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Can cross-listing improve investment efficiency? Empirical evidence from China

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ABSTRACT

With two views of 'premium' and 'discount,' traditional cross-listing motivation theory emphasises the effect of cross-listing on enterprise performance. The effect of cross-listing on enterprise performance is yet uncertain, manifesting that unknown factors play intermediate roles between them. To clarify the influence mechanism of cross-listing on enterprise performance, this study overcame the limitations in simple verification of the relationship between cross-listing and enterprise performance, and returned to the origin of cross-listing, namely, enterprise financing activity. Thus, the relationship between cross-listing and enterprise investment efficiency was analysed to determine the influence mechanism of cross-listing on enterprise performance. Based on financial data of A + H cross-listed enterprises and A-share listed enterprises in Mainland China during 2008–2018, the effect of cross-listing on enterprise inefficient investment behaviours was empirically analysed. Results showed that 58.12% of the listed enterprises in China underwent under-investment (UI). Among them, cross-listed enterprises universally underwent over-investment (OI). Cross-listing remarkably remitted UI, but it further expanded OI. Overall, cross-listing led to the deterioration of investment efficiency. The effect of cross-listing on investment efficiency was discussed by combining basic economic activities of enterprises. Cross-listing theory was further enriched and perfected, and suggestions and countermeasures for improving enterprise performance by elevating investment efficiency were put forward.

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1. Introduction

Since the 1970s, cross-listing by enterprises has increased worldwide and been accelerated in tandem with the economic integration process. In particular, an increasing number of enterprises from emerging markets have crossed national boundaries and

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become cross-listed in security markets of developed countries or regions. According to statistics of the World Federation of Exchanges, up to 30 March 2019, the number of foreign enterprises listed in the New York Stock Exchange reached 508, accounting for 23.66% of the total number of enterprises listed in this stock exchange. The two figures were 378 and 15.91%, respectively, in the London Stock Exchange. The China security market was built in 1992, when the market capacity was relatively small with inferior liquidity, and many Chinese enterprises were faced with the bottleneck of financing constraints. To this end, some qualified enterprises sought overseas listing with the support of the government, and Hong Kong became their first choice for overseas listing. As of 31 December 2019, a total of 280 H-share enterprises were listed in the Hong Kong Stock Exchange, among which 120 enterprises returned to the A-share market in Mainland China, and the number of cross-listed enterprises accounted for 42.86% of the total number of overseas-listed enterprises.

Cross-listing has become an entry point for scholars to research the international capital market. Research on cross-listing focuses on the effect of cross-listing on enterprise performance. The mainstream view is that cross-listing generates a positive effect on enterprise performance, and this improving effect is defined as ‘cross-listing premium’ (Damane, 2019; Doidge et al., 2004; Ghadhab & M’rad, 2018; King & Segal, 2008). However, some scholars have doubted the universality (Bhattacharyay & Jiao, 2019; Bianconia et al., 2013; Durand et al., 2006) and sustainability (Colaka et al., 2020; Esqueda, 2017; Jia & Zhou, 2019; King & Segal, 2009) of ‘cross-listing premium.’ Their empirical studies showed that cross-listing resulted in the degradation of enterprise performance. This degradation effect is defined as ‘cross-listing discount.’ Therefore, the research conclusions regarding the effect of cross-listing on enterprise performance are not consistent at all.

An attempt was made in this study to overcome the research limitation in simple verification of the relationship between cross-listing and enterprise performance. Returning to the origin of cross-listing, namely, enterprise financing activity, the relationship between cross-listing and enterprise investment efficiency was analysed. As an important financing decision for enterprises, cross-listing exerts a remarkable effect on capital costs, playing a significant role in the investment decision as required rate of return in investment project analysis. Therefore, cross-listing influences investment efficiency. Richardson (2006) argued that under most circumstances, enterprise investment behaviours were inefficient. He demonstrated that over-investment (OI) incurred when actual investment expenditure level was higher than reasonable investment expenditure level, and under-investment (UI) incurred alternatively when actual investment expenditure level was lower than reasonable investment expenditure level. Hence, a problem remaining to be solved constantly in the financial management field is how to improve investment efficiency. This study aims to empirically research the effect of cross-listing on the investment efficiency based on Chinese enterprise samples. Can cross-listing, which is an equity financing behaviour of enterprises, effectively relieve the financing constraints faced by enterprises? May the enterprise over-invest after being cross-listed? The discussion over the relationship between cross-listing and investment efficiency in this study is an exploration into the possible influence mechanism of cross-listing on enterprise performance. This study enriches

and perfects the cross-listing theory and contributes to enriching the theory of modern corporate finance by providing the interpretation for realistic investment problems of enterprises in practice.

The remainder of the article is organised as follows. In Section 2, a brief review of the relevant literature about the relationship between cross-listing and investment efficiency is provided, and hypotheses are put forward. In Section 3, the methodology, including samples, data sources, models and variable definitions, is described. In Section 4, descriptive statistics, regression estimates, and analyses with robust tests are presented. In Section 5, results and discussions are given. Finally, in Section 6, the conclusions, corresponding suggestions, and limitations are summarised.

2. Literature review and hypotheses development

By its essence, cross-listing belongs to an enterprise equity financing behaviour. According to modern corporate finance theory, financing decision, investment decision, and dividend policy jointly form the main contents of financial decisions. Financing decision aims to solve capital source for investment projects, dividend policy solves the issue how to distribute the profit from the operating results of investment projects, and investment behaviour plays an intermediate role between the two (Ross et al., 2002, p. 267). According to the net present value (NPV) model of investment decision, the result of financing behaviour, namely, capital cost (k), directly decides investment scale and efficiency. Therefore, cross-listing, as an equity financing behaviour, certainly generates an effect on investment efficiency.

$$NPV = \sum_{t=1}^n \frac{C_t}{(1+k)^t} - C_0 \quad (1)$$

Whether an investment behaviour is efficient or not can be most intuitively judged from the fact of whether actual investment expenditure level is maintained at a reasonable investment expenditure level (Lin & Yeh, 2020; Richardson, 2006). Under most circumstances, enterprise investment behaviours are inefficient: actual investment expenditure level is higher than reasonable investment expenditure level, namely OI; alternately, actual investment expenditure level is lower than reasonable investment expenditure level, namely, UI.

In most cases, UI derives from financing constraints incurred by information asymmetry. Myers and Majluf (1984) found that external equity financing cost was evidently higher than endogenous financing cost because of adverse selection caused by information asymmetry, and financing constraints from excessive financing cost forced enterprises to abandon investment projects with positive net present values, giving rise to UI. On this theoretical basis, Al-Najjar (2013), Farre-Mensa and Ljungqvist (2016), and Cao and Leung (2020) verified the ubiquity of financing constraints based on listed enterprise samples in emerging markets, listed enterprise samples in America, and large and medium-sized listed enterprise samples in Canada, respectively. According to the traditional western cross-listing motivation theory, namely, market segmentation hypothesis, the prevalence of market segmentation

phenomenon restricts enterprises' financing channels, whereas cross-listing can eliminate the negative effects of financing barriers and market segmentation to relieve financing constraints. Important evidence for the remittance of financing constraints is the reduction of capital cost. Karolyi (1998) conducted verification *via* a multi-factor risk model, and found that on average, the cost of equity capital of foreign enterprises declined by 126 base points after being cross-listed in the American market. Bekaert and Harvey (2000) extended research samples into cross-listed enterprises from emerging markets, estimated the change of capital cost through the changes of the real rate of return of stocks and dividend yield. They concluded that enterprises' cost of equity capital declined after cross-listing. Based on empirical research on American listed enterprises, Hail and Leuz (2009) found that the capital cost effect of cross-listing remained following the Sarbanes–Oxley Act.

