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# Does corporate internationalization affect analysts' earnings forecast bias? Evidence from China☆

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ABSTRACT

Using manually collected firm-level data on foreign subsidiaries, we examine the impact of internationalization on analysts' earnings forecast bias in Chinese corporations. We find that analysts' earnings forecast bias is stronger among multinational firms when compared with domestic firms, and the higher the level of internationalization, the greater the bias in analysts' earnings forecasts. Various methods, such as the Heckman two-stage least squares, propensity score matching, and difference in difference tests, are employed to ensure the robustness of our results. The mechanism analysis indicates that oversea business complexity, information asymmetry and analysts' experience are critical factors that moderate the relationship between international diversification and forecast bias. These findings have important implications for multinational corporations, analysts, and investors.

## 1. Introduction

Due to the striking importance of multinational corporations (MNCs) in the integrated world economy (Beuselinck et al., 2019), studies on the economic consequences of internationalization are becoming increasingly popular in developed countries (Attig et al., 2016; Beuselinck et al., 2019; Duru and Reeb, 2002; Ramamurti and Hillemann, 2018). A heated topic is how international diversification affects the corporate information environment, given the complicated corporate structure and operations and increasing earnings management (Dyreng et al., 2013). There are few studies on the relationship between diversification and analysts' behaviours (Duru and Reeb, 2002; Thomas, 2002), and yet the academic field fails to reach an agreement.

In addition, there is a lack of relevant evidence on emerging markets because prior studies focus on developed countries. The distinctive features of MNCs from emerging markets include the early stage of internationalization, high speed of internationalization, government-created advantages, entering psychically distant markets sooner, and high-commitment modes of entry (Ramamurti, 2004; Ramamurti and Hillemann, 2018), which may aggravate information asymmetry and lead to untimely and ineffective supervision by parent firms. Consequently, financial irregularities occasionally occur in overseas businesses. Sutherland et al.(2019) demonstrate that capital flows are routed between mainland China and a number of tax-haven locations and that Chinese MNCs use special-purpose entities to route offshore capital. The questionable multi-billion overseas acquisition of Huaxin (CEFC China Energy) is

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one recent well-known case. Therefore, there is an even greater demand for research on multinational firms in emerging markets than when Buckley et al. (2007) launched their important project (Ramamurti and Hillemann, 2018).

China is the world's largest emerging country, whose development has been promoted by the 'Go Out' strategy and the Belt and Road initiative, and the internationalization process of many Chinese firms accelerates and remarkable progress are made. In 2016, the flow of outward foreign direct investment (OFDI) of Chinese firms reached US$196.2 billion, accounting for 13.5 % globally, ranking second in the world and sixth in terms of OFDI stock (Wang and Gao, 2019). Prior studies note that Chinese firms internationalize in distinctive ways compared with those in other developed countries and are representatives of firms in emerging markets: (1) Chinese firms are in the early stage of internationalization, with more infant multinationals than mature ones (Ramamurti and Hillemann, 2018); (2) The speed of internationalization is faster than it was in earlier decades (Peng, 2012; Ramamurti and Hillemann, 2018); (3) Government activism has led to significant competitive advantages for Chinese MNCs (Buckley et al., 2007; Peng, 2012; Ramamurti and Hillemann, 2018); (4) Chinese multinational firms have entered psychically distant markets, such as developed countries, sooner than one would have expected (Ramamurti, 2004; Ramamurti and Hillemann, 2018); and (5) Chinese MNCs have used high-commitment modes of entry, such as mergers and acquisitions, earlier than expected (Ramamurti and Hillemann, 2018). Based on the uncommon characteristics of internationalization in China and emerging markets, international business scholarship on China and emerging markets has come of age (Ramamurti and Hillemann, 2018).

Analysts play a major role in gathering, analysing, and delivering information. Their forecasts, intended to alleviate information asymmetry between firms and information users, are important information sources for investors and other market participants (Bourveau and Law, 2021; Brauer and Wiersema, 2017; Kim et al., 2017; Gong and Liu, 2023; Mandas et al., 2023). Therefore, whether industrial analysts can deal with the extra challenges brought by internationalization on earnings forecasts is a critical issue (Brauer and Wiersema, 2017), especially in emerging markets such as China, where stock markets are not quite efficient.

Based on manually collected data, we use the number of foreign subsidiaries, foreign scope, and host countries to measure corporate international diversification. We then examine the effect of internationalization on analysts' earnings forecasts bias and explore the mechanisms of the relationship in terms of organisational complexity of overseas business, information asymmetry between management and analysts, and analyst competence.

The contributions of this study are as follows: First, unlike Duru and Reeb (2002) who see businesses outside the United States as homogeneous, we emphasise on the heterogeneity of MNCs. We find that the higher the complexity of foreign businesses, the stronger the bias. Meanwhile, we identify channels through which the positive association between internationalization and forecast bias is more pronounced, such as the poor institutional environment of destination countries, weak corporate governance, and tax-haven subsidiaries. In addition, we examine whether analyst competence can assuage the adverse effects of international presence, and find that experienced analysts can efficiently cope with the challenges caused by internationalization, while analysts with industry expertise and star analysts cannot.

Second, China provides a unique setting in which to examine the impact of international activities on analysts' earnings forecasts. Unlike other developed countries, Chinese firms are heavily influenced by government policies such as the 'Go Out' strategy and the Belt and Road initiative (Peng, 2012; Ramamurti and Hillemann, 2018). In addition, Chinese multinational firms chart different paths in terms of their speed, scope, and means of internationalization (Ramamurti and Hillemann, 2018). Chinese firms' distinctive internationalization methods worsen information asymmetry, making it difficult for analysts to generate accurate forecasts (Gong and Liu, 2023). Moreover, previous studies focus on American and European companies (Duru and Reeb, 2002; Hope and Thomas, 2008; Platikanova and Mattei, 2016), yet those research findings may not be applicable for emerging markets (Brauer and Wiersema, 2017).

Third, a unique set of hand-collected data enables us to measure internationalization in terms of granularity. While extant studies on the economic impact of MNCs use the proportion of overseas sales as a proxy for international activities (Olibe et al., 2008), the measure may be flawed since it mixes export sales with sales from foreign subsidiaries (Duru and Reeb, 2002), Therefore, it might lead to a biased measurement for internationalization (Mauri et al., 2013), which is one of the reasons for the disparities in the outcomes of international business research (Berrill and Kearney, 2010). In contrast to other countries, listed firms in China are required to disclose information on consolidated foreign subsidiaries, including the host country, business scope, and entry mode, allowing us to measure international activities in granularity and test the mechanism by which international diversification affects analysts' forecasts. In addition to the number of foreign subsidiaries and host countries used by Hitt et al. (2006), we also include foreign business segments and modes of entry in the study.

The remainder of this paper is organised as follows: Section 2 presents the research hypotheses; Section 3 describes the data collection process, sample selection, and regression analysis; Section 4 reports the main findings and the results of several robustness tests; Section 5, provides further analysis of the mechanisms involved; and Section 6 briefly concludes the paper.

## 2. Hypotheses development

The association between international diversification and analysts' earnings forecasts has been a focus of public interest since the onset of globalisation. In the internationalization process, firms are challenged by complicated organisational structures and various business scopes. Differences in growth opportunities, competition, government regulation, labour relations, business practices, and market conditions among countries or regions complicate the company's information, and the degree of information asymmetry between management and information users continues to deteriorate (Brauer and Wiersema, 2017; Hope and Thomas, 2008). In addition, international activities provide management with more discretion for decision-making (Dyreng et al., 2013), increasing the complexity and difficulty for analysts to make forecasts (Duru and Reeb, 2002). Thus, the competence of analysts is challenged, leading to greater bias in earnings forecasts.

Internationalization increases the complexity of business activities and organisational structures (Chin et al., 2009; Duru and Reeb, 2002). Multinationals have set up subsidiaries, sub-subsidiaries, and offices in host countries, making organisational structures increasingly sophisticated and reducing information transparency (Hope and Thomas, 2008). When MNCs operate in other countries, differences in the legal system and culture complicate the information environment, operations, and coordination activities (André et al., 2019). Meanwhile, due to exchange rate risk and political risk, multinational firms are exposed to more macro and systematic risks, which further increases the complexity of international operations (Olibe et al., 2008; Reeb et al., 1998). These factors create complexity and difficulty for analysts in understanding, interpreting, and analysing financial reports and forecast earnings (Peterson, 2012). As forecasting difficulties aggravate, analysts' forecast accuracy decreases (Bradshaw et al., 2017; Brown et al., 1987; Duru and Reeb, 2002).

Internationalization exacerbates the degree of information asymmetry between management and external information users in other ways. The first is the increase in management discretion. International business increases the operational flexibility and discretion of management (Bodnar et al., 1999; Chin et al., 2009), in actions such as transferring production to low-cost regions (Duru and Reeb, 2002; Mauri et al., 2013), taking advantage of short-term international capital market imperfections to seize arbitrage opportunities, and exploiting taxation differences to reduce the overall tax burden (Bodnar et al., 1999). Such behaviours reduce the transparency of financial statements (Akamah et al., 2018). Corporate management can take advantage of asymmetric information for self-interest, through, for example, overinvestment, inefficient allocation of resources (Chen et al., 2014), and overseas empire-building (Hope and Thomas, 2008). Second, there is a high level of earnings management. Management may engage in more serious earnings management to conceal the negative consequences of suboptimal decisions. The higher the international level, the more serious the earnings manipulation (Chin et al., 2009). The third factor is a low level of disclosure quality. Although MNCs disclose financial information about international subsidiaries in consolidated financial statements, the details of infra-group transactions and offset accounts are inadequate (Mandas et al., 2023). For segment sales, only aggregate foreign sales are available, whereas subsidiary-level financial information is either missing or incomplete. Akamah et al. (2018) shows that MNCs with tax-haven subsidiaries tend to aggregate geographic disclosures and provide less international operation and revenue transfer information. In terms of segment reports, parent company managers have the discretion whether to consolidate a foreign subsidiary by playing with the definition of material subsidiary/country, tampering with foreign subsidiaries' accounting policies(Huang, 2018). At the same time, because of geographical constraints, institutional disparities, and language barriers of overseas business, it is often extremely difficult for domestic auditors to check important overseas subsidiaries on the spot. Companies that are more international are likely to have a higher degree of information asymmetry and agency costs, making it difficult for stakeholders to supervise management decisions. To a certain extent, analysts are not always able to monitor these issues, leading to greater forecast bias (Duru and Reeb, 2002).

Besides, it is harder for analysts to understand the consolidated statements of international companies than to understand those of domestic companies. Because of cultural differences, geographical dispersion, language and legal systems, and accounting standards variation, analysts cannot obtain sufficient information about overseas operations (Ashbaugh and Pincus, 2001; Duru and Reeb, 2002). Information sufficiency and quality are found to be negatively related to forecast bias. The less information analysts have, the greater their forecast bias. The management of multinationals are able to obtain a complete picture of the cash flow, but outsiders must observe the cash flow through the noise and disruptions (Thomas, 2002). When a financial report is consolidated, external users will only obtain less transparent financial statements and less value-relevant earnings information than insiders, reducing the effectiveness of analyst information processing (Thomas, 2002).

Though researchers recognise the influence of the internationalization process on analysts' forecasts, few studies talk about the emerging markets. Based on the data of American companies from 1995 to 1998, Duru and Reeb (2002) find that international operations increase the difficulty and complexity of analysts' earnings forecasts, and the higher the internationalization level, the lower the accuracy of analysts' forecasts, and the greater the optimism bias (Gong and Liu, 2023). Khurana et al. (2003) suggest that analysts fail to fully understand, or underestimate the sustainability of overseas earnings. Platikanova and Mattei (2016) find that as a company becomes more geographically dispersed, information process costs and analysts' earnings forecast bias increase. However, other scholars report opposite results. Based on data of U.S. firms from 1986 to 1996, Thomas (2002) suggests that corporate diversification does not increase the degree of information asymmetry between management and analysts.

Chinese multinationals differ from U.S. multinationals at both firm-specific and country-specific levels. First, Chinese multinationals are dominated by state-owned enterprises (Huotari and Hanemann, 2014). Kolstad and Wiig (2012), echoing Buckley et al. (2007), verify that the government's heavy hand strongly influences Chinese multinationals in decision-making, making it more difficult for analysts to make forecasts compared with companies without intervention. In addition, the incredible development of China enable Chinese multinationals to expand their businesses to foreign countries at the infant stage instead of the mature stage like multinationals from other countries (Ramamurti, 2009; Ramamurti and Hillemann, 2018). Analysts must consider both macro- and micro-factors. The more variables, the more difficult it is to make forecasts. Consequently, Chinese multinationals are not the same as those from other markets.

In sum, information asymmetry caused by the complex environment of international operations, the increasing degree of earnings management, and the constraints of analysts' competence lead to a stronger bias in analysts' earnings forecasts, especially in Chinese multinational corporations.

On the other hand, multinational firms are likely to be large, successful, and highly profitable (Dastidar, 2009) and have relatively low performance volatility (Mauri et al., 2013; Li et al., 2011; Vithessonthi, 2016). Meanwhile, they are subject to strict information disclosure requirements (Duru and Reeb, 2002) and supervised by stakeholders (Shi et al.,2015), which may also contribute to analysts' forecast accuracy.

First, given that the economic cycles in multiple countries are out of sync with each other, MNCs are capable of reducing earnings volatility by uncorrelated cash flows in multiple countries due to a portfolio effect (Shapiro,1978). Mauri and Neiva de Figueiredo (2012) find that geographic dispersion increases the portfolio effect and therefore leads to lower variability of firm performance. Besides, cross-border business increases operating flexibility and enables MNCs to allocate their resources efficiently, therefore reducing performance volatility. As volatility decreases, analysts would find it easy to make accurate predictions (Hou et al., 2021).

