Journal of Business Research 181 (2024) 114731

Contents lists available at ScienceDirect

Journal of Business Research

journal homepage: www.elsevier.com/locate/jbusres

Unraveling the relationship between innovation performance feedback and outward FDI: Moderating influence of inward FDI spillovers

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ARTICLE INFO

Keywords:
Inovation performance
Outward FDI
Inward FDI spillovers
Industrial environments

ABSTRACT

This study examines the impact of innovation performance feedback on the outward foreign direct investment (FDI) of emerging market firms by differentiating between innovation quantity and innovation quality. It also explores the moderating role of inward FDI spillovers in local industrial environments. Using a zero-inflated negative binomial model, the findings show that: (1) the further a firm is below or above its innovation performance aspirations, the less outward FDI it will take; (2) inward FDI spillovers will strengthen the relationship between positive innovation quantity feedback and outward FDI while weakening the relationship of negative innovation quantity feedback; and (3) inward FDI spillovers will weaken the relationship between innovation quality feedback (both negative and positive) and outward FDI.

1. Introduction

Recent evidence suggests that a considerable number of emerging market firms are becoming global players, and outward foreign direct investment (FDI) from emerging economies has grown dramatically in recent years. In 2020, outward FDI from China, the largest emerging economy, remained high at $133 billion, making it the largest investor in the world (UNCTAD, 2021). Outward FDI has been considered a critical mechanism through which firms from emerging markets can explore new markets, access new resources, and enhance productivity.

Emerging market firms often lack firm-specific expertise, which could be exploited in the global markets (Luo & Bu, 2018; Xie, Huang, Stevens, & Lebedev, 2019). Furthermore, many emerging market firms lack knowledge of the overseas business environment, and the "liability of foreignness" may increase the likelihood of their organizational failure when entering new countries (Cao & Alon, 2021; Zaheer, 1995). Thus, doing outward FDI is often a highly risky move for emerging market firms (Xie et al., 2019). As such, the outward FDI decisions of emerging market firms are not just affected by firms' characteristics but also by their managers' willingness to accept the significant risks that come with outward FDI. While previous studies have examined firm-level determinants of outward FDI (e.g., Bai, Chen, & Xu, 2021; Kalasin, Cuervo-Cazurra, & Ramamurti, 2020; Liu, Lu, & Chizema, 2014; Yan, Zhang, Shen, & Han, 2018), the factors with behavioral insights that impact managers' decision of undertaking risky outward FDI actions were largely overlooked, considered as a noticeable literature gap.

Following the behavioral theory, this study intends to offer behavioral insights into managers' willingness of emerging market firms to undertake risky outward FDI actions. Unlike traditional perspectives, the behavioral theory contends that managerial decisions on risk-taking are based on firms' performance feedback, which depicts the gaps between actual performance and the target or goal (aspirations) (Jung & Bansal, 2009). Specifically, this study focuses on the impact of firms' innovation performance feedback on outward FDI decisions. Innovation performance feedback has been investigated as a key factor that may affect decisions of research and development (R&D) internationalization (Zhong, Song, & Chen, 2022), establishing corporate venture capitals (Gaba & Bhattacharya, 2012), changing technology-sourcing vehicles (Lungeanu, Stern, & Zajac, 2016), and establishing R&D alliances (Tyler & Caner, 2016). However, extant literature leaves a gap in knowledge regarding the role of innovation performance feedback in shaping emerging market firms' outward FDI decisions. Thus, this gives rise to the first research question: *How does a firm's innovation performance feedback affect its outward FDI?*

In line with the notion that a firm's strategic actions are contingent on the characteristics of that firm's environment (Song, Wang, & Sun,

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https://doi.org/10.1016/j.jbusres.2024.114731
Received 16 January 2023; Received in revised form 15 May 2024; Accepted 16 May 2024
Available online 30 May 2024

2018; Santos-Vijande & Álvarez-González, 2007), a firm that takes outward FDI in response to innovation performance feedback must be aware of its industrial environment in order to make more prudent outward FDI decisions (Zhong, Chen, & Ren, 2022). However, there is limited research on the moderating role of the industrial environment in a firm's outward FDI decisions. Rare studies on this question, such as Zhong, Chen, et al. (2022), focus on industry market turbulence and industry technology turbulence, Gao (2021) focuses on industry competition, and Qiao, Lv, and Zeng (2020) focus on ties to industry associations, ignoring the role of industrial inward FDI spillovers. Inward FDI spillovers are "informal transfers of technological know-how (product-related or process-related) from foreign to domestic firms" (Eapen, 2012, p. 246). Managers may use inward FDI spillovers to acquire knowledge assets at home, thereby affecting managers' willingness to take risky outward FDI decisions to obtain knowledge abroad in response to innovation performance feedback. Therefore, this study adopts the industry-based view and integrates the industrial level of inward FDI spillovers into the behavioral theory framework. It intends to examine the interaction effect of inward FDI spillovers and innovation performance feedback on outward FDI. Exploring how inward FDI spillovers shape the influence of innovation performance feedback on outward FDI decisions can help us establish a richer understanding of the relationship between innovation performance feedback and outward FDI. Thus, this study seeks to answer the second research question: *How do inward FDI spillovers moderate the relationship between a firm's innovation performance feedback and its outward FDI?*

This study makes several contributions. First, it advances the understanding of the determinants of emerging market firms' outward FDI activities by following the behavioral theory. The behavioral theory offers behavioral insights into whether managers of emerging market firms will accept the risk of undertaking outward FDI actions, a topic that tends to be overlooked by traditional theories. This is consistent with a recent call by Surdu, Greve, and Benito (2021) that empirical investigations should deviate from more popular theories of internationalization. By capturing what has been overlooked or underexplained by these theories, the behavioral theory can produce insights from managerial aspirations into firms' internationalization-related decisions, thus complementing traditional theories (Surdu et al., 2021).

Second, this study distinguishes between two innovation performances, innovation quantity and innovation quality, to reveal the intragroup heterogeneity of the effect of innovation performance feedback on emerging market firms' outward FDI decisions. Differentiating between quality and quantity helps in making informed decisions regarding resource allocation. The behavioral theory of the firm emphasizes the presence of bounded rationality and limited resources within organizations (Greve & Zhang, 2022; Surdu et al., 2021). By understanding the trade-offs between quality and quantity, firms can allocate their resources strategically. This involves assessing the potential benefits, risks, and resource requirements associated with pursuing high-quality innovations and/or generating a larger number of innovations. This effort enriches the conceptualization of innovation performance by examining more detailed innovation performance metrics and incorporating the often-overlooked quality aspect. By doing this, emerging market firms can generate more fine-grained strategic considerations in the face of innovation performance feedback when making outward FDI decisions.

Third, this study integrates the behavioral theory with the industry-based view to investigate how inward FDI spillovers influence the effect of both positive and negative innovation performance feedback on outward FDI. By incorporating an environmental factor, inward FDI spillovers, this approach enhances the power of the behavioral theory when predicting or explaining firms' strategic decisions. Thus, integrating the behavioral theory and the industry-based view enhances strategic decision-making processes. The behavioral theory emphasizes the bounded rationality of decision-makers (Greve & Zhang, 2022; Surdu et al., 2021), while the industry-based view focuses on the conditions within an industry (Peng, Wang, & Jiang, 2008). By combining these theories, researchers and practitioners can gain valuable insights into the interplay between individual decision-making and industry dynamics. This integration enables a holistic perspective that considers both internal cognitive processes and external market forces, leading to more informed and effective strategic decision-making. Furthermore, by incorporating the moderator, i.e., inward FDI spillovers, this study responds to the call by Lyles et al. (2022) that future research is encouraged to investigate the connections between inward FDI and outward FDI, thus contributing to a more comprehensive understanding of the inward FDI spillovers-outward FDI relationship.

2. Theoretical Background

2.1. The behavioral theory

The behavioral theory suggests that managers' willingness to take new risks and make organizational changes depends on the discrepancy between firms' actual performance and managers' aspirations (Cyert & March 1963). It has been used by previous research to explain whether managers would accept the risk of selecting nonlocal partners (Baum, Rowley, Shipilov, & Chuang, 2005), R&D expenditures (Greve, 2003), or corporate acquisitions (Iyer & Miller, 2008).

Aspirations are defined as "the smallest outcome that would be deemed satisfactory by the decision maker, given the current choice situation" (Schneider, 1992, p. 1053). Aspiration levels are set based on measurable performance outcomes, such as financial performance, innovation performance, sales, and production performance (Tyler & Caner, 2016). While managers seek to meet aspirations on a variety of goals, extant research has mainly focused on financial goals. However, behavioral theory research regarding other performance outcomes is also important. Innovations are playing an important role, especially for emerging market firms, in enhancing competitive advantages, improving financial performance, and catching up with developed market firms. In addition to financial goals, emerging market firms often pursue goals related to innovation performance, and it has been regarded as a key factor when emerging market firms make strategic decisions (Caleb, Yim, Yin, Wan, & Jiao, 2021; Tyler & Caner, 2016; Xie, Wang, & Miao, 2021; Zhong, Song, et al., 2022).

