Executive Salary and TFP: Evidence from Chinese Listed Firms

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Abstract. Over the past decades, China has spared no effort to improve firms' total factor productivity (TFP) and promote high-quality development. A substantial body of academic research has emerged on this topic. No doubt executive salary can influence managerial work attitudes and initiative, potentially reducing or enhancing firms' TFP. But till to today, there is little in-depth academic research on the influence of executive salary on firms' TFP.

This paper, building on a comprehensive literature review, conducts a theoretical investigation into the mechanisms through which executive salary influences TFP. Empirically, the study utilizes data from the CSMAR database, covering the years 2014 to 2023, and constructs a panel data model to perform regression analysis. The results indicate that, overall, executive salary has a significant negative effect on TFP. However, for firms with high levels of R&D investment, executive salary exerts a positive impact on TFP.

Keywords: Executive Salary, TFP, Panel Data Model

1 Introduction

For the past decades, China's government has emphasized the role of science and technology in driving high-quality development. The 2025 Report on the Work of the Government[12] proposes increasing investment in basic research, strengthening the leadership of tech enterprises, integrating industry, academia, and research, and institutionalizing firms' involvement in national innovation strategies. These efforts aim to raise total factor productivity (TFP) through institutional reform and optimized resource allocation. As a key indicator of technological progress and efficiency, TFP is central to shifting from input-driven growth to innovation-based development.

Many factors influence TFP in which executive salary can affect initiative of high level management and hence shape managerial behavior (Balogh et al., 2021)[1]. Executive salary may influence TFP by enhancing innovation and resource utilization (Zhou et al., 2021)[19]. However, empirical evidence on this relationship remains limited, particularly regarding its underlying mechanisms and the magnitude of its impact. Consequently, this study addresses this gap through both theoretical and empirical analysis, aiming to inform incentive design and improve firm productivity.

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2 Literature Review

There is a large body of literature involving TFP. TFP reflects technological progress and efficiency in resource allocation and is a key metric in analyzing economic growth and firm performance. Its measurement primarily relies on three approaches. The Solow residual method, based on the Cobb-Douglas production function, estimates productivity by regressing capital and labor outputs, though it relies heavily on assumptions about market structure (Xiang & Fan, 2024)[15]. Data envelopment analysis (DEA), a non-parametric method, constructs production frontiers and is often combined with the Malmquist index to assess TFP changes (Sun & Li, 2014; Sufian & Kamarudin, 2019)[10][11]. Stochastic frontier analysis (SFA), is another widely used method to calculate TFP (Fox & Smeets, 2011)[5]. Yang et al. (2023)[16] found that TFP grew at a slower speed in central and western cities in China. Zhu (2023)[20], using SFA on manufacturing firms, found SOEs lag behind private firms in TFP improvement. Malikov et al. (2023)[8] found that institutional differences served as key barriers to regional TFP development.

For executive salary, academic findings show that there are different roles for executive salary. Agency theory (Jensen & Meckling, 1976)[6] highlights the misalignment between ownership and control, which well-designed salary can help resolve (Bebchuk & Fried, 2003)[2]. Empirically, executive salary is commonly measured using log-transformed salary (Wang & Deng, 2021)[13], or by using pay-to-revenue or profit ratios (Ye et al., 2023)[17]. Recent studies also consider volatility and sensitivity of salary to performance as indicators of incentive strength (Chulkov & Barron, 2023)[3]. In China, a positive link is generally observed between incentive pay and firm performance (Wang et al., 2023)[14], as stronger incentives promote technological investment and managerial efficiency. However, excessive salary may undermine morale and organizational equity. For example, U.S. CEOs earned 351 times more than median workers in 2020, highlighting growing concerns over fairness in income distribution (EPI, 2021)[4].

