How Public Markets Foster Firm Standardization: Evidence from Chinese IPOs*

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Abstract

To go public, private firms must (a) commit going-concern value to arm's length financiers, (b) minimize concerns about agency conflicts, and (c) reduce perceived information asymmetry. We use IPO suspensions in China to explore how public market access affects this standardization process. Among firms already approved to IPO, the surprise suspensions of indeterminate length caused plausibly exogenous and uncertain listing delay. We find that suspension-induced delay negatively affects proxies for all three standardization activities, with especially large effects on patent applications. Responsiveness varies with venture capital backing. Neither window dressing nor a capital supply shock can independently explain the results.

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1 Introduction

Firms go public primarily to finance new projects and to create liquidity for insiders (Zingales 1995, Pagano 1993, Ritter & Welch 2002).[1] However, going public is costly. First, separating ownership from control gives rise to agency problems (Jensen & Meckling 1976). Second, information asymmetry leaves value "on the table" (Ljungqvist 2007). Third, underwriting and disclosure costs comprise a significant fraction of the funds raised (Ellis, Michaely & O'hara 2000). To minimize these costs, firms preparing to IPO take measures to credibly commit going concern value to potential arm's length financiers, professionalize management (reducing entrenchment), and increase disclosure and transparency. Beyond preparing the firm for public listing, these activities are central to standardizing into the modern corporate form, which sets the stage for long-term business viability (Rajan 2012).

The literature has examined the relationship between going public and the private benefits of control (Doidge, Karolyi, Lins, Miller & Stulz 2009), innovation (Bernstein 2015, Acharya & Xu 2016), investment (Pagano et al. 1998, Asker, Farre-Mensa & Ljungqvist 2014, Gilje & Taillard 2016), profitability (Pástor, Taylor & Veronesi 2009), and product market performance (Chemmanur, He & Nandy 2009), among other topics. However, it is challenging to study how access to public markets affects the more subtle process of standardization. This is because market timing is central to the IPO process in the U.S. (Baker & Wurgler 2002), and because growth through capital infusion can eclipse other aspects of going public.

We offer an initial attempt to address standardization empirically, exploiting several facets of the IPO system in China. First, firms in China have little ability to time the IPO market, because IPO approval takes multiple years in normal, non-suspension times. Second, firms preparing to IPO on the main listing boards in China are not in dire need of capital. They are larger and more mature than firms going public in the U.S., in part due to listing

[1] Other motivations for going public may include better monitoring (Holmström & Tirole 1993) and increased bargaining power with banks (Rajan 1992). Also, growth and liquidity creation are not mutually exclusive. For example, firms can grow through acquiring other businesses using publicly traded shares (Brau & Fawcett (2006)).

requirements such as consistent profitability.

Third, four IPO suspensions between 2004 and 2015 caused plausibly exogenous listing delay among firms approved to IPO. While related to the state of the market - reported rationales have included both perceived market overheating and perceived bear market threat - the suspensions were surprises. Affected firms faced a longer time between approval and listing as well as greater uncertainty about when they would list. In practice, the suspensions lasted between six and thirty months.

These three features enable us to examine how public markets affect standardization. Our primary estimation sample consists of firms approved to IPO on the Shanghai or Shenzhen main boards in the twelve months before a suspension announcement. Those approved early in the year were ahead in a queue and listed with little delay, while the remainder was forced to wait until the suspension ended. We have strong evidence that suspension-induced delay between approval and listing is reasonably exogenous to firm-specific factors. Thus the suspensions provide quasi-experimental variation in access to public capital.

We show that high and low-delay firms are similar before approval. We then estimate the effect of delay in regressions that control for the listing date, industry, and firm controls such as age and market capitalization. All our main results are robust to instrumenting for delay with the approval date. We also demonstrate similar results in the sample of firms that listed in the year following the end of a suspension.

The first aspect of standardization is commitment of firms' going-concern value to future investors. Patent applications provide a useful measure of this commitment, because applying for a patent is an act of disclosure and indicates effort to make tacit assets verifiable and contractable. Patent data are often used to measure innovation, as in Bernstein (2015), but they also reflect managerial effort to separate firm value from specific human capital (Kaplan & Strömberg 2003, Rajan 2012). We find a strong negative effect of total delay on patent applications; the drop-off begins shortly after approval and endures for years after listing. A month of delay reduces invention patent applications by 0.7, or about 15% of the

mean.[2] Within the sample of firm-months during which the firm is delayed, an extra month of delay reduces patents in that month by about 6% of the mean.

The second aspect of standardization is reducing managerial entrenchment and agency frictions. We explore how delay interacts with proxies for these concepts. First, we expect that CEOs at IPO who are also firm founders will be more entrenched, and this will lead to a stronger negative effect of delay. Our primary measure of performance is earnings. We find a small albeit statistically significant negative effect of delay on earnings, but it becomes economically large when the CEO at the time of IPO is also a firm founder, consistent with greater entrenchment in this case. Delay makes a firm less likely to have hired a CFO by the year after IPO, a measure of professionalization. Delay also increases the time to CEO stock option plan introduction, a measure of incentive alignment. Finally, delayed firms tend to increase their CEO's salary between the IPO year and the following year, which may reflect agency problems.

We expect that the market will be less uncertain about firms that have made more effort to reduce information asymmetry. We find that delay increases stock price volatility after listing. This is also a channel through which delay may affect founder and investor payoffs. Motivated by evidence that less transparent issuers have larger underwriting syndicates, we hypothesize that delay will lead to more co-managers. The lead underwriter sacrifices a share of fees in exchange for the information provision and certification role of the additional co-managers. We find a positive effect; a one standard deviation increase in delay (nine months) is associated with a 22.5% increase in the number of co-managers. Delay is also associated with more IPO underpricing, and a lower price to book ratio.[3]

Delay has a larger negative effect on patent applications among VC-backed companies (controlling for industry). We find no relation with VC backing for other metrics, but we find that the source of VC matters. Relative to state-backed or private Chinese VCs, foreign

[2]We show similar effects within granted and rejected patent applications, and across state-owned and private firms.

[3]As discussed in Ljungqvist (2007), this is consistent with information frictions giving rise to underpricing. Given China's extreme underpricing, which appears to have regulatory and behavioral explanations, we do not use underpricing in a formal test.

VCs appear to mitigate the effects of delay on patenting, CEO salary, and underwriting syndicate size. Foreign VCs may have more experience with corporate governance. These effects, however, could reflect selection; for example, foreign VCs may choose startups that are less subject to entrenchment incentives. Regardless, the results are consistent with Hellmann & Puri (2002), Baker & Gompers (2003), and Hochberg (2012), who find that VC funding in the U.S. is associated with firm professionalization.

We use a simple, stylized model to illustrate how the interactions between an entrepreneur's effort to create value, his willingness to standardize his firm, the share of the firm owned by VCs, and the prospects of public listing may generate the stylized facts that we observe. The model is motivated by Rajan (2012), but endogenizes VC investment, incorporates the investor's role in standardization, and allows time-varying public market access and window dressing behaviors. In exchange for a cash windfall at IPO, the entrepreneur must standardize his firm, increasing transparency and ceding control to others. Disclosure and professionalization make the value of the firm more contractible and the entrepreneur's human capital more replaceable. VCs assist this process (Lerner 1995, Hellmann & Puri 2002).

The model has four predictions. First, we expect standardization and window dressing activity (manipulation to improve the firm's appearance) to increase with timely access to public markets. Second, standardization in VC-backed firms is likely to be more sensitive to public market access than non-VC-backed firms. Third, aggregate VC investment should decrease when liquidity opportunities in public markets become more uncertain. Finally, we expect innovation effort to decline after public listing, as in Bernstein (2015). The first two predictions fit well with the empirical results described above.

The third prediction follows from our assumption that the suspensions created uncertainty about future IPO markets. We have anecdotal and industry press evidence that this was the case. We also hypothesize that if instead the suspensions were expected to be short-lived, they should not have affected contemporaneous VC investment. VC portfolios

are highly illiquid; while VCs rely on IPOs for investment exits, they hold positions for many years. Controlling for domestic market conditions and rest-of-world VC, we find that the suspensions were associated with depressed VC investment in Chinese portfolio companies. This persists among elite U.S.-headquartered VC firms active in China. While not causal, this analysis suggests that the suspensions had a chilling effect on VC.

One concern is that our results merely reflect window dressing behaviors around IPO. For example, firms may temporarily manipulate earnings and patenting activities to boost perceived quality. Our model predicts that better access to public markets increases window dressing as well as standardization. We measure window dressing with discretionary accruals, following Brau & Fawcett (2006), and find that consistent with the model, delay is associated with lower accruals (less window dressing) in the first year after IPO. Beyond this evidence that window dressing declines with delay, our findings on long-lasting changes in agency frictions and information asymmetry, such as the hiring of CFO and the introduction of stock option plans, are difficult to interpret through a window dressing lens.

A second alternative to standardization is that less capital among delayed firms affects R&D effort and other outcomes. In this case, delay should increase leverage and decrease investment. However, delay leaves no trace of financial constraints; it has no effect on overall investment, leverage, employment, or payroll. Also, we expect that firms with pressing capital needs would have gone public in Hong Kong or elsewhere. IPO application costs, while substantial, are sunk once the firm is approved. In fact, none of the 425 firms in our primary estimation sample went public abroad rather than wait for the suspension to end. A lack of capital infusion, therefore, does not explain our findings.