When managers set aspiration levels, they use two different points: a historical one and a social one. Historical aspiration levels are determined by a firm's own performance history (Greve, 1998). Managers evaluate the firm's current performance by using its previous performance record as a benchmark. Social aspirations are formed by comparison with the performance of peer firms (Greve, 1998). Managers can make a social comparison and evaluate the firm's current performance by including all firms within the same industry in the reference group. Historical and social aspirations are often aggregated by extant research to create comprehensive aspirations (Deng, Li, & Liesch, 2022; Shijaku, Larraza-Kintana, & Urtasun-Alonso, 2020; Vissa, Greve, & Chen, 2010; Wennberg & Holmquist, 2008). When a firm's actual performance is higher than its aspiration levels, managers receive positive performance feedback; otherwise, the performance feedback is negative.

2.2. Industry-based view

The industry-based view advances the notion that industry conditions determine a firm's strategic actions. The industry-based view was introduced by Porter (1980) and suggests that a firm's strategy is wholly or largely determined by its conditions within an industry. When firms make strategic decisions, except for internal factors on which they are mainly based, they must also adapt to the industrial environment so that they can survive and prosper (Porter, 1980).

Industries differ by their levels of inward FDI spillovers. The technologies of foreign multinational enterprises (MNEs) may not be fully internalized by their subsidiaries and thus be transferred to local firms

through the industrial environment (Crespo & Fontoura, 2007). Extant research has documented several channels through which knowledge is transferred to local firms via inward FDI spillovers in the industrial environment. These channels include: *the demonstration effect,* i.e., local firms directly observe and analyze foreign MNEs' products or processes (Gao, 2021; Liu & Buck, 2007; Tian, 2007); *the employee mobility,* i.e., trained managers and skilled workers move from foreign MNEs to local firms (Cheung & Ping, 2004; Liu & Buck, 2007; Tian, 2007); and *the business linkages,* i.e., knowledge will be transferred by foreign MNEs to their upstream or downstream local partners (Cheung & Ping, 2004; Crespo & Fontoura, 2007; Vujanović, Radošević, Stojčić, Hisarciklilar, & Hashi, 2022). Also, *the competition effect* of inward FDI spillovers indicates that the increased competitive pressure imposed by foreign MNEs pushes local firms to learn (Gao, 2021).

2.3. Conceptual model

This study develops a theoretical framework by drawing on the behavioral theory and the industry-based view. Based on the behavioral theory, it first investigates the main effect of innovation performance feedback on firms' outward FDI. Our conceptual model includes both negative innovation performance feedback and positive innovation performance feedback. Furthermore, to reveal the heterogeneity of the effect of innovation performance feedback on emerging market firms' outward FDI decisions, this study distinguishes between two innovation performances: innovation quantity and innovation quality.

The primary focus of the industry-based view on external conditions allows us to examine how managers' willingness to take risky outward FDI based on innovation performance feedback is contingent on the industrial environment factor of inward FDI spillovers. Therefore, this study examines the moderating role of inward FDI spillovers. Fig. 1 presents the conceptual framework. The next section outlines the hypotheses based on the theoretical framework.

3. Hypothesis Development

3.1. The relationship between innovation performance feedback and outward FDI

We hypothesize that managers of firms that have not met aspirations in innovation performance, both innovation quantity and quality, will undertake less outward FDI than those of firms that have simply met their innovation performance goals. The psychological stress and anxiety, and a strong desire for security created by negative innovation performance feedback tend to inhibit firms' risky outward FDI activities. On the other hand, innovation performance, both innovation quantity and quality, that has exceeded aspirations may increase managers' risk aversion and enhance their confidence in the extant innovation strategies, diminishing their willingness to take risky outward FDI. Hence, firms are more likely to undertake outward FDI when their innovation performance is close to aspiration levels. Next, we will elaborate on the above hypotheses.

We propose two arguments for why innovation performance below aspiration levels might lead to less outward FDI. First, innovation performance below aspiration levels lead to the psychological stress and anxiety of managers (Audia & Greve, 2006). The psychological stress and anxiety will limit managers' ability to process new or complex information and narrow their range of attention (Ketchen & Palmer, 1999). This impaired cognitive function often leads to risk aversion in managers, making them more hesitant to engage in ventures perceived as risky or uncertain (Audia & Greve, 2006). The information about outward FDI tends to be complex, difficult to interpret, and requires managers' consideration (Jiang & Holburn, 2018). Outward FDI, by its nature, involves venturing into new and unfamiliar markets, which may be perceived as particularly risky under heightened stress levels (Bhaumik, Driffield, & Pal, 2010). Therefore, managers are less likely to identify and implement outward FDI when innovation performance is below aspiration levels. In addition, the psychological stress and anxiety can narrow managers' attentional focus, making them more susceptible to tunnel vision and fixating on immediate concerns (Byron, Khazanchi, & Nazarian, 2010). This restricted attention span impedes their ability to consider the broader strategic implications of outward FDI decisions.

Second, managers with underperforming innovation performance have a strong desire for security (Audia & Greve, 2006). The pressure to improve innovation performance forces managers to focus on information from familiar sources, which is consistent with firms' established knowledge (Jiang & Holburn, 2018; Jung & Bansal, 2009). Trying their hopes of achieving short-term goals of rapidly repairing the performance gaps, managers will decrease their consideration of aggressive initiatives (Ketchen & Palmer, 1999). Outward FDI involves substantial risk which

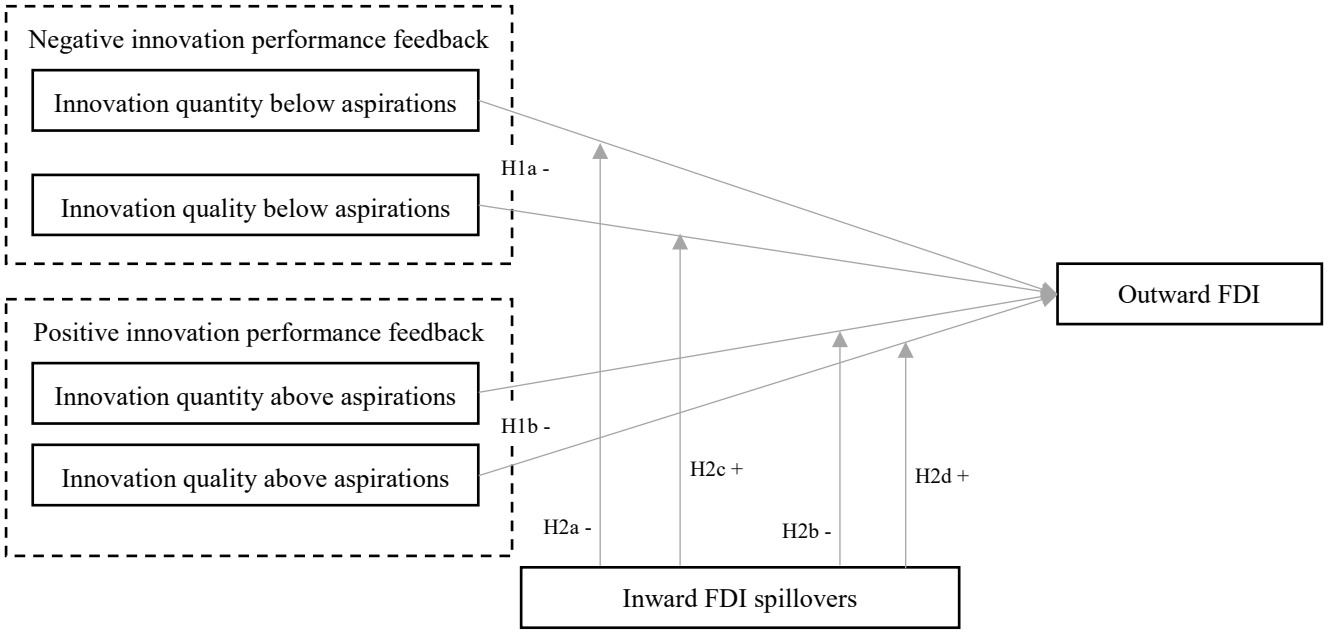

Fig. 1. Conceptual model.

typically takes a long process and requires continued financial or managerial support (McCormick & Fernhaber, 2018; Ref & Shapira, 2017; Zhong, Chen, et al., 2022). Therefore, outward FDI is not suitable for solving the pressing problems faced by firms underperforming in innovation. When managers want to rapidly reverse innovation performance shortfalls, they will be less likely to choose outward FDI (Iyer & Miller, 2008; Jiang & Holburn, 2018). In summary, this study suggests the following hypothesis:

Hypothesis 1a (H1a): The further a firm's innovation performance (both innovation quantity and innovation quality) is below its aspiration levels, the lower the extent of its outward FDI.