Second, due to the diversification of cash flows, multinational firms decrease their systematic risks and thus receive more favourable valuations from creditors (Li et al., 2011). Research argues that international diversification is risk-reducing (Hughes, et al., 1975; Michel and Shaked, 1986). Compared to domestic firms, MNCs have lower systematic risks, idiosyncratic risks, and total risks. Li et al. (2011) find that globally diversified firms receive more favourable valuations from creditors than domestic firms, resulting in lower loan rates and less restrictive non-price contractual terms. The reduction of corporate risks could thus improve the accuracy of analyst's forecasts.

Thirdly, external supervision encourages companies to disclose relevant information, improving information asymmetry and analysts' forecasts. Since geographically dispersed firms have a larger investor base and higher investor recognition (Garcia and Norli, 2012), they might be subject to scrutiny by more institutional shareholders and more media coverage (Shi et al.,2015). MNCs are obligated to add disclosure of geographic segment information (Duru and Reeb, 2002; Mauri et al., 2013). Added disclosure of geographic segment information should increase financial analysts' earnings forecast accuracy because of its relevance (Mauri et al., 2013).

We thus propose the following hypotheses:

**H2a**. Compared with domestic companies, MNCs have higher analysts' earnings forecast bias.

**H2a**. Compared with domestic companies, MNCs have lower analysts' earnings forecast bias.

**H2a**. Internationalization increases analysts' earnings forecast bias.

**H2b**. Internationalization reduces analysts' earnings forecast bias.

## 3. Research design

### 3.1. Sample and data

The initial sample consists of firms in CSI 800 (China Securities Index 800), one of the most popular stock indices in China, which includes large, medium, and small market capitalisation A-share firms without major violations of regulations and irregularities in financial reporting. The *Chinese Accounting Standards* were issued in 2006 and implemented in 2007. In 2008 and 2009, the international financial crisis broke out and heavily influenced foreign direct investment. In late 2010, the internationalization activities of Chinese firms are restored to normal levels. Thus, our sample begin in 2010. We choose 2016 as the end point because multiple Chinese accounting standards are revised in that year. There are, for example, major revisions regarding revenue recognition that leads to significant challenges in analysts' earnings forecasts. We exclude firms in the financial sector, firms delisted during the period, special treatment firms, and firms without analyst followings. After the screening, 4058 observations remain.

We manually collect information such as the name, registered location, and country or region of subsidiaries, which was included in the annual consolidated statements. We then focus on the overseas subsidiaries. We measure internationalization by determining whether there are overseas subsidiaries, the number of overseas subsidiaries, and the number of host countries where those subsidiaries are located, and collect information on the capital investment of overseas subsidiaries, control mode, as well as the establishment mode and business scope. The analyst data are obtained from the China Stock Market and Accounting Research Database (CSMAR) and the other data are from the Wind database. To mitigate the undue influence of outliers, we winsorise the continuous variables that fall at the top and bottom 1 %.

### 3.2. Regression model and variables

Following Duru and Reeb (2002), Godigbe et al. (2024), and Platikanova and Mattei (2016), we run Eq. (1) to test H1.

$$Bias_{it} = \alpha_0 + \alpha_1 FORDUM_{it} + Controls_{it} + Industryfixedeffect + Yearfixedeffect + \varepsilon_{it} \quad (1)$$

Run Eq. (2) and Eq. (3), to test for H2.

$$Bias_{\mathrm{it}} = \alpha_0 + \alpha_1 FORSUB_{it} + Controls_{it} + Industryfixedeffect + Yearfixedeffect + \varepsilon_{it} \quad (2)$$

$$Bias_{\mathrm{it}} = \alpha_0 + \alpha_1 FORCOU_{it} + Controls_{it} + Industryfixedeffect + Yearfixedeffect + \varepsilon_{it} \quad (3)$$

The dependent variable *Bias* is analysts' forecast bias. There are several indicators to measure analysts' earnings forecast accuracy. The most popular measurement is analysts' earnings forecast bias, which is the difference between analysts' earnings forecasts and actual earnings (Ramnath et al., 2008). Following Lang and Lundholm (1996) and Duru and Reeb (2002), we calculate analysts' earnings forecast bias using Eq. (4):

$$Bias_{it} = \frac{|CEF_{it} - EPS_{it}|}{P_{it-1}} \quad (4)$$

$CEF_{it}$ is the mean value of analysts' latest forecast of annual earnings per share, $EPS_{it}$ is the actual earnings per share, and $P_{it\text{-}1}$ is the closing price of the last year. The larger the $Bias_{it}$, the stronger the bias of the analysts' earnings forecast and the lower the forecast accuracy.

The independent variables are indicators of corporate internationalization, including *FORDUM*, *FORSUB*, and *FORCOU*. Following Hitt et al. (1997) and Dunning and Lundan (2008), *FORDUM* is a dummy variable of internationalization, which equals 1 if a firm has a foreign subsidiary, otherwise 0. *FORSUB* refers to the number of foreign subsidiaries and is equal to the logarithm of the number of foreign subsidiaries plus one. *FORCOU* refers to the number of host countries and is equal to the logarithm of the number of host countries plus one. All three variables are manually collected from annual financial reports according to the name, and country or region in which the subsidiaries are located.

Based on Duru and Reeb (2002), we control the following variables: the logarithm of the number of following analysts (*Afnum*), the logarithm of the forecast horizon(*Horizon*), the logarithm of the firm size (*Size*), the earnings surprise (*Surprise*), the loss dummy (*Loss*), the volatility of ROA (*Roavol*), the volatility of monthly stock returns (*Retvol*), the ratio of intangible assets (*Intangible*), the institutional investor shareholdings (*Insti*), discretionary accrual (*DA*), the logarithm of firm age (*Age*) and the dummy variable of cross-listing (*Crosslist*). We also control for the fixed effects of industry and year. Appendix 1 provides detailed definitions and measurements of these variables.

## 4. Empirical results

### 4.1. Descriptive statistics

Panel A of Table 1 reveals that the mean of analysts' earnings forecast bias is 0.0399 and 1829 samples have at least one foreign subsidiary, accounting for 45.1 % of the total sample. On an average, each international company has 5.39 foreign subsidiaries and invests in 2.98 foreign countries or regions. Each firm has an average of approximately 10.55 analysts following, the mean forecast horizon is 226 days, 7.15 % of the companies have losses, intangible assets account for 4.94 % of the total assets, the shareholding ratio of institutional investors is 50.52 %, and 7.22 % of the companies are cross-listed in overseas capital markets. Furthermore, it can be seen in Panel B that the number of multinationals increases year by year, from 211 in 2010–323 in 2016. The proportion of multinationals increases from 33.76 % in 2010 to 56.08 % in 2016. The number of foreign subsidiaries increases from 4.422 in 2010–6.207 in 2016, and the number of host countries increases from 2.555 in 2010–3.235, respectively. Panel C presents the results of the univariate comparison of *Bias* between domestic firms and multinationals. The mean and median biases of multinationals are higher than those of domestic firms. The p-value of the t-test on the mean is 0.0777, indicating that the forecast bias of multinationals is stronger. Panel C of Table 1 presents the preliminary evidence for H1a.

Appendix 2 provides the correlation matrix of the main variables. The pairwise correlation coefficients among the control variables are low, most of which are less than 0.3. The mean variance inflation factor is 3.23, suggesting that multicollinearity is not a major concern in our analysis. Notably, *FORDUM* and *FORCOU* are positively related to *Bias* at the significance levels of 5 % and 1 %, respectively, supporting H1a and H2a to some extent.

### 4.2. Main findings

In order to test H1 and H2, we run Eqs. (1)-(3) using ordinary least regression (OLS) with the standard error corrected for heteroskedasticity and firm clustered to account for the lack of independence of observations within a given firm over time (Attig et al., 2016). Meanwhile, we control for the industry and time fixed effects.

Table 2 presents the regression results of Eqs. (1)-(3). As shown in column (1), we regress *Bias* on the internationalization dummy *FORDUM* and a set of control variables and find that the estimated coefficient of *FORDUM* is significantly positive at the 10 % level, indicating that analysts' forecast bias of internationals is stronger than that of domestic companies. For the economic effects of internationalization on *Bias*, the *Bias* of international companies is 3.93 cents[1] higher than that of domestic firms, accounting for 8.80 %[2] of the EPS. As shown in columns (2) and (3), we regress *Bias* on *FORSUB* and *FORCOU*, and the estimated coefficients of *FORSUB* and *FORCOU* are positive and significant at the 1 % level, indicating that the higher the internationalization, the stronger the analysts' earnings forecast bias. As the number of foreign subsidiaries and host countries increases by 1 %, bias increases by 3.25 cents and 4.98 cents, respectively. Furthermore, we run Eqs. (2) and (3) only for international companies. The results are presented in columns (4) to (5). The coefficients of *FORSUB* and *FORCOU* are similar to those in Eqs. (2) and (3). Consistent with the findings of Duru and Reeb (2002), our findings indicate that factors such as various business activities and of international companies, differences in legal system, culture, and linguistics, geographical constraints, managerial discretion, and earnings management increase the degree of information asymmetry between management and analysts, making it difficult for analysts to make accurate forecasts. Thus, international companies are found to be associated with higher forecast bias, which supports H1 a and H2a.

[1] The average closing price of the stock during the sample period is 9.5869 CNY.
[2] The average earnings per share during the sample period is 0.4467 CNY.

**Table 1**
Descriptive statistics.

Panel A Descriptive statistics of key variables

| Variables | N | mean | sd | min | p50 | max |
|---|---|---|---|---|---|---|
| *Bias* | 4058 | 0.0399 | 0.0515 | 0.0001 | 0.0216 | 0.293 |
| *FORDUM* | 4058 | 0.451 | 0.498 | 0 | 0 | 1 |
| *FORSUB*[a] | 4058 | 2.431 | 7.613 | 0 | 0 | 139 |
| *FORCOU* | 4058 | 1.342 | 2.599 | 0 | 0 | 39 |
| *FORSUB*[b] | 1829 | 5.393 | 10.61 | 1 | 2 | 139 |
| *FORCOU* | 1829 | 2.976 | 3.182 | 1 | 2 | 39 |
| *Afnum* | 4058 | 1.892 | 1.049 | 0 | 2.079 | 4.025 |
| *Horizon* | 4058 | 5.352 | 0.440 | 0 | 5.412 | 6.246 |
| *Size* | 4058 | 23.12 | 0.962 | 20.97 | 22.98 | 28.23 |
| *Surprise* | 4058 | −0.0142 | 0.373 | −1.380 | 0.010 | 1.400 |
| *Loss* | 4058 | 0.0715 | 0.258 | 0 | 0 | 1 |
| *Roavol* | 4058 | 11.27 | 26.82 | 0.0091 | 2.412 | 208.4 |
| *Retvol* | 4058 | 0.0590 | 0.0220 | 0.0262 | 0.0539 | 0.134 |
| *Intangible* | 4058 | 0.0494 | 0.0617 | 0 | 0.0318 | 0.396 |
| *Insti* | 4058 | 50.52 | 20.25 | 2.779 | 52.32 | 89.83 |
| *DA* | 4058 | 0.0501 | 0.0485 | 0.0004 | 0.0359 | 0.274 |
| *CGscore* | 4058 | 0.0578 | 1.311 | −4.654 | 0.180 | 2.639 |
| *Age* | 4058 | 2.939 | 0.256 | 1.609 | 2.944 | 4.220 |
| *Crosslist* | 4058 | 0.0722 | 0.259 | 0 | 0 | 1 |

Panel B Frequency distribution by year

| Year | Number of sample | Number of Multinationals | Proportion | Mean number of foreign subsidiaries | Mean number of host countries |
|---|---|---|---|---|---|
| 2010 | 625 | 211 | 33.76 % | 4.422 | 2.555 |
| 2011 | 611 | 226 | 36.99 % | 4.783 | 2.739 |
| 2012 | 576 | 238 | 41.32 % | 5.097 | 2.958 |
| 2013 | 549 | 252 | 45.90 % | 5.286 | 2.988 |
| 2014 | 552 | 275 | 49.82 % | 5.473 | 3.062 |
| 2015 | 569 | 304 | 53.43 % | 5.901 | 3.099 |
| 2016 | 576 | 323 | 56.08 % | 6.207 | 3.235 |
| Total | 4058 | 1829 | 45.07 % | 5.393 | 2.976 |

Panel C Univariate tests on Bias

| (1) Domestic | | | (2) Multinational | | Difference (2)-(1) | | Difference (2)-(1) | |
|---|---|---|---|---|---|---|---|---|
| Variable | Mean | Median | Mean | Median | Mean | P-stat | Median | Z |
| Bias | 0.0389 | 0.0212 | 0.0412 | 0.0225 | 0.0023 | 0.0777* | 0.0013 | 1.425 |

[a]For intuition, in Descriptive Statistics, *FORSUB* and *FORCOU* are the number of foreign subsidiaries and the number of host countries.
[b]The number of observations with foreign operations is 1829.

We take a further step in testing the impacts of entry mode (Greenfield investments or M&As) and the business type of overseas subsidiaries on analysts' forecast bias. As shown in column (6) of Table 2, the number of subsidiaries by Greenfield investment (GFI) is positively related to analysts' forecast bias at the 5 % level, while the number of foreign subsidiaries acquired through M&A is negatively related to analysts' forecast bias, and the coefficient fails to pass the significance test. Although emerging market firms adopt a high-commitment mode of entry in their early stage of internationalization, it seems that the high-commitment mode does not worsen the overall information environment because of the dominance of GFI.[3] By contrast, GFI exacerbates the information asymmetry between management and analysts, explaining the reasons for similar results as Duru and Reeb (2002). To test the impact of overseas subsidiaries' business scope, this study divides foreign subsidiaries into four categories: sales (*Salesub*), production (*Prodsub)*, investment and financing (*Invesub*), and research and development (*Techsub*).[4] Column (7) shows the results. The number of sales subsidiaries is significantly positively related to analysts' forecast bias at the 90 % confidence interval. Other types of subsidiaries have no significant impact on analysts' forecast bias.

