The effect of geographic distance on independent directors' performance from the perspective of inefficient investment

Duo Shang, Dongliang Yuan, Dehui Li & Libo Fan

Published online: 12 Nov 2022.

Submit your article to this journal ⍩

Article views: 429

View related articles ⍩

View Crossmark data ⍩

Routledge
Taylor & Francis Group

The effect of geographic distance on independent directors' performance from the perspective of inefficient investment

Duo Shang[a], Dongliang Yuan[b], Dehui Li[c] and Libo Fan[d]

[a]School of Economics and Management, University of Science and Technology Beijing, Beijing, China; [b]School of Management, Lanzhou University, Lanzhou, Gansu, China; [c]Business School, Sichuan University, Chengdu, Sichuan, China; [d]Business School, University of International Business and Economics, Beijing, China

ABSTRACT

Geoeconomics has attracted sustained attention in recent years, but the role of independent directors' geographic distance in investment efficiency remains unexplored. We explore the governance effects of independent directors from a geographic location perspective. Specifically, the Great Circle Distance Formula is employed to calculate the geographic distance between the independent directors and the enterprise. Then, we measure the inefficient investment. Using a detailed sample in the Chinese market from 2009 to 2018, we find that geographic distance is not conducive to the functioning of independent directors and that there is a positive relationship between independent directors' geographic distance and inefficient investment. The coefficients are robust to multiple robustness checks. In addition, the positive effect of independent directors' geographic distance on inefficient investment will increase (become more positive) when there is no high-speed rail and the marketisation process is low in the enterprise's location. Mechanism tests show that geographic distance does affect inefficient investment by inhibiting independent directors' access to information as well as their reputation. Our results have important implications for investment policy and corporate governance.

1. Introduction

Efficient investment decisions are not only the main driver of an enterprise's own growth but are also of great importance for macroeconomic sustainability. In the perfect market hypothesis, where the marginal output of capital is equal for each investment project and investment opportunities are the only driver of an enterprise's investment, rational managers will choose to invest in projects with positive net present value (NPV) and return the excess cash to investors. However, the perfect market assumption

is unrealistic, and managers often make irrational investment decisions, specifically in overinvestment and underinvestment. Stein (2003) pointed out that the key factors affecting the efficiency of investment are principal-agent problems and information asymmetries. Specifically, principal-agent problems encourage management to abuse free cash flow, leading to overinvestment (Jensen, 1986); information asymmetries between the internal and external environment ultimately lead to underinvestment through financing constraints (Myers & Majluf, 1984). Corporate governance mechanisms have emerged to alleviate principal-agent problems and information asymmetries (Dat et al., 2020). Independent directors are an important corporate governance mechanism and are theoretically able to play a supervisory role and an advisory role when enterprises are making investment decisions. Therefore, it is reasonable to explore the impact of independent directors on inefficient investment.

However, the current empirical evidence on the effectiveness of independent directors is debated. While some scholars believe that independent directors are merely 'vases' and cannot play an effective governance function, others believe that independent directors have a governance function. Reviewing the relevant literature, we find that most scholars explore independent directors' performance from the perspectives of the proportion (Orhun & Izzet, 2016; Mirza et al., 2020), number (Lipton & Lorsch, 1992; Klein, 1998), and background (Wang et al., 2016) of independent directors. As the market environment in China continues to be optimised, the Chinese Company Law has made clear regulations on variables such as the number, proportion and background of independent directors.[1] The gradual 'homogenization' of independent directors makes it difficult to explain why many teams of independent directors with similar characteristics have widely varying governance outcomes. To explore the performance of independent directors, scholars should look for 'differentiating' characteristic variables. Our review of company annual reports shows that different independent directors choose different places of residence, so the geographic distance between the independent director's residence and the enterprise's registered office is a perfect 'differentiating' variable.

With the rise of geographic economics, some scholars have noticed the impact of geographic location on independent directors (Alam et al., 2018). For example, scholars find that geographic distance affects the efficiency of information transfer (El Ghoul et al., 2013) and the reputation of individuals (Knyazeva et al., 2013), which in turn underpins the supervisory and advisory functions of independent directors. Does the geographic distance between independent directors and the enterprise affect investment efficiency? Does this effect differ across constraints? What are the mechanisms by which the geographic distance of independent directors affects investment efficiency? To answer the above questions, this article manually collects the coordinates of the independent directors' residence and the coordinates of the enterprise's registered office, uses the Great Circle Distance Formula to calculate the geographic distance between the independent directors and the enterprise, measures the governance effect of the independent directors through the enterprise's inefficient investment, and tests the relationship between the geographic distance of the independent directors and the inefficient investment. We have considered the influence of high-speed rail and marketisation on the relationship, and at the same time, this article has found a mechanism for independent directors to exert their governance effect.

This study is committed to contributing to the literature in two ways. On the one hand, this article considers geographic distance as an antecedent factor affecting the governance effectiveness of independent directors. Studies have been conducted to explore the impact of the location characteristics of directors on corporate governance. Alam et al. (2018) choose the fraction of unaffiliated directors who reside more than 100 km from headquarters as a distance measure. Knyazeva et al. (2013) found that local independent directors are independent directors employed at enterprises located within a sixty-mile radius. Unlike existing studies, this article manually collects information on the latitude and longitude of the independent director's residence and the enterprise's registered office and uses a spatial distance formula to specifically measure the geographic distance between each independent director and the enterprise. This is a more refined measure and provides new empirical evidence to explore the governance effectiveness of independent directors.

On the other hand, this article adds to the geography literature and its effects on stakeholders' investment decision making. Most existing studies have explored the impact of independent directors on investment efficiency from the perspective of proportion (Orhun & Izzet, 2016; Mirza et al., 2020), number (Lipton & Lorsch, 1992; Klein, 1998), and background (Wang et al., 2016); however, these scholars have not reached consistent research conclusions. The reason for this is that the characteristic variables of independent directors are too similar to capture the individual differences of independent directors. In fact, the geographic distance between an independent director and their enterprise can be a good indicator of individual differences in independent directors. Therefore, this article considers the geographic location characteristics of independent directors and confirms that short-distance independent directors do a better job at improving investment efficiency, consistent with proximate institutional investors and proximate analysts (Ayers et al., 2011; O'Brien & Tan, 2015).