This study proposes a negative relationship between positive innovation performance feedback and outward FDI for the following reasons. First, when firms achieve their aspiration levels of innovation performance, satisfied managers become more risk-averse and experience strategic inertia, because they will be dominated by the danger of falling below the aspiration levels (Jiang & Holburn, 2018). They will choose strategies that avoid risks and conserve earned gains (Jung & Bansal, 2009; Lu & Wong, 2019). Conducting outward FDI is generally perceived as a risky strategy because of the lack of information on foreign countries, the high cost of acquiring related information, or geographical distance (Jung & Bansal, 2009). Managers will be motivated to continue with their current innovation strategies and will not necessarily be motivated to shift their level of risk associated with further outward FDI. Other research has also argued that managers who have achieved their performance targets are psychologically neutral and, therefore, less likely to seek major strategic changes, such as outward FDI, and take unnecessary risks (Jung & Bansal, 2009).

Second, outperforming in innovation brings managers enhanced confidence in the effectiveness of extant innovation strategies (Audia, Locke, & Smith, 2000). They may become resistant to seek alternative actions to avoid uncertain outcomes (Cheng, Xie, Fang, & Mei, 2022; Gong, Zhang, & Xia, 2019). Positive performance feedback in innovation indicates the efficacy of the current innovation strategies, and any alternative is less likely to outperform the already winning strategies (Lu & Wong, 2019). Therefore, managers of such firms will probably continue with their current innovation strategies, and are less likely to undertake outward FDI and "seek sophisticated technology or advanced manufacturing know-how" in the host country (Luo & Tung, 2007, p. 485). In summary, this study proposes that the better an emerging market firm's innovation performance above its aspiration levels is, the less likely it will be to take the risky outward FDI.

Hypothesis 1b (H1b): The further a firm's innovation performance (both innovation quantity and innovation quality) is above its aspiration levels, the lower the extent of its outward FDI.

3.2. The moderating influence of inward FDI spillovers

3.2.1. Innovation quantity perspective

There are several channels through which knowledge is transferred to firms that are focusing on innovation quantity through inward FDI spillovers: the demonstration effect, employee mobility, and business linkages. First, firms focusing on innovation quantity can gain knowledge and enlarge their knowledge base by directly observing and analyzing foreign MNEs' products or processes in the local markets (Gao, 2021; Liu & Buck, 2007). Second, firms focusing on innovation quantity can hire previous foreign MNE workers and enhance the efficiency of knowledge recombination. These workers can help improve these firms' knowledge recombination success using the knowledge they obtained when they worked for foreign MNEs. Third, firms focusing on innovation quantity can cooperate with foreign MNEs in their local markets to enlarge their knowledge base or speed up their knowledge recombination process. Advanced knowledge will be transferred from foreign MNEs to these firms via technical assistance, staff training, or better inputs provided by the foreign MNEs (Cheung & Ping, 2004; Crespo & Fontoura, 2007; Vujanović et al., 2022).

As we have argued above, managers of firms underperforming in innovation quantity are more likely to take short-sighted strategic options to rapidly repair the problems caused by the innovation performance being below aspirations. Inward FDI spillovers allow firms to access knowledge in their local environment instead of seeking it abroad, which typically takes a long process. Thus, when facing high inward FDI spillovers in the industrial environment, managers' confidence in rapidly repairing their loss in innovation quantity by accessing knowledge in their local environment is enhanced. Equipped with reinforced confidence, managers are more likely to further decrease outward FDI. Therefore, the negative relationship between innovation quantity below aspirations and outward FDI will be strengthened by inward FDI spillovers.

In an industrial environment with high levels of inward FDI spillovers, knowledge via the demonstration effect, employee mobility, and business linkages of inward FDI spillovers are more accessible (Cheung & Ping, 2004; Crespo & Fontoura, 2007; Gao, 2021). For firms above their aspiration levels in innovation quantity, the availability of knowledge from the local environment diminishes the perceived need to seek knowledge through undertaking risky outward FDI. Therefore, managers of these firms who are risk-averse will depend more on existing knowledge sources in their local environment. Their confidence in further avoiding risk-taking by decreasing outward FDI without harming the firms' current innovation quantity will be heightened. Thus, the tendency for managers to decrease outward FDI is enhanced as the levels of inward FDI spillovers in the local environment increase.

Hypothesis 2a (H2a): The further a firm's innovation quantity is below its aspiration levels, the lower the extent of its outward FDI; and this relationship will be strengthened by inward FDI spillovers.
Hypothesis 2b (H2b): The further a firm's innovation quantity is above its aspiration levels, the lower the extent of its outward FDI; and this relationship will be strengthened by inward FDI spillovers.

3.2.2. Innovation quality perspective

Firms developing high-quality innovations depend on more advanced and frontier knowledge resources (Anderson, Benavides-Espinosa, & Mohedano-Suanes, 2011; Wang, Jin, Yang, & Zhou, 2020). Foreign firms have taken precautionary measures against domestic firms to prevent the leakage of their novelty knowledge (Vujanović et al., 2022). Therefore, although firms can gain knowledge and technology from inward FDI spillovers in their local environments, access to superior knowledge and technology is very limited. Because of this, managerial confidence in accessing superior knowledge in the local industrial environment for rapidly solving underperforming innovation quality instead of implementing outward FDI will be impaired. Moreover, opportunities for advanced and frontier knowledge resources are often scarce, particularly in emerging markets (Kotabe, Jiang, & Murray, 2017). High levels of inward FDI spillovers indicate the presence of more foreign firms in the local market, competing with domestic firms for limited novel knowledge resources (Wu, Zahoor, Khan, & Meyer, 2023). Therefore, for firms developing high-quality innovations, the competition effect of inward FDI spillovers is stronger than for firms that adopt existing knowledge and focus on developing a greater quantity of innovations (Vujanović et al., 2022). Considering the intense foreign competition in the local market, managers' confidence in rapidly repairing their loss in innovation quality by relying on local solutions instead of conducting outward FDI will be further weakened. In summary, this study concludes that, when facing frustrated attempts with inward FDI spillovers in the local environment, bruised managers will rely more on outward FDI to solve their problem of underperformance in innovation quality.

In industries with high inward FDI spillovers, increased competition from the local environment will push risk-averse managers of firms

outperforming in innovation quality to shift their level of risk-taking. To sustain their positions in a more competitive environment, such managers are forced to abate their risk aversion to outward FDI. Facing high levels of inward FDI spillovers in the industry, firms outperforming in innovation quality will have an increased likelihood to seek knowledge abroad by undertaking risky outward FDI, due to the intense competition in their local markets (Lu, Liu, & Wang, 2011). Furthermore, inward FDI spillovers can reduce the uncertainty and complexity that accompany outward FDI by providing information about foreign markets (Görg & Greenaway, 2004; Yi, Chen, Wang, & Kafouros, 2015). Thus, inward FDI spillovers will lessen managers' risk concerns and play a role as facilitators that encourage firms outperforming in innovation quality to take more outward FDI actions (Görg & Greenaway, 2004; Yi et al., 2015). In summary, this study hypothesizes that the negative relationship between innovation quality below/above aspirations and outward FDI will be weakened by inward FDI spillovers.

Hypothesis 2c (H2c): The further a firm's innovation quality is below its aspiration levels, the lower the extent of its outward FDI; and this relationship will be weakened by inward FDI spillovers.

Hypothesis 2d (H2d): The further a firm's innovation quality is above its aspiration levels, the lower the extent of its outward FDI; and this relationship will be weakened by inward FDI spillovers.

4. Research Methods

4.1. Data and sample

Our sample comprises all Chinese listed firms on either the Shenzhen or Shanghai Stock Exchange from 2009 to 2020 (inclusive). We choose 2009 as the first study year to avoid the impact of the global financial crisis in 2008 (Hu, Xi, & Zhang, 2021; Huang, Xie, & Wu, 2021). In addition, in 2007, the China Securities Regulatory Commission enacted regulations to mandate accurate financial information disclosure. The data of Chinese listed firms became more complete and reliable after 2007 (Huang et al., 2021; Tang, Gu, Xie, & Wu, 2020). Due to the limitation of available data, the most recent data available for innovation quantity and innovation quality are from 2017 and 2020, respectively.

All the firm-level data is collected from the China Stock Market and Accounting Research (CSMAR) database, a professional database that has been widely used in previous studies conducted with Chinese firms (e.g., Deng, Yan, & Van Essen, 2018; Huang, Xie, Li, & Reddy, 2017; Ma, Cui, Dong, & Liao, 2023; Xie et al., 2019). The inward FDI spillover data and industry-level patent data are obtained from the Chinese statistical yearbooks published by the Chinese National Bureau of Statistics. This study identifies 24,116 firm-year outward FDI observations with 3,228 firms.

We calculate innovation performance feedback variables by comparing with aspiration levels, and a firm's historical aspiration levels are captured as the moving average of the past three years' innovation performance. This calculation method requires continuous data from the past three years. Ultimately, after excluding missing data, we have 12,066 observations of the variables related to innovation quantity below/above aspirations, while for the variables concerning innovation quality below/above aspirations, the observations are 18,295.