For the control variables, consistent with previous studies, the forecast horizon (*Horizon*), loss dummy (*Loss*), and volatility of ROA (*Roavol*) are positively related to analysts' forecast bias. Firm size (*Size*) and earnings surprise (*Surprise*) are negatively related to analysts' forecast bias.

[3] The mean number of GFI is 3.56, whereas it is only 1.26 for mergers and acquisitions.
[4] The process is as follows: we search the business scope of each overseas subsidiary in the annual report. If a subsidiary is involved in marketing, retail, wholesale, import, export, trade, foreign trade, procurement, or distribution, it is classified as a sales subsidiary. If the business scope is involved in production, processing, manufacturing, construction, assembly, mining, etc., it is classified as a production subsidiary. If it is involved in investments, financing, finance, insurance, loans, finance companies, bonds, etc, it is classified as an investment subsidiary. If it is involved in technology, research and development, software development, product development, etc., it is classified as a research and development subsidiary.

**Table 2**
Impact of internationalization on analysts' earnings forecast bias.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Variables | Bias | Bias | Bias | Bias | Bias | Bias | Bias |
| *FORDUM* | 0.0041* | | | | | | |
| | (1.95) | | | | | | |
| *FORSUB* | | 0.0034*** | | 0.0038** | | | |
| | | (2.87) | | (2.08) | | | |
| *FORCOU* | | | 0.0056*** | | 0.0088*** | | |
| | | | (3.35) | | (2.88) | | |
| *GFI* | | | | | | 0.0047** | |
| | | | | | | (2.31) | |
| *MA* | | | | | | −0.0004 | |
| | | | | | | (−0.17) | |
| *Salesub* | | | | | | | 0.0044* |
| | | | | | | | (1.87) |
| *Prodsub* | | | | | | | −0.0001 |
| | | | | | | | (−0.06) |
| *Invesub* | | | | | | | −0.0011 |
| | | | | | | | (−0.55) |
| *Techsub* | | | | | | | 0.0015 |
| | | | | | | | (0.36) |
| *Afnum* | −0.0013 | −0.0014 | −0.0015 | −0.0050*** | −0.0052*** | −0.0051*** | −0.0047** |
| | (−1.27) | (−1.38) | (−1.42) | (−2.75) | (−2.85) | (−2.77) | (−2.59) |
| *Horizon* | 0.0063*** | 0.0064*** | 0.0064*** | 0.0043 | 0.0045 | 0.0044 | 0.0040 |
| | (3.90) | (3.92) | (3.94) | (1.30) | (1.35) | (1.32) | (1.21) |
| *Size* | −0.0027** | −0.0030** | −0.0033** | 0.0005 | 0.0001 | 0.0010 | 0.0006 |
| | (−1.99) | (−2.29) | (−2.55) | (0.22) | (0.04) | (0.44) | (0.25) |
| *Surprise* | −0.0384*** | −0.0384*** | −0.0383*** | −0.0398*** | −0.0398*** | −0.0396*** | −0.0400*** |
| | (−13.70) | (−13.74) | (−13.77) | (−9.07) | (−9.12) | (−9.03) | (−9.07) |
| *Loss* | 0.0508*** | 0.0505*** | 0.0506*** | 0.0482*** | 0.0476*** | 0.0484*** | 0.0487*** |
| | (9.93) | (9.84) | (9.87) | (5.26) | (5.17) | (5.30) | (5.38) |
| *Roavol* | 0.0003*** | 0.0003*** | 0.0003*** | 0.0002*** | 0.0002*** | 0.0002*** | 0.0002*** |
| | (6.78) | (6.68) | (6.71) | (4.42) | (4.41) | (4.44) | (4.58) |
| *Retvol* | −0.0405 | −0.0413 | −0.0389 | −0.0674 | −0.0666 | −0.0655 | −0.0647 |
| | (−0.84) | (−0.85) | (−0.81) | (−0.96) | (−0.95) | (−0.93) | (−0.92) |
| *Intang* | −0.0065 | −0.0052 | −0.0064 | −0.0004 | −0.0024 | 0.0048 | −0.0011 |
| | (−0.46) | (−0.37) | (−0.45) | (−0.02) | (−0.11) | (0.21) | (−0.05) |
| *Insti* | 0.0000 | 0.0000 | 0.0000 | −0.0001 | −0.0001 | −0.0001 | −0.0001 |
| | (0.16) | (0.27) | (0.38) | (−0.68) | (−0.62) | (−0.74) | (−0.79) |
| *DA* | 0.0056 | 0.0077 | 0.0078 | 0.0220 | 0.0242 | 0.0208 | 0.0194 |
| | (0.35) | (0.48) | (0.49) | (0.88) | (0.98) | (0.84) | (0.77) |
| *CGscore* | −0.0012 | −0.0013 | −0.0014 | −0.0004 | −0.0006 | −0.0006 | −0.0005 |
| | (−1.33) | (−1.44) | (−1.56) | (−0.26) | (−0.37) | (−0.36) | (−0.32) |
| *Age* | −0.0059 | −0.0057 | −0.0058 | −0.0113 | −0.0110 | −0.0114 | −0.0117* |
| | (−1.14) | (−1.11) | (−1.12) | (−1.59) | (−1.56) | (−1.56) | (−1.66) |
| *Crosslist* | 0.0022 | 0.0015 | 0.0011 | 0.0010 | 0.0008 | 0.0018 | 0.0017 |
| | (0.37) | (0.26) | (0.18) | (0.14) | (0.11) | (0.26) | (0.25) |
| *Industry* | Controlled | Controlled | Controlled | Controlled | Controlled | Controlled | Controlled |
| *Year* | Controlled | Controlled | Controlled | Controlled | Controlled | Controlled | Controlled |
| *Constant* | 0.0493 | 0.0565 | 0.0622* | 0.0079 | 0.0086 | −0.0021 | 0.0095 |
| | (1.38) | (1.59) | (1.75) | (0.14) | (0.15) | (−0.04) | (0.16) |
| *Obs* | 4058 | 4058 | 4058 | 1829 | 1829 | 1829 | 1829 |
| *R-squared* | 0.3664 | 0.3678 | 0.3696 | 0.3519 | 0.3566 | 0.3531 | 0.3525 |
| *F* | 30.27 | 30.27 | 30.33 | 16.60 | 16.63 | 16.41 | 15.77 |

In parentheses are t-values based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

### 4.3. Robustness tests

#### 4.3.1. Heckman two-stage model and Treatment effect model

The above regression results show that the internationalization level is positively related to analysts' earnings forecast bias. However, analysts do not track firms randomly. Only firms tracked by analysts are subject to analyst forecast bias. That is to say, the self-selection problem could result in data unavailability, which, in turn, causes endogeneity. Following Winkelmann and Boes (2006) and Dastidar (2009), we employ a Heckman two-stage model to mitigate this self-selection problem. In the 1st stage, the dependent variable is whether a company is tracked by any analyst or not. Since the Heckman model requires excluding restrictions (Lennox et al.,

2012), we add an exogenous variable *FORprovince*, to measure the percentage of MNCs in its province in the 1st stage, besides all other variables in the 2nd stage.[5]

Table 3 presents the results. We calculate *IMR* in the 1st stage and put it in Eqs. (1) to (3) to regress in the 2nd stage. The significant coefficient of *IMR* suggests the existence of self-selection problems. Controlled for *IMR*, the coefficients of *FORDUM*, *FORSUB* and *FORCOU* are still positive and significant, indicating that our conclusions are robust.

Secondly, the internationalization decision is not random and depends on a serial of factors (Attig et al., 2016; Dastidar, 2009). We use a treatment effects model to mitigate the impact of self-selection. In the 1st stage, the dependent variable is whether the company operates in multiple countries (*FORDUM*). Following Attig et al. (2016), we use *Size*, *ROA*, *Lev*, *CAPX*, and *MB* as independent variables. All the independent variables are lagged by 1 year. We calculate *Hazard* in the 1st stage and run Eqs. (1) to (3) in the 2nd stage after adding *Hazard*. Table 4 presents the results. *Hazard* has a significant coefficient, suggesting that there are self-selection problems. Controlled for such a problem, the coefficients of *FORDUM, FORSUB* and *FORCOU* are still positive and significant, indicating that our conclusions are not affected by the self-selection problems of internationalization.

#### 4.3.2. Propensity score matching (PSM) test

One of the major concerns about the research on internationalization is that the decision to diversify internationally is endogenous, which depends on firm size, profitability, leverage, capital expenditure, and growth (Attig et al., 2016; Dastidar, 2009). As suggested by Attig et al. (2016), PSM is employed in order to alleviate potential endogeneity concerns. The matching variables are firm-level variables that affect the decision to diversify internationally, including firm size (*Size*), profitability (*ROA*), leverage (*Lev*), capital expenditure (*CAPX*), and growth (*MB*), all lagged by 1 year. Moreover, industry and year effects are controlled. We use the probit model to obtain the probability of a firm being an MNC (propensity score). We match international firms with domestic firms with the nearest score, using a one-to-one match with replacement. The effect of internationalization on analysts' earnings forecast bias is calculated as the difference between the mean of multinational firms' bias and that of their matched neighbours.

Table 5 presents the matching results. After matching, the mean *Bias* for the international firms (treated group) is 0.0414 higher than that of a comparable domestic firm (control group), which is significant at the 95 % confidence interval. To test the validity of PSM, we plot a probability density function graph before and after the PSM (Fig. 1). The graph indicates a significant difference in the probability scores between multinational and domestic firms before PSM. However, after PSM, the density function graphs are highly similar.

After matching, we rerun Eqs. (1), (2), and (3), and the results are shown in Table 6. The estimated coefficients of *FORDUM*, *FORSUB*, and *FORCOU* are positive and significant at the 5 % and 1 % level, indicating that compared with domestic companies, analysts have a stronger forecast bias with regards to international companies, and the higher the internationalization, the greater the bias, implying that our main results are robust.

#### 4.3.3. DID test

To further identify the causality effect of internationalization on analysts' earnings forecast bias, following Francis et al. (2017), we employ the difference-in-differences (DID) test. First, we identify the firms that switch from domestic firms to international firms during the sample period[6] as a treated group (*Treat*= 1), and we obtain 134 treated firms. Second, we employ the PSM approach to identify the control group (Treat= 0) of firms that does not have any foreign subsidiaries in any year during the sample period. The matching method and variables are the same as those described in Section 4.3.2. Given that a control firm does not engage in international diversification, we use the treatment firm's switch year as a pseudo-switch year for the matched control firm. *Post* equals 1 after the switch year, and 0 at other times.

The DID model is constructed as follows:

$$Bias = \alpha_0 + \alpha_1 Treat + \alpha_2 Post + \alpha_3 Treat * Post + Controls_{it-1} + \varepsilon_{it} \quad (5)$$

The results of the DID test are presented in column (1) of Table 6. The estimated coefficient of *Treat*Post* is positive and significant at the 10 % level, suggesting that analysts' earnings forecast bias increases when a firm switches from a domestic firm to an international firm compared with domestic firms, verifying the causality relationship between internationalization and analysts' earnings forecast bias. To test the validity of the DID test, we test the parallel trend, and the results are presented in column (2) of Table 7. *Treat*Year* is insignificant from year *t-3* to *t-1*, indicating that there is no significant difference between the treatment group and the control group. *Treat*Year* is positively significant in years *t+1* and *t+2* and insignificant in year *t+3*[7]. These results suggest that compared to the control group, the treatment group presents a higher level of bias after the switch year, but from the third year of internationalization, such effects disappear.

#### 4.3.4. Additional tests

For further evidence of the impact of internationalization on analysts' earnings forecast bias, we conduct a series of additional tests.

[5] The sample of the first stage are all firms, including firms tracked and not covered by the analysts, but *Afnum* and *Horizon* only appear in samples tracked by analysts; hence, those two variables are excluded from the the first stage regression.

[6] If a firm is domestic when it first appears in the sample, but does starts to have a foreign subsidiary in all the subsequent years, it switches from domestic to international. As few have switched from international firms to domestic ones, thus this scenario is not considered in the test.

[7] $Year_{t+3}$ denotes the third year after the switch year and subsequent years.

**Table 3**
Results of Heckman two-stage model.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | select | *Bias* | *Bias* | *Bias* |
| Variables | 1st stage | 2nd stage | 2nd stage | 2nd stage |
| *FORDUM* | | 0.0034** | | |
| | | (2.36) | | |
| *FORSUB* | | | 0.0027** | |
| | | | (2.14) | |
| *FORCOU* | | | | 0.0072*** |
| | | | | (3.70) |
| *Afnum* | | −0.0015* | −0.0051*** | −0.0053*** |
| | | (−1.92) | (−3.53) | (−3.64) |
| *Horizon* | | 0.0059*** | 0.0036 | 0.0038 |
| | | (3.35) | (1.04) | (1.09) |
| *Size* | 1.0534*** | −0.0046*** | −0.0035** | −0.0037** |
| | (20.40) | (−4.15) | (−2.23) | (−2.37) |
| *Surprise* | −0.2291*** | −0.0375*** | −0.0384*** | −0.0384*** |
| | (−2.85) | (−14.30) | (−9.72) | (−9.78) |
| *Loss* | −0.1683* | 0.0512*** | 0.0489*** | 0.0484*** |
| | (−1.82) | (11.80) | (6.30) | (6.23) |
| *Roavol* | −0.0009 | 0.0003*** | 0.0003*** | 0.0003*** |
| | (−1.09) | (8.12) | (5.06) | (5.05) |
| *Retvol* | −9.6537*** | −0.0455 | −0.0800 | −0.0768 |
| | (−5.72) | (−1.01) | (−1.13) | (−1.08) |
| *Intang* | 0.0727 | −0.0083 | −0.0062 | −0.0075 |
| | (0.16) | (−0.81) | (−0.39) | (−0.47) |
| *Insti* | 0.0083*** | −0.0000 | −0.0001 | −0.0001 |
| | (5.81) | (−0.08) | (−1.53) | (−1.45) |
| *DA* | −0.7350 | 0.0114 | 0.0249 | 0.0274 |
| | (−1.47) | (0.74) | (1.06) | (1.17) |
| *CGscore* | 0.0509** | −0.0011* | −0.0006 | −0.0008 |
| | (2.25) | (−1.95) | (−0.61) | (−0.75) |
| *Age* | −0.4320*** | −0.0057* | −0.0105** | −0.0103** |
| | (−3.26) | (−1.82) | (−2.38) | (−2.32) |
| *Crosslist* | 0.0654 | 0.0024 | 0.0013 | 0.0011 |
| | (0.32) | (0.74) | (0.35) | (0.31) |
| *FORprovince* | 0.3801* | | | |
| | (1.81) | | | |
| *IMR* | | −0.0113** | −0.0261*** | −0.0253*** |
| | | (−2.18) | (−3.12) | (−3.05) |
| *Industry* | Controlled | Controlled | Controlled | Controlled |
| *Year* | Controlled | Controlled | Controlled | Controlled |
| *Constant* | −21.3570*** | 0.0994*** | 0.1104** | 0.1072** |
| | (−17.80) | (3.32) | (2.50) | (2.43) |
| *Observations* | 4842 | 4035 | 1825 | 1825 |
| *Pseudo* $R^2$/ $R^2$ | 0.2618 | 0.3710 | 0.3610 | 0.3646 |

In parentheses are t-values (or z-values) based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

(1) Alternative measurement of analysts' earnings forecast bias

First, we use the median of analysts' earnings forecasts. The analysts' earnings forecast bias used in the main regression is calculated using the mean value of each analyst's latest forecast. Following (Hong and Kacperczyk, 2010), the medians of the latest earnings forecasts are adopted in the robustness test. The results are presented in columns (1) to (3) of Table 8. After replacing the measurement of analysts' earnings forecast bias, the estimated coefficients of *FORDUM*, *FORSUB*, and *FORCOU* are positive and significant. In other words, the higher the internationalization level, the greater the analysts' earnings forecast bias, which is consistent with our main regression results.