The remainder of this article is designed as follows. Section 2 provides a literature review, and Section 3 outlines the research hypotheses. Then, Section 4 describes the data sources, variable measurement methods, and empirical models. Section 5 presents the empirical results with both robustness and endogeneity tests; Section 6 provides further analysis before the conclusions and implications of this article.

2. Literature review

2.1. Agency problems, information asymmetry, and inefficient investment

MM theory suggests that in a perfectly competitive market environment, enterprises do not need to consider the source of capital but only need to select the optimal investment project according to the NPV rule (Modigliani & Miller, 1958). However, in the real market environment, due to the principal-agent problem, information asymmetry and other capital market frictions, the enterprise's investment activities often deviate from the NPV optimal solution, and there are many inefficient investment behaviours, specifically overinvestment and underinvestment.[2] Given that both overinvestment and underinvestment can seriously damage enterprise value, there has been considerable research into the causes and solutions to these two types of inefficient investment.

The overinvestment hypothesis proposed by Jensen (1986) suggests that agency problems arising from a separation of ownership and control can lead to overutilisation of managerial discretion, resulting in overinvestment. That is, managers attempting to maximise personal benefits are inclined to make investments that are not in the best interest of shareholders. Related research suggests that highly compensated (Bebchuk & Fried, 2003), overconfident (Malmendier & Tate, 2005) and powerful (Lo & Shiah-Hou, 2022) executives have more incentives and opportunities to build business empires and diversify into acquisitions, which will increase overinvestment. Scholars have found that enterprises can curb overinvestment behaviour triggered by agency problems from the perspectives of cash holdings (Zhao et al., 2022), CEO inside debts (Thompson & Zhao, 2017), internal controls (Chen et al., 2021), and board structure (Harjoto et al., 2018).

The underinvestment hypothesis is based on asymmetric information between enterprises and capital market investors when credit rationing creates financial constraints that restrict borrowing (Myers & Majluf, 1984). Managers generally have information that is unavailable to outside capital providers about the expected profitability of investment decisions (Xu et al., 2021). If outside capital providers cannot assess an enterprise's investment information, they will limit positive NPV projects through financing constraints, which leads to underinvestment (Biddle et al., 2009). Scholars have proposed a large number of ways to alleviate the problem of information asymmetry. For example, investors can obtain information about enterprises through analysts' forecast quality (Chen et al., 2017), auditor opinions (Elaoud & Jarboui, 2017) and media coverage (Gao et al., 2021).

2.2. Independent directors and inefficient investment

Enterprises often face the problem of inefficient investments in their daily operations. Therefore, enterprises will hire independent directors with extensive management experience and professional knowledge backgrounds to improve investment efficiency. Theoretically, independent directors have a supervisory role and an advisory role and are important in regulating entrepreneurial investment behaviours. However, since the implementation of the independent director system in enterprises in 2001, there has been no consensus on the impact of independent directorship on the efficiency of enterprise investment.

On the one hand, many scholars believe that independent directors positively impact the inefficient investments of their enterprises. Klein (1998) pointed out that the larger the size of independent directors is, the greater they can help enterprises make sound investment decisions. Similarly, Orhun and Izzet (2016) found that the higher the proportion of independent directors is, the better the monitoring effect, thus inhibiting the inefficient investment behaviour of executives. Social network theory suggests that network location can improve investment efficiency (Yang et al., 2020). In addition, relevant studies of higher echelon theory claim that independent directors with professional backgrounds can achieve better corporate performance (Wang et al., 2016).

On the other hand, some scholars argue that independent directors are just 'vases' that cannot improve the investment efficiency of their enterprises. Although the opinions of independent directors are effective for making reasonable suggestions, an

excessive number of independent directors is more likely to reduce enterprise deci-sion-making efficiency and thus miss investment opportunities with good potential returns (Lipton & Lorsch, 1992). Mirza et al. (2020) concluded that the percentage of independent directors does not contribute significantly to investment efficiency. Independent directors with the advantage of network centres and structural holes can also become busy and do not have enough time and energy to participate in corporate governance (Jiraporn et al., 2009).

2.3. Research gap

Based on the foregoing, we find that most scholars state that the proportion, number, professional background and academic background will affect the relationship between independent directors and investment efficiency. However, with the continuous optimisation of China's institutional environment, the Chinese Company Law has provided uniform regulations on the number, proportion, background and other characteristics of independent directors. The 'homogenization' of independent directors in enterprises makes it difficult to explain why many teams of independent directors with similar characteristics have widely varying performance. To explore the relationship between independent directors and investment efficiency, we should look for 'differentiated' characteristic variables. By checking the relevant information in the enterprises' annual reports, we find that enterprises show a clear preference for geographic location when hiring independent directors. Some enterprises like short-distance independent directors, while others like long-distance independent directors. Different independent directors choose different places of residence, so the geographic distance between the independent director's residence and the enterprise's registered office is a 'differentiated' characteristic variable.

Because collecting the information of the independent directors' residence is a time-consuming and energy-intensive task, most scholars only divide independent directors into local independent directors and nonlocal independent directors, which greatly hinders the progress of geographic research on independent directors. We determine the geographic location of the independent directors and the enterprises by reviewing the annual reports to calculate the exact geographical distance between the independent directors and the enterprises. In the vast territory of China, independent directors who are remote from enterprises often do not have access to information, nor are they able to build a reputation, which prevents them from performing supervisory and advisory functions when enterprises make investment decisions. Therefore, it is of theoretical and practical significance for us to explore the influence of independent directors on enterprise investment efficiency from the differentiated characteristics of geographic distance.

3. Research hypotheses

Based on the literature review, we can learn that inefficient investment is caused by principal-agent problems and information asymmetries. The supervisory and advisory functions of independent directors are just right to address principal-agent issues and

information asymmetries. Therefore, this article analyses the impact of independent directors on two types of inefficient investment from the following perspectives.

3.1. Independent directors' geographic distance and inefficient investment

Short-distance independent directors enjoy a higher reputation in the locale where the enterprise is incorporated and have a stronger incentive to monitor principal-agent issues such as overinvestment to avoid reputational damage (Bryan & Mason, 2020). In theory, the mechanism of salary, market, legal and reputation can restrain the behaviour of independent directors. However, Chinese people attach importance to human feelings and relationships (Nolan & Rowley, 2020), and reputation directly affects the career development of independent directors, which can increase the independent directors' motivation to supervise managers. On the one hand, short-distance independent directors are in the same social network as the enterprise (Liu et al., 2022), and earnestly performing their supervisory functions can directly enhance their local reputation, thus obtaining more employment opportunities. On the other hand, the lazy behaviours of short-distance independent directors could easily be observed by the enterprises, which could seriously damage their reputation and social standing in the local community (Ertimur et al., 2012). As a result, the reputation of short-distance independent directors is such that they are willing to supervise the enterprise's principal-agent issues. Because the opportunistic behaviours of management are not effectively monitored, enterprises generate overinvestment (Jensen, 1986). When executives invest heavily to build a business empire, short-distance independent directors actively perform their supervisory role because it is a good opportunity to demonstrate their competence. If short-distance independent directors do not act in a timely manner to discourage overinvestment, their reputation and standing in the local community can quickly take a hit.