Research by Chinese scholars based on Chinese enterprise samples has also proved that cross-listing is beneficial for lowering the cost of equity capital (Jing et al., 2020). Sami and Zhou (2008) selected 73 Chinese enterprises listed in Hong Kong and 684 A-share enterprises exclusively listed in Mainland China as the samples, and used weekly average rate of return to measure the cost of equity capital. Their empirical evidence indicated that the average rate of return of H-share enterprises (cross-listed enterprises included) was lower than that of A-share enterprises by 0.185. Through an empirical study of Asian cross-listed enterprise samples using the event study method, Zheng et al. (2014) found that overcoming market segmentation and lowering capital cost through cross-listing was an important path for Asian enterprises to acquire 'premium.' When investigating the effects of different cross-listing paths on corporate governance, Dong et al. (2016) found that 'overseas returnees' returning to Mainland China for cross-listing were driven by financing motivation rather than by motivation of improving corporate governance. This finding verified the capital cost effect of cross-listing from the side view. In summary, the capital cost effect of cross-listing can effectively mitigate financing constraints, modifying the inefficient investment behaviours of UI. On this basis, Hypothesis 1 was proposed.

Hypothesis 1: Cross-listing can effectively mitigate the degree of UI.

OI is rooted in the agency problem caused by free cash flows (CFs). Given that managers' benefits usually deviate from shareholders' benefits, agency problem is a common existence among enterprises with abundant free CFs, possibly resulting in OI. The main reason for this possibility is that managers' monetary and non-monetary income is an increasing function of enterprise scale, strengthening managers' aspiration to build up a business empire (Grossman & Hart, 1986; Lee et al., 2019), and even over-invest on projects with negative net present values for the pursuit of expansion of enterprise scale. This conclusion is also applicable to agency problems incurred when controlling shareholders seek private benefits. The recently emerging bonding hypothesis, which explains cross-listing behaviours from the perspective of corporate governance, can be traced back to the emergence of *Law and Finance*. Under the analytical framework of *Law and Finance*, Coffee (2002) deemed that cross-listing made enterprises from developing countries voluntarily bond themselves with stricter information disclosure requirements and more advanced legal systems in developed capital markets. Thus, cross-listing could be considered an effective

substitute for law reform in their home country. This viewpoint has been supported by scholars who consistently believe that cross-listing provides minority shareholders legal assistance means with effective execution and low cost (Del Bosco & Misani, 2016; Doidge et al., 2009; Lu et al., 2020). Moreover, cross-listing exposes enterprises to the supervision of ‘reputation media’ (Coffee, 2002), increases the information content of share price (Zhong & Lu, 2018), and improves accounting information quality (Belal et al., 2019; Kamarudin et al., 2020) and information environment (Aggarwal et al., 2011; Ball et al., 2018; Guo et al., 2018). Then, cross-listing effectively relieves a series of agency problems ascribed to information asymmetry (Herrmann et al., 2015; Zhu et al., 2017). Thus, cross-listing is an effective corporate governance mechanism (Abdeljawad et al., 2020; Arenekea & Kimani, 2019).

However, some scholars continue to doubt these findings. For instance, Licht (2003) deemed that the law enforcement made by the *U.S. Securities and Exchange Commission (SEC)* for foreign enterprises was weaker than that for local enterprises in America. Given this weakness, some foreign enterprises evaded harsh regulation in their domestic market *via* cross-listing in America, and this phenomenon was defined as an ‘escape hypothesis.’ Gande and Miller (2012) further supported the viewpoint of Licht (2003) based on empirical research with a larger sample size. They thought that *SEC* regulation for foreign enterprises listed in America was relatively loose, and the cost paid by these enterprises when violating relevant stipulations was relatively low. Sun et al. (2015) further pointed out that transnational corporations escaped from harsh domestic regulation through cross-listing. The corporate governance effect of cross-listing remains controversial.

Theoretically, cross-listing should effectively repress OI caused by the free CF problem. However, in reality, inefficient investment problems, namely, over- and under-investment, of enterprises are complementary, presenting a wane-and-wax and black-or-white relationship. Relieving UI signified aggravation of OI meanwhile, and vice versa. Given that capital cost effect of cross-listing exerts a direct and fast influence on UI, the corporate governance effect of cross-listing remains uncertain, and its influence on OI is indirect and slow (Chen & Huang, 2019; Lian et al., 2019; Przekota et al., 2019). Therefore, cross-listing can effectively improve the inefficient investment problem due to UI. By contrast, the inefficient investment problem caused by OI may be deteriorated with the further loosening of financing constraints and further reduction of capital costs driven by cross-listing. Therefore, Hypothesis 2 was raised:

Hypothesis 2: Cross-listing can evidently aggravate the degree of OI.

3. Methodology

3.1. Model setting and variable definitions

Two models were set in this study. A model of newly increased investment expenditure level was set to measure investment efficiency. On this basis, a multiple linear regression model was established to verify the effect of cross-listing on UI and OI.

3.1.1. Model of newly increased investment expenditure level and variable definitions

Western scholars have investigated inefficient investment problems of enterprises mainly through two mainstream models. One is represented by Vogt (1994) and the other by Richardson (2006). The Vogt (1994) model can measure the overall investment efficiency of sample enterprises, but it fails to measure the concrete inefficient investment degree of one specific enterprise in one specific year. The Richardson (2006) model is an improvement of the Vogt (1994) model, and its core idea is that the newly increased investment expenditure level has an expected optimal value, namely, reasonable newly increased investment expenditure level. When the actual newly increased investment expenditure level is equal to the reasonable one, enterprise investment behaviours are considered efficient. By contrast, when the actual newly increased investment expenditure level deviates from the reasonable one, enterprise investment behaviours are considered inefficient. Following this basic idea, Richardson (2006) included micro- and meso-factors of enterprise investment decisions in the model to measure its reasonable newly increased investment expenditure level, believing that the residual error of the model represented the part in actual newly increased investment expenditure level, which could not be explained using reasonable factors. He then measured the deviation degree from the actual newly increased investment expenditure level to the reasonable one. When the residual error was positive, the actual newly increased investment expenditure level was higher than the reasonable one, manifested by OI. When the residual error was negative, the actual newly increased investment expenditure level was lower than the reasonable one, manifested by UI.

