competitiveness1	Competence1	(ROA industry ranking - average salary industry ranking)/number of companies in the industry in the current year
employee salary competitiveness2	Competence2	(ROE industry ranking - average salary industry ranking)/number of companies in the industry in the current year
enterprise size	Size	Natural logarithm of annual total assets
asset-liability ratio	Lev	Year-end total liabilities/year-end total assets
capital expenditure ratio	CapEx	Total cash paid for purchasing and constructing fixed assets, intangible assets and other long-term assets/total assets at the end of the year
fixed asset ratio	PPE	Total fixed assets/total assets at the end of the year
enterprise age	Age	ln (year of current year-year of listing + 1)
the largest shareholder's shareholding ratio	Top1	Number of shares held by the largest shareholder/total number of shares
Tobin's Q value	TobinQ	(market value of tradable shares + number of non-tradable shares x net assets per share + book value of liabilities)/total assets
book-to-market ratio	BM	Book value/total market value
Industry	Ind	Industry dummy variables, according to the 2012 SFC industry classification
Year	Year	Annual dummy variable

4.2 Regression Analysis

The regression results are shown in Table 3. It can be seen from the table that the regression coefficients of employee salary competitiveness (Competence1, Competence2) and enterprise innovation (Patent) are 0.124 and 0.116, respectively, and both are significantly positive at the 1% level. The above results show that employee salary competitiveness has a significant positive correlation with enterprise innovation, that is, the stronger the employee salary competitiveness, the more innovative achievements and the stronger the innovation ability of the enterprise, so the research hypothesis has been verified.

Table 2. Descriptive statistics (self-drawing)

Variables	count	mean	sd	median	min	max
Patent	16684	1.064	1.237	0.693	0	5.011
Competence1	16684	−0.0279	0.382	−0.0377	−0.987	0.992
Competence2	16684	−0.0100	0.377	−0.0213	−0.991	0.995
Size	16684	21.89	1.154	21.73	19.47	26.10
Lev	16684	0.383	0.202	0.367	0.0484	0.965
CapEx	16684	0.0526	0.0480	0.0385	0.000194	0.228
PPE	16684	0.200	0.149	0.170	0.00164	0.702
Age	16684	2.808	0.366	2.833	1.609	3.497
Top1	16684	33.07	14.12	30.69	8.930	70.77
TobinQ	16684	2.328	1.467	1.845	0.932	9.384
BM	16684	0.499	0.254	0.463	0.0859	1.137

Based on the analysis results of other control variables, it can be seen that the size of the company (Size) has a significant positive correlation with enterprise innovation. This means that larger enterprises are more willing to invest in long-term innovation resources and improve their innovation capabilities in order to achieve sustainable operations and improve their risk response capabilities. The capital expenditure ratio (CapEx), the age of the company (Age), the shareholding ratio of the largest shareholder (Top1) and the Tobin Q value (TobinQ) are significantly negatively correlated with enterprise innovation. Generally speaking, the larger the proportion of capital expenditure, the better the innovation conditions of the enterprise, and the more able to stimulate the innovation output of the enterprise. At the same time, however, capital expenditures will also prolong the life cycle of existing technologies, thereby contributing to the inertia of enterprise innovation and inhibiting enterprise innovation [34]; Older companies are more inclined to implement the original conventions, so it is easy to be trapped in the trap of innovation ability due to technological advantages; Enterprises with higher ownership concentration are more likely to have the second type of agency problem, that is, in order to protect their own interests, major shareholders tend to be conservative in decision-making and are unwilling to carry out high-risk innovation activities [35]; Fast-growing companies often face greater financial pressure, which is not conducive to companies promoting innovative projects with high failure rates and long investment cycles.

4.3 Robustness Test

(1) Replace the core explained variable

In order to avoid the endogeneity problem caused by measurement errors that may exist in the model, this paper uses different innovation variables to measure the innovation capability of enterprises, namely, the number of invention patent authorizations (Patent1)

Table 3. Competitiveness of employee compensation and enterprise innovation (self-drawing)