Second, we use the dispersion of analysts' earnings forecasts. The dispersion of analysts' earnings forecasts is the standard deviation of different analysts' earnings forecasts for the same company, which reflects the differences in opinion among analysts. It is generally believed that dispersion is positively related to bias (Lang and Lundholm, 1996). To test the robustness of our main regression results, following Lang and Lundholm (1996) and Duru and Reeb (2002), we calculate the dispersion of analysts' earnings forecasts using Eq. (6):

$$Dispersion_{it} = \frac{SD_{it}}{P_{it-1}} \tag{6}$$

$SD_{it}$ is the standard deviation of the analysts' latest forecasts for annual earnings per share. We replace *Bias* with

**Table 4**
Results of Treatment effect model.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | select | *Bias* | *Bias* | *Bias* |
| Variables | 1st stage | 2nd stage | 2nd stage | 2nd stage |
| *L.Size* | 0.4430*** | | | |
| | (19.21) | | | |
| *L.ROA* | −0.0091** | | | |
| | (−2.20) | | | |
| *L.Lev* | −0.0041*** | | | |
| | (−2.74) | | | |
| *L.CAPX* | −0.4294*** | | | |
| | (−3.43) | | | |
| *L.MB* | −0.2053*** | | | |
| | (−7.88) | | | |
| *FORDUM* | | 0.0293*** | | |
| | | (3.39) | | |
| *FORSUB* | | | 0.0030* | |
| | | | (1.65) | |
| *FORCOU* | | | | 0.0080*** |
| | | | | (2.62) |
| *Afnum* | | −0.0012 | −0.0056*** | −0.0058*** |
| | | (−1.50) | (−2.97) | (−3.05) |
| *Horizon* | | 0.0061*** | 0.0038 | 0.0040 |
| | | (3.98) | (1.18) | (1.24) |
| *Size* | | −0.0061*** | −0.0034 | −0.0036* |
| | | (−4.10) | (−1.63) | (−1.76) |
| *Surprise* | | −0.0376*** | −0.0381*** | −0.0381*** |
| | | (−19.57) | (−8.73) | (−8.78) |
| *Loss* | | 0.0513*** | 0.0502*** | 0.0495*** |
| | | (17.89) | (5.47) | (5.36) |
| *Roavol* | | 0.0003*** | 0.0002*** | 0.0002*** |
| | | (10.57) | (4.53) | (4.52) |
| *Retvol* | | −0.0076 | −0.0367 | −0.0377 |
| | | (−0.16) | (−0.52) | (−0.53) |
| *Intang* | | −0.0064 | −0.0065 | −0.0078 |
| | | (−0.54) | (−0.32) | (−0.38) |
| *Insti* | | 0.0000 | −0.0001 | −0.0001 |
| | | (0.45) | (−1.22) | (−1.16) |
| *DA* | | 0.0117 | 0.0274 | 0.0298 |
| | | (0.82) | (1.11) | (1.22) |
| *CGscore* | | −0.0012** | −0.0007 | −0.0009 |
| | | (−2.11) | (−0.45) | (−0.55) |
| *Age* | | −0.0100*** | −0.0104 | −0.0102 |
| | | (−2.89) | (−1.49) | (−1.45) |
| *Crosslist* | | 0.0001 | 0.0022 | 0.0019 |
| | | (0.05) | (0.32) | (0.28) |
| *Hazard* | | −0.0158*** | −0.0311*** | −0.0298*** |
| | | (−2.96) | (−2.86) | (−2.76) |
| *Industry* | Controlled | Controlled | Controlled | Controlled |
| *Year* | Controlled | Controlled | Controlled | Controlled |
| *Constant* | −4.0142*** | 0.1307*** | 0.1068* | 0.1040* |
| | (−18.99) | (3.52) | (1.93) | (1.88) |
| *Observations* | 4058 | 4058 | 1825 | 1825 |
| *Pseudo* $R^2$/ $R^2$ | 0.0820 | 0.3658 | 0.3564 | 0.3608 |

In parentheses are t-values(or z-values) based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

**Table 5**
Forecast bias of domestic firms and multinationals before and after matching.

| Variable sample | Treated group | Control group | Difference | S.E. | T-value |
|---|---|---|---|---|---|
| *Bias unmatched* | 0.0412 | 0.0392 | 0.0020 | 0.0016 | 1.21 |
| *ATT* | 0.0414 | 0.0361 | 0.0053 | 0.0022 | 2.35 |

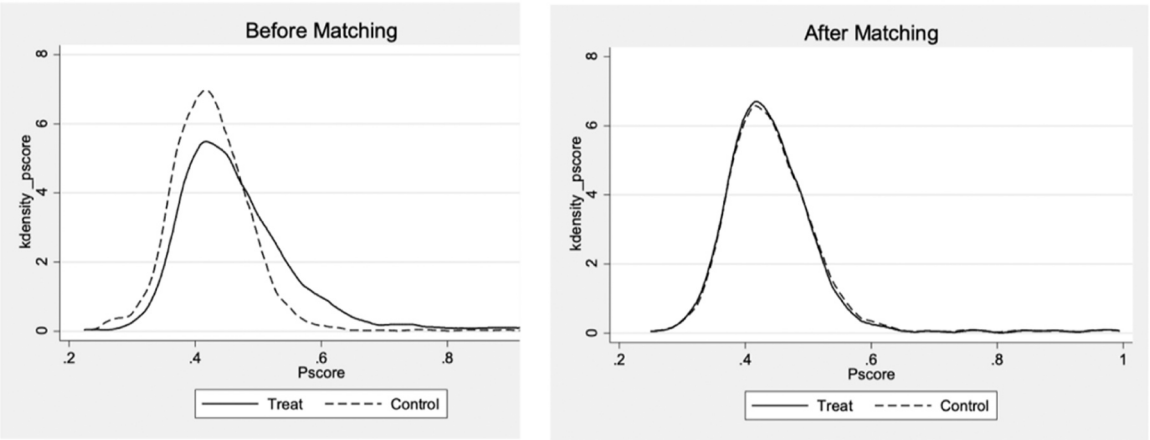


**Fig. 1.** Probability density function graph. The left and right parts of Fig. 1 show the probability density function graph before and after PSM, respectively. The horizontal axis is the propensity score, and the vertical axis is the probability density. The solid and dotted lines represent the density function graph of the Treat (multinational) and Control (domestic) firms, respectively.

**Table 6**
Regression results using PSM.

| | (1) | (2) | (3) |
|---|---|---|---|
| Variables | Bias | Bias | Bias |
| *FORDUM* | 0.0069** | | |
| | (2.52) | | |
| *FORSUB* | | 0.0049*** | |
| | | (3.31) | |
| *FORCOU* | | | 0.0073*** |
| | | | (3.62) |
| *Afnum* | −0.0010 | −0.0011 | −0.0011 |
| | (−0.70) | (−0.72) | (−0.76) |
| *Horizon* | 0.0064*** | 0.0064*** | 0.0064*** |
| | (2.90) | (2.92) | (2.93) |
| *Size* | −0.0027 | −0.0033* | −0.0034* |
| | (−1.45) | (−1.84) | (−1.93) |
| *Surprise* | −0.0342*** | −0.0342*** | −0.0339*** |
| | (−8.66) | (−8.68) | (−8.68) |
| *Loss* | 0.0500*** | 0.0495*** | 0.0497*** |
| | (7.44) | (7.38) | (7.43) |
| *Roavol* | 0.0003*** | 0.0003*** | 0.0003*** |
| | (5.06) | (5.01) | (5.03) |
| *Retvol* | −0.0722 | −0.0752 | −0.0707 |
| | (−1.09) | (−1.13) | (−1.07) |
| *Intangible* | −0.0225 | −0.0202 | −0.0221 |
| | (−1.31) | (−1.17) | (−1.29) |
| *Insti* | 0.0000 | 0.0000 | 0.0000 |
| | (0.22) | (0.31) | (0.37) |
| *DA* | 0.0220 | 0.0259 | 0.0254 |
| | (0.92) | (1.09) | (1.07) |
| *CGscore* | −0.0021 | −0.0023* | −0.0024* |
| | (−1.57) | (−1.69) | (−1.74) |
| *Age* | −0.0036 | −0.0033 | −0.0032 |
| | (−0.53) | (−0.49) | (−0.47) |
| *Crosslist* | 0.0034 | 0.0026 | 0.0024 |
| | (0.52) | (0.42) | (0.38) |
| *Industry* | Controlled | Controlled | Controlled |
| *Year* | Controlled | Controlled | Controlled |
| *Constant* | 0.0424 | 0.0555 | 0.0564 |
| | (0.87) | (1.16) | (1.18) |
| *Observations* | 2054 | 2054 | 2054 |
| *R-squared* | 0.3370 | 0.3389 | 0.3410 |
| *F* | 16.20 | 16.21 | 16.28 |

In parentheses are t-values based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

**Table 7**
Results of DID and parallel trend.

| | (1) | (2) |
|---|---|---|
| Variables | *Bias* | *Bias* |
| *TREAT* | 0.0012 | 0.0017 |
| | (0.38) | (0.53) |
| *POST* | 0.0040 | 0.0076* |
| | (0.83) | (1.65) |
| *TREAT*POST* | 0.0087* | |
| | (1.78) | |
| Treat*Yeart$_{-3}$ | | 0.0011 |
| | | (0.20) |
| Treat*Yeart$_{-2}$ | | −0.0008 |
| | | (−0.16) |
| Treat*Yeart$_{-1}$ | | 0.0054 |
| | | (1.09) |
| *Treat*Year$_{t+1}$* | | 0.0131* |
| | | (1.89) |
| *Treat*Year$_{t+2}$* | | 0.0114* |
| | | (1.74) |
| *Treat*Year$_{t+3}$* | | 0.0077 |
| | | (0.99) |
| *Afnum* | −0.0011 | −0.0011 |
| | (−0.73) | (−0.76) |
| *Horizon* | 0.0062* | 0.0060* |
| | (1.95) | (1.86) |
| *Size* | −0.0054*** | −0.0056*** |
| | (−2.72) | (−2.83) |
| *Surprise* | −0.0401*** | −0.0403*** |
| | (−9.20) | (−9.32) |
| *Loss* | 0.0635*** | 0.0634*** |
| | (8.02) | (8.06) |
| *Roavol* | 0.0003*** | 0.0003*** |
| | (4.26) | (4.33) |
| *Retvol* | 0.0403 | 0.0472 |
| | (0.49) | (0.57) |
| *Intangible* | −0.0158 | −0.0136 |
| | (−0.61) | (−0.53) |
| *Insti* | 0.0000 | 0.0000 |
| | (0.54) | (0.56) |
| *DA* | −0.0018 | −0.0024 |
| | (−0.08) | (−0.10) |
| *CGscore* | −0.0019* | −0.0020* |
| | (−1.82) | (−1.90) |
| *Age* | −0.0204*** | −0.0202*** |
| | (−2.99) | (−2.99) |
| *Crosslist* | −0.0264*** | −0.0270*** |
| | (−4.56) | (−4.60) |
| *Constant* | 0.1402*** | 0.1436*** |
| | (2.75) | (2.85) |
| *Industry* | Controlled | Controlled |
| *Year* | Controlled | Controlled |
| *Observations* | 1344 | 1344 |
| *R-squared* | 0.4230 | 0.4251 |
| *F* | 15.58 | 14.11 |

In parentheses are t-values based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

*Dispersion* in Eqs. (1) to (3) and regress *Dispersion* on *FORDUM*, *FORSUB*, and *FORCOU* respectively. The regression results are shown in columns (4) to (6) of Table 8. *FORDUM*, *FORSUB*, and *FORCOU* are positively related to *Dispersion*, and all are significant at the 95 % confidence interval, indicating that, compared with domestic firms, the dispersion of analysts' earnings forecasts is stronger for multinationals, and the higher the internationalization levels, the greater the dispersion, which is consistent with the main results of our research.

