



Shareholder Relationship Networks and Investment Efficiency

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Abstract. This paper examines how shareholder relationship networks affect corporate investment efficiency in emerging markets. Based on from 2009 to 2023, we construct shareholder networks using common ownership ties among the top ten shareholders, and employ betweenness centrality to capture firms' network positions. Empirical results show that a firm's network centrality significantly improves its investment efficiency. Firms with higher centrality suffer from fewer over-investment and under-investment problems. The results indicate that the coefficient of network centrality on investment inefficiency is negative. In China's market, the governance role of shareholder networks—including better information sharing and stronger external monitoring—dominates the risk of collusive behavior.

Keywords: Shareholder Relationship Network, Investment Efficiency, Corporate Governance

1 Introduction

Efficient investment is crucial for economic growth and optimal resource allocation. However, agency problems and information asymmetry often lead to inefficient investment, including over-investment and under-investment[1]. While formal governance mechanisms have been thoroughly studied, research on informal governance such as shareholder networks remains limited, especially in emerging markets.

Common ownership has formed extensive shareholder relationship networks, which have dual effects. On the one hand, firms with central network positions can obtain more heterogeneous information and strengthen management supervision, thereby improving investment efficiency[7]. On the other hand, close network ties may encourage collusion among firms, damage market competition and reduce investment efficiency[2][4].

The net effect of shareholder networks is therefore an empirical question, particularly in China's relationship-based and developing institutional environment. Using data of Chinese A-share listed firms from 2009 to 2023, this paper examines the impact of network centrality on investment efficiency. We find that higher centrality signifi-

cantly reduces inefficient investment, supporting that the governance effect of shareholder networks outweighs the collusive effect in China.

2 Conceptual Background and Hypothesis Development

Corporate investment decisions often suffer from agency conflicts and information asymmetry. Self-interested managers tend to conduct empire-building and over-investment, while information asymmetry between managers and investors may result in under-investment[3]. Social network theory indicates that shareholder networks can alleviate these frictions[8][9].

Firms with a central network position hold an information advantage. Those with high betweenness centrality, as information bridges, can obtain more diverse and unique information, which helps them make more rational investment decisions. In addition, shareholder networks act as an informal governance mechanism. Common shareholders have stronger incentives to monitor managers, constrain rent-seeking behavior, and improve capital allocation[5][6][7].

Although collusion risks exist, the governance and information effects dominate in markets with severe information friction. We therefore propose the following hypothesis:

H1: A firm's centrality in the shareholder relationship network is negatively associated with its investment inefficiency.

3 Data, Variables, and Empirical Design

3.1 Sample and Data Source

We select Chinese A-share listed firms from 2009 to 2023 as our sample. Financial and shareholder data are obtained from the CSMAR and Wind databases. To ensure data quality, we exclude financial firms, ST/*ST firms, and observations with missing key data or undisclosed top ten shareholders. Our final unbalanced panel includes 21,713 firm-year observations. All continuous variables are winsorized at the 1st and 99th percentiles to alleviate outlier effects.

3.2 Variable Definitions

Investment Efficiency. Following prior studies, we measure investment inefficiency by the deviation between actual and expected investment, which depends on growth opportunities.

Total investment ($I_{TOTAL,t}$) is defined as capital expenditures plus R&D and acquisition expenses minus proceeds from asset sales. New investment ($I_{NEW,t}$) equals total investment minus maintenance investment, approximated by depreciation and amortization.

We estimate expected new investment using the following model:

$$I_{\text{new},t} = \alpha + \beta_1 \left(\frac{V}{P}\right)_{t-1} + \beta_2 \text{Leverage}_{t-1} + \beta_3 \text{Cash}_{t-1} + \beta_4 \text{Age}_{t-1} + \beta_5 \text{Size}_{t-1} + \beta_6 \text{StockReturn}_{t-1} + \beta_7 I_{\text{new},t-1} + \text{Year} + \text{Industry} + \epsilon_{i,t} \quad (1)$$

$\left(\frac{V}{P}\right)_{t-1}$ denotes growth opportunities. Control variables include leverage, cash holdings, firm age, size, stock returns and lagged investment, with year and industry fixed effects.

The regression residual $\epsilon_{i,t}$ represents abnormal investment. We use its absolute value (absINV) to measure investment inefficiency: a larger absINV implies greater investment deviation and lower investment efficiency.

Shareholder Relationship Network Centrality. We construct the shareholder relationship network yearly. A tie exists between two firms if they share at least one common top ten shareholder, generating a yearly “company \times company” adjacency matrix.

Our primary explanatory variable is Betweenness Centrality (BE), computed via the social network analysis software Pajek. BE measures how often a firm lies on the shortest paths between other firm pairs in the network. Firms with high BE act as key intermediaries (“brokers”), controlling information flow across the network. Higher BE indicates a more central and influential position, which we hypothesize enhances information access and governance influence.

