Your potential knows no bounds: do local CEOs influence firms' overseas R&D activities?

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Abstract: CEOs significantly affect firms' strategic choices; however, little is known about whether and how local CEOs influence firms' overseas research and development (R&D) decisions. By synthesising upper echelons theory and place attachment theory, we explore the intrinsic mechanisms and situational boundaries through which local CEOs shape firms' overseas R&D. We posit that local CEOs have a weaker global mindset, which ultimately inhibits firms' overseas R&D activities, and that the negative impact is attenuated when (1) CEOs have more overseas experience, (2) firms are more internationalised, or (3) regions have more international openness. The results from a large dataset of listed Chinese companies spanning 2005 to 2022 support these predictions. This study provides novel theoretical and empirical evidence to expand the current understanding of the micro-foundations of firms' overseas R&D decisions. Moreover, the findings have important implications for firms in better integrating innovation resources on a global scale to increase competitiveness.

Keywords: local CEOs; overseas R&D; overseas experience; firm internationalization; region international openness

1 Introduction

With the promotion of economic globalisation, firms face increasing competitive pressure. In this context, overseas research and development (R&D), as a strategic initiative that helps firms obtain global knowledge and update and enhance their competitive advantages, has received attention from managers and policymakers (Cho & Cantwell., 2024; Zámborský et al., 2023; Zhong et al., 2023). According to Clarivate's report on the 'Top 100 Global Innovators 2024¹', almost all innovative companies have overseas R&D activities. An increasing number of organisations have also begun to implement strategies for overseas R&D. However, some firms still deviate from this trend, remaining cautious or even rejecting it (Zhong et al., 2022). Moreover, no consensus has been reached in the literature on the benefits of overseas R&D. Some studies have warned of the fragility of the value of overseas R&D (Leung & Sharma, 2021) and even the danger of it becoming a burden for firms (Hsu et al., 2015; Hurtado-Torres et al., 2018; Tang et al., 2019). Thus, an important question arises: what are the determinants

¹ https://clarivate.com/top-100-innovators/

of firms' overseas R&D decisions?

A literature review shows that most research on the antecedents of firms' overseas R&D decisions identifies factors at the country (Chiarini et al., 2020; Urbig et al., 2022; Xu et al., 2023) and firm (Asakawa et al., 2018; Nasirov et al., 2022; Xiao & Yu, 2024; Zhong et al., 2022) levels. Organisational activities cannot be separated from human factors. Therefore, scholars who value micro-foundations (e.g. upper echelons scholars) emphasise that a deep understanding of an organisation's strategic choices requires a focus on the observable characteristics of strategic leaders, especially CEOs, and the mindset and cognitive dispositions those characteristics reflect (Barney & Felin, 2013; Hambrick & Mason, 1984). These scholars further emphasise that, in terms of explanations targeting firms' strategic choices, those at the CEO level are more stable, fundamental, and general than those at the firm, industry, or country level (Chittoor et al., 2019; Palmié et al., 2023). This is because strategic leaders, such as CEOs, interpret the external environment, identify strategic opportunities or threats, and take action to capitalise on or avoid them (Biru et al., 2023; Kruse et al., 2023). In contrast, firm-, industry-, and country-level factors often influence strategic choices by changing strategic leaders' mindsets and behavioural tendencies (Ren et al., 2024). The strategic management literature and management practices recognise that CEOs play a central role in firms' overseas R&D decisions (Chen et al., 2023). For example, Yoonho Choi, Samsung SDI's CEO, drove the company's strategy to establish R&D centres in the USA and Europe. Nevertheless, few studies have examined the micro-foundations underlying firms' overseas R&D decisions with respect to top management team (TMT) characteristics (Zhong et al., 2022). Therefore, more individual-level research, such as that on the role of CEO, is needed to enrich and deepen the current understanding of the micro-foundations of firms' overseas R&D decisions.

To fill these knowledge gaps, this study aims to elaborate on the role of local CEOs who choose to work in their birthplace (Chang et al., 2024) in explaining firms' overseas R&D decisions. This study is motivated by the following practical and theoretical reasons. First, with the advancement of economic globalisation, talent flow has become increasingly common (Bernstein et al., 2024). Moreover, the strong competitive pressure brought about by economic globalisation requires firms to integrate and allocate innovative resources globally to renew and enhance their competitive advantage (Fan, 2024; Leung & Sharma, 2021; Zhong et al., 2022). However, as an objective phenomenon that embodies reverse globalisation to some extent, local CEOs are not particularly rare in modern businesses (Ren et al., 2023). Therefore, clarifying the relationship between local CEOs and corporate seafarer R&D decisions is highly important for firms to succeed and achieve sustainable development in the context of

globalisation. Second, how local CEOs engage in various resource allocation activities is an important emerging literature stream (Ren et al., 2021; Yi & Jiang, 2024), and clarity on how local CEOs influence firms' integration and allocation of innovation resources on a global scale is needed to complement this research. Finally, a CEO's choice of workplace may reflect an unseen mindset and cognitive disposition (Ren et al., 2021; Tong et al., 2023). Thus, upper echelons theory (UET) can be used to develop a more refined explanation by capturing the intrinsic attributes of local CEOs and linking them to firms' overseas R&D decisions.

This study integrates UET (Hambrick & Mason, 1984) and place attachment theory (PAT) (Hidalgo & Hernández, 2001) to explain the mechanisms underlying the influence of local CEOs on firms' overseas R&D. Local CEOs tend to be highly emotionally and psychologically connected to their local geographical area (Ren et al., 2023; Tong et al., 2024). Thus, they may be less willing to develop strong emotional and psychological connections with other regions, weakening their global mindset. A stronger global mindset implies that individuals are open to establishing emotional and psychological connections with different geographic regions worldwide (Augusto Felício et al., 2015; Felício et al., 2013). In addition, globally minded CEOs are increasingly seen as key drivers of strategic actions to integrate global resources and enhance competitive advantages in firms (Agnihotri et al., 2023). Thus, CEOs will perceive lower risks and higher returns from global resource integration activities. In short, we argue that compared to nonlocal CEOs, local CEOs are less open to establishing emotional and psychological connections with global markets (implying a weaker global mindset). This, in turn, will make local CEOs perceive higher risks and lower returns from overseas R&D activities, ultimately inhibiting them.

We introduce three weighting factors to reveal the subtle and complex relationships between local CEOs and firms' overseas R&D activities. Several studies have reported that overseas experience changes CEOs' mindsets and behavioural tendencies (Jiang et al., 2024; Ren et al., 2023). Therefore, we first explore how the choice of work location and overseas experience together shape a CEO's global mindset and ultimately lead to differentiated overseas R&D decisions. Second, the environment (e.g. firm and regional environments) to which CEOs are exposed plays an important role in the formation of CEOs' mindsets and behavioural tendencies (Chen et al., 2024; Choi & Jung, 2021). Considering this, we also explore how openness to the global business environment of other actors in the environment to which local CEOs are exposed, reflected through a firm's degree of internationalisation and regional openness, influences the global mindset of local CEOs, which, in turn, shapes their overseas R&D decisions. We predict that CEO overseas experience, firm internationalisation, and a region's international openness offset local CEOs' weak global mindset, thereby weakening the negative impact of local CEOs on firms' overseas R&D. This study uses a longitudinal panel dataset of 629 listed companies in China from 2005 to 2022 for empirical testing and provides strong empirical evidence to support our theoretical hypotheses.

This study makes three contributions to the literature. First, by highlighting and confirming the crucial role of local CEOs in predicting firms' overseas R&D, this study deepens the understanding of the micro-foundations of firms' overseas R&D decisions at the individual level. This helps us develop a more stable, fundamental, and general explanation of the determinants of firms' overseas R&D choices beyond country- and firm-level factors (Urbig et al., 2022; Xiao & Yu, 2024). Second, this study emphasises that workplace choice may be a map of CEOs' intrinsic attributes, thus providing new theoretical and empirical evidence on how local CEOs shape strategic choices and advancing UET (Hambrick & Mason, 1984). In addition, this study theoretically and empirically confirms how CEO overseas experience, firm internationalisation, and regional openness moderate the relationship between local CEOs and firms' overseas R&D, thus helping refine the understanding of when local CEOs' intrinsic traits are more likely to influence firms' strategic choices. Finally, by incorporating firms' decisions on how to integrate resources globally into the analytical framework, this study helps us understand the consequences for local CEOs in a more comprehensive way. This represents a valuable expansion of the local CEO literature, which is currently limited to financial and human decisions (Ren et al., 2023; Tong et al., 2023, 2024).

