Direct overseas listing versus cross-listing: A multivalued treatment effects analysis of Chinese listed firms

Highlights

We examine motives and consequences of overseas listing in a multivalued treatment setting.

High-tech firms are found more likely to seek direct overseas listing, especially in the US.

Firms with high expected private interest choose to list purely in Hong Kong, rejecting legal bonding hypothesis.

Overseas listing of all forms except cross-listing exerts positive average treatment effects.

But there is no evidence of a lower cost of equity as predicted by market segmentation hypothesis.

Abstract

Firms of emerging economies are increasingly seeking various forms of overseas listing as alternatives to the widely studied cross-listing to fund their growth. We examine the motivations and consequences of these alternative forms of overseas listing within the potential-outcome framework using Chinese data. In the setting of multiple treatment groups, high-tech firms are found most likely to seek direct overseas listing. Firms with high pre-IPO state ownership concentrations tend to directly list in Hong Kong rather than in the U.S., rejecting legal bonding as a motive of overseas listing. Although an equity issuance explanation implied by the market segmentation hypothesis is more plausible for the listing decisions, we do not obtain any evidence to support its prediction of a lower cost of capital for firms that have access to the overseas finance. The positive longer-term average treatment effects found in this study suggest that the potential expected returns would have been higher, if all firms were to list overseas rather than domestically.

Key words: overseas listing, emerging economies, average treatment effect, market segmentation hypothesis, legal bonding hypothesis

Introduction

As more and more firms listed their shares on overseas exchanges amid economic and financial globalisation in the past few decades, many studies in the fields of economics, finance, management and accounting have sought to understand the motivations and benefits of the corporate listing decision. However, empirical evidence supporting or refuting well-developed hypotheses, such as the market segmentation hypothesis (Stapleton and Subrahmanyam, 1977 and Errunza and Losq, 1985) and the legal bonding hypothesis (Stulz, 1999; Coffee, 1999 and 2002), is mostly obtained through the analysis of capital market reactions to overseas listing by firms that have already listed on their domestic exchanges (e.g., Miller, 1999; Foerster and Karolyi, 1999; Errunza and Miller, 2000) or through the assessment of value premium of firms that cross-list in the U.S. or other developed markets over those that do not cross-list (e.g., Doidge et al., 2004; Doidge et al., 2009). That is, these studies restrict their samples to include only domestically listed firms that subsequently cross-list overseas (referred to as the conventional cross-listings in this study). Although these studies contribute greatly to our understanding of the motivations and benefits of cross-listing, it is difficult to generalise their findings to advise or explain the corporate decision by firms of emerging economies where the conventional cross-listing is not representative or alternative forms of overseas listing are increasingly adopted to finance emerging industries.

Our concern arises partly from the statistics of overseas listings recorded in the China Stock Market and Accounting Research (CSMAR) Database as presented in the appendix. The anecdotal evidence hardly suggests that the widely studied conventional cross-listing has been a main form of overseas listing pursued by the firms of this major emerging economy since 1991. Instead the Chinese firms have sought various forms of overseas listing and the majority of these firms list overseas without listing domestically first. Furthermore, Bautzer and Mandl (2018) of Reuters report that Brazilian high-tech companies are increasingly skipping the local

Sao Paulo stock exchange in favour of listing directly in the U.S. where a large pool of investors in technology could be found and a better premium could be fetched. Although the conventional cross-listing is more in line with its listing norms, the Securities and Exchange Board of India has periodically relaxed its restrictions on direct overseas listing by domestically unlisted firms since 1993.

Given the changing and more complex nature of overseas listing, it is of great importance to revisit the listing decision by firms of emerging economies. We are interested in investigating whether firms' motivations to seek alternative forms of overseas listing differ from those to pursue the conventional cross-listing and whether these alternative forms of overseas listing could reduce the cost of equity capital as far as the conventional cross-listing does, as suggested by the literature. We will seek answers to these questions through a multivalued treatment effects analysis of 1931 Chinese listed firms during 1997 and 2015 within the potential-outcome framework.

Specifically, we will base this empirical study on the market segmentation hypothesis, which posits that the main motivation of overseas listing by firms of emerging economies is to overcome the investment barriers so as to obtain a lower cost of capital and increased liquidity. Hence, a two-factor asset pricing model in the style of Jorion and Schwartz (1986) will be an appropriate outcome model. We will categorise the Chinese firms into multiple treatment groups firstly by listing form and secondly by listing destination and contrast their observable and counterfactual expected excess returns over two post-listing periods, namely, within the first six months of listing and from the 7^{th} to 36^{th} months after listing. To address the self-selection bias caused by the non-random assignment of a firm to belong to one of the treatment groups, we will simultaneously model the decision to list overseas as a treatment model on the basis of some typical pre-IPO or pre-listing firm characteristics, listing-year macroeconomic variables and a high-tech industry indicator. To overcome the inherent difficulty of correctly

modelling the corporate decision to list overseas, we will adopt the inverse-probability-weighted regression adjustment (IPWRA) estimator that holds the double-robust property to ensure the correct estimation of the unconditional treatment effects of overseas listing in various forms and destinations.

To the best of our knowledge, this is the first study to systematically examine the motivations and economic consequences of the decision to list overseas by firms of an emerging economy through a multivalued treatment effects analysis. We estimate the causal effects of overseas listing in all possible forms or major destinations through contrasting these overseas listings simultaneously with the control group of purely domestic listings. On the contrary, most existing studies accomplish this at most by separately contrasting various forms of overseas listing with the control group as dictated, for instance, by the very popular Propensity-Score Matching estimator. As noted by Roberts and Whited (2012), our application of the multivalued treatment effects analysis is expected to correct the biases and noise associated with the multiple binary treatment effects analyses in the presence of multiple treatment groups. Furthermore, the IPWRA estimator that we adopt serves the purpose of our study better than the other widely used approach, the instrumental variable approach, in the empirical corporate finance. This is because the IPWRA estimator can compute the unconditional average treatment effects and potential outcomes of overseas listing in various forms or destinations, ensuring the direct verification of the prediction of a lower cost of capital by the market segmentation hypothesis.

By examining the behaviour of the firms that seek various forms of overseas listing in two major overseas markets, the U.S. and Hong Kong[1], relative to that of the purely domestically listed firms, we expect to gain full insights about the corporate listing decision in this changing

[1] Hong Kong stock exchange is conventionally treated, by academics as well as the China Securities Regulatory Commission, as an overseas market on the basis that Hong Kong is a separate jurisdiction from mainland China.

and more complex world. The new developments documented in our study will have important implications for other emerging economies, like India[2], that are still debating whether or not to allow firms incorporated in their countries to directly list overseas for good. We find that the conventional cross-listing would underperform the cross-listing in reverse order (i.e., cross-listing domestically after listing overseas first) pursued by the Chinese firms, in terms of the potential outcomes and average treatment effects. In the longer run, directly listing in the U.S. would exert the greatest positive effect on the expected excess return. As a contrast, if firms were to list purely in Hong Kong, whose legal systems may not protect minority shareholder interests so effectively as the U.S. ones, the potential expected excess return would have been negative in the longer run. These results serve as a caution for firms of emerging economies seeking 'reputational' bonding, although Pinegar and Ravichandran (2010) find a revaluation premium of pursuing the SEC Rule 144a private placements that are not subject to stringent regulation or scrutiny in the U.S.

The remainder of the paper is organised as follows. In section 2, we review the literature to help model the decision to list overseas and develop hypotheses or expectations about the estimated parameters of both the treatment and outcome models. We describe the methodology in section 3 and carry out the empirical analysis in section 4. Section 5 concludes.

2 Review of the literature and development of the hypotheses

Our study is broadly related to the literature of motivations and implications of cross-listing (see Karolyi (2006 and 2012) for an extensive review on these topics). More relevant to our study of firms in an emerging economy is the market segmentation hypothesis, which implies that stock prices of firms that cross-list from segmented markets are expected to rise and their subsequent expected returns should fall as the risk premium compensating for the investment

[2] https://www.thehindu.com/business/markets/sebi-committee-to-examine-direct-overseas-listing-for-indian-companies/article24144786.ece

barriers dissipates. Miller (1999) finds a positive 1.15% abnormal return averaged across all firms under study in response to the listing events in contrast to an average announcement-day price reaction of 1.54% for the firms from emerging economies and interprets these results as evidence for the proposition that net benefit of cross-listing stems from overcoming investment barriers. On the other hand, although they observe equally dramatic longer-term share price reactions to listing events for firms of developed and emerging economies, Foerster and Karolyi (1999) find the evidence of a lower cost of capital in the form of an average post-listing decline of 14% in return. Following Foerster and Karolyi (1999), we will estimate an asset pricing model to gauge the cost of equity capital. To capture a lower cost of equity capital, we hypothesise that the longer-run potential expected excess return should be lower than the short-run potential expected excess return. In the longer run, potential expected excess return for the overseas listed firms should be lower than that for the purely domestically listed firms.