For the mechanism of influence of executive salary on TFP, studies offer various perspectives. Some research suggests that executive salary affects resource allocation, thereby influencing TFP. Zhao et al. (2019)[18] find that executive risk aversion affects capacity expansion decisions under uncertainty, which ultimately impacts TFP. Besides, executive salary shapes corporate culture, affecting employee motivation and overall TFP (Rashid et al., 2022)[9]. Some other findings show that the relationship between executive salary and TFP is nonlinear (Luo, Xiang, & Zhu, 2020)[7].

Prior research lacks consensus on executive compensation's impact on TFP, particularly regarding mechanisms. This paper identifies an inverse relationship through principal-agent theory, attributing it to information asymmetry and conflicts of interest. Executives exploit informational advantages under short-term incentives, prioritizing cost-cutting (e.g., R&D reductions) and performance manipulation over substantive productivity gains. These behaviors boost near-term metrics but undermine innovation and resource allocation, ultimately impeding TFP growth. Consequently, misaligned compensation structures establish the observed inverse relationship between rising executive pay and declining TFP.

In summery, although a growing body of literature explores executive salary and TFP, the underlying mechanisms remain underdeveloped. Besides the research on specific influence of executive salary on TFP is not adequate. Hence this paper tends to focus on the influence mechanism and its specific influence, providing academic support for other scholars.

3 Data and Descriptive Statistics

Based on findings from the literature review and the corresponding research methodology, this paper further focuses on the effect of executive salary (SAL) on total factor productivity (TFP). Prior to empirical analysis, appropriate variables are selected. First, TFP serves as the explained variable, measured via Solow's residual method to capture firm-level productivity. Second, executive salary is measured as the natural logarithm of executive compensation (SAL), and serves as the key explanatory variable. Control variables are introduced as listed in Table 1, with specific variable definitions and descriptions provided in the same table.

Table 1. Table captions should be placed above the tables.

Variables	Variable categories	Symbol for variables	Ways of calculating indices
Total factor productivity	Explained Variable	TFP	Solow's residual method
executive salary	Independent explanatory variable	SAL	Natural log of executive salary
Asset Liability Ratio		ALR	Total Liabilities / Total Assets
Asset Turnover Ratio	Control Variables	NT	Sales Revenue / Total Assets
Natural Logarithm of R&D Expenditure		lnRD	Natural log of R&D

To conduct effective theoretical and empirical analysis, this paper thinks that data are critical and emphasizes the data collection quality. First, this paper collects secondary data from the CSMAR database, which is one of the most influential financial databases in China. After obtaining the initial dataset, this paper removes firms with evidently abnormal values and applies a 5% Winsorization to mitigate the influence of outliers. After preprocessing the original data, the final dataset includes 30,819 firm-year observations from 2014 to 2023, covering 4,903 listed companies.

4 Empirical Results

4.1 Regression Model

After selecting variables and compiling corresponding data, this paper establishes an empirical regression model to analyze the specific effect of executive salary (SAL) on

total factor productivity (TFP). Given the significant heterogeneity across firms—including differences in industry sectors, size (lnTA), and innovation capacity (lnRD)—entity fixed effects are incorporated to control for firm-specific characteristics. Moreover, macroeconomic fluctuations and policy reforms during the observation period may systematically influence productivity; therefore, time fixed effects are also included to capture temporal variation. The resulting two-way fixed effects model enables robust identification of the SAL-TFP relationship. Additionally, all control variables in Table 1 are incorporated to mitigate confounding factors affecting TFP. Finally the specific regression model established is as follows:

$$TFP_{it} = \beta_0 + \beta_1 SAL_{it} + \gamma controls_{it} + m_i + \lambda_t + \mu_{it} \quad (1)$$

Where β_1 represents the influence coefficient of executive salary on TFP, and "controls" denote the control variables included in the regression model, whose specific definitions and calculation methods are provided in Table 1.

Before conducting the regression analysis, this paper presents a general overview about the samples and the statistical description is shown in table 2. According to the table, the dataset comprises 30,819 firm-year observations spanning the period from 2014 to 2023.