A third possibility is that our results reflect the effect of delay on corporate governance. Standardization encompasses improving governance, but it is a broader process. For example, governance cannot explain the patent results. Moreover, we do not find effects on governance measures unrelated to the three central activities of standardization, such as the size and composition of the board.

In sum, our results point to public market access fostering standardization in China, where the financial markets are increasingly central to the global economy. Private firm innovation is crucial to China's effort to transition from export- and infrastructure-intensive growth to consumption-, service-, and IT-led growth. The extent to which innovative Chinese firms depend on predictable, well-regulated domestic IPO markets is thus of special urgency. Our findings shed light on how government disruption of the IPO process can have deleterious consequences for firm development.

We join a nascent empirical literature on China (e.g. Derrien et al. 2016, Michaely & Qian 2017, Sun 2017). In a related study, Chemmanur, Hu & Wu (2016) confirm that VC investment helps to standardize Chinese family firms. A different strand of work emphasizes that while China's economic institutions are unique, its stock markets serve a similar purpose as those in the U.S., enabling firms to raise capital from diffuse investors while providing liquidity to early investors and entrepreneurs. Since the early 2000s, Chinese private equity, patenting activity, and stock price informativeness have all borne increasing similarity to the U.S. and Europe (Guo & Jiang 2013, Fang, Lerner & Wu 2016, Zhou et al. 2016, and Carpenter, Lu & Whitelaw 2016).

This paper also relates to the literature on public markets and corporate innovation (Aghion, Van Reenen & Zingales 2013, Brown, Martinsson & Petersen 2013). In particular, Bernstein (2015) finds that when firms go public, patent citations decrease. We similarly find that applications for ultimately granted patents decrease after IPO, but that this decrease is much more severe among delayed firms. While our conclusions complement Bernstein's, our focus is on firm standardization.

2 Institutional Background

In this section, we summarize China's public equity markets and describe the IPO process. Then we explain the IPO suspensions that we use to identify the effect of listing delay.

2.1 Financing Enterprises in China

China's state-dominated banking sector, traditionally the main source of capital for Chinese firms, is slowly giving way to public and private equity finance (Allen et al. 2015). Even as IPOs recede in importance in the U.S., they are growing in importance in China. In 2016, there were 103 IPOs on the Shanghai Stock Exchange main board, and 46 on the Shenzhen board, compared to a total of just 128 in the U.S.[4]

Privately owned firms have been instrumental to China's growth. Recognizing their importance, particularly in sectors perceived to be central to continued economic growth, the government now aggressively promotes private entrepreneurship and innovation. These private firms need public markets for the same reasons that entrepreneurial firms do elsewhere, but also because China's debt markets, which are dominated by state-owned banks that favor SOEs, have disadvantaged them. This paper focuses on how public markets enable these private firms to access the resources they need to grow.

Banks traditionally played a dominant role in funding private and public enterprises in China. While new bank loans per year have more than tripled over the past decade, the credit has often been disproportionally allocated to state-owned enterprises (Cong & Ponticelli 2016). As an important step in modernizing its financial system, the Chinese government in 1990 established two domestic stock exchanges: the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE). These public markets grew quickly, and today there are about 3,000 firms listed and traded on the two exchanges. The Chinese A share market is the second largest in the world, with a total market capitalization of more than 7 trillion USD at the end of 2015. Similarly, the venture capital and private equity in China has grown to be the second largest in the world, but remains relatively understudied.[5]

[4] On China, see http://www.pwccn.com/en/press-room/archive/a-share-ipo-may-speed-up-in-2017-while-new-shares-will-increase-40-50.html. Only 128 companies IPOed in U.S. markets in 2016 (see http://fortune.com/2017/01/20/public-companies-ipo-financial-markets/).

[5] According to EY Global Venture Capital Trends 2015, VC in China totaled $49.2 billion across 1,611 deals in 2015, compared to $72.3 billion across and 3,916 deals in the U.S. According to China Venture Capital and Private Equity Association, by the end of 2013, there are 1225 VC and PE funds with a total AUM of 47.5 billion USD that are invested in 13,615 firms.

Firms incorporated in mainland China can apply to list on these exchanges. Alternatively, they can list in Hong Kong or abroad. Domestic listings are either on a "main board" or on newer, smaller boards targeting younger firms (e.g. ChiNext), which have less stringent listing criteria. We do not use these smaller boards both because of a lack of acceptable data, and because they tend to be in more pressing need of capital. While standardization may of course be different among more mature companies, an advantage of studying them is that we can focus on standardization rather than capital infusion.

In the 1990s, China's public markets primarily served SOEs, and much research focuses on SOE performance and political economy (e.g. Fan et al. 2007, see Carpenter et al. 2016 for a review). Chen et al. (2015) show that privately owned firms are more efficient than state owned firms. Whited & Zhao (2016) find evidence that China's economy suffers from considerable misallocation of debt and equity across firms.

2.2 The IPO Process in China

A company seeking to conduct its IPO in China's domestic markets must navigate an elaborate approval process administered by the China Securities Regulatory Commission (CSRC). China approves IPOs via an administrative governance system, as opposed to a registration system as in the U.S. This is intended to protect retail investors. The central steps are as follows. First, the firm hires financial professionals such as investment bankers and accountants for "tutorship", restructuring the firm into a qualified stock share limited company and preparing the financial and compliance documents. This "restructuring period" often takes about three months but the preparation lasts $1-3$ years.[6]

Second, the firm and underwriter submit an application package to the CSRC. Unlike their Western counterparts, underwriters in China are legally responsible for the materials submitted (Chen et al. 2014). The Stock Issuance Examination and Verification Committee (the "committee") of the CSRC then determines whether the applicant meets the regulator's

[6]See Cao et al. (2016) and
www.legalink.chRootSiteslegalinkResourcesQuestionnairesIPOsAsiaLegalink%20IPO_China.pdf

listing criteria and is eligible to undertake an IPO. The CSRC's listing criteria seek to ensure that only healthy firms gain access to China's public equity markets. Applicant companies must meet stringent historical financial performance criteria to be eligible for an IPO.[7]

Firms applying for IPO form a queue based on the order of application. According to the WIND commercial database, in late 2016 there were 726 firms in the queue. The CSRC has published this list weekly starting in February 2012, so it is now public how many candidates are waiting for IPO approval, as well as how many have been approved recently.[8] The exact length of the queue, however, is typically not a consideration for firms that want to list domestically, according to key partners at Harvest Fund and Springs Capital, two of the largest private and public funds in China, respectively. As Chinese public investors are believed to value firms more highly than other markets would, firms are known to apply as soon as they can meet the requirements.

Third, the committee reviews the application documents and decides whether to approve the IPO.[9] Committees usually have tenures of one year, and today consist of 25 members. In 2004, the committee composition changed from being dominated by government officials to private sector professionals (e.g. auditors, lawyers, bankers, and mutual fund managers).[10] The criteria the CSRC uses to select candidates are not publicly known. Panels consisting of seven members are formed to oversee each IPO application, and five or more affirmative votes are required for the application to be passed. This stage on average takes three to six months, but is highly variable. The committee typically rejects about 20 percent

[7]Regulating IPOs is one of the major ways that the Chinese government has historically sought to protect investors. All applicants must meet the following requirements: (1) Positive net profits for the last three fiscal years prior to the application, and the cumulative net profit in the three years must exceed RMB 30 million; (2) Cumulative revenue in the three years prior to the IPO must equal at least RMB 300 million or cumulative cash flow from operation in three years prior to the IPO must be at least RMB 50 million; (3) Intangible assets cannot account for more than 20% of total assets; (4) Net assets in the year before the IPO must total at least RMB 30 million; (5) the company did not suffer any unrecovered losses at the end of its most recent fiscal period. In addition to these financial performance requirements, firms are subject to other nonfinancial requirements, such as the existence of a functioning corporate governance system and no record of illegal behavior or financial scandals.

[8]CSRC Discloses the queue for application: http://www.csrc.gov.cn/pub/newsite/xxpl/yxpl/.

[9]See http:www.cnbc.comid100525376 government quotas for IPOs were historically imposed at either the provincial or municipal level, and they were more prevalent during the early stages of market development.

[10]From 2004 to 2006, five members, or 20 percent of the total, were audit firms' partners, with the number rising to nine, or 36 percent, in 2007. Auditors are recommended for Committee membership by the China Institute of Certified Public Accountants (the CICPA) and candidates are selected by the CSRC.

of IPO applications (Yang 2013).

If the committee approves the IPO application, the company may apply to list at one of the domestic exchanges. The chosen stock exchange reviews the application to ascertain compliance with exchange rules. Exchange approval, by all accounts, is a rubber stamp. Exchange rules mirror CSRC requirements, and the CSRC has the ultimate authority to approve or deny an IPO and exchange listing.