4.2. Variables and measures

Dependent variable. We utilize the total number of newly established outward FDI projects in a given year to measure outward FDI (Bai et al., 2021; Gao, 2021; Tang et al., 2020). This measurement can reflect annual investment flows, which is much better than the measurement of total outward FDI project stock (Gao, 2021).

The outward FDI activities of a firm are identified by comparing the full list of outward FDI projects of the given firm for consecutive years (Lu, Liu, Wright, & Filatotchev, 2014). If an outward FDI project appears in the list of year t but not in that of year t-1, it is treated as one outward FDI of that firm after carefully checking other documents or public information disclosed by the firm. Outward FDI projects in tax haven countries/regions are excluded to avoid alternative explanations. The excluded countries/regions are Bermuda, the British Virgin Islands, the Cayman Islands, Macau, and Hong Kong (Bai et al., 2021; Lu, Liu, Wright, et al., 2014).

Independent variable. A spline function is used to define innovation performance above a firm's aspiration levels and below a firm's aspiration levels (Jiang & Holburn, 2018):

$$\textit{innovation performance above aspirations} = \begin{cases} \textit{innovation performance} - \textit{aspirations}, & \textit{if innovation performance} \geq \textit{aspirations} \\ 0, & \textit{if innovation performance} < \textit{aspirations} \end{cases}$$

$$\textit{innovation performance below aspirations} = \begin{cases} 0, & \textit{if innovation performance} \geq \textit{aspirations} \\ \textit{innovation performance} - \textit{aspirations}, & \textit{if innovation performance} < \textit{aspirations} \end{cases}$$

Innovation performance below aspirations have been taken the absolute value for better understanding. Innovation performance is studied from both a quantity and quality perspective. Innovation quantity is measured as the firm's number of patent applications (Kim, Kim, & Lee, 2021). The procedures for patent application are a consistent and rigorous process that is uniform across all sectors and industries (Li, 2011; Rong, Wu, & Boeing, 2017). In this sense, patent data is a reliable and objective reflection of a firm's innovation output (Shi & Li, 2023). Furthermore, patent applications instead of patent grants are chosen to measure innovation quantity because patent application data is more stable, reliable, and timely than patent grant data. Besides being standardized across all provinces and industries, the procedures for patent applications have been constant over a relatively long period (Wang & Li, 2015). By contrast, the requirement for testing and the payment of annual fees, which is susceptible to bureaucratic factors, leads to the unreliable and unstable process of patent grants (Hu, Pan, & Huang, 2020).

This study uses the number of forward citations that all the firm's patents have received to measure innovation quality, which is the most frequently used proxy (Lahiri, 2010; Rong et al., 2017). Forward citation counts refer to "the number of times a patent has been cited by subsequent patents, indicating that these newer patents are technologically built upon the cited (previously filed) patent" (Fisch, Sandner, & Regner, 2017, p. 23). This measurement is also consistent with Valentini (2012), who argues that one important dimension of innovation quality is "impact", which is the influence of a patent on future inventions.

The average of the past three years' innovation performance (patent

Table 1
Definition of variables.

Name	Measurements	Sources
Dependent variables		
outward FDI	the count of newly established outward FDI projects in a given year	Bai et al., 2021; Gao, 2021; Tang et al., 2020
Independent variables		
innovation quantity below aspirations	equals to the absolute value of innovation quantity (patent applications) minus aspirations (historical and social) of innovation quantity if innovation quantity is smaller than the aspirations, otherwise equals 0	Greve, 2003; Jiang & Holburn, 2018; Jung & Bansal, 2009; Kim et al., 2021; Lin, 2014; Lungeanu et al., 2016;
innovation quantity above aspirations	equals to innovation quantity (patent applications) minus aspirations (historical and social) of innovation quantity if innovation quantity is larger than the aspirations, otherwise equals 0	Greve, 2003; Jiang & Holburn, 2018; Jung & Bansal, 2009; Kim et al., 2021; Lin, 2014; Lungeanu et al., 2016;
innovation quality below aspirations	equals to the absolute value of innovation quality (patent forward citations) minus aspirations (historical and social) of innovation quality if innovation quality is smaller than the aspirations, otherwise equals 0	Greve, 2003; Jiang & Holburn, 2018; Jung & Bansal, 2009; Lahiri, 2010; Lin, 2014; Lungeanu et al., 2016; Rong et al., 2017
innovation quality above aspirations	equals to innovation quality (patent forward citations) minus aspirations (historical and social) of innovation quality if innovation quality is larger than the aspirations, otherwise equals 0	Greve, 2003; Jiang & Holburn, 2018; Jung & Bansal, 2009; Lahiri, 2010; Lin, 2014; Lungeanu et al., 2016; Rong et al., 2017
Moderators		
inward FDI spillovers	the share of foreign firms in the total sales of an industry	Meyer & Sinani, 2009; Tian, 2007
Control variables		
firm size	the logarithm of the total assets of the firm	Li et al., 2021; Liu et al., 2014; Qiao et al., 2020
firm age	the logarithm of the number of years since a firm's establishment	Gaur et al., 2018
internationalization experience	the ratio of foreign sales to total sales	Qiao et al., 2020
R&D intensity	the ratio of R&D expenditures to firms' total sales	Qiao et al., 2020; Tang & Buckley, 2022
ROA	the ratio of profits divided by the average total assets	Lu, Liu, Filatotchev, et al., 2014
sales growth rate	the growth rate of total sales from the previous year	Qiao et al., 2020
leverage ratio	the ratio of debt to total assets	Lu et al., 2011
fixed asset ratio	the ratio of fixed assets to total assets	Gao, 2021
state-owned ownership	the ratio of shares owned by the Chinese government	Bai et al., 2021; Liu et al., 2014
foreign-owned ownership	the ratio of shares owned by foreign entities	Liu et al., 2014
overseas experience	the number of executives who have studied or worked abroad	Ding et al., 2022
political connections	if the chairman or CEO of a firm is or was an NPC deputy, a member of the CPPCC, or currently has or once had a government position, scores are assigned from 1 to 4 for county levels, prefecture levels, provincial levels, and national levels, respectively. Otherwise, the scores are 0.	Deng et al., 2018; Su et al., 2019
board size	the total number of directors on the board	Deng et al., 2018; Liu et al., 2014
industry concentration	Herfindahl–Hirschman index	Qiao et al., 2020; Wang et al., 2021

applications or patent forward citations) is used to measure a firm's *historical aspirations* (Jung & Bansal, 2009; Lin, 2014). *Social aspirations* are measured as the mean of all firms' innovation performance in the focal firm's industry (Lungeanu et al., 2016). The final measure of aspirations is constructed following Greve (2003), as *aspirations* $= 0.8 \times$ *historical aspirations* $+ 0.2 \times$ *social aspirations.* Like previous behavioral theory-based research, the weights are estimated by examining all parameter values by increments of 0.1 and taking the values that provide the best model fit (Shijaku et al., 2020). Therefore, we have four independent variables: innovation quantity above aspirations, innovation quantity below aspirations, innovation quality above aspirations, and innovation quality below aspirations.

Moderator. The variable is proxied by the presence of foreign firms in the industry. Following previous studies, this study measures inward FDI as the share of foreign firms in the total sales of an industry (Meyer & Sinani, 2009; Tian, 2007). Both independent variables and moderators are standardized to avoid collinearity between interaction terms and to increase the interpretability of the findings (Tan & Sousa, 2019).

Control variables. Multiple firm-level and industry-level variables, which have been identified as important factors influencing firms' outward FDI activities, are controlled in this study. At the firm level, we control firm size, proxied as the logarithm of the firm's total assets (Li, Zhang, Fan, & Li, 2021; Liu et al., 2014; Qiao et al., 2020), and firm age, which is measured as the logarithm of the number of years since a firm's establishment (Gaur, Ma, & Ding, 2018). A firm's prior internationalization experience is controlled by including the ratio of foreign sales to total sales (Qiao et al., 2020). R&D intensity is controlled by including the ratio of R&D expenditures to the firms' total sales (Qiao et al., 2020; Tang & Buckley, 2022). The impact of a firm's past financial performance is controlled by using the ratio of profits divided by the average total assets (ROA) (Lu, Liu, Filatotchev, & Wright, 2014). The firm's sales growth rate, which is measured as the growth rate of total sales from the previous year, is controlled (Qiao et al., 2020). One slack measure that is commonly used in extant research, the leverage ratio, is added with the measurement of the ratio of debt to total assets (Lu et al., 2011). The fixed asset ratio, measured as the ratio of fixed assets to total assets, is included to control the flexibility of the firms to shift their investments among different countries (Gao, 2021). State-owned ownership, which is measured as the ratio of shares owned by the Chinese government, is controlled to capture the effect of direct intervention by local governments (Bai et al., 2021; Liu et al., 2014). Similarly, we also control the ratio of shares owned by foreign entities to proxy foreign-owned ownership (Liu et al., 2014).