2 Theory and hypotheses

2.1 Theory base and research framework

As early as the 1960s, to gain a foothold in a highly competitive landscape, a few leading firms in developed countries were no longer satisfied with moving only their production, manufacturing, or sales segments globally (Awate et al., 2015; Dachs et al., 2024). Since the 1990s, competition in the global market has accelerated, and information and communications technology has developed rapidly. Under these circumstances, an increasing number of businesses in emerging economies (e.g. China and India) have begun to implement overseas R&D strategies to overtake enterprises in developed economies (Xu et al., 2023; Zhong et al., 2022).

Scholars have generally acknowledged that overseas R&D provides valuable opportunities for firms to improve their innovation capabilities and competitive advantages (Awate et al., 2015; Chen et al., 2023). However, compared with domestic R&D, overseas R&D has more complexities, such as difficulties in searching for and integrating global knowledge

and the pressure of cross-cultural and cross-language operations (Hurtado-Torres et al., 2018; Leung & Sharma, 2021; Tang et al., 2019). Therefore, exploring the determinants of firms' overseas R&D and the underlying mechanisms holds significant theoretical and practical value (Urbig et al., 2022; Xu et al., 2023; Zhong et al., 2022). Our literature review reveals that studies on the influencing factors of firms' overseas R&D have focused mainly on the country (Xu et al., 2023) and firm (Asakawa et al., 2018; Nasirov et al., 2022; Zhong et al., 2022) levels. However, with a few exceptions (Zhong et al., 2022), these studies have generally neglected the potential role played by key decision-makers, especially CEOs. Thus, this study aims to extend this research stream by introducing the role of local CEOs, thereby deepening the understanding of the micro-foundations of overseas R&D research.

UET (Hambrick & Mason, 1984) has been widely used in research on strategic management, innovation management, and other fields. It posits that CEOs' values, mindsets, and cognitive frameworks determine how they filter, interpret, and utilise information (Popli et al., 2022). On this basis, CEOs form personalised interpretations and understandings of the external environment, ultimately leading to different corporate strategic choices (Wang, 2024). Moreover, UET suggests that CEOs' visible characteristics can reflect their invisible intrinsic attributes (e.g. mindset and cognitive framework) (Hambrick & Mason, 1984). However, UET implies that local CEOs may have unique intrinsic attributes that may ultimately influence the heterogeneity of firms' overseas R&D decisions. However, this theory cannot effectively explain the differences in intrinsic attributes between local and nonlocal CEOs. In this context, PAT (Hidalgo & Hernández, 2001) is a useful complementary theory.

According to PAT, individuals develop a subjective connection to a particular place that they consider important or meaningful, referred to as place attachment (Hidalgo & Hernández, 2001; Manzo, 2005). Place attachment implies that people develop special emotions towards important places in their lives (Manzo, 2005), one of which is their birthplace. Place attachment shapes individuals' emotions, cognitive experiences, and interactions with their environment (Tong, Tian, & Cao, 2024). Scholars have found that CEOs' dependence on specific locations changes their strategic logic, which in turn affects their corporate strategic choices (Tong, Tian, & Cao, 2024; Yonker, 2017). Thus, we aim to synthesise the perspectives of UET and PAT to reveal the intrinsic mechanisms through which local CEOs influence firms' overseas R&D.

Moreover, according to UET, CEOs' interactions with the external environment (e.g. organisational context and macroenvironment) play a key role in the formation and development of their values, mindsets, and cognitive frameworks (Hambrick & Mason, 1984). Therefore, we introduce several key situational factors to clarify the conditions under which

local CEOs are more likely to exhibit unique intrinsic attributes, thereby leading to heterogeneity in firms' overseas R&D decisions. First, we explore how CEOs' exposure to international environments (e.g. overseas experience) and choice of workplace combine to shape local CEOs' global mindsets. Globalisation advances and more frequent talent flows between countries have resulted in an increasing number of CEOs having overseas experience (Gu & Yuan, 2024; Jiang et al., 2024). Scholars have found that overseas experience can deepen CEOs' knowledge and understanding of foreign environments, enhance their ability to solve cross-border managerial problems, and ultimately lead to a more open attitude towards non-local opportunities and information (Su et al., 2023).

Second, CEOs are always embedded in specific organisational and regional environments, and the formation and development of their intrinsic characteristics are inevitably shaped by other subjects and their attitudes towards organisational and regional environments (Chen et al., 2024; Choi & Jung, 2021). Considering this, we also explore how CEOs' choice of workplace and degree of openness to the global business environment of other actors in their environment combine to shape local CEOs' global mindsets. The openness of other actors in a CEO's environment to the global business environment is reflected in two ways. On the one hand, the degree of firm internationalisation can capture the openness of other members of the local CEO's organisation to the global business environment (Biru et al., 2023). On the other hand, the degree of a region's international openness can capture the openness of actors outside a local CEO's organisation to the global business environment (Wang & Wang, 2021). Based on the above, we construct the theoretical framework shown in Figure 1.

<Insert Figure 1 about here>

2.2 Local CEOs and firm overseas R&D

Combining the ideas of UET (Hambrick & Mason, 1984) and PAT (Hidalgo & Hernández, 2001), we argue that, compared with nonlocal CEOs, local CEOs are less likely to push their firms to engage in overseas R&D activities. The reasons for this are outlined below.

Compared with nonlocal CEOs, local CEOs are less open to establishing emotional and psychological connections with global markets (implying a weaker global mindset). Birthplace is not only a geographical concept but also has human, environmental, and psychosocial connotations (Chang et al., 2024; Yang et al., 2023). Scholars have recognised that people develop a great deal of attachment to or identification with their birthplace during their long-term residence (Hernández et al., 2007; Tong et al., 2024). Related studies have shown that the aforementioned dependency tendencies are particularly salient when CEOs choose to work in their birthplace; that is, local CEOs display particularly strong place attachment tendencies (Hu,

2023; Ren et al., 2021; Tong et al., 2024). In particular, local CEOs choose to work in their birthplace likely because they are motivated by emotions to return to their birthplace and build it up. Place attachment can lead individuals to favour locally relevant activities (Atta-Owusu & Fitjar, 2022) and be less willing to incorporate nonlocal (e.g. host country) information, perspectives, and ideas into their decision frameworks. This is because investing too much energy, time, and emotion in nonlocal activities can result in greater economic (e.g. lack of familiarity with nonlocal culture, business practices, and consumer behaviour) and psychological (e.g. feeling guilty for 'betraying' their birthplace and experiencing emotional disorders) costs (Tong et al., 2024). Atta-Owusu and Fitjar (2022) reported that academics with a strong sense of place attachment interact more with local partners. Individuals with a weaker global mindset tend to be reluctant to make emotional and psychological connections with different geographical regions worldwide (Augusto Felício et al., 2015; Felício et al., 2013). Thus, the above situation is also directly reflected in local CEOs potentially having a weaker global mindset than nonlocal CEOs (Jiang et al., 2019). As supporting evidence, Jiang et al. (2019) found that CEOs with birthplace attachment are less likely to select acquisition targets outside their birthplace.

Furthermore, a global mindset influences CEOs' resource and psychological commitments overseas (Augusto Felício et al., 2015), thereby determining firms' success in international markets (Felício et al., 2016; Jiang et al., 2021). A weaker global mindset is generally believed to reduce a CEO's commitment to and efforts to understand the relevant elements of foreign markets (Felício et al., 2013). Thus, they tend to ignore a wide range of information relevant to the global business environment (Jiang et al., 2021). Furthermore, CEOs with a weaker global mindset are more likely to view the growth of their businesses from a domestic rather than an international perspective (Mohr & Batsakis, 2019). Thus, in terms of overseas R&D decisions, a weaker global mindset leads CEOs to search for fewer overseas R&D opportunities, making them less likely to see overseas R&D as an effective means of improving their companies' competitiveness. They perceive greater risk and lower returns from overseas R&D activities (Rodgers et al., 2022), ultimately inhibiting firms' overseas R&D activities. Previous research has confirmed that a weak global mindset among decision-makers is an important factor that prevents firms from engaging in internationalisation activities (Augusto Felício et al., 2015; Felício et al., 2013). This shows that local CEOs have strong place attachment, which leads them to develop a weak global mindset and, hence, less interest in overseas R&D activities.

