Analysis Of the Effect of Vertical Executive Interlocks on Corporate Digital Transformation

Tianhao Li

School of Inner Mongolia University, Inner Mongolia 010000, China.

15081818936@163.com

Abstract. As China's digital economy continues to expand, the digital transformation of enterprises has emerged as a new trend driving future economic development. Vertical executive interlocks, a critical corporate governance mechanism, exert significant influence on firms' digital transformation processes. Using a sample of Chinese A-share listed companies from 2007 to 2023, this study investigates the impact of vertical executive interlocks on corporate digital transformation.Empirical results demonstrate that vertical executive interlocks significantly inhibit firms' digital transformation efforts. This conclusion remains robust after conducting robustness checks, including the Heckman two-stage model and propensity score matching (PSM). Further analysis reveals that vertical executive interlocks suppress digital transformation through enhanced tunneling effects. Specifically, the inhibitory effect is more pronounced when firms with vertically interlocked executives exhibit lower institutional investor ownership or poor audit quality.This research contributes to the literature by deepening our understanding of the determinants of corporate digital transformation and shedding light on the role of vertical executive interlocks as a governance mechanism. The findings provide practical implications for optimizing corporate governance structures, accelerating digital transformation, and fostering the flourishing development of China's digital economy.

Keywords: vertical executive interlocks; corporate digital transformation; tunneling effect.

1. Introduction

With digital tech advancing and China's digital economy rising, Chinese firms' digital transformation is crucial for high - quality market - driven growth. It boosts efficiency, management, and innovation. However, challenges such as difficulties in implementation and incomplete transformation remain widespread in the process of advancing corporate digitalization [1]. Therefore, exploring effective strategies for digital transformation is vital for firms to gain competitive edge in a rapidly evolving market and to boost the sustained development of China's digital economy. Given the complex and risky nature of digital transformation, corporate governance mechanisms face higher demands. Specifically, balancing executives' actions with strategic goals has become a key focus in both academic and practical fields. Against this backdrop, vertical executive interlocks—a key internal governance mechanism—have increasingly demonstrated their importance, as their characteristics and behaviors may influence not only decision-making efficiency[2]but also profoundly impact the progress of digital transformation.

Vertical executive interlocks involve vertical connections between major shareholders and management. Vertical executive interlocks are regarded as a crucial internal governance mechanism and are widely prevalent in China's listed companies, accounting for 57.26% of cases [3]. However, research on vertical executive interlocks remains underdeveloped, with limited studies exploring their impact on corporate digital transformation.

Vertically executive interlocks can theoretically boost corporate digital transformation.As a vital strategic path, it is significantly shaped by executives' decisions, strategic choices, and firm performance.Existing studies have shown that corporate innovation - development policies can notably promote corporate digital transformation[4]. Moreover, the quality of executives also plays a crucial role in this process[5]. Specifically, executives' expertise in information technology can remarkably enhance the innovation efficiency of enterprises[6].Based on the existing literature, executive characteristics have a significant impact on a company's strategic choices and performance. For instance, executives' technical backgrounds [7], team management experience, and team

heterogeneity[8] all have a marked influence on corporate digital transformation. At the same time, as a major transformation for enterprises, digital transformation requires executives to provide effective leadership and make correct decisions in aspects such as enterprise management and resource allocation. Vertical executive interlocks can not only reduce a company's operational risks[9] but also improve corporate performance and investment efficiency[10], thereby driving corporate digital transformation.

Vertical executive interlocks may hinder corporate digital transformation by linking major shareholders and executives, which can undermine decision-making independence and autonomy, thus limiting transformation efforts.Existing literature indicates that vertical executive interlocks provide controlling shareholders with opportunities to tunnel minority shareholders' interests for personal gain, reducing corporate profitability[11]. Additionally, excessive power concentration under such interlocks can lead to decision-making limitations and damage firm value[12].Due to unfamiliarity with corporate culture and performance demands, interlocked executives often adopt conservative decision-making and risk-averse behaviors, reducing risk-taking capacity and exacerbating financing constraints [13]. These factors further restrict digital transformation initiatives. Lastly, vertical executive interlocks may intensify internal coordination challenges, undermining overall operational efficiency[14].

