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ABSTRACT

Capital controls and other policy distortions in the capital market are costly to entrepreneurs. We propose a structural estimation approach to quantify the effect using IPO locational choices. We estimate the willingness-to-pay to bypass these distortions by the Chinese entrepreneurs with overseas listed firms to be a haircut in firm value by 50-60%. We infer that the welfare for the entrepreneurs could rise by 22% from the relevant capital market reforms.

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1 Introduction

Entrepreneurs are important drivers of job creation, innovation, and economic growth. Those that have founded a company that eventually becomes publicly listed are especially important as they are often entrepreneurs by ambition rather than by necessity. To satisfy the demanding requirements for public listing, their firms tend to be more innovative and faster-growing than non-listed firms. Nonetheless, these entrepreneurs in developing countries often face large policy frictions in the capital market, including capital controls which imply a potentially large cost in converting their wealth from their home currency to an internationally convertible one, the monetary and time costs in overcoming the bureaucratic scrutiny and delays in listing their companies in their home countries, and the risk of losing their wealth due to an insecure property right protection. The greater these frictions, the stronger the disincentive for these entrepreneurs to create wealth and jobs. This represents a concrete channel through which capital controls and other policy distortions in the capital market discourage entrepreneurship though the economic magnitude of the discouragement is not yet well understood.

The goal of the paper is to quantify the cost of the distortions to entrepreneurs in China, the largest economy in the world (in terms of PPP-adjusted GDP). However, quantifying these frictions is a non-trivial task as many components of the frictions are implicit and not a part of any standard disclosure or reporting items. In this paper, we propose a willingness-to-pay approach to estimate the cost of these frictions to the entrepreneurs using observed IPO locational choices made by the entrepreneurs. We uncover a very sizable cost. For example, we estimate that those entrepreneurs with an overseas listed firm are willing to forego 50-60% in the value of their firms in order to bypass these distortions. Aided by an estimated structural model, we compute counterfactual "reform dividends" - how much the entrepreneurs could benefit from various policy changes.

China is a good setting for investigating these questions for a number of reasons. It is known for not only pervasive capital controls and other distortions but also an abundance of firms listed on both onshore and offshore stock exchanges. Indeed, few countries can match China in recent years in terms of the number of entrepreneurs who take their firms for an overseas listing. By the end of 2020, about 30% of all Chinese publicly listed firms are listed outside Mainland China. Hong Kong and the US are the top two offshore locational choices. The total market capitalization of Chinese

firms listed these two offshore markets reached $5.4 trillion in 2020, or about 44% of the Mainland China's total market capitalization.[1]

Overseas listings *per se* are not uncommon. The explanations offered in the literature include[2]: making shares accessible to global investors (Errunza and Losq, 1985; Miller, 1999), taking advantage of liquidity in a more developed equity market (Merton, 1987; Foerster and Karolyi, 1999), signalling firm quality by accepting stricter disclosure requirements (Baker et al., 2002; Lang et al., 2003), improving corporate governance by "bonding" themselves to stronger investor protection (Coffee, 1999, 2002; Lel and Miller, 2008), insulating firms from potential hostile takeovers (Tsang et al., 2022), as well as building a stronger brand in the product or labor market (Pagano et al., 2002; Tolmunen and Torstila, 2005). Most studies find that listing in the US generates a premium in firm valuation. For example, Doidge et al. (2004) summarize that "foreign companies with shares cross-listed in the US had Tobin's Q ratios that were 16.5% higher than the Q ratios of non-cross-listed firms from the same country."

It is also worth noting that the samples of foreign firms listed in the US in the existing literature are dominated by firms from other developed countries. Very few Chinese firms are included in the samples of these studies because overseas listing by Chinese firms only becomes common in more recent years. These firms, however, do exhibit some distinct features. First, most overseas listed Chinese firms are listed only outside China. Out of the 1,586 Chinese firms listed in either Hong Kong or US in 2020, 1,431 or 90% of them do not have a corresponding listing inside Mainland China.[3] Second and more importantly, instead of achieving a higher valuation than domestic peers, the overseas listed Chinese firms appear to receive a lower valuation. A well-known example is the puzzling A-H premium or H-A discount: for Chinese firms simultaneously listed in Hong Kong and Mainland China stock markets, the Hong Kong listed H-shares are often priced at a substantial discount relative to their Mainland listed A-shares. [4] The overseas discount goes beyond the A-H dual-listed firms. For

[1] Feng et al. (2024) describe patterns of initial public offerings by Chinese firms in Hong Kong, New York, London and Singapore in addition to Shanghai ad Shenzhen, together with evolution of the listing requirements in the major markets. In addition, recent regulatory pressure on Chinese stocks including delisting threats from both the Chinese and US authorities are discussed.

[2] Karolyi (2006), Roosenboom and Van Dijk (2009) and Liu (2014) provide a nice review of the extensive literature on the subject.

[3] Among the rest, 130 are dual-listed in Hong Kong and Mainland China; 21 are cross-listed in Hong Kong and US via ADRs; 4 are cross-listed in Hong Kong, US, Singapore and Canada via ordinary shares.

[4] A-shares, listed on Shanghai or Shenzhen Stock Exchange, are issued by firms registered in China. By the end of 2019, about 130 of them also list H-shares on the Hong Kong Stock Exchange. These dual-listed A-H shares offer identical shareholder rights, cash flow rights, and fundamental

all Chinese firms that had an IPO during 2009 - 2019 and could potentially be listed either in a domestic or overseas market, we find a valuation discount associated with an offshore listing. For example, the average Tobin's Q one year after IPO is 4.05 on a Mainland Chinese stock exchange, but only 1.91 for those listed overseas. This appears to imply a 53% valuation discount facing overseas listed Chinese firms. Why do so many Chinese firms choose to go overseas IPOs, despite the substantial valuation discount?

We will evaluate the hypothesis that the discount in the overseas valuation represents a willingness-to-pay by the entrepreneurs to bypass capital controls and other "inconveniences" associated with China's capital market regulations. Such an evaluation would have to take into account alternative stories such as a selection effect - perhaps "worse" firms with observable or unobservable attributes are more likely to be listed offshore.

China has both binding restrictions on cross-border capital flows and regulation of domestic IPO market.[5] First, neither firms nor individuals can easily convert their assets into foreign currencies, or otherwise send them abroad. Second, an application for IPO on a Chinese stock exchange involves a long review process by China Securities Regulatory Commission (CSRC) with an uncertain outcome. Even after a successful IPO, major shareholders have to face a one-to-three-year lock-up period. An overseas listing allows an entrepreneur to bypass these regulations. For example, when a firm is listed in Hong Kong or US stock markets, the dividend payments and the proceeds from IPO and future selling down shares would be in a foreign currency and can be kept and used outside the border. By choosing to list her firm on an overseas stock exchange, the entrepreneur also bypasses the long IPO application process and the longer lock-up period in Mainland China. An overseas listing provides a legitimate avenue to circumvent both distortions. Therefore, a portion of the difference in the firm valuations in the offshore and onshore listings should represent the entrepreneur's willing-to-pay to bypass such frictions.

The reasoning above requires an important qualification: IPO locations are endogenously chosen, and other factors can also affect the decision. For example, the burdensome IPO approval process in the domestic stock market may be motivated

value. However, except during Mainland China stock market crises, the prices of A-shares have been persistently higher than the corresponding H-shares, often by a margin more than 20%.

[5] Amstad, Sun, and Xiong (2020) provide an overview of China's financial system and various significant reforms. Li and Wei (2020) and Allen et al. (2024) provide a more specialized review on reforms and challenges in China's international and domestic capital markets, respectively.

by a desire of the domestic regulators to select "good" firms for domestic investors. This interpretation would be consistent with a paternalistic approach to regulation in general. If the domestic regulators succeed in doing this, then it is possible for the overseas listed Chinese firms to be negatively selected and therefore to exhibit a lower valuation on average than their domestically listed counterparts. Of course, conceptually, overseas listing could also reflect a positive selection if firms with a higher growth potential are more likely to "bond" themselves with a stock market in a developed economy.

To guide our empirical estimation, we first articulate a conceptual framework on IPO locational choices, similar to a model of international migration (Borjas, 1987; 1991). The decision on where to list the firm boils down to a comparison between the cross market valuation gap and the cost of domestic capital market distortions. We then estimate a non-linear system of equations that allows for an endogenous decision on IPO location and for the possibility that some of the factors that influence the locational choice also affect firm valuation directly. In other words, the model estimates simultaneously and consistently the probability of an overseas listing and the firm valuation in different markets. For example, how much the entrepreneur is concerned about the security of her property rights, a factor not directly observed by the researchers, can both affect her IPO locational choice, and potentially create a valuation wedge between a home listing and an overseas listing. We address the endogeneity arising from the correlation between factors that influence the IPO locational choice and factors that affect the firm valuation with two instrumental variables. Specifically, pre-IPO industry-averages and market-wide conditions are assumed to influence an entrepreneur's IPO locational choice but are outside her control. However, conditional on post-IPO industry and market conditions and firm features, these variables provide no additional information on firm valuations.

Our main empirical findings are as follows. We reject the negative selection hypothesis. If anything, the opposite appears to be true: domestic investors value the features of the overseas listed firms more than those listed at home. The selection can arise from both observable and unobservable factors. After controlling for a long list of observable firm characteristics, we estimate that overseas listings are also positively selected on unobservable factors. As noted earlier, the valuation discount by overseas listings is sizable. Without correcting for endogenous selection, the unconditional Tobin's Q for overseas listed Chinese firms is 53% lower than their domestic coun-

terparts. A model that corrects the endogenous selection produces an even greater valuation haircut of 59%.

With a more general model for selection that also allows a given firm characteristic to produce different valuations in different markets (due to segmentation of the investor pools in the different markets), the estimated haircut rises to 66%. Interestingly, the valuation haircut is persistent – the valuation gap in Tobin's Q in the two markets does not disappear even after five years following the IPOs. While these estimates are large, we use two independent datasets and approaches to assess the plausibility of the estimates.

We examine how the estimated treatment effect responds to shocks that alter the severity of some distortions. For example, during the time periods when China tightens capital controls (2018-2019) or when it suspends the domestic IPO approval (2013-2014), we find that the entrepreneurs appear to be willing to accept an even larger valuation haircut for overseas listings. Firms with certain characteristics such as a higher percentage of initial foreign ownership or a higher operating risk, or those that are more sensitive to capital controls, also exhibit a larger valuation discount in an overseas listing and an even greater discount when the distortions get worse. These findings support the interpretation that the valuation discount reflects an entrepreneur's willingness-to-pay to bypass capital controls and the "inconvenience" of domestic IPO regulations.

Finally, we estimate the structural parameters in our theoretical model by matching the simulated model moments to the empirically estimated moments. The value of the parameter that captures the overall distortion costs suggests that the proportional cost to a representative Chinese entrepreneur due to domestic IPO regulations and capital controls is equivalent to 32% of the firm value. In addition, the marginal entrepreneur – the one that is indifferent between an onshore and offshore IPO – is willing to pay 24% of the firm valuation in order to bypass the relatively greater insecurity of property rights at home. Together with other estimated parameters, we infer a 22% welfare gains for the entrepreneurs, if China reforms its IPO and relaxes its capital controls to the efficiency level of the overseas markets.

Our paper contributes to several strands of literature. First, it deepens an understanding of capital market distortions as a source of economic under-development. While a large literature has studied the cost of credit channel in developing countries, including those focusing on China (Dollar and Wei, 2007; Hsieh and Klenow, 2009;

Song et al., 2011; Song and Wu, 2015; Wu, 2018), we quantify the additional costs associated with the distortions at the IPO stage, capital controls, and insecure property rights. These costs discourage "entrepreneurs by ambition" even though there is no lack of "entrepreneurs by necessity" (e.g., street vendors) in developing countries. Our methodology can be applied to other developing countries with capital controls. (According to the IMF, more than half of the developing countries have some form of capital controls.)

Second, it enriches our understanding of how the "twin agency problems" may manifest themselves in the prices of overseas listed stocks. According to Stulz (2005), "twin agency problems" arise because rulers of sovereign states and corporate insiders pursue their own interests at the expense of outside investors. The bonding theory, by regarding overseas listing as a mechanism to restrain insiders from expropriating outside investors, is interpreted in the existing literature as predicting a valuation premium of offshore listed stocks. We generalize the framework by incorporating a willingness-to-pay perspective to circumvent domestic distortions and allow for either a valuation discount or a premium in the empirical realization. Our estimation show a big haircut in the valuation of offshore listings.

Third, it offers new insights into the literature on the effect of financial globalization on developing economies. As surveyed in Kose et al. (2009), there has been a long-lasting and intense debate on the benefits and costs of integrating a country into the international capital market. Our paper quantifies a new type of costs of capital controls that have not been estimated before. Our methodology is also applicable to other countries with capital account restrictions and overseas listings.

Finally, our paper offers new insights into the nature of capital flows into China. As noted in Clayton et al. (2023), in the past two decades, China's presence went from raising a negligible amount of capital in offshore equity markets to accounting for more than half. Ma et al. (2025) observe that China's capital outflows have generated a channel for China's monetary policy to have a global impact. Our paper provides a new micro-foundation for capital flows into overseas listed Chinese firms.

The rest of the paper is organized as follows. After a summary of the capital controls and other policy distortions in the capital market in China in Section 2, we delineate a conceptual model of IPO locational choices in Section 3 and a corresponding estimation framework that regards an overseas listing as an endogenous treatment in Section 4. We describe the data sample in Section 5, the main empirical results in

Section 6, and additional checks on the plausibility of our estimates in Section 7. Using the structural estimates of the model, we conduct counterfactual simulations in Section 8, and conclude the paper in Section 9. We provide extensions and more robustness checks in appendices.

2 Capital Market Distortions

2.1 Controls on Capital Outflows

Capital controls are common in emerging countries. While China has pursued current account convertibility since 1996, it retains restrictions on capital account transactions, with especially binding ones on capital outflows. For example, one cannot convert RMB savings into foreign exchange to purchase an offshore real estate property purchase or engage in portfolio investment as they are considered capital account transactions. Each Chinese individual can convert up to USD 50,000 equivalent foreign exchange per year. This number would be considered too tiny for a typical entrepreneur with a listed firm. For firms, activities that may lead to capital outflows, such as outbound direct investment and offshore portfolio investment, must seek approval from the related government departments before obtaining foreign exchange. The approval process may become longer or the applications are more likely rejected when the government tightens capital outflow controls. This happened during 2018-19, for example, when China experienced a quick and substantial decline in foreign reserves.

Evading the capital controls is not impossible but costly[6]. People caught using illegal currency-exchange services in Mainland China could be fined 30% or more of the amount they attempted to transfer. If the sum is significant, those providing the service face significant jail time (from one to five years). Financial institutions that violate or neglect forex rules – such as helping companies falsify trade documents for foreign currency purchase or failing to conduct due diligence to verify their clients' applications – are also sanctioned by China's State Administration of Foreign Exchange.[7]

An overseas listing could provide a way for entrepreneurs to move wealth outside the country without triggering the capital controls. When a firm is listed in New York, all the dividend payouts will be in US dollars outside China, which the entrepreneur and

[6] See, for example, the report from Financial Times on "Why wealthy Chinese buy their insurance in Hong Kong?" at https://www.ft.com/content/e990ec76-b98f-3649-aaa5-bbe7cbdb3db4.

[7] See, for example, the report from Caixin Global on "Nine Banks Fined for Foreign Exchange Violations" at https://www.caixinglobal.com/2017-08-05/nine-banks-fined-for-foreign-exchange-violations-101126722.html.

other shareholders can keep and use outside China. In addition, when the entrepreneur downsizes her ownership holdings or receives dividends, the proceeds will also be in US dollars. She would not need to deal with the Chinese capital control regimes for moving assets around the world. It is useful to note that, since Hong Kong has no capital controls and one can convert between Hong Kong dollars and US dollars without restrictions, a listing in either Hong Kong or New York could achieve the same goal of bypassing the Chinese capital controls.[8]

2.2 Administrative Approvals for IPOs

In our sample period, an application for an IPO on a Chinese domestic stock exchange requires approval from the Chinese security regulator.[9] The CSRC's review not only checks the authenticity of information disclosures but also makes a judgment on the "quality" of the stocks based on company fundamentals. For example, negative earnings would disqualify an applicant. Even conditional on eventual approval, the time it takes to complete the review process could be lengthy and uncertain. In our baseline sample, the mean (and median) waiting time is 464 (and 459) days. In comparison, the Hong Kong and US markets use a checklist-based registration system with the presumption that the IPO will take place as long as an aspirant firm truthfully discloses the required information. In our sample, the mean (and median) waiting time from an initial application and the eventual IPO is 185 (and 155) days for an overseas listing.

The Chinese securities regulator sometimes suspends the reviews of IPO applications altogether for a sustained period of time. This happened from 2013 to 2014 when the regulator thought an IPO suspension could help to arrest a decline in the broad market index. For the entrepreneurs, an IPO suspension is a negative shock to an already long and uncertain waiting period for a domestic IPO.[10]

[8] See, Bloomberg's report on how "Soho China's founders shifted much of their fortune out of the country before controls tightened and the market imploded via its IPO in Hong Kong" at https://www.bloomberg.com/news/articles/2022-11-30/soho-china-s-founders-safeguard-their-fortune-with-new-york-real-estate.

[9] See Qian et al. (2022) for a comprehensive and informative review on China's IPO policies. Tsang (2010) discusses the IPO application process and listing requirements in Hong Kong and New York. A registration-based IPO system was piloted on the science and technology innovation board (STAR) in 2019, before being rolled out to the main board in 2023. But the approval process was effectively resumed shortly afterwards in response to concerns with a decline in market prices.

[10] In its prospectus for IPO on the Hong Kong Stock Exchange in 2013, Bank of Chongqing disclosed that "We filed with the CSRC an application for the listing of our A shares on the Shanghai Stock Exchange in September 2007. We received the CSRC's formal written comments in April 2009 and two letters requiring us to address certain complaints in July 2009 and March 2013, respectively, which we had responded without any non-compliance being discovered.....In early 2013, in view of the P. R. China regulatory policies and the offshore capital market conditions, we proposed to conduct

Even after a successful IPO, the Chinese regulation imposes a longer IPO lock-up period – a time interval between an IPO and when insiders are allowed to sell their shares – than their international counterparts. By our calculations, in Hong Kong and the US, the lock-up period is typically 6 to 12 months.[11] In comparison, the Chinese Company Law has specified a minimum of 12 months. In practice, concerned with the possibility that insiders might inundate the market with a large number of shares, the CSRC often stipulates a longer lock-up period from 18 months to 36 months.[12] This implies an additional cost of delay for entrepreneurs who seek a domestic listing.

Finally, the CSRC also sets either explicit or implicit restrictions on the level of initial offered prices. For example, for a period following April 2014, the CSRC implicitly mandated that the initial offered price cannot be more than 23 times the estimated earnings. The ceiling on the initial PE ratio is meant to improve the chance that the stock price will rise after the IPO. In contrast, in Hong Kong and the US, there is no ceiling on initial stock price. Presumably, entrepreneurs who believe the fair value of their stocks is more than 23 times the earnings see a serious cost of listing their stocks at home.

2.3 Concern for Insecure Property Rights

Entrepreneurs in developing countries often have to worry about insecurity of property rights or expropriation risk. Protection of private property rights did not have an explicit legal foundation until 2007, when the Property Law of that year established equal protection for state-owned, collective, and private property, marking a significant shift from the previous emphasis on public ownership. Even with protection in the legal text, government officials in practice could still tax cash flows, confiscate assets, forbid particular activities, or require bribes to enrich themselves (Stulz, 2005). According to Transparency International, a Berlin-based international NGO that provides an annual measure of corruption around the world, China is ranked 76 out of 180 countries in its Corruption Perceptions Index 2024.[13]

Even an anti-corruption campaign aiming at reducing corruption could be associ-

the listing of our H-Shares on the Hong Kong Stock Exchange."

[11] The specific rule on lock-up period is HKEX's Rule 10.07 (main board) and Rule 13.16A (GEM) and SEC's Rule 144.

[12] See, for example, a summary for various applicable lock-up period in China's stock market at https://www.dehenglaw.com/CN/tansuocontent/0008/023941/7.aspx?MID=0902.

[13] Transparency International 2024: https://www.transparency.org/en/cpi/2024.

ated with a reduction in the value of an entrepreneur's personal wealth. In the roaring early years of economic reforms in the 1980s and 1990s, it was not uncommon for the entrepreneurs to evade some tax payment or pay a bribe to obtain government permits, land, or contracts. Because China does not practice a statute of limitations, those entrepreneurs are vulnerable to a confiscation of their assets or even a jail time in later years. The younger generation of Chinese entrepreneurs, who take the ride of internet and platform economy and build up their fortune in more recent years, might feel a different type of insecurity. The anti-monopoly regulations, cybersecurity administration and crackdowns on ideologically out-of-favor industries could jeopardize their wealth in an unexpected way.[14]

3 A Model of IPO Locational Choices

To guide our estimation and welfare analysis, we propose a model of IPO locational choices. A key insight is that, if capital market distortions are greater in the domestic market relative to those in the overseas market, we can generally expect a valuation discount for those firms listed overseas. The valuation haircut can be thought of as the willingness-to-pay by the entrepreneur to bypass the greater relative "inconvenience" and "risk" in the home market. The valuation haircut is expected to increase when the relative "inconvenience" and "risk" become greater. The model is inspired by the classic model of international labor migration (Borjas, 1987 and 1991).

3.1 Basic Setup

Consider an entrepreneur i who has already determined to list her firm publicly but who still has to decide on an IPO location between the domestic stock exchange, denoted by market 0, and an offshore one, denoted by market 1. We use i to denote both the entrepreneur and her firm. The two capital markets are segmented due to binding capital controls, so the value of the same firm can be different in the two markets. If the company is listed in the home market, her portion of the firm ownership is worth $Q_{i0,T0}$ in local currency by the time she has the right to cash in on her equity ownership (which is T_0 periods after she decides to apply for IPO in market 0). On the other hand, if her company is listed on the overseas stock market, her ownership would be worth $Q_{i1,T1}$, also measured in local currency using the official exchange, when she has the right to cash in, which is T_1 periods after she applies for IPO in that market.

[14] Zhang (2024) provides an overview of how China's shifting regulations affect its technology sector.

The different time subscripts in the two valuations allow for possibly different lengths of waiting time for the entrepreneur to access her money in the two markets. The entrepreneur takes the values of Q_{i0} and Q_{i1} as given, but understands that they are related to the features of both her firms and the markets.

A variety of reasons could cause the value of the same firm to be different in the two markets.[15] With binding capital controls, the underlying pools of investors are different. Suppose the investors in the home market have more behavioral bias, a higher savings rate, a smaller set of portfolio choices, or a greater tolerance of risk, a given firm might achieve a higher market valuation in market 0 than in market 1. Separately, differences in the tax rates on dividends and capital gains, and in the regulation of the local markets could also lead to a divergence of the valuation of a given market. Suppose short-selling is infeasible or more costly in market 0 than in market 1, then the valuation of a given firm could be higher in market 0 since negative sentiment towards a firm is harder to find its way into the market price. Importantly, we assume that when the entrepreneur makes optimal IPO location choice, she knows the respective valuations of her firm in the two markets, and takes them as given.