Therefore, we propose the following hypothesis:

H1: Local CEOs are less likely than nonlocal CEOs to drive firms to engage in overseas R&D activities.

2.2 Moderating effect of CEO overseas experience

CEO overseas experience refers to a CEO's current or previous experience working and/or studying abroad (Gu & Yuan, 2024). Overseas experience provides new stimuli for CEOs and exposes them to values that differ from those in their home countries, potentially leading to changes in their cognitive structures and thought patterns (Jiang et al., 2024; Ren et al., 2023). We argue that CEO overseas experience mitigates the formation of a weaker global mindset by local CEOs, weakening the negative impact of local CEOs on firms' overseas R&D.

Local CEOs with overseas experience, who have been exposed to a host country's environment and have a more open-minded perspective (Gu & Yuan, 2024), are unlikely to see the promotion of firms' overseas R&D activities to improve their competitiveness as betraying their birthplace. In contrast, local CEOs with overseas experience may argue that integrating innovation resources globally is essential for firms to succeed in a globalised economy (Fan, 2024; Zhong et al., 2022) and that firms' success enables them to give back to their birthplace. As a result, local CEOs with overseas experience will be less likely to experience strong psychological costs associated with investing energy, time, and emotions outside their local area, leading to a lower likelihood they will exhibit a weaker global mindset. CEOs with overseas experience have more formal and informal networks in international markets. This makes it easier (or less expensive) for them to gain insights into differentiated cultures and institutions (Gu & Yuan, 2024), absorb valuable information about the international market, and avoid threats (Zhou & Liao, 2024). Therefore, when local CEOs have an overseas background, they are less likely to experience high economic costs, even if they invest their energy, time, and emotions outside their local area, thereby allowing them to demonstrate a stronger global mindset. Thus, local CEOs with overseas experience are less likely to develop a weaker global mindset, which weakens the negative impact of local CEOs on firms' overseas R&D in turn.

Therefore, we propose the following hypothesis:

H2a: *CEO* overseas experience weakens the negative impact of local CEOs on firms' overseas R&D activities.

2.3 Moderating role of firm internationalisation

The degree of firm internationalisation refers to the extent to which a firm operates and grows

in the international market. Internationalisation can generate long-term returns for firms through experience and technology acquisition, risk diversification, and competitive advantage enhancement (Han et al., 2024). Each firm has a specific culture and strategic logic, and these factors play important roles in shaping CEOs' values and behavioural tendencies. We argue that firm internationalisation offsets the formation of a weaker global mindset among local CEOs and mitigates their negative impact on firms' overseas R&D.

Internationalisation reflects firms' and organisational members' resource and psychological commitment to the global business environment (Biru et al., 2023; Witt et al., 2024). In internationalised firms, other members are open to absorbing information, views, and ideas from the national market and tend to view firm development from an international rather than an inward domestic perspective. Thus, in internationalised firms, local CEOs are less likely to incur high psychological costs (e.g. less likely to feel guilty) when they attempt to create high emotional and psychological connections with international markets because they can receive emotional support (e.g. emotional comfort and affirmation) from organisational members. Therefore, in internationalised firms, local CEOs are less likely to exhibit a weaker global mindset. Furthermore, internationalisation involves complex activities that expose firms to complex institutional environments (e.g. different cultures, languages, and values) (Purkayastha & Gupta, 2023; Safari, 2024). This requires firms to make sustained efforts to understand dynamic international markets and address the corresponding challenges (Biru et al., 2023; Liu et al., 2023). Thus, internationalised firms may develop effective mechanisms or methodologies to absorb valuable information and avoid threats in the international market. By utilising these mechanisms and methods, local CEOs are better positioned to avoid potentially high economic costs when absorbing information and knowledge from international markets (Purkayastha & Gupta, 2023). Consequently, local CEOs are unlikely to develop a weaker global mindset in internationalised firms. In summary, the internationalisation of firms reduces the likelihood of local CEOs developing a weaker global mindset, which in turn weakens the negative impact of local CEOs on firms' overseas R&D.

Therefore, we propose the following hypothesis:

H2b: Firm internationalisation weakens the negative impact of local CEOs on firms' overseas R&D activities.

2.4 Moderating role of a region's international openness

A region's international openness refers to its degree and depth of openness to international markets. This indicator can be reflected in several ways, including the level of trade

liberalisation, foreign investment policies, degree of international trade cooperation, and people's ease of movement between regions (Camarero et al., 2016; Kafouros & Aliyev, 2016). As regional cultures and norms also influence CEOs' mindsets and behavioural tendencies (Chen et al., 2024; Choi & Jung, 2021), we further incorporate the contingency role of a region's international openness. We argue that a region's international openness mitigates the formation of a weaker global mindset among local CEOs and the negative impact of local CEOs on firms' overseas R&D.

A higher degree of international openness in a region usually implies more open market access conditions and closer international economic ties (Dou et al., 2021; Wang & Wang, 2021). These regions have a general developmental attitude towards the global environment and are willing to engage in a wide range of trades, investments, and cooperation with other countries and regions (Wang & Wang, 2021). When local CEOs engage in activities recognised and encouraged by the majority, they are less likely to be socially ostracised and more likely to be praised. Thus, in regions with high international openness, local CEOs are less likely to incur high psychological costs when attempting to develop strong emotional and psychological ties with international markets. Thus, in regions with greater international openness, local CEOs are less likely to exhibit a weaker global mindset. More internationally open regions tend to develop a range of matching product markets, factor markets, and market intermediary organisations (Kafouros et al., 2015; Kafouros & Aliyev, 2016). For example, regional governments are more likely to implement policies that encourage firms to take advantage of international market opportunities. These regions also tend to have many specialised organisations designed to help firms effectively understand the complexities of the international market environment and identify and seize international market opportunities. By utilising government support and specialised institutions, local CEOs are better able to fully absorb international market information and knowledge at relatively low costs. Therefore, they are less likely to experience high economic costs in the process. Consequently, local CEOs are unlikely to develop a weaker global mindset in regions with greater international openness. Thus, a region's international openness reduces the likelihood of local CEOs developing a weaker global mindset, which, in turn, weakens the negative impact of local CEOs on firms' overseas R&D.

Therefore, we propose the following hypothesis:

H2c: A region's international openness weakens the negative impact of local CEOs on firms' overseas R&D activities.

3 Research design

3.1 Data and sample

We select Chinese multinational enterprises (MNEs) as our research sample. First, China is a country with high power distance (Aycan et al., 2013), providing CEOs with a stronger influence on corporate strategic choices compared to those in countries with lower power distance. Second, the Chinese government encourages companies to continue advancing their global R&D presence. Over the last decade, Chinese companies have created laboratories and research centres worldwide at an unprecedented rate. For example, according to FDI Markets, a data service owned by the *Financial Times*, Chinese companies announced the establishment of nine new overseas investment centres in 2016 alone, with a total capital expenditure of approximately US\$224 million². Finally, empirical evidence from China, which is the largest developing economy, can provide important insights for other emerging economies that follow or emulate China's development pace and model.

Specifically, we select Chinese listed MNEs from 2005 to 2022. The data related to CEOs' birthplaces are from firms' annual reports, and other data are from the China Stock Market and Accounting Research (CSMAR) database. To ensure the validity of the sample, we excluded the following: (1) firms lacking overseas subsidiaries (Tang et al., 2020); (2) firms listed for fewer than two years to avoid the impact of unusual cash holdings after the initial public offering; (3) financial and insurance industries owing to their distinct asset structures, capital structure, and operational characteristics; (4) firms with poor financial status or those classified as special treatment (ST) with unusual conditions (Chen et al., 2023); and (5) firms with incomplete data (Zhong et al., 2022). To avoid potential endogeneity issues related to reverse causality, the dependent variable was delayed by one period for further analysis. The final dataset comprises 2,723 observations from 629 listed firms.

3.2 Measurement

Dependent variable: *Firm overseas R&D*. Although Chinese listed MNEs disclose their total R&D expenditures in their annual reports, they do not disclose many details about R&D expenditures in various overseas markets. Thus, in accordance with Hsu et al. (2015) and Xiao and Yu (2024), we use the total number of firms' overseas R&D subsidiaries to measure overseas R&D intensity.