Table 2. Statistical description table

Variable	Observed Number	Mean	Standard Deviation	Minimum Value	Maximum Value
TFP	30819	-0.0047	0.1873	-0.4701	0.3427
SAL	30819	12.7423	0.6696	6.7456	15.8696
ALR	30819	0.4202	0.1974	0.1048	0.8211
NT	30819	0.5632	0.3026	0.1095	1.3119
lnRD	30819	18.0288	1.6032	7.5548	24.6303
Age	30819	10.4264	7.7733	0	33
LSP	30819	0.3237	0.1362	0.1242	0.6097

Table 2 presents descriptive statistics for all regression variables. The TFP distribution shows a mean of -0.0047, ranging from -0.4701 to 0.3427. For the key explanatory variable, executive salary averages 12.7423 with values spanning 6.7456 to 15.8696. All variables demonstrate reasonable dispersion without extreme outliers. The full sample of 30,819 firm-year observations confirms sufficient variation for robust regression analysis.

To further analyze whether there exist multi-collinearity among independent variables ,this paper uses Pearson correlation matrix to analyze multi-collinearity problem. The Pearson correlation matrix is as table 3.

Table 3. Pearson coefficient matrix

Variable	TFP	SAL	ALR	NT	lnRD	Age	LSP
TFP	1.0000						
SAL	-0.0026	1.0000					
ALR	-0.0098	-0.0094	1.0000				
NT	0.0511	0.0990	0.0744	1.0000			
lnRD	0.0201	0.4446	0.0453	0.1090	1.0000		
Age	0.0013	0.0116	0.1755	0.0813	0.0717	1.0000	
LSP	0.0058	-0.0263	-0.0036	0.0716	0.0261	-0.0368	1.0000

Examination of the correlation coefficients reveals that the absolute values of correlations between the control variables are generally low. Crucially, all pairwise correlations between control variables exhibit absolute values below 0.5 (maximum = 0.4446 for SAL-lnRD), effectively excluding significant multicollinearity concerns for Model (1).

4.2 Basic Regression Model

To investigate the effect of executive salary on total factor productivity (TFP), this paper first conducts a simple multivariate regression, with the results presented in Table 4. The regression result shows that TFP is negatively related with executive salary (SAL), suggesting that higher salary levels would lead to lower productivity. However, this finding is based on a baseline model that does not account for firm-specific heterogeneity. To further discuss and analyze the effect of salary in a more precise way, this paper continues to conduct regression with firms' individual fixed effect and with individual time double fixed effects. The corresponding regression results are shown in table 4. According to specifications (1), (2), and (3) in Table 4, the effect of executive salary on TFP remains consistently negative and statistically significant, indicating that the relationship is robust across different model settings.

Table 4. Regression Results Table

TFP	TFP (1)	TFP (2)	TFP (3)
SAL	- 0.0605*** (0.0212)	-0.1439*** (0.0451)	-0.1407*** (0. 0453)
ALR	-0.0815** (0.0323)	-0.0323 (0.0451)	-0.0282 (0.0452)
NT	0.2404*** (0.0269)	0.9616*** (0.0637)	0.9745*** (0.0640)
lnRD	0.0325*** (0.0089)	0.0744*** (0.0234)	0.0735** (0.0234)
Age	-0.0005 (.0016)	-0.0053 (0.0071)	0.1591 (0.4065)
LSP	0.0142 (0.0878)	0.0237 (0.2766)	0.0151 (0.2768)

C	0.0330	-0.0496	-0.9639
	(0.2490)	(0.6033)	(2.1653)
Adj.R^2	0.0031	0.0113	0.0032
F-statistic	17	41.56	18.16
Prob(F-stat)	0.0000	0.0000	0.0000
N	30819	30819	30819
Company control	N	Y	Y
Year control	N	N	Y
TFP	TFP	TFP	TFP
	(1)	(2)	(3)
SAL	- 0.0605***	-0.1439***	-0.1407***
	(0.0212)	(0.0451)	(0. 0453)
ALR	-0.0815**	-0.0323	-0.0282
	(0.0323)	(0.0451)	(0.0452)
NT	0.2404***	0.9616***	0.9745***
	(0.0269)	(0.0637)	(0.0640)
lnRD	0.0325***	0.0744***	0.0735**
	(0.0089)	(0.0234)	(0.0234)
Age	-0.0005	-0.0053	0.1591
	(.0016)	(0.0071)	(0.4065)
LSP	0.0142	0.0237	0.0151
	(0.0878)	(0.2766)	(0.2768)
C	0.0330	-0.0496	-0.9639
	(0.2490)	(0.6033)	(2.1653)
Adj.R^2	0.0031	0.0113	0.0032