The approval rate is determined by CSRC based on market conditions (Guo & Zhang 2012).[11] Interviews with regulators and other stakeholders indicate that the CSRC is concerned that too many IPOs will reduce liquidity and pull down the market. This concern arises because the state limits offer prices to a multiple of earnings that is typically far below the multiple that will prevail once the stock trades in the open market (Tian 2011). Currently, this multiple is 23 times earnings per share. Regulators worry that capital would flow out of listed companies and into newly listed companies, creating instability and reduced liquidity for incumbent stocks. The number of IPOs, therefore, are positively correlated with past market returns. During the bull markets in 2006-2007, 2014-2015, CSRC sped up the process. During bear markets, they have more slowly rationed IPOs.

Fourth, once an application is approved, the firm can do its road show and list. This stage generally takes between two and six months, but the CSRC has been known to pressure firms to delay listing at this stage in order to stabilize the market. Very rarely do firms and CSRC delay listing due to disagreements on share prices, according to a former deputy director at CSRC Shanghai. In general, firms have little ability to time the market in their IPO (Guo & Zhang 2012).

[11] For example, the regulators are looking to cut down the line, by tightening the screening standards. In June, 2016, the CSRC launched a campaign to crack down on fraudulent applicants. In July, it banned firms that have violated environmental protection laws within the past three years from issuing new shares.

2.3 IPO Suspensions

As an extreme form of regulating the IPO market, the CSRC occasionally suspends IPO activities. During these suspensions, all steps beyond application submission stop. Between 1994 and 2015, there have been nine major IPO suspensions. Our data allows us to analyze five of them from 2004-2015. Appendix Table A1 contains details about the nine suspensions.

The start and end of these suspensions are typically unannounced, and there is no evidence of queue jumping (potentially because of political ties) to shift a firm's listing ahead of the suspension start. Regulators as well as market participants have found the CSRC IPO suspension decisions to be unpredictable.[12] For example, after October 19, 2012, the CSRC ceased holding weekly review meetings, with no initial public explanation. The financial press initially expected the suspension to be short, but instead it lasted more than a year. Apparently, the historically low stock market in mid-2013 made the CSRC cautious in resuming the IPO market. More generally, the suspensions are predicated on the CSRC's concern for "market stability," not on individual firms' characteristics.[13]

The delay and increased uncertainty during IPO suspensions are costly for firms planning to list publicly. This is because of the time value of money, lost market and strategic opportunities (e.g. to make acquisitions or large investments using public funds).[14] For a discussion of the cost of uncertainty in external financing from the public market, see Almeida et al. (2011) and Wang & Zhu (2013). The existing literature on financing constraints largely focuses on investment; we extend this literature by describing a relationship between a specific type of financing uncertainty and firm standardization, with a focus on

[12]Based on interviews with Liliang Zhu, deputy director of CSRC's department of Public Offering Supervision, Feng Yu, deputy director of CSRC Zhejiang, and George Jiang, a partner at Springs Capital. The latter noted that while many funds tend to speculate on the timing and duration of IPO suspension, few get it right. See also this article from China Economics Times: http://finance.sina.com.cn/stock/stocktalk/20131011/084016956195.shtml.

[13]For example, the official announcements for the first two suspensions cite "consecutive abnormal falls of the SSE Composite Index" and "327 debt event that disrupted normal trading" as the reasons. The latest suspension in 2015 was due to "abnormal volatile movements in the stock market". See http://finance.sina.com.cn/stock/y/20150704/195622592273.shtml. These are also confirmed in our interviews conducted with senior CSRC officials (the interviewees request to remain anonymous), as well as the CSRC officially designated media outlet, Security Daily. For example, see Hou and Zhu, "A Review of China IPO Suspensions", Security Daily, June 19 2013, Published: A3, retrieved from http://zqrb.ccstock.cn/html/2013-06/19/content_362206.htm.

[14]See also http://www.ddjtsg.com/detail/?id=837 and
http://dailynews.sina.com/gb/chn/chnoverseamedia/cna/20140610/01345796883.html

inter-temporal tradeoffs.[15]

These institutional features make China an ideal setting for our empirical approach to standardization, because (1) the IPO process is sufficiently long that the firms typically do not foresee suspensions or future market conditions at the time of application; (2) once a firm has filed the application, the approval and listing are primarily determined by the aggregate market conditions and CSRC's actions; (3) there is sufficient dispersion in the time from approval to listing that it is possible for a suspension to affect some approved firms but not other approved firms; and (4) firms listing on the main board are less prone to financial constraints, which allows us to focus on public markets' role in firm transformation beyond capital provision for investment.

3 Empirical Strategy

In this section, we explain how we use the IPO suspensions described above to identify a causal effect of uncertain listing delay on firm outcomes.

3.1 Approach

The suspensions imposed an uncertain period of delay on firms that were approved to IPO just before the suspensions were announced. This provides a real-world, albeit imperfect, analog to an experiment that temporarily removes the option to go public from a random subset of relatively mature private firms. Other approaches in the literature that take different perspectives on approximating this experiment are Bernstein (2015), who uses market movements that lead firms to retract their IPO applications, and Acharya & Xu (2016), who match public firms to similar private firms.

The key advantage of our empirical design is that all firms in the sample seek to and ultimately do go public.[16] We compare firms approved prior to the suspension start,

[15] For a review, see for example Stein (2003).

[16] Only eighteen firms were approved and dropped out, primarily because regulators found evidence of fraud. No

some of which experienced additional delay due to the IPO suspension. Specifically, we examine the effect of a government-imposed delay in listing on outcomes among companies that were approved to IPO in the 365 days prior to the IPO suspension announcement. We also consider firms that listed in the 365 days after the end of a suspension.

Figures 2-5 describe our approach graphically. Each dot is an IPO, and the delay between approval and listing is on the y-axis. Figure 2 (3) has the approval (listing) date on the x-axis. Both show all Chinese IPOs. Figures 4 and 5 are the same, but restrict the sample to that used in our analysis. Firms approved in the first part of the twelve months before a suspension announcement list within a few months, while those approved in the latter part are delayed; the 75th percentile of delay is 13 months.

We do not require the suspensions to be exogenous to markets. What is crucial is that delays are exogenous among firms approved in a window prior to a suspension.[17] Interviews with market participants and our research leads us to believe this is the case. However, as with any quasi-experimental strategy, and particularly given the relative paucity of information in China, it is impossible to completely rule out endogeneity in delay. To lessen concern that firms may jump the line, we instrument for the months of delay using the month of IPO approval. We conduct t-tests for whether high delay firms appear different ex-ante than low delay firms (summarized in Section 4).

3.2 Specification

Our primary specification estimates variants of Equation 1

$$P_{jt} = \alpha + \beta_1 MonthsDelay_j + \delta' \mathbf{V}_{jt} + \gamma' \mathbf{Y}_t + \varepsilon_{jt} \quad (1)$$

firm approved to IPO in China has failed to do so and listed abroad instead.

[17] Based on interviews conducted with senior CSRC officials and CSRC documents, such as 中国证监会发行监管部首次公开发行股票审核工作流程 at http://www.csrc.gov.cn/pub/zjhpublic/G00306202/cyb/201202/P020120810637128285398.doc and http://www.csrc.gov.cn/pub/newsite/fxjgb/gzdt/ , the orders of approval and of subsequent listing are largely determined by a firm's position in the queue, and the approved firms could not have anticipated the start and the end of these suspensions at the time of application because of the significant waiting time between application and approval and the fact that these firms only experience the suspensions after approval.

P_j is an outcome variable of interest; for example, patents filed after IPO. We primarily compare firms after they have listed, so as to avoid confounding delay with the treatment effect of listing. In addition to months of delay (a continuous variable), we use indicators for a medium delay between the 25th percentile (2.5 months) and 75th percentile (12.8 months), and high delay (above the 75th percentile). We also include a vector of listing year fixed effects, $\mathbf{Y}_t$. Our primary specifications cluster errors by industry and listing quarter.

The vector of controls $\mathbf{V}_j$ include: firm age, as firms that experienced delay will be older than their non-delayed peers, once they have both listed; investment in property, plants, and equipment in the approval year, which encompasses R&D investment; 2-digit SIC code industry fixed effects; a fixed effect for the exchange (Shanghai or Shenzhen); firm total market capitalization; leverage in the 2nd year prior to IPO; total proceeds from the IPO; and indicators for whether the firm is state-owned and whether it previously received private equity financing. We consider only firms that were approved and ultimately listed.

Two important characteristics of firms are whether they are state owned and whether they received VC funding. Following Hsieh & Song (2015), we define a firm as an SOE if either the share of registered capital owned by the state is equal or larger than 50 percent or if the state is reported as the controlling shareholder. We examine the interaction between private financing and outcomes by making use of hand-collected private equity investment data from the IPO prospectuses. Specifically, we interact the delay variable with measures of VC investment, ownership, and presence on the company board.

In an alternative specification for patenting, we use monthly panel data, and include listing quarter fixed effects. This approach, described in Equation 2, includes all firm-months after approval, and includes an indicator for having already listed.

$$P_{jm} = \alpha + \beta_1 MonthsDelaySoFar_{jm} + \beta_2 AlreadyListed_{jm} + \delta' \mathbf{V}_{jt} + \gamma' \mathbf{Y}_t + \varepsilon_{jt} \qquad (2)$$

Here, we cluster standard errors by firm. Instead of using the total months of delay, our

independent variable of interest is the months thus far of delay; that is, we look at patent applications in, say, the third month after approval, either within the sample of firms not yet listed or controlling for whether the firm has listed.