The executives' characteristics will affect firms' outward FDI decisions; therefore, we control their overseas experience, political connections, and board size. The overseas experience is represented by the number of executives who have studied or worked abroad (Ding, Fan, Jin, & Qi, 2022). Following Deng et al. (2018), we construct the variable of political connections by measuring whether the chairman or CEO of a firm is politically connected. Scores of political connections are assigned from 1 to 4 for county levels, prefecture levels, provincial levels, and national levels, respectively (Su, Xiao, & Yu, 2019), if the chairman or CEO of a firm is or was a National People's Congress (NPC) deputy, a member of the Chinese People's Political Consultative Conferences (CPPCC), or currently has or once had a government position. Otherwise, the scores are 0. Board size is represented by the total number of directors on the board (Deng et al., 2018; Liu et al., 2014).

At the industry level, we include the Herfindahl–Hirschman index to control for industry concentration (Qiao et al., 2020; Wang, Sadiq, Khan, & Wang, 2021). Finally, year dummies and industry dummies are included in the analysis to control for any unobserved effects. Table 1 is the summary of all variables, Table 2 shows the summary statistics, and

Table 2
Summary statistics.

Variables	Obs	Mean	SD	Min	Median	Max
outward FDI	24,116	0.549	2.177	0	0	86
innovation quantity below aspirations	12,066	3.828	38.339	0	0	2448.464
innovation quantity above aspirations	12,066	37.154	204.346	0	4	11704.440
innovation quality below aspirations	18,295	12.210	141.437	0	1.080	10808.710
innovation quality above aspirations	18,295	19.711	187.318	0	0	8276.596
inward FDI spillovers	24,095	0.270	0.163	0.012	0.230	0.774
firm size	24,114	21.941	1.297	13.076	21.775	28.636
firm age	24,108	2.729	0.418	0	2.773	4.127
internationalization experience	18,223	0.182	0.237	0	0.077	0.932
R&D intensity	19,396	1.089	1.149	−7.601	1.310	10.365
ROA	22,091	0.039	0.072	−0.290	0.038	0.234
sales growth rate	22,078	0.425	7.756	−1	0.099	665.540
leverage ratio	24,106	0.413	0.213	0.008	0.401	0.999
fixed asset ratio	24,106	0.241	0.155	0	0.210	0.954
state-owned ownership	24,107	0.040	0.126	0	0	0.922
foreign-owned ownership	24,107	0.014	0.077	0	0	0.903
overseas experience	24,108	1.352	1.837	0	1	30
political connections	23,968	0.796	1.306	0	0	4
board size	24,108	20.037	6.530	8	18	84
industry concentration	24,115	0.109	0.096	0.014	0.081	1

Table 3
Correlation table.

Variables	1	2	3	4	5	6	7	8	9
1.innovation quantity below aspirations	1								
2.innovation quantity above aspirations	−0.018**	1							
3.innovation quality below aspirations	−0.006	−0.029***	1						
4.innovation quality above aspirations	0.379***	0.621***	−0.009	1					
5.inward FDI spillovers	0.019**	0.077***	0.030***	0.060***	1				
6.firm size	0.099***	0.268***	0.117***	0.217***	−0.178***	1			
7.firm age	0.014	0.013	0.046***	−0.001	−0.147***	0.174***	1		
8.internationalization experience	0.014	0.037***	0.016*	0.033***	0.172***	−0.089***	−0.029***	1	
9.R&D intensity	0.034***	0.049***	0.032***	0.033***	0.317***	−0.286***	−0.115***	0.150***	1
10.ROA	−0.015	0.049***	−0.004	0.011	0.008	0.055***	−0.084***	−0.013*	0.028***
11.sales growth rate	−0.004	−0.001	−0.002	−0.004	−0.001	0.009	0.015**	−0.003	−0.012
12.leverage ratio	0.017*	0.068***	0.025***	0.057***	−0.107***	0.375***	0.165***	−0.078***	−0.275***
13.fixed asset ratio	−0.024***	−0.049***	−0.016**	−0.019**	−0.233***	0.208***	0.069***	−0.017**	−0.290***
14.state-owned ownership	−0.008	0.014	−0.011	0	−0.053***	0.152***	−0.038***	−0.078***	−0.075***
15.foreign-owned ownership	0.002	0.004	−0.004	−0.003	0.056***	−0.048***	−0.093***	0.086***	0.023***
16.overseas experience	0.090***	0.142***	0.048***	0.144***	0.062***	0.125***	−0.042***	0.151***	0.121***
17.political connections	0.014	0.022**	0.009	0.021***	−0.001	0.050***	−0.075***	−0.076***	−0.017**
18.board size	0.066***	0.110***	0.033***	0.135***	−0.050***	0.192***	−0.064***	−0.049***	−0.060***
19.industry concentration	0.033***	0.066***	0.033***	0.062***	−0.085***	0.097***	0.035***	−0.015**	−0.138***

Variables	10	11	12	13	14	15	16	17	18	19
10.ROA	1									
11.sales growth rate	0.029***	1								
12.leverage ratio	−0.399***	0.028***	1							
13.fixed asset ratio	−0.143***	−0.01	0.262***	1						
14.state-owned ownership	−0.009	0.044***	0.123***	0.135***	1					
15.foreign-owned ownership	0.073***	0.006	−0.087***	−0.030***	−0.029***	1				
16.overseas experience	0.044***	0.023***	−0.065***	−0.096***	−0.041***	0.194***	1			
17.political connections	0.060***	0	−0.028***	0.018***	−0.025***	−0.035***	0.019***	1		
18.board size	−0.039***	0.040***	0.038***	0.014**	0.173***	0.071***	0.249***	0	1	
19.industry concentration	−0.036***	−0.001	0.047***	0.004	0.025***	0.01	0.015**	−0.005	0.023***	1

Notes: *Indicates significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ level of confidence.

Table 3 shows the correlational analysis for all variables.

4.5. Research models

This paper employs a zero-inflated negative binomial model for the following three reasons. First, our dependent variable – outward FDI – is a discrete and non-negative count variable which means the conventional linear regression models are not appropriate (Fosfuri, 2006).

Second, although the Poisson regression model is the simplest model to accommodate count data, the model assumes that the standard deviation of the dependent variable is the same as its mean (Yasuda & Kotabe, 2021). However, there is overdispersion in our dependent variable (i.e., the standard deviation of outward FDI (2.17) is much bigger than its mean (0.55)). The violation leads to underestimated standard errors and thus spuriously high levels of significance (Fosfuri, 2006; Yasuda & Kotabe, 2021). To address this problem, a negative binomial regression should be employed which provides more efficient estimators (Hausman, Hall, & Griliches, 1984).

Third, our dependent variable contains a significant number of zero observations. To control for this problem, a zero-inflated negative binomial model should be employed (Greene, 2000). In addition to the count process (i.e., a negative binomial model explains the remaining counts of outward FDI), this model contains a zero-inflated process (i.e., a logit model explains the excess zeros of outward FDI). A positive

Table 4
Innovation quantity relative to aspirations and outward FDI.

	1	2	3	4	5
innovation quantity below aspirations	−0.047***		−0.083***		−0.089***
	(0.015)		(0.020)		(0.020)
innovation quantity above aspirations		−0.067***		−0.054***	−0.058***
		(0.016)		(0.018)	(0.015)
innovation quantity below aspirations × inward FDI spillovers			0.024**		0.024**
			(0.010)		(0.010)
innovation quantity above aspirations × inward FDI spillovers				−0.037***	−0.037***
				(0.012)	(0.011)
inward FDI spillovers			0.214	0.204	0.190
			(0.266)	(0.264)	(0.264)
firm size	0.523***	0.538***	0.526***	0.538***	0.549***
	(0.061)	(0.063)	(0.061)	(0.063)	(0.063)
firm age	−0.343*	−0.343*	−0.347*	−0.342*	−0.347*
	(0.203)	(0.203)	(0.204)	(0.203)	(0.202)
internationalization experience	2.228***	2.228***	2.213***	2.223***	2.222***
	(0.267)	(0.265)	(0.275)	(0.267)	(0.265)
R&D intensity	0.083	0.083	0.083	0.084	0.087
	(0.067)	(0.067)	(0.067)	(0.067)	(0.068)
ROA	2.715***	2.827***	2.697***	2.848***	2.768***
	(0.781)	(0.766)	(0.778)	(0.751)	(0.759)
sales growth rate	0.003	0.003	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
leverage ratio	0.794**	0.794**	0.789**	0.814**	0.804**
	(0.388)	(0.387)	(0.385)	(0.385)	(0.383)
fixed asset ratio	−1.720***	−1.729***	−1.726***	−1.744***	−1.758***
	(0.415)	(0.412)	(0.411)	(0.407)	(0.403)
state-owned ownership	−0.365	−0.364	−0.333	−0.327	−0.324
	(0.273)	(0.264)	(0.272)	(0.258)	(0.258)
foreign-owned ownership	−0.827	−0.814	−0.843	−0.826	−0.822
	(0.854)	(0.849)	(0.863)	(0.871)	(0.861)
overseas experience	0.131***	0.130***	0.133***	0.130***	0.134***
	(0.028)	(0.028)	(0.027)	(0.028)	(0.027)
political connections	−0.011	−0.011	−0.008	−0.008	−0.006
	(0.030)	(0.030)	(0.031)	(0.030)	(0.030)
board size	−0.003	−0.003	−0.003	−0.003	−0.003
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
industry concentration	−0.375	−0.501	−0.634	−0.802	−0.729
	(1.148)	(1.172)	(1.241)	(1.287)	(1.238)
industry dummy	Yes	Yes	Yes	Yes	Yes
year dummy	Yes	Yes	Yes	Yes	Yes
N	6656	6656	6656	6656	6656
ll	−5630.139	−5628.286	−5628.518	−5626.089	−5621.778
VIF	1.19	1.20	1.28	1.23	1.30
Vuong Z-score	4.84	4.87	4.84	4.89	4.90

Notes: Standard errors are given in parentheses. *Indicates significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ level of confidence.