Note. Standard errors in parentheses, *, ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

According to the data analysis and variable features, this paper concludes that the two-way fixed effect model is proper and regression (3) should be used as the fundamental regression. In regression (3), the influence coefficient of executive salary (SAL) on TFP is -0.1407, which means when executive salary increases one unit, TFP would decrease by 0.1407 units. Hence firms should avoid excessive salary packages and implement technology-oriented policy to avoid productivity decrease. Besides firms should establish sound governance mechanisms for executive pay and optimize operational efficiency.

Besides, to further analyze the model selection and determine whether fixed effect model or random effect model is appropriate, this paper uses Hausman test to make decisions. According to Hausman test result, the chi-square statistics is 183.68 and the corresponding P is 0.0000, which shows two-way fixed effect model (3) in table 4 should be used as basic regression model.

4.3 Heterogeneity Analysis

To further discuss the feature of executive salary's effect on TFP in different scenarios, this paper separates the data into subgroups for heterogeneity analysis. This paper argues that asset liability ratio (ALR) influences firms' operational capacity and thus TFP, with firms of different ALR levels exhibiting distinct characteristics. Hence, this paper first uses asset liability ratio as the heterogeneity variable to divide the data into two groups. According to descriptive statistics, firms whose asset liability ratio is above 0.4283 are classified as high ALR firms, and firms below 0.4283 are classified as low ALR firms. Then, this paper conducts regressions for these groups, with results shown in columns (4) and (5) of Table 5. The regression results show the negative effect of SAL on TFP is stronger in high ALR firms than in low ALR firms.

Similarly, heterogeneity analysis based on R&D levels reveals distinct patterns. Firms are classified as high-R&D (lnRD > 18.0228) or low-R&D groups. Table 5 columns (6)-(7) show SAL negatively impacts TFP more strongly in low-R&D firms, while exerting a positive effect in high-R&D firms.

The positive relationship in high-R&D firms stems from principal-agent incentive alignment. Long-term compensation tools (e.g., equity incentives) bind executive interests to sustainable value creation, motivating increased R&D investment and optimized innovation resource allocation. Concurrently, competitive compensation mitigates risk aversion in high-uncertainty environments while attracting strategically adept talent - enabling efficient R&D integration, accelerated technology commercialization, and ultimately driving TFP growth.

Table 5. Heterogeneity Regression

TFP	TFP (4) High asset liability ratio	TFP (5) Low debt-to-asset ratio	TFP (6) High level of research and development	TFP (7) Low level of research and development
SAL	-0.1970**	-0.0150	0.0273***	-0.3023***
	(0.0940)	(0.0141)	(0.1008)	(0.1000)
ALR	0.0995	0.2819***	0.2402***	-0.0258
	(0.0945)	(0.0645)	(0.0306)	(0.0697)
NT	1.1386***	0.6759***	0.5670***	1.3079***
	(0.1208)	(0.0232)	(0.0177)	(0.1227)
lnRD	0.0767*	0.0381***	0.0035	-0.0929*
	(0.0456)	(0.0082)	(0.0090)	(0.0476)
Age	0.0098	0.1187	-0.0056***	0.1808
	(0.0186)	(0.0808)	(0.0021)	(0.5893)
LSP	0.1805	-0.0677	0.0651	-0.0374
	(0.5823)	(0.0905)	(0.0835)	(0.6037)
C	0.0560	-1.2841***	-0.9086***	0.5672
	(1.2553)	(0.3279)	(0.1851)	(2.9915)
Adj.R^2	0.0131	0.0051	0.0050	0.0032