Short-distance independent directors have the advantage of information and can provide advisory advice when enterprises are underinvested. For independent directors, access to detailed and truthful information about the company is the basis for their advisory function (Wu et al., 2019), which mainly includes publicly disclosed hard information as well as nonpublicly disclosed soft information (Liberti & Petersen, 2019). First, short-distance independent directors do not have to consider the speed of enterprise information dissemination and can obtain hard information such as operating performance, shareholding structure and product prices at the first instance (Zhang, 2018). Second, short-distance independent directors can have face-to-face communication with the enterprise's management, employees and suppliers to obtain soft information that can only be understood but not described (Alam et al., 2018). Therefore, short-distance independent directors have the advantage of information and can better perform their advisory function. The underinvestment behaviour of enterprises is mainly due to the information asymmetry between the external market environment and the internal corporate environment, which results in financing constraints and the lack of funds for enterprises to invest even when faced with projects with positive NPV (Biddle et al., 2009). Short-distance independent directors have both hard and soft information about the enterprise, and the advisory function

prompts them to convey information to external stakeholders, thereby mitigating the degree of information asymmetry (Huy & Hien, 2010). In addition, short-distance independent directors will also have some interaction with some local financial institutions who can help the enterprises to obtain more financing and thus break the dilemma of having no money for investment.

In summary, from the perspective of information and reputation, short-distance independent directors can perform a better supervisory and advisory function and thus improve inefficient investment in the enterprise, so we propose the first hypothesis.

H1: *The geographic distance of independent directors is positively associated with inefficient investment; the closer the geographic distance is, the smaller the inefficient investment.*

3.2. Moderating effect of high-speed rail in the enterprises' location

High-speed rail has significantly shortened travel time and facilitated communication between regions, and geographic accessibility has alleviated the information disadvantage of long-distance independent directors (Kong et al., 2020). On the one hand, high-speed rail facilitates media, analysts, and institutional investors in deeply conducting field research about enterprises and publishing news to the market (Zhang et al., 2020). On the other hand, high-speed rail helps long-distance independent directors save considerable time and transportation costs and provides them with convenient conditions to visit the enterprise and attend board meetings (Firoozi et al., 2019). In summary, high-speed rail improves the information collecting ability of long-distance independent directors and can weaken the positive relationship between geographic distance and inefficient investments. We thus posit the second hypothesis.

H2: *High-speed rail weakens the positive relationship between independent directors' geographic distance and inefficient investment.*

3.3. Moderating effect of the marketisation process in the enterprises' location

The marketisation process is the centralised embodiment of a series of legal systems and economic rules, which can restrain independent directors and guide investment behaviour (Xin & Xin, 2017). On the one hand, regions with high marketisation have many media outlets that can monitor independent directors from time to time. Independent directors' inaction, once exposed by media, will seriously affect their employment prospects and social status. On the other hand, the marketisation process also affects enterprises' investment behaviour in the region (Yuan et al., 2021). When the market mechanism works, there will be dynamic competition and imitation learning between enterprises. The investment experience of benchmark enterprises guides others to follow market rules (Bergman & Nicolaievsky, 2007). Therefore, we propose hypothesis 3.

H3: *The marketization process weakens the positive relationship between independent directors' geographic distance and inefficient investment.*

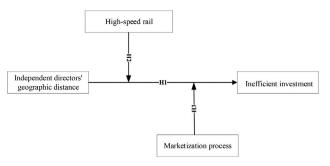The research framework of this article is shown in Figure 1:

Figure 1. The research framework.
Source: Made by authors.

4. Method

4.1. Sample selection and data sources

We select all enterprises listed in China from 2009–2018 as the research sample. The following criteria are used for screening: (1) ST, *ST, and delisted enterprises during the research period; (2) financial and insurance enterprises; (3) enterprises listed for less than one year; (4) enterprises with missing financial data; and (5) enterprises for which the coordinates of their independent directors' residences and their corporate registration locations cannot be determined. After selection, the number of final valid observations is 8821. All continuous variables are tailed at the 1% and 99% levels to control the effect of outliers on the research results. All data are from the Wind financial database and CSMAR database. The independent directors' residence is manually collected and checked according to Baidu and Google.

4.2. Empirical models

To test the hypotheses mentioned above, this article controls the fixed effects of individual, industry, and year, as shown in Model (1). This article treats the dependent and control variables with a one-period lag to overcome possible endogeneity interference, which means that the research interval for the dependent variable in this article is from 2010 to 2018, and the research interval for independent and control variables is from 2009 to 2017.

$$
\begin{aligned}
\text{Abs\_inv}_{i,t} = &\ \alpha_0 + \alpha_1 \text{Ln Dis}_{i,t-1} + \sum \alpha_j \text{Control}_{i,t-1} + \sum \text{Firm} + \sum \text{Year} \\
& + \sum \text{Industry} + \varepsilon
\end{aligned} \tag{1}
$$

In Model (1), the dependent variable (Abs_Inv) is inefficient investment. The independent variable (Ln_Dis) is independent directors' geographic distance, and Control represents the control variables. α_0 is the intercept term, α_1 is the coefficient of the effect of the independent directors' geographic distance on inefficient investment, α_j is the regression coefficient of the control variables, and ε is the random disturbance.