(2) Alternative estimation methods

In the final set of additional tests, we employ alternative estimation methods. To alleviate the effects of omitted variables and firm heterogeneity on the regression results, we use a fixed-effect model. Before this, the Hausman test is performed, and the Chi-square values are 65.8, 42.5, and 42.28 for Eq. (1), Eq. (2), and Eq. (3), respectively (corresponding p-values are 0.0002, 0.0090, and 0.0408), indicating that a fixed-effect model is appropriate. The results of the fixed-effect model are shown in

**Table 8**
Results of alternative measures.

| *Variables* | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | *Biasmed* | *Biasmed* | *Biasmed* | *Dispersion* | *Dispersion* | *Dispersion* |
| *FORDUM* | 0.0048** | | | 0.0021* | | |
| | (2.40) | | | (1.74) | | |
| *FORSUB* | | 0.0027* | | | 0.0039** | |
| | | (1.66) | | | (2.28) | |
| *FORCOU* | | | 0.0071*** | | | 0.0078*** |
| | | | (2.62) | | | (2.77) |
| *Afnum* | −0.0031*** | −0.0063*** | −0.0064*** | 0.0010 | −0.0008 | −0.0009 |
| | (−3.12) | (−3.52) | (−3.61) | (1.43) | (−0.53) | (−0.59) |
| *Horizon* | 0.0062*** | 0.0041 | 0.0042 | −0.0030* | −0.0055** | −0.0053* |
| | (3.61) | (1.16) | (1.20) | (−1.65) | (−1.97) | (−1.91) |
| *Size* | −0.0026** | 0.0010 | 0.0006 | −0.0012 | −0.0002 | −0.0005 |
| | (−2.04) | (0.47) | (0.31) | (−1.48) | (−0.13) | (−0.27) |
| *Surprise* | −0.0417*** | −0.0435*** | −0.0435*** | −0.0111*** | −0.0127*** | −0.0127*** |
| | (−13.85) | (−9.26) | (−9.29) | (−5.69) | (−5.01) | (−5.02) |
| *Loss* | 0.0526*** | 0.0528*** | 0.0522*** | 0.0154*** | 0.0110* | 0.0105* |
| | (9.88) | (5.47) | (5.39) | (4.99) | (1.80) | (1.72) |
| *Roavol* | 0.0003*** | 0.0002*** | 0.0002*** | 0.0002*** | 0.0001*** | 0.0001*** |
| | (6.59) | (4.58) | (4.57) | (6.76) | (2.62) | (2.62) |
| *Retvol* | −0.0542 | −0.0575 | −0.0572 | −0.0145 | −0.0317 | −0.0309 |
| | (−1.10) | (−0.76) | (−0.76) | (−0.38) | (−0.52) | (−0.50) |
| *Intangible* | −0.0081 | 0.0037 | 0.0023 | 0.0019 | −0.0134 | −0.0155 |
| | (−0.58) | (0.17) | (0.11) | (0.21) | (−0.77) | (−0.90) |
| *Insti* | 0.0000 | −0.0001 | −0.0001 | −0.0000 | −0.0000 | −0.0000 |
| | (0.42) | (−0.73) | (−0.68) | (−0.22) | (−0.34) | (−0.29) |
| *DA* | 0.0180 | 0.0312 | 0.0335 | −0.0032 | 0.0068 | 0.0084 |
| | (1.09) | (1.17) | (1.26) | (−0.27) | (0.33) | (0.41) |
| *CGscore* | −0.0014 | −0.0008 | −0.0010 | −0.0007 | 0.0003 | 0.0002 |
| | (−1.58) | (−0.54) | (−0.64) | (−1.55) | (0.26) | (0.15) |
| *Age* | −0.0046 | −0.0092 | −0.0090 | −0.0043* | −0.0065 | −0.0063 |
| | (−0.98) | (−1.40) | (−1.37) | (−1.65) | (−1.03) | (−1.00) |
| *Crosslist* | 0.0039 | 0.0023 | 0.0021 | −0.0000 | 0.0012 | 0.0011 |
| | (0.68) | (0.36) | (0.34) | (−0.00) | (0.19) | (0.19) |
| *Industry* | Controlled | Controlled | Controlled | Controlled | Controlled | Controlled |
| *Year* | Controlled | Controlled | Controlled | Controlled | Controlled | Controlled |
| *Constant* | 0.0504 | −0.0037 | −0.0025 | 0.0532** | 0.0527 | 0.0524 |
| | (1.50) | (−0.07) | (−0.05) | (2.28) | (1.00) | (1.00) |
| *Observations* | 4058 | 1829 | 1829 | 3882 | 1781 | 1781 |
| *R-squared* | 0.3676 | 0.3455 | 0.3487 | 0.2167 | 0.2207 | 0.2263 |
| *F* | 26.59 | 14.61 | 14.82 | 26.34 | 11.75 | 11.66 |

In parentheses are t-values based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

columns (1) to (3) of Table 9. In addition, following Petersen(2009), we adopt two-way clustering by firm and year to control for cross-sectional and serial dependence. The results are shown in columns (4) to (6) of Table 9. As can be seen, all estimated coefficients of *FORDUM*, *FORSUB*, and *FORCOU* are significantly positive. The results of the fixed-effects model and two-way clustering validate the findings of the positive association between forecast bias and internationalization.

## 5. Possible channels through which internationalization could affect analysts' earnings forecast bias

The above results show that analysts' earnings forecast bias of multinationals is stronger than that of domestic companies. We conduct further analyses on the mechanisms involved from the perspective of organisational complexity of overseas business, information asymmetry caused by internationalization, and challenges to analysts' competence.

### *5.1. Effect of overseas business complexity*

#### *5.1.1. Effect of motivation complexity*

Unlike their counterparts in developed countries, Chinese MNCs are strongly promoted by the government policies (Buckley et al., 2007; Peng, 2012; Ramamurti and Hillemann, 2018), such as the "Going out" strategy and the Belt and Road Initiative. Compared with non-SOEs, State-owned enterprises (SOEs) are under the guidance of the government and are obliged to fulfill certain social goals. Under such a circumstance, frequent government interventions make it difficult for analysts to make forecasts (Kolstad and Wiig, 2012; Buckley et al., 2007). In the process of internationalization, SOEs need to consider not only the company's interests and strategies but also the achievement of governmental goals, which makes their internationalization drivers more complex. Thus, if the complexity of

**Table 9**
Results of alternative methods.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Fixed effect model | | | Two-way clustering | | |
| Variables | *Bias* | *Bias* | *Bias* | *Bias* | *Bias* | *Bias* |
| *FORDUM* | 0.0090*** | | | 0.0043* | | |
| | (3.48) | | | (1.80) | | |
| *FORSUB* | | 0.0031* | | | 0.0036* | |
| | | (1.75) | | | (1.79) | |
| *FORCOU* | | | 0.0043* | | | 0.0075*** |
| | | | (1.94) | | | (2.61) |
| *Afnum* | −0.0091*** | −0.0091*** | −0.0090*** | −0.0017 | −0.0046* | −0.0047* |
| | (−8.60) | (−8.59) | (−8.57) | (−1.13) | (−1.83) | (−1.88) |
| *Horizon* | 0.0062*** | 0.0063*** | 0.0063*** | 0.0059*** | 0.0045 | 0.0045 |
| | (4.67) | (4.71) | (4.71) | (5.33) | (1.59) | (1.60) |
| *Size* | −0.0118*** | −0.0115*** | −0.0115*** | −0.0019 | −0.0011 | −0.0013 |
| | (−5.81) | (−5.61) | (−5.63) | (−1.49) | (−0.47) | (−0.60) |
| *Surprise* | −0.0325*** | −0.0326*** | −0.0326*** | −0.0384*** | −0.0394*** | −0.0394*** |
| | (−19.93) | (−19.94) | (−19.96) | (−5.43) | (−5.39) | (−5.41) |
| *Loss* | 0.0442*** | 0.0442*** | 0.0442*** | 0.0466*** | 0.0454*** | 0.0450*** |
| | (16.29) | (16.25) | (16.25) | (10.40) | (7.05) | (6.88) |
| *Roavol* | 0.0003*** | 0.0003*** | 0.0003*** | 0.0003*** | 0.0003*** | 0.0003*** |
| | (10.26) | (10.23) | (10.25) | (7.68) | (4.04) | (4.04) |
| *Retvol* | 0.1335*** | 0.1315*** | 0.1318*** | −0.0117 | −0.0534 | −0.0495 |
| | (2.91) | (2.87) | (2.87) | (−0.16) | (−0.50) | (−0.47) |
| *Intangible* | −0.0094 | −0.0110 | −0.0107 | 0.0005 | 0.0240 | 0.0211 |
| | (−0.35) | (−0.42) | (−0.40) | (0.03) | (1.01) | (0.88) |
| *Insti* | −0.0001 | −0.0001 | −0.0001 | −0.0000 | −0.0000 | −0.0000 |
| | (−1.32) | (−1.38) | (−1.35) | (−0.16) | (−0.25) | (−0.23) |
| *DA* | −0.0058 | −0.0058 | −0.0057 | 0.0095 | 0.0105 | 0.0124 |
| | (−0.44) | (−0.44) | (−0.43) | (1.05) | (0.60) | (0.71) |
| *CGscore* | −0.0008 | −0.0006 | −0.0007 | −0.0001 | 0.0002 | 0.0002 |
| | (−0.80) | (−0.67) | (−0.69) | (−0.07) | (0.15) | (0.12) |
| *Age* | −0.0238 | −0.0255 | −0.0257 | −0.0069 | −0.0114* | −0.0113* |
| | (−1.17) | (−1.26) | (−1.27) | (−1.46) | (−1.77) | (−1.77) |
| *Crosslist* | 0.0067 | 0.0063 | 0.0067 | 0.0007 | 0.0023 | 0.0020 |
| | (0.65) | (0.62) | (0.65) | (0.14) | (0.38) | (0.34) |
| *Firm/Industry* | Controlled | Controlled | Controlled | Controlled | Controlled | Controlled |
| *Year* | Controlled | Controlled | Controlled | Controlled | Controlled | Controlled |
| *Constant* | 0.3332*** | 0.3386*** | 0.3418*** | 0.0769* | 0.0480 | 0.0512 |
| | (4.40) | (2.82) | (2.85) | (1.83) | (0.78) | (0.84) |
| *Observations* | 4058 | 1829 | 1829 | 4058 | 1829 | 1829 |
| $R^2$/*Adjusted* $R^2$ | 0.4352 | 0.4126 | 0.4129 | 0.3900 | 0.3702 | 0.3727 |
| *F* | 129.0 | 50.43 | 50.50 | 45.59 | 75.01 | 23.21 |

In parentheses are t-values. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

internationalization drivers affects the quality of analysts' forecasts, the adverse effect of internationalization on analyzing earnings bias will be more pronounced in SOEs.

In order to examine the effect of motivation complexity on analysts' forecast quality, we adopt a dummy variable, *Ownership*, which equals to 1 when the enterprise is owned by the state and 0 otherwise. We put *Ownership* and its intersection term with the independent variable in Eqs. (1), (2) and (3), respectively. Columns (1) to (3) of Table 10 present significant and positive coefficients for all three interaction terms, indicating that the negative influences of internationalization on analysts' forecast bias are more prominent for SOEs than for non-SOEs.

### *5.1.2. Effect of overseas operation complexity*

Operation complexity is an important factor that influences the accuracy of analysts' earnings forecasts (Brown et al., 2015; Godigbe et al., 2024). The more various kinds of activities the MNC engages in, the higher the operation complexity. We use the variety of overseas businesses to proxy overseas operation complexity. Overseas operation complexity increases the difficulty for analysts to get to know the company, hurting the quality of analysts' forecasts. As a result, the negative influences of internationalization on analysts' forecast bias would be more prominent in the sample when companies engage in various kinds of activities.

In order to examine the effect of overseas operation complexity on analysts' forecast bias, first, we divide oversea business scope into four categories: sales, production, investment and financing, and research and development, same as described in Section 4.2. Second, we construct a new dummy variable, *Busiscope*, to proxy operation complexity. *Busiscope* equals 1 if the subsidiary engages in more than one kind of business activity, and 0 otherwise. Third, we discuss the effect of overseas operation complexity. We put

**Table 10**
Effect of motivation complexity.

| | (1) | (2) | (3) |
|---|---|---|---|
| *Variables* | Bias | Bias | Bias |
| *FORDUM* | 0.0021 | | |
| | (0.86) | | |
| *FORDUM*Ownership* | 0.0022* | | |
| | (1.75) | | |
| *FORSUB* | | −0.0023 | |
| | | (−1.09) | |
| *FORSUB*Ownership* | | 0.0107*** | |
| | | (2.84) | |
| *FORCOU* | | | −0.0018 |
| | | | (−0.59) |
| *FORCOU*Ownership* | | | 0.0187*** |
| | | | (3.12) |
| *Ownership* | −0.0050** | −0.0167*** | −0.0240*** |
| | (−2.31) | (−2.87) | (−3.38) |
| *Afnum* | −0.0013* | −0.0050*** | −0.0050*** |
| | (−1.72) | (−2.69) | (−2.72) |
| *Horizon* | 0.0066*** | 0.0041 | 0.0044 |
| | (3.70) | (1.26) | (1.32) |
| *Size* | −0.0028*** | 0.0006 | 0.0002 |
| | (−2.91) | (0.29) | (0.11) |
| *Surprise* | −0.0384*** | −0.0400*** | −0.0398*** |
| | (−14.63) | (−9.08) | (−9.23) |
| *Loss* | 0.0511*** | 0.0484*** | 0.0482*** |
| | (11.86) | (5.28) | (5.29) |
| *Roavol* | 0.0003*** | 0.0002*** | 0.0002*** |
| | (7.72) | (4.41) | (4.49) |
| *Retvol* | −0.0423 | −0.0733 | −0.0725 |
| | (−0.97) | (−1.05) | (−1.04) |
| *Intangible* | −0.0064 | 0.0016 | −0.0013 |
| | (−0.62) | (0.08) | (−0.06) |
| *Insti* | 0.0000 | −0.0001 | −0.0001 |
| | (0.56) | (−0.72) | (−0.77) |
| *DA* | 0.0055 | 0.0232 | 0.0257 |
| | (0.36) | (0.93) | (1.04) |
| *CGscore* | −0.0017*** | −0.0008 | −0.0009 |
| | (−2.74) | (−0.47) | (−0.59) |
| *Age* | −0.0055* | −0.0109 | −0.0112 |
| | (−1.75) | (−1.54) | (−1.58) |
| *Crosslist* | 0.0029 | 0.0016 | 0.0015 |
| | (0.90) | (0.24) | (0.23) |
| *Industry* | Controlled | Controlled | Controlled |
| *Year* | Controlled | Controlled | Controlled |
| *Constant* | 0.0505** | 0.0139 | 0.0219 |
| | (1.96) | (0.24) | (0.38) |
| *Observations* | 4058 | 1829 | 1829 |
| *R-squared* | 0.3674 | 0.3576 | 0.3659 |
| *F* | 35.00 | 15.92 | 16.14 |

In parentheses are t-values based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

*Busiscope* and its interaction terms with the independent variable in Eqs. (2) and (3),[8] respectively. Table 11 presents the results. Columns (1) and (2) report significant and positive coefficients of both interaction terms, indicating that overseas business complexity increases analysts' forecast bias significantly.