By reference to the research of Lin and Yeh (2020), newly increased investment expenditure Model (2) was constructed in this study based on the Richardson (2006) model to measure investment efficiency. The residual error of model (2) was the measurement of investment efficiency. In consideration of the persistence of investment behaviours, the newly increased investment expenditure level in the previous period was also included in the independent variables of the model. Variable definitions are shown in Table 1.

$$\begin{aligned} \frac{I_{i,t}}{K_{i,t-1}} = & \alpha_0 + \alpha_1 \frac{I_{i,t-1}}{K_{i,t-1}} + \alpha_2 \frac{CF_{i,t}}{K_{i,t-1}} + \alpha_3 Q_{i,t-1} \\ & + \alpha_4 \frac{CF_{i,t}}{K_{i,t-1}} \times Q_{i,t-1} + \alpha_5 \frac{Cash_{i,t-1}}{K_{i,t-1}} + \alpha_6 \frac{Sale_{i,t}}{K_{i,t-1}} \\ & + \alpha_7 Asset_{i,t-1} + \alpha_8 Leverage_{i,t-1} + \alpha_9 Controller_{i,t} \\ & + \alpha_{10} Age_{i,t} + \alpha_{11} \sum Industry_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

3.1.2. Multiple linear model of the effects of cross-listing on over- and under-investment and variable definitions

Regression residual errors of model (2) were used to measure investment efficiency. A negative residual error indicated UI, and the negative residual error was then defined as the degree of UI. A positive residual error represented OI, and then the positive residual error was defined as the degree of OI. Multiple linear models (3)

Table 1. Variables in the model of newly increased investment expenditure level.

Variable	Symbol	Operational definition
Newly increased investment expenditure level	I_t	(Increment of fixed assets + increment of construction in progress + increment of long-term investments + increment of working capitals) of the enterprise in year t
	I_{t-1}	(Increment of fixed assets + increment of construction in progress + increment of long-term investments + increment of working capitals) of the enterprise in year $t-1$
Free cash flow	CF_t	Net cash flows generated by business activities of the enterprise in year t - cash paid by the enterprise to purchase fixed assets, intangible assets, and other long-term assets in year t
Investment opportunity	Q_{t-1}	Tobin's Q value of the enterprise at the end of year $t-1$
Cash balance	$Cash_{t-1}$	Balance of cash and cash equivalents held by the enterprise at the end of year $t-1$
Operating revenue	$Sale_t$	Net sales of the enterprise in year t
Enterprise scale	$Asset_{t-1}$	Natural logarithm of total assets of the enterprise at the end of year $t-1$
Capital structure	$Leverage_{t-1}$	Asset-liability ratio of the enterprise at the end of year $t-1$
Nature of property right	$Controller_t$	It is 1 under state-owned holding status, or otherwise it is 0
Listed years	Age_t	Time span of enterprise listing up to year t , unit being year
Dummy variable of the industry	$Industry_t$	According to <i>Guidelines on Industry Classification of Listed Companies</i> by China's Securities Regulatory Commission, the industries of sample companies are divided into 17 categories, and 16 industry dummy variables are constructed to control the influence of different industries. The concrete assignment method is as follows: the industry of farming, forestry, animal husbandry, side-line production and fishery taken as the reference group, when a listed company belongs to industry, $Industry = 1$, or otherwise, $Industry = 0$.

Among the above variables, newly increased investment (I_t/I_{t-1}), free cash flow (CF_t), cash balance ($cash_{t-1}$) and operating revenue ($Sale_t$) are all standardised by total assets at the beginning of the period (K_{t-1}) to eliminate the influence of enterprise scale.

Source: Made by authors with reference to related literature.

and (4) were established by taking UI and OI degrees as dependent variables and cross-listing as the independent variable while other factors influencing investment efficiency were controlled, verifying the effects of cross-listing on the degrees of UI and OI, respectively. The definitions of major variables in the models were illustrated in Table 2. The model descriptions and definitions of major variables were as follows:

$$UI_i = \alpha_0 + \alpha_1 Cross_i + \alpha_2 Q_i + \alpha_3 HHI_i + \alpha_4 Dividend_i + \alpha_5 Share_i + \alpha_6 Controller_i + \alpha_7 \sum Year_i + \alpha_8 \sum Industry_i + \varepsilon_i \quad (3)$$

$$OI_i = \alpha_0 + \alpha_1 Cross_i + \alpha_2 Q_i + \alpha_3 HHI_i + \alpha_4 Dividend_i + \alpha_5 Share_i + \alpha_6 Controller_i + \alpha_7 \sum Year_i + \alpha_8 \sum Industry_i + \varepsilon_i \quad (4)$$

3.1.2.1. Cross-listing (Cross). Cross-listing refers to such a behaviour that the same enterprise is simultaneously listed in two or more different stock exchanges, namely, listed simultaneously within the territory and overseas. Overseas listing means that a domestic enterprise issues shares to foreign investors and goes public in an overseas stock exchange. Overseas listing of Chinese enterprises has two patterns: direct and

Table 2. Definitions and measurements of variables in models (3) and (4).

Dimensionality	Variable	Symbol	Operational definition
Independent variable	Cross-listing dummy variable	<i>Cross</i>	The variable value is 1 under cross-listing circumstance; otherwise, it is 0
Dependent variables	Degree of Over-investment	<i>OI</i>	Residual error (positive value) of model (2)
Control variables	Degree of Under-investment	<i>UI</i>	Residual error (negative value) of model (2)
	Ownership concentration	<i>Share</i>	Shareholding ratio of the largest shareholder of the enterprise at the end of year <i>t</i>
	Nature of ultimate controller's property right	<i>Controller</i>	The variable value is 1 when the ultimate controller is a state-owned legal person or a state, otherwise it is 0
	Degree of product market competition	<i>HHI</i>	The sum of the squares of enterprise market shares in the industry $HHI_i = \sum (X_i/X)^2$
	Investment opportunity	<i>Q</i>	Tobin's <i>Q</i> value of the enterprise at the end of year <i>t</i> -1. For a non-cross-listed enterprise, Tobin's <i>Q</i> value = enterprise market value/replacement cost = (market value of circulating A shares at the end of the year + non-circulating shares * net asset per share at the end of the year + total non-current liabilities + total current liabilities)/book value of total assets at the end of the year. For a cross-listed enterprise, Tobin's <i>Q</i> value = enterprise market value/enterprise replacement cost = (market value of circulating A shares at the end of the year + market value of overseas circulating shares at the end of the year + non-circulating shares * net asset per share at the end of the year + total non-current liabilities + total current liabilities)/book value of total assets at the end of the year
	Listed years	<i>Age</i>	Time span of enterprise listing up to year <i>t</i> , unit being year
	Dividend payout ratio	<i>Dividend</i>	Cash dividend per share (before tax)/net income per share of the enterprise in year <i>t</i>
Year dummy variable	<i>Year</i>	Ten year-dummy variables are constructed to control the influence of different years. The concrete assignment method is: year 2008 taken as the reference group, when sample data belongs to year <i>t</i> , <i>Year</i> = 1; otherwise, <i>Year</i> = 0.	
Industry dummy variable	<i>Industry</i>	According to <i>Guidelines on Industry Classification of Listed Companies</i> formulated by China Securities Regulatory Commission, the industry of sample companies is divided into 17 categories, and 16 industry dummy variables are constructed to control the influence of different industries. The particular assignment method is as follows. The industries of farming, forestry, animal husbandry, side-line production, and fishery are as the reference group. When a listed company belongs to industry <i>i</i> , <i>Industry</i> = 1; otherwise, <i>Industry</i> = 0.	