4.3. Definition of variables

4.3.1. Independent variable: independent directors' geographic distance

We borrow the approach from Chu et al. (2019). First, we query the location of independent directors and the location of the enterprises through the annual report. Then, we use Google Maps to locate the latitude and longitude coordinates of the independent directors and the enterprises. Finally, we use the Great Circle Distance Formula to calculate mileage between two pairs of latitudes and longitudes. Considering that enterprises may have multiple independent directors, this article calculates the average geographical distance based on the total number of independent directors of the enterprise and logarizes it. The specific formula is shown below.

$$
\begin{aligned}
C = {}& \cos\left(latitude_i\right) \times \cos\left(longitude_i\right) \times \cos\left(latitude_j\right) \times \cos\left(longitude_j\right) \\
& + \cos\left(latitude_i\right) \times \sin\left(longitude_i\right) \times \cos\left(latitude_j\right) \times \sin\left(latitude_j\right) \\
& + \sin\left(latitude_i\right) \times \sin\left(latitude_j\right)
\end{aligned}
\tag{2}
$$

$$
Dis = 6378.8 \times \mathrm{Arccos}(C) \times (\pi/180)
\tag{3}
$$

$$
LnDis = Ln(1 + (Dis_1 + Dis_2 + \ldots + Dis_n)/N)
\tag{4}
$$

where C is the spatial angle between the location of the independent director and the location of the enterprise, $latitude_i$ is the latitude of the independent director, $longitude_i$ is the longitude of the independent director, $latitude_j$ is the latitude of the enterprise, $longitude_j$ is the longitude of the enterprise, and Dis is the spherical distance between the independent director and the enterprise, 6378. 8 is the radius of the earth, Arccos (C) is the value of the inverse trigonometric function between the independent director and the enterprise, and N denotes the number of independent directors. Ln_Dis is the independent variable of this article, the geographic distance of independent directors.

4.3.2. Dependent variable: inefficient investments

This article refers to the method of Richardson (2006), uses regression model (5) to estimate the normal investment, and then takes the absolute value of the residual ε as the proxy variable for inefficient investments. In this Model (5), Q represents the growth opportunity, Cash represents cash holdings, ListY is the age at IPO, Size is the natural logarithm of total assets, Lev is the asset-liability ratio, Ret is stock return, and Inv is the amount of capital investment.

$$
\begin{aligned}
Inv_{i,t} = {}& \delta_0 + \delta_1 Q_{i,t-1} + \delta_2 Cash_{i,t-1} + \delta_3 ListY_{i,t-1} + \delta_4 Size_{i,t-1} \\
& + \delta_5 Lev_{i,t-1} + \delta_7 Ret_{i,t-1} + \delta_8 Inv_{i,t-1} + \varepsilon
\end{aligned}
\tag{5}
$$

4.3.3. Moderating variable: high-speed rail and marketisation process

Referring to Zhang et al. (2020), we first identify cities that have opened high-speed rail on the website of the National Railway Bureau and then further collect the year in which the city opened high-speed rail. This article uses Hsr to examine whether

Table 1. Variable definitions.

Variable	Definition
Ln_Dis	The latitude and longitude distance between the independent directors' residence and the enterprises' registration location
Abs_Inv	The absolute value of residuals in the model of Richardson (2006)
Size	The logarithm of total assets
Lev	Total liabilities/total assets
Growth	(Current operating income-previous operating income)/previous operating income
Inshold	Shares held by institutional investors/total shares
Roa	Net profit/total assets
Mcr	Overhead expense/prime operating revenue
Soe	Dummy variable, 1 represents the state-owned company and 0 represents the nonstate-owned company
Top1	Number of shares held by the largest shareholder/total number of shares
Board	Logarithm of the number of board members
Indep	Number of independent directors/number of board members
Dual	Dummy variable; the value is 1 if the chairman of the board and the general manager are the same person, 0 if not
Firm	Individual dummy variable
Year	Year dummy variable
Industry	Industrial dummy variables

Notes: This table shows the specific definition of all variables used in the study.
Source: Made by authors with reference to related literatures.

the enterprise's location is open to high-speed rail. If the enterprise's location has opened the high-speed rail, Hsr is 1; otherwise, it is 0. The National Economic Research Institute China Reform Foundation scores and summarises the process of marketisation in various provinces in China. We divide the samples into two groups according to the median marketisation index. If the marketisation index of the enterprise's location is higher than the median, then Market is 1; otherwise, it is 0.

4.3.4. Control variables

This article controls the basic characteristics of enterprises using firm size, asset-liability ratio asset-liability ratio, growth capacity, institutional ownership ratio, profitability, management expense ratio, and nature of ownership. This article also controls the governance characteristics of enterprises using equity concentration, board size, proportion of independent directors, and separation of powers. The specific definition of each variable is listed in Table 1.

5. Empirical results

5.1. Descriptive statistics

Table 2 shows the results of descriptive statistics for relevant variables. Specifically, the minimum value of Ln_Dis is 0, and the maximum value is 7.623, suggesting that listed enterprises do have geographic location preferences when selecting independent directors. The mean of Abs_Inv is 0.048, and its median is 0.032, which indicates that less than half of the listed enterprises have above-average inefficient investments. The mean and median of size are 21.339 and 21.268, respectively, which are very close to each other, suggesting that firm size is evenly distributed around the median. The mean of Lev is 0.448, and its maximum is 0.795, which indicates that listed enterprises generally have high debt. The minimum of Growth is −0.591, and its

Table 2. Descriptive statistics.

Variable	N	Average	Standard	Minimum	Median	Maximum
Ln_Dis	8821	4.528	2.637	0.000	5.671	7.623
Abs_Inv	8821	0.048	0.059	0.000	0.032	0.382
Size	8821	21.339	1.320	18.017	21.267	24.968
Lev	8821	0.448	0.202	0.060	0.446	0.795
Growth	8821	0.176	0.396	−0.591	0.111	2.330
Inshold	8821	0.395	0.223	0.002	0.403	0.862
Roa	8821	0.039	0.054	−0.158	0.034	0.214
Mcr	8821	1.096	0.061	1.020	1.082	1.252
Soe	8821	0.422	0.494	0.000	0.000	1.000
Top1	8821	0.339	0.146	0.826	0.320	0.741
Board	8821	2.243	0.171	1.792	2.303	2.708
Indep	8821	0.371	0.052	0.308	0.333	0.571
Dual	8821	0.241	0.428	0.000	1.000	1.000

Notes: This table reports descriptive statistics of the main variables used in the study.
Source: Created by the authors based on the Wind database and CSMAR database.

maximum is 2.330, which signifies that listed enterprises in the sample have significant differences in terms of growth, with some having started to decline while others are in a steady or even rapid growth stage. The mean and median of Inshold are 0.395 and 0.403, respectively, suggesting that personal investments dominate listed enterprises in the sample. The mean and median of Roa are 0.039 and 0.034, respectively, which indicates that more than half of the enterprises among the research sample are profitable. The minimum of Mcr is 1.020, and its maximum is 1.252, which suggests that the administrative expenses of all listed enterprises in the sample exceed the main business income. The median of Soe is 0, which suggests that at least half of the listed enterprises are nonstate-owned enterprises. The median of Top1 is 0.320, which indicates that more than half of the enterprises' top controlling shareholders hold more than 32.0% of the shares, consistent with the high concentration of shares in listed enterprises in China. The minimum of Board is 1.792, and its maximum is 2.708, which indicates that the number of board members of listed enterprises is basically in compliance with the company law. The mean of Indep is 0.333, which suggests that more than half of the enterprises have 30% of independent directors on the board. Finally, the median of Dual is 1, which indicates that at least half of the enterprises' chairman and general manager are the same person.