F-statistic	7.96	77.32	100.40	9.26
Prob(F-stat)	0.0000	0.0000	0.0000	0.0000
N	14395	16424	15424	15395
Company control	Y	Y	Y	Y
Year control	Y	Y	Y	Y

4.4 Robustness Analysis

To further analyze whether the effect of executive salary on TFP is robust and stable, this paper conducts robustness tests using two methods. The first method reduces the sample size, while the second substitutes the one-time lag of SAL for the original SAL variable. Specifically, this paper first deletes observations from the year 2014 while retaining all variables unchanged. This approach tests whether the effect of SAL on TFP remains consistent under sample size variation. The regression result for this test is shown in column (8) of Table 6. Additionally, this paper argues that employing the lagged SAL variable mitigates potential endogeneity concerns and provides an alternative specification to verify robustness. The result of this method is presented in column (9) of Table 6.

Table 6. Heterogeneity Regression

TFP	TFP (8)	TFP (9)
SAL	-1.1335*** (0.0497)	-0.2970*** (0.0538)
ALR	0.0691 (0.0626)	0.1436** (0.0674)
NT	1.0438*** (0.0712)	1.0582*** (0.0767)
lnRD	0.0752*** (0.0260)	0.1086*** (0.0297)
Age	0.1556 (0.4178)	0.1365 (0.4416)
LSP	0.0291 (0.3151)	-0.0659 (0.3442)
C	-1.2373 (2.5302)	0.1771 (3.0392)
Adj.R^2	0.0011	0.0006
F-statistic	18.02	18.32
Prob(F-stat)	0.0000	0.0000
N	28918	25785
Company control	Y	Y
Year control	Y	Y

4.5 Endogeneity Analysis

Based on the regression model, this paper finds that executive salary exerts a negative influence on TFP. Therefore there might exist endogeneity in the model. To analyze whether the endogeneity is severe or not, this paper utilizes two-stage least square method to conduct endogeneity analysis. The specific process is as follows:

$$SAL_{\mathrm{it}} = \alpha_0 + \alpha_1 SAL_{it\text{-}1} + \gamma controls_{it} + m_i + \lambda_t + \mu_{it} \tag{2}$$

At the first stage, this paper uses the one time lag of executive salary and other control variables to regress, which means using one time lag of executive salary as instrumental variable.

$$TFP_{\mathrm{it}} = \phi_0 + \phi_1 SAL_{it} + \gamma controls_{it} + m_i + \lambda_t + \mu_{it} \tag{3}$$

At the second stage, this paper, this paper further conducts the regression by using the SAL coming from the first stage. The regression shows that the new regression coefficient of competition on profitability is -0.7365, which has the same trend compared with the that in regression (3) in table 4. Thus the fundamental regression has no severe endogeneity problem and the effect of executive salary on TFP is still robust.

5 Conclusion

This study establishes that executive salary has an overall negative influence on total factor productivity (TFP). Consistent regression results show that higher salary levels are associated with lower TFP. This negative correlation is primarily caused by principal-agent conflicts in traditional firms, where short-term compensation structures encourage short-sighted cost-cutting and misallocation of resources, which ultimately undermines long-term productivity growth.

However, the relationship undergoes a substantial reversal in innovation-intensive enterprises, where the implementation of well-designed compensation systems facilitates incentive alignment. It has been demonstrated that long-term performance linkages exist between executive rewards in high-R&D firms and the subsequent strategic investment in innovation. These linkages have been shown to have a positive effect on the attraction of managerial talent capable of navigating technological uncertainty and accelerating value creation.

Consequently, corporate governance policies should differentiate approaches: rationalizing salary structures to mitigate short-termism in traditional firms while implementing strategically calibrated long-term incentives in innovation-driven enterprises to harmonize executive motivation with sustainable productivity enhancement.

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