If she applies for an IPO in the domestic market, there is a waiting period of T_{0a} from the date of the initial application to the date of eventual IPO. The waiting period includes the time that the local security market regulator uses to scrutinize the application. In our sample period, T_{0a} is about 16 months in the Chinese stock market. In addition, there is a minimum lock-up period of T_{0b} before the entrepreneur can sell down her shares after the IPO. In our sample, T_{0b} is about 24 months. We use $T_0 = T_{0a} + T_{0b}$ to denote total amount of time needed for entrepreneur i from the initial IPO application to receiving the money from selling down her shares. T_0 is about 40 months or 3.33 years in the Chinese domestic stock market.

Similarly, T_1 denotes the total time needed by entrepreneur i to realize her equity wealth if she chooses to list her firm on an overseas stock exchange. In our sample, for a Chinese firm listed in either Hong Kong or New York, T_1 is on average about 15 months or 1.25 years, including 6 months for IPO review by the regulator (T_{1a}) and 9 months of a mandatory lock-up period (T_{1b}).

Let r denote the entrepreneur's discount rate. If the entrepreneur chooses to debut her firm on a domestic stock exchange, the present value of her wealth after considering

[15] See some possible explanations in the literature on China's A-H price premium or A-B price premium, such as Fernald and Rogers (2002), Arquette et al. (2008), Chan et al. (2008), Mei et al. (2009), Karolyi et al. (2009), and Carpenter et al. (2020).

the IPO waiting and lock-up period is $\frac{Q_{i0}}{(1+r)^{T_0}}$. On the other hand, if she chooses an overseas IPO, the present value of her wealth is $\frac{Q_{i1}}{(1+r)^{T_1}}$. With a domestic listing, the IPO proceeds and future capital gains and dividends are in the non-convertible local currency. For the entrepreneur, converting local currency into foreign currency in a large quantity may involve using the black market or other underground channels to bypass capital controls. Let τ denote the proportional cost of converting the Chinese yuan into US dollar. In countries without capital outflow controls, $\tau = 0$. In the presence of capital outflow controls, it is generally positive.

Even with the US dollars at hand, the entrepreneur is not indifferent between holding her wealth onshore versus offshore due to differences in wealth tax and risk of expropriation. Let us assume that, in entrepreneur i's subjective assessment, 1 unit of offshore wealth $= (1 + \delta_i)$ units of onshore wealth. If $\delta_i > 0$, the entrepreneur prefers keeping her wealth offshore on the margin. Conversely, if $\delta_i < 0$, she prefers keeping her wealth onshore.

For simplicity, assume the entrepreneur's utility is log linear in the present value of her equity stake in the international convertible currency (the US dollars) in a place with a minimum risk of expropriation (which we take as the offshore location). To decide where to list her firm, the entrepreneur compares her utilities in each IPO location, which are, respectively,

$$U_{i0} = \ln\left[\frac{(1-\tau)}{(1+\delta_i)} \cdot \frac{Q_{i0}}{(1+r)^{T_0}}\right], \tag{1}$$

and

$$U_{i1} = \ln\left[\frac{Q_{i1}}{(1+r)^{T_1}}\right]. \tag{2}$$

She would choose an overseas IPO if and only if $U_{i1} \geq U_{i0}$, equivalently,

$$\ln Q_{i1} - \ln Q_{i0} \geq \ln(1-\tau) - \ln(1+\delta_i) - (T_0 - T_1) \cdot \ln(1+r).$$

Use approximation $\ln(1-\tau) \simeq -\tau$, $\ln(1+\delta_i) \simeq \delta_i$, $\ln(1+r) \simeq r$, and denote $q_{i1} = \ln Q_{i1}$, $q_{i0} = \ln Q_{i0}$, $d = r(T_0 - T_1)$, the overseas IPO decision is pinned down by:

$$q_{i1} - q_{i0} \geq -c_i, \tag{3}$$

where c_i summarizes the combined relative cost associated with a domestic IPO over an overseas IPO:

$$c_i \equiv \tau + d + \delta_i. \tag{4}$$

3.2 Probability of Overseas Listing

Suppose q_{i0}, q_{i1} and c_i can each be decomposed into an observable and an unobservable component:

$$q_{i0} = \mu_0 + \varepsilon_{i0},\ q_{i1} = \mu_1 + \varepsilon_{i1}, \tag{5}$$

and

$$c_i = \mu_c + \varepsilon_{ic}. \tag{6}$$

Here, μ_0 and μ_1 are the means of the valuations in the two markets, which in turn can be functions of observable firm characteristics such as firm size, industry, and growth prospect. μ_c is the relative cost of capital market distortions.

Assuming the unobservable firm-specific components, ε_{i0}, ε_{i1} and ε_{ic}, follow a trivariate normal distribution, and by using decision rule (3), we can derive the probability that entrepreneur i would choose an overseas IPO for her firm ($D_i = 1$) as

$$\begin{aligned} P(D_i &= 1) = P(U_{i1} \geq U_{i0}) = P(q_{i1} - q_{i0} \geq -c_i) \\ &= \Pr[\varepsilon_{i1} - \varepsilon_{i0} + \varepsilon_{ic} > -(\mu_1 - \mu_0 + \mu_c)] \\ &= \Phi[(\mu_1 - \mu_0 + \mu_c)/\sigma_v], \end{aligned} \tag{7}$$

where Φ is the CDF of a standard normal distribution. σ_v^2 is the variance of v_i, where

$$v_i = \varepsilon_{i1} - \varepsilon_{i0} + \varepsilon_{ic}. \tag{8}$$

Equation (7) produces three intuitive predictions. First, $\partial P/\partial \mu_0 < 0$. That is, a smaller proportion of the Chinese firms would go for an overseas IPO if the expected firm valuation in domestic market, μ_0, goes up (while holding everything else constant). Second, $\partial P/\partial \mu_1 > 0$. That is, a larger proportion of the Chinese firms would choose an overseas IPO if the expected firm valuation in the overseas market, μ_1, rises. Third, $\partial P/\partial \mu_c > 0$. If the costs due to regulatory and market frictions in the home market, μ_c, increase, a greater proportion would prefer an overseas listing. None of these theoretical predictions is surprising, which is reassuring.

When μ_0, μ_1 and μ_c are modelled as functions of firm characteristics x, the effect of x on the probability of an overseas listing could be derived as

$$\frac{\partial P(D_i = 1)}{\partial x} = \frac{1}{\sigma_v}\phi(\cdot)\frac{\partial[\mu_1(x) - \mu_0(x) + \mu_c(x)]}{\partial x}, \tag{9}$$

where $\phi(\cdot)$ is the PDF of a standard normal distribution.

3.3 Effect of Overseas Listing on Firm Valuation

Recall that a quarter of the Chinese listed firms choose an overseas listing. Our model interprets this as an equilibrium outcome when entrepreneurs shop around different listing locations. There exists a marginal entrepreneur m, who is indifferent between the two IPO locations, given his firm characteristics and the general market and policy environment. That is, his utility from an IPO in the home market $U_{m0} = E[U_{i0}]$, is the same as from an IPO in the overseas market $U_{m1} = E[U_{i1}]$. By definition of (1) and (2), this implies that

$$E[q_{i1}] - E[q_{i0}] = -c_m, \tag{10}$$

where $c_m = \tau + d + \delta_m$ is the total cost of market 0 relative to market 1 facing the marginal entrepreneur. If this market equilibrium condition did not hold, due to, for example, one additional entrepreneur moving from the overseas to domestic market, he would find his expected waiting period in the domestic market increases and his expected waiting period in the overseas market decreases. This would reduce his utility in the home market and increase his utility in the overseas market, attracting him back to the overseas market. Such adjustment continues until the marginal entrepreneur is indifferent between listing in any of the two markets.

According to equations (5) and (10),

$$E[q_{i1}] - E[q_{i0}] = \mu_1 - \mu_0 = -c_m. \tag{11}$$

Here $\mu_1 - \mu_0$ measures the valuation gap in the two markets, which is equal to the extent of relative capital market distortions facing the marginal entrepreneur ($-c_m$). There are several noteworthy implications. First, because the entrepreneur wants to maximize his utility rather than firm value, the Law of One Price could fail in terms of the value of the same firm in the two markets. Second, when $c_m > 0$, overseas listing comes with a valuation discount,

$$\mu_1 - \mu_0 = -c_m < 0. \tag{12}$$

In other words, the entrepreneurs whose firms are listed offshore choose to accept a valuation discount, to circumvent a longer waiting period, bypass capital controls, and avoid greater expropriation risk associated with an IPO in the domestic market. The valuation haircut associated with an overseas listing thus represents a willingness-to-pay to bypass the greater relative capital market distortions in the home country.[16]

[16] Equation (11) indicates that a valuation premium is possible when the opposite situation arises,

Equation (11) also provides a clear prediction for how a particular policy shock or firm characteristic may affect the magnitude of the average valuation discount:

$$\frac{\partial(\mu_1 - \mu_0)}{\partial \tau} < 0, \frac{\partial(\mu_1 - \mu_0)}{\partial d} < 0. \tag{13}$$

In other words, either a tighter capital outflow control, or a longer IPO review process and lock-up period at home relative to the overseas market, should translate into a larger valuation discount. We will report results from various difference-in-differences type exercises that are consistent with these predictions.

4 An Empirical Framework

To test the predictions of the model and quantify the valuation discount associated with overseas listings, we employ an empirical framework of endogenous treatment effect. An overseas listing is a treatment, which is decided endogenously and optimally by the entrepreneurs. Our empirical framework allows for the possibility that firm features, both observable and unobservable could simultaneously affect the firm's IPO locational choice and its valuation.

4.1 A General Model of Endogenous Treatment Effect

The endogenous treatment effect model consists of the following equations:

$$\begin{aligned} D_i &= \mathbf{1}\{X_i'\alpha_1 + Z_i'\alpha_2 + v_i > 0\}, && (14)\\ y_i &= D_i y_{i1} + (1 - D_i) y_{i0}, && (15)\\ y_{i0} &= X_i'\beta_{10} + \varepsilon_{i0}, && (16)\\ y_{i1} &= X_i'\beta_{11} + \varepsilon_{i1}, && (17)\\ cov[\varepsilon_{ij}, v_i] &\neq 0 \text{ for } j \in \{0, 1\}. && (18) \end{aligned}$$

Equation (14) is an empirical correspondence of the decision rule (3) on IPO locational choice and the probability of an overseas IPO (7). D_i is the observed treatment indicator, which equals 1 if firm i is listed overseas and 0 otherwise. Equation (15) says y_i is the observed market value for firm i, e.g. measured by Tobin's Q, while y_{i1} and y_{i0} are the potential market value, if firm i is listed in the overseas and home markets, respectively. In general, for a given firm, only either y_{i1} or y_{i0} is directly observed.

e.g., lower listing criteria and shorter waiting period in the domestic market, fewer capital controls across the border, and stronger preference on keeping wealth onshore.

According to equations (16) and (17), each one of the potential market values is determined by a set of regressors X_i and an unobserved random component ε_{ij}. We consider a set of firm characteristics together with market and policy variables that determine firm's market valuation in X_i, including both those from the existing cross-listing literature and those highlighting the role of capital market distortions. Meanwhile, the treatment or the IPO locational choice is determined by a set of regressors X_i and Z_i, and an unobserved component v_i. Thus, Z_i represents those variables that affect listing location choice but not market valuation after the listing. The fact that X_i appears in both choice and valuation equations accounts for the possibility of selection on observables. For example, firms with a higher growth potential are likely to have an overseas listing, and at the same time may receive a higher valuation from the investors.

Equation (18) highlights the nature of endogeneity. It states that on top of the observables, the unobservables in the valuation equations ε_{ij} $(j = 0, 1)$ could be correlated with the unobservable v_i in the choice equation, and thus with the treatment status D_i. For example, all else being equal, an entrepreneur's lack of political connection in her home country may make her more likely to choose an overseas IPO for her firm. At the same time, the same attribute could make her firm receive a lower valuation in the domestic market than an otherwise similar firm had she chosen to list her firm at home instead**.** As a different example, an entrepreneur's MBA degree from a US university could simultaneously make her more likely choose an overseas IPO and make her firm receive better valuation from the investors in the overseas market. Finally, an entrepreneur with a stronger subjective risk of expropriation is more likely to list her firm in the overseas market. How her firm is valued in the home and overseas markets then depends on how the unobservables in the valuation equations are correlated with this attribute.

4.2 The Treatments Effects

When overseas listing is modeled as a treatment, the treatment effect estimates the valuation gap of an overseas listing. Formally, the average treatment effect (ATE) is defined as

$$ATE = E[y_{i1}] - E[y_{i0}] = E[X_i' (\beta_{11} - \beta_{10})], \tag{19}$$

where $E[y_{i0}]$ and $E[y_{i1}]$ denote the average firm valuations, when all Chinese firms were listed at home and when all listed abroad, respectively. Thus, the ATE is the

empirical measure of the valuation gap $\mu_1 - \mu_0$ defined in equation (11), and can be consistently estimated by the sample counterpart of $E[X_i'(\beta_{11} - \beta_{10})]$, once β_{11}, β_{10} are consistently estimated.

For the subset of the firms that are actually listed in an overseas market, the average willingness-to-pay by these entrepreneurs is measured by the average treatment effect on the treated ($ATET$), i.e., the valuation gap for those firms conditional on $D_i = 1$:

$$\begin{aligned} ATET &= E[y_{i1} - y_{i0}|D_i = 1] = E[y_{i1}|D_i = 1] - E[y_{i0}|D_i = 1] \\ &= E[X_i'(\beta_{11} - \beta_{10})|D_i = 1] + E[\varepsilon_{i1} - \varepsilon_{i0}|D_i = 1], \end{aligned} \tag{20}$$

where $E[y_{i1}|D_i = 1]$ denotes the (observable) average valuation of those overseas listed Chinese firms in the overseas market, while $E[y_{i0}|D_i = 1]$ denotes the (counterfactual and not directly observable) average valuation of these same firms in the domestic market.[17] Equation (20) suggests the estimates of β_{11}, β_{10} alone are insufficient to calculate the $ATET$, which also depends on the average difference between the unobservables in the valuation equations $E[\varepsilon_{i1} - \varepsilon_{i0}|D_i = 1]$.

4.3 Identification and Estimation

As usual, we assume that $E[v_i|X_i, Z_i] = 0$ so that α_1 and α_2 can be consistently estimated from a probit model on equation (14). Under the joint normality assumption on v_i, ε_{i0} and ε_{i1} in equations (14), (16) and (17), β_{11}, β_{10} can be consistently estimated by MLE or the Heckit. Alternatively, without the normality assumption, a control function (CF) approach can be used (Wooldridge, 2010). The main idea of the CF approach is to model the correlation between D_i and ε_{ij} $(j = 0, 1)$ by projecting ε_{ij} on D_i, X_i and Z_i. Given that $D_i = E[D_i|X_i, Z_i] + (D_i - E[D_i|X_i, Z_i])$, we derive:

$$E[\varepsilon_{ij}|D_i, X_i, Z_i] = E[\varepsilon_{ij}|D_i - E(D_i|X_i, Z_i)] = E[\varepsilon_{ij}|v_i] = \beta_{2j}v_i,$$

where $v_i = D_i - E[D_i|X_i, Z_i]$. This implies

$$E[y_i|D_i, X_i, Z_i] = X_i'\beta_{1j} + \beta_{2j}v_i. \tag{21}$$

The correlation between D_i and ε_{ij} due to the self selection of firm's listing location is now controlled by including the additional term v_i. This suggests that (β_{1j}, β_{2j}) can be consistently estimated by regressing y_{ij} on X_i and v_i,

$$y_{ij} = X_i'\beta_{1j} + \beta_{2j}v_i + e_{ij},\ j \in \{0, 1\} \tag{22}$$

[17] For a special group of Chinese firms dual-listed both in mainland China and Hong Kong stock markets, $E(y_{0i}|D_i = 1)$ is observable, and $ATET$ is the so-called (negative) AH premium. We will make use of the information from this special group in Section 7.2.

where υ_i is proxied by $\widehat{\upsilon}_i = D_i - \Phi(X_i'\widehat{\alpha}_1 + Z_i'\widehat{\alpha}_2)$, the residual from the probit regression (14); and e_{ij} is a new error term which is uncorrelated with X_i and υ_i.

The estimated ATE and $ATET$ can then be calculated as:

$$\begin{aligned}
\widehat{ATE} &= \frac{1}{N}\sum_{i=1}^{N} X_i' \left(\hat{\beta}_{11} - \hat{\beta}_{10}\right), \\
\widehat{ATET} &= \frac{1}{\sum_{i=1}^{N} D_i}\sum_{i=1}^{N} X_i' \left(\hat{\beta}_{11} - \hat{\beta}_{10}\right) D_i + \frac{1}{\sum_{i=1}^{N} D_i}\sum_{i=1}^{N} \widehat{\upsilon}_i \left(\hat{\beta}_{21} - \hat{\beta}_{20}\right) D_i,
\end{aligned}$$

where $\hat{\beta}_{11}, \hat{\beta}_{10}, \hat{\beta}_{21}$,and $\hat{\beta}_{20}$ can be simultaneously estimated with $\widehat{\alpha}_1$ and $\widehat{\alpha}_2$ using GMM in the one-step CF approach. Alternatively, in the two-step CF approach, $\hat{\beta}_{11}, \hat{\beta}_{10}, \hat{\beta}_{21}$,and $\hat{\beta}_{20}$ are the OLS estimates from equation (22) in the second step, after obtaining $\widehat{\upsilon}_i$ as the residual from the probit regression (14) in the first step.

4.4 Exclusion Restrictions

Analogous to an Heckit approach, our identification strategy requires exclusion restrictions with some variables, Z_i, that affect the IPO locational choices, but do not directly affect firm values once variables X_i are accounted for. Otherwise, β_{1j} in equation (22) are not identified due to multi-collinearity.

We consider two such variables in Z_i. First, we construct a relative expected IPO waiting period in the home market relative to the overseas market. Specifically, for a given firm i, we calculate the average number of days that a similar firm in the same industry has waited before receiving an approval for IPO in the domestic and overseas markets, respectively, in the past two years. Using the language of our previous model, the idea here is to construct expected $d = r(T_0 - T_1)$, a component of c_i, which will affect i's IPO locational choice. However, since d is not part of q_{i0} or q_{i1}, this pre-IPO industry-average condition is unlikely to affect i's post-IPO valuation, conditional on firm-specific characteristics and post-IPO industry fixed effects.

The second variable is the relative market sentiment as proxied by the broad market index in the home versus overseas market in the 12-months prior to the actual IPO. This is inspired by the findings in the existing IPO literature (Ljungqvist et al., 2006, and Pástor and Veronesi, 2005) that IPOs on a given market are more active when the market is "hot" and entrepreneurs often time their IPOs accordingly. Since an entrepreneur has to decide on the IPO location at least one year before the actual IPO, it is reasonable to expect that her decision is partly affected by the relative sentiment in the two markets one year before the IPO. In the firm valuation equation,

we can directly control for the effect of the contemporaneous market sentiment on the firm valuation. We assume that, once the contemporaneous market sentiment and firm characteristics are controlled for, prior sentiment does not have additional effect on the firm valuation.[18]

4.5 The Selection Effects

As overseas listing (the "treatment") is an endogenous outcome of a deliberate decision by the entrepreneur, a key question is the nature of the selection. If the overseas listed firms, on average, are "worse" firms – those that would have received a lower valuation from the investors in the domestic market, then the "raw" valuation gap – the observed difference in the valuation of the firms actually listed at home $E(y_{i0}|D_i = 0)$ and that of those listed offshore $E(y_{i1}|D_i = 1)$ – can potentially be explained in part or in whole by this negative selection. On the other hand, if overseas listed firms are positively selected, then the observed valuation difference between the two markets, $E(y_{i1}|D_i = 1) - E(y_{i0}|D_i = 0)$, could be an underestimate of the true valuation haircut experienced by the entrepreneurs whose firms are listed abroad.

Formally, the observed group mean difference (GMD) in firm valuation is linked to the conditional difference in valuation, $ATET$, in the following way:

$$\begin{aligned} GMD &= E(y_{i1}|D_i = 1) - E(y_{i0}|D_i = 0) \\ &= [E(y_{i1}|D_i = 1) - E(y_{i0}|D_i = 1)] + [E(y_{i0}|D_i = 1) - E(y_{i0}|D_i = 0)] \\ &\equiv ATET + SE. \end{aligned} \tag{23}$$

Here, SE represents the selection effect associated with overseas listing in the domestic market:

$$SE = E(y_{i0}|D_i = 1) - E(y_{i0}|D_i = 0). \tag{24}$$

It measures the difference in valuation by the investors in the domestic market between those firms actually listed abroad and those actually listed at home.

From equation (23), the lower valuation of the overseas listed firms than their counterparts in the home market ($GMD < 0$) could come from either the greater relative distortions of the home market that the entrepreneurs of the overseas listed firms are willing to pay to bypass ($ATET < 0$), or a negative selection in the overseas

[18] In Appendix 4.4.5, we construct an alternative instrument using the relative market sentiment 6 months or 24 months before the actual IPO. This will produce similar estimates.

listing ($SE < 0$). We will empirically estimate the model and decompose GMD into different components to quantify the effect of capital market distortions.

Define

$$S_0 = E(y_{i0}|D_i = 1) - E(y_{i0}) \tag{25}$$

as the difference in the expected firm valuation in the home market between the subset of Chinese firms that are actually listed abroad and the entire set of Chinese listed firms. It can be easily verified that

$$SE = \frac{S_0}{1 - P(D_i = 1)},$$

so SE has the same sign as S_0. It is useful to decompose S_0 into "selection on observables" (S_{0x}) and "selection on unobservables" ($S_{0\varepsilon}$), $S_0 = S_{0x} + S_{0\varepsilon}$, where

$$\begin{aligned} S_{0x} &= \beta_{10}[E(X_i'|D_i = 1) - E(X_i'|D_i = 0)][1 - P(D_i = 1)], & (26) \\ S_{0\varepsilon} &= E[\varepsilon_{i0}|D_i = 1] = \beta_{20}E[\upsilon_i|D_i = 1], & (27) \end{aligned}$$

where the last equality in $S_{0\varepsilon}$ uses the control function (21). Similarly, we can define the selection effect associated with overseas listing in the overseas market:

$$S_1 = E(y_{i1}|D_i = 1) - E(y_{i1}) \tag{28}$$

and also decompose $S_1 = S_{1x} + S_{1\varepsilon}$, where

$$\begin{aligned} S_{1x} &= \beta_{11}[E(X_i'|D_i = 1) - E(X_i'|D_i = 0)][1 - P(D_i = 1)], & (29) \\ S_{1\varepsilon} &= E[\varepsilon_{i1}|D_i = 1] = \beta_{21}E[\upsilon_i|D_i = 1]. & (30) \end{aligned}$$

By definition, $ATET = ATE + (S_1 - S_0)$. Thus, depending on the sign and magnitude of S_1 and S_0, the $ATET$ could be larger or smaller than ATE.[19]

4.6 A Simplified Model

If we assume that y_{i1} and y_{i0} in equations (16) and (17) differ from each other only by a constant term, the model can be substantially simplified. In that case, equations (16) , (17) and (18) are reduced to:

$$\begin{aligned} y_i &= X_i'\beta_1 + \gamma D_i + \varepsilon_i, & (31) \\ cov[\varepsilon_i, \upsilon_i] &\neq 0. & (32) \end{aligned}$$

[19] See Appendix 1.1 for a discussion on the sign of S_1 and S_0, and the related implications on the nature of selection.