5.2. Regression analysis

Table 3 reports the regression results for Model (1), with column (1) showing the results for the whole sample. The coefficient of Ln_Dis is significantly greater than zero. For listed enterprises in China in general, this indicates that the ineffectiveness of independent directors increases as geographic distance increases, thus decreasing investment efficiency, which is consistent with H1 and the views of previous studies (Alam et al., 2018; Knyazeva et al., 2013). In addition, the results for Size, Growth, Inshold, Roa, and Mcr in column (1) are all significantly positive, suggesting that firms with large capitalisation, fast growth, high institutional ownership, good earnings performance, and high administrative costs are more likely to engage in inefficient investment behaviour. The reason for this is that such firms have severe principal-agent problems and high information asymmetry, so many investment decisions are not made according to the NPV, and the

Table 3. Regression analysis.

Variable	Full Abs_Inv (1)	Hrs = 1 Abs_Inv (2)	Hrs = 0 Abs_Inv (3)	Market = 1 Abs_Inv (4)	Market = 0 Abs_Inv (5)
Ln_Dis	0.002***	0.001	0.003***	−0.000	0.004***
	(3.204)	(1.245)	(3.117)	(-0.417)	(3.801)
Size	0.020***	0.023***	0.016***	0.018***	0.021***
	(9.360)	(7.003)	(4.727)	(6.061)	(5.715)
Lev	0.011	0.035***	−0.005	0.009	0.040***
	(1.335)	(2.641)	(-0.409)	(0.743)	(2.721)
Growth	0.004***	0.002***	0.008***	0.015***	0.002***
	(9.682)	(3.504)	(7.902)	(16.054)	(3.794)
Inshold	0.014**	0.022**	0.004	0.012	0.005
	(2.415)	(2.472)	(0.492)	(1.631)	(0.510)
Roa	0.030***	0.020**	0.140***	0.106***	0.015*
	(3.906)	(2.491)	(4.744)	(5.722)	(1.703)
Mcr	0.277***	0.361***	0.286***	0.411***	0.192***
	(8.178)	(7.040)	(5.368)	(9.421)	(3.342)
Soe	−0.001	−0.014	0.009	0.003	−0.004
	(-0.186)	(-1.457)	(1.049)	(0.305)	(-0.386)
Top1	0.001***	0.001***	0.001***	0.001***	0.001***
	(7.058)	(4.219)	(6.240)	(6.464)	(3.006)
Board	−0.019*	−0.005	−0.028	−0.021	−0.023
	(-1.674)	(-0.292)	(-1.595)	(-1.388)	(-1.217)
Indep	−0.022	−0.052	0.034	−0.020	−0.010
	(-0.781)	(-1.241)	(0.791)	(-0.536)	(-0.209)
Dual	0.000	0.002	−0.007	0.001	−0.004
	(0.124)	(0.569)	(-1.620)	(0.364)	(-0.729)
Constant	−0.668***	−0.852***	−0.591***	−0.786***	−0.582***
	(-8.582)	(-7.218)	(-4.913)	(-7.446)	(-4.405)
Firm/Year/Industry	YES	YES	YES	YES	YES
p value	–	0.068*		0.048**	
N	8,821	4,403	4,418	4,593	4,228
Adj_R²	0.200	0.451	0.471	0.187	0.309

Notes: This table presents the regression results of Model (1) for our study using a fixed effects model. Column (1) shows the regression results for the full sample; columns (2) to (4) show the results of the grouped regressions, grouped according to the high-speed rail and marketability in the enterprise's location. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.
Source: Created by the authors based on the Wind database and CSMAR database.

results for these control variables are similar to previous studies (Zhao et al., 2022; Xu et al., 2021). The coefficients of Top1 and Board have passed the significance test, which shows that it is reasonable to explore how to improve the enterprises' investment efficiency from the perspective of corporate governance.

Columns (2) through (5) in Table 3 show the regression results for the subsample. We divide the sample into one subsample in which high-speed rail is available in the enterprises' location (Hsr = 1) and another subsample in which high-speed rail is not available (Hsr = 0). The coefficient of Ln_Dis in column (2) does not pass the significance test, but the coefficient of Ln_Dis in column (3) is significantly positive at the 1% level. We group the sample according to the median of marketisation, with Market = 1 representing a high level of marketisation in the enterprise's location and Market = 0 representing a low level of marketisation in the enterprise's location. The coefficient of Ln_Dis in column (4) is not significant, and the coefficient of Ln_Dis in column (5) is significantly positive. The above results indicate that the positive relationship between independent directors' geographic distance and inefficient investments is mainly found in cities where high-speed rail is not available and the marketisation process is low. Hypotheses 2 and 3 of this article hold true.

Table 4. Robustness tests.

| Variable | New measure | | New sample | | New method | Endogenous |
	N_Abs_Inv (1)	Abs_Inv (2)	Abs_Inv (3)	Abs_Inv (4)	Abs_Inv (5)	Abs_Inv (6)
Ln_Dis	0.001**		0.005**	0.002**	0.0001*	0.001**
	(1.979)		(2.500)	(2.502)	(1.867)	(2.414)
N_Ln_Dis		0.001***				
		(3.272)				
Constant	−0.699***	−0.668***	−0.738***	−0.616***	−0.011	−0.020
	(-8.351)	(-8.582)	(-7.837)	(-5.592)	(-0.324)	(-0.567)
Controls	YES	YES	YES	YES	YES	YES
Firm/Year/Industry	YES	YES	YES	YES	YES	YES
N	8,821	8,821	6,733	5,045	8,821	8,821
Adj_R^2	0.211	0.200	0.231	0.202	0.078	0.075

Notes: Columns (1) and (2) show the regression results after replacing the independent variable and the dependent variable. Columns (3) and (4) show the regression results after eliminating special samples. Column (5) shows the regression results of the least-squares method. To eliminate the interference of endogeneity issues, we use the entropy balance method in column (6). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.
Source: Created by the authors based on the Wind database and CSMAR database.