Source: Made by authors with reference to related literature.

indirect listing. Overseas direct listing means that an enterprise, as a domestic legal person, directly applies for issuing shares to be traded by foreign investors in an overseas stock exchange and becomes listed. The enterprises that adopt overseas direct listing can only be preselected enterprises approved by the government for overseas listing, and overseas listing locations are only restricted to the stock exchanges in countries and regions that have signed memorandums of understanding in regulation cooperation with the *China Securities Regulatory Commission*, e.g., Hong Kong, New York, London, and Singapore. Overseas indirect listing means that the overseas affiliated entity of a domestic enterprise issues stocks overseas to become listed overseas, or acquires an overseas listed enterprise to become listed overseas, specifically in five

paths. These paths refer to listing of affiliated entity, ‘backdoor’ listing, listing by ‘initial public offering,’ listing by issuing convertible bonds, and listing by depository receipts. However, clearly demarcating whether a domestic enterprise is listed by issuing shares overseas in the name of an overseas enterprise is difficult because of the complex situation of affiliated entities. Given that overseas listing is divided into overseas direct listing and overseas indirect listing, cross-listing can be divided into two patterns, namely, overseas direct listing + domestic listing and overseas indirect listing + domestic listing. Given the difficulties in demarcating the subjects of overseas indirect listing, cross-listing involved in this study is only restricted to domestic and overseas direct listing behaviours. The variable value is 1 under cross-listing circumstance; otherwise, it is 0.

3.1.2.2. Degree of under-investment/degree of over-investment (UI/OI). After regression estimation is conducted according to model (2) with reference to Richardson (2006), the negative residual error is defined as the degree of UI and the positive residual error as the degree of OI.

3.1.2.3. Dividend payout ratio (Dividend). The dividend source is net profit after tax of an enterprise. Issuing cash dividends reduces its retained earnings to influence its future investment behaviours. A consensus is reached among the existing studies, that is, paying cash dividends as a measure of corporate governance (Rajput & Jhunjhunwala, 2019), can reduce the manager’s disposable cash, effectively inhibit enterprise OI behaviours (Lamont, 1997; Zhang et al., 2018), and alleviate agency problem (Chassé & Courrent, 2018; Rossi et al., 2018).

3.1.2.4. Ownership concentration (Share). The research of La Porta et al. (1999) indicated that due to separation of CF rights from control rights under ownership concentration, controlling shareholders could have an intense motivation to deviate enterprise investment behaviours from the goal of shareholder wealth maximisation to gain the private benefits of control through inefficient investment behaviours. Claessens et al. (2000) believed that the existence of the private benefits of control was an important motivation for enterprise inefficient investment behaviours under ownership concentration. Cheung et al. (2006) and Peng et al. (2011) verified the tunnelling and entrenchment effects of substantial shareholders through empirical studies based on enterprise samples listed in Hong Kong and enterprise samples listed in Mainland China, respectively. In an empirical study based on A-share market data in Mainland China, Zhu and Zhang (2019) found that the entrenchment effect existed in the control right and the incentive effect in the CF right of controlling shareholders. With an increasing separation degree between the two, enterprise inefficient investment behaviours became increasingly serious. The empirical study of Pai et al. (2018) based on cross-listed enterprise samples supported the interest convergence effect of controlling shareholders. In summary, ownership concentration, measured by the shareholding ratio of the largest shareholder may markedly influence enterprise investment decisions and behaviours.

3.1.2.5. Nature of property rights (Controller). The effect of nature of an ultimate controller’s property right on enterprise investment behaviours is the extension in empirical

studies made by Chinese scholars on the effect of controlling shareholders on enterprise investment behaviours under the Chinese context. Enterprise investment behaviours are not only markedly related to the shareholding ratio of ultimate controllers but also severely rely upon the nature of the ultimate controller's property rights (Liu & Dou, 2009). When tracing the ultimate controllers of local enterprises in relevant studies, Chinese scholars have found that ultimate controllers of many enterprises are the central government, local governments, or *State-Owned Assets Supervision and Administration Commissions* at all levels. In other words, the property rights of these enterprises are owned by the state. Given this, the nature of the controller's property rights has generally been divided into state-owned and non-state-owned types in empirical studies. Wang and Hu (2004) deemed that state-owned controlling shareholders had a natural motivation to plunder, and they would use concealed and even direct plundering means to transfer resources of listed enterprises so that enterprise investment expenditure was reduced. Xu (2007) subdivided the natures of ultimate controllers into three types, namely, state-owned, private and state-owned legal person shares. His statistical results showed that the investment scales of state-owned and private listed enterprises were large, possibly along with OI behaviours characterised as fund abuse. However, investment scales of state-owned legal person enterprises were relatively smaller, and the investment decisions were relatively rational. Accordingly, the nature of the ultimate controller's property right generates a remarkable effect on enterprise investment behaviours.

3.1.2.6. Degree of product market competition (HHI). Product market competition is considered a generalised external corporate governance mechanism. Holmstrom (1982) deemed that product market competition was a more effective incentive measure than supervision and control right market. In a market full of fierce competition, if a manager abuses enterprise resources and over-invests, he or she can be more easily punished because competition elevates the manager's risk and cost of OI. In a hyper-competitive industry, after an enterprise invests on a project with a negative net present value, the existence of competition weakens its competitiveness, deteriorating enterprise performance and the enterprise may even be expelled out of the product market. Therefore, to avoid income reduction or unemployment, managers of the enterprises in a hyper-competitive industry may constrain their OI behaviours of their own accord. Through an empirical study on data of listed enterprises in China's manufacturing industry during 2001–2004, Zhang and Wang (2010) proved that product market competition evidently affected enterprise investment behaviours, especially OI behaviours. They also found that market competition could effectively constrain OI level and improve investment efficiency. Based on the empirical evidence of A-share listed companies in Mainland China, Dou et al. (2018) found that in comparison to listed companies without horizontal competitive relationships, listed companies with horizontal competitive relationships had lower investment efficiency. The most common index used to reflect the degree of product market competition in the existing research is the Herfindahl–Hirschman Index (HHI) (Grullon et al., 2019 ; Boubaker et al., 2018).

3.1.2.7. Investment opportunity (Q). Tobin's Q value is universally adopted as the measure of investment opportunity. In view of the persistence of enterprise

investment behaviours, the investment behaviours in the current period are markedly influenced by the investment opportunity in the previous period (Lin & Yeh, 2020; Richardson, 2006). Thus, the Tobin's Q value in the previous period is introduced in the model to measure the investment opportunity in the previous period.

3.2. Sample selection and data source

The research subjects in this study involved Chinese enterprises listed in overseas main board markets and those listed in the main board market in Mainland China. Up to 31 December 2019, the number of the H-share enterprises listed in the *Hong Kong Stock Exchange* reached 280, where 120 ones returned to the A-share main board market in Mainland China, constituting A + H cross-listings. A total of 68 A + H cross-listed enterprises were finally obtained to constitute the research samples in this study after the exclusion of 32 enterprises in the financial insurance industry, 1 enterprise with abnormal financial status, 8 enterprises listed in small and medium enterprise boards and 11 enterprises listed in 2018 or later. In consideration of requirements for data breadth and depth in the measurement of reasonable investment expenditure levels, matched samples were extended to all enterprises listed in the A-share main board in Mainland China. Up to 31 December 2018, the number of enterprises listed in the A-share main board was 1915. On this basis, a total of 1092 enterprises listed in the A-share main board were obtained as matched samples used to estimate investment efficiency after enterprises that failed to acquire continuous financial data and enterprises undergoing main business change or recombination were excluded.