Vuong Z-score confirms that the zero-inflated negative binomial model is more appropriate for our data than the standard negative binomial model (Vuong, 1989).

This method can offer insights into the origin of these excess zeros, as well as the inherent heterogeneity and relative dependencies within the data structure (Moghimbeigi, Eshraghian, Mohammad, & Mcardle, 2008). By incorporating elements from the negative binomial distribution and zero-inflated dependent variables, the zero-inflated negative binomial model provides a more suitable approach for modeling our data, where both structural and random zeros are present in outward FDI observations. Stata 16 was used to perform the zero-inflated negative binomial model using the "zinb" command.

5. Research Results

5.1. Main findings

The results of outward FDI pertaining to innovation quantity relative to aspirations are reported in Table 4, and the results pertaining to innovation quality relative to aspirations are in Table 5. In Table 4 and Table 5, we include all control variables and negative innovation performance feedback measures in Model 1, the positive innovation performance feedback measures in Model 2, and the interaction terms in Model 3 and Model 4. Model 5 includes all variables.

In support of H1a, Model 1 in Table 4 and Table 5 show that the impacts of innovation performance below aspirations on outward FDI are negative and significant ($b = –0.047$, $p < 0.01$, Model 1 in Table 4; $b = –0.060$, $p < 0.01$, Model 1 in Table 5). Since we measure the innovation performance below aspirations as the absolute value of the difference between innovation performance and aspirations, which represents the negative of the real value, negative regression coefficients reflect a positive relationship between the real value and outward FDI. It indicates that the number of outward FDI decreases as innovation performance falls further below aspiration levels. Conversely, the number of outward FDI increases as innovation performance moves closer to aspiration levels. Model 2 in Table 4 and Table 5 shows that the estimated coefficients of innovation performance above aspirations are negative and significant, which fully support H1b ($b = –0.067$, $p < 0.01$, Model 2 in Table 4; $b = –0.075$, $p < 0.01$, Model 2 in Table 5). These estimates show that the further a firm's innovation performance is above its aspiration levels, the lower the number of its outward FDI.

Model 3 in Table 4 shows that the interaction term between innovation quantity below aspirations and inward FDI spillovers is positive and significant ($b = 0.024$, $p < 0.05$, Model 3 in Table 4). It indicates that inward FDI spillovers weaken the negative relationship between the extent of a firm's innovation quantity below aspirations and outward

Table 5
Innovation quality relative to aspirations and outward FDI.

	1	2	3	4	5
innovation quality below aspirations	−0.060***		−0.142***		−0.149***
	(0.020)		(0.030)		(0.033)
innovation quality above aspirations		−0.075***		−0.106***	−0.113***
		(0.010)		(0.020)	(0.019)
innovation quality below aspirations × inward FDI spillovers			0.080***		0.083***
			(0.024)		(0.026)
innovation quality above aspirations × inward FDI spillovers				0.018*	0.021**
				(0.011)	(0.010)
inward FDI spillovers			0.215**	0.216**	0.220**
			(0.091)	(0.092)	(0.093)
firm size	0.544***	0.552***	0.552***	0.557***	0.574***
	(0.052)	(0.051)	(0.052)	(0.051)	(0.052)
firm age	−0.387**	−0.388***	−0.384**	−0.386***	−0.387***
	(0.153)	(0.150)	(0.152)	(0.149)	(0.149)
internationalization experience	2.253***	2.262***	2.246***	2.253***	2.254***
	(0.226)	(0.220)	(0.229)	(0.222)	(0.221)
R&D intensity	0.069	0.072	0.071	0.074	0.076
	(0.058)	(0.059)	(0.058)	(0.059)	(0.059)
ROA	1.213**	1.216**	1.183**	1.187**	1.158**
	(0.561)	(0.565)	(0.572)	(0.573)	(0.582)
sales growth rate	0.004	0.004	0.004	0.004	0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
leverage ratio	0.907***	0.913***	0.891***	0.911***	0.877***
	(0.261)	(0.263)	(0.256)	(0.261)	(0.257)
fixed asset ratio	−1.902***	−1.934***	−1.935***	−1.961***	−1.948***
	(0.276)	(0.275)	(0.275)	(0.275)	(0.279)
state-owned ownership	−0.666**	−0.693**	−0.651**	−0.668**	−0.706**
	(0.312)	(0.305)	(0.311)	(0.301)	(0.304)
foreign-owned ownership	−0.572	−0.601	−0.572	−0.603	−0.610
	(0.774)	(0.774)	(0.775)	(0.771)	(0.771)
overseas experience	0.118***	0.121***	0.119***	0.122***	0.122***
	(0.018)	(0.017)	(0.017)	(0.017)	(0.017)
political connections	0.022	0.021	0.024	0.022	0.024
	(0.026)	(0.025)	(0.025)	(0.025)	(0.025)
board size	−0.017***	−0.016***	−0.018***	−0.017***	−0.016***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
industry concentration	−0.063	−0.068	0.110	0.143	0.107
	(0.605)	(0.614)	(0.573)	(0.560)	(0.558)
industry dummy	Yes	Yes	Yes	Yes	Yes
year dummy	Yes	Yes	Yes	Yes	Yes
N	11,123	11,123	11,123	11,123	11,123
ll	−11100.49	−11096.23	−11093.91	−11092.95	−11081.63
VIF	1.17	1.18	1.33	1.44	1.54
Vuong Z-score	5.46	5.44	5.49	5.41	5.48

Notes: Standard errors are given in parentheses. *Indicates significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ level of confidence.

FDI. Thus, H2a is not supported. Fig. 2 (based on Model 3 in Table 4) is plotted to demonstrate how the marginal effect of innovation quantity below aspirations on outward FDI (y-axis) changes with the raw values of inward FDI spillovers (x-axis). The shaded areas are for 95 % confidence ranges (the same for Fig. 3 to Fig. 5).Fig. 2 shows that the higher the level of inward FDI spillovers in the industry, the less negative the linkage between the extent of a firm's innovation quantity below aspirations and outward FDI, contrary to H2a. In particular, the negative linkage between innovation quantity below aspirations and outward FDI is offset when inward FDI spillovers are sufficiently high.

Model 4 in Table 4 shows that the interaction term between innovation quantity above aspirations and inward FDI spillovers is negative and significant ($b = –0.037$, $p < 0.01$, Model 4 in Table 4), which is consistent with H2b. The results show that the further a firm's innovation quantity is above its aspiration levels, the lower the number of its outward FDI, and this relationship will be strengthened by inward FDI spillovers. Fig. 3 (based on Model 4 in Table 4) shows that the higher the level of inward FDI spillovers in the industry, the more negative the linkage between the extent of a firm's innovation quantity above aspirations and outward FDI, which supports the H2b.

The interactive effect of innovation quality below aspirations and inward FDI spillovers is positive and significant ($b = 0.080$, $p < 0.01$, Model 3 in Table 5), supporting H2c. The further a firm's innovation quality is below its aspiration levels, the lower the number of its outward FDI; and this relationship will be weakened by inward FDI spillovers. Fig. 4 (based on Model 3 in Table 5) shows that the higher the level of inward FDI spillovers in the industry, the less negative the linkage between the extent of a firm's innovation quality below aspirations and outward FDI. When industrial inward FDI is sufficiently high, the negative relationship is offset and becomes non-significant.