Compared with the general model, equation (31) assumes that any given characteristic x has same effect on firm valuation in the two markets. Thus, the only difference in the valuation comes from the listing location dummy D_i. This leads to $ATE = E[y_{i1} - y_{i0}] = \gamma$. Furthermore, the single unobservable ε_i implies $E[\varepsilon_{1i} - \varepsilon_{0i}|D_i = 1] = 0$ in equation (20) of the general model. As the result, $ATET = ATE = \gamma$ in the simple model.

Two comments are in order. First, the simple model allows us to obtain the $ATET$ and ATE from a single parameter γ, which is computationally efficient. This is particularly useful when the treatment effect rather than the selection effect is of our key interest. Second, the $ATET$ and ATE are equal in this model, not because there is no selection effect but because the selection effects in the domestic and overseas markets are now assumed to be the same, i.e., $S_1 = S_0 = S$. The simple model is still an endogenous treatment effect model, as highlighted by equation (32), which implies a non-zero selection effect: $SE = \frac{S}{1-P(D_i=1)} = \frac{E(y_i|D_i=1)-E(y_i)}{1-P(D_i=1)} \neq 0$.

5 Data

5.1 Sample

We start with all Chinese firms that were debuted between 2009 and 2019 on either one of the two domestic stock exchanges in Shanghai (SSE) and Shenzhen (SZSE), or one of the exchanges in Hong Kong (HKEX) and New York (NYSE and NASDAQ). Following FTSE Russell's Guide to Chinese Share Classes, a firm is defined as "Chinese" if it meets any of the following criteria: (1) incorporated in mainland China; (2) with the headquarters, establishment, or origin of the firm in mainland China; (3) with the controlling shareholder (holding more than 30% of the total outstanding shares) located in mainland China; or (4) with more than 55% of the sales revenue from mainland China.

We choose 2009 as the starting year of our sample for two reasons. First, ChiNext was launched that year as a new segment of the SZSE to provide an opportunity for small and medium-sized firms to become publicly traded firms. While Chinese stock exchanges generally have more demanding listing conditions, especially minimum financial performance requirements than those in Hong Kong or New York, ChiNext has the least demanding requirements among all segments of Chinese stock exchanges. Second, due to an agreement between Hong Kong and Mainland China on accounting

reporting requirements in 2007, 2009 is also the first year for which two previous years of accounting data can be obtained on a consistent basis.

We choose 2019 as the end year of our IPO sample in order to filter out the impacts of major regulatory changes in both China and the US since 2020. As documented in Feng et al. (2024), the Market Regulation and Anti-Monopoly Guidelines for the Platform Economy issued by the Chinese authorities, together with the delisting risk facing US-listed Chinese firms due to the Holding Foreign Companies Accountable Act (HFCAA), imply a structural change in the general environment facing Chinese overseas listed firms after 2020.[20]

Since our theoretical framework and empirical exercises apply to a set of Chinese firms that are potentially free to choose where to go IPO, we exclude a set of firms from our initial sample to increase the comparability between our treatment group – the overseas listed Chinese firms, and control group – the domestic listed Chinese firms. As detailed in Appendix 2, we exclude those overseas listed firms that are either on the Negative List for foreign investment, or do not satisfy the minimum financial indicator requirements in Mainland China at the times of their IPOs, or both. In addition, because A-H dual listed firms are different from other overseas listed firms, we also exclude such firms from our baseline sample, though we will report some information from them later for a validity check. After dropping firms with missing values or with a perfect prediction in the selection model, in the end, we are left with a baseline sample of 2,153 Chinese firms listed in Mainland China, and 576 in Hong Kong or US markets. These firms can in principle choose where to list, and about 21% of them chose an overseas IPO.[21]

5.2 Variables and Patterns

A small contribution on data is that we go beyond the standard databases and hand-collect the IPO prospectus for all firms in our sample from the websites of SSE, SZSE and HKEX, and the US Securities Exchange Commission (SEC). From these documents, we extract and code information on pre-IPO ownership structure and corporate

[20] Overseas IPO, however, is still an ongoing venture for many Chinese firms. After the CSRC and the Ministry of Finance of China formally signed an Audit Regulation Cooperation Agreement with PCAOB on 26 August 2022, the delisting risk for Chinese concept stocks was temporarily resolved. According to the disclosure of the CSRC, in 2023, 81 Chinese firms have received approval for an overseas IPO, of which 26 went to New York.

[21] Appendix Figure A1 summarizes our sample construction and Figure A2 describes how the filters are applied. In Section 6.4, we consider an extension in which the treatment group will be broadened to include all overseas listed Chinese firms.

governance, such as share of foreign ownership, the ownership share of each of the top five shareholders, the presence of strategic investors, number of independent directors, and whether CEO and chairman are the same person.[22]

From the Wind Financial Database, we obtain firm characteristics and financial indicators such as year of establishment, industry, headquarters address, and standard financial variables from balance sheet, income statement and cash flow tables, together with stock prices at various points in time. Table A1 in the appendix provides a list of the variables and their definitions. Table 1 presents their summary statistics for firms listed in Hong Kong, the US and Mainland China. Comparing firms listed in Mainland China and those listed overseas, we observe three important patterns. First, a remarkable valuation discount for firms listed overseas is observed. Their average Tobin's Q is 1.9, only half of 4.1 for firms listed in Mainland China one year after IPO. Second, firms listed overseas are more profitable and of higher growth potentials on average. For example, their average ROA of 14.0% is significantly higher than 11.6% for domestically listed firms. In addition, they dwarf their domestic counterparts by their annual average sales growth rates of 28.9% vs 18.8%. Third, these overseas listed firms have average foreign ownership of 34.9%, three times that of domestically listed firms.

The striking valuation discount for overseas listed firms is more pronounced in Table 2 with different valuation measures at various time points. The top panel tabulates the mean, 25^{th} percentile, median and 75^{th} percentile of Tobin's Qs for the two groups of firms at the moment of IPO, and one, three and five years after IPO. Across all the statistics and over all the horizons, the Tobin's Qs for overseas listed Chinese firms are always lower than those in Mainland China. For example, the average Tobin's Q one year after IPO suggests a 53% valuation discount for overseas-listed Chinese firms relative to their domestic peers. When using the Price-to-Book Value (PB) ratio and Price-to-Earnings (PE) ratio as alternative ways to gauge market valuation, as

[22]The pre-IPO ownership data are manually collected from the prospectuses posted on stock exchanges. We manually collect the shareholding ratio of the top 5 shareholders in each firm and identify their nature. The shareholdings are classified into three categories, foreign-owned, state-owned, and domestic-private-owned. The shareholdings are defined as foreign-owned if the ultimate controlling shareholders are: (1) foreign individuals, (2) individuals with overseas permanent residency, or (3) foreign firms including those owned by foreign states and private entities. The "foreign" includes individuals and firms in Hong Kong, Macau, and Taiwan. The shareholdings are defined as state-owned if the ultimate controlling shareholders are: (1) controlled by China's state-owned assets supervision and administration commission at the national, provincial, or municipal level, or (2) controlled by other SOEs at the local or central level. The shareholdings are defined as domestic-private-owned if the ultimate controlling shareholders are: (1) domestic individuals, or (2) domestic firms controlled by non-SOEs.

shown in the middle and lower panels of Table 2, we reach a similar conclusion. The valuation is always higher inside China than outside, the magnitude of the valuation discount for overseas listed firms is substantial, and the pattern of valuation discount is persistent.

6 Empirical Results

6.1 Motivation for an Overseas IPO

The equations for IPO locational choices and firm valuations can either be jointly estimated using maximum likelihood or in a two-step control function approach. We adopt the control function approach. Although it loses some efficiency, it is more robust to the distributional assumption about the error terms, and is easier to achieve convergence in the estimation.[23]

We present the probit model results for the IPO locational choice (14) in Table 3– the first step in the control function approach. The table includes the coefficients, the marginal effects and the product of the marginal effect and one standard deviation of each explanatory variable. We find that smaller firms with a higher ROA, a higher sales growth rate, more intangible assets, a higher leverage ratio, or a lower cash flow from operations, tend to be listed offshore. Such patterns are consistent with the bonding hypothesis that firms with higher growth potential and those that could benefit more from a deeper capital market would self select for overseas listing. Corporate governance features also matter for IPO locational choices. Those firms that choose to list overseas tend to have more independent directors on their board, a higher ownership concentration, and greater likelihood of merging the roles of the chairman and the CEO in the same person.

Other coefficients allow us to examine whether internationally oriented firms favor an overseas IPO. The evidence on this is mixed. On the one hand, we find that a higher pre-IPO share of foreign ownership significantly raises the chance that the entrepreneur takes her firm to an overseas stock exchange. An increase in foreign ownership by one standard deviation raises the probability of an overseas IPO by 5.8%. Having a strategic investor also increases the chance of an overseas IPO. On the other hand, the size of a firm's exports and imports relative to its sales does not significantly affect the probability of an overseas IPO.[24]

[23] Appendix 3 discusses the technical details of the control function approach.

[24] When we enter the export ratio and the import ratio separately, we find neither to be statistically

Variables that measure possible relative benefits and costs of listing in the two markets to the entrepreneur do matter. In particular, a longer relative waiting period for IPO in the domestic market, and a hotter sentiment in the overseas market, significantly push up the chance that the entrepreneur goes for an overseas IPO. Restrictive initial PE ratio regulation, and the depreciation of CNY also do the same. These results are consistent with the interpretation that an overseas listing is a way to bypass China's capital market regulations — longer waiting time, lower required initial PE ratio, and restrictions on how soon the founder and foreign investors can sell down their shares and receive future dividends and how easy it is for them to obtain international convertible currency.

6.2 Valuation Discounts

In Table 4, we report the valuation estimation for equation (31) of the simple model in column (1), and for equations (16) and (17) of the general model in columns (2) and (3). The dependent variable is the firm's Tobin's Q value one year after the IPO. (We will report alternative measures of firm valuation in sensitivity checks and extensions.) The pre-IPO regressors are the same as in Table 3. Other basic firm features are measured one year after IPO.

The results from the simple model in column (1) indicate that firms with a smaller asset value, a higher ROA, a faster sales growth, more intangible assets, more state ownership, and a lower leverage ratio, tend to receive a higher valuation. While greater foreign ownership also helps with valuation, trade orientation or the presence of a strategic investor does not significantly affect the valuation.

Importantly, the Tobin's Q for the overseas listed Chinese firms is significantly lower than their domestically listed counterparts by 2.72, an estimate for γ in equation (31), after controlling for observable firm characteristics and taking into account the endogenous nature of listing location. This difference in valuation is equivalent to a discount of 58.9%, relative to what they would have achieved had they been listed on the home stock exchange. As noted earlier, $ATE = ATET = \gamma$ in the simple model.

The results reported in columns (2) and (3) allow the mapping from firm and market characteristics to firm values to be market specific. In this case, ATE and

significant. One possible explanation is that firms with international trade, on one hand, have a greater ambition of globalization and thus are more likely to go overseas listing. On the other hand, such firms have more means to bypass capital control via the current account and are thus less likely to go overseas listing when facing a high valuation discount.

$ATET$ are different. The $ATET$ estimate suggests a valuation discount of 66.4% for those firms listed abroad relative to what they could have achieved at home, which is bigger than the estimate from the simple model.

It is worth noting that a significantly positive β_{20} in column (3) indicates that those unobservable factors that lead to an overseas IPO are favorably valued by the investors in the domestic market. This means we can reject the negative selection story. That is, we can reject the hypothesis that worse firms choose to go for an overseas IPO on average. This helps to explain why the estimated haircut in valuation for those overseas listed firms is bigger than a raw difference in the average Tobin's Q between the control and treatment groups.[25]

We can decompose the difference in the average Tobin's Q between the treatment and control groups into two categories as reported in columns (4) and (5): that due to different coefficients across the two capital markets, and that due to differences in the firm characteristics in the treatment and control groups evaluated by the domestic market. By comparing the coefficients in columns (2) and (3) for the same variables, we see in column (4) that the domestic stock market tends to assign a higher value than the overseas market to those firms that are smaller in assets, with a higher ROA, a higher sales growth, more state ownership, more independent directors and more foreign ownership; while the overseas market gives a higher valuation to younger firms and those firms with more operating cash flows. In terms of differences in firm characteristics, we observe from column (5) that the firms listed in the overseas market on average have a higher ROA, faster sales growth rate, more intangible assets, more independent directors, more controlling shareholders, and more foreign ownership. These happen to be the features that are highly valued by domestic investors, which partly contribute to the positive selection.

6.3 Understanding the Nature of Selection

It is not clear *ex ante* whether overseas listing represents a positive or negative selection. Since the Chinese stock market regulator adopts a paternalistic approach and may regard as its duty to select "good" firms for domestic investors, it is possible that "better" firms are listed in the domestic stock market, and "worse" firms go for an overseas IPO. This implies a negative selection for overseas listing. On the other hand,

[25] On the other hand, a significantly negative β_{21} suggests that the same unobservables are unfavorably valued by the investors in the overseas market.

the bonding hypothesis suggests that "better" firms have a stronger incentive to go for an overseas listing. This implies a positive selection. The estimation results in Table 4 provide information on the nature of the actual selections.

We tabulate a decomposition result on the selection for the simple and general models in Columns 1 and 2 of Table 5, respectively. Since the results are comparable between the two models, we focus our discussion below on the general model. First, we observe from the data directly that the average Tobin's Q a year after IPO in the home stock market, $E[y_{i0}|D_i = 0] = 4.05$, is greater than the similar statistic for the overseas market, $E[y_{i1}|D_i = 1] = 1.91$. We observe neither $E[y_{i1}|D_i = 0]$, what the Tobin's Q in the overseas market would have been for the stocks that are only listed in the home market, nor $E[y_{i0}|D_i = 1]$, what the Tobin's Q in the domestic market would be for those stocks that are only listed in the overseas market. The model estimation provides these counterfactuals: $E[y_{i1}|D_i = 0] = 3.08$ and $E[y_{i0}|D_i = 1] = 5.69$. Together with the probability of overseas listing $P = 21\%$, these four quantities allow us to obtain the potential population outcome if all Chinese firms were listed in the domestic market $E[y_{i0}] = 4.40$, or if they were all listed overseas $E[y_{i1}] = 2.83$.

By definition, $ATE = E[y_{i1} - y_{i0}] = -1.56$, which implies an average valuation discount of $1.56/4.40 = 35\%$. According to our model prediction, this suggests that the marginal entrepreneur has a 35% valuation discount due to an overseas listing. Since the marginal entrepreneur is indifferent between domestic and overseas listing, this implies that she is facing a cost from domestic capital market distortions equivalent to a 35% of her stake in the firm. For those actually listed overseas, $ATET$ is of key interest: $ATET = E[y_{i1} - y_{i0}|D_i = 1] = 1.91 - 5.69 = -3.78$. This means if all overseas listed Chinese firms in our sample were listed instead in Mainland China, their Tobin's Q one-year after IPO would have been 5.69. In other words, those entrepreneurs with overseas listed firms appear to have accepted a 66% haircut in the valuation of their firms ($-3.78/5.69 = -66\%$).

For those firms actually listed offshore, $S_0 = E[y_{i0}|D_i = 1] - E[y_{i0}] = 1.29$. This means that the domestic investors would have given them a higher valuation than those firms actually listed in the home market. On the other hand, since $S_1 = E[y_{i1}|D_i = 1] - E[y_{i1}] = -0.92$, their valuation in the offshore market is no better what the firms listed onshore would have achieved had they been listed offshore. To understand why, we further decompose S_0 and S_1 into an observable and an unobservable component, according to (26), (27), (29), and (30). For observable fac-

tors, for example, the source of $S_{0x} > 0$ and $S_{1x} < 0$ can be inferred from columns (4) and (5) of Table 4: The domestic market values some firm characteristics more than the overseas market; and the overseas listed firms on average have a higher realization on those firm characteristics, such as ROA, sales growth rate and foreign ownership.

Finally, according to (23), we decompose the observed group mean difference $GMD = E[y_{i1}|D_i = 1] - E[y_{i0}|D_i = 0] = -2.15$ into the sum of $ATET$ and SE, and further decompose $ATET$ and SE each into an observable and an unobservable component. The observable components for $ATET$ and SE come from columns (4) and (5) of Table 4, respectively, while the unobservable components for $ATET$ and SE depend on the estimates of β_{21} and β_{20} reported in Table 4. Given these estimates, regardless of selection on the observables or unobservables, the overall GMD is negative.

These estimates suggest that the domestic Chinese investors do not regard those firms approved by the CSRC for listing in the domestic stock market as than the overseas listed Chinese firms. In other words, overseas listing on average represents a positive selection. The valuation difference in the raw data in Table 2 is not due to a negative selection for overseas listing. Instead, the entrepreneurs are willing to forgo some firm valuation in order to bypass the capital market distortions. From the above discussion, those entrepreneurs with overseas listed firms have given up 66% of the valuation.

6.4 Robustness Checks and Extensions

We use Tobin's Q one year after the IPO as the valuation measure in the baseline analysis. We now examine the sensitivity of the results to the use of Tobin's Q in different time horizons (at the time of the IPO as well as 2, 3, 4 and 5 years after the IPO). To save space, we report the estimated $ATE's$ and $ATET's$ in such cases in Table 6, with additional details in Appendix 4.1. While the entrepreneur cares about the firm valuation at the time of IPO, she also cares about the valuation in subsequent periods as most of her stake in the firm will last for a long time. From Table 6, we see that the valuation discount associated with an offshore listing is long-lasting. The size of the haircut ranges from 40% to 60%, with no obvious trend over time.

As noted in Section 5.1**,** the treatment group excludes those overseas listed firms that may not satisfy the listing criteria at the home market, such as Alibaba (BABA) and Pinduoduo (PDD). We now check how our results are affected by sequentially

expanding our treatment group to include firms that are on the Negative List, or are not eligible for a domestic listing due to financial requirements. The results are summarized in Table A2 with additional details in Appendix 4.2. In general, the estimated valuation haircut, $ATET$, becomes even bigger in the expanded samples. This suggests that those overseas listed firms that are excluded for a domestic listing by domestic regulations would have received an even better valuation from the domestic investors.

While we combine Hong Kong and New York listings in the treatment group in our baseline analysis, we now investigate possible differences between them as an extension. In addition, a "Variable Interest Entity" (VIE) structure is used for many overseas listed firms, especially those in sectors that are on the Negative List.[26] We also code IPO with and without a VIE structure as separate listing modes. We apply a multinomial logit model for choices of the IPO location and listing mode in the first step of the two-step control function approach, and estimate the different treatment effects in the second step. We summarize the estimation results in Appendix Table A3 with a more detailed discussion in Appendix 4.3. The key finding is that the valuation discount is slightly larger in the US than in Hong Kong, and slightly larger for firms with a VIE than those without a VIE. However, as firms listed in the US or with a VIE also tend to have a larger counterfactual valuation in the home market, the percentage valuation haircut is similar across the two overseas markets and between the two different listing modes.

We conduct a series of additional robustness checks in Appendix 4.4 including: (i) using IV, Inverse-Probability-Weighted Regression Adjustment (IPWRA) and matching approaches as alternative estimation methods (reported in Appendix Table A4); (ii) different subsamples by industries, firm sizes, or sample periods (Appendix Table A5); (iii) adding or dropping regressors (Appendix Table A6); (iv) using log Tobin's Q as the dependent variable (Appendix Tables A7 and A8); (v) using the market value-to-book value ratio (also known as the P/B ratio) as an alternative market valuation measure as well as using market index 6 or 24 months pre-IPO to construct relative market sentiment in Table A9. We find that our conclusions are robust to these variations.

[26] Appendix 2 provides a detailed institutional background on VIE structure.

7 Independent Checks and Policy Shocks

Taken as a whole, both our baseline results and extended analyses demonstrate a large negative, statistically significant, and persistent treatment effect on firm valuation from an overseas listing. On average, the Chinese entrepreneurs appear to have given up about 60% of their firm valuation in an overseas listing. As the magnitude is fairly large, one may wonder whether such a discount is plausible. We provide two independent checks to gauge whether our estimates are sensible.

Furthermore, according to our theoretical framework, the negative average treatment effect reflects the cost from capital market distortions facing the marginal entrepreneur, i.e., $ATE = \mu_1 - \mu_0 = -c_m$. One way to interpret the estimated valuation discount is how much Chinese entrepreneurs are willing to give up in order to bypass a series of distortions associated with a domestic IPO. There are, of course, many factors that might drive the valuation discount across the domestic and overseas markets.[27] In our interpretation, the entrepreneur is assumed to know the valuations of her firm in the two markets. Taking the discount as given, she then makes an optimal IPO locational choice according to the capital market distortions she faces. The valuation discount therefore allows us to indirectly infer the cost of capital market distortions. We explore some exogenous policy shocks to check the validity of this interpretation.

7.1 The Home-coming Stocks

Some Chinese companies used to be listed on an overseas market, but the controlling shareholders have chosen to delist them from the overseas stock exchange and re-list them on a domestic exchange. A subset of them have changed their lines of business substantially during the process. Still, during 2009-2020, 12 Chinese private firms – including 10 from the US and 2 from Hong Kong – were delisted and re-listed with no known change in their business lines and a reasonably short gap between the delisting and re-listing dates. The behavior of the last set of firms provides an interesting and independent check on the plausibility of our story.

The controlling shareholder of an overseas listed firm presumably re-assesses from time to time whether to adjust the listing location of her firm by comparing its current valuation in the offshore market with the potential alternative if it were listed in the onshore market. Based on our conceptual framework, if the changing market conditions

[27] For example, home bias of investors, short-selling restrictions in Mainland China market, and different dividends and capital gain taxes across markets.

are such that the valuation discount for the overseas listing becomes too large (relative to the cost of tolerating the capital market distortions at home), she may choose to delist her firm from the overseas stock exchange and re-list it on a domestic exchange. On the other hand, if the valuation discount is no larger than the cost of domestic distortions, she may choose to stay with the overseas listing.

A convenient feature of these 12 firms is that the valuation discount can be gauged directly by comparing the market valuation in the overseas market shortly before the delisting and the market valuation on the domestic exchange shortly after the re-listing. This can be done without fancy econometrics (and the associated assumptions).

Table 7 reports the Tobin's Q for these firms in the overseas market on the last trading day, three months, and one year before delisting and that in the domestic market on the first trading day, three months, and one year after relisting. In terms of the percentage difference in the Tobin's Q between the overseas and domestic listings, the average is around 68%-75%, and the median is around 68%-78%. Note a difference of 75% means the valuation increases by 300% when the listing changes from the overseas to the domestic stock market. Based on this table, the 66% valuation discount for an overseas listing estimated from our general model is not implausibly large.

The valuation gap between the overseas and domestic listings presumably spans over a range. The results indicate that, for firms with similar risk of state expropriation, when a (non-state) controlling shareholder sees that a switch to a domestic listing could mean a tripling of the market valuation (corresponding to an overseas haircut of 67%) or more, she may decide to make the switch. On the other hand, if a switch to a domestic listing means an increase in valuation by only 33%, the shareholders of most such firms would choose to stay with the overseas listing.

7.2 The Dual-listed Stocks

An H-share refers to the share of a Chinese company listed on the HKEX, whereas an A-share refers to the share on a domestic stock exchange. During 2009-2019, 24 Chinese companies that have already been listed on a domestic stock exchange have chosen an additional listing on the HKEX. Note that all the dual-listed stocks are excluded from our regression sample, but such stocks provide another independent and complementary source of information for our story.