Foerster and Karolyi (1999) also examine changes in the risk exposures of the firms in response to their listing in the U.S. and uncover a significant decrease in local market beta with no change in global or U.S. market beta or a significant increase in the latter with no change in the former. These results are interpreted as being consistent with the prediction of a lower cost of capital due to the elimination by cross-listing of a 'super' risk premium that compensates local investors for not being able to diversify their risk globally. Hence to acquire a lower cost of equity capital, we hypothesise that the Chinese firms that list overseas in any form or destination should expose on average more to the global risk factor than to the national risk factor in the longer run and the longer-run exposure by the overseas listed firms to the global risk factor on average should be greater than that by the purely domestically listed firms.

However, the extremely small abnormal returns obtained from the existing studies, e.g., 1-2% by Miller (1999), cannot reconcile the significant changes in exposures to the national and global market risks or cost of capital implied by the asset pricing models. Stulz (1999) argues

that the weaknesses in the mechanisms that firms use to monitor management could have limited the capital market reactions and calls for research on corporate governance issues. Coffee (1999, 2002) asserts that firms from countries whose legal systems provide weak protection for minority shareholder interests can bond themselves to protect these shareholders by agreeing to abide by laws of cross-listing destinations. The implications are that firms motivated predominantly by legal bonding will choose to list on an exchange under stringent regulatory oversight and firms most likely to benefit from legal bonding will come from countries with weak legal systems. While earlier work like Reese and Weisbach (2002) and Doidge et al. (2004) find evidence in support of the legal bonding hypothesis, more recent studies like Doidge et al. (2009) and Ayyagari and Doidge (2010) identify the stringent disclosure requirements as a constraint for foreign firms to cross-list in the U.S. These more recent studies find that firms from economies under weaker legal systems are associated with more concentrated ownership structure and very few of these firms would pursue cross-listing in markets under stringent regulatory oversight. If they do pursue, however, they obtain higher valuations and improved capital raising opportunities. Doidge et al. (2009) interpret these results as evidence in favour of a 'private benefit' explanation of why many firms choose not to list overseas. Pinegar and Ravichandran (2010) focus on firms from Taiwan, Korea and India and also note that these firms have especially high ownership concentration. Contrary to the assertion of the legal bonding hypothesis, these firms instead pursue the SEC Rule 144a private placements that are under less stringent scrutiny in the U.S. Nonetheless, firms undertaking these private placements also benefit from a positive cross-listing premium. Pinegar and Ravichandran (2010) suggest that this cross-listing premium stems from the reputational bonding through the activities of 'reputational intermediaries' like analysts or the media. Sarkissian and Schill (2012) concur that the cross-sectional variation in the valuation premium appears to have little association with the difference in cross-country institutional quality.

In the case of China, corporate governance is usually discussed in the context of privatization or state ownership and contrasted with the standards set by the Hong Kong stock exchange. Jones et al. (1999) and Dinc and Gupta (2011) show that politicians prefer to delay privatisation activity due to the expected loss of control benefits, while Piotroski and Zhang (2014) find that the rate of domestic IPO activity of state-owned firms temporarily increases in the period directly preceding an impending provincial level personnel promotion event. Hung et al. (2012) find that Chinese state-owned enterprises (SOEs) with strong political connections are more likely to list in Hong Kong than non-politically connected firms and managers of politically-connected firms use overseas listing to realise private political benefits. In their assessment of the motives of 92 Chinese firms cross-listed in Hong Kong during 1993-2006, Sun et al. (2013) confirm that cross-listing is used by the Chinese government as a policy tool to maintain the domestic market order and leverage on the governance and stringent standards of the Hong Kong stock exchange. Given Hong Kong's political dependence on China and the result of La Porta et al. (1998) that Hong Kong scores lower points in many aspects of governance than the U.S., it is reasonable to assume that the Hong Kong legal systems do not provide as effective protection of minority shareholder interests as the U.S. legal systems do. Hence, we hypothesize that the more heavily a Chinese firm is owned by the state, the greater the probability that the firm will pursue overseas listing. The Chinese firms under more concentrated state ownership will be more likely to purely list on the stock exchange in Hong Kong than in the U.S.

3 Methodology

We follow Jorion and Schwartz (1986) and Foerster and Karolyi (1999) and adopt a two-factor asset pricing model to gauge the cost of equity capital. Within this framework, risk-adjusted expected return of an asset depends on the national and global systematic risks. If the national market is segmented from the global market, investors will price only the national or global

systematic risk and earn different risk-adjusted expected returns on similar assets in national and global markets. If the national market is mildly segmented, investors may expose to both the national and global systematic risks and do so to different extents. In the case of market integration, only the global risk factor will be significant in explaining the expected returns and investors will earn the same risk-adjusted expected returns on similar assets across markets. Hence the risk exposures will determine the expected return, which is equal to the cost of equity capital by definition. Changes in the cost of capital due to access to overseas finance can be gauged by the unconditional treatment effects on the expected return of overseas listing. We will estimate the effects of overseas listing as a whole, in specific forms and in selected destinations over two periods, e.g., within 6 months of listing and beyond 6 months and up to the 36th month of listing, within the potential-outcome framework.

3.1 A binary treatment setting: overseas listing as a whole versus domestic listing

The following two-factor asset pricing model captures the determination of the expected return of a firm.

$$R_i = \alpha + \beta_1 R_{Ni} + \beta_2 R_{Gi} + \gamma D_i + \phi_1 (D_i \cdot R_{Ni}) + \phi_2 (D_i \cdot R_{Gi}) + \varepsilon_i \qquad (1)$$

where R is excess return of a firm under study; α is a constant, representing the average excess return of the purely domestically listed firms when national and global market excess returns, R_N and R_G, are zero; β_1 and β_2 are the exposures by the domestically listed firms to the national and global market excess returns; D is a binary indicator that equals one if a firm lists its shares on any overseas stock exchange and zero if a firm lists purely domestically. The parameters, γ, ϕ_1 and ϕ_2, respectively, measure the differentials in the average excess return and exposures to the national and global market risks due to overseas listing. However, if estimated by OLS, the estimates of equation (1) are confounded by a selection bias term. That is, the estimates are biased due to the fact that the overseas listed firms differ from the domestically listed firms for reasons other than the listing status per se.

Undoubtedly, a firm's decision to list overseas is never random, but self-selective. That is, firms decide whether to list their shares on an overseas exchange on the basis of their firms' public and non-public information or observable and unobservable factors, such as expected revenue growth, unreported liabilities, corporate strategy, anticipated competitive pressures, corporate governance etc. Failure to account for the relationship between these factors and the decision to list overseas creates the self-selection bias that prevents the unbiased estimation of equation (1). To alleviate the selection bias, we model the decision to list overseas as follows.

$$D_i = a + b_1 X_{1i} + b_2 X_{2i} + b_3 X_{3i} + cTech_i + e_i \qquad (2)$$

where b_1, b_2 and b_3 are vectors of the coefficients on the pre-IPO or pre-listing firm characteristics (X_1), and listing-year economic indicators (X_2) of provinces where firms locate and listing-year national stock market development measurements (X_3); Tech is a binary sector indicator and e_i is an error term. The sector indicator, taking value 1 for firms that fall in the sectors identified to be high-tech by Pagano et al. (2002), accounts for the possibility that high-tech firms are more likely to list overseas. The pre-IPO or pre-listing firm characteristics include firm size proxied by log total assets, revenue growth averaged over two to three years prior to IPO or listing, leverage as a ratio of total liability to total assets, return on assets and state ownership concentration. As usual, firm size is included to control for the economies of scale that decrease the fixed listing cost proportionally as firm size increases. Revenue growth represents growth opportunities that a firm could seize by pursuing overseas listing to raise new equity capital. Return on assets represents firms' profitability and controls for the possibility that higher quality firms may be more likely to list overseas in order to signal their quality. Leverage is included to indicate that firms that have high pre-IPO or pre-listing leverage might have run out of debt finance capacity and would be more likely to list overseas. State ownership concentration is measured by the percentage of shares that are owned by the state. It is expected that the more heavily a firm is owned by the state, the more easily the firm

will get the approval from the authorities to list overseas. Finally, the provincial economic indicators include the ratio of exports to GDP and the growth rate of per capita GDP, while the national stock market development is measured by the stock market turnover ratio and the ratio of stock market capitalisation to GDP. All these macroeconomic variables control for economic and financial environments of the listing years.