The data used in this study were mainly public financial data in annual reports given by listed enterprises. Data sources included the *Wind* database, *CHOICE* database, *CCER* database, *GTA* database, websites of stock exchanges and annual reports of listed enterprises. In consideration of data robustness, each item of financial data could be used only after being mutually corroborated by two or more databases. If the results of the same index extracted from different databases were different or the index data was missing in any database, it would be subject to financial data specified in annual reports of listed enterprises.

4. Empirical results and analysis

4.1. Descriptive analysis

Stata version 16.0 (StataCorp., College Station, TX) was used to conduct regression estimation of balanced panel data of 68 cross-listed and 1092 non-cross-listed enterprises during 2008–2018 based on model (2). The residual error was the quantification of inefficient investment degree, and it was the deviation degree of actual newly increased investment expenditure level from the expected reasonable newly increased investment expenditure level. Its value could be positive or negative. A positive residual error expressed OI, and the greater the value, the higher the OI degree. A negative residual error represented UI, and the greater its absolute value, the higher the UI degree. *Hausman* test results showed that $prob > chi2 = 0.0000$, so a fixed-effect model should be established. A total of 12,463 residual errors were obtained

Table 3. Descriptive statistics of residual errors of model (2) (2008–2018).

Year	Minimum	Maximum	Mean	Standard deviation
2008	-25.6573	26.3268	-0.2375	1.5126
2009	-16.942	42.466	-0.0482	1.7496
2010	-13.8389	14.6177	-0.2684	1.0703
2011	-31.1174	57.8898	-0.2048	2.6125
2012	-86.3687	16.6209	-0.2280	2.8057
2013	-14.705	30.6215	-0.1743	1.5224
2014	-5.885	12.1828	-0.1495	0.8749
2015	-18.9699	55.4311	-0.0097	2.7325
2016	-42.6175	24.8658	-0.1542	2.7307
2017	-8.8596	9.7031	-0.1891	0.8618
2018	-4.97	22.5500	-0.0871	1.1182

Data source: Wind database, CCER database and enterprises' annual reports.

Table 4. Descriptive statistics of major variables in models (3) and (4) (2008–2018).

Variables/ Group	Group of under-investment				Group of over-investment			
	Minimum	Maximum	Mean	Standard deviation	Minimum	Maximum	Mean	Standard deviation
UI/OI	-1.6156	-0.0005	-0.3589	0.3152	0.0010	2.0880	0.3772	0.2761
Cross	0.0000	1.0000	0.1897	0.3926	0.0000	1.0000	0.4116	0.4925
Q	0.3582	11.5020	1.7857	1.1707	0.1971	6.9385	1.3138	0.5576
Age	1.0000	23.0000	12.9655	4.1782	0.0000	24.0000	12.7107	4.7522
HHI	0.0299	0.4014	0.1806	0.1388	0.0299	0.4014	0.0787	0.0609
Dividend	0.0000	5.0000	0.2826	0.3566	0.0000	12.5000	0.3033	0.6285
Share	0.0785	0.7600	0.4156	0.1560	0.0974	1.0000	0.4712	0.1512
Controller	0.0000	1.0000	0.8707	0.3360	0.0000	1.0000	0.9036	0.2954

Data source: Wind database, CCER database and enterprises' annual reports.

through fixed-effect estimation, and the descriptive statistics are shown in Table 3. During 2008–2018, the mean values of residual errors in all of the years were negative, where 7243 samples had negative residual errors, accounting for 58.12%, and 5220 samples had positive residual errors, accounting for 41.88%. Accordingly, UI but not OI was a common phenomenon among listed enterprises in Mainland China.

According to the positive or negative natures of residual errors, all samples were divided into UI samples and OI samples. The 5220 samples with positive residual errors constituted OI samples, and the 7243 samples with negative residual errors constituted UI samples. Descriptive statistics of over- and UI samples was carried out in Table 4, illustrating that the mean value of the UI degree of UI samples was -0.3589, and the mean value of the OI degree of OI samples was 0.3772. On average, Tobin's Q value in the previous year of UI samples was higher than the corresponding index of OI samples, indicating that UI samples were faced with relatively more investment opportunities, which was embodied their low investment efficiency. The mean HHI index of OI samples was only 0.0787, and that of UI samples was 0.1806, reflecting that the intense degree of product market competition of OI enterprises in the industry where they were located was far higher than that of UI enterprises. Rightly, the intense degree of competition facilitated expansion in enterprises by increasing investments to consolidate their competitive status, aggravating their OI degree. Dividend payout and shareholding ratios of the largest shareholders of OI samples were higher than the corresponding indexes of UI samples. The two indexes constitute an important basis for distinguishing OI from UI.

Table 5. Correlation matrix of under-investment samples.

	UI	Cross	Q	Age	HHI	Dividend	Share	Controller
UI	1.00	-0.22***	-0.01	-0.23***	0.69***	0.12**	0.16***	0.08
Cross	-0.23***	1.00	-0.09	-0.17**	-0.1	-0.03	0.13	0.27***
Q	0.02	-0.25***	1.00	-0.03	-0.04	-0.06	-0.10	-0.19***
Age	-0.26***	-0.13	0.01	1.00	-0.09	-0.02	-0.15**	-0.20***
HHI	0.68***	-0.05	-0.04	-0.12	1.00	-0.08	0.02	-0.01
Dividend	0.13**	0.05	-0.08	-0.01	-0.11	1.00	0.22***	0.10
Share	0.20***	0.16**	-0.09	-0.12	0.02	0.36***	1.00	0.33***
Controller	0.09	0.27***	-0.10	-0.19***	0.1	0.17**	0.36***	1.00

Pearson coefficients were listed in the upper right corner, and Spearman coefficients were listed in the lower left corner, with *, ** and *** representing the significance under levels of 10, 5 and 1%, respectively.

Data source: Wind database, CCER database and enterprises' annual reports.

4.2. Effect of cross-listing on under-investment

The consequence caused by grouping according to the positive or negative nature of residual errors was that continuous data of the same enterprise during 2008–2018 would be segmented into two different groups, and the data were more approximate to repeated cross-section data but not panel data in a real sense. Therefore, they could only be processed as mixed cross-section data. The sequence stationarity test was not necessary for cross-section data, so only correlation analysis and regression estimation were hereby implemented.

A correlation test of UI samples was carried out. As shown in Table 5, UI degree was negatively correlated with the cross-listing dummy variable, *Pearson* coefficient was -0.22 , *Spearman* coefficient was -0.23 , and the significance test was passed at 1% confidence level. Thus, our hypothesis that cross-listing could be beneficial for mitigating the degree of UI was preliminarily verified. The correlation coefficients between variables were below 0.7. Therefore, the multicollinearity problem among main variables could be neglected and regression estimation could be performed.

Based on model (3), taking degree of UI as the dependent variable and cross-listing dummy variable as the independent variable, and controlling other factors influencing investment efficiency, the multiple regression estimation of mixed cross-section data was conducted. The results in Table 6 showed that the regression coefficient of cross-listing independent variable was -0.2232 and significant at the 1% level, indicating that cross-listing presented a remarkable negative correlation with the degree of UI, and cross-listing effectively mitigated the degree of UI. Thus, Hypothesis 1 was verified.