It is important to note that, for dual-listed firms, an H-share has identical cash flow right and voting right as its A-share twin. Because this is a relatively small sample,

it is hard to compute the statistical significance level. Nonetheless, if there is any difference in the valuations of the twins on a given date, it can be computed easily from market prices without any fancy econometrics.

By construction, the controlling shareholder of such a firm does not need to endure the pains and inconvenience of IPO delays since her company has already been listed on a domestic exchange. Still, any dividend that she receives from her A-share ownership and any proceeds from selling down her A-shares will be in the onshore local currency. Both a conversion to an international currency and a relocation of her wealth to an offshore location could involve costs for her.

Under our story, since the entrepreneur of a dual-listed firm endures a subset of the capital market distortions, we would expect the H-share price to still display a valuation haircut relative to its A-share twin, but not as large as our baseline estimate for the set of firms that are only listed outside China. This can be contrasted with an alternative world free of any domestic market distortion. In that case, an entrepreneur would presumably choose an additional H-share listing if the latter gives a higher valuation to her company.

The actual H-share price discounts relative to corresponding A-share twins are reported in Table 8. Without exception, the H-share prices represent a valuation haircut, which is quantitatively significant and somewhere between 20% to 30% across different horizons. At the same time, the H-share discounts are smaller than those experienced by the stocks listed solely outside Mainland China. These numbers are consistent with the interpretation that the H-share valuation haircuts represent the willingness-to-pay by the entrepreneurs to bypass a subset of the capital market distortions not related to domestic IPO.

One might compare our estimate with the valuation haircuts for Argentinian dual-listed stocks in both New York and Buenos Aires as studied by Auguste et al. (2006). In response to a foreign exchange crisis, the Argentine government suspended currency convertibility during 2001-2002. Consequently, Argentinians sold the ADRs (shares of Argentine companies in the US) at a discount of 50% relative to the shares of the same company on the Buenos Aires stock exchange.

7.3 Policy Shocks and Valuation Discounts

Another way to validate (or falsify) our interpretation of the large valuation haircut as the cost of capital market distortions is to examine whether and how the estimated

valuation haircut varies in periods known to experience an increase in some components of the distortions. Detailed discussions are included in Appendix 5. We provide a brief summary here.

First, the Chinese central bank is reported to have tightened capital outflow controls during 2018-2019. This suggests that τ, the cost of converting Chinese yuan into foreign currency, further increases. We examine whether the valuation haircut becomes bigger for those Chinese firms that listed overseas during this period. Second, the CSRC has suspended IPOs in the domestic market during 2013-2014. One can interpret it as the expected waiting period for any firm wishing to do a domestic IPO during this period suddenly became a lot longer than before, or d further increases. Accordingly, we examine whether the valuation haircut becomes greater for overseas listed Chinese firms during this period. Third, we also consider the impact of restriction on PE ratio at IPO in the Chinese stock market from early 2014 on the valuation discount. Estimation results of DiD type exercises are reported in Table 9, confirming our theoretical prediction of a larger discount due to these policy shocks.

We also study interactions between firm characteristics and policy shocks under a triple-differences type exercise. For example, international investors may prefer to receive proceeds in hard currency outside China. We study whether the valuation haircut is bigger for firms with a larger share of foreign investors before the IPO and whether the haircut becomes even greater during periods of tightened capital controls. Another example, firms with higher operating risks or more intangible assets rely more on external equity finance. Thus, the administrative approval IPO system in China is more costly to such firms. We investigate whether firms with higher operating risks or more intangible assets have a larger valuation haircut, and whether the haircut gets even larger during domestic IPO suspension. We find the answers to be yes to all of them, with detailed results presented in Tables A10 and A11 in the Appendix.

8 Welfare Analysis

We assess the welfare effects of capital market distortions and evaluate how potential policy changes could affect a representative entrepreneur's expected utility. To quantify these effects, we estimate structural model parameters by linking the data and empirical results in Section 6 to our model in Section 3, and perform counterfactual thought experiments.

8.1 Structural Estimation

Mapping our theoretical model to the empirical specifications of equations (14), (16) and (17), we have the following relations:

$$(\mu_1 - \mu_0 + \mu_c)/\sigma_v = E[(X_i'\alpha + Z_i'\gamma)/\sigma_v] \tag{33}$$

$$\mu_0 = E[X_i'\beta_{10}] \tag{34}$$

$$\mu_1 = E[X_i'\beta_{11}] \tag{35}$$

where $v_i = \varepsilon_{i1} - \varepsilon_{i0} + \varepsilon_{ic}$. The firm-specific random draws in valuation and cost $(\varepsilon_{i0}, \varepsilon_{i1}, \varepsilon_{ic})$ are assumed to follow a trivariate joint normal distribution with mean zero and the following variance-covariance matrix:

$$\begin{bmatrix} \sigma_0^2 & \rho_{01}\sigma_0\sigma_1 & \rho_{0c}\sigma_0 \\ \rho_{01}\sigma_0\sigma_1 & \sigma_1^2 & \rho_{1c}\sigma_1 \\ \rho_{0c}\sigma_0 & \rho_{1c}\sigma_1 & \sigma_c^2 \end{bmatrix}. \tag{36}$$

There are 9 structural parameters. In addition to the population mean μ_0, μ_1, and μ_c, we use σ_0, σ_1 and σ_c to describe the dispersion of ε_{i0}, ε_{i1} and ε_{ic} in the population of Chinese listed firms, and use ρ_{01}, ρ_{0c}, and ρ_{1c} to denote the pair-wise correlation coefficients between ε_{i0}, ε_{i1} and ε_{ic}. Although researchers only observe the valuation for any firm in one market and can not directly observe the cost facing the firms, the endogenous treatment framework allows us to infer the distribution of market valuation and cost in the entire population, from the potential market valuation predicted by the empirical model.

We use simulated method of moments (SMM) to estimate the structural parameters. It minimizes the quadratic distance between a set of model moments and their empirical counterparts. Intuitively, the value of the simulated moments depends on the structural parameters imposed in each round of simulation. Therefore, if the model is well-specified, the distance between the moments is minimized at the optimal estimates of the parameters. A formal technical presentation can be found at Gourieroux and Monfort (1996). This methodology has been employed by Bloom (2009) and Hennessy and Whited (2007) in the investment and finance literature, among others.

Our empirical estimates from the endogenous treatment effect model are informative for these 9 parameters. While the model parameters are jointly estimated, it is useful to explain intuitively the main variations in the data that help to identify each parameter. By equations (34) and (35) above, the population mean of valuation in the domestic and overseas markets $E[y_{i0}]$ and $E[y_{i1}]$ are informative about μ_0 and

μ_1. According to (33), conditional on μ_0 and μ_1, the probability of going overseas IPO in our final sample, $P(D_i = 1)$, contains the information on μ_c. The first and second moments of the residuals from the valuation equation for the control and treatment groups in the general model $E[\varepsilon_{i0}|D_i = 0]$, $E[\varepsilon_{i1}|D_i = 1]$, $sd[\varepsilon_{i0}|D_i = 0]$, and $sd[\varepsilon_{i1}|D_i = 1]$, together with the correlation coefficients between the residuals from the probit model and the valuation equations $corr[v_i, \varepsilon_{i0}|D_i = 0]$ and $corr[v_i, \varepsilon_{i1}|D_i = 1]$ are used to infer $(\sigma_0, \sigma_1, \sigma_c)$ and $(\rho_{01}, \rho_{0c}, \rho_{1c})$.

Table 10 presents the SMM estimation results. The left panel lists the estimates for the structural parameters and their standard errors. The right panel reports the empirical and the corresponding simulated moments. Overall the model is able to fit the data closely. As this is an exactly identified model, we also compare two untargeted moments – the subsample mean of market valuation in the domestic and overseas markets, respectively. Different from the 9 targeted moments, these two untargeted moments are directly observed from the data. As shown in Table 10, simulating our model at the structural estimates reported in the left panel generates the salient feature of the substantial valuation gap between the domestic and overseas listed Chinese firms. Appendices 6.1 and 6.2 show that the structural estimation results are robust to model specification, and the estimates are generally not sensitive to small perturbations in data moments. Corresponding results are reported in Tables A12 and A13.

The estimates for the structural parameters μ_0, μ_1, and μ_c have direct economic implications on the benefits and costs of overseas listing. First, μ_0 is estimated to be significantly higher than μ_1. This suggests on average stock valuations in the Chinese domestic market are higher than those of the Chinese firms in the overseas market. The valuation gap in the population mean could be driven by many factors as discussed earlier including the relative importance of retail investors and market regulations. However, the entrepreneurs take μ_0 and μ_1 as given, and make optimal IPO locational choices according to equation (7). Second, we find μ_c to be positive and statistically significant, indicating the significant net cost in the domestic market in the minds of entrepreneurs. On average, to make an IPO for every 1 dollar of capital, an entrepreneur is willing to pay 32 cents to shorten the IPO review and lockup period and to bypass the capital control. The economic implications of structural estimates for σ_0, σ_1, σ_c, and for ρ_{01}, ρ_{0c}, ρ_{1c}, are more subtle and mainly affect the sign of self-selection. We leave the technical discussion in Appendix 1.2.

8.2 Parameters Describing the Capital Market Distortions

By equations (7), (8), and (36), with the structural estimates reported in Table 10, the simulated probability of overseas listing $P(D_i = 1)$ is 23%. This is somewhere in between 21% – the probability of overseas listing in our baseline sample made of comparable groups, and 32% – the probability of overseas listing among all Chinese firms that went an IPO during 2009-2019.

Recall that while $c_i = d + \tau + \delta_i$ in the theoretical model, we estimate $c_i = \mu_c + \varepsilon_{ic}$, where $\mu_c = 0.32$ and $\varepsilon_{ic} \sim N(0, 1.17^2)$. Assuming $E(\delta_i) = 0$, we take $\mu_c = d + \tau$, as reflecting the combined IPO and lockup regulation (d) and tightness of capital controls (τ) that are common to all entrepreneurs. In comparison, $\delta_i = \varepsilon_{ic}$ is treated as entrepreneur-specific due to her idiosyncratic concern for insecurity of property rights.

In the data, the average IPO waiting period in the Chinese A-share market is 16 months. Together with an average 2-year lockup period, it is reasonable to assume $T_0 = 3.33$ years. For overseas listing, as the average IPO waiting period is 6 months and the lockup period is 9 months, we assign a value of $T_1 = 1.25$ years. If the discount rate is $r = 5\%$, the relative cost of domestic stock market regulation (over the overseas market) would be $d = r(T_0 - T_1) = 0.10$. Since $\mu_c = 0.32$, this implies $\tau = \mu_c - d = 0.22$. With these estimates, together with the simulated probability of overseas listing, the expected utility of a representative entrepreneur can be calculated as $E(U_i) = E(U_{i0})[1 - P(D_i = 1)] + E(U_{i1})P(D_i = 1) = 1.21$, where $E(U_{i0})$ and $E(U_{i1})$ are defined in (1) and (2). The first row of Table 11 summarizes the values representing the factual economy.

For the marginal entrepreneur who is indifferent between IPOs in the onshore and offshore markets, his cost is $c_m = q_0 - q_1 = 0.56$, using the estimate in column (3) of Table 4.[28] This implies $\varepsilon_{mc} = \delta_m = c_m - \mu_c = 0.56 - 0.32 = 0.24$. In other words, the marginal entrepreneur is willing to pay a fee of 10% of his IPO wealth to shorten the IPO process and the lockup period to the same level in the overseas market ($d = 0.10$), a fee of 22% to convert her wealth from the local to foreign currency ($\tau = 0.22$), and a further 24% to convert his onshore wealth to offshore ($\delta_m = 0.24$).

[28] To be precise, $c_m = q_0 - q_1 = \ln Q_0 - \ln Q_1 = \ln \frac{Q_0}{Q_1} = \ln\left(1 + \frac{Q_0 - Q_1}{Q_1}\right) \simeq \frac{Q_0 - Q_1}{Q_1} = \frac{4.40 - 2.83}{2.83} = 0.555$. A similar estimate for c_m is obtained if we directly look at $q_0 - q_1$ from a model estimated based on logarithm of Tobin's Q instead of level of Tobin's Q. According to column (3) of Table A12, $c_m = q_0 - q_1 = 1.297 - 0.751 = 0.546$.

8.3 Reform Dividends: Counterfactual Simulation

With the estimated structural parameters, we now use our model in Section 3 to assess the welfare effects of capital market distortions and to perform counterfactual thought experiments. In particular, components of cost parameter c would be our central focus. A change in c would induce a representative entrepreneur to re-optimize the IPO locational choice. We quantify the effects on $E(U_i)$ of potential policy changes represented by varying τ, T_0 and T_1. The results are presented in Table 11.

First, if the CSRC streamlines the IPO approval and review process and shortens the post-IPO lock-up period to the offshore level, this can be represented by new $T_0 = T_1 = 1.25$. As shown in row (1a), this reform would reduce the probability of overseas listing from 23% to 19% and raise the expected utility of the representative entrepreneur to 1.29 or by 6.8% = (1.29-1.21)/1.21. While some of the entrepreneurs with overseas listed firms would have gained from the reform by listing their firms at home instead, even entrepreneurs with domestically listed firms benefit from this reform.

Second, in row (1b), if capital control is to be removed completely, represented by $\tau = 0$, the overseas listing probability will reduce to 15% and there would be a 14.6% gain in the entrepreneurs' welfare. Third, in row (1c), if both reforms are implemented, the overseas listing probability will reduce to 12%, and the gain in entrepreneurial welfare would be 22.1%.

On the opposite, we can also conduct counterfactual thought experiments by raising the cost. If either the home authorities ban overseas listing, or the overseas authorities ban Chinese firms on their stock exchanges, how much would this affect entrepreneurial welfare? We represent this scenario in row (2a) by raising the value of T_1 to a very large number (30), far above what is observed in the data. There would be no more overseas listing and the entrepreneur would suffer an additional 7.8% welfare loss.

Alternatively, consider a complete capital control, $\tau = 1$ as in row (2b). In this case, 65% of the entrepreneurs would choose overseas IPOs in spite of a large haircut in firm valuations. Under this scenario, a representative entrepreneur faces a substantial welfare loss of 36.7%.

8.4 Willingness-to-pay of Domestic-listed Entrepreneurs

Our reduced form regressions have predicted a 66% valuation discount for those overseas listed firms, which we interpret as the willingness-to-pay of entrepreneurs with

overseas listed firms. As the majority of Chinese entrepreneurs list their firms in the domestic market, it is interesting to know the effect of capital market distortions on their welfare. In Appendix 6.3, we distinguish the welfare loss between entrepreneurs with currently onshore listings and those with offshore listings, by switching $\mu_c = 0.32$ into $\mu_c = 0$ and calculating the utility of those always go offshore, those switch from offshore to onshore, and those always stay onshore. Table A14 reports the findings from such an anatomy.

It turns out that more than 80% of the total welfare loss is in fact accrued to the group of entrepreneurs that have chosen a domestic listing. That is because they have to endure the longer IPO review process and lockup period, they have to pay a transaction cost when moving wealth from listing the firms at home across the border, and there are more of them than those with an overseas IPO. We investigate how much valuation discount these domestic listed entrepreneurs would be willing to give up for a capital market environment similar to that overseas. Specifically, we calculate the percentage change in the counterfactual and factual firm valuation along an indifference curve: $U_{i0}\left(Q_{i0}, \tau = 0.22, T_0 = 3.33\right) = U_{i0}\left(Q_{i0}^{CF}, \tau = 0, T_0 = 1.25\right)$, from which we obtain $(Q_{i0}^{CF} - Q_{i0})/Q_{i0} = -27.7\%$. This implies that domestic listed entrepreneurs on average are willing to give up 28% of firm valuation in exchange for a distortion-free capital market.

9 Conclusion

This paper employs a willingness-to-pay approach to estimate the cost of capital market regulations in China by exploring IPO locational choices and comparing the valuations in different locations. We reject the null that overseas listing reflects a negative selection. In fact, we find that overseas listings exhibit a (modestly) positive selection – both observable firm characteristics and unobservable factors suggest overseas listed firms are on average better than domestic listed firms in the domestic market. Thus, the true treatment effect of an overseas listing on those overseas listed firms after correcting for endogenous selection is even larger than what is directly observed from the valuation gap across the two groups of firms. In particular, we estimate a substantial, significant, and persistent valuation discount (about 60%) facing overseas listed Chinese firms. Additional validations using different models or different data sets confirm the plausibility of the estimate.

With a structural model, we show that the combination of IPO regulations and cap-

ital controls reduces the entrepreneurial welfare by 18.1%. Interestingly, even though our estimation leverages the observation that only a portion of the entrepreneurs in the data have chosen overseas IPOs, about 80% of the welfare loss in fact comes from the group of entrepreneurs that have stayed in the domestic capital market. These entrepreneurs are willing to give up 28% of firm valuation in order to bypass the inconveniences associated with China's capital controls, IPO approval delays, and other capital market regulations.

With the estimates of the structural parameters, we show that reforming the IPO process and removing capital controls can both raise the welfare of the entrepreneurs (by 6.8% and 14.6%, respectively). On the other hand, making it harder to do overseas listing (such as through the actions of either overseas or domestic authorities), or tightening capital controls could substantially reduce the welfare of the entrepreneurs. These findings have important policy implications. Capital account liberalization, and reforms of the IPO system and other capital market regulations would reduce the tolls on entrepreneurs, and thus create more jobs and promote more growth.

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Table 1: Summary Statistics of Firm Characteristics

Category	Variables	Mean	S.D.	P25	P75	N	Diff	Mean	S.D.	P25	P75	N
		Listed in Overseas						Listed in Mainland China				
Basic firm features	Tobin's Q	1.9	2.0	1.0	2.2	576	-2.2***	4.1	2.6	2.3	5.1	2,153
	Age	16.3	10.0	10.0	20.0	576	2.3***	14.0	6.0	10.0	17.0	2,153
	Log (total asset)	21.1	1.7	20.0	22.0	576	0.1***	21.0	1.0	20.4	21.4	2,153
	ROA (%)	14.0	11.6	7.9	19.6	576	2.4***	11.6	5.2	8.2	14.3	2,153
	Sales growth rate (%)	28.9	50.7	4.7	41.0	576	10.1***	18.8	24.7	4.4	29.7	2,153
	Leverage (%)	40.0	22.0	22.0	55.7	576	13.9***	26.1	17.2	12.7	35.3	2,153
	Intangible asset ratio (%)	13.4	15.5	3.3	16.7	576	1.8***	11.6	9.3	5.8	14.0	2,153
	Operating cash flow ratio (%)	10.6	13.9	2.3	18.3	576	-1.2***	11.8	9.1	6.0	17.1	2,153
Corporate governance	State ownership percentage (%)	8.5	25.8	0.0	0.0	576	0.1	8.4	22.4	0.0	0.0	2,153
	Independent director ratio (%)	44.3	12.2	36.4	50.0	576	7.1***	37.2	5.0	33.3	42.9	2,153
	CEO = Chairman	0.6	0.5	0.0	1.0	576	0.1***	0.5	0.5	0.0	1.0	2,153
	Top5 ownership percentage (%)	93.0	14.1	93.2	100.0	576	8.3***	84.7	14.6	76.7	96.3	2,153
	Controlling shareholder dummy	0.7	0.4	0.0	1.0	576	0.2***	0.5	0.5	0.0	1.0	2,153
International orientation	Stratigic investor dummy	0.2	0.4	0.0	0.0	576	0.1***	0.1	0.2	0.0	0.0	2,153
	Import and export rate (%)	22.7	31.1	2.8	28.5	576	-3.9***	26.6	28.2	6.3	38.3	2,153
	Foreign ownership percentage (%)	34.9	41.1	0.0	83.6	576	24.2***	10.7	23.5	0.0	2.8	2,153
Regulations and market features	Foreign reserve growth rate (%)	8.2	12.7	-1.4	16.8	576	0.3	7.9	14.2	-5.6	18.7	2,153
	Exchange rate growth (%)	-0.2	1.8	-1.1	0.9	576	0.1	-0.3	1.8	-1.1	0.2	2,153
	PE regulation	9.1	10.0	0.0	16.9	576	0.1	9.0	8.1	0.0	16.5	2,153
	Expected relative waiting days	3.4	1.7	2.3	3.7	576	0.9***	2.5	1.2	1.6	3.0	2,153
	Log (relative market index)	0.1	0.5	0.1	0.4	576	0.1***	0.0	0.5	-0.4	0.3	2,153

Notes:

1. Firms in this sample are eligible to list both in mainland China and overeas.
2. Tobin's Q, ROA, Sales growth rate, Age, Log(total asset) and Leverage reported here are one year after IPO.
3. Diff = mean(Overseas)-mean(Mainland China)
4. ***, ** indicate statistical significance at the 1% and 5% level, respectively.