4 Data

This section first describes our data sources. It then discusses the variables we use, in the context of their relation to the three categories of common activities associated with public listing: (a) committing going-concern value to arm-length financiers; (b) mitigating the agency issues that accompany separation of ownership and control; and (c) reducing informational asymmetry between a firm and outside investors.

4.1 Sources of Data

We collect data from eight sources to construct variables used in this paper:

1. China Securities and Regulatory Commission (CSRC): We begin with the list of firms that applied to IPO on the A-share Shenzhen and Shanghai Main Boards. CSRC provides IPO application and approval data between 2004 and 2015 for 1,567 IPOs. We do not use data from the smaller boards (ChiNext and SME) for three reasons. First, they are relatively new. Second, there is less financial data available from the commercial databases for firms listed on these boards. Third, firms going public on these boards tend to be in more pressing need of capital, and thus the effect of capital infusion may swamp observable effects of standardization.

2. Hand-collected private equity investment data: We hand-collected data from IPO prospectuses for all IPOs between 2006 and 2013.[18] This data was checked for ac-

[18]The investment information comes from the prospectus section entitled "发行人基本情况" ("Basic introduction of issuer"). Within this section, the sub-section entitled "发起人、主要股东及实际控制人基本情况" ("Basic introduction of major stockholders and ultimate controllers") permits ascertaining whether a major stockholder is a venture capitalist or not. A second subsection entitled "发行人的股本形成及变化" ("Equity Capital Formation and Change") provides information on investment periods, amounts, and share holdings for the major stockholders.

curacy with the commercial ChinaVenture Source and SDC VentureXpert databases. Investor board membership was hand-collected from the resumes of board members included in the IPO prospectus.

3. China Securities Market and Accounting Research (CSMAR)/WIND: These commercial databases (the Bloomberg equivalents) provide IPO prospectus data (sometimes called "predisclosure" data), listing, and financial statement data from these sources.

4. Compustat: We supplement the Chinese sources with Compustat data for Chinese companies.

5. SDC New Issues: This database provides listing information for Chinese companies, supplementing WIND.

6. State Intellectual Property Office (SIPO): We have annual and monthly invention, design, and utility patent application and grant data. The latter two types of patent applications are rarely rejected.

7. Private Capital Research Institute (PCRI): Our aggregate VC analysis relies on PCRI data, which we have as a weekly time series for China and the rest of the world, by investment stage and GP location. It includes both investment values in US dollars and number of deals. The underlying PCRI data includes all investments from 30 large PE/VC firms, VentureXpert, EMPEA, unquote, Venture Intelligence (India), and Startup nation (Israel).

8. Pedata.cn: We also obtained data from a leading Chinese purveyor of private equity investment data; this contains monthly time series by investment stage, including investment values in nominal RMB and number of deals.

Table 1 Panel 1-6 describe data used in the delay analysis. Our primary estimation sample consists of firms approved to IPO in the year prior to an IPO suspension. Among these 425

firms, only 18 did not ultimately list in China. In 14 of these cases, the firm did not list because fraudulent activities were discovered. No firm chose to go public abroad.

Panels 8-10 describe data used in the aggregate VC investment analysis. Aggregate weekly and monthly time series of VC investment by stage in mainland Chinese portfolio companies, provided by PCRI, are in Panel 8. The PCRI data is in nominal USD. To ensure that exchange rates and inflation do not confound the analysis, we also present results and graphs using real 2010 RMB.[19] We categorize the PCRI investment types as early (seed, early stage, VC) or late stage (growth equity). Table 1 Panel 10 shows the list of firms we describe as "elite" U.S. VCs active in China. These 14 firms are all the firms in Preqin's top 30 by IRR or multiple that had at least two investments in China during our sample period.

We conduct t-tests for whether high delay firms appear different ex-ante than low delay firms. The results are in Table 2. We examine pre-IPO approval year patenting activity, firm characteristics, and financial variables in the 2nd year prior to IPO. We report two-tailed as well as the more stringent upper and lower one-tailed tests.

For invention patent applications, none of the tests find a significant difference. For utility and design patent applications, the lower tail test finds a significant difference at the 10% level. There is no significant difference for market cap or IPO proceeds, but the difference for age is significant for the lower tail test at the 5% level. However, the difference is quite small in magnitude, at less than a year (relative to the sample mean of 11.3 years). Among the financial variables, the only significant difference is in leverage and in underpricing. Perhaps surprisingly, the low delay firms have somewhat more leverage than high delay firms. The difference in underpricing is consistent with the market being more uncertain about delayed firms; this is further discussed in Section 4.

[19]Inflation data is from the IMF Cross-Country Macroeconomic statistics, and conversion data is from www.tradingeconomics.com.

4.2 Committing going-concern value

One way a firm can increase its public equity valuation is to reduce the firm's reliance on specific human capital (Hellmann & Puri 2002, Rajan 2012). One salient measure of such commitment of going-concern value to future investors is patent applications – the embedding of intellectual property of the firm in formal patents over time (Kortum and Lerner 2001). Patents are usually associated with innovation, and patent citations are commonly used as a measure of innovation quality. However, patenting is also a way to codify and disclose a firm's intellectual property; it represents an effort to standardize the firm in the sense of making it contractible (Rajan 2012). Firms apply for patents as part of the process of readying themselves for listing.

Patent applications in China have increased dramatically since China established formal patent law was established in 1985, and there are now more invention patents filed in China than in the U.S. China has three classes of patents: invention, utility model, and design. Invention patents are the analogue to utility patents in the U.S.; they cover new technical solutions relating to a product, a process, or improvement. Utility model patents represent new technical solutions relating to the shape, the structure, or their combination, of a product; and design patents cover new designs in relation to shapes, patterns, colors, or their combination, of a product. Invention patent protection lasts twenty years from the application, while protection for the other two types of patents lasts ten years (see Xie & Zhang 2015 for more detail).

Recent evidence suggests that while average quality may differ across countries, patents generally serve the same purpose in China as they do elsewhere; to protect and establish a firm's control rights over a particular technology. Fang, Lerner & Wu (2016) find patenting behavior in China that is generally in line with U.S. studies. Within-firm increases in patent stocks are associated with higher productivity, exports, and new product revenue. Interestingly, Fang, He & Li (2016) find that SOE patents are more associated with TFP growth than private firm patents. Wei et al. (2016) find that patent approval ratio is not

usually high in China, and a variety of comparisons suggest that Chinese patent quality also exhibits a real and robust improvement over time that is quite favorable relative to international experience.

We use five patent measures: total, granted, and rejected invention patent applications, and design and utility patent applications. Granted invention patent applications are closest to an "innovation" measure. The others are better proxies for standardization effort (increasing contractibility and disclosure). Finally, design and utility patent applications (which are rarely rejected) are an additional proxy for standardization.

4.3 Mitigating agency issues

To mitigate potential agency conflicts after going public, a firm can reduce founder or CEO entrenchment. It can also separate and professionalize managerial roles. Postponing standardization could be a way for CEO to entrench himself and prolong tenure. Such actions may manifest in CEO compensation and replacement, as well as managerial hiring (Hellmann & Puri 2002, Kaplan et al. 2009).

4.3.1 CEO compensation

We examine overall compensation to managers and the introduction of stock option plans in CEO compensation.[20] First, we expect that if delay leads to CEO entrenchment, the CEO will pay himself more. Second, we note that equity-based compensation, especially stock options, is widely used in publicly listed firms in the US and in Europe. Stock option compensation helps align incentives between managers and shareholders and reflects a form of corporate standardization (Core & Larcker 2002, Kato et al. 2005). Therefore, we focus on the time between IPO approval and stock option plan implementation among private firms.[21]

[20]The cash flow statement and balance sheet provide different measures of payroll, and both have been used in the Chinese financial literature. We use both, but present results using payroll from the cash flow statement.

[21]For the use of equity and options in managerial compensation in China, see Chen et al. (2013) for details. The authors argue that the standard use of stock options does not quite apply to state-owned firms, which is why we

4.3.2 Manager Replacement

Hellmann & Puri (2002) find that VCs professionalize startups in part by replacing founders with professional manager CEOs. Kaplan et al. (2009) also emphasize the importance of replaceable human capital in early firm development, finding in a sample of 50 VC-backed firms that most replace the founder with a new CEO prior to IPO. However, in China it is less common for founders to be replaced as CEO by VCs.

We document CEO changes prior to IPO, focusing on whether the CEO at the time of listing was a founder of the company, or whether there was any change in the three years prior to IPO. Over half of the CEOs in our estimation sample are described as firm founders. Only 75 firms replaced their CEO in the three years prior to IPO, of which 38 replaced the CEO in the year prior to IPO. The correlations between VC funding and CEO replacement are much smaller than the survey evidence from Hellmann & Puri (2002) would suggest. This may reflect the institutional differences between Chinese and U.S. firms, as well as the relative maturity of the firms in our sample.

4.3.3 CFO hiring

The hiring of CFO signifies a clear separation of core management, potentially reducing the CEO's private benefits of control. We consider whether the firm hired a CFO by the year after IPO. About 7% of firms do not have a CFO by the year after listing.