In this binary case, the endogenous treatment-effects estimation is implemented. Specifically, equation (1) is estimated as a linear model, while equation (2) is estimated as a probit model. Residuals from equation (2) are further included in equation (1), as stipulated by the control-function approach, to control for the endogeneity of treatment assignment. To obtain the unconditional causal effect of overseas listing, we follow the regression adjustment approach. Firstly, the potential outcome models estimated by the control-function approach are used to predict observed and unobserved (counterfactual) excess returns for each firm. Then, the mean of the predicted observed and unobserved excess returns (also known as mean of potential outcomes), $E(R_1)$, of overseas listing and the mean of the predicted observed and unobserved excess returns, $E(R_0)$, of domestic listing are calculated respectively. The contrast of these means of potential outcomes, $E(R_1-R_0)$, produces the average treatment effect (ATE) in the population, measuring the total effect including both the direct and indirect effects of overseas listing on the expected excess return.

3.2 A multivalued treatment setting: Overseas listing in various forms versus domestic listing

The Chinese firms have pursued overseas listing through four forms, namely, the conventional cross-listing, purely overseas listing, cross-listing in reverse order and simultaneously domestic and overseas listing. In this case of multivalued treatment groups, the outcomes and treatment models are as follows.

$$R_i = \alpha + \beta_1 R_{Ni} + \beta_2 R_{Gi} + \sum_{k=1}^{4} \gamma_k D_{ki} + \sum_{k=1}^{4} \phi_{1k} (D_{ki} \cdot R_{Ni}) + \sum_{k=1}^{4} \phi_{2k} (D_{ki} \cdot R_{Gi}) + \varepsilon_i \quad (3)$$

$$D(k,i) = a_k + b_{1k} X_{1i} + b_{2k} X_{2i} + b_{3k} X_{3i} + c_k Tech_i + e_i \quad (4)$$

where k=1, 2,…, 4. D(k, i) is a regression function that would predict the probability that observation i has outcome k. Equation (3) is again a linear regression model, while equation (4) is estimated as a multinomial logistic model instead. The treatment assignment and potential outcomes are assumed to be independent conditional on the given specification of the outcome and treatment models. We will estimate equations (3) and (4) using the inverse-probability-weighted regression adjustment[3] estimator. Due to the property of double-robust, the IPWRA estimator only requires one of equations (3) and (4) to be correctly specified in order to correctly estimate the average treatment effects. The average treatment effects of the four forms of overseas listing are computed as the differences between the weighted means of the treatment-specific predicted outcomes and that of the predicted outcomes of domestic listing.

The successful estimation of equations (3) and (4) using any treatment effects estimator, e.g., the IPWRA or propensity-score matching estimator, relies on the assumption of overlap. In the context of our study, firstly, each firm must have a positive probability of overseas listing so that the predicted inverse-probability weights do not get too large. Over-sized weights will make the estimator unstable. Secondly, there must be a chance of seeing observations in both the control and treatment groups at each combination of covariate values.

3.3 A multivalued treatment setting: overseas listing in selected destinations versus domestic listing

[3] This estimator uses the inverse of the probabilities estimated from the treatment model as weights to address the missing-data problem arising from the fact that each subject is observed in only one of the potential outcomes. The missing-data-corrected regression coefficients are subsequently used to compute the potential outcomes.

The majority of the Chinese firms have chosen to list and stay listed on the stock exchanges in Hong Kong and/or the U.S. (see the statistics in the appendix). Given that these two stock markets have distinct legal and oversight requirements, it will be interesting to see how the Chinese firms choose between these listing destinations. As discussed in the review of the literature, the decision to listing overseas is related to ownership concentration. In the case of China, as state ownership has enabled the managers to seek their private benefits, we use the state ownership concentration to proxy the extent that the minority shareholder interests are neglected. We will verify whether the Chinese firms with concentrated state ownership will seek to benefit from legal bonding. In this setting, there are 3 levels of treatments, namely, purely listing in Hong Kong, purely listing in the US and cross-listing or simultaneous listing, against the control group of purely domestic listings. The procedure of this multivalued treatment effects analysis will be the same as those described in section 3.2.

3.4 Data and variables

Our data set includes all mainland Chinese firms that have listed on the stock exchanges in China, Hong Kong and/or the U.S. for at least three years following listing in the period of 1997 and 2015. These firms must have also filed their prospectuses on the public domains to enable us to collect their pre-IPO or pre-listing information. Because we have noted the dates of their first-time listing in the U.S. or/and Hong Kong and cross-checked with those of the domestically listed firms, we are able to identify the forms of overseas listing by the Chinese firms. Note that we count the conventional cross-listings as overseas listings at the time they first listed overseas. With the criteria that firms must have pre-IPO or pre-listing information and should have stayed listed domestically and/or overseas for at least three years since first listing, our sample size is restricted to 1931 firms. 1688 of the firms are purely domestic listings, while 179 firms are purely overseas listings. In addition to these firms, 20 firms follow

the conventional cross-listing route, while 35 firms cross-list in reverse order. The final nine firms simultaneously list domestically and overseas after IPO.

Monthly share prices of all purely domestically listed firms are downloaded from the China Stock Market and Accounting Research (CSMAR) database, while those of overseas listed firms are from Datastream. Share prices of the purely domestically listed firms are converted to the US dollars using the official exchange rate obtained from the Federal Reserve website. For the firms purely listed on the Hong Kong stock exchange and simultaneously listed or cross-listed in the U.S., Hong Kong and China, we use the share prices traded on the Hong Kong stock exchange and convert these prices into the U.S. dollars using the official exchange rate between the Hong Kong dollar and the U.S. dollar. Note that we do not include Chinese firms that pursue the SEC Rule 144a private placements or over-the-counter listings in the U.S. in our sample.

We calculate the realised returns by taking the first differences of the natural logarithms of the share prices of the firms and the excess returns by subtracting risk-free rates of returns from the realised returns. For the domestically listed firms, the risk-free rate of return is the risk-free interest rate, downloaded from the CSMAR database. The Hong Kong three-month deposit interest rate from Datastream is used as the risk-free rate for the shares listed in Hong Kong, while the U.S risk-free return from the Kenneth French's data library is used for the firms purely listed on the U.S. stock exchanges. The Chinese national market index is represented by the Shanghai Stock Exchange (SSE) composite index, which is also converted into the U.S. dollars. The national market excess return is hence the log difference of the SSE index in excess of the risk-free interest rate from the CSMAR database. The global market excess return is the average excess return of developed markets, including the U.S., Hong Kong and 21 other economies, downloaded from the Kenneth French Data Library website. To check for the robustness of the results, we will replace the global excess return with the host market excess

returns for the firms that purely list in the U.S. and Hong Kong respectively. The host market excess return for the firms that purely list in the U.S. will be the excess return of the U.S. market downloaded from the Kenneth French Data Library, while that for the listings in Hong Kong is the realised return of the Hang Seng Index in excess of the three-month deposit interest rate. Following the convention, we collapse each firm's monthly excess returns to two averages, respectively, over the first 6 months and over the 7^{th} up to 36^{th} months since listing. The national and global (or host) market excess returns are also collapsed, respectively, to two averages that correspond to each firm's post-listing periods.

By reading the prospectuses filed by the Chinese firms when they first listed or cross-listed on the stock exchanges in Hong Kong or the U.S., we hand-collected pre-IPO or pre-listing firm characteristics, such as firm size, return on assets, leverage, revenue growth rate averaged over 2 or 3 years prior to IPO or listing and the percentage of shares owned by the state, for each of the overseas listed firms. The pre-IPO firm characteristics for the purely domestically listed firms are, on the other hand, downloaded from the CSMAR database. The national variables, such as the stock turnover ratio and the ratio of market capitalisation to GDP, are obtained from the World Bank data bank. The economic indicators, e.g., the ratio of exports to GDP and the growth rate of GDP per capita, of the provinces where the firms locate are obtained from the website of the Chinese statistical Bureau.