Table 2: Summary Statistics for Firm Valuation

	At IPO		1st Year		3rd Year		5th Year	
Market	Mainland	Overseas	Mainland	Overseas	Mainland	Overseas	Mainland	Overseas
				Tobin's Q				
Mean	**4.53**	2.89	**4.05**	1.91	**3.25**	1.53	**3.63**	1.38
p25	**2.30**	1.34	**2.32**	0.98	**1.84**	0.84	**2.10**	0.79
p50	**3.32**	2.12	**3.29**	1.41	**2.58**	1.09	**3.00**	0.98
p75	**5.51**	3.34	**5.05**	2.21	**3.83**	1.70	**4.43**	1.47
				PB ratio				
Mean	**7.12**	5.90	**5.15**	2.45	**4.31**	2.12	**5.04**	1.82
p25	**3.40**	2.00	**2.84**	0.93	**2.31**	0.62	**2.82**	0.47
p50	**5.11**	3.58	**4.13**	1.75	**3.41**	1.19	**4.12**	0.93
p75	**9.22**	6.69	**6.45**	2.84	**5.12**	2.17	**6.14**	1.84
				PE ratio				
Mean	**30.65**	21.36	**57.54**	19.33	**72.82**	20.48	**98.05**	12.27
p25	**20.26**	9.99	**32.16**	7.06	**27.83**	4.31	**29.23**	-1.11
p50	**22.49**	14.84	**46.88**	12.45	**44.50**	9.54	**56.07**	7.16
p75	**39.27**	23.52	**68.96**	22.79	**77.30**	18.24	**111.84**	15.45
No. of firms	2,153	576	2,153	576	1,864	414	1,202	315

Table 3: Determinants of Overseas Listings

	Dependent	Overseas lisitng		
		(1)	(2)	(3)
Category	Variables	Coeff	dy/dx	dy/dx * S.D.
Basic firm features	Age	0.034***	0.004***	4.25%
		(0.006)	(0.001)	
	Log (total asset)	-0.157***	-0.020***	-3.30%
		(0.047)	(0.006)	
	ROA (%)	0.036***	0.004***	5.42%
		(0.007)	(0.001)	
	Sales growth rate (%)	0.007***	0.001***	4.63%
		(0.001)	(0.000)	
	Leverage (%)	0.024***	0.003***	6.56%
		(0.003)	(0.000)	
	Intangible assets ratio (%)	0.015***	0.002***	2.87%
		(0.004)	(0.001)	
	Operating cash flow ratio (%)	-0.025***	-0.003***	-4.26%
		(0.047)	(0.006)	
Corporate governance	State ownership percentage (%)	0.003	0.000	0.94%
		(0.002)	(0.000)	
	Independent director ratio (%)	0.071***	0.009***	10.89%
		(0.008)	(0.001)	
	CEO = Chairman	0.323***	0.040***	1.98%
		(0.084)	(0.011)	
	Top5 ownership percentage (%)	0.008**	0.001**	1.43%
		(0.004)	(0.001)	
	Controlling shareholders dummy	0.340***	0.042***	1.89%
		(0.096)	(0.012)	
International orientation	Strategic investor dummy	0.750***	0.093***	3.51%
		(0.125)	(0.015)	
	Import and export ratio (%)	-0.001	-0.000	-0.38%
		(0.001)	(0.000)	
	Foreign ownership percentage (%)	0.011***	0.001***	5.80%
		(0.001)	(0.000)	
Regulations and market features	Foreign reserve growth rate (%)	0.011	0.001	1.77%
		(0.009)	(0.001)	
	Exchange rate growth (%)	0.199***	0.025***	4.35%
		(0.040)	(0.005)	
	PE regulation	0.018	0.002	2.22%
		(0.012)	(0.001)	
	Expected relative waiting days	0.362***	0.045***	7.64%
		(0.040)	(0.005)	
	Log (relative market index)	0.432***	0.054***	2.87%
		(0.105)	(0.013)	
Other controls	Industry	YES	YES	
	Year	YES	YES	
	Province GDP per capita	YES	YES	
	No. of Obs.	2,729	2,729	

Notes:

1. Column (1) reports coefficient estimates in probit regression.
2. Column (2) reports the partial effects.
3. Column (3) uses the standard deviation of X of overseas listed Chinese firms in baseline sample.
4. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 4: Estimating Valuation Discount of Overseas Listing by Endogeneous Treatment Effect Models

	Dependent	Tobin's Q				
		Simple model	General model			
		(1)	(2)	(3)	(4)	(5)
Category	Variables	All	Treated	Control	$(\beta_{11} - \beta_{10}) * (x_i \mid D_i = 1)$	$\beta_{10} * ((x_i \mid D_i = 1) - (x_i \mid D_i = 0))$
	ATE (Overseas listing)	-2.717***	-1.56***			
		(0.350)	(0.40)			
	ATE/E[y_{i0}]	-65.2%	-35.5%			
	ATET	-2.717***	-3.78***			
		(0.350)	(0.39)			
	ATET/E[$y_{i0} \mid D_i = 1$]	-58.9%	-66.4%			
Basic firm features	Age	-0.006	-0.013*	-0.006	-0.120	-0.013
		(0.007)	(0.008)	(0.007)	(0.181)	(0.017)
	Log (total asset)	-0.531***	-0.145	-0.809***	14.035***	-0.107*
		(0.068)	(0.105)	(0.065)	(2.644)	(0.058)
	ROA (%)	0.062***	-0.002	0.146***	-2.074***	0.348***
		(0.014)	(0.013)	(0.014)	(0.275)	(0.081)
	Sales growth rate (%)	0.006***	-0.000	0.011***	-0.316***	0.108***
		(0.002)	(0.001)	(0.002)	(0.076)	(0.033)
	Leverage (%)	-0.006**	-0.003	-0.004	0.015	-0.054
		(0.003)	(0.006)	(0.004)	(0.279)	(0.054)
	Intangible assets ratio (%)	0.017***	0.013**	0.015***	-0.021	0.027*
		(0.004)	(0.007)	(0.005)	(0.119)	(0.015)
	Operating cash flow ratio (%)	0.012*	0.028**	-0.006	0.361**	0.007
		(0.007)	(0.013)	(0.005)	(0.147)	(0.008)
Corporate governance	State ownership percentage (%)	0.004***	-0.000	0.008***	-0.073**	0.001
		(0.002)	(0.003)	(0.002)	(0.033)	(0.010)
	Independent director ratio (%)	-0.006	-0.031***	0.020**	-2.257***	0.142**
		(0.007)	(0.011)	(0.010)	(0.628)	(0.070)
	CEO = Chairman	0.093	-0.113	0.064	-0.105	0.006
		(0.085)	(0.215)	(0.079)	(0.136)	(0.005)
	Top5 ownership percentage (%)	-0.007	-0.020	-0.008**	-1.129	-0.064**
		(0.005)	(0.022)	(0.003)	(2.070)	(0.029)
	Controlling shareholders dummy	0.152*	-0.110	0.181**	-0.211	0.048**
		(0.092)	(0.197)	(0.092)	(0.160)	(0.024)
International orientation	Strategic investor dummy	0.102	-0.098	0.178	-0.047	0.021
		(0.140)	(0.163)	(0.163)	(0.040)	(0.020)
	Import and export ratio (%)	-0.002	0.002	-0.001	0.065	0.004
		(0.001)	(0.003)	(0.002)	(0.077)	(0.007)
	Foreign ownership percentage (%)	0.003*	-0.002	0.007***	-0.330***	0.173***
		(0.002)	(0.002)	(0.002)	(0.107)	(0.052)
Regulations and market features	Foreign reserve growth rate (%)	0.005	-0.009	0.010	-0.155	0.002
		(0.009)	(0.018)	(0.011)	(0.176)	(0.010)
	Exchange rate growth (%)	0.014	0.156	0.081*	-0.017	0.002
		(0.040)	(0.184)	(0.049)	(0.046)	(0.008)
	PE regulation	-0.027**	0.001	-0.060***	0.547***	-0.006
		(0.013)	(0.009)	(0.019)	(0188)	(0.028)
Other controls	Industry	YES	YES	YES	0.093	0.034
					(1.272)	(0.060)
	Year	YES	YES	YES	1.592	0.353***
					(0.983)	(0.121)
	Province GDP per capita	YES	YES	YES	-2.595	0.028
					(1.887)	(0.025)
	β_{20}	0.446		1.399***		
		(0.330)		(0.413)		
	β_{21}	0.446	-1.277***			
		(0.330)	(0.490)			
	Observations	2,729	576	2,153		

Notes:

1. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 5: Decomposition for Quantities of Interest

Quantity of Interest	Simple model	General model
ATE	-2.72***	-1.56***
	(0.35)	(0.40)
ATE/E[y_{i0}]	-65.23%	-35.45%
ATET	-2.72***	-3.78***
	(0.35)	(0.39)
ATET/E[$y_{i0}\|D_i=1$]	-58.87%	-66.43%
E[$y_{i0}\|D_i=0$] - observed	4.05	4.05
E[$y_{i1}\|D_i=1$] - observed	1.91	1.91
E[$y_{i1}\|D_i=0$] - predicted	1.34	3.08
E[$y_{i0}\|D_i=1$] - predicted	4.62	5.69
E[y_{i0}] - potential outcome mean	4.17	4.40
E[y_{i1}] - potential outcome mean	1.46	2.83
S_0 = E[$y_{i0}\|D_i=1$] - E[y_{i0}]	0.45*	1.29***
	(0.24)	(0.30)
S_{0x} =β_{10}*(E[$x_i\|D_i=1$] - E[$x_i\|D_i=0$])*(1-P)	0.31*	0.84**
	(0.16)	(0.20)
$S_{0\varepsilon}$ =β_{20}*E[$v_i\|D_i=1$]	0.14	0.45***
	(0.11)	(0.13)
S_1= E[$y_{i1}\|D_i=1$] - E[y_{i1}]	0.45*	-0.92***
	(0.24)	(0.34)
S_{1x} = β_{11}*(E[$x_i\|D_i=1$] - E[$x_i\|D_i=0$])*(1-P)	0.31*	-0.51**
	(0.16)	(0.21)
$S_{1\varepsilon}$ =β_{21}* E[$v_i\|D_i=1$]	0.14	-0.41**
	(0.11)	(0.16)
GMD = E[$y_{i1}\|D_i=1$] - E[$y_{i0}\|D_i=0$]	-2.15***	-2.15***
	(0.10)	(0.10)
ATET = E[$y_{i1}\|D_i=1$] - E[$y_{i0}\|D_i=1$]	-2.72***	-3.78***
	(0.35)	(0.39)
$ATET_x$ =(β_{11} - β_{10})*E[$x_i\|D_i=1$]	-2.72***	-2.92***
	(0.35)	(0.35)
$ATET_\varepsilon$ =(β_{21} - β_{20})*E[$v_i\|D_i=1$]	0.00	-0.86***
	(0.00)	(0.21)
SE = E[$y_{i0}\|D_i=1$] - E[$y_{i0}\|D_i=0$]	0.57*	1.63***
	(0.31)	(0.38)
SE_x =β_{10}*(E[$x_i\|D_i=1$] - E[$x_i\|D_i=0$])	0.39**	1.06***
	(0.20)	(0.25)
SE_ε =β_{20}*(E[$v_i\|D_i=1$] - E[$v_i\|D_i=0$])	0.18	0.57***
	(0.13)	(0.17)

Notes:

1. We consider the valuation discount one year after IPO.

2. Bootstrap standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 6: Valuation Discount Over Time

Dependent	Tobin's Q					
	(1) At IPO	(2) 1st Year	(3) 2nd Year	(4) 3rd Year	(5) 4th Year	(6) 5th Year
	Simple Model					
ATE	-2.353***	-2.717***	-1.608***	-0.989**	-1.285***	-1.998***
	(0.194)	(0.350)	(0.476)	(0.436)	(0.479)	(0.268)
$E[y_{i0}]$	4.676	4.174	3.260	3.117	3.301	3.581
$ATE/E[y_{i0}]$	-50.32%	-65.09%	-49.33%	-31.73%	-38.93%	-55.79%
ATET	-2.353***	-2.717***	-1.608***	-0.989**	-1.285***	-1.998***
	(0.191)	(0.350)	(0.476)	(0.436)	(0.479)	(0.268)
$E[y_{i0} \mid D_i = 1]$	5.24	4.623	3.360	2.517	2.732	3.377
$ATET/E[y_{i0} \mid D_i = 1]$	-44.90%	-58.77%	-47.86%	-39.29%	-47.04%	-59.16%
	General Model					
ATE	-1.864***	-1.564***	-1.012**	-1.371***	-1.883***	-2.420***
	(0.385)	(0.403)	(0.401)	(0.253)	(0.229)	(0.191)
$E[y_{i0}]$	4.451	4.399	3.324	3.204	3.364	3.655
$ATE/E[y_{i0}]$	-41.88%	-35.55%	-30.45%	-41.62%	-55.98%	-66.21%
ATET	-1.287***	-3.782***	-1.930***	-1.465***	-1.596***	-2.295***
	(0.407)	(0.387)	(0.331)	(0.334)	(0.414)	(0.384)
$E[y_{i0} \mid D_i = 1]$	4.174	5.687	3.683	2.997	3.049	3.735
$ATET/E[y_{i0} \mid D_i = 1]$	-30.83%	-66.50%	-52.40%	-48.88%	-52.35%	-61.45%
X	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
Province GDP per capita	YES	YES	YES	YES	YES	YES
Observations	2,729	2,729	2,455	2,278	1,787	1,517

Notes:

1. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 7: Valuation Changes for Stocks Relisted from Overseas to Domestic Markets

Firms in A shares	Date of the last trading day	Tobin's Q last trading day before delisting	Tobin's Q 3 month before delisting	Tobin's Q 1 year before delisting	Date of relisting in A-share market	Tobin's Q 1st trading day after re-listing	Tobin's Q 3 month after re-listing	Tobin's Q 1 year after re-listing	Valuation discount: 1 day	Valuation discount: 3 month	Valuation discount: 1 year
China TransInfo Technology	31/10/2012	0.98	0.96	0.92	5/6/2014	4.56	5.47	12.03	-78.4%	-82.5%	-92.4%
Focus Media	23/5/2013	2.06	1.89	2.00	28/12/2015	15.51	10.47	10.59	-86.7%	-81.9%	-81.1%
Giant Network	18/7/2014	3.61	3.55	2.99	19/4/2016	6.81	9.78	11.52	-46.9%	-63.7%	-74.0%
Montage Technology	19/11/2014	4.52	4.32	7.96	22/7/2019	20.17	16.08	12.76	-77.6%	-73.2%	-37.6%
Perfect World	28/7/2015	1.18	1.15	1.23	27/4/2016	3.22	3.46	3.18	-63.5%	-66.8%	-61.3%
Mindray	3/3/2016	1.74	1.66	1.63	16/10/2018	7.05	6.24	8.98	-75.3%	-73.4%	-81.9%
Xueda Education	3/6/2016	1.91	1.89	1.51	6/7/2016	2.37	2.20	1.98	-19.4%	-13.8%	-23.8%
Ming Yang Smart Energy	22/6/2016	0.89	0.85	0.88	23/1/2019	1.25	1.57	1.39	-28.8%	-45.8%	-36.7%
360 Total Security	15/7/2016	3.45	3.32	2.98	28/2/2018	12.26	7.97	5.33	-71.8%	-58.4%	-44.1%
Trina Solar	13/3/2017	0.94	0.95	0.95	10/6/2020	1.65	1.49	2.47	-43.1%	-36.0%	-61.7%
Bloomage Biotech	1/11/2017	2.45	2.26	2.43	6/11/2019	21.38	8.11	11.52	-88.5%	-72.1%	-78.9%
JA Solar Technology	16/7/2018	0.79	0.78	0.77	27/11/2019	1.23	1.58	2.99	-35.9%	-50.8%	-74.2%
Average		**2.04**	**1.97**	**2.19**		**8.12**	**6.20**	**7.06**	**-74.8%**	**-68.3%**	**-69.0%**
Median		**1.83**	**1.78**	**1.57**		**5.68**	**5.85**	**7.16**	**-67.9%**	**-69.7%**	**-78.1%**

Notes:

1. SOEs and firms re-listed in A-share market more than five years after delisting are excluded.
2. Six firms listed on the A-share market in a shell, thus we chose the day of the completion of the merger as the date of their relisting.

Table 8: Discounts for A-H Dual Listed Stocks

	(1)	(2)	(3)	(4)	(5)	(6)
Valuation discount	At IPO	1st Year	2nd Year	3rd Year	4th Year	5th Year
Mean	-20%	-23%	-23%	-26%	-30%	-24%
Median	-20%	-17%	-29%	-28%	-27%	-24%
No. of firms	24	24	22	20	19	15

Notes:

1. These firms first issued A-share then issued H-share.
2. Both the A-share and H-share IPO took place during 2009-2020.

Table 9: Policy Shocks and Valuation Discounts

Dependent	Tobin's Q			
VARIABLES	(1) Tightening capital outflow control	(2) IPO suspention	(3) PE restriction	(4) All distortions
Overseas listing	-2.845***	-2.490***	-2.219***	-2.083***
	(0.319)	(0.335)	(0.326)	(0.363)
Capital control	1.018***			0.960***
	(0.362)			(0.364)
Overseas listing*Capital controls	**-0.676***			**-0.728***
	(0.396)			**(0.435)**
IPO suspension		0.258		0.347
		(0.271)		(0.300)
Overseas listing*IPO suspension		**-1.669*****		**-1.550*****
		(0.325)		**(0.380)**
PE restriction			-0.804	-1.074**
			(0.503)	(0.531)
Overseas listing*PE restriction			**-0.986*****	**-0.695*****
			(0.202)	**(0.249)**
X	YES	YES	YES	YES
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
Province GDP per capita	YES	YES	YES	YES
Observations	2,729	2,729	2,729	2,729

Notes:

1. The results are estimated using simple endogeneous treatment effect model for firms in their first year of IPO.
2. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.
3. Capital controls == 1 if firms submit IPO application during 2018 and 2019.
4. IPO suspension == 1 if firms submit IPO application during 2013 and 2014.
5. PE restriction == 1 if firms go IPO during 31 March 2014 and 30 June 2020.

Table 10: SMM Estimation

parameter	estimate	s.e.	targeted moments	data	simulated
μ_0	1.500	0.028	$E[y_{i0}]$	**4.40**	4.74
μ_1	0.663	0.052	$E[y_{i1}]$	**2.83**	2.24
μ_c	0.322	0.085	$P[D_i = 1]$	**0.21**	0.23
σ_0	0.333	0.013	$E[\varepsilon_{i0} \mid D_i = 0]$	**-0.12**	-0.12
σ_1	0.540	0.037	$E[\varepsilon_{i1} \mid D_i = 1]$	**-0.41**	-0.48
σ_c	1.172	0.031	$sd[\varepsilon_{i0} \mid D_i = 0]$	**1.71**	1.57
ρ_{01}	0.229	0.614	$sd[\varepsilon_{i1} \mid D_i = 1]$	**1.81**	0.98
ρ_{0c}	0.584	0.089	$corr[v_i, \varepsilon_{i0} \mid D_i = 0]$	**0.15**	0.13
ρ_{1c}	-0.775	0.058	$corr[v_i, \varepsilon_{i1} \mid D_i = 1]$	**-0.23**	-0.15
			untargeted moments	**data**	**simulated**
			$E[Y_{i0} \mid D_i = 0]$	**4.05**	4.62
			$E[Y_{i1} \mid D_i = 1]$	**1.91**	1.76

Table 11: Counterfactual Simulations

	τ	r	T_0	T_1	d	μ_c	P (D = 1)	expected U	Δ in U %
Factual Economy	0.22	0.05	3.33	1.25	0.10	0.32	0.23	1.21	NA
Counterfactual Experiments:									
(1a) IPO reform in China to US	0.22	0.05	**1.25**	1.25	**0.00**	0.22	0.19	1.29	6.8%
(1b) CA liberalization in China	**0.00**	0.05	3.33	1.25	0.10	0.10	0.15	1.39	14.6%
(1c) both reforms	**0.00**	0.05	1.25	1.25	**0.00**	0.00	0.12	1.48	22.1%
(2a) forbidden overseas listing	0.22	0.05	3.33	**30.00**	**-1.33**	-1.12	0.00	1.12	-7.8%
(2b) complete capital outflow control	**1.00**	0.05	3.33	1.25	0.10	1.10	0.65	0.77	-36.7%

Appendix

1 More on the Selection Effect

1.1 Sign of the Selection Effect

Define S_0 as the difference in the expected Tobin's Q between the overseas listed Chinese firms and all Chinese listed firms when they are both listed at home, and S_1 as the difference in the expected Tobin's Q between the same two groups when they are both listed abroad:

$$\begin{aligned} S_0 &= E(y_{i0}|D_i = 1) - E(y_{i0}), \\ S_1 &= E(y_{i1}|D_i = 1) - E(y_{i1}), \end{aligned}$$

Both S_0 and S_1 can be further decomposed into an observable and an unobservable components:

$$\begin{aligned} S_0 &= S_{0x} + S_{0\varepsilon}, \\ S_1 &= S_{1x} + S_{1\varepsilon}. \end{aligned}$$

While the selection on observables S_{0x} and S_{1x} can be obtained by regression, the selection on unobservables $S_{0\varepsilon}$ and $S_{1\varepsilon}$ have an analytical solution, if the errors $(\varepsilon_{i1}, \varepsilon_{i0}, \varepsilon_{ic})$ follow a trivariate joint normal distribution with standard deviation $(\sigma_0, \sigma_1, \sigma_c)$ and pair-wise correlation coefficients $(\rho_{01}, \rho_{0c}, \rho_{1c})$:

$$\begin{aligned} S_{0\varepsilon} &= \frac{\sigma_0\sigma_1}{\sigma_v}[(\rho_{01} - \frac{\sigma_0}{\sigma_1}) + \rho_{0c}\frac{\sigma_c}{\sigma_1}]h, \\ S_{1\varepsilon} &= \frac{\sigma_0\sigma_1}{\sigma_v}[(\frac{\sigma_1}{\sigma_0} - \rho_{01}) + \rho_{1c}\frac{\sigma_c}{\sigma_0}]h, \end{aligned}$$

where $h(\cdot) = \phi(\cdot)/\Phi(\cdot)$ with $\phi(\cdot)$ and $\Phi(\cdot)$ being the PDF and CDF of the standard normal. $h(\cdot)$ is known as the hazard rate, or the inverse Mills ratio.

There are four possible cases of selection. Case 1: if $S_0 > 0$ and $S_1 > 0$, then overseas listings reflect a positive selection, where those firms choosing for an overseas IPO would on average be on the right side of the distribution for Tobin's Q across all Chinese firms in both home and overseas markets. Case 2: if $S_0 < 0$ and $S_1 < 0$, then overseas listings represent a negative selection. In Case 3, if $S_0 < 0$ and $S_1 > 0$, it would be called "refuge sorting" in the immigration context, where firms that are listed overseas are on average selected from "worse" firms in terms of Tobin's Q at the home market and would do "better" than other Chinese firms in the overseas market.

Finally, in Case 4, if $S_0 > 0$ and $S_1 < 0$, this seems nonsensical or irrational, as those firms actually listed abroad would have been the "better" firms in terms of Tobin's Q in the home market but "worse" firms compared to other Chinese firms in the overseas market. However, mathematically, one can prove that at least $S_{0\varepsilon} > 0$ and $S_{1\varepsilon} < 0$ is possible, if σ_c is sufficiently greater than σ_0 and σ_1, and if $\rho_{0c} > 0$ and $\rho_{1c} < 0$.

1.2 Structural Estimation for the Selection Effect

According to the results reported in Table 10, the estimates for the three standard deviations σ_0, σ_1, and σ_c suggest three things. First, there is a substantial heterogeneity in valuation with either the domestic or overseas markets. Second, the dispersion is even greater for the valuation in the overseas market. Third, the dispersion in the distortion cost is even larger than either of the market valuations. A large and significant σ_c highlights the role of cost in driving the overseas listing decision.

The relative magnitude of σ_0, σ_1, and σ_c also has direct implications on the self-selection, together with the estimates on ρ_{01}, ρ_{0c}, and ρ_{1c}. We cannot formally reject the null hypothesis that $\rho_{01} = 0$. In other words, the correlation between the unobservables in the valuation in the two markets is insignificant. In contrast, ρ_{0c} and ρ_{1c} are significantly positive and negative, respectively. By definition, $S_{0\varepsilon} = -\frac{1-P}{P}E[\varepsilon_{i0}|D_i = 0]$, and $S_{1\varepsilon} = E[\varepsilon_{i1}|D_i = 1]$. Our structural estimation finds that $\sigma_c > \sigma_0$, $\sigma_c > \sigma_1$, together with $\rho_{0c} > 0$ and $\rho_{1c} < 0$, it explains mathematically why we have obtained $S_{0\varepsilon} > 0$ and $S_{1\varepsilon} < 0$ in our decomposition results of Table 5.

Intuitively, all else being equal, those firms facing higher distortion costs in the domestic market are more likely to list overseas. However, since there is a positive correlation between the unobservables in valuation in domestic market and the unobservables in cost ($\rho_{0c} > 0$), and a negative correlation between the unobservables in valuation in overseas market and the unobservables in cost ($\rho_{1c} < 0$), those who finally choose to list overseas are on average selected from the right half in domestic market in terms of Tobin's Q distribution but end up in the left half of the overseas market.

Figure A4 visualizes the potential population distribution in the domestic and overseas market, and highlights the sign of selection of the treated in each market.

2 Negative List, Financial Requirements and VIE

While some Chinese firms will eventually be able to go IPO in a domestic stock exchange after going through the opaque, prolonged and ad-hoc process, other firms are denied access to the domestic stock market in the first place, due to restrictions on foreign investment, or stringent financial listing requirements.