Vertical executive interlocks can both promote and hinder corporate digital transformation. This study examines their relationship, noting theoretical "incentive" and "inhibitory" effects. Analysis of 2007–2023 Chinese A-share listed firms shows vertical interlocks negatively impact digital transformation, with robustness confirmed via alternative measures and instrumental variables. The effect is stronger in firms with non-Big Four audits and lower institutional ownership. Empirical results show they exacerbate type II agency issues, limiting digital transformation.

This paper contributes to literature in two ways. First, it enriches digital transformation and internal governance research by addressing under-explored drivers, filling a gap as prior studies focused more on digital economy outcomes. Second, unlike prior work on horizontal interlocks, it examines vertical executive interlocks—a key governance mechanism—in the digital economy context, expanding research scope with the first digital transformation perspective on vertical interlocks.

The structure of this paper is as follows: Section 2 provides the Literature Review, Section 3 outlines the Research Design, Section 4 presents the Empirical Tests and Analysis, Section 5 conducts Further Mechanism Tests, and Section 6 concludes the study.

2. Literature References

Research on Vertical Executive Interlocks

From the perspective of agency problems within enterprises, the role of vertical executive interlocks can be analyzed from two dimensions. First, regarding type I agency problems, vertical executive interlocks may strengthen the monitoring effect over management, reducing type I agency conflicts. Meanwhile, they may also generate a supporting effect from major shareholders, improving corporate operational performance and facilitating digital transformation. Existing literature indicates that based on type I agency problems, vertical executive interlocks exert monitoring effects to reduce stock price crash risk[15], decrease corporates' number of violations[16], enhance corporate risk-taking capacity[17], and significantly improve innovation performance [18,19].From the supporting effect perspective, vertical executive interlocks align major shareholders' personal interests with corporate objectives[20,21], prompting shareholders to utilize their connections and resources to support long-term corporate development[22].

On the other hand, from the perspective of type II agency problems, vertical executive interlocks may lead to either more or less tunneling effects. Existing research shows that vertical executive interlocks can raise a company's equity financing costs and financing constraints through increased tunneling[23]. They can also reduce accounting conservatism[24]. At the same time, due to tunneling

effects, major shareholders may hold more cash, resulting in a reduction in the company's available liquid assets and a decrease in its sustaining Operational Capacity[11].

Vertical executive interlocks, as an effective mechanism to address principal-agent problems, can reduce information asymmetry and lower agency costs, thereby playing a crucial role in ensuring the normal operation of enterprises and facilitating sound strategic decision-making.

Research On Corporate Digital Transformation

Existing literature indicates that internal management directly influences operational efficiency, strategic decision-making, and long-term development[25]. As a critical strategic direction for corporate development, digital transformation relies heavily on management decisions. In an increasingly competitive economic environment, efficient management teams can ensure the effective implementation of strategic decisions. Sound internal management also optimizes resource allocation, enhances market adaptability and corporate performance [26], and helps enterprises gain competitive advantages. Additionally, effective internal governance mitigates the impact of external environmental uncertainties on decision-making.

Regarding the mechanisms driving corporate digital transformation, existing research has focused on both internal governance and external environments. From an internal governance perspective, studies have found that executive team heterogeneity significantly reduces digital transformation intensity[8], while CEOs with composite functional background (multi-functional backgrounds) promote digital transformation [27]. These outcomes are closely linked to managerial capabilities[2] and decision-making effectiveness. Other research shows that director liability insurance can significantly accelerate digital transformation. From a macro-policy perspective, economic policy uncertainty acts as a stepping stone to promote digital transformation [28]. Government subsidies facilitate transformation by improving corporate financial health[29,30], while tax incentives also play a positive role[31].

In summary, while abundant literature exists on promoting digital transformation, vertical executive interlocks - a critical internal governance mechanism with significant impacts on corporate performance and management - remain understudied in this context. This paper addresses this gap by examining the role of vertical executive interlocks in corporate digital transformation, thereby contributing to both theoretical and practical understanding in this field.