4.3. Effect of cross-listing on over-investment

A correlation test of OI samples was implemented. As shown in Table 7, OI showed a remarkable positive correlation with the cross-listing dummy variable. The *Pearson* coefficient was 0.13, *Spearman* coefficient was 0.16, and the significance test was passed at 1% confidence level, preliminarily verifying our hypothesis: Cross-listing could further aggravate the degree of OI. The correlation coefficients between variables were all smaller than 0.5. Hence, the multicollinearity problem among main variables can be ignored and regression estimation can be implemented.

On the basis of model (4), the degree of OI was used as the dependent variable, cross-listing dummy variable was used as the independent variable, and other factors

Table 6. Regression estimates of effects of cross listing on degree of under-investment.

Variable	Estimate	Standard deviation	T statistics
Constant	-0.3359	0.1461	-2.2988**
Cross	-0.2232	0.0261	-8.5570***
Q	0.0142	0.0095	1.5046
Age	0.0186	0.0036	5.1498***
HHI	1.1403	0.5645	2.0201**
Dividend	0.0600	0.0276	2.1761**
Share	-0.1353	0.0840	-1.6111
Controller	0.0472	0.0332	1.4210
R ²	0.7025		
Adjusted R ²	0.6834		
F statistics	36.6633***		

*, ** and *** represented the significance under levels of 10, 5 and 1%, respectively. Coefficients of industry dummy and year dummy are ignored in this table.

Data source: Wind database, CCER database and enterprises' annual reports.

Table 7. Correlation matrix of over-investment samples.

	OI	Cross	Q	Age	HHI	Dividend	Share	Controller
OI	1.00	0.13***	-0.23***	-0.23***	-0.16***	-0.03	0.20***	0.06
Cross	0.16***	1.00	-0.18***	-0.31***	0.08	-0.06	-0.13***	0.04
Q	-0.20***	-0.15***	1.00	0.05	-0.01	0.01	-0.15***	-0.21***
Age	-0.24***	-0.31***	0.03	1.00	-0.34***	0.01	-0.16***	-0.16***
HHI	-0.17***	0.08	0.00	-0.34***	1.00	-0.02	0.25***	0.13***
Dividend	0.01	-0.07	0.06	0.06	0.12**	1.00	0.06	0.04
Share	0.21***	-0.18***	-0.15***	-0.17***	0.12**	0.147***	1.00	0.08
Controller	0.07	0.04	-0.17***	-0.17***	0.15***	0.10**	0.08	1.00

Pearson coefficients are listed in the upper right corner, and Spearman coefficients are listed in the lower left corner, with *, ** and *** representing the significance under levels of 10, 5 and 1%, respectively.

Data source: Wind database, CCER database and enterprises' annual reports.

Table 8. Regression estimates of effects of cross listing on degree of over-investment.

Variable	Estimate	Standard deviation	T statistics
Constant	0.6034	0.1402	4.3031***
Cross	0.1151	0.0200	5.7467***
Q	-0.1028	0.0181	-5.6701***
Age	-0.0219	0.0024	-8.9852***
HHI	-0.6649	0.4960	-1.3406
Dividend	-0.0064	0.0142	-0.4499
Share	0.4015	0.0737	5.4487***
Controller	0.0122	0.0335	0.3648
R ²	0.3443		
Adjusted R ²	0.3221		
F statistics	15.5378***		

*, ** and *** represented the significance under levels of 10, 5 and 1%, respectively. Coefficients of industry dummy and year dummy are ignored in this table.

Data source: Wind database, CCER database and enterprises' annual reports.

influencing investment efficiency were controlled. The multiple regression estimation of mixed cross-section data was carried out. The results in Table 8 showed that the regression coefficient of the cross-listing independent variable was 0.1151 and significant at the 1% level. Thus, cross-listing evidently aggravated the degree of OI. Thus, Hypothesis 2 was verified.

4.4. Further analysis

The emerging and transition features of the Chinese capital market decide the conclusive effect of state-owned background on enterprise investment behaviours. Scholars

Table 9. Comparison of residual errors of model (2) between cross-listing enterprises and non-cross-listing enterprises.

Indicator	Group	Mean	standard deviation	Standard error of mean	<i>F</i>	Sig.	<i>t</i>	<i>df</i>	Sig. (2-tailed)
Residual errors of model (2)	Cross-listing enterprises	0.2636	0.6138	0.0241	7.192	0.007	14.983	1501	0.0000
	Non cross-listing enterprises	-0.1829	1.9090	0.0176					

Data source: Wind database, CCER database and enterprises' annual reports.

have fully considered the effects of institutional factors on enterprise investment behaviours in this field. The studies on this aspect started from the soft budget constraint theory proposed by Kornai (1980). Kornai (1980) regarded the market transition as a hardening process of soft budget constraints, and believed that soft budget constraints would distort real financing constraints faced by enterprises, thus reducing the dependence of investments on internal CFs and influencing enterprise investment levels. Research by Mueller and Peev (2007) based on enterprise samples in central and eastern European countries during 1999–2003, and that by Gugler and Peev (2010) using data of 13 transitional countries during 1993–2003 both proved that soft budget constraints generated an effect on enterprise investment behaviours. Compared with state-owned enterprises, private enterprises under hard budget constraints were faced with more serious financing constraints. Based on empirical studies of Chinese enterprises, Xin and Lin (2006) and Lai et al. (2019) consistently agreed that state-owned enterprises, especially state-owned manufacturing enterprises, experienced weaker financing constraints than private enterprises did (Liu & He, 2019) with more serious OI phenomenon. The soft budget constraint was the primary cause of low investment efficiency of state-owned enterprises.

Statistics of this study indicate that 75% of cross-listed enterprises are large state-owned enterprises, mainly concentrated on industries, such as manufacturing, mining and transportation. Thus, cross-listed enterprises are speculated to be generally under OI but not UI according to Xin and Lin (2006), and Lai et al. (2019). Based on residual errors obtained through regression estimation of model (2), whether being cross-listed was used as a grouping variable to perform inter-group difference significance test on all residual errors. The output results of the independent-samples *t*-test *via* SPSS version 19.0 (SPSS, Chicago, IL) are shown in Table 9. The mean residual error of cross-listed enterprises was 0.2636, being higher than that (-0.1829) of non-cross-listed enterprises, and all inter-group differences passed the significance test within a 1% confidence interval. In summary, in comparison with non-cross-listed enterprises, cross-listed enterprises are faced with relatively smaller financing constraints, generally manifested by OI. This result indirectly certifies that enterprises can evade the inefficient investment problem of UI through cross-listing. However, cross-listing is proven to expand the degree of OI. Thus, generally, cross-listing behaviours of Chinese enterprises may result in the deterioration of their overall investment efficiency.

To verify this viewpoint, balanced panel data of all cross-listed enterprises and non-cross-listed enterprises during 2008–2018 were taken as samples. The absolute value of regression residual error of model (2) was used to measure investment efficiency. The

Table 10. Regression estimates of effect of cross listing on investment efficiency.