Model 4 in Table 5 reports that the interaction term between innovation quality above aspirations and inward FDI spillovers is positive ($b = 0.018$, $p < 0.1$, Model 4 in Table 5), leading support to H2d. The further a firm's innovation quality is above its aspiration levels, the lower the number of its outward FDI; and this relationship will be weakened by inward FDI spillovers. Fig. 5 (based on Model 4 in Table 5) shows that, although inward FDI spillovers, on average, weaken the negative relationship between innovation quality above aspirations and outward FDI, this effect only occurs when inward FDI spillovers in the industry reach a certain high level. The competition effect is low when industrial inward FDI spillovers are at a lower level, especially for firms that outperform in innovation quality. Therefore, there is no need for

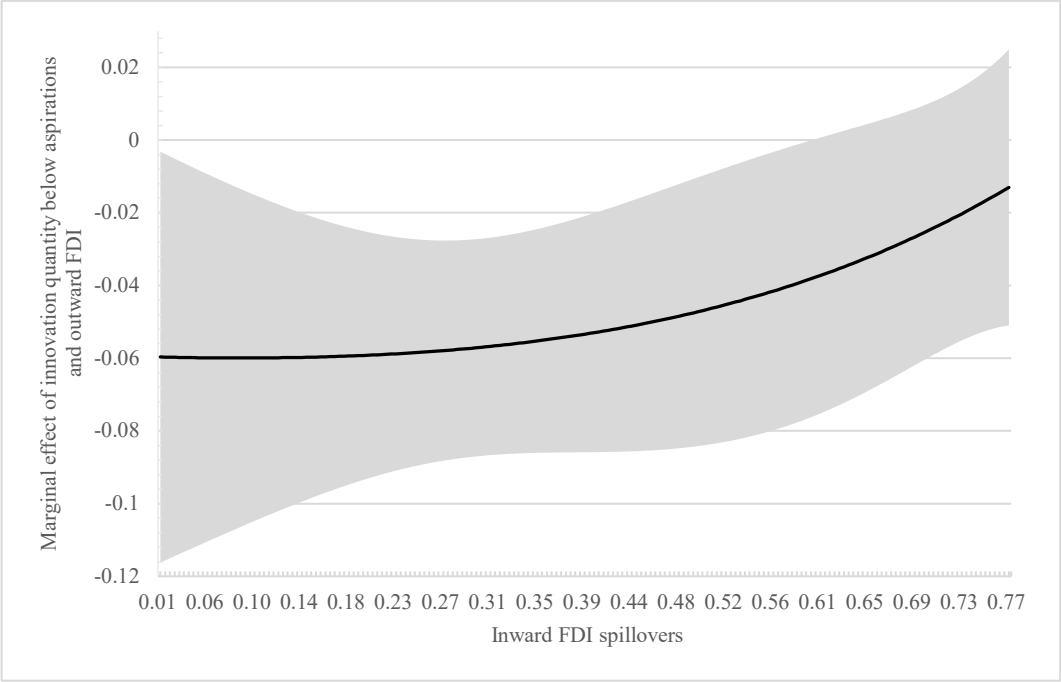

Fig. 2. Moderating role of inward FDI spillovers in innovation quantity below aspirations – outward FDI link.

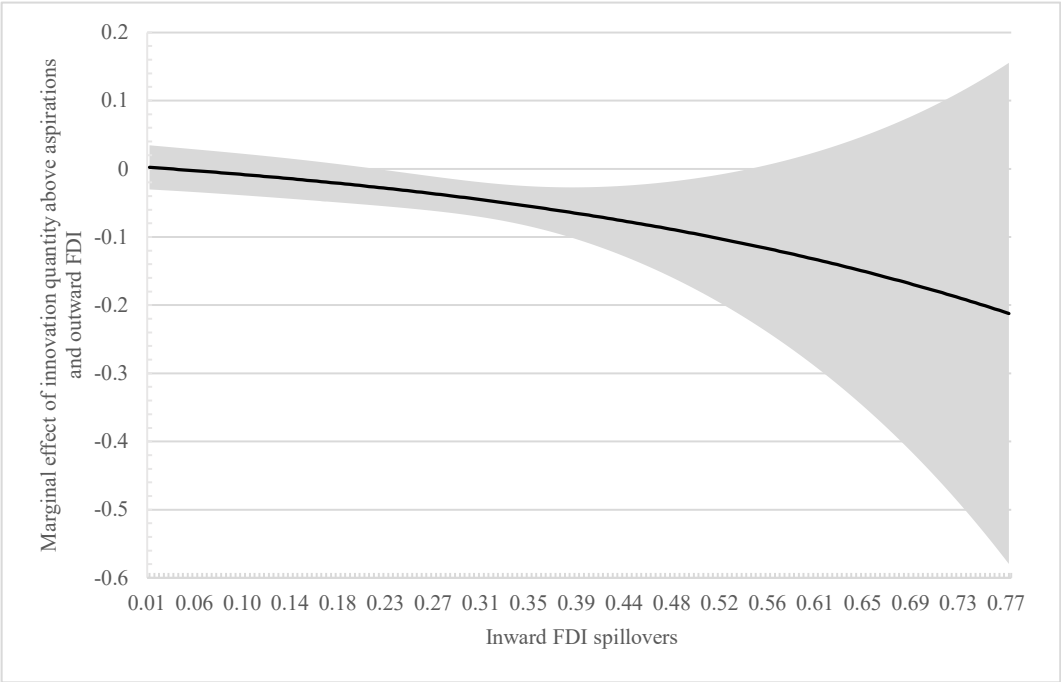

Fig. 3. Moderating role of inward FDI spillovers in innovation quantity above aspirations – outward FDI link.

these firms to change their outward FDI decisions. However, due to more and more foreign firms entering their local markets, firms that outperform in innovation quality will undertake outward FDI in response to increasing competition in the local environment and to sustain their good performance in innovation quality. Table 6 summarizes the hypothesis testing results.

5.2. Robustness check

A series of robustness checks are conducted. First, we adopt the other two measurements of inward FDI spillovers, the share of foreign firms in total assets and the share of foreign firms in employment of an industry, for a robustness check, following the work of Tian (2007). The results are consistent.

Second, historical aspirations are calculated by the exponentially weighted moving average of the previous innovation performance of the focal firm (Baum et al., 2005; Deng et al., 2022; Jiang & Holburn, 2018; Lungeanu et al., 2016; Xie, Huang, Peng, & Zhuang, 2016):

$$historicalaspirations_{i,t} = \alpha \times innovationperformance_{i,t-1} + (1-\alpha) \times historicalaspirations_{i,t-1}$$

$historicalaspirations_{i,0}$ are defined as a firm's innovation performance for the first year in the sample. α is the weight given to the previous year's innovation performance, reflecting the relative importance of previous innovation performance and prior historical aspirations. The results using different α are consistent.

Third, we run a two-stage Heckman selection model as a robustness check to control for potential sample selection bias. We first predict the likelihood of firms undertaking outward FDI by running a binary probit

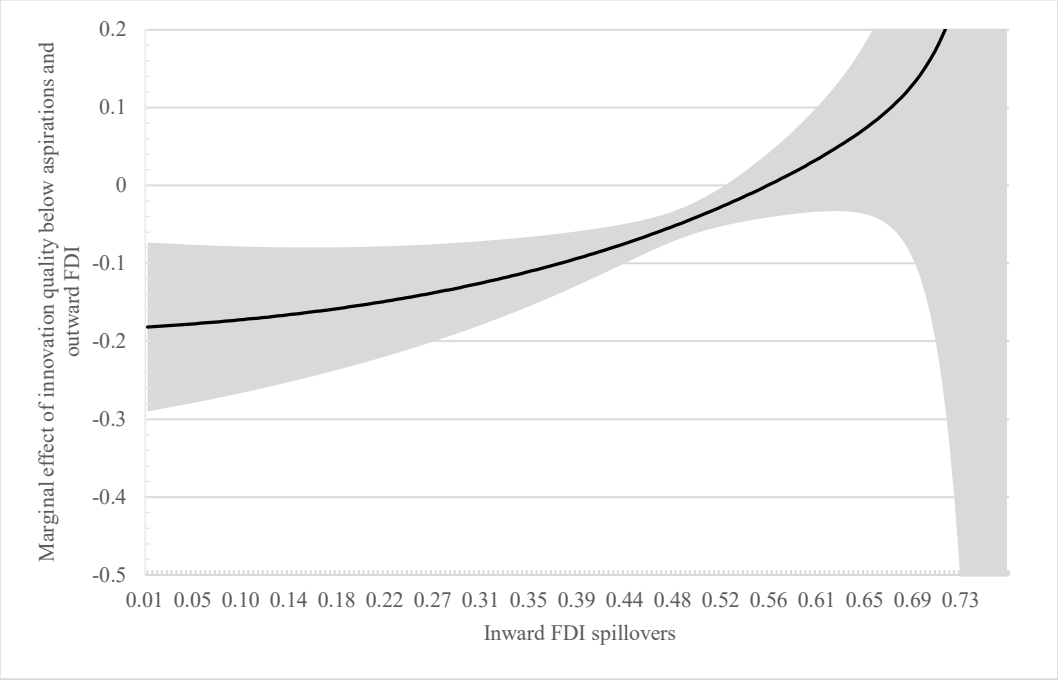

Fig. 4. Moderating role of inward FDI spillovers in innovation quality below aspirations – outward FDI link.