4.4 Reducing Informational Asymmetry

4.4.1 Payoff & uncertainty

We would ideally want to know how delay affects the payoff of the founder and early investors. While we cannot estimate this exactly, we can proxy for it using two variables. One is the price to book ratio on the first day of trading and in subsequent years. The second is uncertainty about the firm with its stock price volatility after listing. If delay increases the

exclude SOEs in our analysis.

market's uncertainty about the firm, this could be reflected after listing through volatility. Since the founder and early investors can sell their shares after a lockup period expires, volatility in the stock price will have a direct effect on their windfalls from the IPO.

4.4.2 Underwriting Syndicates

An additional, less conventional uncertainty measure is the number of co-managers in the underwriting syndicate. The responsibility for placing shares in an IPO is typically spread across a number of co-managers, who form a syndicate with the lead underwriter. Underwriting fees and selling concessions are shared across syndicate members, so underwriters have financial reasons to limit the number of co-managers. However, the lead underwriter's incentive to reduce the number of co-managers is balanced by the information and risk-sharing benefits they provide.

Corwin & Schultz (2005) show how syndicate members serve an information production role about the issuer, in part by generating additional analyst coverage and providing a certification function for the issuer's quality (also see Chen & Ritter 2000). Davidson et al. (2006) show that issuing firms hire more co-managers when they face higher placement risk, where placement risk is the possibility that the firm does not sell the planned shares at the offering price. They associate placement risk with uncertainty, especially about valuation. Corwin & Schultz (2005) conclude that larger syndicates reduce information asymmetry between public investors and the issuer, a finding confirmed by Popescu & Xu (2011) and Jeon & Ligon (2011). Finally, Yang et al. (2016) examine corporate bond issuance in China. They find that more co-managers increase information available to investors and serve a certification role, reducing the cost of debt. Table 1 panel 2 shows that the mean number of co-managers is 1.6; similarly, in the Corwin & Schultz (2005) sample, the number is two.

4.4.3 Underpricing

A large literature on IPO underpricing suggests that it is best explained by information asymmetry among investors or between the issuer and new investors (Ljungqvist 2007). For example, Beatty & Ritter (1986) show that uncertainty about valuation and firm quality should lead to greater underpricing. Some work relates this to the underwriting syndicate. For example, Corwin & Schultz (2005) and Davidson et al. (2006) present empirical evidence that uncertainty is associated with greater underpricing, and suggest that more co-managers alleviate this uncertainty.[22] Consistent with the uncertainty hypothesis, high delay is on average associated with more underpricing in our sample (Table 2).

However, an alternative explanation for underpricing is that new investors irrationally drive the price above its fair value (reviewed in Ljungqvist 2007). This behavioral explanation has received support in the Chinese context, where underpricing has been very extreme (Gao 2010). Further, Chinese IPO pricing regulations set the offer price mechanically at a multiple of net earnings per share, which has generally been below the price to earnings ratio prevailing in the market (Tian 2011). For these reasons, we do not explicitly use underpricing in our analysis. Average underpricing (the difference between the closing price on the first trading day and the offer price) in our data is about 80%, consistent with the literature finding large underpricing in China (Table 1 panel 6).

4.5 Additional Variables

4.5.1 Window Dressing

Our model allows for window dressing actions such as earnings or patent manipulation. A commonly used accounting measure for window dressing is the volume of discretionary accruals, which reflects the flexibility and scale of firms to manage their earnings and has been used by researchers in both the U.S. and Chinese contexts (Becker et al. 1998, Hutton

[22]There is, of course, a tension between placement risk and underpricing; if underpricing is highly likely, it is not obvious why there would be placement risk. It may originate in frictions in underwriting and the IPO process that are beyond the scope of this paper, but seem to exist in both the U.S. and China.

et al. 2009, Chen et al. 2011, Kim & Zhang 2016). We measure discretionary accrual as the residual from a Jones model, adjusted by a performance matched firm, following Jones (1991), Dechow et al. (1995), and Kothari et al. (2005).

4.5.2 Board of Directors

Expansion of the board, greater board diversity, and more independent board directors are strongly associated with better corporate governance but are less central to standardization. To assess whether our results are likely to simply reflect an effect of delay on corporate governance, we analyze these variables as well. It is worth noting, however, that evidence on relationship between board variables and outcomes in developed countries is mixed (Boone et al. 2007, Adams et al. 2010). For example, Yermack (1996) finds that board size and firm performance are negatively correlated. Further, some literature suggests that boards may play a somewhat different and more informal role than in China than they do in the U.S. (Choi et al. 2011, Lin et al. 2016).

4.5.3 Performance

Performance measures can be subject to window dressing behavior (see 4.4.1). However, they could also reflect operational changes after IPO. We consider the price to book ratio at the close of the first day of trading as a measure of value creation. Earnings are our primary measure of performance (net profit in millions of nominal RMB), following Fan et al. (2007). We also consider revenue, return on sales, abnormal return, and market share.[23]

4.5.4 Capital Structure and Investment

We follow precedent in the literature in constructing financial variables, where possible, in particular Piotroski & Zhang (2014). Leverage is the ratio of the firm's total liabilities to

[23]Revenue is total operating sales revenue in millions of nominal RMB. It includes all income except that from interest, commissions, fees, and earned premiums. Return on sales is the average of firm earnings before interest and taxes (EBIT) divided by total revenue, where EBIT is net profit plus interest expense.

total assets at the fiscal year-end. Cash is also scaled by assets. We use investment variables that are standard in the Chinese financial literature, primarily relaying on total investment.[24]

5 Empirical Results

This section contains the main empirical results. As in Section 4, we consider each of the three standardization activities in turn. Our main empirical analysis focuses on firm outcomes at or slightly after firm listing because firm actions in preparation to go public are not always observable. When data are available after approval but before listing, we also examine them directly. We test alternative explanations for our results (e.g., the capital supply shock) in Section 7.

5.1 Patenting as a measure to commit going-concern value

Suspension-induced listing delay significantly reduces patent applications both during delay and for years after listing. Average patenting activity in our sample is consistent with Bernstein (2015), who finds that public firms tend to innovate less. Appendix Figure A1 shows a decline in successful (ultimately granted) invention patent applications around the IPO year. Our results demonstrate that this decline is much more severe for delayed firms. Estimates of Equation 1 in Table 3 Panel 1 show strong negative effects of delay on invention patent applications in the year of IPO. The table also contains a number of alternative specifications, including the IV using an exponential conditional mean model (column 5).

Further results from estimating Equation 1 are depicted in Figures 6-9. These depict the main specification using a negative binomial model.[25] They show significant negative effects of months of delay on patenting throughout the four years after IPO. Figure 6 shows

[24]The first is property, plant and equipment (PPE) investment, which includes intangible and other long-term assets. The second is financial investment, or cash flow used to purchase equity and debt. The third is acquisition investment, or cash flow used to purchase subsidiaries. We scale all three by total assets at the beginning of the year, so the investment variables are percents. For example, 程仲鸣, 夏新平, and 余明桂. (2008), '政府干预, 金字塔结构与地方国有上市公司投资', 管理世界, 37-47.

[25]We do not use the Poisson model because the patent counts are overdispersed.

the effect on total invention patent applications. The magnitude is slightly smaller for granted patents (Figure 7) than for rejected ones (Figure 8). About half of patent applications are accepted, on average. Figure 9 shows that the negative effect persists for the lower quality design and utility patents.

We next turn to centering the analysis around the approval date rather than the listing date. Figure 10 shows a local polynomial of the average patents by month around the IPO approval date. As in the previous figures, the sample is limited to the 425 firms approved in the year prior to an IPO suspension announcement (our primary estimation sample), and we divide them around median delay of four months. In the top graphs, we consider only firm-months in which the firm has not yet listed. Therefore, all firms are included in months through zero, and then drop out of the sample as they list. The bottom graphs include all-firm months. For example, in the bottom left graph, all firms experience at least four months of delay. After the 4th month following IPO approval, some will have listed and some not.

Figure 10 reveals that firm patent applications rise leading up to approval as firms ready themselves for listing, perhaps reflecting a need to increase disclosure or, more nefariously, "window dressing" that we discuss in the model shortly. It is comforting that firms ultimately affected by suspensions (left graphs) have similar pre-approval behavior as firms that were not delayed (right graphs). After approval, patents decline much more for delayed firms, both when we exclude post-listing months (top graphs) and when we include them (bottom graphs).

Figure 11 shows the coefficient of months of delay (hereafter "delay") on invention patent applications filed in a specific year relative to the IPO approval year.[26] The results for negative years are placebo tests; delay should have no effect on patent applications in years prior to approval. Indeed, the coefficients are near zero and quite precise. Starting in

[26] A disadvantage of our patenting data is that its frequency is annual. A share of the patents filed in the approval year may have been filed prior to approval and thus not affected by delay, increasing error in the measured effect. If the delay is truly exogenous, this error should be equal across months of delay, and thus simply add some noise to the analysis.

the approval year, we see a significant negative effect; a month of delay reduces invention patent applications by 14% (0.7 of a patent relative to a sample mean of 4.8). The drop is slightly larger in the year after, at 0.74 of a patent in the year after relative to a sample mean of 6, and still larger in the second year after approval, at 1.1 patents relative to a sample mean of 7.9. In the fourth and fifth years, the coefficients continue to be strongly negative, but become noisy.