Variable	Estimate	Standard deviation	T statistics
Constant	0.3814	0.1429	2.6688***
Cross	0.2081	0.0167	12.4926***
Q	-0.0624	0.0101	-6.2015***
Age	-0.0212	0.0021	-10.2204***
HHI	-0.1023	0.4117	-0.24859
Dividend	-0.0067	0.0138	-0.4850
Share	0.5935	0.0592	10.0258***
Controller	-0.0353	0.0271	-1.3041
R ²	0.5957		
Adjusted R ²	0.5864		
F statistics	63.9265***		

*, ** and *** represented the significance under levels of 10, 5 and 1%, respectively. Coefficient of industry dummy was ignored in this table.

Data source: Wind database, CCER database and enterprises' annual reports.

greater the absolute value, the lower the investment efficiency. Investment efficiency (EI) was used as the dependent variable and cross-listing dummy variable as the independent variable, and other factors influencing investment efficiency were controlled. Thus, model (5) was constructed to conduct regression estimation.

$$EI_{i,t} = \alpha_0 + \alpha_1 Cross_{i,t} + \alpha_2 Q_{i,t-1} + \alpha_3 HHI_{i,t} + \alpha_4 Dividend_{i,t} + \alpha_5 Share_{i,t} + \alpha_6 Controller_{i,t} + \alpha_7 \sum Industry_{i,t} + \varepsilon_{i,t} \quad (5)$$

Initially, the *Hausman* test was implemented based on panel data to decide to perform random effect estimation or fixed-effect estimation. *Hausman* test results showed that *Prob* was smaller than 0.05, and the original hypothesis was rejected, so a fixed-effect model should be established. The estimation results are listed in Table 10. The regression coefficient of the cross-listing dummy variable for EI was 0.2081, which passed the significance test within 1% confidence interval, proving that cross-listing remarkably elevated the degree of inefficient investment. On the whole, cross-listing led to the deterioration of EI.

4.5. Robustness test

The key of the Richardson (2006) model lies in the reasonable measurement of newly increased investment expenditure level. In model (2), newly increased investment expenditure level (I_t) was defined as an increment of fixed assets + increment of construction in progress + increment of long-term investments + increment of working capital of the enterprise in year t . Based on a robustness test and referring to the practice of Richardson (2006), Xin and Lin (2006) and Xu (2007), the newly increased investment expenditure level (I_t^*) was also defined as increment of fixed assets + increment of long-term investments + increment of working capital of the enterprise in year t .

No unified metric is used for free CFs. In empirical research, scholars usually use two metering methods: free CF = earnings before interest and tax + depreciation - capital expenditures and free CF = net operating CF - capital expenditures. The understanding of capital expenditures varies from scholar to scholar, and many different computing methods of free CFs have been deduced. In model (2), free CF_t was defined as net operating CF - cash paid to purchase fixed assets and other long-term assets in year t . Out of consideration of robustness and by reference to practices of some scholars, only net

Table 11. Regression estimates of robustness test.

Variable	Estimate	Standard deviation	T statistics
Constant	0.4188	0.1582	2.6468***
Cross	0.2376	0.0184	12.9037***
Q	-0.0741	0.0111	-6.6639***
Age	-0.0263	0.0023	-11.2647***
HHI	-0.1745	0.4550	-0.3836
Dividend	-0.0066	0.0153	-0.4351
Share	0.6729	0.0652	10.3144***
Controller	-0.0463	0.0299	-1.5445
R ²	0.6663		
Adjusted R ²	0.6586		
F statistics	86.6292***		

According to the *Hausman* test based on panel data, fixed-effect estimation was implemented for the robust test^{*}, ** and *** represented the significance under levels of 10, 5 and 1%, respectively. Coefficient of industry dummy was ignored in this table.

Data source: Wind database, CCER database and enterprises' annual reports.

operating CF_t^* was used as a proxy variable for free CF. Given differences in concrete variable definitions of newly increased investment expenditure level and free CF, the following three models were deduced based on model (2) to measure the reasonable investment expenditure level of enterprises, and the absolute value of arithmetic mean value of regression errors of the four models was used to measure investment efficiency robustly. Taking the $EI_{i,t}$ as the dependent variable and cross-listing dummy variable as the independent variable, and controlling other factors influencing investment efficiency, multiple regression based on model (5) was carried out with the estimation results shown in Table 11. The regression coefficient of cross-listing was 0.2376, which passed the significance test within a 1% confidence interval. The conclusion that cross-listing obviously degraded investment efficiency remained robust.

$$\begin{aligned} \frac{I_{i,t}^*}{K_{i,t-1}} = & \alpha_0 + \alpha_1 \frac{I_{i,t-1}^*}{K_{i,t-1}} + \alpha_2 \frac{CF_{i,t}}{K_{i,t-1}} + \alpha_3 Q_{i,t-1} + \alpha_4 \frac{CF_{i,t}}{K_{i,t-1}} \times Q_{i,t-1} + \alpha_5 \frac{Cash_{i,t-1}}{K_{i,t-1}} + \\ & \alpha_6 \frac{Sale_{i,t}}{K_{i,t-1}} + \alpha_7 Asset_{i,t-1} + \alpha_8 Leverage_{i,t-1} + \alpha_9 Controller_{i,t} + \alpha_{10} Age_{i,t} + \\ & \alpha_{11} \sum Industry_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (6)$$

$$\begin{aligned} \frac{I_{i,t}}{K_{i,t-1}} = & \alpha_0 + \alpha_1 \frac{I_{i,t-1}}{K_{i,t-1}} + \alpha_2 \frac{CF_{i,t}^*}{K_{i,t-1}} + \alpha_3 Q_{i,t-1} + \alpha_4 \frac{CF_{i,t}^*}{K_{i,t-1}} \times Q_{i,t-1} + \alpha_5 \frac{Cash_{i,t-1}}{K_{i,t-1}} + \\ & \alpha_6 \frac{Sale_{i,t}}{K_{i,t-1}} + \alpha_7 Asset_{i,t-1} + \alpha_8 Leverage_{i,t-1} + \alpha_9 Controller_{i,t} + \alpha_{10} Age_{i,t} + \\ & \alpha_{11} \sum Industry_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (7)$$

$$\begin{aligned} \frac{I_{i,t}^*}{K_{i,t-1}} = & \alpha_0 + \alpha_1 \frac{I_{i,t-1}^*}{K_{i,t-1}} + \alpha_2 \frac{CF_{i,t}^*}{K_{i,t-1}} + \alpha_3 Q_{i,t-1} + \alpha_4 \frac{CF_{i,t}^*}{K_{i,t-1}} \times Q_{i,t-1} + \alpha_5 \frac{Cash_{i,t-1}}{K_{i,t-1}} + \\ & \alpha_6 \frac{Sale_{i,t}}{K_{i,t-1}} + \alpha_7 Asset_{i,t-1} + \alpha_8 Leverage_{i,t-1} + \alpha_9 Controller_{i,t} + \alpha_{10} Age_{i,t} + \\ & \alpha_{11} \sum Industry_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (8)$$