Independent variable: *Local CEO*. Most Chinese CEOs were born in the 1960s–1980s and deeply influenced by clans and Confucian culture. Thus, they usually consider their

² https://www.sohu.com/a/113148714_162522

hometowns to be the most important aspect of their social identity (Lazarkenko, 2020; Chen et al., 2024). Following previous research (Ren et al., 2023; Tong et al., 2024; Yi & Jiang, 2024), we measure *LocalCEO* as a dummy variable. We define local CEOs as those with their birthplace and firm headquarters in the same province (Tong et al., 2024). Thus, the variable takes a value of one if the firm has a local CEO and zero otherwise (Ren et al., 2021; Ren et al., 2023; Tong et al., 2024).

Moderator variables. *CEO overseas experience*. Following previous studies (Purkayastha & Gupta, 2023; Safari, 2024), we use the '0–1' dummy variable to measure *CEO overseas experience*. If a CEO has experience studying or working overseas, the variable is coded as 1; otherwise, it is coded as 0. *Firm internationalisation*. According to Hsu et al. (2015), firm internationalisation can be measured using the number of foreign countries in which a firm has investments. *The region's international openness*. According to Dong et al. (2022), a region's international openness can be measured using the ratio of inward FDI to GDP in each region as a proxy (Dong et al., 2022; Dou et al., 2021).

Control variables. Previous studies have shown that CEO-, firm-, and regional-level characteristics can influence firms' overseas R&D (Urbig et al., 2022; Xiao & Yu, 2024). Therefore, we control for several variables, as outlined below.

First, firms with abundant resources or easier access to resources have stronger incentives to implement overseas R&D activities; therefore, we control for firm size, firm age, total liabilities, and state ownership. This is because they reflect a firm's ownership of or ability to access resources. The control variables were measured as follows:

Firm size. Following Dong et al. (2022), firm size is measured using the natural logarithm of total assets.

Firm age is operationalised as the natural logarithm of the number of years since a firm was established.

Firm total liabilities are gauged as the natural logarithm of total liabilities.

State ownership is measured using a dummy variable: if the firm is state-owned, it is coded as 1; otherwise, it is coded as 0.

Second, as Xiao and Yu (2024) have shown, better-performing firms tend to lack incentives to undertake overseas R&D activities. Therefore, we control for *total income*, measured by the natural logarithm of a firm's total income in the current year. Furthermore, companies with many overseas branches may avoid overseas R&D activities to prevent management complications and communication difficulties. Therefore, we also controlled for *foreign subsidiaries* as measured by the natural logarithm of the total number of foreign

subsidiaries in the current year.

Third, prior research suggests that characteristics such as decision-makers' size, gender, and age shape their behavioural tendencies and may ultimately lead to different firms exhibiting different overseas R&D activities (Zhong et al., 2022). Therefore, we also control for *TMT size*, *CEO gender*, *CEO age*, and *director size*. *TMT size* is measured as the natural logarithm of the number of top management figures, including chairpersons, general managers, assistant general managers, deputy general managers, directors of functional departments, chief accountants, chief economists, chief engineers, and party secretaries (Zhang et al., 2023). *CEO gender* is coded as one when the CEO is male and zero otherwise. *CEO age* is measured using the natural logarithm of the CEO's age in the current year. *Director size* is measured as the natural logarithm of the total number of directors in the current year.

Finally, we control for industry- and region-level variables that may affect firms' overseas R&D activities, including regional GDP, industry concentration, and industry competition (Urbig et al., 2022; Xiao & Yu, 2024). *Regional GDP* is measured by the natural logarithm of the total GDP in each province in the current year. *Industry concentration* is measured as the proportion of the main business income of the top five companies in the industry to the main business income of the current year. *Industry competition* is measured using the natural logarithm of the total number of listed companies in an industry in the current year.

4 Results

Table 1 presents the descriptive statistics for all variables in our sample. The mean values *firm overseas R&D* and *local CEOs* are 0.372 and 0.547, respectively, meaning that 54.7% of the sample firms have a local CEO. The standard deviations of *firm overseas R&D* and *local CEOs* are 1.135 and 0.498, respectively, indicating that the sample captures sufficient variation to explore the relationship between *local CEOs* and *firm overseas R&D*.

<Insert Table 1 about here>

Table 2 reports the correlations among all the variables. The correlation coefficient between *local CEOs* and *firm overseas R&D* is 0.008, but not significant. Thus, the effect of *local CEOs* of firms on *firm overseas R&D* requires further exploration.

<Insert Table 2 about here>

To avoid the potential endogeneity of unobserved variables, we apply panel data regression methods to test the relationship between *local CEOs* and *firm overseas R&D*. We use the Hausman test to determine whether to adopt a fixed- or random-effects model. The

results of the Hausman test are significant (p=0.0000<0.05, $\chi 2=128.11$), and the fixed-effect model is used in the regression analysis. To avoid potential reverse causality endogeneity, we lag the dependent variable by one year in the fixed-effects model.

Table 3 presents the results of the fixed-effects regression analysis. Model 1 shows *that local CEOs* negatively affect *firm overseas* R&D (β =-0.330, p<0.01), supporting H1. Models 2–4 present the results for the three moderating variables. Model 5 shows the results for the full model, in which (1) *CEO overseas experience* alleviates the negative relationship between *local CEOs* and *firm overseas* R&D (β =0.448, p<0.05), in line with H2a; (2) *firm internationalisation* alleviates the negative relationship between *local CEOs* and *firm overseas* R&D (β =0.039, p<0.001), which is consistent with H2b; and (3) *regional international openness* alleviates the negative relationship between *local CEOs* and *firm overseas* R&D (β =1.141, p<0.001), supporting H2c.

In summary, the results show that *local CEOs* negatively affect *firm overseas R&D* and *firm internationalisation, regional international openness,* and *CEO overseas experience* mitigate this negative effect.

<Insert Table 3 about here>

4.1 Endogeneity problem tests

In the baseline model (Table 3), to avoid potential endogeneity, we control for the effects of year and industry and lag the dependent variable by one year in the fixed-effects model. However, our results are subject to endogeneity. For example, potential estimation biases related to time-varying and unobserved factors may have been ignored in the baseline model. In addition, reverse causality may still exist, as firms that conduct more overseas R&D may become more attractive to nonlocal talent. This section reports the four approaches we use to address potential endogeneity concerns: controlling for time-varying province and industry effects, instrumental variable regressions, Heckman's two-stage approach, and difference-in-differences (DID) analysis.

Controlling for time-varying *province* and *industry* effects. To address the potential effects of time-varying variables related to geographic location and industry selection, we added interaction dummies *province*year* and *industry*year* to the model. The results in Table 4 show that the coefficient of *local CEOs* remains negative and significant, suggesting that the findings are unlikely to be caused by time-varying omitted variables.

<Insert Table 4 about here>

Instrumental variable analysis. We use a two-stage least squares (2SLS) instrumental regression to mitigate potential endogeneity concerns. Following previous studies (Hochberg

& Lindsey, 2010; Kang et al., 2018; Ren et al., 2021), the average value of *local CEOs* of all other firms in the same province is used as the instrument in the 2SLS instrumental regression. Table 5 presents the results of the 2SLS instrumental regression. The instrumental variable, the *average value of local CEOs*, is the average value of *local CEOs* for all firms in the same province. The first-stage estimation results show that the instrument is positively related to the main variable of interest, *local CEOs*. The F-statistic is 477.88, indicating that the instrument is strong. The second-stage estimation results show that the coefficient of *local CEOs* is negative and statistically significant (β =-0.316, p<0.05), which is similar to the results of the baseline regressions. These results further support our hypothesis that *local CEOs* can negatively affect *firms' overseas R&D*.

<Insert Table 5 about here>

Heckman's two-stage approach. We employ Heckman's two-stage approach to mitigate potential self-selection bias. Following Yang et al. (2023), the number of '211-project universities' in the province of a firm's headquarters is used as an exclusion restriction, helping to mitigate multicollinearity issues in Heckman models. The firms in provinces with more '211-project' universities are less likely to hire local CEOs because these provinces can attract more talented people, providing local firms with have more opportunities to hire top talent. First, we estimate a probit model with *local CEOs* as the dependent variable and calculate the inverse Mills ratio (IMR). In the second-stage model, we estimate the impact of *local CEOs* and IMR on *firm overseas R&D*. Table 6 presents the results of the Heckman two-stage analysis. As shown in Table 6, the number of '211-project' universities has a significant negative effect on *local CEOs* in the first-stage model (β =-0.096, p<0.1). In the second-stage model, the coefficient of *local CEOs* is both negative and significant (β =-0.301, p<0.01), further supporting the hypothesis that *local CEOs* are less likely to drive firms towards *overseas R&D* activities.