3. Research Hypotheses and Empirical Design

Research Hypotheses

As a key internal governance mechanism, vertical executive interlocks can boost corporate performance and risk-taking ability. Analyzed from the type I agency problem angle, these interlocks—connecting major shareholders and management—exert monitoring effects to enhance operational efficiency, firm value, and performance. Given digital transformation's need for substantial capital and digital investments, interlocks may facilitate it.

Vertical executive interlocks can also generate supporting effects. Because major shareholders' long-term interests are closely aligned with corporate development [20,21], research indicates that controlling shareholders may utilize their private resources to support enterprise growth[22]. By appointing vertically interlocked executives, major shareholders can reduce information asymmetry and build stronger alliances with the firm [33]. Moreover, studies show that compared to subsidiaries or affiliates, major shareholders are more inclined to allocate resources to vertically connected enterprises[21], thereby accelerating development and advancing digital transformation. Based on these theoretical foundations, we propose our first hypothesis:

H1a: Vertical executive interlocks positively promote corporate digital transformation;

From the type II agency problem perspective, vertical executive interlocks may generate two contrasting effects: more tunneling effects or less tunneling effects. Less tunneling aligns major shareholders' interests with corporate goals, reduces expropriation of minority shareholders, and enhances operational efficiency and risk-taking capacity, thereby promoting digital transformation.

Conversely, greater tunneling exacerbates minority shareholder expropriation. Vertical executive interlocks reduce information asymmetry between major shareholders and the firm, lowering information acquisition costs and enabling concealed tunneling behavior [33]. This reduces operational efficiency and risk-taking capacity. Tunneling effects also increase the probability of information disclosure violations[34] and reduce investment efficiency [35], thereby weakening digital transformation intensity. Therefore, we hypothesize that executive interlocks reduce digital transformation through enhanced tunneling effects, leading to our second hypothesis:

H1b: Vertical executive interlocks negatively inhibit corporate digital transformation;

Empirical Design

1. Data source

This study uses annual data of Chinese A-share listed companies from 2007 to 2023 as the initial sample, which undergoes the following processing:1)Exclusion of ST and PT firms;2)Removal of financial industry listed companies;3)Exclusion of samples with missing key variables;4)Winsorization of all continuous variables at the 1% level for both tails to mitigate extreme value effects.Corporate financial data are obtained from the CSMAR database.

2. Model settings

To investigate the impact of vertical executive interlocks on corporate digital transformation, this paper specifies the following baseline regression model:

$$DT_{it} = \beta_0 + \beta_1 AM + \beta_2 Control + \sum Industry + \sum Year + \varepsilon_{\varepsilon it} \quad (1)$$

In Equation (1), t denotes the year, i represents the firm,The dependent variable *DT* measures the dgree of corporate digital transformation,The key independent variable *AM*,is a dummy variable indicating the presence of vertical executive interlocks;Controlincludes a set of control variables;Industry and Year represent industry and year fixed effects respectively;εitis the error term.

3. Variable Selection and Explanation

(1) Dependent variable: Corporate Digital Transformation

Drawing on existing literature practices[36], there are currently two primary methods for measuring corporate digital transformation. The first approach involves quantifying annual report texts of listed companies. The second method assesses the proportion of specific textual content in annual reports. This paper employs the first measurement method - taking the natural logarithm of (digital transformation keyword frequency + 1) from listed companies' annual reports (Cai et al., 2023).

(2) Explanatory variable:vertical executive interlocks

Drawing on relevant literature, this paper uses a dummy variable (*AM*) indicating whether the firm has vertical executive interlocks as the key explanatory variable. The dummy variable is assigned a value of 1 if the listed company has vertically interlocked executives, and 0 otherwise[31].