### *5.1.3. Effect of overseas accounting complexity*

Since our paper focuses on Chinese firms, we believe that accounting treatment discrepancies would result in bias. Given that the Chinese accounting standards (CAS) have converged to the International Financial Reporting Standards (IFRS) since 2007, the difference between CAS and IFRS is minor. When a host country adopts IFRS, the accounting standard of its local subsidiaries complies with the parent firms in China and we believe the consolidated financial statements are consistent (De George et al., 2016). However, if

[8] Given that only MNCs have foreign subsidiaries, we examine the influence of overseas business complexity based on MNC observations, exclusively. Similarly, we later consider the effect of accounting treatment, the institutional quality in host countries and tax haven subsidiaries based on MNC observations, exclusively.

**Table 11**
Effects of overseas operation complexity and accounting complexity.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Variables | *Bias* | *Bias* | *Bias* | *Bias* |
| *FORSUB* | −0.0040 | | −0.0002 | |
| | (−1.28) | | (−0.10) | |
| *FORCOU* | | 0.0016 | | −0.0004 |
| | | (0.32) | | (−0.12) |
| *FORSUB*Busiscope* | 0.0058** | | | |
| | (2.21) | | | |
| *FORCOU*Busiscope* | | 0.0083* | | |
| | | (1.91) | | |
| *Busiscope* | 0.0067 | −0.0029 | | |
| | (1.40) | (−0.52) | | |
| *FORSUB*Domestic* | | | 0.0043* | |
| | | | (1.70) | |
| *FORCOU*Domestic* | | | | 0.0122*** |
| | | | | (2.71) |
| *Domestic* | | | −0.0013 | −0.0123** |
| | | | (−0.28) | (−2.07) |
| *Afnum* | −0.0052*** | −0.0051*** | −0.0049*** | −0.0049*** |
| | (−3.62) | (−3.57) | (−3.43) | (−3.46) |
| *Horizon* | 0.0043 | 0.0045 | 0.0043 | 0.0045 |
| | (1.23) | (1.26) | (1.21) | (1.29) |
| *Size* | 0.0005 | 0.0001 | 0.0001 | −0.0002 |
| | (0.30) | (0.08) | (0.07) | (−0.15) |
| *Surprise* | −0.0397*** | −0.0398*** | −0.0397*** | −0.0396*** |
| | (−10.02) | (−10.10) | (−10.04) | (−10.12) |
| *Loss* | 0.0482*** | 0.0475*** | 0.0486*** | 0.0482*** |
| | (6.26) | (6.17) | (6.32) | (6.28) |
| *Roavol* | 0.0002*** | 0.0002*** | 0.0002*** | 0.0002*** |
| | (4.79) | (4.79) | (4.89) | (4.94) |
| *Retvol* | −0.0697 | −0.0646 | −0.0683 | −0.0638 |
| | (−1.00) | (−0.93) | (−0.98) | (−0.92) |
| *Intangible* | −0.0014 | −0.0017 | −0.0021 | −0.0002 |
| | (−0.09) | (−0.11) | (−0.13) | (−0.01) |
| *Insti* | −0.0001 | −0.0001 | −0.0001 | −0.0001 |
| | (−1.10) | (−0.97) | (−1.00) | (−1.02) |
| *DA* | 0.0224 | 0.0243 | 0.0205 | 0.0228 |
| | (0.94) | (1.03) | (0.86) | (0.97) |
| *CGscore* | −0.0004 | −0.0006 | −0.0005 | −0.0006 |
| | (−0.39) | (−0.56) | (−0.52) | (−0.60) |
| *Age* | −0.0112** | −0.0108** | −0.0107** | −0.0107** |
| | (−2.52) | (−2.44) | (−2.41) | (−2.40) |
| *Crosslist* | 0.0011 | 0.0008 | 0.0015 | 0.0014 |
| | (0.29) | (0.21) | (0.41) | (0.37) |
| *Industry* | Controlled | Controlled | Controlled | Controlled |
| *Year* | Controlled | Controlled | Controlled | Controlled |
| *Constant* | 0.0073 | 0.0116 | 0.0194 | 0.0265 |
| | (0.16) | (0.25) | (0.42) | (0.58) |
| *Observations* | 1829 | 1829 | 1829 | 1829 |
| *R-squared* | 0.3525 | 0.3568 | 0.3539 | 0.3588 |
| *F* | 15.06 | 15.25 | 15.38 | 15.76 |

In parentheses are t-values based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

a host country follows its local accounting standards instead of IFRS, the accounting treatment is regarded as different from that in China. We use whether IFRS is adopted to measure accounting complexity. If accounting treatment plays a vital role in the association between internationalization and analysts' predictions, we would find the negative association is more prominent in the sample using local accounting standards.

First, we find whether a host country adopts the IFRS or local accounting standards. Following De George et al. (2016), we obtain the data for accounting standards before 2013 and collect the data after 2013 from the IASB website. We then construct a dummy variable, *Domestic,* which equals to 1 when a subsidiary follows local accounting standards instead of IFRS, and 0 otherwise. Then we put *Domestic* and its interaction terms with the independent variable in Eqs. (2) and (3), respectively. Columns (3) and (4) of Table 11 present significant and positive estimators of both interaction terms, indicating that the accounting complexity increases analysts' forecast bias.

### 5.2. Effect of information asymmetry

Information asymmetry between management and analysts is a key factor that affects analysts' prediction accuracy. During the process of internationalization, information asymmetry exacerbates due to increasing managerial discretion, earnings management, and incomplete disclosure in terms of international business. We explore the impact of information asymmetry caused by international business on analysts' behaviour from three perspectives: corporate governance, the host country's institutional environment, and whether the host country (region) is a tax haven.

#### 5.2.1. Effect of corporate governance

Corporate governance plays a vital role in MNC operations (Agnihotri and Bhattacharya, 2019). It helps reduce information asymmetry and external supervision costs. It can also monitor and constrain management behaviour, increase management voluntary disclosure and information transparency, and transmit more information to the market. Thus, it provides reliable information for outsiders to evaluate a company's decisions and outcomes. Therefore, we test the impact of corporate governance on the association between internationalization and analysts' earnings forecasts.

Following Gompers et al. (2003), we adopt the principal component analysis method to measure corporate governance level. We construct a 3-dimension measurement that includes shareholding structure and rights, management governance, directors, supervisors, and other governance. There are 12 specific indicators for measuring governance. The load coefficient of each variable is consistent with the theoretical prediction.[9] We divide the sample into two groups based on the annual median of the governance score. When a firm's corporate governance score is greater than the annual median, its corporate governance is assigned a value of one ($CG = 1$); otherwise, it is assigned a value of zero ($CG = 0$). We add *CG* and its interaction term with the independent variables to Eqs. (1), (2) and (3), respectively. Columns (1) – (3) of Table 12 present the results. We find that all the coefficients of the interaction terms are significant and negative, indicating that corporate governance can mitigate the influences of internationalization on analysts' forecasts. In other words, good corporate governance can improve the accuracy of analysts' predictions.

#### 5.2.2. Effect of institutional quality in the host country

Duru and Reeb (2002) point out that international markets outside the United States should not be treated as homogeneous. Government regulations substantially influence the behaviour of MNCs, which further affects analysts' forecast behaviour. In common-law countries, investor protection and information disclosure are more well-established than in civil-law countries. Consequently, firms located in the former tend to have fewer earnings management behaviours and higher accounting information quality (Chin et al., 2009).

First, regulators in host countries can facilitate parent companies' supervision of their foreign subsidiaries. Shroff et al. (2014) point out that supervision can reduce the possibility of local management taking advantage of arbitrage opportunities, improve the effectiveness of investment decisions made by overseas managers, and alleviate agency problems caused by international operations. Meanwhile, the institutional environment in the host country can motivate foreign branches to disclose information highly relevant to the interests of investors with quality and in large quantities, enabling domestic and foreign investors to better understand the entire operational and financial situation of overseas business and thus reduce the degree of information asymmetry of MNCs (Cannizzaro and Weiner, 2018). Finally, well-developed institutions can reduce parent firms' abuse such as income transfer and earnings management through overseas subsidiaries (Choi and Jiang, 2009; Huang, 2018). Therefore, foreign subsidiaries will have less information asymmetry when operating in countries (regions) with regulators, which benefits analysts' earnings forecasts to a certain extent.

To further examine the impact of the host country's institutional quality on analysts' forecast bias, we use the World Governance Index (WGI) released by the World Bank to measure the institutional quality of the host country. The WGI[10] consists of six indicators. They are voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. Each indicator ranges from −2.5–2.5. The higher the WGI, the better the institutional quality. To measure institutional quality, following Dyreng et al. (2013) and Attig et al. (2016), we use the average score of the six indicators for each country (region). Second, weighting the number of overseas subsidiaries, we calculate the average score of institutional quality and divide the samples into good ($Wgsub = 1$) and poor ($Wgsub = 0$) groups, according to the median of the average score. Third, weighting the number of host countries, we calculate the average score and divide the samples into good ($Wgcou=1$) and poor groups ($Wgcou =0$), according to the median of the average score. Four, we add *Wgsub*, *Wgcou* and its interaction terms with the independent variable (*FORSUB*Wgsub* and *FORCOU*Wgcou*) in Eqs. (2) and (3), respectively. Columns (4) and (5) of Table 12 both present significant and negative coefficients, indicating that the institution quality in the host country has significant influences. We conclude that a well-designed local institution could alleviate the negative impacts of internationalization on analysts' predictions.

#### 5.2.3. Effect of tax haven subsidiaries

Multinationals tend to transfer income from countries (regions) with high tax rates to those with low tax rates, especially when overseas subsidiaries are established in regions with low tax rates (Klassen et al., 2014). Tax havens provide a natural cradle for income transfer and tax avoidance (Taylor et al., 2015). The purpose of establishing subsidiaries in tax havens is usually to reduce taxes rather than to conduct business activities. To cover up income transfer, management will increase the opacity of financial reports (Akamah

[9] The indicators and loading factors are listed in Appendix 3.

[10] http://info.worldbank.org /governance/wgi/index.aspx#home

**Table 12**
Effects of corporate governance and institutional quality in the host countries.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Variables | Bias | Bias | Bias | Bias | Bias |
| *FORdum* | 0.0063*** | | | | |
| | (3.40) | | | | |
| *FORdum*CG* | −0.0053* | | | | |
| | (−1.95) | | | | |
| *FORSUB* | | 0.0043*** | | 0.0060*** | |
| | | (2.69) | | (3.43) | |
| *FORSUB*CG* | | −0.0024* | | | |
| | | (−1.95) | | | |
| *FORCOU* | | | 0.0084*** | | 0.0122*** |
| | | | (3.52) | | (4.69) |
| *FORCOU*CG* | | | −0.0017* | | |
| | | | (−1.74) | | |
| *CG* | 0.0051** | 0.0027 | 0.0012 | | |
| | (2.19) | (0.55) | (0.20) | | |
| *FORSUB*Wgsub* | | | | −0.0055* | |
| | | | | (−1.89) | |
| *Wgsub* | | | | 0.0092** | |
| | | | | (2.07) | |
| *FORCOU*Wgcou* | | | | | −0.0101* |
| | | | | | (−1.78) |
| *Wgcou* | | | | | 0.0157*** |
| | | | | | (2.58) |
| *Afnum* | −0.0013* | −0.0046*** | −0.0047*** | −0.0045*** | −0.0046*** |
| | (−1.68) | (−3.25) | (−3.36) | (−3.06) | (−3.14) |
| *Horizon* | 0.0060*** | 0.0040 | 0.0041 | 0.0046 | 0.0046 |
| | (3.39) | (1.12) | (1.17) | (1.29) | (1.31) |
| *Size* | −0.0029*** | −0.0004 | −0.0007 | −0.0012 | −0.0015 |
| | (−3.06) | (−0.28) | (−0.44) | (−0.71) | (−0.94) |
| *Surprise* | −0.0383*** | −0.0398*** | −0.0398*** | −0.0396*** | −0.0395*** |
| | (−14.75) | (−10.11) | (−10.17) | (−10.32) | (−10.39) |
| *Loss* | 0.0501*** | 0.0470*** | 0.0466*** | 0.0453*** | 0.0451*** |
| | (11.69) | (6.04) | (5.99) | (6.02) | (6.00) |
| *Roavol* | 0.0003*** | 0.0002*** | 0.0002*** | 0.0002*** | 0.0003*** |
| | (8.03) | (4.96) | (4.94) | (4.84) | (4.95) |
| *Retvol* | −0.0657 | −0.1111 | −0.1057 | −0.0469 | −0.0452 |
| | (−1.49) | (−1.58) | (−1.50) | (−0.66) | (−0.64) |
| *Intangible* | −0.0052 | −0.0018 | −0.0033 | 0.0275 | 0.0241 |
| | (−0.51) | (−0.11) | (−0.20) | (1.35) | (1.19) |
| *Insti* | 0.0000 | −0.0000 | −0.0000 | −0.0000 | −0.0000 |
| | (0.36) | (−0.72) | (−0.65) | (−0.32) | (−0.28) |
| *DA* | 0.0094 | 0.0199 | 0.0223 | 0.0083 | 0.0104 |
| | (0.61) | (0.85) | (0.95) | (0.35) | (0.44) |
| *CGscore* | −0.0003 | −0.0005 | −0.0007 | 0.0002 | 0.0001 |
| | (−0.42) | (−0.34) | (−0.48) | (0.22) | (0.11) |
| *Age* | −0.0059* | −0.0113** | −0.0111** | −0.0107** | −0.0108** |
| | (−1.88) | (−2.54) | (−2.50) | (−2.27) | (−2.30) |
| *Crosslist* | 0.0017 | 0.0001 | 0.0001 | 0.0029 | 0.0024 |
| | (0.53) | (0.04) | (0.02) | (0.71) | (0.60) |
| *Industry* | Controlled | Controlled | Controlled | Controlled | Controlled |
| *Year* | Controlled | Controlled | Controlled | Controlled | Controlled |
| *Constant* | 0.0536** | 0.0294 | 0.0283 | 0.0375 | 0.0390 |
| | (2.08) | (0.68) | (0.66) | (0.81) | (0.84) |
| *Observations* | 4058 | 1829 | 1829 | 1829 | 1829 |
| *R-squared* | 0.3719 | 0.3584 | 0.3620 | 0.3962 | 0.4001 |
| *F* | 33.54 | 14.65 | 14.78 | 25.19 | 22.19 |

In parentheses are t-values based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

et al., 2018), thus increasing the information asymmetry between management and external stakeholders. At the same time, when a company sets up subsidiaries in tax havens, the quality of information disclosure also declines. When foreign subsidiaries can provide opportunities for earnings management, the company strengthens its control over its financial policies and makes full use of subsidiaries to improve performance, transfer assets, and avoid taxes (Beuselinck et al., 2019). Transferring income to tax havens also increases the opacity of corporate disclosure (Balakrishnan et al., 2019). Making investments in tax havens adversely affects firm transparency (Bennedsen and Zeume, 2018).