<Insert Table 6 about here>

Difference-in-differences analysis. To address potential endogeneity, we apply a DID model to estimate the impact of *local CEOs* on *firms' overseas R&D*. Following previous research (Chen et al., 2024), we construct *CEO turnover* as the variation in *local CEOs* (Chen et al., 2024). Our sample includes 123 firm-year observations with *CEO turnover* during the sample period. We compared the levels of *firm overseas R&D* before and after the transition from nonlocal to local CEO (i.e. the treatment group) against a control group that consistently had a nonlocal CEO. In addition, another case exists in which firms switch from a local CEO

to a nonlocal CEO, with a control group that consistently has a local CEO. However, after encoding, we found only 51 observations for the latter case, which is insufficient for the regression analysis. Therefore, we only analyse the difference in overseas R&D for firms that transitioned from a nonlocal CEO to a local CEO compared to a control group of firms with a consistent nonlocal CEO.

The DID model is expressed as follows:

Firm overseas $R \& D_{i,t} = \beta_0 + \beta_1 Treat_i \times Post_t + \sum \gamma Controls_{i,t} + \sum Firm + \sum Year + \sum Industry + \varepsilon_{i,t}$ where *Treat* equates 1 if the firm is in the treatment group (i.e. switching from a nonlocal CEO to a local CEO) and 0 otherwise (i.e. consistently having a local CEO). *Post* is coded as 1 if the CEO is replaced in *t*. The results in Table 7 show that the coefficient of *Treat* × *Post* is significant and negative (β =-0.582, p<0.05), indicating that the switch from a nonlocal to a local CEO can significantly restrain a firm's overseas R&D activities.

<Insert Table 7 about here>

4.2 Additional analyses

To further explore the relationship between local CEOs and firms' overseas R&D, we divide the regions in which firms' headquarters are located into eastern, middle, and western regions because of China's cultural and geographic diversity. Specifically, culture and geography are likely to influence the effects of local CEOs on firms' overseas R&D activities.

In accordance with Ren et al. (2021), we divide the sample into two subsets: the eastern region and the central and western regions. The eastern region includes Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, and Hainan. The central and western regions include Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan, Sichuan, Chongqing, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Ningxia, Qinghai, and Xinjiang.

Table 8 shows the results of *local CEOs*' effects on *firms' overseas R&D* across regions. For firms headquartered in eastern China, *local CEOs* negatively affect *firm overseas R&D*, but not significantly (β =-0.229, p>0.1). All three moderators alleviate the negative relationship between *local CEOs* and *firm overseas R&D*: *firm internationalisation* (β =0.047, p<0.001), *regional international openness* (β =1.771, p<0.001), and *CEO overseas experience* (β =0.937, p<0.01).

For firms with headquarters in central or western China, *local CEOs* can significantly negatively affect *firm overseas* R&D (β =-0.802, p<0.001). *Firm internationalisation* strengthens the negative relationship between *local CEOs* and *firm overseas* R&D (β =-0.167,

p<0.001). Furthermore, *regional international openness* alleviates the negative relationship between *local CEOs* and *firm overseas R&D* (β =14.737, p<0.01), whereas the moderating effect of *CEO overseas experience* is not significant (β =-0.384, p>0.1). One possible explanation for these findings is that the corporate governance system in central and western China is relatively imperfect, granting CEOs more managerial discretion. This makes local CEOs more likely to implement their own values and mindsets (e.g. weaker global mindset) in formulating and executing their firms' overseas R&D decisions.

<Insert Table 8 about here>

We use *CEO workplace* as another proxy for measuring the variable of *local CEOs*. We code *local CEOs* as 1 if the *CEO workplace* is in the same province as the firm headquarters and if the CEO has worked in the province for more than 10 years; otherwise, we code it as 0. Table 9 presents the regression analysis results using these alternative metrics for *local CEOs*. In Model 1, the relationship between *local CEOs* and *firms' overseas R&D* is negative and significant (β =-0.276, p<0.05), further supporting H1. Model 5 is the complete model and shows that the interaction between *CEO overseas experience* and *local CEOs* is positive and significant (β =0.439, p<0.1), indicating that *CEO overseas experience* alleviates the negative relationship between *local CEOs* and *firm overseas R&D*, thus supporting H2a. The interaction effect between *regional international openness* and *local CEOs* is positive and significant (β =0.738, p<0.01), indicating that *regional international openness* alleviates the negative relationship between *local CEOs* and *firm overseas R&D*, which supports H2c. Although *firm internationalisation* also alleviates the negative relationship between *local CEOs* and *firm overseas R&D*, which supports H2c. Although *firm overseas R&D*, this effect is not significant (β =0.001, p>0.1). These results further support the robustness of our findings.

<Insert Table 9 about here>

5 Discussion and implications

Firms' establishment of R&D centres overseas has received extensive attention from researchers and practitioners in recent years (Xu et al., 2023; Zhong et al., 2022). Researchers have attempted to explain this phenomenon from several perspectives. However, existing studies have focused mainly on country- and firm-level factors that determine overseas R&D, with limited attention paid to CEOs as the primary decision makers to reveal the micro-foundations behind these behavioural decisions. This study integrates emerging insights from the literature on local CEO and environmental psychology (place attachment) to understand firms' overseas R&D activities. By conducting an empirical study, we investigate the influence of local CEOs on firms' overseas R&D in the Chinese A-shares market (traded on the Shanghai

Stock Exchange and Shenzhen Stock Exchange) among listed firms over the 18 years from 2005 to 2022.

The empirical results strongly support our core argument that local CEOs significantly inhibit firms' overseas R&D activities, after controlling for several variables that may affect these activities. We attribute this relationship to a weaker global mindset among local CEOs, which makes them perceive higher risks and lower returns from overseas R&D activities. These empirical findings are similar to those of Jiang et al. (2019) and reveal that local CEOs may be resistant to allocating corporate resources to nonlocal areas. Furthermore, we find that CEOs' overseas experience, firm internationalisation, and a region's international openness mitigate this effect by reducing the likelihood that local CEOs will develop a weaker global mindset. These empirical findings echo the idea posited in UET that strategic leaders' intrinsic characteristics form as a result of continuous interaction between their experiences and environment (Hambrick & Mason, 1984). Finally, our results show that the above empirical findings are more likely to be observed in central and western China than in eastern China. Thus, this study offers important theoretical and practical implications by systematically addressing how and when local CEOs influence firms' overseas R&D decisions.

5.1 Theoretical implications

First, by highlighting the role of local CEOs, this study provides new insights into the determinants of firms' overseas R&D activities. Previous research exploring firms' overseas R&D decisions has largely focused on factors at the country (e.g. host country market size) and firm (Chen et al., 2023; Odagiri & Yasuda, 1996; Urbig et al., 2022; Xu et al., 2023; Zhong et al., 2022) levels. A few scholars have made initial attempts to deepen the current understanding of the micro-foundations of firms' overseas R&D decisions by exploring the determinants of such decisions from the perspective of TMT characteristics (Zhong et al., 2022). However, the role of CEOs, particularly local CEOs, in firms' overseas R&D decisions has remained unclear, representing a knowledge gap that needs to be filled. Empirical anecdotal evidence suggests (e.g. Samsung) that CEOs, as the most central subject of firms' strategic choices, play a key role in firms' overseas R&D decisions. Furthermore, scholars who value micro-foundations (e.g. upper echelons scholars) emphasise that explanations based on CEO-level factors are more stable, fundamental, and general than explanations based on factors at other levels in explaining firms' cross-border resource allocation decisions (Chittoor et al., 2019; Liu et al., 2023). This study provides the first theoretical analysis and empirical confirmation of the importance of local CEOs in overseas R&D decisions. We draw on UET and PAT to illustrate the internal mechanism through which CEO locality influences firms' overseas R&D and

confirm that local CEOs inhibit firms' overseas R&D activities. Accordingly, this study expands the current understanding of the micro-foundations underlying overseas R&D decisions of key decision-makers (e.g. CEOs) and responds more directly to Chen et al.'s (2023) call for more research that explores the predictive effects of CEO characteristics on firms' overseas R&D decisions.