4 Empirical results

4.1 Preliminary data analysis

The summary statistics of our variables are reported in Table 1. Firstly, it is noted that the overseas listed firms, on average, were bigger in size, faster in revenue growth, more highly geared and more heavily owned by the state than their domestic counterparts prior to IPO or listing. Secondly, the overseas listed firms consistently outperform, in terms of the realised return, the purely domestically listed firms both in the short run and in the longer run. Over

time, while the overseas listed firms improve their performance, the domestically listed firms make greater losses. Among the overseas listed firms, cross-listings in reverse order have consistently performed the best, earning positive average monthly returns in both periods. As a contrast, the conventionally cross-listed firms make the greatest loss in the short run, although they improve their performance in the longer run. By listing destination, the firms that list purely in Hong Kong have consistently performed better than those purely listed in the U.S. Nonetheless, the firms that purely list in the U.S. improve their performance by losing less in the longer run.

[Table 1 is about here.]

4.2 Treatment-effects analysis of overseas listing as a whole

4.2.1 Determinants of overseas listing

In this binary treatment setting, the determinants of overseas listing can be examined on the basis of the probit coefficients and their average marginal effects reported in Panel A of Table 2. It seems that the high-tech indicator is not related to the decision to list overseas as a whole. Pre-IPO or pre-listing firm characteristics, such as firm size, revenue growth and state ownership concentration, tend to be positively related to the probability of overseas listing, while the provincial and national macroeconomic variables negatively affect the decision to list overseas. The stronger the revenue growth or the larger the firm size, the greater the possibility that firms will list on an overseas market. The estimates of their marginal effects suggest that an increase in revenue growth and firm size by 1% will increase the probability of overseas listing by 0.003 and 0.046 respectively. As expected, it is more likely for the Chinese firms to list their shares on an overseas exchange, if they are more heavily owned by the state. However, an increase in state ownership by 1% will merely increase the probability of overseas listing by 0.0005. As expected, the more developed a national stock market is, the smaller the probability that firms will list overseas. For instance, an increase in the ratio of market

capitalisation to national GDP by 1% will decrease the probability of overseas listing by 0.0025. However, the less profitable a firm is, the more likely that the firm will list its shares overseas, contrary to the finding of Zhang and King (2010). It seems that the Chinese firms do not simply list overseas to signal their good quality in the more recent period. Moreover, leverage is unrelated to overseas listing, refuting the hypothesis that firms list overseas because they have run out of debt finance capacity.

[Table 2 is about here.]

4.2.2. Potential outcome and causal effect of overseas listing

Table 3 reports the coefficient estimates of the outcome model, i.e., equation (1) of the two-factor asset pricing model. Firstly, given the statistics, $\chi^2(2)=1.58$ and $\chi^2(2)=4.28$, we cannot reject the null hypothesis of no correlation between the residuals from the treatment and outcome models, suggesting that there is no endogeneity caused by the unobservable factors of the treatment assignment in the short run or longer run. This result is also mostly confirmed by the statistically insignificant average residuals, included as one of the explanatory variables in the outcome model by the control-function approach, from the probit models across two types of listed firms over two post-listing periods.

[Table 3 is about here.]

Table 3 further shows that, if the systematic risks are zero, the average excess returns will be statistically significant and negative for the purely domestically listed firms both in the short run and in the longer run. It can be said that these domestically listed stocks are priced persistently incorrectly. On the contrary, the overseas listed shares on average are priced without error, given the statistically insignificant intercepts in both periods. Secondly, within the first 6 months of listing, the domestically listed firms expose only positively to the national risk. In the longer run, the domestically listed firms expose to the global factor additionally, albeit negatively. The negative pricing of the global risk is not uncommon to emerging

economies, where domestic listings are mainly available to the domestic investors who may wish to discount the global risk. On the contrary, the overseas listed firms expose positively to both the national and global risks in the short run and in the longer run. That is, investors are compensated for taking on both the Chinese national and global risks on the overseas markets. Furthermore, the risk exposures are in line with those predicted by the market segmentation hypothesis: in the longer run, overseas listed firms expose on average more to the global risk than to the national risk and the longer-run exposure to the national risk by the overseas listed firms is smaller than that by the domestically listed firms.

With the chosen endogenous treatment-effects estimator, we do not rely on the estimated γ, ϕ_1 and ϕ_2 to measure the difference in the expected excess returns between the purely domestically listed firms and the overseas listed firms. We can estimate the unconditional impact of overseas listing and the potential outcomes of overseas and domestic listings directly. The means of the potential outcomes of -1.13% and -1.54%, reported in Table 3, suggest that the expected monthly excess returns would have been negative in the short run and in the longer run, if all firms were to list purely domestically. That is, investors of the domestically listed firms would receive an average return that is lower than the risk-free interest rate. While the unconditional total effect of overseas listing on the expected excess return is statistically insignificant in the short run, it is statistically significant and positive at 2.108% in the longer run. That is, overseas listing does not increase the potential outcome until the second post-listing period. In the longer run, the potential expected excess return will be 2.108% higher than the potential outcome that would have arisen if all firms were to list domestically. Hence, we would expect the cost of equity capital to be higher for the overseas listed firms in the longer run. Although this result appears to contradict the prediction of a lower cost of capital by the market segmentation hypothesis, the average monthly excess return would not have been statistically different from zero, if all firms were to list overseas. That is, investors of the overseas listed firms would have required the rate of return as high as the risk-free interest rate, hence the cost of equity capital

for the overseas listed firms would have been as low as the risk-free interest rate. It seems that overseas listing corrects the negative excess return that would have arisen if all firms were to list domestically.

4.3 Treatment effects analysis of various forms of overseas listing

4.3.1 Determinants of overseas listing in specific forms

To examine the determinants of the decisions to list overseas in various forms, we estimate the treatment model of equation (4) as a multinomial logistic model independently in this section. The estimated multinomial logistic regression coefficients are reported in Panel B of Table 2. These coefficients represent the logits of seeking overseas listing in specific forms relative to the reference group, purely domestic listing. The multinomial logit coefficients can be exponentiated to obtain the relative risk ratios, i.e., the probabilities of seeking overseas listing in specific forms relative to probability of seeking purely domestic listing. The results reported in Table 2 firstly show that the high-tech indicator is only statistically significant in explaining the decision to purely list overseas, confirming the report that high-tech firms tend to skip their domestic stock exchanges and list directly overseas. Being a firm in the high-tech sector increases the logit of purely listing overseas relative to purely listing domestically by 0.480 unit, given that all other predictor variables in the treatment model are held constant. In terms of the relative risk ratio, for firms in the high-tech sector, the probability of purely listing overseas relative to that of purely listing domestically would be expected to increase by a factor of 1.616, given that the other variables in the model are held constant. Pre-IPO or pre-listing firm characteristics, such as the revenue growth and firm size, are positively associated with all overseas listing decisions, while return on assets and leverage exert at most a negative influence, as found in the binary treatment case. For instance, if a firm were to increase its revenue growth by 1%, its multinomial logit of simultaneously listing domestically and overseas relative to purely listing domestically would be 0.061 unit higher, or its relative

probability of simultaneously listing domestically and overseas would be expected to increase by a factor of 1.062, the highest factor among all treatment groups, given that the other variables in the model are held constant. On the contrary, if a firm were to increase its leverage by 1%, the multinomial logit of simultaneously listing domestically and overseas relative to purely listing domestically would be 0.816 unit lower. Its relative risk ratio for simultaneously listing domestically and overseas would decrease by a factor of 0.442, given that the other variables in the model are held constant. While it is negatively related to the relative probability to cross-list conventionally, state ownership concentration positively affects the decisions to seek all alternative forms of overseas listing. Its impacts are the greatest on the relative probability to simultaneously list domestically and overseas and the least on that to purely list overseas. The provincial and national variables also influence the corporate decisions differently. For instance, with stronger domestic economic and stock market development, the Chinese firms are less likely to list purely overseas or cross-list in reverse order. The ratio of exports to GDP at the provincial level affects the decision to cross-list overseas by the domestically listed firms, consistent with the finding in the literature.