Although foreign investment is generally welcomed and has played an important role in China's economic miracle, there are certain industry sectors that prohibit or restrict foreign investment. From the earliest Investment Catalogue in 1995, to the Free-Trade Zone Negative List in 2013, and to the first nationwide Negative List in 2018, the Chinese authorities have been adopting the traffic-light system to regulate foreign investment. For example, the 2020 Negative List sets 33 clauses across 12 industry sectors to restrict or prohibit foreign investment. In particular, foreign investment is prohibited in internet news providers, courier services, and gene diagnosis. Foreign ownership in automobile manufacturing should be 50% or less and in public air transportation should be 25% or less. Pre-school, general high school and higher education institutions are restricted to Sino-foreign cooperation.

Furthermore, China's domestic stock market, which is well-known for its emphasis on investor protection, sets more stringent listing standards than its Hong Kong and US counterparts.[1] One of the most criticized financial requirements of the Chinese stock market is the requirement for profitability. Until the recent registration-based IPO reform, a positive net profit in two or three consecutive years before filing an IPO application was required for all issuers, regardless of which board they apply for. In contrast to Mainland China stock exchanges imposing the *ex-ante* stringent financial requirements for IPOs, the US stock market focuses on full disclosure and strong enforcement. The Hong Kong authority utilizes a combination of financial requirements and legal arrangements somewhere in the middle of the two ends. As a result, there are several alternative standard categories for firms applying for IPOs on these exchanges. The standards typically include the earnings test, capitalization or revenue test, cash flow test, or some combinations of them. A firm that fits any one of these standards can be listed.

As early as late 1990s, foreign VC and PE seek for investment opportunities in

[1] Feng et al. (2024) summarize the operating history and threshold financial requirements that the issuer must satisfy for IPO in Mainland China (main board, ChiNext and STAR) in Table 2. The requirements for listing in Hong Kong (main board and GEM), and NYSE and NASDAQ in the US are presented in Tables A2-A4 for comparison.

China. Certain industries, such as internet and healthcare, also heavily rely on foreign VC and PE to finance capital expenditure and R&D. In normal circumstance, VC and PE achieve a profitable exit following a successful IPO. However, the Negative List imposes a legal restriction on domestic listing for firms with foreign investment in the specified industries. The positive profitability requirement also prevents firms with good growth potentials but no positive net profit from going public and raising capital in the homeland. Going IPO abroad via a Variable Interest Entity (VIE) has been the creative solution adopted by many Chinese firms. A VIE is an overseas holding company that is most often registered in a tax haven. It separates the listed entity from the operational entity in terms of shareholding, as the listed entity controls the operating business in Mainland China through a series of contracts. The VIE structure circumvents the Negative List by effectively disguising foreign ownership. That is why ever since the NASDAQ IPO of Sina.com in 2000, many private shares listed on Hong Kong and about two-thirds on New York have employed the VIE structure, including those most well-known internet giants "BAT" – Baidu, Alibaba and Tencent. About 30% of these firms do not make a positive net profit at the moment of IPO.

3 Control Function Approach

Some technical remarks on the control function (CF) approach are in order. First, compared with MLE or Heckit, an important advantage of the CF approach is that it does not require any distributional assumption on (ε_i, v_i), such as the bivariate normality. Second, similar to the Heckit, the CF approach deals with the selection bias by including an additional regressor v_i. Different variables from x_i should be included in v_i, for example, z_i. Without the additional identifying variables, parameter β_1 may not be identified due to multi-collinearity. Third, as pointed out by Wooldridge (2010), the CF approach includes the incremental variable estimation as a special case in linear regression models. Similarly, the endogenous treatment effect model can be considered as a two-equation simultaneous equations model. If overseas listing decision is considered as a linear probability model, it can then be treated as the first-stage regression, and the variables z_i in this equation can be considered as excluded exogenous variables and thus as instruments for endogenous variable D_i in the valuation equation. In this case, Hausman test for endogeneity is equivalent to the F test for $\beta_2 = 0$. Fourth, γ can be consistently estimated by the IV estimation directly from the valuation equation, thus it can also be interpreted as the local average treatment effect

(LATE). Fifth, using GMM in the one-step CF approach provides efficient estimates while the two-step CF approach provides consistent estimates.

In Tables 3, 4, and 5, we present the regression results and decompose the treatment and selection effects for a model where the valuation equation is for one-year after IPO Tobin's Q in great detail, followed by summarized results for other valuation horizons in Table 6. The one-year model is estimated using the two-step CF approach. The point estimates and standard errors for the model coefficients when using the one-step CF approach are very similar. However, with a two-step CF approach, the standard errors for the ATE, $ATET$, GMD, SE in addition to the model coefficients could be obtained via bootstrapping. Results using alternative estimating approaches are reported in Table A4 as robustness checks.

4 Additional Empirical Results

4.1 Valuation Discount at Different Horizons

To examine how the treatment effects vary with different time horizons, columns (1) to (6) of Table 6 list the ATE and $ATET$ at the moment of IPO, and from one-year to five-year after IPO, estimated from the simple model in the upper panel, and from the general model in the lower panel.

Comparison across columns (1) and (2) shows that at IPO issue price, the valuation discount for overseas listed Chinese firms is in general smaller than that from their first year after IPO. This difference could be due to the implicit PE restrictions at IPO in the Mainland China stock market, as discussed in Section 2.2.

Comparison across columns (2) to (6) shows that the valuation discount varies somewhere between 31% to 67%, depending on whether one looks at ATE or $ATET$, and at the simple model or the general model. However, all these treatment effects are significantly negative, suggesting that the valuation discount persists many years after the IPO. Somewhat more interesting is a "V" shaped trend in valuation discounts across one to five years after IPO. The valuation discount in the third year after IPO is relatively small. This can be explained by the difference in lock-up period in Mainland China and overseas markets. As discussed earlier in Section 2.2, based on the regulations of the CSRC, the insiders have a lock-up period of 18 to 36 months, and the 36-months regulation applies to the actual controllers or controlling shareholders. While the lock-up period for controlling shareholders in Hong Kong and the US mar-

kets is 6 to 12 months. Some literature finds that IPO lock-up expiration is usually accompanied by a decline in stock price, an increase in trading volume, and negative abnormal returns (Bradley et al., 2001; Ofek, 2000; Brau et al., 2004; Field & Hanka, 2001). Consistent with the literature, our models also find that the potential outcome $E[y_{i0}]$ and $E[y_{i0}|D_i = 1]$ are indeed lowest at three-year after IPO compared with other horizons. This explains why there is a "V" shape trend in valuation discount one to five years after listing. Nevertheless, even at the bottom of the "V" shape, we still find a significantly negative treatment effect. More importantly, such effect soon bounces back and does not disappear even five years after listing.

4.2 Extended Samples

We include firms that cannot be listed domestically due to the Negative Lists and harsh financial listing requirements in Table A2. Column (1) lists the benchmark results from the simple model for one-year after IPO. Columns (2) and (3) sequentially add back firms that are in the Negative List and unqualified for domestic listing. We report both $E[y_{i1}|D_i = 1]$ and $E[y_{i0}|D_i = 0]$, that is, the average Tobin's Q of overseas listed firms when they are listed overseas and if they were listed at home. While there is little change in $E[y_{i1}|D_i = 1]$ from columns (1) to (3), $E[y_{i0}|D_i = 0]$ has gradually increased from 4.6 to 5.4. It suggests that these "excluded" or "unqualified" firms would obtain an even higher valuation than firms in our "qualified" sample if they were listed in the domestic market, although the overseas market does not value them very differently. As a result, the absolute value of $ATET$ from columns (2) to (3) is even larger than each from the previous column. As the percentage in valuation discount is defined as $ATET/E[y_{i0}|D_i = 0]$, it remains about 60% across all the columns.

Table A2 thus has two interesting implications. First, our finding on a significant negative value discount in the baseline sample is not driven by how we select the sample or by the fact some well-known overseas listed Chinese firms are not in our sample by construction. On the contrary, had these firms been included in our analyses, the absolute value of the estimated valuation discount would be even larger. Second, those Chinese firms that have been excluded or deemed unqualified to list in China's domestic market by the CSRC are in fact favored by Chinese investors. The additional valuation discount facing such firms relative to those in our baseline sample reflects the additional cost due to restrictions to capital market access.

4.3 Multiple Choices

We now consider a generalization that treats Hong Kong and New York as separate markets, and with and without VIE as different listing modes. Specifically, we consider a two-step estimation. We conduct a multinomial logit model in the first step to investigate the determinants of the different choices. In the spirit of a control function approach, we obtain the estimated residual from the multinomial logit model and plug it into the valuation equation of the simple model.

As shown in Table A3, in terms of listing locational choice, all else being equal, having higher state ownership implies a lower probability of listing in the US or listing with a VIE; and having a controlling shareholder implies a higher probability of listing in the Hong Kong or listing without a VIE. In terms of valuation, both the Hong Kong-listed and US-listed Chinese firms face a valuation discount compared with their domestically-listed counterparts, with the absolute value of discount somewhat larger in the US (-3.11) than in Hong Kong (-2.67), and the absolute valuation discount is larger for firms with a VIE (-3.28) than without a VIE (-2.80). However, the differences in valuation discount percentage across listing location and listing mode are very small, because listing in the US or listing with a VIE also implies a larger counterfactual valuation for those firms. The firms listed in the US or listed with a VIE structure are potentially even favored if they were listed in the Mainland China stock market.

4.4 Robustness Checks

4.4.1 Alternative Estimating Approaches

One may be curious whether the significant valuation discount of overseas-listed Chinese firms is due to our fancy econometric approaches. Table A4 shows the results from instrumental variable (IV) regression, exogenous treatment effect model, and the matching approach. Columns (1) and (2) show that the IV regression with little concern on weak instruments also predicts a significant valuation discount. Columns (3) and (4) report the results of inverse-probability-weighted regression adjustment (IPWRA) estimator under the treatment effect model. The results suggest that even if we ignore the endogeneity from the unobserved factors, there is still a significant negative $ATET$. Column (5) presents the results using propensity score matching approach, which also find a significant valuation discount for overseas listing.

4.4.2 Industry, Firm Size and Sample Period

We also check the sensitivity of the results to sample construction. Results are reported in Table A5. In columns (1) to (3), we exclude the firms from various specific industries (e.g., real estate, finance, and technology industry), and find that the main results are robust. In other words, the valuation discount we find is not driven by a specific industry but a general feature of overseas listed Chinese firms. China's IPOs are tightly regulated, so many private companies choose to go public by reverse merger. Hence, the potential for the smallest firms to serve as shells in reverse mergers is reflected largely in the market valuations of these firms. To investigate whether our results are driven by the shell value of very small firms, following Liu et al. (2019), we exclude the smallest 30% of Chinese firms based on their market capitalization. As shown in column (4) of Table A5, Chinese firms listed overseas still undertake a 60% valuation discount.

Since November 2013, China's IPO system has entered a new phase. Some reforms and adjustments have been made to include some features of the registration system. We divide our sample into two groups: firms listed before 2014 and after 2014, to examine the time trend of valuation discount as a robustness check. In columns (5) and (6), the firms listed before 2014 face a smaller valuation discount than those listed after 2014. This could be due to the increased regulation of the IPO process and the tighter capital control in Mainland China. The CSRC halted all reviews to cool down the secondary market in 2013 and employed window guidance on the PE ratio during the IPO in 2014. The foreign exchange reserve declined rapidly after June 2014. The Chinese government has begun to tighten controls on capital outflows. In this case, the Chinese firms are willing to pay a high cost to go IPO overseas.

4.4.3 Missing or Redundant Explanatory Variables

Another set of robustness checks investigates whether our valuation equation omits any important variables or includes redundant ones. Results are reported in Table A6. Firstly, according to the Fama-French model, a stock's excess return can be explained by many risk, liquidity, and size factors. Thus, we include those factors in our outcome model to explain the firm's valuation. As a robustness check, the Beta coefficients, a measure of the sensitivity of securities to the movement of markets, turnover ratio, a measure of liquidity, and tradable shares, a measure of share size, are included in column (1) of Table A6. We find consistent results with our baseline model. The

valuation discounts still exist for Chinese firms listed overseas.

Secondly, in the baseline model, we include many pre-IPO features in both the treatment model and outcome models. A potential concern is that those pre-IPO features should not affect the firms' valuation after listing as these factors are pre-IPO features that may affect the post-IPO valuation only by affecting the listing location. Thus, we exclude those pre-IPO firm-specific features from our outcome models to examine whether the main findings remain unchanged. As we have the same observations, the treatment model is the same as the treatment model in our baseline results. Despite excluding the pre-IPO features in the outcome models, our main results still remain, as shown in column (2) of Table A6.

4.4.4 Logarithm of Tobin's Q as Outcome Variable

Instead of using level of Tobin's Q as the outcome variable, we re-estimate both the simple model and general model using logarithm of Tobin's Q. The results are presented in Table A7. We then decompose the treatment effects and the selection effects from the estimation in Table A8. A comparison between Table A7 and Table 4, and between Table A8 and Table 5, shows the robustness of our findings to the choice of dependent variable. Although the magnitude of the estimated effects are slightly different, as one is for level and the other is for logarithm of Tobin's Q, we find significant negative treatment effects and a positive selection in the domestic market, in both sets of estimation.

4.4.5 PB Ratio and Pre-IPO Observation Period

In addition to Tobin's Q, we use Market-to-Book ratio (PB ratio), calculated by dividing the current market value by the most current book value on equity, as an alternative gauge for valuation discount. As shown in column (1) of Table A9, the motives for Chinese firms listed overseas remain similar to the baseline estimates and there is a substantial and persistent valuation discount for Chinese firms listed overseas.

In the previous estimation, we use the 12-month average relative market index prior to the IPO application date in the IPO locational decision equation. This is functionally equivalent to an instrumental variable. As a robustness check, we use the 6-month and 24-month average relative market index prior to the IPO application date to measure the relative market sentiment. From the probit model, we find the impact of the relative market index on the overseas listing to still be significantly positive.

Columns (2) and (3) of Table A9 illustrate that the estimated valuation discounts for the overseas listings are almost unchanged with these alternative instruments.

5 Validating Roles of Capital Market Distortions

5.1 Tightening of Capital Outflow Controls

In response to a sharp decline in China's foreign exchange reserve in 2016, the country tightened controls on capital account restrictions after 2017, mostly through "window guidance" from the central bank to commercial banks, aiming at reducing the speed of a loss of foreign exchange reserves.[2] If our interpretation of the ATE is correct, we should expect to see an even higher valuation discount. That is, with fewer legal channels and tightened loop holes to take assets outside China, the cost of converting local currency to the US dollars, τ, should increase. According to our model prediction, the probability of an overseas listing increases or the urge to bypass capital controls via an overseas listing becomes stronger. Furthermore, the valuation discount that the marginal entrepreneur is willing to accept should also become larger. In this sense, this policy change provides an opportunity to check our interpretation.

Following Cappiello and Ferrucci (2008), we construct the capital control premium for Mainland China using the covered interest rate parity. As shown in Figure A3, there is a clear episode of positive capital control premium or tightening of capital outflow controls during 2018 to 2019. Firms that submitted their IPO applications (to any stock market) during 2018 to 2019 are thus defined as affected by China's tightening of capital controls.

We use a straightforward DID specification to evaluate our hypothesis by including an interaction term between a dummy for this tightened capital control period and the overseas listing dummy in the valuation equation of the simple model. As shown in column (1) of Table 9, the tightening of capital outflow controls amplifies the valuation discount in the data: the average Tobin's Q for overseas listed Chinese firms declines by a further 0.68.

5.2 IPO Suspension and PE Regulation

The administrative approval needed for an IPO is another potential "inconvenience" that Chinese entrepreneurs are willing to pay to bypass. China's suspension of initial

[2] See, for example, an official Notice released in August 2017 on regulating China's overseas direct investment, at https://www.gov.cn/zhengce/content/2017-08/18/content_5218665.htm.

public offerings between 2012 and 2014 represents a shock,[3] in the form of a lengthening in d, to the already long wait for IPO approval in the country's domestic stock market. It therefore may provide another opportunity to check whether the valuation discount reflects a willingness to bypass the capital market distortions. According to our model prediction, all else being equal, we expect the valuation discount to rise during IPO suspension period.

It is reasonable to assume that those firms that submitted an IPO application (to any stock exchange) between 2012 and 2014 are affected by the Chinese IPO suspension during that period. In column (2) of Table 9, we see that the Chinese IPO suspension indeed enlarges the valuation discount for overseas-listed Chinese firms. The coefficient on the interaction term indicates that the firms applying for an IPO during the IPO suspension period are willing to accept an additional haircut on Tobin's Q by -1.67.

The restriction on the PE ratio < 23 upon IPO is another policy distortion under the administrative IPO approval system. The PE restriction is in place from early 2014 – after the resumption of IPO review, to June 2020 – until the recent IPO registration reform, and is probably motivated by a desire of the regulator to generate a stock price increase after the IPO. Presumably, an entrepreneur would estimate the likely PE ratio in the absence of the restriction, and if it is close to or above 23, she would be more inclined to take her firm for an overseas listing. Given the fact that she will only receive a price of her stock no larger than 23 times of the earnings per share, she is more likely to accept a lower than otherwise price in the overseas market. In column (3) of Table 8, we see that the firms listed overseas during this period indeed experienced a larger valuation discount. Compared with those listed overseas during other time periods in the sample, firms listed overseas in this PE restriction period accept an additional or further reduction in Tobin's Q by -0.99.

In column (4) of Table 9, we include all three policy distortions in the same regression. We see that the valuation discount is significantly larger in periods when the capital controls are tightened, when the domestic IPOs are suspended, or when PE restrictions are binding.

[3]Exploiting the same exogenous shock, Cong and Howell (2021) studies how this IPO suspension reduces corporate innovation activity both during the delay and for years after listing.

5.3 Firm Heterogeneities

Another way to obtain supportive evidence on the willingness-to-pay interpretation is to examine the heterogeneous impact on firm valuations of the same distortion across different firms. We consider four firm-specific features in particular. First, state ownership should reduce the need to bypass domestic capital market restrictions. A large number of studies compare SOEs and non-SOEs and find that the political connection with the government helps SOEs obtain a low cost of capital, regulatory benefits, and strong market power (Sapienza, 2004; Khwaja and Mian, 2005; Li et al., 2008). Presumably, SOEs may also have more leeway to bypass capital outflow controls because of the political connection. Thus, one might expect that firms with higher state ownership are less likely to accept a large valuation discount. As shown in column (1) of Table A10, those firms with state ownership exhibit a smaller valuation discount than those without any state ownership by 24% (0.703/2.908).

Foreign investors in the pre-IPO stage generally prefer to obtain their proceeds in hard currency. We have found a higher share of foreign investment raises the chance of an overseas listing in Table 3. Now we examine whether it also leads to a larger valuation discount. We divide our sample into two groups of firms based on whether their foreign ownership share is above the sample median or not. From column (2) of Table A10, we indeed see a larger valuation discount for those firms with a higher share of foreign ownership.

The CSRC, with a paternalistic view of investor protection, often prefers mature firms with stable cash flow and more tangible assets, increasing the difficulty of risky firms in the public offering. To reflect firms' needs for external equity finance and highlight the impact of the administrative approval IPO system, we investigate whether firms with high operating risks or high intangible assets ratio have a larger valuation discount. The operating risk is defined as the standard deviation of the ratio of earnings before interest and taxes (EBIT) to total assets (Billingsley et al.,1990). Following Peters and Taylor (2017), the intangible assets consist of two components, externally purchased intangible assets, which are usually measured by intangible assets on the balance sheet, and internally created intangible assets, which are measured by past accumulated intangible investments. Firms above the median in operating risk or intangible assets are classified as high-risk or high-intangible group (dummy = 1). Presumably, such firms would have to wait for an even longer period in an IPO application in Mainland China, provided their applications were finally approved or they

even attempted to submit an application. This implies that all else being equal they might be willing to accept an even larger valuation discount in an overseas listing. In columns (3) and (4) of Table A10, the valuation discount is indeed even greater for these firms than other overseas listed Chinese firms – 32% (0.717/2.216) larger for the high operating risk group and 14.4% (0.381/2.63) larger for the high intangible assets group.

In column (5), we include measures of firm heterogeneity and indicators of policy distortions in the same regression. This specification has the most comprehensive list of variables and therefore is more general than other columns in either Table 9 or A10. We continue to see that a firm with a higher operating risk or higher foreign ownership share tends to tolerate a larger valuation discount in an overseas market. Furthermore, the valuation discount tends to be bigger during the periods of tightening capital controls, suspension of domestic IPOs, or binding PE restrictions.

5.4 Policy Distortions and Firm Heterogeneities

We previously examine the effects of capital market distortions on the valuation discount by exploring policy shocks based on the DID specification. Then, we also study the impact of policy distortions from firm heterogeneities. Next, we combine the capital market regulations and the firm heterogeneities to further sharpen our identification. We focus on two capital market policy distortions: capital control and IPO suspension, and three corresponding firm-specific features: foreign ownership, operating risk, and intangible assets ratio. We use the triple-differences specification to evaluate whether the firms with intense demand for circumventing capital controls or urgent need for accessing equity finance are more sensitive during the period of policy reinforcement.

As we discussed before, foreign investors generally prefer pushing the firms going IPO abroad to get their return in foreign currency and bypass China's capital controls. This preference may be even stronger in periods of tightened capital controls. As shown in column (1) of Table A11, the firms with higher shares of foreign ownership undertake a larger discount when capital control was tightened. During IPO suspension, if firms urgently need to raise equity capital to support their growth, they are likely to be willing to pay a greater discount to pursue an overseas listing. From columns (2) and (3), we indeed find a greater valuation discount for firms with high operating risk or high intangible asset ratio during the IPO suspension.

Taken together, the evidence from Table A10 and A11 is consistent with an inter-

pretation that the significant valuation discount documented in our empirical exercises reflects the cost of China's capital market distortions. Chinese entrepreneurs who list their firms abroad are giving up substantial valuation in order to bypass such distortions. When the distortions get more severe, they have to give up even more.

6 Additional Results for Structural Estimation

6.1 Logarithm of Tobin's Q as Outcome Variable

We apply the SMM to the empirical moments obtained in columns (2) and (3) of Table A7, i.e. when we estimate the general model using logarithm of Tobin's Q as the outcome variable. Results are reported in Table A12. Comparison between Table A12 and Table 8 shows that the two sets of estimated structural parameters are very close to each other.

In particular, the estimated $\mu_c = 0.35$ and is significantly different from zero. This provides direct evidence for the cost of capital market distortions facing the entrepreneurs in our model. Thus, both the reduced-form results and the structural estimation suggest that our empirical findings are robust to the choice between level and logarithm of Tobin's Q, although the results using level of Tobin's Q are easier for interpretation.

6.2 Small Perturbation in Data Moments

Since our structural parameters are obtained by matching the model simulated moments with the data moments from a reduced-form regression, it is important to check whether our structural estimation is robust to a small perturbation in the data moments. To do so, we increase each of the data moments by 5% and re-estimate the model under the same setup. Results are presented in Table A13. Compared with the benchmark estimates listed in the first column, when there is a small change in each of the data moments listed in the first row, there are some corresponding changes in the optimal structural estimates.

This is a necessary condition of identification – the model simulated structural parameters do move with the data moments. Furthermore, the movements are in the direction consistent with the prediction of our economic theory. For example, when the potential outcome $E[y_{i0}]$ and $E[y_{i1}]$, and the probability of going overseas IPO $P(D_i = 1)$ increase one by one, the population mean of Tobin's Q listed at home

μ_0 and abroad μ_1, and the cost of capital market distortions μ_c increase one by one accordingly.