Second, by focusing on firms' overseas R&D activities, this study contributes to a more comprehensive understanding of how CEOs' attachment to a specific and meaningful region (i.e. their birthplace) can significantly influence firms' strategic choices. Previous studies on local CEOs have focused on their impact on firms' hiring decisions (Yonker, 2017), disclosure decisions (Hu, 2023), innovation decisions (Ren et al., 2021), and productivity (Tong et al., 2023). Offshore R&D activities have become common and are considered an important means for firms in emerging economies to catch up with those in developed economies. Therefore, the effects of local CEOs on firms' overseas R&D are important to examine, both theoretically and practically. From this perspective, this study goes beyond the perspectives of disclosure and financial decision-making to more comprehensively reveal the consequences of CEO locality from the perspective of firms' international innovation activities, which are key to gaining valuable knowledge and a sustainable competitive advantage. Moreover, much of the literature on local CEOs emphasises their positive impact on firms (e.g. more investment in innovation and less opportunistic behaviour) (Lai et al., 2020; Ren et al., 2021). In contrast, our results suggest that local CEOs' strong attachment to their birthplace is likely to have unintended negative consequences. Specifically, local CEOs may lack the motivation to integrate global innovation resources and enhance competitiveness. Thus, this study helps develop balanced insights into the economic consequences of local CEOs.

Finally, this study extends UET by focusing on how and when CEOs' choice of workplace affects their global mindset. As a series of studies has confirmed, the key proposition of UET (Hambrick & Mason, 1984) is that CEOs' intrinsic attributes generally influence firm strategies and outcomes (Solano et al., 2024). UET research has focused on how individual CEOs' physiology, events, and experiences reflect their intrinsic traits (Chen et al., 2024; Tang et al., 2024) and shape their managerial styles and decision-making logics (Liang et al., 2024). However, these studies have neglected the potential impact of workplace choice. We emphasise that workplace choice may be an indicator of the strength of CEOs' global mindsets and provide new theoretical and empirical evidence on how local CEOs make strategic choices. To the best of our knowledge, this study is the first to provide theoretical evidence that local CEOs have a weaker global mindset than nonlocal CEOs. In addition, we explore how a CEOs' choice of

workplace interacts with their experience and environment to influence their intrinsic traits and strategic logic. This helps develop a more refined understanding of when local CEOs' intrinsic traits are more likely to influence firms' strategic choices. In doing so, we provide new empirical evidence to support the idea that the formation and development of CEOs' intrinsic traits are the result of their ongoing interaction with their environment.

5.2 Practical implications

First, local CEOs may have a weak global mindset, which can lead them to circumvent overseas R&D activities. This finding suggests that shareholders should be concerned about a CEO's global mindset and its impact on a firm's overseas R&D activities. If a CEO lacks a global mindset, the firm may miss valuable innovation opportunities outside its home country, which is not conducive to long-term growth. Thus, shareholders can train CEOs and executives to improve their understanding of international markets and technological trends. Moreover, shareholders can consider recruiting CEOs and executives with a global mindset to improve their firms' global competitiveness.

The government can strengthen higher education and vocational training to nurture talent with a global mindset and cross-cultural communication skills to increase local enterprises' overseas R&D activities, thereby strengthening regional competitiveness. The government can also establish a platform to facilitate exchanges and cooperation between domestic enterprises, international enterprises, and research institutions. This will broaden local CEOs' horizons and enable them to gain a better understanding of international market dynamics and R&D trends, thereby promoting global innovation and competitiveness.

Second, when assessing the effect of local CEOs on firms' overseas R&D decisions, firm boards should consider a combination of CEOs' other experiences (e.g. overseas experience) and the environment in which they operate (e.g. whether the firm is internationalised). For example, overseas experience helps local CEOs develop a global mindset. Moreover, a high level of firm internationalisation helps offset the negative effects of local CEOs on overseas R&D activities. Finally, our findings should encourage policymakers to be more proactive in implementing open-door policies. Specifically, our empirical findings suggest that international openness to the outside world can neutralise local CEOs' weak global mindset, enabling firms to more actively integrate global resources into their competitive advantage and ultimately improve the region's global competitiveness.

5.3 Limitations and future research directions

First, we use China as the background for our empirical study. Under the influence of the household registration system and Confucian culture, most Chinese people strongly identify

with their birthplace. Therefore, while our findings may also be applicable to other Asian countries (e.g. Singapore and South Korea) that are heavily influenced by Chinese culture, whether they are applicable to regions such as Europe and the United States requires more studies to explore the generalisability of our findings to samples from other countries. In addition, CEOs may develop place attachment to other locations (e.g. headquarters or office space, place of residence) besides their birthplace, as these locations not only carry important experiences from their careers but also may reflect personal values, social networks, and cultural identity. Thus, future research could explore how and when CEOs' attachment to locations other than their birthplace shapes their strategic choices.

Second, we propose that a global mindset is an explanatory mechanism for the relationship between local CEOs and firms' overseas R&D activities. However, because of issues with data availability, we were unable to capture and test this intrinsic mechanism empirically and directly. We encourage future research to obtain relevant data using methods such as experiments or questionnaires to address these research limitations. Third, information related to the CEO's birthplace is not mandatory for listed firms in China; thus, local CEO data may be incomplete, leading to potential endogeneity problems. We took various ex post measures to address potential endogeneity issues (e.g. sample selection bias) as much as possible. However, this does not mean that our empirical findings can completely circumvent the adverse effects of endogeneity.

Fourth, by focusing on the intensity of overseas R&D, we do not pay further attention to other dimensions of firms' overseas R&D, such as speed and rhythm. The literature suggests that the intensity, speed, and rhythm of internationalisation operations are accompanied by different benefits and risks (Fu et al., 2024). This implies that CEOs may make decisions related to overseas R&D speed and rhythm based on different logics. Therefore, we encourage researchers to further explore the logical associations between local CEOs and overseas R&D speed and rhythm. Finally, UET suggests that unless CEOs have strong managerial discretion, their mindsets and behavioural tendencies cannot be carried over into corporate strategic choices. Therefore, future research should incorporate moderators related to managerial discretion. Despite these limitations, we believe that this study provides promising empirical evidence from a micro-foundational approach to examine the determinants of firms' overseas R&D decisions and opens a new research stream to examine the consequences for local CEOs.

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Variables	Ν	Mean	Standard	Min	Max
			Deviation		
Firm overseas R&D	2723	0.372	1.135	0	12
local CEOs	2723	0.547	0.498	0	1
Firm internationalization	2723	3.983	5.218	1	45
The region's international	2723	0.963	0.260	0	1.256
openness					
CEO overseas experience	2723	0.846	0.361	0	1
Firm size	2723	23.023	1.559	17.019	28.502
Firm age	2723	2.865	0.366	1.099	3.829
State ownership	2723	0.314	0.464	0	1
Firm total liabilities	2723	22.176	1.905	16.149	28.190
TMT size	2723	2.868	0.237	2.197	4.007
Total income	2723	22.401	1.759	0	28.268
CEO gender	2723	0.045	0.207	0	1
CEO age	2723	3.950	0.138	3.296	4.407
Foreign subsidiaries	2723	5.373	9.463	1	96
Directors size	2723	2.253	0.196	1.609	2.944
Regions' GDP	2723	10.601	0.698	6.800	11.734
Industry concentration	2723	0.599	0.189	0.156	1
Industry competition	2723	4.131	0.862	1.792	6.004