To discuss the impact of information asymmetry on the association between internationalization and analysts' earnings forecasts analysts' forecasts from the use of tax havens, we set up a new dummy variable, *Taxhaven*. If a MNC has subsidiaries located in tax

**Table 13**
Effects of tax haven subsidiaries.

| | (1) | (2) |
|---|---|---|
| Variables | *Bias* | *Bias* |
| *FORSUB* | −0.0048* | |
| | (−1.69) | |
| *FORSUB*Taxhaven* | 0.0061*** | |
| | (2.83) | |
| *FORCOU* | | −0.0031 |
| | | (−0.49) |
| *FORCOU*Taxhaven* | | 0.0069* |
| | | (1.77) |
| *Taxhaven* | 0.0110*** | 0.0102** |
| | (2.72) | (2.23) |
| *Afnum* | −0.0043** | −0.0045** |
| | (−2.36) | (−2.49) |
| *Horizon* | 0.0039 | 0.0041 |
| | (1.18) | (1.23) |
| *Size* | −0.0009 | −0.0010 |
| | (−0.43) | (−0.52) |
| *Surprise* | −0.0399*** | −0.0399*** |
| | (−9.22) | (−9.23) |
| *Loss* | 0.0467*** | 0.0465*** |
| | (5.09) | (5.05) |
| *Roavol* | 0.0002*** | 0.0002*** |
| | (4.66) | (4.59) |
| *Retvol* | −0.1000 | −0.1012 |
| | (−1.43) | (−1.44) |
| *Intangible* | −0.0003 | 0.0014 |
| | (−0.01) | (0.07) |
| *Insti* | −0.0000 | −0.0000 |
| | (−0.45) | (−0.39) |
| *DA* | 0.0161 | 0.0200 |
| | (0.66) | (0.82) |
| *CGscore* | −0.0006 | −0.0006 |
| | (−0.38) | (−0.39) |
| *Age* | −0.0113 | −0.0112 |
| | (−1.59) | (−1.58) |
| *Crosslist* | 0.0005 | 0.0002 |
| | (0.08) | (0.04) |
| *Industry* | Controlled | Controlled |
| *Year* | Controlled | Controlled |
| *Constant* | 0.0395 | 0.0395 |
| | (0.71) | (0.71) |
| *Observations* | 1829 | 1829 |
| *R-squared* | 0.3645 | 0.3656 |
| *F* | 14.57 | 14.76 |

In parentheses are t-values based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

havens, *Taxhaven* is 1; otherwise, it is 0. We add *Taxhaven* and its interaction terms with the independent variable in Eqs. (2) and (3), respectively. Columns (1) and (2) of Table 13 demonstrate the effect of tax haven subsidiaries. We find that both estimators are significant and positive, indicating that tax haven investments aggravate information asymmetry between management and analysts, increasing forecast bias. This result is in line with the spirit of Akamah et al. (2018), who find that MNCs with tax-haven subsidiaries are more inclined to crude and opaque disclosure of foreign operations.

### 5.3. Impact of analyst competence

The increasing difficulty and complexity of earnings forecasts caused by international operations challenges analysts' competence in forecasting accuracy. To test whether analyst competence can minimise adverse effects, we calculate the bias in earnings forecasts at the analyst level (*PMAFE*) following Clement (1999). The calculation method is given by Eq. (7):

$$PMAFE_{ijt} = \frac{AFE_{ijt} - \overline{AFE_{jt}}}{\overline{AFE_{jt}}} \tag{7}$$

$AFE_{ijt}$ is the absolute value of forecast bias of analyst $i$ for company $j$ in year $t$. $\overline{AFE_{jt}}$ is the mean of absolute value of $AFE_{ijt}$, referring to the forecast bias of all analysts for company $j$ in year $t$. The higher the value of $PMAFE_{ijt}$, the stronger the bias and the less accurate

**Table 14**
Effects of analyst competence.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| *Variables* | PMAFE | PMAFE | PMAFE | PMAFE |
| *FORDUM* | 0.0140** | 0.0067 | 0.0134* | 0.0215** |
| | (2.32) | (0.40) | (1.89) | (1.98) |
| *FORDUM*Spec* | | 0.0111 | | |
| | | (0.46) | | |
| *FORDUM*Star* | | | 0.0030 | |
| | | | (0.15) | |
| *FORDUM*Experience* | | | | −0.0028* |
| | | | | (−1.80) |
| *Spec* | −0.0672*** | −0.0726*** | −0.0671*** | −0.0674*** |
| | (−4.36) | (−3.47) | (−4.36) | (−4.37) |
| *Star* | −0.0400*** | −0.0399*** | −0.0415*** | −0.0401*** |
| | (−3.98) | (−3.98) | (−2.85) | (−4.00) |
| *Experience* | −0.0094*** | −0.0094*** | −0.0094*** | −0.0078*** |
| | (−5.09) | (−5.10) | (−5.09) | (−2.85) |
| *Coverage* | −0.0006*** | −0.0006*** | −0.0006*** | −0.0006*** |
| | (−3.80) | (−3.80) | (−3.80) | (−3.80) |
| *Horizona* | 0.3405*** | 0.3405*** | 0.3405*** | 0.3405*** |
| | (33.26) | (33.27) | (33.26) | (33.26) |
| *Size* | 0.0212*** | 0.0212*** | 0.0212*** | 0.0212*** |
| | (4.71) | (4.72) | (4.71) | (4.71) |
| *Surprise* | 0.0383*** | 0.0382*** | 0.0383*** | 0.0382*** |
| | (4.58) | (4.57) | (4.58) | (4.55) |
| *Loss* | 0.0101 | 0.0101 | 0.0101 | 0.0099 |
| | (0.77) | (0.77) | (0.77) | (0.76) |
| *Roavol* | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| | (0.90) | (0.88) | (0.90) | (0.90) |
| *Retvol* | 0.5779** | 0.5765** | 0.5776** | 0.5782** |
| | (2.46) | (2.45) | (2.46) | (2.46) |
| *Intangble* | −0.0195 | −0.0217 | −0.0194 | −0.0198 |
| | (−0.46) | (−0.51) | (−0.45) | (−0.46) |
| *Insti* | 0.0003 | 0.0003 | 0.0003 | 0.0003 |
| | (1.61) | (1.61) | (1.61) | (1.60) |
| *DA* | −0.1082* | −0.1074* | −0.1083* | −0.1081* |
| | (−1.78) | (−1.77) | (−1.78) | (−1.78) |
| *Cgscore* | 0.0018 | 0.0018 | 0.0018 | 0.0018 |
| | (0.79) | (0.77) | (0.79) | (0.80) |
| *Age* | 0.0279* | 0.0277* | 0.0279* | 0.0282* |
| | (1.87) | (1.86) | (1.87) | (1.89) |
| *Crosslist* | −0.0108 | −0.0109 | −0.0108 | −0.0104 |
| | (−1.04) | (−1.05) | (−1.04) | (−1.00) |
| *Industry* | Controlled | Controlled | Controlled | Controlled |
| *Year* | Controlled | Controlled | Controlled | Controlled |
| *Constant* | −2.3394*** | −2.3348*** | −2.3391*** | −2.3446*** |
| | (−17.78) | (−17.88) | (−17.79) | (−17.83) |
| *Observations* | 39,501 | 39,501 | 39,501 | 39,501 |
| *R-squared* | 0.1391 | 0.1391 | 0.1391 | 0.1391 |
| *F* | 43.13 | 42.09 | 42.24 | 41.99 |

In parentheses are t-values based on robust standard errors clustered at the firm level. ***, **, and * stand for statistical significance based on two-sided tests at the 1 %, 5 %, and 10 % level, respectively.

the forecast is. To test the impact of internationalization on the bias in earnings forecasts at the analyst level, we run Eq. (8):

$$PMAFE_{ijt} = \alpha_0 + \alpha_1 FORDUM_{it} + Analystcontrols_{ijt} + Controls_{it} + \sum Industry + \sum Year + \varepsilon_{it} \quad (8)$$

*Analystcontrols* are the control variables at the analyst level, including analyst industry expertise (*Spec*), whether the analyst is a star analyst (*Star*), analyst experience (*Experience*), the number of companies covered by that analyst (*Cover*), and analyst forecast period (*Horizona*). The sample in this study has 39,501 analyst-year observations. The regression results of Eq. (8) are listed in column (1) of Table 14. The estimated coefficient of *FORDUM* is positive and significant at the 5 % level, suggesting that analysts' earnings forecast bias for multinationals is stronger than that for domestic firms. This finding provides additional evidence for our main results at the analyst level. Given that analyst industry expertise, star analysts, and analyst experience are common indicators of analyst competence (Clement, 1999), we examine the effect of analyst competence on the relationship between internationalization and analysts' earnings forecast bias from the above three perspectives.

### 5.3.1. Effect of analysts' industry expertise

Industry information is an important source for analysts predicting earnings. To examine how analysts' industry expertise

moderates the relationship between internationalization and forecast bias, following Jacob et al. (1999), we measure industry expertise by the number of companies covered by each industry in the total number of companies covered by the analyst. Based on the median of industry expertise, we divide analysts into two groups: those with (*Spec* = 1) and without industry expertise (*Spec* = 0).

We add interaction terms, *FORDUM*Spec* to Eq. (8), the results are shown in column (2) of Table 14. It can be seen that the coefficient of *FORDUM*Spec* is not significant, which suggests that analysts' industry expertise can not moderate the negative impact of internationalization on analysts' earnings forecast.

#### 5.3.2. Effect of star analysts

In 2003, the *New Fortune magazine in China* began to publish a list of outstanding analysts. Institutional investors vote for the top 3–5 star analysts in each industry according to their performance (Xu et al., 2013). Many studies use star analysts as a proxy for their competence (Loh and Stulz, 2018; Xu et al., 2013). Based on this standard, we divide analysts into star (*Star* = 1) and non-star analysts (*Star* = 0) and examine their effect on the relationship between internationalization and analysts' forecast bias.

We add interaction terms, *FORDUM*Star* to Eq. (8) to examine whether the star analysts are capable of the challenges by internationalization. The results are shown in column (3) of Table 14. It can be seen that the coefficient of *FORDUM*Star* does not pass the significant test, suggesting that the star analysts cannot moderate the inverse relationship between MNCs and forecast bias.

#### 5.3.3. Effect of analyst experience

Analyst experience is also a commonly used indicator of analyst competence. Analyst experience is the tenure between the analysts' first forecast year and the current forecast year. According to the median number of years (5 years) of analyst experience, we divide the analysts into experienced (*Experience*=1) and inexperienced (*Experience*=0), and then we add interaction terms, *FORDUM*Experience* to Eq. (8) to examine whether the experienced analysts are capable of the challenges by internationalization. The results are shown in column (4) of Table 14. It can be seen that the coefficient of *FORDUM*Experience* is negative and significant at the 10 % level, suggesting that only experienced analysts are capable of dealing internationalization challenges.

## 6. Conclusion

Since 2015, China has achieved net capital outflow for two consecutive years. In 2016, two Chinese companies ranked among the world's top 100 non-financial multinationals, and 18 companies from mainland China were among the top 100 non-financial multinationals in developing and transition economies. Thus, information quality in such a large market is an important issue. Analysts' forecast bias is a typical measure of information quality, providing information for optimising investors' investment decisions, and playing a critical role in facilitating the effective operation of the capital market (Brauer and Wiersema, 2017).

Overall, we find that it is challenging for analysts to make more accurate forecasts for Chinese MNCs compared with their domestic counterparts. Forecast bias grows as multinationals expand their business scope. The Heckman two-stage least squares, PSM, and DID tests, and additional tests are conducted to ensure the robustness of our findings. We then explore the possible channels through which internationalization affects forecast bias. It is found that complexity of internalisation motivation, overseas operation and accounting complexity, corporate governance, institutional quality, investment in tax havens and analysts experience can moderate the relationship between MNCs and forecast bias. Although the mergers and acquisitions mode of entry is thought to be more aggressive than the Greenfield investment, the mergers and acquisitions mode does not seem to affect analysts' forecast bias. Our study provides more evidence in terms of firms' internationalized operations and analysts' forecasts in the largest emerging market.