Compared with the results of two separate binary probit models reported in Zhang and King (2010), the effects of the pre-IPO or pre-listing firm characteristics, such as firm size, revenue growth and leverage, on the decision to cross-list overseas have not changed since 1993-2005. What have changed are their influences on the corporate decision to directly list overseas. More significantly, the influence of the high-tech indicator has evolved. Zhang and King (2010) find that their high-tech indicator affected the decision to cross-list during 1993-2005, while we find that high-tech firms are more likely to purely list overseas during 1997-2015. The change in the form of overseas listing sought by the Chinese firms can be explained by the change in the composition of the high-tech industry. High-tech firms in the earlier period were mainly of hard science and technology in nature and owned by the state so that they could easily be approved to list domestically first and cross-list overseas subsequently. In the recent period,

the increasing number of firms engaging in computer software development is more likely to be privately owned and would have to seek external finance independently.

4.3.2 Potential outcomes and causal effects of overseas listing in specific forms

When examining the causal effects of overseas listing in various forms, we also address self-selection bias by modelling simultaneously the listing decisions with the observable pre-IPO or pre-listing firm characteristics and listing-year macroeconomic variables. However, we have to omit three pre-IPO firm characteristics, namely, firm size, leverage and return on assets, and the high-tech indicator due to their violation of the overlap assumption. The removal of these variables from the treatment model will not affect the correct estimation of the causal effects of overseas listing due to the double-robust property of the IPWRA estimator we adopt in this case. We also note that the correlations between the residuals of the treatment assignment and the outcome models are mostly statistically insignificant (as reported in Table 4), justifying the assumption of conditional independence that underpins the adoption of the IPWRA estimator in this case.

The estimates of the outcome models are reported in Panel A of Table 4. It is noted that the intercepts and slope coefficients for the control group in this multivalued treatment setting do not vary from those obtained in the binary treatment setting. With the statistically significant and negative intercepts, the shares of the domestically listed firms are under-priced in the short run and in the longer run. Furthermore, the domestically listed firms only expose positively to the national risk in the short run, and expose additionally to the global risk, albeit negatively, in the longer run. As we categorise overseas listings by listing form, we can see the following features. While the shares of the conventional cross-listed firms are priced incorrectly in both periods, the alternative overseas listings experience pricing errors only in the longer run. As for the risk exposure patterns, we find that more categories of overseas listed firms expose to the national risk in the short run, while more of them expose to the global risk to a greater

extent in the longer run, consistent with the risk exposure pattern implied by the market segmentation hypothesis. It seems that the second post-listing period of 30 months is not long enough for the conventionally cross-listed firms and the firms cross-listed in reverse order to expose to the systematic risks uniformly. Firms that cross-list in reverse order expose to both the national and global risk factors in the longer run, while those conventionally cross-listed firms do not expose to any of the risks.

[Table 4 is about here.]

The means of potential outcomes and the average treatment effects of overseas listing in various forms estimated by the IPWRA estimator are reported in the upper part of Panel A of Table 5. Similar to the results obtained in the binary setting, the expected monthly excess return would have persistently been negative over the two post-listing periods, if all firms were to list domestically. Although the majority of them are statistically insignificant in the shorter run, the average treatment effects of overseas listing in all forms but one are statistically significant in the longer run. A stark contrast exists between the conventional cross-listing and the cross-listing in reverse order; while neither the short-run nor longer-run average treatment effect is statistically significant in the former, both the effects are statistically significant in the latter. The positive average treatment effects ensure that the expected monthly excess returns would not have been negative in the longer run, if all firms were to list overseas in any form other than the conventional cross-listing. Our results obtained from this multivalued treatment setting differ from the findings in the literature and reflect the new developments in the stock return determination. For instance, Zhang and King (2010) find that post-listing stock returns are negative for all overseas listings (i.e., cross-listing ADRs and foreign IPOs) both in the short run and long run over 1993-2005, while Lou et al. (2012) find that cross-listing ADRs show superior performance relative to single-listings in the long run over 1993-2010.

[Table 5 is about here.]

4.4 Multivalued treatment effects analysis of overseas listing in selected destinations

4.4.1 Choice of overseas listing destinations

We re-categorise the overseas listed firms into three levels of treatments, namely, direct listings in the Hong Kong, direct listings in the U.S. and cross-listings or simultaneous listings, in contrast with the control group of the purely domestic listings. Panel C of Table 2 reports the multinomial logistic regression coefficients of the treatment model. It is evident that high-tech firms tend to purely list in the U.S. only. Being a firm in the high-tech sector would increase the multinomial logit of purely listing in the U.S. relative to purely listing domestically by 0.682 unit or increase its relative probability to purely list in the U.S. by a factor as high as 1.978, given that all other variables in the treatment model are held constant. As expected, some of the observable factors affect the choice of a listing destination consistently, while others do so differently. The revenue growth and firm size are statistically significant in explaining the decision by the Chinese firms to list overseas in any destination, consistent with the results in the previous sections. The stronger the revenue growth, the greater the possibility that firms will list overseas, especially on a stock exchange in the U.S. This is supported by the rejection, on the basis of $\chi^2(1)=11.86$ and $\chi^2(1)=14.16$ (not reported in the tables), of the null hypotheses that there is no difference in the coefficients of revenue growth between the listings in the U.S. and Hong Kong and between the listings in the U.S. and the simultaneous or cross listings. Similarly, state ownership concentration does not influence the choice of a listing destination consistently. The more heavily a firm is owned by the state, the more likely the firm will purely list in Hong Kong. On the contrary, purely listing in the U.S. is negatively related to state ownership concentration. These results reject the legal bonding hypothesis and support the private benefit explanation of Doidge et al. (2010) that the direct constraints associated with listing on a stock exchange in the U.S. are an important deterrent for foreign firms with high expected private control benefits. However, our results do not exclude the equity issuance

explanation implied by the market segmentation hypothesis. This is because firms with better growth prospects are found highly likely to pursue purely listing in the U.S., given that an increase in revenue growth by 1% would increase the multinomial logit of purely listing in the U.S. relative to purely listing domestically by 0.052 unit or the relative probability of purely listing in the U.S. by a factor of 1.053. Finally, consistent with the estimates of the previous sections, the provincial per capita GDP growth and the ratio of national market capitalisation to GDP negatively affect the probabilities to list purely in Hong Kong and the U.S, respectively, while the ratio of exports to GDP is positively related to the decision to cross-list or simultaneously list domestically and overseas.

4.4.2 Potential outcomes and causal effects of overseas listing in selected destinations

In this section, the outcome model is also simultaneously estimated with the treatment model in the absence of the pre-IPO or pre-listing firm size, leverage, return on assets and the high-tech indicator and the results are reported in Panel B of Table 4. Note that the correlations between the residuals of the treatment assignment and the outcome models are statistically insignificant, justifying the adoption of the IPWRA estimator. The estimated parameters show once more that all estimates for the domestically listed firms are consistent with those obtained in the previous sections. As we categorise the overseas listings by listing destination, the pricing errors in the shares of overseas listed firms in all destinations are reduced in the longer run. However, the Chinese firms purely listed in the selected overseas destinations have very different risk exposure patterns. Although the firms listed purely in Hong Kong expose positively to both the national and global risks within 6 months of listing, they do not expose to either of the risk factors in the longer run. On the contrary, while the firms purely listed in the U.S. do not expose to either the national or global risk in the short run, they expose positively to the global risk and negatively to the national risk in the longer run. Finally, the simultaneously listed or cross-listed firms expose positively to both the national and global

risks in both post-listing periods. We will check for the robustness of these risk exposure patterns in the next section.

The causal effects and potential outcomes of overseas listing in selected destinations are reported in the lower part of Panel A of Table 5. These results are mostly consistent with those found in the previous sections too. Firstly, the potential expected monthly excess returns would have been negative in both periods if all firms were to list domestically. Secondly, listing in any of the overseas destinations will not exert any positive average treatment effect on the expected monthly excess return until the second post-listing period. It is noted that listing purely in the U.S. exerts the greatest average treatment effect on the expected excess return in the longer run. However, if all firms were to list purely in Hong Kong, the potential expected excess return would have been negative. Hence, our new findings are that firms with concentrated state ownership tend to list purely in Hong Kong and such listing would exert a smaller causal effect on the expected excess return, resulting in a negative potential excess return in the longer run.