Meanwhile, compared with the first column, estimates in the other columns are all in the neighborhood of the benchmark values. None of the changes are large enough to substantially change the model implications. This means our structural estimates are relatively robust to a small perturbation in data moments. Thus, even if researchers obtain slightly different data moments with different samples, empirical models and estimating approaches, the ultimate structural estimates and hence the welfare implications could be very similar.

6.3 Decomposition of Welfare Loss

Our estimated economic environment allows us to investigate welfare loss between those with currently onshore versus offshore listings. Results are reported in Table A14. All else being equal, under the ideal scenario when $\mu_c = 0$, only 11.5% of the entrepreneurs in our sample would still choose to go an overseas listing. Those are entrepreneurs who happen to have such a large random draw on δ_i that home market reform does not change their choice and affect their welfare. However, there are 11.6% of the entrepreneurs in our sample who would list at home and have an average utility of 0.610 if $\mu_c = 0$, in fact switch to overseas IPO due to $\mu_c = 0.32$. Their factual average utility decreases to 0.436, which is equivalent to a 28.5% welfare loss.

The most interesting group is those 76.8% of entrepreneurs, who would list at home if $\mu_c = 0$ and also currently list at home at $\mu_c = 0.32$. Although there seems no change in their listing locational choice, their average utility has decreased from 1.784 to 1.462, or a 18.0% welfare loss due to capital market distortions. Since the total welfare loss comes from those who switch and from those who currently list at home, with the proportion of each category of such entrepreneurs and the average welfare loss in each category, we find the switchers and the home listers contribute 19.3% and 80.7% respectively in the total welfare loss.

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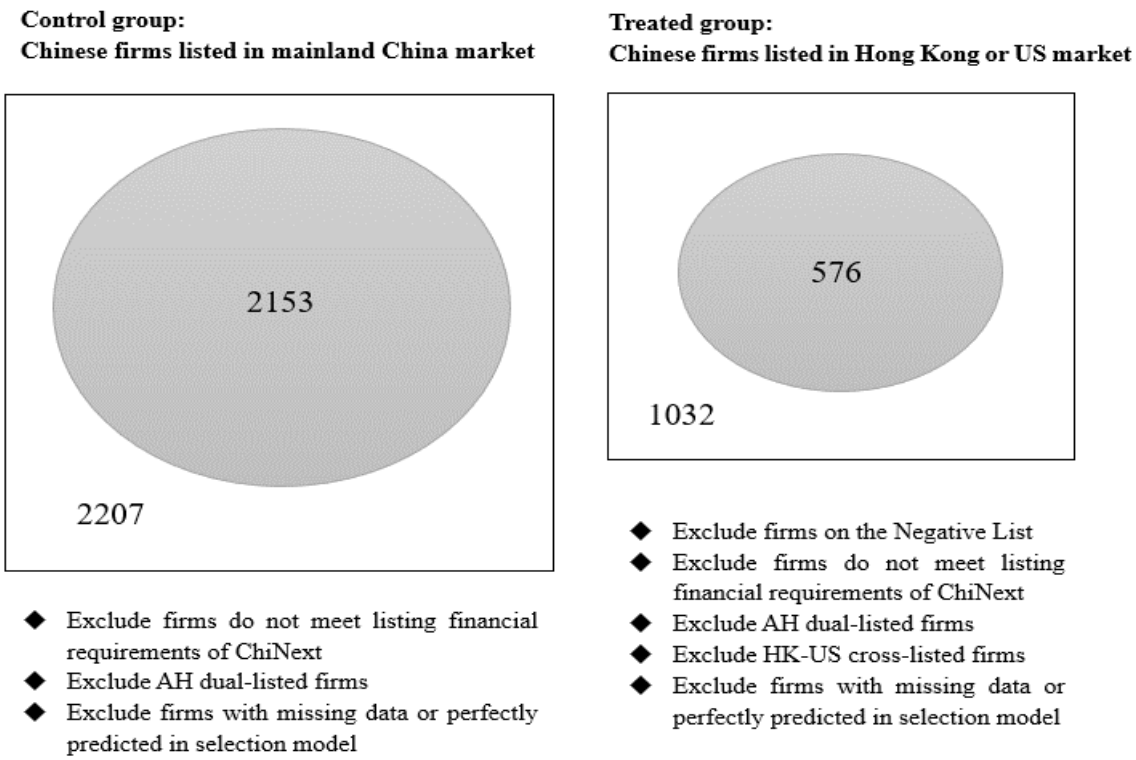

Figure A1: Sample Construction for Chinese Firms Listed in Mainland China and Overseas

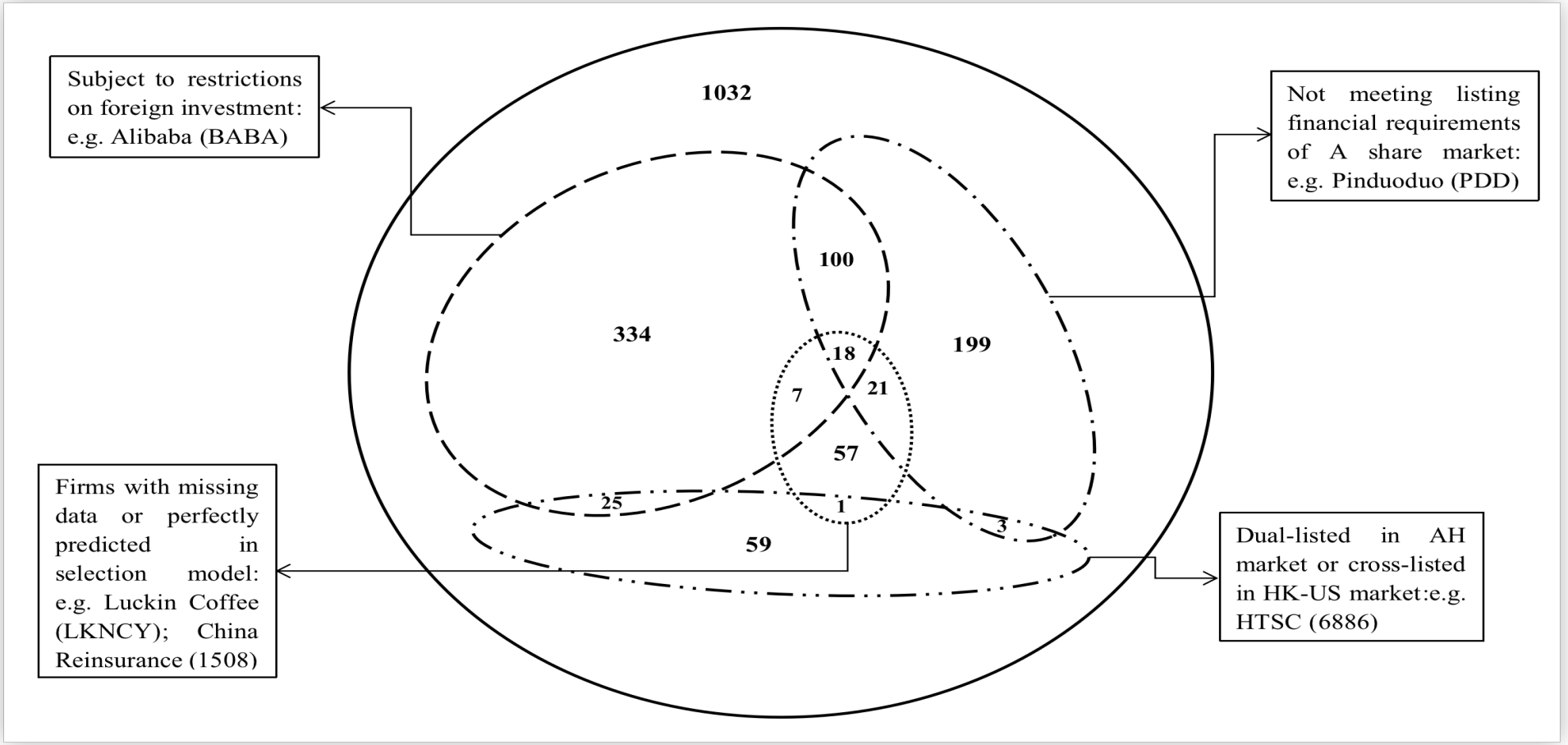

Figure A2: Sample Construction for Overseas Listed Chinese Firms

Note:

Number of overseas listed Chinese firms in our baseline sample = 1032 - (334+199+59+57-100-25-21-7-3-1-2×18) = 576.

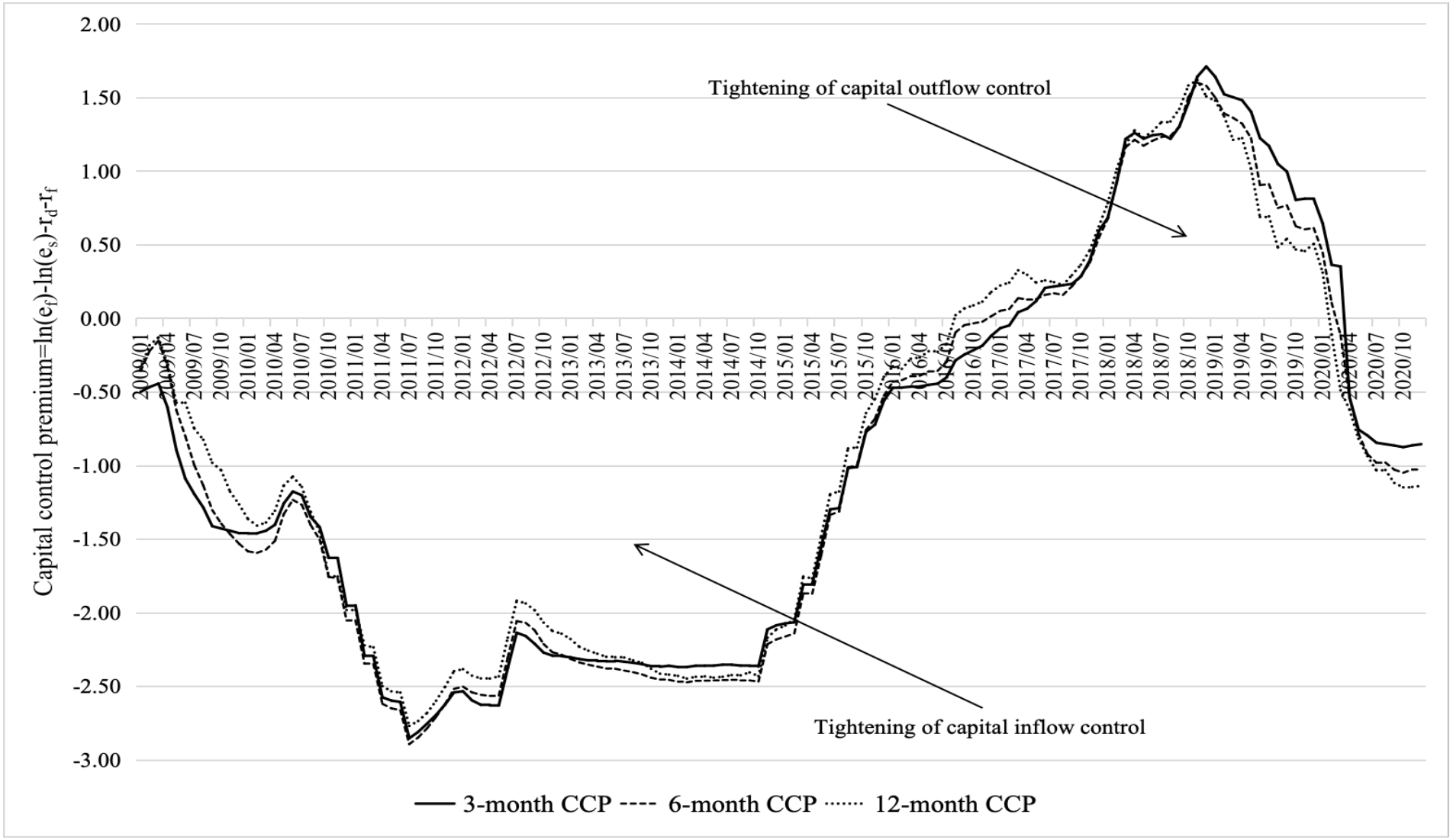

Figure A3: Capital Control Premium (CCP)

Note:

e_f is the forward exchange rate (USD/CNY); e_s is the spot exchange rate (USD/CNY); r_d is interest rate in China; r_f is interest rate in the US.

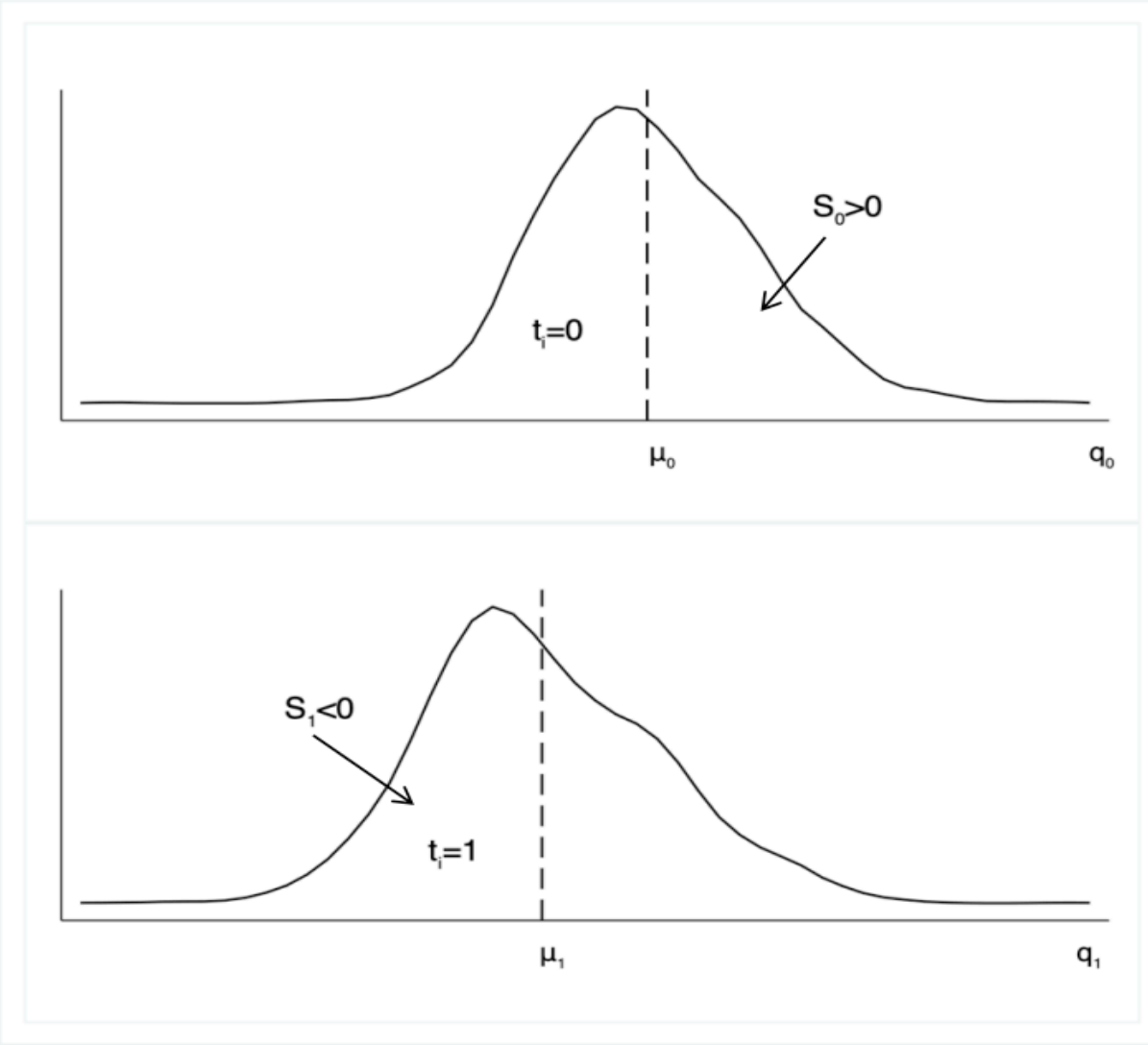

Figure A4: The Population Valuation Distribution and the Selection of the Treated

Table A1: Variable List and Data Sources

Category	Variable	Definition	Sources
	Tobin's Q	(market value of equity + book value of total assets - book value of equity) / the book value of assets	Wind
	OverList	Dummy = 1 if the firm is listed in Hong Kong or New York (NYSE or Nasdaq), and 0 otherwise	Wind; CSMAR; S&P capital IQ
Basic firm features	Age	Number of years since establishment	Prospectus
	Log (total asset)	Log (the book value of total assets)	Wind
	ROA (%)	Earnings before interest and tax × 2/(total assets at the beginning of the period + total assets at the end of the period) × 100 (%)	Wind
	Sales growth rate (%)	Growth rate of total sales × 100 (%)	Wind
	Leverage (%)	Book value of total liabilities / book value of total assets × 100 (%)	Wind
	Intangible asset ratio (%)	Intangible capital (constructed by following Peters and Taylor (2017)) / book value of total assets	Wind
	Operating cash flow ratio (%)	Operating cash flow/total assets × 100 (%)	Wind
Corporate governance	State ownership percentage (%)	Percentage of shares owned by state entities prior to IPO (only the top5 shareholders considered)	Prospectus
	Independent director ratio (%)	Number of independent directors/ number of directors on board	Wind
	CEO = Chairman	Dummy= 1 if CEO and Chairperson of the board are the same person at IPO; 0 otherwise	Prospectus
	Top5 ownership percentage (%)	Total shares (%) owned by the top 5 shareholders just prior to IPO	Prospectus
	Controlling shareholder dummy	Dummy: 1 if the top shareholder holds 50% or more of the shares and 30% or more of the voting rights prior to IPO; 0 otherwise	Wind; Prospectus
International orientation	Stratigic investor dummy	Dummy: 1 if there is at least one of the strategic investors at IPO; 0 otherwise	Prospectus
	Import and export rate (%)	(imports/revenue + foreign sales/ revenue) × 100 (%). The import ratio is calculated from the input and output table at industry level, while the foreign sales revenue ratio is at the firm level. For those firms without observations on foreign sales revenue ratio, we replace them with industrial average export ratio from the input and output table	Wind; National Bureau of Statistics of China
	Foreign ownership percentage (%)	Shares owned by foreign entities (among the top 5 owners) prior to IPO	Prospectus
Regulations and market features	Foreign reserve growth rate (%)	12-month growth rate of China's foreign exchange reserve before the firm's IPO application	SAFE
	Exchange rate growth (%)	The growth rate of USD to RMB exchange rate 1 year before IPO	SAFE
	PE regulation	PE regulation=Max(median PE ratio in HK among those firms in the same industry, median PE ratio US among those firms in the same industry)* Dummy for IPO dates between 31 March 2014 and 30 June 2020	Wind
	Expected relative waiting days	Average waiting days of those firms in the same industry when listed in Mainland China 1-year before IPO application date /Average waiting days of those firms in the same industry when listed overseas 1-year before IPO application date	Wind
	Log (relative market index)	Log (Overseas market index 12-month before IPO application date / Mainland market index 12-month before IPO application date)	Wind
Other controls	Industry dummy	4-digit code of Wind industry classification	Wind
	Year dummy	Year dummy from 2009 to 2020	
	Province GDP per capita	Log (provincial GDP per capita in 2009)	National Bureau of Statistics of China

Table A2: Valuation Discount in the Simple Model across Extended Samples

Dependent	Tobin's Q		
Variables	(1) Benchmark sample	(2) + firms on Negative List	(3) + Negative list & Unqualified firms
ATE	-2.717***	-2.936***	-3.176***
	(0.350)	(0.234)	(0.331)
$E[y_{i0}]$	4.174	4.274	4.449
$ATE/E[y_{i0}]$	-65.09%	-68.69%	-71.39%
ATET	-2.717***	-2.936***	-3.176***
	(0.350)	(0.234)	(0.331)
$E[y_{i1} \mid D_i = 1]$	1.906	1.958	2.198
$E[y_{i0} \mid D_i = 1]$	4.623	4.894	5.374
$ATET/E[y_{i0} \mid D_i = 1]$	-58.77%	-59.99%	-59.10%
X	YES	YES	YES
Industry	YES	YES	YES
Year	YES	YES	YES
Province GDP per capita	YES	YES	YES
Observations	2,729	2,913	3,072

Notes:

1. The vaulation equation is estimated with the overseas listing decision simultaneously.

2. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level.