(3) Control variable

To enhance the accuracy and reliability of the model and avoid specification bias caused by omitted variables, this paper draws on existing literature, and incorporates a set of control variables that may influence corporate digital transformation. These include firm size (*Size*). leverage ratio (*Lev*). return on assets (*ROA*). firm age (*Age*). board size (*BoardSize*). CEO duality (*Dual*). growth opportunities (*Growth*). cash holdings (*Cash*). and ownership concentration of the largest shareholder (*Top1*). Detailed variable definitions are provided in Table 1.

Table 1. Variable definitions and description

Variable Symbol	*Variable Name*	*Variable Construction*
DT	Corporate Digital Transformation	Logarithm of (word frequency of feature words related to corporate digital transformation in listed companies' annual reports+1)
AM	Vertical Executive Interlock	Dummy variable: 1 if the listed company has vertical executive interlocks, 0 otherwise
Size	Firm *Size*	Natural logarithm of total assets at the end of the period
Lev	Debt Ratio	Total liabilities divided by total assets
ROA	Return on Assets	Ratio of annual operating income to average total assets
Age	Firm *Age*	Natural logarithm of (number of years since listing + 1)
BoardSize	Board *Size*	Natural logarithm of the number of board members
Dual	*Dual* Leadership	Dummy variable: 1 if the CEO also serves as chairman, 0 otherwise
Growth	Firm *Growth*	*Growth* rate of main business revenue
Cash	*Cash* Ratio	Net cash flow from operating activities divided by total assets
Top1	**Largest Shareholder Ownership**	Proportion of shares held by the largest shareholder

4. Variable Descriptive Statistics

Table 2 presents the descriptive statistics of key variables. The descriptive statistics of all variables fall within reasonable ranges.

Table 2. Descriptive statistics for the main variables

	(1)	(2)	(3)	(4)	(5)
Variable	*Sample Size*	*Mean*	*Variance*	*Minimum*	*Maximum*
DT	44942	1.307	1.371	0.000	5.030
AM	44942	0.435	0.496	0.000	1.000
Size	44942	22.100	1.302	19.720	26.190
Lev	44942	0.417	0.205	0.051	0.880
ROA	44942	0.053	0.065	-0.214	0.238
Age	44942	2.882	0.362	1.792	3.555
BoardSize	44942	2.121	0.201	1.609	2.708
Dual	44942	0.294	0.456	0.000	1.000
Growth	44942	0.155	0.357	-0.546	2.028
Top1	44942	0.344	0.150	0.085	0.749
Cash	44942	0.172	0.136	0.011	0.663

4. Empirical results and analysis

The benchmark regression results and analysis

The baseline regression results of vertical executive interlocks on corporate digital transformation are presented in Table 3. These consistent findings support Hypothesis H1b, confirming that vertical

executive interlocks generate greater tunneling effects which constrain corporate digital transformation.

Table 3. Vertical Concurrent Executives and Corporate Digital Transformation

	(1)	(2)	(3)	(4)
VARIABLES	*DT*	*DT*	*DT*	*DT*
AM	-0.301***	-0.165***	-0.154***	-0.055***
	(-11.372)	(-8.210)	(-6.102)	(-2.921)
Size	0.217***	0.261***	0.108***	0.160***
	(16.641)	(25.215)	(8.343)	(15.634)
Lev	-0.813***	-0.537***	-0.119	-0.022
	(-9.387)	(-8.024)	(-1.386)	(-0.333)
ROA	-2.465***	-1.102***	-1.565***	-0.442***
	(-12.851)	(-7.607)	(-8.393)	(-3.150)
Age	0.409***	0.523***	-0.282***	-0.084**
	(10.262)	(16.522)	(-5.843)	(-2.225)
BoardSize	-0.601***	-0.334***	-0.190***	-0.014
	(-8.281)	(-6.123)	(-2.686)	(-0.268)
Dual	0.290***	0.197***	0.163***	0.102***
	(9.577)	(8.616)	(5.540)	(4.671)
Growth	0.081***	0.022	0.085***	0.034**
	(3.992)	(1.338)	(4.201)	(2.111)
Cash	1.286***	0.039	1.517***	0.279***
	(12.485)	(0.495)	(15.438)	(3.730)
Top1	-1.020***	-0.356***	-0.879***	-0.291***
	(-9.874)	(-4.716)	(-8.941)	(-4.139)
Constant	-2.762***	-5.188***	-0.751***	-3.089***
	(-9.767)	(-20.916)	(-2.651)	(-12.254)
Observations	44942	44942	44942	44942
R^2	0.115	0.429	0.212	0.493
Industry FE	NO	YES	NO	YES
Year FE	NO	NO	YES	YES