4.5 Robustness of the results

4.5.1 Risk exposures of overseas listed firms in selected destinations

Given that the two-factor asset pricing model is well-developed and serves the purpose of testing for the market segmentation hypothesis, we do not change the specification of the outcomes model. Instead we replace the global market risk for the purely overseas listings with their host market risk factors in the outcome models. We re-estimate the system of equations (3) and (4) and report the results in Table 6. It is clear that the host market risk factors have not changed the results substantially. The intercepts and slopes of the outcome models for the domestically listed firms, cross-listed or simultaneously listed firms and even those purely listed in the U.S. are consistent with those obtained from the outcome models with the global market risk. Although the short-run risk exposures of the firms that purely list in Hong Kong

differ from those obtained from the original model, their longer-run risk exposure pattern remains unchanged. As opposed to a positive exposure to the global risk in the short run, the firms purely listed in Hong Kong do not expose to the host market risk within 6 months of listing. However, in the longer run, the firms do not expose to either the host market risk or the Chinese national market risk, as found earlier.

[Table 6 is about here.]

We further check for the robustness of the risk exposures by overseas listings in the selected destinations by estimating the outcome model and the treatment model simultaneously using the instrumental variable approach. The results are reported in Table 7. Note that the instrumental variable approach does not estimate specifically the parameters for the multivalued treatment groups. Instead it estimates the differentials in the intercept and slopes, γ, ϕ_1 and ϕ_2, from the control group of domestic listings for the overseas listings by destination. It is evident that the results for the domestically listed firms are consistent with those obtained via the IPWRA estimator, while the results for overseas listings overall deviate from what we found earlier. However, the risk exposures of overseas listings by destination in the second post-listing period are less inconsistent with what we found earlier. The instances of consistent results include that the firms purely listed in Hong Kong do not expose to the national market risk and the firms purely listed in the U.S. expose positively to the global risk in the longer run. Using this instrumental variable approach, the longer-run risk exposure pattern for the firms purely listed in Hong Kong is found to be the same as that for the firms purely listed in the U.S. That is, the firms purely listed in Hong Kong also expose positively to the global market risk in the longer run, albeit to an extent smaller than that by the firms purely listed in the U.S., contrary to what we found using the IPWRA estimator. The conclusion is that the risk exposures by the firms purely listed in Hong Kong are sensitive to the methods of estimation.

[Table 7 is about here.]

4.5.2 Average treatment effects of overseas listing in specific forms or selected destinations

In our multivalued treatment effects analyses, we remove three pre-IPO firm characteristics as well as the high-tech indicator from the estimation of the treatment effects due to their violation of overlap assumption. We now re-estimate the treatment effects using the regression adjustment (RA) estimator that models the outcome without any assumption about the functional form for the probability of treatment model. The RA estimator will break down more slowly than the IPWRA estimator, as the overlap assumption begins to fail. The results are reported in Panel B of Table 5. It seems that the short-run and longer-run potential expected excess returns for the purely domestically listed firms estimated by the RA estimator are consistent with those obtained by the IPWRA estimator, in terms of sign, magnitude and statistical significance. The results are robust that the investors would earn negative returns in the short run and longer run if all firms were to list domestically. Although there is slight deviation from the short-run estimates, the RA estimator provides the longer-run potential expected returns and average treatment effects consistent with those obtained by IPWRA for overseas listing in the specific forms and selected destinations. In the longer run, overseas listing in nearly all forms or destinations evidently exerts positive causal effects, which are just strong enough to make their own potential excess returns be equal to zero. It is confirmed that the longer-run average treatment effect of purely listing in Hong Kong is not strong enough to correct the negative potential excess return that would have arisen if all firms were to list domestically. Once more, there is no evidence of a lower cost of capital as predicted by the market segmentation hypothesis.

To further check the robustness of the average treatment effects estimated by the IPWRA estimator, we now use the propensity-score matching (PSM) estimator to estimate the effects of overseas listing in the specific forms or selected destinations. Note that the PSM estimator

depends on the same set of the assumptions underpinning the IPWRA estimator, but can only estimate the average treatment effects in the binary settings against purely domestic listing respectively. We have also removed the same firm characteristics that violate the overlap assumption in the estimation. The results are reported in Panel C of Table 5. These results show that the majority of the short-run and longer-run treatment effects is statistically insignificant, hardly suggesting any evidence of a lower cost of capital as predicted by the market segmentation hypothesis. Although the short-run average treatment effect of the conventional cross-listing is statistically significant at -4.45%, we cannot be sure that the conventional cross-listing lowers the cost of equity capital without knowing that the potential expected excess return of the purely domestic listings would be positive. However, given their statistically significant and positive longer-run average treatment effects, we are sure that the conventional cross-listing and purely listing in the U.S. outperform the purely domestic listing in the longer run.

5 Conclusion

We examine the motivations and economic consequences of overseas listing through a multivalued treatment effects analysis of a sample of 243 Chinese firms that list in the U.S. and/or Hong Kong against a sample of 1688 purely domestically listed firms during 1997-2015.

We find some new developments in the listing decision by the Chinese firms. Firstly, high-tech firms tend to directly list overseas, especially in the U.S., in the period under study, contrary to the finding of Zhang and King (2010) that high-tech firms were more likely to cross-list in the form of ADR during 1993-2005. Secondly, firms heavily owned by the state tend to directly list in Hong Kong rather than the U.S., supporting the private benefit explanation by Doidge et al. (2010) that the stricter constraints associated with listing in the U.S. are an important deterrent for foreign firms with high expected private control benefits. We do not find any

evidence in favour of legal bonding that both Zhang and King (2010) and Lou et al. (2012) suggest as one of the motives to cross-list by the Chinese firms.

As for the economic consequences, our results overall suggest that overseas listing, especially directly listing in the U.S., raises the potential expected returns. Although they do not support the prediction by the market segmentation hypothesis that firms from segmented economies would acquire a lower cost of equity capital through accessing the international capital market, the positive average treatment effects of overseas listing found in this study correct the negative potential excess return that would have arisen if all firms were to list domestically.

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Table 1 Summary statistics of Chinese firms that first listed during 1997 and 2015

	Purely domestic listings (m1)	Overseas listing						Purely overseas listing in	
		As a whole		Conventional cross-listing	Purely overseas listing	Cross-listing in reverse order	Simultaneous listing	HK	US
		Summary statistics (m2)	t test for H0: m1=m2						
Average return within 6 months of listing	-0.86 (7.73)	0.073 (7.33)	-1.84**	-2.24 (4.87)	-0.42 (7.51)	3.84 (7.14)	0.38 (4.24)	-0.04 (6.63)	-1.08 (8.84)
Average return from 7th to 36th months post listing	-1.37 (2.62)	0.842 (3.21)	-11.81***	0.42 (1.79)	0.42 (3.06)	3.51 (3.63)	-0.268 (1.688)	0.83 (2.19)	-0.28 (4.07)
Revenue growth over two or three years	23.43 (19.01)	42.29 (45.25)	-6.42***	28.15 (13.83)	48.25 (50.61)	24.98 (17.93)	22.37 (8.92)	29.35 (30.74)	80.62 (60.83)
Leverage	0.48 (0.17)	0.67 (0.60)	-4.86***	0.66 (0.19)	0.66 (0.69)	0.622 (0.21)	0.94 (0.05)	0.66 (0.71)	0.66 (0.66)
Return on assets	15.48 (8.35)	7.85 (16.50)	7.08***	7.31 (6.23)	8.13 (18.92)	8.36 (5.52)	1.55 (0.80)	9.32 (9.98)	6.10 (28.32)
Firm size	6.40 (1.06)	8.42 (2.74)	-11.36***	11.23 (1.74)	7.71 (2.47)	9.22 (2.21)	13.24 (2.01)	8.34 (2.60)	6.63 (1.77)
State ownership	15.99 (31.99)	41.11 (43.43)	-8.68***	26.74 (22.27)	34.22 (42.18)	71.93 (42.40)	90.25 (14.57)	51.54 (41.83)	4.55 (20.99)
Provincial per capita GDP growth	11.12 (2.32)	10.63 (2.39)	3.03***	10.64 (2.46)	10.45 (2.40)	11.31 (2.36)	11.52 (1.53)	10.36 (2.36)	10.59 (2.49)
Provincial exports/GDP	0.34 (0.26)	0.29 (0.23)	3.38***	0.47 (0.30)	0.27 (0.22)	0.30 (0.21)	0.21 (0.04)	0.26 (0.22)	0.28 (0.22)
National stock turnover	187.51 (72.89)	166.10 (67.82)	4.56***	182.84 (59.35)	168.81 (68.46)	143.92 (66.92)	161.23 (66.34)	158.21 (67.51)	186.94 (66.74)
National capitalisation/GDP	49.80 (15.50)	41.90 (14.66)	7.79***	52.36 (15.19)	42.43 (13.31)	32.61 (13.33)	44.20 (24.35)	40.98 (11.93)	44.91 (15.16)
No. obs	1688	243		20	179	35	9	113	66
% of high-tech firms	37.2	29.6		25	36.9	5.7	0	25.7	56.1
% of firms with non-zero state ownership	29.4	56.4		75	48	77.1	0	73.5	4.5

Note: Firm characteristics are values prior to IPO or listing. Values in brackets are standard deviations. ***, ** and * represent the level of significance at 1%, 5% and 10% respectively.