5. Discussion

5.1. Dual effects of cross-listing on enterprise investment efficiency

The above regression results indicated that Hypotheses 1 and 2 were verified, thereby verifying the dual effects of cross-listing on investment efficiency. Cross-listing effectively decreased the degree of UI degree, but it also increased the degree of OI. The empirical evidence in this study supported the conclusion that the capital cost effect of cross-listing should remarkably alleviate the degree of UI, which was consistent with the research conclusions of Bekaert and Harvey (2000), Sami and Zhou (2008), Hail and Leuz (2009) and Zheng et al. (2014). The traditional ‘bonding hypothesis’ of cross-listing regards cross-listing as an effective mechanism of improving corporate governance. In recent years, western studies have provided empirical evidence proving that corporate governance effect of cross-listing can repress OI (Abdeljawad et al., 2020; Arenekea & Kimani, 2019). However, some scholars have also doubted the corporate governance effect of cross-listing, and proposed the opposite ‘escape hypothesis’ (Gande & Miller, 2012; Licht, 2003; Sun et al., 2015). Following the thought of Sun et al. (2015), this study believes that many Chinese enterprises listed overseas return to the domestic capital market in Mainland China to evade harsher regulation of overseas markets. Thus, the corporate governance effect of cross-listing cannot be effectively exerted, and abundant capital brought by cross-listing expands the degree of OI of Chinese enterprises. The empirical results in this study further supported the viewpoint of Sun et al. (2015), and provided empirical evidence from China for the ‘escape hypothesis’ of cross-listing. However, why cannot corporate governance effect of cross-listing exert its due effect? An analysis is made as follows. The inhibiting effect of corporate governance on the degree of OI depends on whether the corporate governance mechanism is perfect and whether the transmission route is smooth to a certain degree, possibly with a certain time lag (Chen & Huang, 2019). However, the improving effect of lowered capital cost on the degree of UI can obtain instant effects. Therefore, when cross-listed enterprises are universally faced with OI, cross-listing results in deterioration of investment efficiency overall. An increasing number of scholars have started shifting from the ‘premium view’ to the ‘discount view’ of cross-listing. A series of studies was carried out regarding cross-listing problems of Chinese enterprises, and the discount effect was robustly verified by Xu (2013). The empirical conclusions in this study motivated our thought that deteriorated investment efficiency triggered by cross-listing might be an important cause for the performance degradation of cross-listed enterprises in China. In other words, the empirical results in this study verified a possible action mechanism between cross-listing and enterprise performance deterioration. Cross-listing might lead to deterioration of enterprise performance by deteriorating EI. Thus, while extending the effect of cross-listing on EI, the research horizon of the cross-listing discount effect was broadened in this study. The mediating role of investment efficiency in the effect of cross-listing on enterprise performance based on a reasonable measurement of enterprise performance is planned to be verified in the future.

5.2. Effect of product market competition on different types of inefficient investment behaviours

Further analysis of the regression results in this study resulted in some interesting findings. In Table 6, the regression coefficient of the *HHI* index used to measure product market competition was 1.1403, passing the significance test within a 5% confidence interval, indicating that among all factors influencing UI degree, product market competition exerted the maximum influence. The *HHI* index reflects the mutual behavioural influence degree among enterprises in the same industry. The lower the index, the fiercer the product market competition. According to descriptive statistics, the average *HHI* index of OI samples was only 0.0787, and that of UI samples was 0.1806, reflecting that the degree of product market competition in the industry where OI enterprises were located was far higher than that in the industry in which the UI enterprises were located. The empirical results further proved that with the increase in the index, the degree of UI increased, indicating that the degree of UI would be elevated when product market competition became weaker. Therefore, by contrast, here the positive regression coefficient indicated that product market competition presented a negative correlation with the degree of UI. This phenomenon might be understood as follows. The weaker the product market competition, the stronger the monopoly. The capital 'siphon' effect of dominant manufacturers might aggravate the UI degree of the other enterprises within the industry. Nevertheless, in Table 8, the *HHI* index was negatively correlated with OI degree, not passing the significance test. Boubaker et al. (2018) believed that product market competition would influence enterprise financing decision as an external corporate governance mechanism. Given the internal association between investment and financing decisions, product market competition would obviously influence enterprise investment decision and efficiency. This study further proved that product market competition generated different influences on inefficient investment behaviours of different types. On this basis, cross-listed enterprises should compress unnecessary diversified investments and focus on the main business to improve their core competitiveness and enhance enterprise performance.

5.3. Effect of dividend payout ratio on inefficient investment behaviours of different types

In an empirical study, Park et al. (2017) pointed out that investment behaviours accompanying the residual dividend policy could transmit more information related to enterprise future growth than those accompanying the smooth dividend policy. Thus, they constructed an association between dividend payout ratio and investment behaviour. The former was the cause, and the latter was the result. According to the empirical evidence presented in this study, dividend payout ratio presented a remarkable positive correlation with the degree of UI. The higher the dividend payout ratio, the more easily the reduction of free CF would result in UI. As indicated in Table 8, dividend payout ratio was negatively correlated with the degree of OI, but the significance test was not passed. This study also further demonstrated that dividend payout ratio could exert different influences on inefficient investment behaviours of different

types. On this basis, cross-listed enterprises should reasonably dispose of free CFs and share their operating results with investors by granting cash dividends because these practices contribute to an increase in enterprise values.

6. Conclusions

To clarify the influence mechanism of cross-listing on enterprise performance, the data of A + H cross-listed enterprises and non-financial enterprises listed in the A-share main board in Mainland China during 2008–2018 were used as the samples to investigate the effects of cross-listing on different types of inefficient investment behaviours and overall investment efficiency. The following conclusions were drawn.

Chinese enterprises are universally faced with UI while cross-listed enterprises are generally under OI status because most of the cross-listed enterprises are large state-owned manufacturing enterprises facing few financial constraints.

The influence path of cross-listing on investment efficiency is of status dependency. Cross-listing effectively decreases the degree of UI, but it also markedly increases the degree of OI.

The inefficient investment status faced by cross-listed enterprises determines that the cross-listing further increases the degree of OI. Thus, cross-listing leads to the deterioration of EI on the whole.

This study has several contributions. Theoretical contributions are as follows. First, this study has extended antecedent studies on EI and broadened the research breadth of cross-listing problems. Second, this study has transcended limitations of studies on cross-listing motivation and its effects on performance, and found the dual effects of cross-listing on EI. Thus, the study provides a new approach in answering the question of how cross-listing influences enterprise performance and lays a foundation for in-depth studies. Contributions to management practice are as follows. The conclusions of this study put forward suggestions for improving enterprise performance from the angle of improving investment efficiency, namely, the enterprise should prudently deal with subsequent financing, and should not blindly raise funds for ‘money encirclement’ any longer. The enterprise should reasonably dispose free CF and compress unnecessary diversified investments.

Although the effect of cross-listing on EI has been clarified to a certain degree in this study, some problems remain. First, this study was unfolded using data of Chinese listed companies, but features of cross-listed Chinese enterprises and institutional background of Chinese capital market were significantly different from those in western countries. Thus, whether the conclusions are applicable to cross-listed enterprise samples in developed countries remains to be further verified. Second, only the effect of cross-listing on EI was verified in this study, but the influence mechanism of cross-listing on investment efficiency was not revealed. Based on a reasonable measurement of capital cost, the mediating role played by capital cost in the effect exerted by cross-listing on investment efficiency can be explored in the future study. Third, the sample range may be lengthened in the subsequent study for further discussion over the inhibiting effect of corporate governance on the degree of OI within a certain time lag.

Disclosure statement

No potential conflict of interest was reported by the authors.

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