5.3. Robustness tests

We conducted robustness tests from the perspectives of replacing variable measures, eliminating special samples, and changing regression methods. To eliminate the interference of endogeneity issues, we use the entropy balance method. The specific results are shown in Table 4.

5.3.1. Replace variable measures
We use the method of Biddle et al. (2009) to re-measure inefficient investments. The regression result is shown in column (1). Replacing the independent variable by dividing the original value of the independent directors' geographic distance by 1000, the result of the re-regression is shown in column (2), and the main point of this article is not changed.

5.3.2. Eliminate special samples
Local independent directors are a special sample because their geographical distance is 0. This article re-verifies the relationship between independent directors' geographic distance and inefficient investments after excluding these special samples, and the result is shown in column (3). In addition, compared with private enterprises, state-owned enterprises need to take more social responsibilities, such as improving the employment rate and driving the local economy, in addition to pursuing investment efficiency. Therefore, this article excludes the SOE samples, the result is shown in column (4), and the primary hypothesis is not changed.

5.3.3. Change regression methods
To avoid possible bias from the single regression model, this article further uses the least-squares model to re-verify the primary hypothesis, and the result is shown in column (5). The coefficient of Ln_Dis is significantly positive in the above results, again verifying that the hypothesis is valid.

5.3.4. Entropy balance

To reduce the interference of endogenous problems, we use the entropy balance method to divide the sample into the control and treatment groups based on the independent directors' geographic distance, treat the control variables in a balanced manner, and conduct regression tests on the primary hypothesis. The result is shown in column (6). The coefficient of Ln_Dis is still significantly positive, which indicates that the hypothesis remains valid and is consistent with the findings above.

6. Mechanism research

6.1. Geographic distance and information accessibility

Due to geographic location limitations and considerations of time and opportunity costs, there are relatively few connections and true interactions between long-distance independent directors and their enterprises (Opie et al., 2019). Low-frequency interactions make it difficult for enterprises to develop emotional commitment to their long-distance independent directors and create an information barrier that is difficult to break through.

This article uses independent directors' meeting attendance as a proxy variable for independent directors' information accessibility (Adams & Ferreira, 2012) and conducts a mediating test, the result of which is shown in Table 5. The coefficients of Ln_Dis in columns (2) and (3) are −0.001 and 0.002, respectively, which are both significant at the 10% level, and the coefficient of Information in column (3) is significantly negative. The results indicate that geographic distance affects inefficient investments by reducing independent directors' information accessibility.

6.2. Geographic distance and personal reputation

The personal reputation mechanism is a necessary basis to motivate and restrict independent directors in China. However, geographic distance can act as a 'natural barrier' to personal reputation, and the performance of long-distance independent directors in the location of enterprises' registration can hardly affect their reputation in the location of residence, whether it is good performance or bad performance.

This article refers to the research of Milbourn (2003) and uses the number of independent directors' exposure to the media as a proxy variable for personal reputation and conducts a mediating test, the result of which is shown in Table 5. The coefficients of Ln_Dis in columns (4) and (5) are −0.030 and 0.002, respectively, which both pass the 1% significance test, and the coefficient of Reputation in column (5) is −0.005, which is significant at the 1% level. The results suggest that geographic distance affects inefficient investments by suppressing independent directors' personal reputation.

7. Conclusions, implications and limitations

7.1. Major research conclusions

We explore the governance effects of independent directors from a geographic location perspective. The results show that geographic distance is not conducive to the

Table 5. Mechanism research.

Variable	Abs_Inv (1)	Information (2)	Abs_Inv (3)	Reputation (4)	Abs_Inv (5)
Ln_Dis	0.002***	−0.001***	0.002***	−0.030***	0.002***
	(3.204)	(-2.621)	(3.256)	(-4.493)	(2.958)
Information			−0.040*		
			(-1.671)		
Reputation					−0.005***
					(-4.508)
Size	0.020***	0.003**	0.020***	0.220***	0.019***
	(9.360)	(2.328)	(9.404)	(9.425)	(8.799)
Lev	0.011	−0.004	0.011	0.098	0.011
	(1.335)	(-0.918)	(1.316)	(1.057)	(1.279)
Growth	0.004***	0.000	0.004***	0.009*	0.004***
	(9.682)	(0.499)	(9.693)	(1.850)	(9.592)
Inshold	0.014**	0.002	0.014**	0.008	0.014**
	(2.415)	(0.731)	(2.430)	(0.127)	(2.412)
Roa	0.030***	−0.002	0.030***	0.180**	0.029***
	(3.906)	(-0.423)	(3.898)	(2.161)	(3.792)
Mcr	0.277***	0.045***	0.278***	0.675*	0.273***
	(8.178)	(2.604)	(8.227)	(1.819)	(8.088)
Soe	−0.001	0.002	−0.001	0.011	−0.001
	(-0.186)	(0.655)	(-0.173)	(0.166)	(-0.195)
Top1	0.001***	−0.000***	0.001***	−0.005***	0.001***
	(7.058)	(-2.819)	(6.997)	(-3.177)	(7.236)
Board	−0.019*	0.013**	−0.019	0.286**	−0.021*
	(-1.674)	(2.298)	(-1.626)	(2.276)	(-1.800)
Indep	−0.022	−0.005	−0.022	0.046	−0.022
	(-0.781)	(-0.323)	(-0.787)	(0.152)	(-0.790)
Dual	0.000	−0.001	0.000	−0.079**	0.001
	(0.124)	(-0.624)	(0.111)	(-2.487)	(0.260)
Constant	−0.668***	−0.093**	−0.672***	−4.239***	−0.647***
	(-8.582)	(-2.338)	(-8.627)	(-4.964)	(-8.308)
Firm/Year/Industry	YES	YES	YES	YES	YES
N	8,821	8,821	8,821	8,821	8,821
Adj_R^2	0.200	0.252	0.200	0.418	0.197

Notes: Mechanism tests show that geographic distance does affect inefficient investment by inhibiting independent directors' access to information as well as their reputation. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.
Source: Created by the authors based on the Wind database and CSMAR database.

functioning of independent directors and that there is a positive relationship between the geographic distance of independent directors and inefficient investment. This positive relationship is more pronounced in cities where high-speed rail is not available and the marketisation process is low. Mechanistic tests suggest that geographic distance does inhibit independent directors' access to information as well as their personal reputation.