Table 2 Estimates of the treatment models for overseas listing as a whole, in specific forms and in selected destinations

	Panel A: Probit		Panel B: Multinomial logistic model				Panel C: Multinomial logistic model		
Y = indicator	Overseas listing		Conventional cross-listing	Purely overseas listing	Cross-listing in reverse order	Simultaneous listing	Purely listing in HK	Purely listing in US	Simultaneous or cross-listing
	coefficient	AME							
Constant	-2.304***		-27.48***	-3.310***	-6.203**	-43.44***	-3.521***	-4.267**	-10.92***
	(0.443)		(3.450)	(0.914)	(2.536)	(11.63)	(0.978)	(1.938)	(1.686)
Revenue growth	0.020***	0.003***	0.024***	0.040***	0.024***	0.061***	0.027***	0.052***	0.028***
	(0.002)	(0.0003)	(0.008)	(0.004)	(0.009)	(0.011)	(0.006)	(0.006)	(0.006)
Firm size	0.324***	0.046***	2.343***	0.531***	0.726***	2.221***	0.589***	0.362**	1.123***
	(0.040)	(0.005)	(0.233)	(0.078)	(0.150)	(0.561)	(0.082)	(0.182)	(0.136)
Return on assets	-0.020***	-0.003***	-0.007	-0.051***	-0.047	-0.208***	-0.035	-0.066**	-0.035*
	(0.008)	(0.001)	(0.017)	(0.018)	(0.032)	(0.059)	(0.021)	(0.027)	(0.0201)
Leverage	-0.005	-0.001	-7.680***	0.092	-1.291	-0.816**	0.209	0.133	-2.519**
	(0.169)	(0.023)	(1.695)	(0.256)	(1.333)	(0.382)	(0.263)	(0.460)	(1.099)
State ownership concentration	0.003**	0.0005**	-0.033**	0.005*	0.016**	0.072***	0.010***	-0.024*	0.007
	(0.001)	(0.0002)	(0.013)	(0.003)	(0.006)	(0.025)	(0.003)	(0.013)	(0.005)
Provincial GDP per capita growth	-0.069***	-0.010***	0.305**	-0.178***	-0.045	0.571**	-0.209***	-0.120*	0.054
	(0.022)	(0.003)	(0.136)	(0.047)	(0.135)	(0.294)	(0.054)	(0.080)	(0.086)
Provincial exports/GDP	-0.129	-0.018	3.774***	-0.506	0.316	2.492	-0.259	-1.017	1.243**
	(0.180)	(0.025)	(1.404)	(0.392)	(0.762)	(1.534)	(0.461)	(0.661)	(0.600)
National stock turnover	0.0002	0.00003	0.001	0.001	0.005	0.011	-0.002	0.007**	-0.002
	(0.001)	(0.0001)	(0.007)	(0.002)	(0.006)	(0.008)	(0.002)	(0.003)	(0.004)
National market capitalisation/GDP	-0.018***	-0.002***	0.043**	-0.036***	-0.081**	0.036	-0.033***	-0.050***	-0.022*
	(0.004)	(0.0001)	(0.019)	(0.008)	(0.036)	(0.035)	(0.008)	(0.019)	(0.012)
High-tech indicator	0.170	0.024	1.081	0.480**	-1.209	-11.74***	0.353	0.682*	-0.524
	(0.109)	(0.015)	(0.901)	(0.217)	(0.886)	(1.128)	(0.255)	(0.409)	(0.548)
R^2	0.344		0.387				0.364		
LR χ^2	234.44*** (d.f.=10)		818.67*** (d.f.=40)				386.2*** (d.f.=30)		
No. observations	1931		1931				1931		

Note: The probit model is simultaneously estimated with its corresponding outcome model whose results are reported in Table 3. AME stands for average marginal effect. The multinomial logistic models are estimated independently. Values in brackets are standard errors. The standard errors for the probit model are robust by default as they are corrected for the three steps that are involved in the estimation process, namely, estimation of listing probabilities, estimation of stock excess returns and estimation of average treatment effects. The standard errors for the multinomial logistic models are also robust as they are adjusted for 1931 clusters of stocks. ***, ** and * represent the level of significance at 1%, 5% and 10% respectively.

Table 3 Estimates of the outcome models and causal effects by endogenous treatment-effects estimation

	In the short run		In the longer run	
Y=excess return	Domestically listed firms	Overseas listed firms	Domestically listed firms	Overseas listed firms
Constant	-0.836*** (0.241)	-1.134 (0.832)	-1.335*** (0.123)	-0.229 (0.387)
National market excess return (R_N)	0.493*** (0.050)	0.524*** (0.099)	0.986*** (0.037)	0.381*** (0.140)
Global market excess return (R_G)	0.032 (0.076)	1.056*** (0.232)	-0.315*** (0.092)	0.883*** (0.239)
Residuals from Probit model	-1.609 (1.906)	-1.136 (1.262)	0.198 (0.558)	-1.392** (0.689)
$\chi^2(2)$ for H0 of no correlation between residuals	1.58		4.28	
Average treatment effect	0.032 (0.856)		2.108*** (0.433)	
Mean of potential outcomes	-1.126*** (0.241)	-1.095 (0.828)	-1.537*** (0.079)	0.571 (0.426)

Note: Standard errors in brackets are adjusted for 1931 clusters of firms. The outcome models (equation (1)) are simultaneously estimated with equation (2), whose results are reported in Panel A of Table 2, using an endogenous treatment-effects estimator and by a control-function approach. Short-run and longer-run periods are those over post-listing 6 months and over the 7th to 36th months respectively. ***, ** and * represent the level of significance at 1%, 5% and 10% respectively.

Table 4 Estimates of the outcome models for overseas listings in specific forms or selection destinations

	In the short run				In the longer run			
	Constant	R_N	R_G	Cor(e_T, e_O)[a]	Constant	R_N	R_G	Cor(e_T, e_O)
Panel A: In specific forms								
Purely domestic listing	-0.705***	0.525***	-0.009	-0.0093	-1.257***	0.987***	-0.425***	-0.0132
	(0.182)	(0.049)	(0.075)		(0.088)	(0.035)	(0.083)	
Conventional cross-listing	-2.626**	0.551**	0.762*	-0.0062	-1.679**	-0.215	0.677	-0.1595
	(1.087)	(0.236)	(0.441)		(0.734)	(0.344)	(0.752)	
Purely overseas listing	0.149	0.60**	1.148***	0.0460	-1.506*	0.163	1.644**	0.1412*
	(0.977)	(0.315)	(0.307)		(0.802)	(0.203)	(0.717)	
Cross-listing in reverse order	1.440	0.807***	0.270	0.0366	-0.762**	0.915***	0.965***	-0.3440**
	(0.922)	(0.235)	(0.718)		(0.297)	(0.132)	(0.228)	
Simultaneous listing	-2.207	-0.053	0.935*	-0.4559	-1.574***	-0.384	1.059***	-0.2520
	(1.720)	(0.247)	(0.560)		(0.310)	(0.442)	(0.210)	
Panel B: In selected destinations								
Purely domestic listing	-0.708***	0.527***	-0.020	-0.0104	-1.266***	0.987***	-0.413***	-0.0120
	(0.181)	(0.049)	(0.076)		(0.090)	(0.036)	(0.083)	
Purely listing in Hong Kong	-1.259	0.668*	1.867***	0.0134	-0.860*	0.0005	0.352	-0.0926
	(0.924)	(0.365)	(0.319)		(0.489)	(0.180)	(0.435)	
Purely listing in the US	-0.395	0.007	0.563	.0622	-2.884**	-0.585*	3.356***	0.1693
	(1.216)	(0.242)	(0.369)		(1.154)	(0.345)	(0.824)	
Simultaneous or cross-listing	-1.609***	0.699***	0.834**	0.1093	-0.625*	0.626**	0.609**	-0.0743
	(0.660)	(0.169)	(0.372)		(0.321)	(0.258)	(0.296)	

Note: The outcome models are estimated by the IPWRA estimator simultaneously with equation (4) in the absence of firm size, leverage, return on asset and the high-tech indicator due to the violation of overlap assumption. Robust standard errors are in brackets. R_N and R_G are national and global market excess returns respectively. The short run and longer run periods represent those of post-listing 6 months and over 7th to 36th months respectively. ***, ** and * represent the level of significance at 1%, 5% and 10% respectively. [a] The correlation coefficients are manually calculated for the residuals of the multinomial logistic regressions in the absence of the three firm characteristics and the high-tech indicator and those of the outcome models.