Table 1 Descriptive statistics

Table 2	Description	and correl	lation of	variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Firm overseas	1																
R&D																	
2 local CEOs	0.007	1															
3 firm	0.237	-0.059	1														
internationalization	***	***															
4 The region's	-0.025	0.310	-0.047	1													
international		***	*														
openness	0.020	0.005	0.045	0.010	1												
5 CEO overseas	-0.030	0.085	-0.045	0.012	1												
C Eime size	0.100	0.105	*	0.097	0.004	1											
o Filmi size	0.100 ***	-0.105	0.400 ***	-0.080 ***	0.094 ***	1											
7 Firm total	0.096	-0.091	0.385	-0.061	0.101	0.968	1										
liabilities	***	***	***	**	***	***											
8TMT size	0.104 ***	-0.022	0.235 ***	-0.064 ***	0.100 ***	0.452 ***	0.450 ***	1									
9Total income	0.100	-0.098	0.409	-0.045	0.087	0.902	0.885	0.411	1								
	***	***	***	*	***	***	***	***									
10CEO gender	0.060	-0.031	-0.039	-0.018	0.004	0.009	0.004	-0.131	0.013	1							
	**		*					***									
11CEO age	0.003	-0.018	0.108 ***	0.057 **	0.058	0.161 ***	0.165	0.064 ***	0.126	0.023	1						
12Foreign	0.186	0.051	0.818	0.054	0.063	0.367	0.340	0.181	0 337	0.026	0.101	1					
subsidiaries	***	**	***	**	**	***	***	***	***	-0.020	***	1					
13Directors size	0.049	0.035	0.090	0.030	0.101	0.223	0.222	0.626	0.199	-0.086	0.023	0.086	1				
	**		***		***	***	***	***	***	***		***					
14Regions' GDP	-0.005	0.084	0.099	0.155	-0.108	-0.043	-0.047	-0.227	-0.043	0.010	0.126	0.122	-0.139	1			
		***	***	***	***	*	*	***	*		***	***	***				
15Industry	-0.082	-0.040	-0.018	-0.035	0.002	0.214	0.236	0.080	0.182	-0.020	-0.013	0.019	0.086	-0.132	1		
concentration	***	*				***	***	***	***				***	***			
16Industry	0.143	-0.030	0.135	0.111	-0.018	-0.039	-0.054	-0.059	-0.037	0.015	0.081	0.091	-0.091	0.289	-0.727	1	
competition	***	0.070	***	***	0.040	*	**	**	0.050	0.024	***	***	***	***	***	0.155	
1/Firm age	-0.061 **	0.078	0.019	0.244 ***	0.049 **	0.118 ***	0.158 ***	-0.019	0.070	0.034	0.197	0.017	-0.014	0.251 ***	-0.021	0.157	
18State ownership	0.001	-0.099	0.058	-0.102	0.078	0.425	0.426	0.391	0.420	-0.055	0.086	0.049	0.239	-0.249	0.152	-0.114	0.043*
1		***	**	***	***	***	***	***	***	**	***	*	***	***	***	***	

Note: * p < 0.05, ** p < 0.01, *** p < 0.001

Table 3 Results of regression analysis

Variables	Firm overseas R&D					
	Model 1	Model 2	Model 3	Model 4	Model 5	
CEO overseas experience × local CEOs		0.397 [†]			0.448*	
		(1.841)			(2.087)	
Firm internationalization × local CEOs			0.044***		0.039***	
			(4.248)		(3.744)	
The region's international openness \times local				1.343***	1.141***	
CEOs				(4.436)	(3.730)	
local CEOs	-0.330**	-0.691**	-0.573***	-1.666***	-2.091***	
	(-3.259)	(-3.130)	(-4.945)	(-5.245)	(-5.658)	
The region's international openness	1.081***	1.064***	1.004^{***}	0.704**	0.671**	
	(5.339)	(5.249)	(4.956)	(3.217)	(3.076)	
CEO overseas experience	0.110	-0.071	0.125	0.094	-0.094	
	(0.978)	(-0.474)	(1.119)	(0.839)	(-0.635)	
Firm internationalization	0.039***	0.039***	0.017^{\dagger}	0.041***	0.022^{*}	
	(4.225)	(4.279)	(1.652)	(4.421)	(2.054)	
Firm size	0.278^{*}	0.272^{*}	0.269*	0.278^{*}	0.263*	
	(2.509)	(2.457)	(2.437)	(2.515)	(2.390)	
Firm age	0.636*	0.616^{*}	0.712**	0.751**	0.778^{**}	
	(2.533)	(2.449)	(2.840)	(2.988)	(3.100)	
State ownership	0.059	0.049	0.079	0.032	0.042	
	(0.492)	(0.409)	(0.657)	(0.262)	(0.350)	
Firm total liabilities	-0.001	0.010	0.003	-0.003	0.012	
	(-0.012)	(0.135)	(0.036)	(-0.043)	(0.172)	
TMT size	-0.489*	-0.495*	-0.440*	-0.512**	-0.472*	
	(-2.498)	(-2.530)	(-2.254)	(-2.629)	(-2.426)	
Total income	-0.054	-0.060	-0.048	-0.048	-0.049	
	(-0.868)	(-0.957)	(-0.767)	(-0.760)	(-0.788)	
CEO gender	0.016	-0.025	-0.052	0.135	0.010	
	(0.043)	(-0.069)	(-0.142)	(0.370)	(0.028)	
CEO age	-0.094	-0.146	-0.066	-0.099	-0.132	
	(-0.282)	(-0.436)	(-0.199)	(-0.298)	(-0.397)	
Foreign subsidiaries	-0.025***	-0.025***	-0.023***	-0.026***	-0.025***	
	(-7.153)	(-7.212)	(-6.723)	(-7.446)	(-7.072)	
Directors size	-0.359†	-0.368†	-0.409*	-0.323	-0.383†	
	(-1.756)	(-1.802)	(-2.005)	(-1.583)	(-1.882)	
Regions' GDP	0.203	0.208	0.227	0.137	0.174	
	(1.347)	(1.379)	(1.514)	(0.912)	(1.160)	
Industry concentration	0.530*	0.529*	0.492^{*}	0.507^{*}	0.476^{*}	
	(2.543)	(2.540)	(2.371)	(2.445)	(2.303)	
Industry competition	0.060	0.061	0.058	0.058	0.056	
	(1.290)	(1.298)	(1.244)	(1.241)	(1.216)	

Industry	control	control	control	control	control
Year	control	control	control	control	control
Constant	-7.202**	-6.875**	-7.525**	-6.751**	-6.738**
	(-3.020)	(-2.877)	(-3.167)	(-2.841)	(-2.837)
No.	2723	2723	2723	2723	2723
<i>R</i> -squared	0.086	0.088	0.094	0.095	0.103
F value	6.83	6.85	6.83	6.89	6.88

Note: t statistics in parentheses; † p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Variables	Controls for the year trend of province	Controls for the year trend of industries
-	Firm overseas R&D	Firm overseas R&D
Local CEOs	-0.367**	-0.211†
	(0.115)	(0.122)
Constant	-7.834**	-2.463
	(3.104)	(3.291)
Controls	YES	YES
Province*year fixed	YES	
Industry*year fixed		YES
Observations	2723	2723
R-squared	0.341	0.227

Table 4 Control of time-varying province and industry effects

Note: Standard errors clustered at the firm level are reported in parentheses. [†], *, **, and *** indicate significance at the 10%, 5%, 1% and 1‰ levels, respectively.

Table 5 2SLS instrumental variable regressions

Variables	First stage	Second stage
	Local CEO	Firm overseas R&D
Instrumental variable	0.952***	
(average value of local CEOs)	(0.032)	
Local CEOs		-0.316*
		(0.126)
The region's international openness	0.012	0.215
	(0.043)	(0.134)
CEO overseas experience	0.079***	-0.055
	(0.023)	(0.064)
Firm internationalization	0.001	0.038*
	(0.003)	(0.015)
Firm size	0.028	-0.024
	(0.027)	(0.055)
Firm age	0.121***	-0.085
	(0.027)	(0.076)
State ownership	-0.019	-0.166**
	(0.022)	(0.057)
Firm total liabilities	0.033†	0.156**
	(0.019)	(0.046)
TMT size	0.028	0.121
	(0.050)	(0.136)
Total income	-0.081***	-0.088*
	(0.021)	(0.036)

CEO gender	-0.092*	0.430**	
	(0.039)	(0.153)	
CEO age	-0.067	-0.061	
	(0.065)	(0.117)	
Foreign subsidiaries	0.001	-0.001	
	(0.002)	(0.007)	
Directors size	0.090^{+}	0.154	
	(0.054)	(0.149)	
Regions' GDP	0.003	-0.046	
	(0.014)	(0.035)	
Industry concentration	-0.122	0.559*	
	(0.104)	(0.254)	
Industry competition	-0.023	0.087	
	(0.024)	(0.058)	
Industry	Control	Control	
Year	Control	Control	
Constant	0.619 [†]	-1.996*	
	(0.372)	(0.898)	
No.	2723	2723	
R ²	0.368	0.146	

Note: The standard errors clustered at the firm level are reported in parentheses. [†], *, **, and *** indicate significance at the 10%, 5%, 1% and 1‰ levels, respectively.