We next turn to monthly data (Equation 2), in Table 3 Panel 2. We find that an extra month of delay reduces patents in that month by about 6% of the sample mean (column 1). With a quadratic specification, the effect on the linear term is somewhat larger, at about 13% of the sample mean. As Figure 10 shows, most of the delay effect happens between months five and fifteen of delay; hence, the coefficient on the second moment of delay is positive and significant. The negative binomial and instrumented approaches also continue to find strong negative effects (Table 3 Panel 2 columns 3 and 4). We find that VC-backed firms largely drive the overall effect (column 5). The coefficient on the month being post-listing ("Post-IPO") is always very large, negative, and highly significant, consistent with our annual results that application activity on average declines after listing.

Robustness tests of these main findings on patenting are in Table 3 Panel 3. Columns 1-5 use the number of invention patent applications in the approval year. Our first test changes the sample to companies listed within a year after a suspension ended (instead of approved within a year prior to a suspension announcement), but still considers patent applications in the year of approval. We find an effect of an additional month of delay of -.18, significant at the 5% level (column 1). Second, we consider only companies approved in the six months prior to a suspension announcement. We continue to find a large negative effect of -.39, significant at the 1% level (column 2).

Omitting controls increases the main effect somewhat (column 3). Limiting the sample to the Shenzhen exchange slightly reduces the effect to -.39 (column 4). Limiting the sample to the final, largest, and arguably most exogenous suspension (2012-14) increases the main

effect to -.52, significant at the 5% level. When we separate the sample by industry type (using the SDC New Issues indicator for being in a "high-tech sector"), we find that the effect is much stronger in high-tech sectors, at -.55 (column 6), but is also present for non-high-tech firms (-.37, in column 7). Column 8 conducts a placebo test, examining the effect on granted invention patent applications in the year prior to approval. Note that placebo tests for the main dependent variable are in Figure 11 (for the pre-approval years). Finally, column 9 omits the IPO suspension associated with the financial crisis, and continues to find a strong negative effect of -.47 patents, significant at the 5% level.

5.2 Measures to mitigate agency conflicts

In anticipation of the agency conflicts due to the separation of ownership and control when going public, a firm may take measures to professionalize management, reduce executive entrenchment, and align incentives between managers and shareholders.

5.2.1 Executive Compensation

A more entrenched entrepreneur might pay himself more. Indeed, Table 4 columns 1-3 show that between the IPO year and the year after IPO, an extra month of delay increases the CEO's salary change by 8.5 million nominal RMB (relative to a mean change of -8). In subsequent years, we continue to see a positive relationship, but it loses statistical significance by the third year after approval. We find no effects of delay on CFO salary, all managers' salaries (which includes lower-level supervisors), or overall payroll (Table 4 columns 4-6).

An alternative to agency conflict that might explain the initial increase in pay is a contracting channel. It may be that shareholders must agree to a pay increase in order to retain the CEO during the delay period, when uncertainty increases. We expect that VC backing, particularly from foreign investors, plays a monitoring role, reducing the extent of agency issues arising from delay. While we do not find a robust relationship between VC backing and delay in general, Table 4 column 3 shows that foreign VC funding has a strong

mitigating effect. This is suggestive evidence that the agency channel is more plausible than the contracting channel.

Stock option compensation helps align incentives between managers and shareholders and reflects a form of corporate standardization (Core & Larcker 2002, Kato et al. 2005). We find delays slightly raise the time to implement a stock option plan for the CEO. An additional month of delay increases by about 30 business days the time to an announcement of a CEO stock option plan, relative to a mean (median) of about four (three) years (Table 4 columns 7-9). Note that only a small share of private firms issue stock option plans to their CEO (this practice is much less common in China than in the U.S., in part due to regulatory controls).

5.2.2 Manager Replacement

We next turn to CEO replacement as a metric of firm professionalization (specifically, replacing the founder as CEO with a professional manager CEO). The correlations between VC funding and CEO replacement are much smaller than the survey evidence from Hellmann & Puri (2002) would suggest. This is likely because we study all IPOs, rather than a subset of entrepreneurial IPOs, because the VC sector in China is immature, and because a subset of firms has heavy state involvement. Appendix Table A2 shows that delay is slightly negatively associated with both (1) a change in CEO in the year prior to IPO (CEO replacement) and with (2) the founder being CEO at the time of IPO (founder-as-CEO). However, we find no independent effect of delay on CEO replacement.

We find small negative effects of delay on earnings (Appendix Table A3). This effect is much stronger when the CEO at the time of IPO is also a firm founder. In Table 5, we interact delay with a founder-as-CEO indicator. While founders-as-CEOs independently have higher earnings than their counterparts, delay decreases earnings substantially in the year after IPO and in the following year. Relative to firms that have replaced their founders, an extra month of delay decreases earnings in the year following IPO by 12 million RMB

(relative to a mean of 644), and in the second year after IPO by 30 million RMB (relative to a mean of 727). We do not find statistically significant effects in the year of IPO or in the 3rd year after IPO, though the coefficients remain negative. Columns 2-3 and 5-6 show that there are no apparent effects of replacing a CEO in the years before IPO.

5.2.3 CFO Hiring

A firm without a CFO might be expected to delay hiring one if it is only needed for listing, but we should expect delay to affect the presence of a CFO in the year following the IPO year only if the delay had a lasting effect on separation of managerial roles. We find a strong negative relationship between delay and ultimate CFO hiring. In our primary specification in Table 6 column 1, an extra month of delay decreases the log odds of having a CFO by 0.098; in other words, an extra month of delay decreases the odds of having a CFO by a factor of 1.1, or around 10%. The effect is robust to our IV strategy (column 4). Among private firms, in column 5, the effect is larger and more precise.

In sum, we observe that delay leads to some degree of managerial entrenchment, and stunts the professionalization of the firm.

5.3 Measures to Reduce Information Asymmetry

5.3.1 Payoff & uncertainty

Delay increases stock price volatility, measured as the standard deviation of returns in the 100 days after listing. The results, in Table 7, find that an extra month of delay increases volatility by 0.0023, about 3% of the mean. This increase in volatility is one way that delay may affect payoff to the founder and early investors (note they must wait until the expiration of a lock-up period, typically 180 days).

The price to book ratio (P/B) is both a proxy for market expectations about the firm's assets in place and also, in the longer term, sheds light on the payout to insiders.

Table 8 column 1 shows that delay has a strong negative effect on P/B, with a month of delay reducing it by .28 relative to a mean of 14. Relative to the least delayed quartile of firms, the most delayed quartile experiences a near halving of their P/B ratio (column 3). This negative effect endures in the second year after IPO (column 5), though the linear effect of delay loses significance (column 4). We find no substantial effect on return on sales. Together, these results suggest that delay affects market uncertainty about the firm.

5.3.2 Underwriting Syndicates

As explained in Section 4, we expect that when the market has less information about a firm, the negotiation between the firm and the lead underwriter will result in more IPO co-managers of the IPO. We find in Table 7 that an extra month of delay increases the number of co-managers by 0.04, or 2.5% (column 1). This small positive effect is significant only at the 10% level. A negative binomial approach in column 2 yields a much more precise estimate of a difference in log expected counts of .025, or an increase of about 2.5%. When we use an indicator for delay above the 75th percentile, in column 3, we find that relative to all other firms, high delay firms have almost one more co-manager.

The instrumental variables approach in column 4 finds a larger and much more precise estimate, with a very strong first stage. A robustness test is in Appendix Table A4, where we change the estimation sample to firms listed in the year after the end of an IPO suspension. We find strong and more precise results for this group, suggesting that a month of delay increases the number of co-managers by about .05, significant at the 1% level.

Delay has no effect on the number of co-managers when a firm has foreign VC backing (column 6). This is consistent with information asymmetry leading to a greater need for co-managers, and VCs serve a monitoring and certification function, as in Baker & Gompers (2003). That is, expert VCs may partially substitute for the disciplining function of an imminent IPO.

6 A Model of Standardization and Entrepreneurial Exits

In this section we develop a simple, stylized model to interpret our empirical findings. The model captures key aspects of standardization, focusing on the archetypal high-growth entrepreneur who may receive early private equity financing, and then ultimately seeks public equity financing. To illustrate how standardization, VC investment, and public listing interact, we build on and extend Rajan (2012) to incorporate time-varying public market access, the role of VC, and potential window dressing behaviors.[27]

Consider a three-period world. In the first period $T = 0$, a founder possesses a viable startup and finances the firm with personal or VC capital (as described in Rajan (2012)). Suppose the entrepreneur retains a fraction $\alpha \in (0, 1]$ of the firm.

At $T = 1$, the entrepreneur or the VC picks the degree $\gamma \leq 1$ to which she standardizes the enterprise. Standardization reduces the idiosyncratic and personalized aspects of the entrepreneur's role. It implies greater routinization of work, making the firm's human capital more replaceable. For example, patenting reduces the firms' reliance on specific individuals' tacit knowledge, and makes the intellectual property of the firm more easily verifiable. Motivated by empirical studies such as Hellmann & Puri (2002), we assume the entrepreneur is less skilled at standardization and can achieve a maximum standardization at $\bar{\gamma} < 1$.