Robustness tests

To ensure the accuracy of the model, this paper conducts robustness tests by changing regression models and variables. The results are presented in Table 4.

1. Propensity Score Matching (PSM)

Due to potential systematic differences between listed companies with and without vertical executive interlocks that could influence digital transformation outcomes, this paper follows existing research[37]and employs Propensity Score Matching (PSM). Column (1) results show a significantly negative coefficient for vertical executive interlocks (AM) at the 5% significance level. These findings reinforce the robustness of our original conclusion.

2. Changing Regression Models

This paper uses the Tobit model for regression analysis. Column (2) results show that even after switching to the Tobit model, the estimated coefficient for vertical executive interlocks (AM) remains significantly negative at the 1% statistical level. This indicates that vertical executive interlocks continue to exhibit a significant inhibitory effect on corporate digital transformation, confirming the robustness of our original conclusion.

3. Replace the explained variable

The measurement of the dependent variable, corporate digital transformation, is changed to the frequency of digital transformation-related words in the annual reports of listed companies divided

by the total number of words in the Management Discussion and Analysis section of the annual reports of the same year[31]. Then, the regression is conducted again. As shown in Column (3) of the results, the coefficient of the explanatory variable AM is still significantly negative.That is, vertical executive interlocks will significantly inhibit the level of corporate digital transformation, and the above conclusion still holds.

4. Replace the explanatory variable

Replace the explanatory variable with the number of vertically interlocked executives (AMN) and re - run the regression. As shown in Column (4), the coefficient of the explanatory variable AMN remains significantly negativeThat is to say, vertical executive interlocks significantly inhibit the level of corporate digital transformation, and the above conclusion still holds.

Table 4. Robustness Tests

	(1)	(2)	(3)	(4)
VARIABLES	*DT*	*DT*	*DT2*	*DT*
AM	-0.048**	-0.055***	-0.009***	
	(-2.425)	(-2.924)	(-2.983)	
AMN				-0.013***
				(-3.345)
Size	0.150***	0.160***	0.014***	0.162***
	(14.267)	(15.652)	(5.291)	(15.740)
Lev	-0.053	-0.022	0.002	-0.014
	(-0.793)	(-0.334)	(0.180)	(-0.209)
ROA	-0.239	-0.442***	-0.073***	-0.446***
	(-1.553)	(-3.153)	(-2.860)	(-3.179)
Age	-0.112***	-0.084**	-0.001	-0.078**
	(-2.928)	(-2.227)	(-0.121)	(-2.080)
BoardSize	0.051	-0.014	-0.017	0.017
	(0.914)	(-0.269)	(-1.478)	(0.307)
Dual	0.086***	0.102***	0.006	0.100***
	(3.649)	(4.676)	(1.624)	(4.576)
Growth	0.033*	0.034**	0.006	0.033**
	(1.793)	(2.114)	(1.628)	(2.019)
Cash	0.238***	0.279***	0.011	0.286***
	(2.856)	(3.734)	(0.731)	(3.829)
Top1	-0.266***	-0.291***	-0.045***	-0.265***
	(-3.694)	(-4.144)	(-4.211)	(-3.752)
Constant	-2.913***	-3.089***	-0.275***	-3.204***
	(-11.002)	(-12.268)	(-6.737)	(-12.450)
Observations	30457	44942	40360	44942
R^2	0.479	0.1960	0.296	0.494
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Endogeneity Test

In reality, the assignment of a sample to the treatment group (i.e., having vertical executive interlocks) is not random but driven by unobservable factors omitted from the regression model. These unmeasured factors influence the explanatory variable AM while being included in the error term. This results in a correlation between AM and the error term, leading to endogeneity issues. Therefore, it is necessary to conduct an endogeneity test.