Table A3: Multiple Listing Locations and Listing Modes

Category	Dependent	HK listing	US listing	Tobin's Q	Without VIE	With VIE	Tobin's Q
		(1)	(2)	(3)	(4)	(5)	(6)
Basic firm features	Age	0.050***	-0.069*	-0.005	0.056***	-0.088***	-0.005
		(0.012)	(0.037)	(0.006)	(0.011)	(0.028)	(0.005)
	Log (total asset)	-0.165*	-0.359**	-0.455***	-0.198**	-0.189	-0.445***
		(0.088)	(0.176)	(0.063)	(0.087)	(0.155)	(0.062)
	ROA (%)	0.055***	0.040**	0.044***	0.064***	0.021	0.044***
		(0.012)	(0.017)	(0.012)	(0.012)	(0.017)	(0.011)
	Sales growth rate (%)	0.014***	0.021***	0.007***	0.013***	0.021***	0.007***
		(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)
	Leverage (%)	0.044***	0.026***	-0.009***	0.044***	0.024***	-0.009***
		(0.005)	(0.010)	(0.003)	(0.006)	(0.009)	(0.003)
	Intangible assets ratio (%)	0.033***	0.052***	0.015***	0.028***	0.043***	0.016***
		(0.008)	(0.009)	(0.004)	(0.008)	(0.009)	(0.004)
	Operating cash flow ratio (%)	-0.041***	-0.007	0.014**	-0.042***	-0.012	0.013**
		(0.009)	(0.013)	(0.005)	(0.008)	(0.012)	(0.005)
Corporate governance	State ownership percentage (%)	0.000	-0.371***	0.003*	0.004	-0.046**	0.003*
		(0.004)	(0.114)	(0.001)	(0.004)	(0.021)	(0.001)
	Independent director ratio (%)	0.107***	0.151***	-0.003	0.133***	0.118***	-0.003
		(0.013)	(0.021)	(0.005)	(0.014)	(0.016)	(0.006)
	CEO = Chairman	0.615***	0.696**	0.053	0.641***	0.617**	0.060
		(0.155)	(0.306)	(0.081)	(0.152)	(0.286)	(0.075)
	Top5 ownership percentage (%)	0.055***	-0.057***	-0.008*	0.016**	0.000	-0.006
		(0.011)	(0.011)	(0.005)	(0.008)	(0.011)	(0.005)
	Controlling shareholders dummy	0.421**	0.272	0.169*	0.567***	0.024	0.169*
		(0.175)	(0.354)	(0.089)	(0.173)	(0.303)	(0.092)
International orientation	Strategic investor dummy	1.423***	1.636***	0.100	1.354***	1.868***	0.139
		(0.223)	(0.498)	(0.123)	(0.219)	(0.398)	(0.124)
	Import and export ratio (%)	-0.002	-0.001	-0.002	-0.002	-0.006	-0.002
		(0.003)	(0.008)	(0.001)	(0.003)	(0.010)	(0.001)
	Foreign ownership percentage (%)	0.016***	0.025***	0.003**	0.020***	0.008*	0.003**
		(0.002)	(0.005)	(0.001)	(0.002)	(0.005)	(0.001)
Regulations and market features	Foreign reserve growth rate (%)	-0.025	0.111***	0.006	0.010	0.012	0.004
		(0.016)	(0.032)	(0.008)	(0.016)	(0.029)	(0.008)
	Exchange rate growth (%)	0.230***	0.591***	0.020	0.324***	0.337***	0.015
		(0.077)	(0.132)	(0.036)	(0.076)	(0.123)	(0.038)
	PE regulation	0.031	0.034	-0.021**	0.036	0.075**	-0.022**
		(0.022)	(0.033)	(0.010)	(0.022)	(0.032)	(0.009)
	Expected relative waiting days	0.642***	0.028		0.616***	0.244**	
		(0.070)	(0.186)		(0.068)	(0.117)	
	Log(relative market index)	0.732***	4.296***		0.852***	2.217***	
		(0.202)	(0.881)		(0.201)	(0.476)	
	US listing			-3.107***			
				(0.410)			
	HK listing			-2.674***			
				(0.254)			
	Listing with VIE						-3.277***
							(0.372)
	Listing without VIE						-2.803***
							(0.245)
	$E[y_{i0} \mid D_{i\,(\text{US listing})} = 1]$			5.322			
	$E[y_{i0} \mid D_{i\,(\text{HK listing})} = 1]$			4.580			
	$E[y_{i0} \mid D_{i\,(\text{with VIE})} = 1]$						5.729
	$E[y_{i0} \mid D_{i\,(\text{without VIE})} = 1]$						4.665
	$ATET/E[y_{i0} \mid D_{i\,(\text{US listing})} = 1]$			58.38%			
	$ATET/E[y_{i0} \mid D_{i\,(\text{HK listing})} = 1]$			58.38%			
	$ATET/E[y_{i0} \mid D_{i\,(\text{with VIE})} = 1]$						-57.20%
	$ATET/E[y_{i0} \mid D_{i\,(\text{without VIE})} = 1]$						-60.09%
Other controls	Industry	YES	YES	YES	YES	YES	YES
	Year	YES	YES	YES	YES	YES	YES
	Province GDP per capita	YES	YES	YES	YES	YES	YES
	β_2			0.488*			0.651**
				(0.261)			(0.273)
	No. of obs	2,913	2,913	2,913	2,913	2,913	2,913

Notes:

1. The results are estimated using firms in their first year of IPO.
2. The valuation equation added by residuals from the multinomial logit model are estimated by OLS.
3. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table A4: Robustness Checks: Alternative Estimation Approaches

	Dependent	Overseas listing	Tobin's Q			Overseas listing
		(1) IV	(2) IV	(3) IPWRA	(4) IPWRA	(5) Matching
Category	Variables	1st Year	1st Year	1st Year-treated	1st Year-control	1st Year
Basic firm features	Age	0.005***	0.004	-0.006	-0.002	0.034***
		(0.001)	(0.007)	(0.006)	(0.013)	(0.006)
	Log(total asset)	-.0767***	-0.674***	-0.180	-0.709***	-0.157***
		(0.009)	(0.074)	(0.111)	(0.097)	(0.047)
	ROA (%)	0.011***	0.084***	0.002	0.137***	0.036***
		(0.002)	(0.018)	(0.011)	(0.019)	(0.007)
	Sales growth rate (%)	0.000	0.006***	-0.000	0.006**	0.007***
		(0.000)	(0.002)	(0.001)	(0.003)	(0.001)
	Leverage (%)	0.007***	0.008	-0.000	0.007	0.024***
		(0.001)	(0.005)	(0.006)	(0.006)	(0.003)
	Intangible assets ratio (%)	0.002***	0.020***	0.016***	-0.007	0.015***
		(0.001)	(0.005)	(0.006)	(0.006)	(0.004)
	Operating cash flow ratio(%)	-0.002***	0.009	0.026**	0.010	-0.025***
		(0.001)	(0.007)	(0.012)	(0.009)	(0.005)
Corporate governance	State ownership percentage (%)	0.000	0.005***	-0.001	0.005*	0.003
		(0.000)	(0.002)	(0.003)	(0.003)	(0.002)
	Independent director ratio (%)	0.012***	0.014*	-0.018**	-0.001	0.071***
		(0.001)	(0.008)	(0.007)	(0.010)	(0.008)
	CEO=Chairman	0.035***	0.155*	-0.066	0.242*	0.323***
		(0.011)	(0.087)	(0.197)	(0.146)	(0.084)
	Top5 ownership percentage (%)	0.001**	-0.005	-0.015	-0.015*	0.008**
		(0.000)	(0.005)	(0.020)	(0.008)	(0.004)
	Controlling shareholders dummy	0.043***	0.232**	-0.024	0.143	0.340***
		(0.013)	(0.095)	(0.193)	(0.176)	(0.096)
International orientation	Strategic investor dummy	0.164***	0.401**	0.111	0.102	0.750***
		(0.027)	(0.177)	(0.155)	(0.222)	(0.125)
	Import and export ratio (%)	-0.000	-0.002	0.002	0.002	-0.001
		(0.000)	(0.002)	(0.003)	(0.003)	(0.001)
	Foreign ownership percentage (%)	0.002***	0.007***	0.000	0.005**	0.011***
		(0.000)	(0.002)	(0.002)	(0.002)	(0.001)
Regulations and market features	Foreign reserve growth rate (%)	0.000	0.001	-0.009	0.021	0.011
		(0.001)	(0.009)	(0.017)	(0.018)	(0.009)
	Exchange rate growth (%)	0.035***	0.060	0.204	-0.024	0.199***
		(0.006)	(0.042)	(0.193)	(0.075)	(0.040)
	PE regulation	0.004***	-0.019	0.002	-0.059**	0.018
		(0.002)	(0.012)	(0.007)	(0.025)	(0.012)
	Expected relative waiting days	0.068***				0.362***
		(0.007)				(0.040)
	Log(relative market index)	0.057***				0.432***
		(0.013)				(0.105)
	Overseas listing		-4.418***			
			(0.595)			
	ATET		-4.418***	-2.552***		-1.610**
			(0.532)	(0.198)		(0.669)
	$E[y_{i0} \mid D_i = 1]$			4.458***		
				(0.190)		
	$ATET/E[y_{i0} \mid D_i = 1]$			-57.25%		
Other controls	Industry	YES	YES	YES	YES	YES
	Year	YES	YES	YES	YES	YES
	Province GDP per capita	YES	YES	YES	YES	YES
	Cragg-Donald Wald F statistic	89.23				
	Kleibergen-Paap rk LM statistic	88.23				
	No. of Obs.	2,729	2,729	2,729	2,729	2,729
	R^2		0.427			

Note:
Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level.

Table A5: Robustness Checks: Valuation Discounts Excluding Firms in Specific Industries, Small Size and Sample Periods

Dependent	Tobin's Q					
	(1)	(2)	(3)	(4)	(5)	(6)
	Excluding real estate industry	Excluding financial industry	Excluding technology industry	Excluding small firms	IPO before 2014	IPO after 2014
Variables	1st Year	1st Year	1st Year	1st Year	1st Year	1st Year
ATE	-2.930***	-2.804***	-2.554***	-3.367***	-1.314***	-3.788***
	(0.297)	(0.262)	(0.344)	(0.426)	(0.188)	(0.440)
$E[y_{i0}]$	4.213	4.220	4.035	4.802	2.988	4.987
$ATE/E[y_{i0}]$	-69.55%	-66.45%	-63.30%	-70.12%	-43.98%	-75.96%
ATET	-2.930***	-2.804***	-2.554***	-3.367***	-1.314***	-3.788***
	(0.297)	(0.262)	(0.344)	(0.426)	(0.188)	(0.440)
$E[y_{i0} \mid D_i = 1]$	4.854	4.683	4.444	5.527	3.173	5.722
$ATET/E[y_{i0} \mid D_i = 1]$	-60.36%	-59.88%	-57.47%	-60.92%	-41.41%	-65.63%
X	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
Province GDP per capita	YES	YES	YES	YES	YES	YES
Observations	2,659	2,655	2,525	1,908	1,119	1,610

Notes:

1. The outcome models are estimated with the treatment models simultaneously.

2. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level.

Table A6: Robustness Checks: Missing or Redundant Explanatory Variables

Dependent	Tobin's Q	
	(1) including Factors in FF model	(2) excluding pre-IPO firm charactistics
Variables	1st Year	1st Year
ATE	-3.005***	-2.672***
	(0.315)	(0.224)
$E[y_{i0}]$	4.235	4.165
$ATE/E[y_{i0}]$	-70.96%	-64.15%
ATET	-3.005***	-2.672***
	(0.315)	(0.224)
$E[y_{i0} \mid D_i = 1]$	4.905	4.572
$ATET/E[y_{i0} \mid D_i = 1]$	-61.26%	-58.44%
X	YES	YES
Industry	YES	YES
Year	YES	YES
Province GDP per capita	YES	YES
Observations	2,728	2,729

Notes:

1. The outcome models are estimated with the treatment models simultaneously.

2. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table A7: Valuation Discount: ln (Tobin's Q)

	Dependent	ln of Tobin's Q		
		Simple model	General model	
		(1)	(2)	(3)
		All	Treated	Control
Category	Variables	1st Year	1st Year	1st Year
Basic firm features	Age	-0.002	-0.004	-0.000
		(0.001)	(0.003)	(0.001)
	Log(total asset)	-0.144***	-0.040	-0.221***
		(0.013)	(0.025)	(0.012)
	ROA(%)	0.014***	0.002	0.030***
		(0.003)	(0.003)	(0.002)
	Sales growth rate(%)	0.002***	0.000	0.002***
		(0.000)	(0.001)	(0.000)
	Leverage(%)	-0.002***	-0.002	-0.001*
		(0.001)	(0.002)	(0.001)
	Intangible assets ratio(%)	0.005***	0.006***	0.003***
		(0.001)	(0.002)	(0.001)
	Operating cash flow ratio(%)	0.004***	0.009***	-0.000
		(0.001)	(0.002)	(0.001)
Corporate governance	State ownership percentage(%)	0.000	-0.002	0.002***
		(0.000)	(0.001)	(0.000)
	Independent director ratio(%)	-0.007***	-0.014***	0.003**
		(0.002)	(0.003)	(0.002)
	CEO=Chairman	0.002	-0.038	-0.001
		(0.016)	(0.052)	(0.014)
	Top5 ownership percentage(%)	0.000	0.002	-0.001**
		(0.001)	(0.004)	(0.001)
	Controlling shareholders dummy	0.020	-0.076	0.041***
		(0.019)	(0.067)	(0.016)
International orientation	Strategic investor dummy	0.057*	0.017	0.032
		(0.033)	(0.054)	(0.029)
	Import and export ratio(%)	-0.000	0.001	-0.000
		(0.000)	(0.001)	(0.000)
	Foreign ownership percentage(%)	0.000	-0.001	0.001***
		(0.000)	(0.001)	(0.000)
Regulations and market features	Foreign reserve growth rate(%)	-0.002	-0.014**	0.003*
		(0.002)	(0.007)	(0.002)
	Exchange rate growth (%)	-0.003	-0.008	0.022***
		(0.009)	(0.031)	(0.009)
	PE regulation	-0.002	0.001	-0.009***
		(0.002)	(0.004)	(0.003)
	Overseas listing	-0.844***		
		(0.079)		
Other controls	Industry	YES	YES	YES
	Year	YES	YES	YES
	Province GDP per capita	YES	YES	YES
	Constant	YES	YES	YES
	β_{20}	-0.024		0.237***
		(0.081)		(0.072)
	β_{21}	-0.024	-0.456***	
		(0.081)	(0.138)	
	Observations	2,729	576	2,153

Note:

Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level.

Table A8: Decomposition for Quantity of Interest - ln of Tobin's Q

Quantity of Interest	Simple model	General model
$E[y_{i0} \mid D_i = 0]$ - observed	1.240	1.240
$E[y_{i1} \mid D_i = 1]$ - observed	0.411	0.411
$E[y_{i1} \mid D_i = 0]$ - predicted	0.396	0.842
$E[y_{i0} \mid D_i = 1]$ - predicted	1.255	1.512
$E[y_{i0}]$ - potential outcome mean	1.243	1.297
$E[y_{i1}]$ - potential outcome mean	0.399	0.751
ATE	-0.844***	-0.546***
	(0.080)	(0.114)
$E[y_{i0}]$	1.243***	1.297***
	(0.018)	(0.018)
$ATE/E[y_{i0}]$	-71.12%	-42.10%
ATET	-0.844***	-1.101***
	(0.080)	(0.072)
$E[y_{i0} \mid D_i = 1]$	1.255***	1.512***
	(0.074)	(0.070)
$ATET/E[y_{i0} \mid D_i = 1]$	-67.25%	-72.82%
$S_0 = E[y_{i0} \mid D_i = 1] - E[y_{i0}]$	0.012	0.215***
	(0.059)	(0.056)
$S0_x = \beta_{10} * (E[x_i \mid D_i = 1] - E[x_i \mid D_i = 0]) * (1-P)$	0.020	0.139***
	(0.038)	(0.039)
$S_{0\varepsilon} = E[\varepsilon_{i0} \mid D_i = 1] = \beta_{20} * E[v_i \mid D_i = 1]$	-0.008	0.076***
	(0.025)	(0.023)
$S_1 = E[y_{i1} \mid D_i = 1] - E[y_{i1}]$	0.012	-0.340***
	(0.059)	(0.106)
$S_{1x} = \beta_{11} * (E[x_i \mid D_i = 1] - E[x_i \mid D_i = 0]) * (1-P)$	0.020	-0.193***
	(0.038)	(0.067)
$S_{1\varepsilon} = E[\varepsilon_{i1} \mid D_i = 1] = \beta_{21} * E[v_i \mid D_i = 1]$	-0.008	-0.147***
	(0.025)	(0.045)
$GMD = E[y_{i1} \mid D_i = 1] - E[y_{i0} \mid D_i = 0]$	-0.829***	-0.829***
	(0.030)	(0.030)
$ATET = E[y_{i1} \mid D_i = 1] - E[y_{i0} \mid D_i = 1]$	-0.844***	-1.101***
	(0.080)	(0.072)
$ATET_x = (\beta_{11} - \beta_{10}) * E[x_i \mid D_i = 1]$	-0.844***	-0.878***
	(0.080)	(0.074)
$ATET_\varepsilon = (\beta_{21} - \beta_{20}) * E[v_i \mid D_i = 1]$	0.000	-0.223***
	(0.000)	(0.053)
$SE = E[y_{i0} \mid D_i = 1] - E[y_{i0} \mid D_i = 0]$	0.015	0.272***
	(0.075)	(0.071)
$SE_x = \beta_{10} * (E[x_i \mid D_i = 1] - E[x_i \mid D_i = 0])$	0.025	0.176***
	(0.048)	(0.050)
$SE_\varepsilon = \beta_{20} * (E[v_i \mid D_i = 1] - E[v_i \mid D_i = 0])$	-0.01	0.096***
	(0.032)	(0.029)

Table A9: Robustness Checks: PB Ratio and Pre-IPO Observation Period

Dependent	PB ratio	Tobin's Q	Tobin's Q
	(1)	(2)	(3)
Variables	1st Year	6-month index	24-month index
ATE	-4.105***	-2.790***	-2.853***
	(0.674)	(0.309)	(0.300)
$E[y_{i0}]$	5.448	4.190	4.202
$ATE/E[y_{i0}]$	-75.35%	-66.59%	-67.90%
ATET	-4.105***	-2.790***	-2.853***
	(0.674)	(0.309)	(0.300)
$E[y_{i0} \mid D_i = 1]$	6.555	4.69	4.753
$ATET/E[y_{i0} \mid D_i = 1]$	-62.62%	-59.49%	-60.03%
X	YES	YES	YES
Industry	YES	YES	YES
Year	YES	YES	YES
Province GDP per capita	YES	YES	YES
Observations	2,729	2,729	2,727

Notes:

1. The outcome models are estimated with the treatment models simultaneously.

2. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level.

Table A10: Firm Heterogeneities and Valuation Discounts

Dependent	Tobin's Q					
Variables	(1) SOE	(2) Foreign ownership	(3) Operating risk	(4) Intangible assets	(5) All firm heterogeneities	(6) Heterogeneities + policy distortions
Overseas listing	-2.908***	-2.308***	-2.216***	-2.630***	-1.632***	-0.686
	(0.324)	(0.370)	(0.411)	(0.319)	(0.508)	(0.529)
SOE dummy	0.007				0.090	0.067
	(0.149)				(0.151)	(0.149)
Overseas listing*SOE dummy	**0.703*** **				**0.075**	**0.093**
	(0.235)				**(0.256)**	**(0.231)**
High foreign ownership percentage		0.300**			0.305**	0.276*
		(0.139)			(0.143)	(0.143)
Overseas listing*High foreign ownership		**-0.909*** **			**-0.892*** **	**-0.862*** **
		(0.249)			**(0.290)**	**(0.277)**
High operating risk			0.396***		0.379***	0.406***
			(0.082)		(0.083)	(0.084)
Overseas listing*High operating risk			**-0.717*** **		**-0.614*** **	**-0.843*** **
			(0.191)		**(0.197)**	**(0.195)**
High intangible assets				0.246**	0.215**	0.189*
				(0.099)	(0.099)	(0.098)
Overseas listing*High intangible assets				**-0.381***	**-0.245**	**-0.132**
				(0.218)	**(0.219)**	**(0.213)**
Capital control						1.003***
						(0.358)
Overseas listing*Capital control						**-0.708***
						(0.428)
IPO suspension						0.280
						(0.305)
Overseas listing*IPO suspension						**-1.408*** **
						(0.383)
PE restriction						-0.745
						(0.523)
Overseas listing*PE restriction						**-0.921*** **
						(0.259)
X	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
Province GDP per capita	YES	YES	YES	YES	YES	YES
Observations	2,729	2,729	2,698	2,729	2,698	2,698

Notes:

1. The results are estimated using simple endogeneous treatment effect model for firms in their first year of IPO.

2. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table A11: Triple Differences

Dependent	Tobin's Q		
Variables	(1) Foreign ownership	(2) Operating risk	(3) Intangible assets
Overseas listing	-2.313***	-1.910***	-2.346***
	(0.405)	(0.472)	(0.347)
Capital control	0.236		
	(0.350)		
High foreign ownership percentage	0.142		
	(0.134)		
Overseas listing*High foreign ownership	-0.881***		
	(0.288)		
Overseas listing*Capital control	-0.185		
	(0.467)		
High foreign ownership percentage*Capital control	1.922***		
	(0.688)		
Overseas listing*High foreign ownership*Capital control	**-1.443***		
	(0.791)		
IPO suspension		-0.340	-0.161
		(0.275)	(0.290)
High operating risk		0.175**	
		(0.084)	
Overseas listing*IPO suspension		-0.866***	-1.255***
		(0.331)	(0.369)
Overseas listing*High operating risk		-0.508**	
		(0.208)	
High operating risk*IPO suspension		1.435***	
		(0.277)	
Overseas listing*High operating risk*IPO suspension		**-1.604***	
		(0.518)	
High intangible assets			0.116
			(0.099)
High intangible assets*IPO suspension			0.914***
			(0.288)
Overseas listing*High intangible assets			-0.265
			(0.244)
Overseas listing*High intangible assets*IPO suspension			**-1.025***
			(0.543)
X	YES	YES	YES
Industry	YES	YES	YES
Year	YES	YES	YES
Province GDP per capita	YES	YES	YES
Observations	2,729	2,698	2,729

Notes:

1. The results are estimated using simple endogeneous treatment effect model for firms in their first year of IPO.

2. Standard errors are reported in parenthesis. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table A12: SMM Estimation - ln of Tobin's Q

parameter	estimate	s.e.	targeted moments	data	simulated
μ_0	1.414	0.035	$E[y_{i0}]$	**1.30**	1.41
μ_1	0.623	0.020	$E[y_{i1}]$	**0.75**	0.62
μ_c	0.353	0.047	$P[D_i = 1]$	**0.21**	0.26
σ_0	0.272	0.008	$E[\varepsilon_{i0} \mid D_i = 0]$	**-0.02**	-0.02
σ_1	0.426	0.013	$E[\varepsilon_{i1} \mid D_i = 1]$	**-0.15**	-0.18
σ_c	1.022	0.035	$sd[\varepsilon_{i0} \mid D_i = 0]$	**0.30**	0.27
ρ_{01}	0.276	0.431	$sd[\varepsilon_{i1} \mid D_i = 1]$	**0.55**	0.41
ρ_{0c}	0.560	0.066	$corr[v_i, \varepsilon_{i0} \mid D_i = 0]$	**0.14**	0.13
ρ_{1c}	-0.745	0.040	$corr[v_i, \varepsilon_{i1} \mid D_i = 1]$	**-0.28**	-0.17
			untargeted moments	**data**	**simulated**
			$E[Y_{i0} \mid D_i = 0]$	***1.24***	*1.39*
			$E[Y_{i1} \mid D_i = 1]$	***0.41***	*0.45*

Table A13: Robustness Check for Structural Estimation

	benchmark	$E[y_{i0}]$	$E[y_{i1}]$	$P[D_i = 1]$	$E[\varepsilon_{i0} \mid D_i = 0]$	$E[\varepsilon_{i1} \mid D_i = 1]$	$sd[\varepsilon_{i0} \mid D_i = 0]$	$sd[\varepsilon_{i1} \mid D_i = 1]$	$corr[v_i, \varepsilon_{i0} \mid D_i = 0]$	$corr[v_i, \varepsilon_{i1} \mid D_i = 1]$
μ_0	1.50	1.60	1.50	1.49	1.50	1.50	1.50	1.50	1.50	1.50
μ_1	0.66	0.70	0.76	0.67	0.66	0.62	0.65	0.64	0.62	0.59
μ_c	0.32	0.37	0.32	0.34	0.32	0.36	0.33	0.37	0.36	0.36
σ_0	0.33	0.31	0.31	0.36	0.32	0.32	0.35	0.33	0.31	0.35
σ_1	0.54	0.51	0.47	0.53	0.54	0.51	0.53	0.50	0.51	0.55
σ_c	1.17	1.16	1.02	1.20	1.21	1.22	1.22	1.17	1.21	1.27
ρ_{01}	0.23	0.26	0.17	0.25	0.32	0.32	0.24	0.20	0.30	0.24
ρ_{0c}	0.58	0.57	0.60	0.59	0.58	0.56	0.58	0.57	0.56	0.57
ρ_{1c}	-0.77	-0.75	-0.78	-0.78	-0.77	-0.76	-0.77	-0.75	-0.76	-0.75

Note:
The values in the table are the optimal structural etimates if there is a 5% increase in each of the moment listing in the corresponding column.

Table A14: Decomposition of Welfare Loss

$\mu_c = 0$	$U_0 = 1.784$	$U_s = 0.610$	$U_1 = 0.300$
identity	always $D_i = 0$	$D_i = 0$ if $\mu_c = 0$ switchers $D_i = 1$ if $\mu_c = 0.32$	always $D_i = 1$
$\mu_c = 0.32$	$U_0 = 1.462$	$U_s = 0.436$	$U_1 = 0.300$
proportion	76.8%	11.6%	11.5%