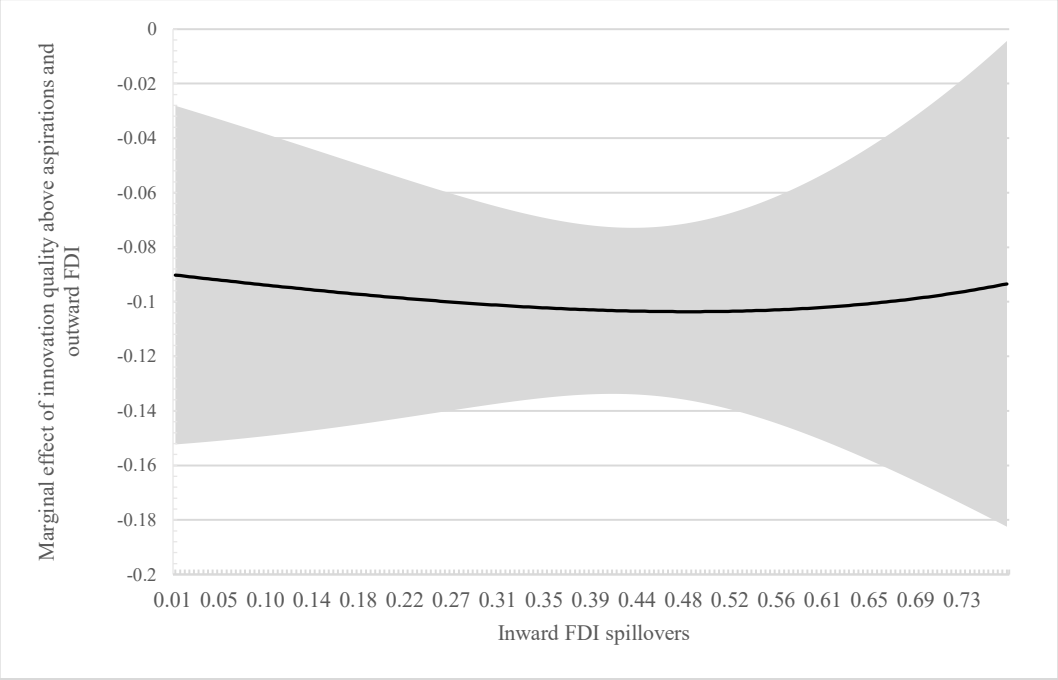

Fig. 5. Moderating role of inward FDI spillovers in innovation quality above aspirations – outward FDI link.

Table 6
Hypothesis testing results.

	Hypothesized relationship	Result
H1a	*Negative feedback* on innovation performance (both quantity and quality) ⥤ outward FDI	Supported
H1b	*Positive feedback* on innovation performance (both quantity and quality) ⥤ outward FDI	Supported
H2a	Inward FDI ⥤ Negative main effect between *negative feedback on innovation quantity* and outward FDI	Not supported
H2b	Inward FDI ⥤ Negative main effect between *positive feedback on innovation quantity* and outward FDI	Supported
H2c	Inward FDI $\overset{+}{\rightarrow}$ Negative main effect between *negative feedback on innovation quality* and outward FDI	Supported
H2d	Inward FDI $\overset{+}{\rightarrow}$ Negative main effect between *positive feedback on innovation quality* and outward FDI	Supported

model, and then include the inverse Mill's ratio in all the regression models. The results are consistent with our main analysis.

Fourth, we check the curvilinear relationship between innovation performance feedback and outward FDI by adding quadratic term of innovation quantity and quality feedback. The results support the linear main effects.

Fifth, to exclude the potential effect induced by COVID-19, we re-run the models using data before the outbreak (i.e., before 2020). The results are consistent with our original analysis.

6. Discussion And Implications

This study focuses on the effect of negative and positive feedback on innovation performance on outward FDI decisions and the moderating role of inward FDI spillovers. We found that the deviation between innovation performance, both innovation quantity and quality, and aspiration levels always decreases the likelihood of doing outward FDI, and these effects are conditional to inward FDI spillovers.

This study makes several contributions to the literature. First, it enhances the comprehension of the determinants behind emerging market firms' outward FDI activities based on a behavioral view. Second, this study further differentiates between innovation quantity and quality, which brings an in-depth understanding of innovation performance. Third, this study provides an important supplement – the environmental moderators – to the existing behavioral theory models.

6.1. Theoretical implications

Several important theoretical implications can be drawn from this study. First, we apply the behavioral view by investigating firms' innovation performance feedback. Innovation performance feedback is a key factor when emerging market firms make strategic decisions (Gaba & Bhattacharya, 2012; Lungeanu et al., 2016; Tyler & Caner, 2016), however, it has been largely ignored in the extant outward FDI literature. Furthermore, by incorporating the often-overlooked quality aspect, this study enriches the conceptualization of innovation performance and generates more fine-grained strategic considerations for firms to make outward FDI decisions.

Second, the extant research, which is based on the behavioral theory, mainly considers moderators related to the firm's characteristics or executives' characteristics but pays limited attention to environment-related factors (Xu, Zhou, & Du, 2019; Zhong, Chen, et al., 2022). The predictions of the moderating effects of industrial inward FDI spillovers are generally supported by the empirical results, suggesting that incorporating environmental factors into the behavioral theory can enhance the explanatory and predictive power of the behavioral theory.

It is worthwhile to note that the further a firm's innovation quantity is below its aspiration levels, the lower the extent of its outward FDI. However, this relationship will be weakened by inward FDI spillovers instead of being strengthened, as proposed in the hypothesis development section. There are possible explanations for this unanticipated finding. In an industry with a high level of inward FDI spillovers, which means a high degree of foreign firms' presence, firms that are below their innovation quantity targets can acquire knowledge about foreign markets from foreign firms in their industry. Thus, managerial confidence in reducing expected entry costs or post-entry risks will be enhanced. Additionally, managers usually have a strong desire to pass the aspiration levels. Equipped with this knowledge, managers of these firms are more likely to treat outward FDI as an opportunity to pass the aspiration levels instead of a threat that will bring in risk. Therefore, managers of firms with innovation quantity below aspiration levels who have a strong desire to pass the aspiration levels may be encouraged to look for solutions in foreign markets.

6.2. Practical implications

This study also has practical implications. First, it suggests that managers are constrained to rationality and susceptible to cognitive biases when making strategic decisions. The results show that managers of firms close to their innovation performance goals will undertake more outward FDI than those that underperform or outperform in innovations. Managers should be altered their limitations and the possibility of overreaction to poor or strong innovation performance when making outward FDI strategies. For example, when a firm's innovation performance is above the aspiration levels, risk-averse managers will be less likely to commit to sufficient overseas investments (Jiang & Holburn, 2018). Although this is understandable when considering that managers are bounded by their rationality, it would harm the firm's long-term success due to the lack of sufficient strategic investments abroad.

Second, the findings show managers should pay attention to industrial inward FDI spillovers when designing outward FDI strategies. The levels of inward FDI spillovers in the industry significantly influence managers when they adjust the extent of firms' outward FDI in response to innovation performance feedback. Specifically, in industries with high levels of inward FDI spillovers, which means a high competition effect, to better compete with foreign firms in their local markets, managers should invest abroad to solve underperformance problems in innovation quality or sustain the competitive advantage in the innovation quality of their firms. However, in industries with high levels of inward FDI spillovers, managers of firms with good innovation quantity should adopt inward FDI spillovers as an alternative way to acquire knowledge and further decrease the risks of the firm.

6.3. Limitations and directions for further research

This study has some limitations, which are summarized as follows. First, this study focuses on a more straightforward issue of whether inward FDI spillovers have a moderating effect and uses a single variable to estimate the aggregate role of inward FDI spillovers. It fails to distinguish between different channels of inward FDI spillovers. However, the effects of different channels of inward FDI may differ (Tian, 2007). To present a more detailed picture of inward FDI spillovers, future research should decompose different channels of inward FDI spillovers and estimate the effect of every detailed component.

Second, public firms' data are more reliable and accessible. Nevertheless, to enhance the generalizability of the findings, future research is encouraged to test different types of firms (e.g., small and medium-sized firms, family firms, and new ventures). Small and medium-sized firms have the potential to expand further in the global markets. However, the drivers of medium-sized firms' outward FDI are not yet fully understood (Qiao et al., 2020). Family firms possess some unique features and have an important role in the growth of outward FDI (Metsola, Leppäaho, Paavilainen-Mäntymäki, & Plakoyiannaki, 2020). New ventures based in emerging markets also deserve some attention, considering the fact that an increasing number of new ventures based in emerging markets

have begun to internationalize (Yamakawa, Peng, & Deeds, 2008).

Third, this study investigates innovation performance from both quality and quantity perspectives. However, extant studies have also come up with other classifications of innovations. For example, Jansen, Van Den Bosch, and Volberda (2006) examine two types of innovations: exploratory innovations, which are "radical innovations and are designed to meet the needs of emerging customers or markets," and exploitative innovations, which are "incremental innovations and are designed to meet the needs of existing customers or markets" (Jansen et al., 2006, p. 1662). By conducting surveys or interviews, future research is encouraged to investigate other classifications for innovations, find suitable measurements for the metrics, and apply them in the context of this study.

Finally, the COVID-19 pandemic has had a profound effect on countless businesses worldwide. Consequently, future studies should prioritize gathering more up-to-date data post-pandemic to offer a more precise depiction of the pandemic's substantial impact on the strategic decision-making processes of global companies.

CRediT authorship contribution statement

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