7.2. Implications for practice

This article has certain practical implications. First, the academic and practical criteria for evaluating the governance effect of independent directors should be multidimensional and should not be limited to background and quantitative characteristics. Second, the geographic distance between independent directors and enterprises can reflect investment efficiency, thereby providing an indirect method for investors to identify a company's operating conditions. Finally, only when internal and external

governance mechanisms work in collaboration can agency conflicts and information asymmetry be effectively mitigated.

7.3. Limitations

It is important to note that this article has some limitations. First, this article uses the arithmetic average method to measure the geographic distance of independent directors from their corresponding enterprises and does not focus on the differences among independent directors. Second, independent boards with accounting and finance backgrounds are more sensitive to investment efficiency, but due to the difficulty in obtaining data on independent directors' professional backgrounds, this article does not analyse the professional background among independent directors in assessing investment efficiency. Finally, we find that some of the control variables are also significant. However, to better focus on the main research question of this article, we did not expand some interesting control variables into the study.

Acknowledgements

Disclosure statement

Notes

1. In 2002, the Chinese Company Law stipulated that there must be at least two independent directors on the board, that the proportion of independent directors on the board must be at least one-third, and that independent directors must have financial and legal backgrounds.
2. Overinvestment is when an enterprise invests in projects with negative NPV, and underinvestment is when an enterprise abandons an investment project with positive NPV.

Funding

ORCID

Dehui Li 🆔 http://orcid.org/0000-0002-9418-110X

References

Adams, R. B., & Ferreira, D. (2012). Regulatory pressure and bank directors' incentives to attend board meetings. *International Review of Finance*, *12*(2), 227–248. https://doi.org/10.1111/j.1468-2443.2012.01149.x

Alam, Z. S., Chen, M. A., Ciccotello, C. S., & Ryan, H. E. Jr. (2018). Board structure mandates: Consequences for director location and financial reporting. *Management Science*, *64*(10), 4735–4754. https://doi.org/10.1287/mnsc.2017.2736

Ayers, B. C., Ramalingegowda, S., & Yeung, P. E. (2011). Hometown advantage: The effects of monitoring institution location on financial reporting discretion. *Journal of Accounting and Economics*, *52*(1), 41–61. https://doi.org/10.1016/j.jacceco.2011.03.003

Bebchuk, L. A., & Fried, J. M. (2003). Executive compensation as an agency problem. *Journal of Economic Perspectives*, *17*(3), 71–92. https://doi.org/10.1257/089533003769204362

Bergman, N. K., & Nicolaievsky, D. (2007). Investor protection and the Coasian view. *Journal of Financial Economics*, *84*(3), 738–771. https://doi.org/10.1016/j.jfineco.2005.11.003

Biddle, G. C., Hilary, G., & Verdi, R. S. (2009). How does financial reporting quality relate to investment efficiency. *Journal of Accounting and Economics*, *48*(2-3), 112–131. https://doi.org/10.1016/j.jacceco.2009.09.001

Bryan, D. B., & Mason, T. W. (2020). Independent director reputation incentives, accruals quality and audit fees. *Journal of Business Finance & Accounting*, *47*(7–8), 982–1011. https://doi.org/10.1111/jbfa.12435

Chen, S., Li, Z., Han, B., & Ma, H. (2021). Managerial ability, internal control and investment efficiency. *Journal of Behavioral and Experimental Finance*, *31*, 100523. https://doi.org/10.1016/j.jbef.2021.100523

Chen, T., Xie, L., & Zhang, Y. (2017). How does analysts' forecast quality relate to corporate investment efficiency? *Journal of Corporate Finance*, *43*, 217–240. https://doi.org/10.1016/j.jcorpfin.2016.12.010

Chu, Y., Tian, X., & Wang, W. (2019). Corporate innovation along the supply chain. *Management Science*, *65*(6), 2445–2466. https://doi.org/10.1287/mnsc.2017.2924

Dat, P. M., Mau, N. D., Loan, B. T. T., & Huy, D. T. N. (2020). Comparative China corporate governance standards after financial crisis, corporate scandals and manipulation. *Journal of Security and Sustainability Issues*, *9*(3), 931–941. https://doi.org/10.9770/jssi.2020.9.3(18)

El Ghoul, S., Guedhami, O., Ni, Y., Pittman, J., & Saadi, S. (2013). Does information asymmetry matter to equity pricing? Evidence from firms' geographic location. *Contemporary Accounting Research*, *30*(1), 140–181. https://doi.org/10.1111/j.1911-3846.2011.01147.x

Elaoud, A., & Jarboui, A. (2017). Auditor specialization, accounting information quality and investment efficiency. *Research in International Business and Finance*, *42*, 616–629. https://doi.org/10.1016/j.ribaf.2017.07.006

Ertimur, Y., Ferri, F., & Maber, D. A. (2012). Reputation penalties for poor monitoring of executive pay: Evidence from option backdating. *Journal of Financial Economics*, *104*(1), 118–144. https://doi.org/10.1016/j.jfineco.2011.12.004

Firoozi, M., Magnan, M., & Fortin, S. (2019). Does proximity to corporate headquarters enhance directors' monitoring effectiveness? A look at financial reporting quality. *Corporate Governance: An International Review*, *27*(2), 98–119. https://doi.org/10.1111/corg.12264

Gao, X., Xu, W., Li, D., & Xing, L. (2021). Media coverage and investment efficiency. *Journal of Empirical Finance*, *63*(7), 270–293. https://doi.org/10.1016/j.jempfin.2021.07.002

Harjoto, M. A., Laksmana, I., & Yang, Y. (2018). Board diversity and corporate investment oversight. *Journal of Business Research*, *90*, 40–47. https://doi.org/10.1016/j.jbusres.2018.04.033

Huy, D. T. N., & Hien, D. T. N. (2010). The backbone of European corporate governance standards after financial crisis, corporate scandals and manipulation. *Economic and Business Review*, *12*(4), 215–240. https://doi.org/10.15458/2335-4216.1254

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review*, *76*(2), 323–329. https://www.jstor.org/stable/1818789