1. Heckman Two - Step Method

Given the existence of variables that influence both the dependent variable DT and the explanatory variable AM, and considering that the explanatory variable vertical executive interlock (AM) in this paper is a binary (0 - 1) variable, we employ the Heckman two - step method for endogeneity testing [38]. The regression results are presented in Table 5. This indicates that even after addressing endogeneity concerns, our core finding persists: vertical executive interlocks significantly inhibit corporate digital transformation.

Table 5. Heckman Two - Step Method

	(1)	(2)
VARIABLES	*AM*	*DT*
AM		-0.054***
		(-2.874)
IMR		0.576**
		(2.291)
Size	0.140***	0.211***
	(21.572)	(8.840)
Lev	0.222***	0.065
	(5.152)	(0.876)
ROA	-0.096	-0.469***
	(-0.851)	(-3.330)
Age	0.108***	-0.038
	(4.952)	(-0.899)
BoardSize	0.812***	0.293**
	(23.390)	(2.110)
Dual	-0.290***	-0.017
	(-19.833)	(-0.308)
Growth	-0.058***	0.013
	(-3.116)	(0.664)
Cash	0.001	0.281***
	(0.022)	(3.755)
Top1	0.559***	-0.088
	(12.429)	(-0.794)
Constant	-4.936***	-5.406***
	(-28.656)	(-5.306)
Observations	44942	44942
R^2/*PseudoR*^{2}	0.1159	0.494
Industry FE	YES	YES
Year FE	YES	YES

2. Instrumental Variable Method

This paper employs the IV method using two instruments: the industry - level average and province - level average of vertical executive interlocks (AM). The results are presented in Figure 6. These results are consistent with the baseline regression results, meaning that vertically - concurrent executives will significantly inhibit the digital transformation of enterprises.

Table 6. Instrumental Variable Method

	(1)	(2)	(3)	(4)
VARIABLES	*AM*	*DT*	*AM*	*DT*
	First Step	Second Step	First Step	Second Step
AM_hat		-0.526***		-0.881***
		(-5.671)		(-5.658)
IV_industry	0.941***			
IV_province	(25.792)		0.788*** (13.632)	
Size	0.049***	0.183***	0.050***	0.201***
	(10.011)	(16.325)	(10.273)	(15.794)
Lev	0.074**	0.016	0.057*	0.045
	(2.389)	(0.250)	(1.851)	(0.684)
ROA	-0.030	-0.456***	-0.016	-0.466***
	(-0.500)	(-3.246)	(-0.264)	(-3.324)
Age	0.038**	-0.065*	0.042**	-0.052
	(2.146)	(-1.729)	(2.377)	(-1.369)
BoardSize	0.269***	0.116**	0.263***	0.214***
	(10.886)	(1.970)	(10.684)	(3.214)
Dual	-0.097***	0.055**	-0.090***	0.020
	(-9.743)	(2.286)	(-9.089)	(0.755)
Growth	-0.021***	0.024	-0.022***	0.016
	(-2.934)	(1.459)	(-3.095)	(0.956)
Cash	-0.007	0.279***	-0.000	0.279***
	(-0.208)	(3.736)	(-0.014)	(3.746)
Top1	0.191***	-0.198***	0.201***	-0.128
	(5.253)	(-2.715)	(5.622)	(-1.640)
Constant	-1.797***	-3.666***	-1.768***	-4.103***
	(-13.407)	(-13.131)	(-12.901)	(-13.219)
Observations	44942	44942	44942	44942
R^2	0.165	0.494	0.164	0.495
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

5. Further Analysis

Heterogeneity Analysis

1. Institutional Investor Ownership Ratio Heterogeneity

Institutional investor ownership ratio limits the scope of controlling shareholders' power and influences the extent of expropriation from minority shareholders, reflecting the quality of corporate governance. The impact of vertical executive interlocks on digital transformation may therefore vary across firms with different institutional ownership levels. To address this, we partition the sample into high and low institutional investor ownership groups and examine the differential impact of vertical executive interlocks on digital transformation. We further test for heterogeneity using an interaction term. The results in Table 7. These findings are consistent with the results of the baseline regression.