3.3 Empirical Model

To test our hypothesis, we estimate the baseline regression model:

$$\text{absINV}_{i,t} = \alpha_0 + \alpha_1 BE_{i,t} + \alpha_2 X_{i,t} + \delta_j + \gamma_t + \epsilon_{i,t} \quad (2)$$

where: $\text{absINV}_{i,t}$ denotes firm i 's investment inefficiency in year t ; $BE_{i,t}$ is firm i 's betweenness centrality in the shareholder network in year t , $X_{i,t}$ is a vector of firm-level control variables (dual, ocf, roa, adm, size); δ_j and γ_t represent industry and year fixed effects, respectively. Our hypothesis predicts a negative and statistically significant α_1 , indicating that higher network centrality reduces investment inefficiency.

4 Empirical Results

4.1 Descriptive Statistics

Table 1 presents the descriptive statistics for our key variables. The mean of investment inefficiency (absINV) is 0.037, with a standard deviation of 0.035. This indicates that inefficient investment is a prevalent issue among Chinese listed firms, and there is considerable variation across the sample. The betweenness centrality (BE) measure has a mean of 0.0003 and is highly skewed, which is typical for network centrality metrics, where most firms have low centrality and a few firms act as major hubs.

Table 1. Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
absINV	21,713	0.037	0.035	0	0.204
BE	21,713	0.0003	0.0005	0	0.002
dual	21,713	0.723	0.448	0	1
ocf	21,713	0.055	0.065	-0.130	0.242
roa	21,713	0.055	0.045	0	0.232
adm	21,713	0.081	0.059	0.008	0.350
size	21,713	22.35	1.293	20.069	26.364

4.2 Baseline Regression Results

Table 2 reports the baseline OLS results of shareholder network centrality on investment inefficiency. Column (5) shows the main specification with all controls, industry and year fixed effects.

The coefficient of Betweenness Centrality (BE) is -1.876 , statistically significant at the 1% level, strongly supporting our hypothesis. Higher network centrality significantly reduces investment inefficiency. Firms as key information intermediaries make more efficient investment decisions.

This finding is also economically significant: a one-standard-deviation increase in BE lowers investment inefficiency remarkably. It confirms that the informational and governance effects of network centrality effectively improve capital allocation. The control variables are consistent with prior literature; for example, firm size is negatively related to investment inefficiency.

Table 2. Baseline Regression Results.

Variable	(1)	(2)	(3)	(4)	(5)
BE	-2.432*** (-4.87)	-2.059*** (-4.06)	-1.876*** (-3.47)	-2.040*** (-3.85)	-1.876*** (-3.50)
dual		-0.001 (-1.05)	-0.000 (-0.48)	-0.000 (-0.48)	-0.000 (-0.21)
ocf		-0.003 (-0.77)	-0.005 (-1.01)	-0.002 (-0.41)	-0.003 (-0.71)
roa		0.014** (2.42)	0.015** (2.08)	0.012* (1.67)	0.013* (1.74)
adm		0.003 (0.64)	0.006 (1.04)	0.001 (0.24)	0.005 (0.78)
size		-0.001*** (-4.22)	-0.001*** (-3.61)	-0.001*** (-2.63)	-0.001*** (-3.00)
Constant	0.038*** (124.98)	0.057*** (12.11)	0.059*** (9.61)	0.054*** (8.59)	0.056*** (8.82)
Industry FE	No	No	Yes	No	Yes
Year FE	No	No	No	Yes	Yes
Observations	21,713	21,713	21,713	21,713	21,713
R-squared	0.001	0.003	0.004	0.005	0.006

Note: t-statistics are in parentheses. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively

Our main findings are robust across alternative specifications, including models without controls and those with only industry or year fixed effects. To address potential endogeneity and ensure reliability, we conduct further robustness tests using alternative measures of network centrality (e.g., structural hole index) and instrumental variable regressions. Although not reported for brevity, all additional tests consistently confirm the significantly negative relationship between network centrality and investment inefficiency.

5 Discussion, Limitations, and Conclusion

5.1 Discussion and Conclusion

This paper provides direct empirical evidence on shareholder relationship networks and corporate investment efficiency in China. Our key finding is that a firm's network embeddedness (measured by betweenness centrality) significantly reduces investment inefficiency, as firms acting as key information bridges better align investments with growth opportunities and mitigate over- and under-investment.

These results shed light on corporate governance in emerging markets: informal governance (e.g., common ownership networks) complements formal institutions. In environments with low information transparency and underdeveloped minority shareholder protection, the information-sharing and monitoring functions of shareholder networks are particularly valuable. For Chinese listed firms, the “governance and synergy” effect of these networks outweighs the “collusion” effect, with diverse information access and enhanced oversight from central network positions driving improved capital allocation.

5.2 Limitations and Future Research

This study has limitations that offer directions for future research. First, our shareholder network is constructed based on top ten shareholders, a common approach due to data availability but failing to capture full ownership complexity; future research could use more detailed shareholder data. Second, this paper does not explore specific mechanisms (e.g., tie strength) or moderating conditions (e.g., firm heterogeneity), though the original thesis finds the effect is more pronounced in non-state-owned enterprises; investigating these moderators is promising. Third, network tie construction and centrality interpretation are complex; alternative metrics and strategies could deepen insights into causal pathways.

In conclusion, our research shows shareholder relationship networks positively improve corporate investment efficiency in China. As information conduits and informal governance platforms, these networks help firms make more informed, disciplined investment decisions, highlighting the need to consider inter-corporate relationships when analyzing corporate financial policies.

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