In addition to setting the level of standardization, the entrepreneur also exerts effort μ in innovation at a personal cost μ.[28] At the end of the period, the entrepreneur produces $V^E(\mu) > 0$, where $V^E_\mu(\mu) > 0$ and $V^E_{\mu\mu}(\mu) < 0$. As in Diamond & Rajan (2000), the CEO serves at the discretion of the controlling equity. Thus before production, the controlling equity can replace the entrepreneur with another individual, who can generate γV^E.

In the third period, $T = 2$, the company prepares to go public, which permits the

[27] Rajan (2012) describes the high-growth entrepreneur undergoing through two transformations. First, he innovates and differentiates to create significant net present value. Second, to raise adequate capital, he standardizes (or "professionalizes") the firm. The standardization process makes human capital more replaceable, and often includes restructuring the firm into divisions, patenting intellectual property, and formalizing implicit employment agreements.

[28] It does not matter whether the entrepreneur sets the effort or standardization first. (Also, the entrepreneur here really represents the entrepreneurial team.) In Rajan (2012), the effort is exerted by employees. Our modeling choice is based on simplicity of conveying the paper's insights, which focus on a manager who owns a certain share of the company and is responsible for innovation.

entrepreneur and any VC investors to liquidate their shares.[29] We assume the total value of the firm given full access to public markets is $V^C(\nu) > V^E(\infty)$, $\forall\nu$, where $\nu \geq 0$ is the amount of window dressing the entrepreneur or VC does to temporarily boost perceptions of the firm's quality. This simply implies that a firms' life-time revenue dwarfs its revenue as a nascent startup enterprise. We assume window dressing behavior costs ν per share of ownership, and $V^C_\nu(\nu) > 0$.[30]

An unexpected IPO suspension delays listing for an indeterminate period, thereby reducing access to public markets. After controlling for market conditions, suspensions can be modeled as a repetition of the second period $T = 1$, followed by a modified third period in which there is a stochastic delay drawn from an exponential distribution with parameter λ, under an instantaneous opportunity cost of $r > \lambda$.

The expected payoff of the firm in the IPO period is mV^C, where $m = \frac{\lambda}{r+\lambda}$ with suspension-induced delay. The key parameter of analysis m broadly represents public market access; a lower m might represent uncertainty associated with IPO timing and feasibility, but it could also represent underdeveloped markets, manifesting in inefficient market valuation, or excessive regulatory and disclosure burdens.

Following Nash bargaining, the entrepreneur - or his replacement - serves as CEO in equilibrium. This CEO gets $\frac{1-\gamma}{2}V_i$. The VC extracts the entire surplus from any potential replacement and gets $\frac{1+\gamma}{2}V^i$ in equilibrium. The entrepreneur thus chooses γ and μ to maximize

$$U_{EN} = \frac{1-\gamma}{2}V^E(\mu) + \alpha\frac{1+\gamma}{2}\left[V^E(\mu) + mV^C(\nu)\right] - \mu - \alpha\nu. \tag{3}$$

Given a standardization level γ, the optimal effort solves $\left[\frac{1-\gamma}{2} + \alpha\frac{1+\gamma}{2}\right]V^E_\mu(\mu^*) = 1$. Total differentiation with respect to γ gives $\frac{d\mu}{d\gamma} = \frac{(1-\alpha)V^E_\mu}{[1-\gamma+\alpha(1+\gamma)]V^E_{\mu\mu}} \leq 0$. Greater standardization reduces

[29] VCs are typically required to hold their shares for a period of time after IPO, and entrepreneurs often continue leading the firm, but the period that they hold a significant fraction of the shares relative to the life of the firm is small. All we aim to capture is that entrepreneurs and early investors have to exit at some point, potentially due to retirement, investment horizon, liquidity shocks, and contractral agreements. For example, Sahlman (1990) discusses the organization of VC funds that prompts timely exits.

[30] ν can be a fixed private cost too, or can be interpreted as the cost of allocating attention of resources that hurts firm's future value.

effort because it reduces the entrepreneur's rent extraction, which is not fully compensated through the increase in ownership.

Suppose first that the entrepreneur determines standardization. We note that $\frac{1-\gamma}{2}V^E(\mu)+\alpha\frac{1+\gamma}{2}V^E(\mu)-\mu$ is supermodular in $(\gamma,\nu,-\mu)$, and $\alpha\left[\frac{1+\gamma}{2}mV^C(\nu)-\nu\right]$ has increasing differences in (m,γ), (m,ν), (α,γ) and (α,ν). By Theorem 4.4 in Athey et al. (1998), we have the robust comparative static that γ^* and ν^* are non-decreasing in m. In fact, for most reasonable functional forms, γ^* and ν^* are increasing in m. The intuition is that given an original level of standardization γ or window dressing ν, when the public market is more important, the marginal benefit of standardization or window dressing increases. Standardization's effect of increasing the founder's ability to extract future rents as a shareholder outweighs the marginal benefit of rent extraction in the current period as CEO. Note that the standardization chosen by the entrepreneur increases in α.

Now suppose that the VC decides on standardization. If the VC pays I to acquire $1-\alpha$ shares, her payoff is:

$$U_{VC}=(1-\alpha)\frac{1+\gamma}{2}\left[V^E(\mu)+mV^C\right]-I-(1-\alpha)\nu=\frac{1-\alpha}{\alpha}\left[U_{EN}-\frac{1-\gamma}{2}V^E(\mu)+\mu\right]-I \quad (4)$$

U_{VC} is supermodular in $(\gamma,\nu,-\mu)$ and satisfies the single-crossing property in $\{(\gamma,-\mu),m\}$ and in $\{(\gamma,-\mu),1-\alpha\}$. By Theorem 4 in Milgrom & Shannon (1994), γ^* and ν^* are again non-decreasing in m and $1-\alpha$. Therefore, we conclude that regardless of which party chooses standardization, **(1) standardization (γ) and window dressing (ν) increase as access to efficient public markets increases (m).** When public market access is suddenly restricted, firms will standardize less and window dress less. Following a proof similar to proposition 3 in Rajan (2012), the entrepreneur standardizes less than the VC would prefer. Moreover, note that non-VC-backed firms standardize to $\bar{\gamma}$. If $\bar{\gamma}$ is small and the VC makes standardization decisions in VC-backed firms (by contracting on milestones with the entrepreneur), it is likely that VC-backed firms standardize more.[31]

[31]We note that VC-backing is endogenous, so we should be careful in drawing conclusions on standardization

In addition to modeling public market access through m and permitting the VC to determine γ and ν, we further deviate from Rajan (2012) by allowing the VC to determine how much to invest: the investment cost $I(\alpha)$ is increasing in the share that the VC owns, α.[32] In this case, because U_{VC} is again supermodular in $(1-\alpha, \gamma, \nu, -\mu)$ and satisfies the single-crossing property in $\{(1-\alpha, \gamma, \nu, -\mu), m\}$, by Theorem 4 in Milgrom & Shannon (1994), γ^*, ν^*, and $1-\alpha$ are again non-decreasing in m. This strengthens our prediction (1), but also predicts that **(2) the amount of VC investment is increasing in public market access.**

IPOs provide the VC with profitable exit opportunities, which are generally realized at least several years after investment. If the VC's beliefs about the future rely to some degree on the present state of affairs, then when public listing is readily available for eligible companies, the VC will invest more in early stage private firms. If VC firms are heterogeneous in $I(\alpha)$, with some $I(\alpha) > (1-\alpha)V^E(\mu)$, a large decrease in m may lead some VCs to cease investing. Through these channels, we expect public market access to affect both the intensive and extensive margins of VC investing activity.

When the entrepreneurial firm does not have VC investment, $\frac{dU_{EN}}{d\gamma} = \frac{mV^C(\nu^*)}{2} > 0$ by the envelop theorem. The founder always standardizes to the fullest extent possible ($\gamma = \overline{\gamma}$). In this case, m has no effect. Recall that when a firm is VC-backed, optimal standardization γ^* is increasing in m and is an interior solution (i.e., it exists for some intermediate α).[33] Thus we expect VC-backed firm standardization to be more sensitive to changes in m. When m increases, future rent extraction increases. The marginal benefit of standardizing more to extract future rents exceeds the marginal benefit of extracting current rent, as long as the VC or entrepreneur does not own too little or too much a fraction of firm value. Note that corner solutions occur when $\alpha = 1$ (entrepreneur standardizes to $\bar{\gamma}$ anyway), and when α is

measures that interact with firm characteristics.

[32] In reality, the amount of investment is jointly determined by entrepreneurs and VCs. For simplicity, we assume VCs determine the investment, which would not affect our mechanism or main conclusions.