	(1)	(2)
	Patent	Patent
<i>Competence</i> _{1<i>t</i>-1}	0.124*** (4.53)	
<i>Competence</i> _{2<i>t</i>-1}		0.116*** (4.34)
Size	0.277*** (23.09)	0.279*** (23.16)
Lev	-0.096 (-1.53)	-0.044 (-0.72)
CapEx	1.521*** (6.64)	1.499*** (6.56)
PPE	-0.683*** (-8.67)	-0.683*** (-8.67)
Age	-0.183*** (-5.59)	-0.181*** (-5.52)
Top1	-0.002*** (-2.73)	-0.002*** (-2.74)
TobinQ	-0.061*** (-6.13)	-0.061*** (-6.09)
BM	-0.756*** (-10.56)	-0.758*** (-10.56)
Constant	-4.358*** (-15.76)	-4.425*** (-15.93)
Industry	YES	YES
Year	YES	YES
observations	13979	13979
R-squared	0.177	0.177

Note: ***, **, * indicate that the variable significance levels are 1%, 5%, and 10%, respectively, the same below

and the number of joint invention patent applications between listed companies and other economic entities (Patent2) [36] as a replacement indicator (the data processing method is the same as the number of invention patent applications). Combining formula (1) and re-regressing, the results all show that employee compensation competitiveness has a significant positive effect on enterprise innovation. The specific estimation results are shown in Table 4.

Table 4. The impact of employee compensation competitiveness on enterprise innovation: replace variable (self-drawing)

	(1)	(2)	(3)	(4)
	Patent1	Patent1	Patent2	Patent2
$Competence1_{t-1}$	0.087***		0.077***	
	(7.23)		(4.53)	
$Competence1_{t-1}$		0.088***		0.075***
		(7.48)		(4.49)
CV	YES	YES	YES	YES
Constant	-3.096***	-3.150***	-4.291***	-4.336***
	(-25.63)	(-25.96)	(-24.91)	(-25.06)
Ind/Year FE	YES	YES	YES	YES
observations	13979	13979	13979	13979
R-squared	0.097	0.097	0.100	0.100

(2) Replace the regression model

Since the explained variables in this paper have a large number of “0” values and have the characteristics of left-censored data distribution, it is difficult to obtain a consistent estimate by using the OLS method, while the Tobit estimation method can solve the “left-censored” problem well, so this paper uses the Tobit model of left merge to re-regress. Analysis of the regression data shows that the regression results are consistent with the aforementioned conclusions. The sign and significance of the main variables under investigation have not changed, that is, employee compensation competitiveness has a significant positive impact on enterprise innovation. The regression results are shown in Table 5.

(3) Two-period lag processing is performed on the independent variable

In the process of empirical research, the independent variable data is processed with a lag of one period. However, in the actual innovation process of enterprises, the output of some innovation results may take more than one year, so this part will return the independent variable data after two periods of lag. The results show that (see Table 6), employee compensation competitiveness has a positive impact on enterprise innovation, and the conclusion is still established after robustness tests from various aspects. The above conclusions prove that the research results obtained in this paper have certain robustness.

Table 5. The impact of employee salary competitiveness on enterprise innovation: replace model (self-drawing)

	(1)	(2)
	Patent	Patent
<i>Competence</i> 1_{t-1}	0.124*** (4.53)	
<i>Competence</i> 2_{t-1}		0.116*** (4.34)
CV	YES	YES
Constant	−4.531*** (−17.13)	−4.597*** (−17.30)
Ind/Year FE	YES	YES
observations	13979	13979
Pseudo R^2	0.0590	0.0590

Table 6. Robustness test results with a two-year lag (self-drawing)

	(1)	(2)
	Patent	Patent
<i>Competence</i> 1_{t-2}	0.119*** (4.00)	
<i>Competence</i> 2_{t-2}		0.115*** (3.94)
CV	YES	YES
Constant	−4.572*** (−15.83)	−4.650*** (−16.04)
Ind/Year FE	YES	YES
observations	11952	11952
R-squared	0.179	0.179

5 Further Research

5.1 The Moderating Role of Personnel Structure

Considering the inherent differences in innovation ability among different employees due to different educational levels, this paper collects data on the proportion of employees with a bachelor's degree or above in each sample enterprise based on the existing mainstream research methods [30]. Taking the median of the data as the dividing point,

Table 7. Further investigation based on personnel structure (self-drawing)

	(1)	(2)	(3)	(4)
	High	Low	High	Low
	Patent	Patent	Patent	Patent
<i>Competence</i> 1_{t-1}	0.190*** (2.91)	0.100 (1.63)		
<i>Competence</i> 1_{t-2}			0.193*** (3.01)	0.090 (1.53)
CV	YES	YES	YES	YES
Constant	-6.139*** (-9.77)	-4.944*** (-8.61)	-6.255*** (-9.86)	-4.989*** (-8.65)
Ind/Year FE	YES	YES	YES	YES
observations	3183	3201	3183	3201
R-squared	0.250	0.184	0.251	0.184

the sample data is divided into high education group and low education group, and the moderating effect of personnel structure on the relationship between employee compensation competitiveness and enterprise innovation is analyzed. The regression results are shown in Table 7.