Variables	First stage	Second stage
	Local CEO	Firm overseas R&D
The number of 211 universities	-0.096†	
	(0.051)	
Local CEOs		-0.301**
		(0.102)
IMR		-2.619***
		(0.635)
The region's international openness	1.608***	-1.881*
	(0.178)	(0.748)
CEO overseas experience	0.310***	-0.407*
	(0.078)	(0.169)
Firm internationalization	0.002	0.034***
	(0.010)	(0.009)
Firm size	0.015	0.235*
	(0.087)	(0.115)

Table 6 Heckman two-stage approach

Firm age	0.354***	0.073	
	(0.095)	(0.306)	
State ownership	-0.165*	0.322*	
	(0.073)	(0.138)	
Firm total liabilities	0.074	-0.107	
	(0.062)	(0.078)	
TMT size	0.192	-0.773***	
	(0.178)	(0.212)	
Total income	-0.169***	0.212*	
	(0.046)	(0.091)	
CEO gender	-0.082	0.209	
	(0.142)	(0.371)	
CEO age	-0.106	0.008	
	(0.212)	(0.345)	
Foreign subsidiaries	0.002	-0.028***	
6	(0.005)	(0.004)	
Directors size	0.248	-0.814**	
	(0.189)	(0.237)	
Regions' GDP	0.190***	-0.102	
	(0.050)	(0.183)	
Industry concentration	-0.511	1.306***	
	(0.373)	(0.280)	
Industry competition	-0.117	0.245***	
	(0.084)	(0.065)	
Industry	Control	Control	
Year	Control	Control	
Constant	-1.854	-0.128	
	(1.428)	(2.939)	
No.	2635	2635	
Pseudo R ² /R ²	0.170	0.095	

Note: The standard errors clustered at the firm level are reported in parentheses. [†], *, **, and *** indicate significance at the 10%, 5%, 1% and 1‰ levels, respectively.

Variables	Firm overseas R&D
TREAT×POST	-0.582*
	(0.273)
The region's international openness	1.057*
	(0.3978)
CEO overseas experience	0.012
	(0.333)
Firm internationalization	0.053 [†]
	(0.028)
Firm size	-0.415
	(0.365)
Firm age	-0.936 [†]
	(0.457)
State ownership	0.744 [†]
	(0.426)
Firm total liabilities	0.041
	(0.303)
TMT size	0.143*
	(0.597)
Total income	0.001
	(0.199)
CEO age	2.471*
	(1.017)
Foreign subsidiaries	0.034**
	(0.011)
Directors size	0.415
	(0.785)
Regions' GDP	-0.129
	(0.156)
Industry concentration	1.071
	(1.748)
Industry competition	-0.058
	(0.276)
Industry	Control
Year	Control
Constant	-4.906
	(5.681)
No.	72
<u>R</u> ²	0.767

Table 7 Analysis of difference-in-differences

Note: The standard errors clustered at the firm level are reported in parentheses. [†], *, **, and *** indicate significance at the 10%, 5%, 1% and 1‰ levels, respectively.

Variables	Firm overseas R&D									
	Eastern Middle and Western									
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
CEO overseas		0.769**			0.937**		-0.356			-0.384
experience×local CEOs		(2.605)			(3.194)		(-0.416)			(-0.474)
Firm			0.056***		0.047***			-0.197***		-0.167***
internationalization×local			(4.133)		(3.430)			(-5.883)		(-4.793)
CEOs										
The region's international				2.021***	1.771***				22.150***	14.737**
openness×local CEOs				(5.450)	(4.691)				(4.341)	(2.837)
Local CEOs	-0.229	-0.911**	-0.497**	-2.071***	-2.903***	-0.802***	-0.450	0.091	-27.384***	-17.352**
	(-1. 519)	(-3.017)	(-3.042)	(-5.605)	(-6.377)	(-3.947)	(-0.516)	(0.368)	(-4.470)	(-2.755)
Controls/Industry/Year	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	-7.092*	-6.509	-7.351*	-5.795†	-5.465†	-19.594**	-19.608**	-18.840**	-13.107*	-14.654*
	(-2.337)	(-2.144)	(-2.435)	(-1.922)	(-1.818)	(-3.299)	(-3.297)	(-3.325)	(-2.192)	(-2.524)
N	1969	1969	1969	1969	1969	496	496	496	496	496
R ²	0.090	0.094	0.101	0.108	0.120	0.209	0.209	0.283	0.251	0.300
F value	6.95	6.96	6.94	7.10	7.08	4.77	4.75	5.18	5.17	5.34

Table 8 Results of the regression analysis of different regions of firms located

Note: t statistics in parentheses; † p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Variables	riables Firm overseas R&D					
	Model 1	Model 2	Model 3	Model 4	Model 5	
CEO overseas experience×local CEOs		0.370			0.439†	
		(1.407)			(1.660)	
Firm internationalization×local CEOs			-0.001		0.001	
			(-0.064)		(0.050)	
The region's international openness×local				0.693*	<i>0.738</i> **	
CEOs				(2.504)	(2.655)	
Local CEOs	-0.276*	-0.605*	-0.271*	0.403	0.053	
	(-2.460)	(-2.333)	(-1.989)	(1.373)	(0.141)	
The region's international openness	1.121***	1.096***	1.122***	1.541***	1.538^{***}	
	(5.453)	(5.314)	(5.432)	(5.812)	(5.782)	
CEO overseas experience	0.110	-0.174	0.111	0.109	-0.229	
	(0.980)	(-0.753)	(0.982)	(0.974)	(-0.982)	
Firm internationalization	0.038^{***}	0.038^{***}	0.039**	0.038***	0.038^{*}	
	(4.100)	(4.155)	(2.599)	(4.105)	(2.554)	
Firm size	0.305**	0.292^{**}	0.305**	0.315**	0.300^{**}	
	(2.747)	(2.623)	(2.746)	(2.836)	(2.696)	
Firm age	0.642^{*}	0.634^{*}	0.641^{*}	0.644^{*}	0.635^{*}	
	(2.551)	(2.517)	(2.542)	(2.561)	(2.519)	
State ownership	0.041	0.043	0.041	0.056	0.060	
	(0.336)	(0.355)	(0.336)	(0.463)	(0.494)	
Firm total liabilities	-0.010	0.000	-0.010	-0.016	-0.005	
	(-0.135)	(0.004)	(-0.135)	(-0.223)	(-0.064)	
TMT size	-0.476^{*}	-0.476*	-0.476*	-0.474*	-0.474*	
	(-2.426)	(-2.427)	(-2.426)	(-2.421)	(-2.419)	
Total income	-0.057	-0.058	-0.057	-0.050	-0.051	
	(-0.904)	(-0.920)	(-0.899)	(-0.797)	(-0.810)	
CEO gender	-0.023	-0.077	-0.023	-0.022	-0.087	
	(-0.063)	(-0.210)	(-0.063)	(-0.060)	(-0.236)	
CEO age	-0.138	-0.168	-0.136	-0.097	-0.132	
	(-0.415)	(-0.504)	(-0.405)	(-0.291)	(-0.392)	
Foreign subsidiaries	-0.025***	-0.026***	-0.025***	-0.025***	-0.025***	
	(-7.239)	(-7.311)	(-7.214)	(-7.169)	(-7.223)	
Directors size	-0.360†	-0.361*	-0.360*	-0.349†	-0.349*	
	(-1.754)	(-1.758)	(-1.748)	(-1.698)	(-1.699)	
Regions' GDP	0.217	0.219	0.217	0.190	0.191	
	(1.440)	(1.452)	(1.432)	(1.261)	(1.264)	
Industry concentration	0.565**	0.557**	0.565**	0.568**	0.559**	
	(2.693)	(2.656)	(2.693)	(2.712)	(2.666)	
Industry competition	0.065	0.064	0.065	0.067	0.066	
	(1.391)	(1.361)	(1.391)	(1.436)	(1.402)	
Year	Control	Control	Control	Control	Control	
Industry	Control	Control	Control	Control	Control	
Constant	-7.525**	-7.065**	-7.533**	-7.962***	-7.438**	
	(-3.143)	(-2.924)	(-3.140)	(-3.321)	(-3.070)	
No.	2718	2718	2718	2718	2718	
K-	0.084	0.085	0.084	0.087	0.088	

Table 9 Results of	alternative metrics for l	ocal CEOs
rubic / rubuits or	and matrix connectines for a	ocal CLOS

Note: t statistics in parentheses; † p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001



Figure 1 Theoretical framework



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