Table 5 Estimates of potential outcomes and average treatment effects of overseas listing in specific forms or selected destinations

	Panel A: Inverse-probability-weighted regression adjustment				Panel B: Regression adjustment				Panel C: Propensity-score matching		
	Short-run		Longer-run		Short-run		Longer-run		Short-run	Longer-run	No.
	POM	ATE	POM	ATE	POM	ATE	POM	ATE	ATE	ATE	Obs
Purely domestic listing	-1.031***		-1.555***		-0.996***		-1.553***				
	(0.187)		(0.062)		(0.187)		(0.602)				
Conventional cross-listing	-2.704**	-1.674	-1.105	0.449	-2.551***	-1.555*	-0.151	1.402***	-4.459***	1.527***	1708
	(1.237)	(1.248)	(0.823)	(0.826)	(0.889)	(0.905)	(0.357)	(0.362)	(2.044)	(0.544)	
Purely overseas listing	-0.129	0.901	-0.084	1.470***	-1.859***	-0.863	-0.340	1.213***	-0.862	0.232	1867
	(0.906)	(0.923)	(0.477)	(0.481)	(0.501)	(0.528)	(0.213)	(0.221)	(1.155)	(0.703)	
Cross-listing in reverse order	1.036	2.066**	0.148	1.702***	-0.295	0.701	0.417	1.970***	4.768	2.576	1723
	(0.931)	(0.906)	(0.260)	(0.262)	(0.844)	(0.860)	(0.568)	(0.571)	(3.835)	(2.088)	
Simultaneous listing	-1.855	-0.825	-0.679	0.876**	-2.676	-1.680	-1.236	0.317	2.648	1.576	1697
	(1.697)	(1.706)	(0.424)	(0.430)	(1.857)	(1.864)	(0.786)	(0.789)	(2.104)	(1.293)	
Purely domestic listing	-1.038***		-1.553***		-0.996***		-1.553***				
	(0.187)		(0.064)		(0.187)		(0.602)				
Purely listing in HK	-1.032	0.007	-0.553*	1.000***	-2.092***	-1.096**	-0.483**	1.070***	-1.075	0.130	1801
	(0.787)	(0.804)	(0.298)	(0.303)	(0.492)	(0.519)	(0.199)	(0.208)	(1.024)	(0.550)	
Purely listing in US	-0.207	0.832	-0.0006	1.552**	-1.516	-0.520	0.168	1.721***	-1.264	1.074*	1754
	(1.291)	(1.301)	(0.650)	(0.655)	(1.040)	(1.054)	(0.475)	(0.478)	(0.774)	(0.582)	
Simultaneous listing or cross-listing	-1.754***	-0.715	-0.047	1.506***	-1.319**	-0.323	0.065	1.618***	0.165	0.484	1752
	(0.646)	(0.667)	(0.440)	(0.433)	(0.609)	(0.631)	(0.304)	(0.308)	(0.293)	(0.541)	

Note: POM is mean of potential outcomes, while ATE represents average treatment effects. Both IPWRA and RA estimators estimate the POMs and ATEs in the multivalued setting using a sample of 1931 observations. The estimates of the outcome model that facilitate the computation of the POMs and ATEs by the IPWRA estimators are reported in Table 4. The PSM estimator estimates ATEs in a binary setting with their corresponding sample sizes. POMs estimated by PSM cannot be retrieved. Values in bracket are standard errors.

Table 6 Estimates of the outcome models of overseas listing by destination (local market factors)

	Purely domestic listing	Purely listing in HK	Purely Listing in US	Cross-listing or simultaneous listing
Panel A: In the short run				
Constant	-0.708*** (0.182)	0.077 (0.688)	-0.589 (1.183)	-1.609** (0.660)
National market excess return	0.527*** (0.049)	1.014** (0.465)	0.025 (0.244)	0.699*** (0.169)
Global market excess return[a]	-0.020 (0.076)	0.283 (0.378)	0.520 (0.369)	0.834** (0.372)
Panel B: In the Longer run				
Constant	-1.266*** (0.090)	-0.570* (0.297)	-2.614** (1.179)	-0.625* (0.321)
National market excess return	0.986*** (0.036)	0.040 (0.203)	-0.768* (0.458)	0.626** (0.258)
Global market excess return[a]	-0.413*** (0.083)	0.085 (0.241)	3.377*** (0.992)	0.609** (0.296)

Note: Robust standard errors are in brackets. [a] local market excess returns are used for the purely listed firms in the US or Hong Kong. Short-run and longer-run periods are those over post-listing 6 months and over 7th to 36th months respectively. ***, ** and * represent the level of significance at 1%, 5% and 10% respectively.

Table 7 Estimates of the outcome model by destination via instrumental variables (2SLS) regression

	Purely domestic listing (A)	Purely listing in HK		Purely Listing in US		Simultaneous listing or Cross-listing	
		γ (constant) or ϕ (slope)	$\chi^2(1)$ for H0: A+γ=0 or A+ϕ=0	γ (constant) or ϕ (slope)	$\chi^2(1)$ for H0: A+γ=0 or A+ϕ=0	γ (constant) or ϕ (slope)	$\chi^2(1)$ for H0: A+γ=0 or A+ϕ=0
Panel A: In the short run							
Constant	-1.238*** (0.231)	16.14*** (5.259)	8.32***	-4.091 (2.774)	3.74*	-12.592** (5.097)	7.24***
National market excess return	0.456*** (0.054)	-0.373 (0.447)	0.03	0.100 (0.245)	5.38**	0.421 (0.388)	5.29**
Global market excess return	0.105 (0.077)	-0.302 (1.340)	0.02	0.879 (0.585)	2.87*	1.458 (1.374)	1.29
Panel B: In the longer run							
Constant	-1.171*** (0.182)	-2.517 (1.956)	4.00**	-2.860* (1.716)	5.98**	4.673*** (1.622)	4.36**
National market excess return	0.997*** (0.039)	-0.763** (0.297)	0.60	-0.613* (0.338)	1.33	-0.640** (0.284)	1.63
Global market excess return	-0.454*** (0.149)	2.368** (1.120)	3.42*	4.287*** (1.330)	8.89***	-0.829 (1.032)	1.47

Note: The instrumental variables include all pre-IPO or pre-listing firm information, the high tech indicator and the macroeconomic and financial variables. Standard errors are robust and adjusted for 1931 clusters in firms. Short-run and longer-run periods are those over post-listing first 6 months and over 7th to 36th months respectively. ***, ** and * represent the level of significance at 1%, 5% and 10% respectively.

Appendix 1 Chinese overseas listings Oct 1991-March 2017

	Destination	No. listing	No. delisted
Overseas markets only	AMEX	15	8
	Frankfurt stock exchange	45	22
	Hong Kong stock exchange	653	40
	London stock exchange	44	31
	Nasdaq	184	73
	NYSE	85	14
	Singapore stock exchange	67	54
	Tokyo stock exchange	3	2
	Two or more overseas stock exchanges	10	6
Dual-listing	Simultaneously domestic and overseas	13	
	Cross-listing overseas after listing domestically first	27	
	Cross-listing domestically after listing overseas first	59	

Source: China Security Market and Accounting Research database