5.2 The Moderating Role of Fintech

This part uses the data of the third phase of the Peking University Digital Financial Inclusion Index from 2011 to 2020 to measure the level of financial technology. According to the regression results, when the level of financial technology is high, the impact of employee compensation competitiveness on enterprise innovation is no longer significant. The current integration of emerging technologies such as big data and cloud computing with finance represents the trend of global financial development. The deep integration of technology and finance has a great impact on the traditional financial industry, breaking the barriers of traditional finance, changing the current situation of information asymmetry in the financial industry and the high threshold for SME financing, and providing a solid financial foundation for enterprise innovation. Therefore, in regions with a high level of fintech development, the impact of employee salary competitiveness will be weakened (Table 8).

Table 8. Further investigation based on fintech (self-drawing)

	(1)	(2)	(3)	(4)
	High	Low	High	Low
	Patent	Patent	Patent	Patent
<i>Competence</i> _{<i>t</i>-1}	0.047 (1.21)	0.232*** (5.46)		
<i>Competence</i> _{<i>t</i>-2}			0.039 (1.03)	0.222*** (5.38)
CV	YES	YES	YES	YES
Constant	-4.040*** (-10.04)	-5.550*** (-10.85)	-4.058*** (-10.04)	-5.681*** (-11.09)
Ind/Year FE	YES	YES	Ind/Year FE	YES
observations	7108	5957	7108	5957
R-squared	0.161	0.199	0.161	0.199

6 Research Conclusion

Based on the social comparison theory, this paper examines the impact mechanism of employee salary competitiveness on enterprise innovation. This paper takes A-share listed companies from 2010 to 2020 as a sample and finds that there is a significant positive correlation between employee salary competitiveness and enterprise innovation. That is, the stronger the employee salary competitiveness, the stronger the innovation ability of the enterprise. Further research found that in the sample enterprises with higher human capital quality, the correlation between employee salary competitiveness and enterprise innovation is more significant.

According to the research conclusion, this paper puts forward the following suggestions: (1) Enterprises should design and arrange flexible and reasonable compensation mechanism. Based on the relevant research conclusions [39], when setting the basic salary, enterprises should fully consider the average salary level of the industry, and narrow the gap within a reasonable range, so as to improve the salary satisfaction of employees. At the same time, in order to give full play to the incentive effect of the compensation mechanism, enterprises can introduce relevant indicators for measuring their own profitability into the salary calculation system based on their own conditions, realize flexible adjustment of employees' salary with changes in corporate revenue, close the correlation between enterprise profitability and employee salary, and encourage employees to boldly innovate and create value; (2) Adjust the personnel structure based on the corporate innovation strategy. By increasing the proportion of highly educated employees and establishing a reasonable innovative personnel structure, the innovation capability and innovation efficiency of enterprises can be affected to a large extent. In addition to the personnel structure, the personnel hierarchy cannot be ignored. This means that in the process of personnel structure adjustment, enterprises should not only pay attention

to the level of education, but also pay attention to the selection of vocational skills, so as to lay a solid foundation for enterprise innovation; (3) Enterprises should pay attention to the improvement of innovation efficiency. Only by maximizing the input of innovation resources into the output of innovation results, can the maximum benefit of the enterprise be realized. At the same time, enterprises should not blindly pursue the number of results, and high-quality results can often create more considerable benefits for the enterprise; (4) The development of financial technology will bring new development opportunities to enterprises. In the process of innovation, enterprises should make full use of emerging technologies, such as artificial intelligence and blockchain, to help their own development.

It should be pointed out that the current academic definition of employee compensation competitiveness and the measurement of indicators are not perfect. Therefore, in the follow-up research, this theoretical mechanism still needs to be further tested based on more measurement indicators. Moreover, the specific mechanism and empirical evidence of employee compensation competitiveness promoting enterprise innovation are not sufficient, and further research is needed in the future.

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