Jiraporn, P., Davidson, W. N., Dalt, P., & Ning, Y. (2009). Too busy to show up? An analysis of directors' absences. *The Quarterly Review of Economics and Finance*, 49(3), 1159–1171. https://doi.org/10.1016/j.qref.2008.08.003

Klein, A. (1998). Firm performance and board committee structure. *The Journal of Law and Economics*, 41(1), 275–304. https://doi.org/10.1086/467391

Knyazeva, A., Knyazeva, D., & Masulis, R. W. (2013). The supply of corporate directors and board independence. *Review of Financial Studies*, 26(6), 1561–1605. https://doi.org/10.1093/rfs/hht020

Kong, D., Liu, L., & Liu, S. (2020). Market information traveling on high-speed rails: The case of analyst forecasts. *Pacific-Basin Finance Journal*, 61, 101320. https://doi.org/10.1016/j.pacfin.2020.101320

Liberti, J. M., & Petersen, M. A. (2019). Information: Hard and soft. *The Review of Corporate Finance Studies*, 8(1), 1–41. https://doi.org/10.1093/rcfs/cfy009

Lipton, M., & Lorsch, J. W. (1992). A modest proposal for improved corporate governance. *The Business Lawyer*, 48(1), 59–77. https://www.jstor.org/stable/40687360

Liu, Y., Ma, S., & Tang, X. (2022). Independent director networks and executive perquisite consumption—"Collusion" or "Coordination" in governance? *Emerging Markets Finance and Trade*, 58(13), 3824–3839. https://doi.org/10.1080/1540496X.2022.2072202

Lo, H. C., & Shiah-Hou, S. R. (2022). The effect of CEO power on overinvestment. *Review of Quantitative Finance and Accounting*, 59(1), 23–63. https://doi.org/10.1007/s11156-022-01060-0

Malmendier, U., & Tate, G. (2005). CEO overconfidence and corporate investment. *The Journal of Finance*, 60(6), 2661–2700. https://doi.org/10.1111/j.1540-6261.2005.00813.x

Milbourn, T. (2003). CEO reputation and stock-based compensation. *Journal of Financial Economics*, 68(2), 233–262. https://doi.org/10.1016/S0304-405X(03)00066-7

Mirza, S. S., Majeed, M. A., & Ahsan, T. (2020). Board gender diversity, competitive pressure and investment efficiency in Chinese private firms. *Eurasian Business Review*, 10(3), 417–440. https://doi.org/10.1007/s40821-019-00138-5

Modigliani, F., & Miller, H. M. (1958). The cost of capital, corporation finance and the theory of investment. *American Economic Review*, 48(3), 261–297. https://www.jstor.org/stable/1809766

Myers, S. C., & Majluf, N. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

Nolan, J., & Rowley, C. (2020). Whither guanxi and social networks in China? A review of theory and practice. *Asia Pacific Business Review*, 26(2), 113–123. https://doi.org/10.1080/13602381.2020.1737391

O'Brien, P. C., & Tan, H. (2015). Geographic proximity and analyst coverage decisions: Evidence from IPOs. *Journal of Accounting and Economics*, 59(1), 41–59. https://doi.org/10.1016/j.jacceco.2014.11.002

Opie, W., Tian, G. G., & Zhang, H. F. (2019). Corporate pyramids, geographical distance, and investment efficiency of Chinese state-owned enterprises. *Journal of Banking & Finance*, 99, 95–120. https://doi.org/10.1016/j.jbankfin.2018.12.001

Orhun, G., & Izzet, S. D. (2016). Too much of a good thing: Board monitoring and R&D investments. *Journal of Business Research*, 69(8), 2931–2938. https://doi.org/10.1016/j.jbusres.2015.12.062

Richardson, S. (2006). Over-investment of free cash flow. *Review of Accounting Studies*, 11(2–3), 159–189. https://doi.org/10.1007/s11142-006-9012-1

Stein, J. C. (2003). Agency, information and corporate investment. *Handbook of the Economics of Finance*, 1, 111–165. https://doi.org/10.1016/S1574-0102(03)01006-9

Thompson, Y. Y., & Zhao, S. (2017). CEO inside debt and overinvestment. *Journal of Accounting and Finance*, 17(2), 83–99.

Wang, Y., Jin, P., & Yang, C. (2016). Relations between the professional backgrounds of independent directors in state-owned enterprises and corporate performance. *International Review of Economics & Finance*, *42*, 404–411. https://doi.org/10.1016/j.iref.2015.10.011

Wu, K., Sorensen, S., & Sun, L. (2019). Board independence and information asymmetry: Family firms vs non-family firms. *Asian Review of Accounting*, *27*(3), 329–349. https://doi.org/10.1108/ARA-05-2018-0110

Xin, Z., & Xin, S. (2017). Marketization process predicts trust decline in China. *Journal of Economic Psychology*, *62*(9), 120–129. https://doi.org/10.1016/j.joep.2017.07.001

Xu, H., Fu, Y., & Jasinskas, E. (2021). Can cross-listing improve investment efficiency? Empirical evidence from China. *Economic Research-Ekonomska Istraživanja*, *34*(1), 1789–1813. https://doi.org/10.1080/1331677X.2020.1848606

Yang, X., Cao, D., Andrikopoulos, P., Yang, Z., Bass, T., & Phillips, F. (2020). Online social networks, media supervision and investment efficiency: An empirical examination of Chinese listed firms. *Technological Forecasting and Social Change*, *154*, 119969. https://doi.org/10.1016/j.techfore.2020.119969

Yuan, B., Li, C., & Xiong, X. (2021). Innovation and environmental total factor productivity in China: The moderating roles of economic policy uncertainty and marketization process. *Environmental Science and Pollution Research International*, *28*(8), 9558–9581. https://doi.org/10.1007/s11356-020-11426-3

Zhang, S. S. (2018). Need for speed: Hard information processing in a high-frequency world. *Journal of Futures Markets*, *38*(1), 3–21. https://doi.org/10.1002/fut.21861

Zhang, X., Wu, W., Zhou, Z., & Yuan, L. (2020). Geographic proximity, information flows and corporate innovation: Evidence from the high-speed rail construction in China. *Pacific-Basin Finance Journal*, *61*, 101342. https://doi.org/10.1016/j.pacfin.2020.101342

Zhao, J., Wang, M., & He, Q. (2022). Cash holdings, the internal capital market, and capital allocation efficiency in listed companies. *Economic Research-Ekonomska Istraživanja*, 1–18. https://doi.org/10.1080/1331677X.2022.2080740