Table 7. Institutional Investor Ownership Ratio Heterogeneity

	(1) **High Institutional Investor Ownership Ratio**	(2) Low Institutional Investor Ownership Ratio	(3) **Heterogeneity Test Using Interaction Terms**
VARIABLES	*DT*	*DT*	*DT*
AM	-0.020	-0.113***	-0.205***
	(-0.825)	(-4.106)	(-4.974)
AM×InstHold			0.003***
			(4.192)
InstHold			-0.001*
			(-1.856)
Size	0.140***	0.195***	0.158***
	(10.856)	(11.823)	(14.788)
Lev	0.070	-0.097	-0.009
	(0.840)	(-1.073)	(-0.145)
ROA	0.260	-1.004***	-0.439***
	(1.350)	(-5.402)	(-3.119)
Age	-0.087*	-0.082	-0.075**
	(-1.918)	(-1.436)	(-2.003)
BoardSize	0.051	-0.063	-0.013
	(0.748)	(-0.843)	(-0.250)
Dual	0.092***	0.101***	0.101***
	(3.066)	(3.491)	(4.637)
Growth	0.000	0.073***	0.034**
	(0.023)	(3.037)	(2.088)
Cash	0.348***	0.237**	0.279***
	(3.292)	(2.325)	(3.734)
Top1	-0.268***	-0.269**	-0.316***
	(-2.922)	(-2.044)	(-4.007)
Constant	-2.796***	-3.826***	-3.014***
	(-8.677)	(-9.535)	(-11.659)
Observations	22420	22420	44840
R^2	0.459	0.518	0.494
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

2. Big Four

The impact of vertical executive interlocks on corporate digital transformation may differ between firms audited by Big Four vs. non - Big Four auditors. To explore this, we partition the sample into Big Four and non - Big Four groups and examine the differential effects of vertical executive interlocks on digital transformation. We further test for heterogeneity using an interaction term. The estimation results are presented in Table 8. These results align with our baseline regression findings.

$$DT_{it} = \alpha 0 + \alpha 1AE + \alpha 2Big4 + \alpha 3AE \times Big4 + \alpha 4Control + \sum Industry + \sum Year + \varepsilon_{it} \quad (2)$$

Table 8. Big Four Auditors Heterogeneity Analysis

	(1) **Big Four Auditors**	(2) **Non - Big Four Auditors**	(3) **Heterogeneity Test Using Interaction Terms**
VARIABLES	*DT*	*DT*	*DT*
AM	0.161**	-0.068***	-0.063***
	(2.440)	(-3.507)	(-3.263)
AM×Big4			0.133**
			(2.026)
Big4			-0.089
			(-1.599)
Size	0.141***	0.165***	0.160***
	(4.105)	(14.468)	(14.795)
Lev	0.087	-0.033	-0.022
	(0.322)	(-0.505)	(-0.340)
ROA	0.827	-0.526***	-0.444***
	(1.601)	(-3.658)	(-3.168)
Age	-0.283**	-0.066*	-0.082**
	(-2.316)	(-1.672)	(-2.187)
BoardSize	0.002	-0.023	-0.014
	(0.014)	(-0.413)	(-0.260)
Dual	0.253***	0.098***	0.102***
	(3.123)	(4.368)	(4.650)
Growth	-0.128**	0.043**	0.034**
	(-2.331)	(2.547)	(2.127)
Cash	0.494	0.260***	0.278***
	(1.444)	(3.389)	(3.719)
Top1	-0.189	-0.276***	-0.288***
	(-0.833)	(-3.770)	(-4.093)
Constant	-3.169***	-3.186***	-3.099***
	(-3.880)	(-11.649)	(-11.827)
Observations	2711	42221	44932
R^2	0.563	0.493	0.494
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

Mechanism Analysis

Existing research indicates that corporate agency problems significantly influence strategic decision - making [42]. Therefore, this paper aims to empirically test the mechanism by which vertical executive interlocks inhibit corporate digital transformation.