Overall, our findings provide valuable insights into how analysts are perplexed by the complexity of internationalization in Chinese MNCs. However, as high institutional quality and robust corporate governance can reduce forecast bias, our findings have important implications for managers and directors of MNCs in terms of their decision-making regarding FDI destination choices and governance in the internationalization process.

## CRediT authorship contribution statement

**Linjiang Wang:** Writing – original draft, Validation. **Guiling Zhang:** Supervision, Conceptualization. **Xu Lou:** Visualization, Software, Methodology, Formal analysis. **Fei Guo:** Writing – review & editing, Writing – original draft, Supervision.

## Data availability

Data will be made available on request.

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*Declaration of Consent to Publication*

Authors are declaring their consent for the final accepted version of the manuscript to be considered for publication in Research in International Business and Finance.

*Duplicate Publishing*

Authors are confirming that this manuscript is not currently under consideration by any other journal.

## Appendix 1. Variables definition and measurement

| Variables | Definitions |
|---|---|
| Dependent variable | |
| *Bias* | The bias of analysts' earnings forecast, the calculation is shown in Eq. (4) |
| *PMAFE* | The bias of earnings forecast at the analyst level,the calculation is shown in Eq. (10) |
| Independent variables | |
| *FORDUM* | Dummy variable of internationalization, which sets to 1 if a company has a foreign subsidiary, 0 otherwise. |
| *FORSUB* | International level, the logarithm of the number of foreign subsidiaries plus one. |
| *FORCOU* | International level, the logarithm of number of host countries plus one. |
| *GFI* | The logarithm of the number of foreign subsidiaries gained by greenfield investments plus one. |
| *MA* | The logarithm of the number of foreign subsidiaries acquired through M&A plus one. |
| *Salesub* | The logarithm of the number of marketing subsidiaries plus one. |
| *Prodsub* | The logarithm of the number of production subsidiaries plus one. |
| *Invesub* | The logarithm of the number of investment subsidiaries plus one. |
| *Techsub* | The logarithm of the number of research and development subsidiaries plus one. |
| Control variables in the main analysis | |
| *Afnum* | The logarithm of the number of following analysts. |
| *Horizon* | The logarithm of the mean forecast horizon, the period between the release date of analysts' earnings forecast and actual date of annual report. |
| *Size* | The logarithm of the market value of tradable shares. |
| *Surprise* | (EPS of current year- EPS of the last year)/ EPS of the last year. |
| *Loss* | Dummy variable, which takes the value of 1 when there is a net loss in the year, and 0 otherwise. |
| *Roavol* | The volatility of ROA, the standard deviation of the return on assets for the previous three years (including the current year). |
| *Retvol* | The volatility of monthly stock returns, the standard deviation of the monthly stock returns. |
| *Intangible* | The ratio of intangible assets in total assets. |
| *Insti* | The share holdings of institutional investors. |
| *DA* | Discretionary accrual, calculated according to adjusted Jones Model. |
| *CGsocre* | Corporate governance level, following Gompers et al. (2003), we adopt the principal component analysis method and construct a 3-dimension measurement(12 specific indicators) that includes shareholding structure and rights, management governance, directors, supervisors, and other governance. The indicators are listed in Appendix 3. |
| *Age* | Corporate age, the logarithm of firm age. |
| *Crosslist* | Dummy variable, which takes the value of 1 if the company's share cross-listed in overseas capital markets and 0 otherwise. |
| Additional control variables in the analysis of analysts' competence | |
| *Spec* | Analyst industry expertise |
| *Star* | Whether the analyst is a star analyst |
| *Experience* | Analyst experience |
| *Cover* | The number of companies that an analyst covers |
| *Horizona* | Analyst forecast period |
| Variables in robustness tests: | |
| *FORprovince* | The percentage of MNCs in its located province. |
| *Treat* | Dummy variable, which takes the value of 1 if a firm switches from domestic firms to international firms during the sample period, and 0 otherwise. |
| *POST* | Dummy variable, which takes the value of 1 after the switch year (switch from domestic firms to international firms and pseudo-switch year for the control firm), zero other time. |
| *Biasmed* | The bias of analysts' earnings forecasts, calculated by the median of analysts' earnings forecasts instead of the mean value in Eq. (4) |
| *Dispersion* | The standard deviation of different analysts' earnings forecasts of the same company |

## Appendix 2. Pearson Correlation matrix

| | *Bias* | *FORDUM* | *FORSUB* | *FORCOU* | *Afnum* | *Horizon* | *Size* | *Surprise* | *Loss* | *Roavol* | *Retvol* | *Intangible* | *Insti* | *DA* | *CGscore* | *Age* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Bias* | 1.000 | | | | | | | | | | | | | | | |
| *FORDUM* | 0.020 | 1.000 | | | | | | | | | | | | | | |
| *FORSUB* | 0.047** | . | 1.000 | | | | | | | | | | | | | |
| *FORCOU* | 0.101*** | . | 0.886*** | 1.000 | | | | | | | | | | | | |
| *Afnum* | −0.062*** | 0.140*** | 0.165*** | 0.164*** | 1.000 | | | | | | | | | | | |
| *Horizon* | 0.130*** | −0.029* | −0.023 | −0.025 | 0.251*** | 1.000 | | | | | | | | | | |
| *Size* | −0.118*** | 0.309*** | 0.254*** | 0.226*** | 0.401*** | −0.055*** | 1.000 | | | | | | | | | |
| *Surprise* | −0.425*** | −0.012 | −0.008 | −0.022 | 0.058*** | −0.091*** | 0.078*** | 1.000 | | | | | | | | |
| *Loss* | 0.391*** | −0.048*** | 0.022 | 0.039* | −0.169*** | 0.059*** | −0.115*** | −0.357*** | 1.000 | | | | | | | |
| *Roavol* | 0.195*** | −0.031** | 0.043** | 0.041* | −0.005 | −0.012 | −0.041*** | −0.010 | 0.175*** | 1.000 | | | | | | |
| *Retvol* | −0.050*** | 0.019 | −0.003 | −0.011 | −0.208*** | −0.161*** | 0.060*** | −0.016 | 0.105*** | 0.044*** | 1.000 | | | | | |
| *Intangible* | −0.023 | −0.008 | −0.040* | −0.010 | 0.013 | 0.012 | 0.002 | −0.016 | 0.023* | 0.018 | −0.024* | 1.000 | | | | |
| *Insti* | −0.028* | 0.050*** | 0.071*** | 0.040* | 0.295*** | 0.003 | 0.407*** | 0.031** | −0.068*** | −0.042*** | −0.101*** | 0.023* | 1.000 | | | |
| *DA* | 0.020 | −0.026* | −0.094*** | −0.099*** | −0.061*** | −0.065*** | −0.047*** | 0.013 | 0.066*** | 0.164*** | 0.085*** | −0.077*** | −0.045*** | 1.000 | | |
| *CGscore* | 0.056*** | 0.111*** | 0.021 | 0.054** | 0.003 | 0.117*** | −0.172*** | −0.032** | 0.033** | −0.008 | 0.024* | −0.024* | −0.030** | 0.014 | 1.000 | |
| *Age* | 0.022 | 0.046*** | −0.035 | −0.066*** | −0.100*** | 0.167*** | −0.061*** | 0.032** | 0.024* | −0.018 | 0.074*** | −0.050*** | −0.082*** | 0.052*** | 0.297*** | 1.000 |
| *Crosslist* | −0.004 | 0.211*** | 0.137*** | 0.119*** | 0.138*** | 0.002 | 0.342*** | 0.008 | −0.002 | −0.023* | −0.089*** | 0.074*** | 0.198*** | −0.064*** | 0.005 | −0.127*** |

## Appendix 3. Loading Factor of Corporate Governance

| Indicators | Variables | Loading Factor |
|---|---|---|
| *Shareholding structure and shareholder rights* | The shareholding of the top shareholder | −0.4902 |
| | Balance Mechanism of Shareholding | 0.3583 |
| | The number of shareholder meetings | 0.1064 |
| | The percentage of traded shares | 0.4747 |
| | The percentage of state-owned shares | −0.5539 |
| *Management governance* | Duality | 0.1020 |
| | Management shareholding | 0.1344 |
| | Board size | −0.0814 |
| | The percentage of non-executive directors | −0.0326 |
| *Directors, supervisors and other governance* | The number of board meeting | 0.1816 |
| | The number of supervisory board meeting | 0.1247 |
| | The number of sub-committee | 0.0557 |

## Appendix 4. Effect of analysts' competence-continued

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Variables | PMAFE | PMAFE | PMAFE | PMAFE | PMAFE | PMAFE |
| *FORSUB* | 0.0310** | 0.0104** | 0.0177** | | | |
| | (2.12) | (1.97) | (2.09) | | | |
| *FORSUB*Spec* | −0.0314 | | | | | |
| | (−1.62) | | | | | |
| *FORSUB*Star* | | −0.0034 | | | | |
| | | (−0.23) | | | | |
| *FORSUB*Experience* | | | −0.0028* | | | |
| | | | (−1.86) | | | |
| *FORCOU* | | | | 0.0583*** | 0.0182** | 0.0301** |
| | | | | (2.86) | (2.34) | (2.58) |
| *FORCOU*Spec* | | | | −0.0619 | | |
| | | | | (−1.27) | | |
| *FORCOU*Star* | | | | | −0.0131 | |
| | | | | | (−0.64) | |
| *FORCOU*Experience* | | | | | | −0.0050* |
| | | | | | | (−1.73) |
| *Spec* | −0.0156 | −0.0642*** | −0.0642*** | 0.0137 | −0.0644*** | −0.0647*** |
| | (−0.46) | (−3.07) | (−3.08) | (0.36) | (−3.11) | (−3.12) |
| *Star* | −0.0365*** | −0.0313 | −0.0365*** | −0.0362*** | −0.0199 | −0.0363*** |
| | (−2.63) | (−1.07) | (−2.63) | (−2.61) | (−0.63) | (−2.62) |
| *Experience* | −0.0113*** | −0.0113*** | −0.0070 | −0.0113*** | −0.0113*** | −0.0049 |
| | (−4.73) | (−4.73) | (−1.49) | (−4.73) | (−4.71) | (−0.95) |
| *Coverage* | −0.0005* | −0.0005** | −0.0005** | −0.0005** | −0.0005** | −0.0005** |
| | (−1.95) | (−1.99) | (−1.99) | (−1.97) | (−2.00) | (−2.01) |
| *Horizona* | 0.3413*** | 0.3414*** | 0.3414*** | 0.3415*** | 0.3415*** | 0.3415*** |
| | (23.47) | (23.45) | (23.48) | (23.44) | (23.41) | (23.47) |
| *Size* | 0.0304*** | 0.0299*** | 0.0296*** | 0.0304*** | 0.0295*** | 0.0292*** |
| | (4.94) | (4.82) | (4.78) | (4.95) | (4.76) | (4.73) |
| *Surprise* | 0.0369*** | 0.0365*** | 0.0366*** | 0.0370*** | 0.0364*** | 0.0367*** |
| | (3.47) | (3.42) | (3.43) | (3.50) | (3.42) | (3.44) |
| *Loss* | 0.0172 | 0.0151 | 0.0151 | 0.0164 | 0.0145 | 0.0144 |
| | (0.95) | (0.82) | (0.82) | (0.92) | (0.80) | (0.79) |
| *Roavol* | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 |
| | (1.12) | (1.09) | (1.11) | (1.14) | (1.13) | (1.15) |
| *Retvol* | 0.5066 | 0.5307* | 0.5338* | 0.5159* | 0.5254* | 0.5231* |
| | (1.63) | (1.72) | (1.73) | (1.69) | (1.72) | (1.71) |
| *Intangble* | −0.0265 | −0.0386 | −0.0371 | −0.0230 | −0.0404 | −0.0388 |
| | (−0.34) | (−0.50) | (−0.48) | (−0.30) | (−0.53) | (−0.51) |
| *Insti* | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| | (0.32) | (0.40) | (0.38) | (0.27) | (0.40) | (0.39) |
| *DA* | −0.1052 | −0.1055 | −0.1055 | −0.0994 | −0.1069 | −0.1060 |
| | (−1.06) | (−1.06) | (−1.06) | (−1.00) | (−1.08) | (−1.07) |
| *Cgscore* | 0.0032 | 0.0028 | 0.0027 | 0.0028 | 0.0026 | 0.0023 |
| | (0.97) | (0.87) | (0.83) | (0.86) | (0.80) | (0.72) |
| *Age* | 0.0347** | 0.0369** | 0.0370** | 0.0342** | 0.0381** | 0.0383** |
| | (2.05) | (2.20) | (2.21) | (2.02) | (2.27) | (2.28) |
| *Crosslist* | −0.0183 | −0.0185 | −0.0181 | −0.0182 | −0.0183 | −0.0181 |
| | (−1.55) | (−1.56) | (−1.53) | (−1.57) | (−1.59) | (−1.57) |

(*continued on next page*)

(*continued*)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Constant* | −2.5990*** | −2.5630*** | −2.5685*** | −2.6336*** | −2.5684*** | −2.5760*** |
| | (−15.27) | (−15.00) | (−15.03) | (−15.49) | (−15.09) | (−15.12) |
| *Industry* | YES | YES | YES | YES | YES | YES |
| *Year* | YES | YES | YES | YES | YES | YES |
| *Observations* | 20,003 | 20,003 | 20,003 | 20,003 | 20,003 | 20,003 |
| *R-squared* | 0.1478 | 0.1477 | 0.1477 | 0.1479 | 0.1477 | 0.1478 |
| *F* | 28.99 | 29.40 | 29.45 | 29.68 | 29.89 | 29.96 |

Beneath each coefficient estimate is t-statistics based on robust standard errors. ***, **, and * denote statistically significant coefficients at the 1 %, 5 %, and 10 % levels, respectively.

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