In the study of corporate agency problems, Total Asset Turnover (ATR) is commonly used to measure type I agency conflicts [43]. ATR reflects management's efficiency in utilizing corporate resources - low ATR may indicate severe type I agency problems due to inefficient resource allocation. This paper adopts ATR to measure type I agency conflicts..Drawing on prior research[11], we use the Other Receivables Ratio (OR) to measure type II agency conflicts. Other receivables typically represent non - operational capital flows, and a high OR often signals resource misappropriation and benefit tunneling, which are classic manifestations of type II agency conflicts. Therefore, this paper employs ATR to measure type I agency conflicts and OR to measure type II agency conflicts.

The regression results in Table 9 show,Column (1) reveals that the coefficient of AM is not statistically significant, indicating vertical executive interlocks have no discernible impact on type I

agency conflicts. Theoretically, vertical executive interlocks could enhance managerial oversight, reduce self - serving behaviors, and improve resource efficiency [43], but this expectation was not validated in our sample.Column (2) demonstrates a significantly positive coefficient for AM, indicating vertical executive interlocks exacerbate type II agency conflicts. In type II agency problems where controlling and minority shareholders have divergent interests, vertical executive interlocks may leverage their positional advantage to facilitate private benefits for controlling shareholders, increasing other receivables ratios and resource misappropriation [11]. Digital transformation requires substantial capital investment and rational resource allocation; worsening type II conflicts lead to funding shortages and inefficient resource distribution, thereby inhibition digital transformation. This supports our hypothesis that vertical executive interlocks inhibition corporate digital transformation through tunneling behaviors that intensify type II agency conflicts.

Table 9. Mechanism Analysis

	(1)	(2)
VARIABLES	*ATR*	*OR*
AM	0.010	0.001***
	(1.315)	(3.124)
Size	-0.023***	-0.000**
	(-5.108)	(-1.969)
Lev	0.556***	0.017***
	(18.852)	(12.141)
ROA	1.361***	-0.031***
	(25.691)	(-10.884)
Age	0.025	0.001*
	(1.637)	(1.685)
BoardSize	0.009	-0.003**
	(0.449)	(-2.284)
Dual	-0.025***	-0.001***
	(-3.427)	(-2.665)
Growth	0.051***	-0.001***
	(8.592)	(-3.610)
Cash	0.101***	-0.005***
	(3.496)	(-3.514)
Top1	0.172***	-0.010***
	(5.616)	(-6.984)
Constant	0.595***	0.043***
	(5.216)	(6.281)
Observations	44942	44942
R^2	0.343	0.158
Industry FE	YES	YES
Year FE	YES	YES

6. Conclusion

Using a sample of Chinese A - share listed companies from 2007 to 2023, this paper examines the impact and underlying mechanisms of vertical executive interlocks on corporate digital transformation.Key findings reveal that vertical executive interlocks significantly inhibit corporate digital transformation, with this conclusion remaining robust after multiple robustness tests such as the Heckman two - stage model and propensity score matching (PSM). Mechanism analysis demonstrates that vertical executive interlocks suppress digital transformation by exacerbating type II agency problems and increasing tunneling behavior by controlling shareholders. Heterogeneity

analysis further shows that the inhibitory effect is more pronounced in firms with lower institutional investor ownership or non - Big Four auditors.Theoretical contributions highlight that while vertical executive interlocks improve internal information communication efficiency, excessive power concentration and tunneling behavior lead to limited decision - making that undermines strategic investments in digital transformation. In the context of China's economic transformation, this study provides practical implications by suggesting strengthening institutional investor oversight, enhancing audit quality (especially for firms with vertical interlocks), and preventing tunneling behaviors. These measures would not only improve corporate digital transformation efficiency but also positively promote the high - quality development of China's digital economy.

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