[33] When the solution is interior, $\frac{d\mu}{d\gamma} + \frac{\alpha-1}{2}V^E(\mu) + \frac{\alpha}{2}mV^C = 0$ if the entrepreneur sets γ, and $\frac{1+\gamma}{1-\gamma}\frac{d\mu}{d\gamma} + \frac{1}{2}[V^E(\mu) + mV^C] = 0$ if VC sets γ, so when m increases in either case, and γ^* must increase to adjust.

too small (either entrepreneur does not standardize, or VC standardizes to 1). Therefore, our third prediction is that **(3) VC-backed firms reduce standardization more than non-VC-backed firms when public market access declines.**

Finally, we extend our model to allow effort provision by the new CEO in $T = 2$. We assume that the CEO owns fewer shares after public listing than the founder did before listing. Effort provision in each period satisfies $[\frac{1-\gamma}{2} + \alpha' \frac{1+\gamma}{2}] V_{\mu}^{E}(\mu^*) = 1$, where $\alpha' < \alpha$. This implies that μ^* is smaller and less effort is exerted. To the extent that standardization is unaffected, on average **(4) effort declines after public listing**. Patent applications, as we discuss below, represent standardization effort. Granted patents and patent quality measures reflect innovation, which is one outcome of entrepreneur effort expenditure. Thus, we expect that on average, granted high quality patents will decline after listing, as Bernstein (2015) finds.

We have assumed that the entrepreneur cannot adjust standardization in $T = 2$. As explained in Rajan (2012), standardization is hard to reverse because power is easier to relinquish than to repossess. The CEO no longer holds large shares of the equity to make the decisions, any aggrieved party can appeal to outside equity, and reversing standardization is against the interests of outside equity. Therefore, we assume standardization is always set prior to public listing.

Now consider the Chinese IPO context (see Section 2). A firm on the cusp of an IPO faces a lower m at $T = 1$ if an IPO suspension occurs. During the suspension, the firm remains private and has more uncertain access to public markets in the future. Similarly, VC investing in firms not yet about to IPO also faces a lower m at $T = 0$ as the firm's eventual listing is delayed and more uncertain. Window dressing behaviors require costly effort and deplete resources. If done a second time, they entail a cost $k\nu$, where $k > 1$ to reflect that manipulation is likely harder to maintain during delay. This implies that window dressing and standardization should be lower for delayed firms. Consistent with our empirical findings, the model predicts the the following:

- On average, innovation declines after public listing, consistent with Bernstein (2015).
- When an IPO suspension exogenously delays a firm's listing, we expect less standardization (and window dressing).
- We expect that suspensions enervate the standardization of VC-backed firms more than non-VC-backed firms.

A fourth prediction that emerges from the model, which we test in the next section, is that:

- During IPO suspensions, we expect contemporaneous VC investment in private companies to decrease.

We believe that timely access to public markets affects firm standardization through the channel of liquidity and exit opportunities. Standardization is an abstract concept and is not observed directly, but our empirical findings fit well with the model's predictions. We discuss several alternative interpretation of our empirical findings in the next section.

7 Robustness & Alternative Explanations

In this section, we first test whether suspensions were associated with depressed VC investment, as our model predicts. This will provide suggestive evidence that the suspensions created meaningful uncertainty, a core assumption of our empirical approach. Then we provide evidence that plausible alternative channels do not fully explain our results. For example, Section 7.2.2 shows that the results do not emerge from a capital supply shock that occurs when a firm is denied an expected capital infusion.

7.1 Market uncertainty test: effect on contemporaneous VC

Our model predicts that if the suspensions generated uncertainty in the market about the future of IPOs in China, they would have depressed contemporaneous VC investment. VC returns depend on IPOs for liquidity events. During a suspension, investors who believed

China's IPO market could be jeopardized in the medium term, perhaps through a change in IPO regulations or stringent future restrictions on the number of IPOs, might be expected to reduce investment activity. Anecdotal evidence suggests this occurred. According to a KPMG/CB Insights report following the 2012-2014 IPO suspension,

> "There are approximately 800 companies still waiting for IPO listing approvals in China. This has affected the overall deal flow, particularly for Series B and C investors considering their exit strategies" (Insights 2016).

Conversely, if the suspensions were perceived as short term hiatuses, we would not expect an effect. This is because VC investments are typically illiquid and held for three to ten years.

7.1.1 Empirical approach

We are interested in the effect of an IPO suspension on VC investment. This exercise relates to Gompers, Kovner, Lerner & Scharfstein (2008), who document that VCs react rationally to public market signals about fundamentals. In Equation 5 below, we estimate an association between periods of IPO suspension and contemporaneous VC, using data at monthly and weekly frequencies. Controlling for the market indices, as well as VC investment in the rest of the world (outside mainland China), help give the coefficient of interest on the indicator for an IPO suspension being in effect (β_1) a more causal interpretation. Nonetheless, a conservative interpretation is to view the specification as testing for correlation.

Specifically, the dependent variable is either the amount or number of deals of early or later stage VC investment. Controls include either the Shenzhen and Shanghai (SZ and SH, respectively) indices, or an overall China market index. We also control for PCRI's rest-of-world VC investment at the relevant stage (early or late). Let $1 \mid IPO\ Suspension_t$ be an indicator for the IPO market being suspended in month or week t.

$$VC\ China_t = \alpha + \beta_1 \left(1 \mid IPO\ Suspension_t\right) + \gamma_1 SH\ Index_t \tag{5}$$
$$+ \gamma_2 SZ\ Index_t + \gamma_3 VC\ ROW_t + \varepsilon_t$$

Disturbances are likely autocorrelated, leading to underestimated standard errors. Therefore, our preferred approach uses heteroskedasticity and autocorrelation consistent (HAC) standard errors (specifically, Newey-West errors). Note that this analysis is one of correlation, not causation. The suspensions themselves were not exogenous to Chinese economic conditions. For example, it may be that during IPO suspensions it is more difficult for private equity investors to fundraise from limited partners. While we control for the market index and show similar results for elite U.S. VCs who likely do not face such fundraising cycles, we cannot rule out this channel.

7.1.2 Results

We find a correlation between the suspension periods and depressed VC investment in China. Figure 12 (13) shows later stage VC in in mainland Chinese (rest-of-world) portfolio companies. Appendix Figures A2-A5 show weekly frequencies and investment in real 2010 RMB. The negative correlation between suspension periods and VC investment in China is obvious, especially for the 2012-14 suspension.

Table 9 confirms this visual evidence in regression estimates, using versions of Equation 5. In Panel 1, the dependent variable is weekly early stage VC investment in nominal USD. Columns 1-3 use Newey-West standard errors with an optimal lag. While a naive regression (column 1) has a strong negative coefficient on the indicator for months in which an IPO suspension was in effect, the coefficient falls and loses significance with controls for market indices and VC investment in the rest of the world (columns 2 and 3). With less stringent error assumptions (columns 4 and 5), these effects are significant at the 10% level, and imply that the suspensions reduce weekly early stage investment by about $25 million, relative to a mean of $74 million. We are surprised to find evidence of any effect at all on early stage VC investment, as these investments are illiquid and typically held for 3-8 years (Gompers & Lerner 2004).

There is a much stronger relationship for later stage investment. In our more stringent

specifications (Table 9 panel 2 columns 2-3), we find that the suspensions appear to reduce weekly later stage investment by about $53 million, relative to a mean of $181 million, significant at the 5% and 1% levels, respectively. Excluding the 2009 suspension (which was associated with the global financial crisis) leads the coefficients to increase to -$64 million.

Alternative specifications focused on early stage investment are in the Appendix. First, Appendix Table A5 replaces nominal dollar units with real 2010 RMB to measure early stage investment, and finds slightly more robust results. The suspensions decrease weekly later stage investment by at least 270 million real 2010 RMB, relative to a mean of 4,812 million. Second, Table A6 panel 1 shows that suspensions decrease monthly later stage investment by about $200 million (US dollars), relative to a mean of $726 million. We turn to investment by the location of the VC firm in Appendix Table A7. Panel 1 considers investment by China-located general partners (GPs) only, and continues to find the reduction in investment, particularly for later stage investment.

The aggregate correlations we measure could arise from a capital supply shock; GPs may have more difficulty raising funds during suspensions and so reduce their contemporaneous investment. If this were the case, we would not expect elite foreign firms' investments in China to be affected by the suspensions. They presumably have greater access to capital in general, and their access to capital should be less sensitive to Chinese markets in particular.

In Appendix Table A7 panel 2, the dependent variable is the number of VC deals in Chinese companies by elite U.S. VCs active in China. As the PCRI data do not include GP-level investments, we constructed this time series using data from pedata.cn, which is only available from 2005. The sample is thus smaller. Even so, columns 1-2 suggest that IPO suspensions decrease the number of elite U.S. VC deals in China by a bit more than three deals, relative to a mean of 63.5. However, this effect is less robust than the results in Table 9.

We conduct several robustness tests in Appendix Table A8. First, a placebo tests in columns 1-2 examines the effect of the suspensions on VC investment outside of China. As

expected, we find no statistically significant effect, though the coefficients are negative. In columns 3-6, we confirm our main results using the alternative data source, pedata.cn, which is only available from 2005. We continue to find a strong reduction in overall and later stage VC investment, of about 26 deals relative to a mean of 152. We confirm that the result is specific to VC in Appendix Table A9, where we show no effect of the suspensions on monthly aggregate bank lending.

In sum, this analysis suggests that the suspensions created uncertainty about the overall regulatory environment and the future of IPOs in China, and had a chilling effect on VC investment.

7.2 Alternative Interpretations

Many of our empirical findings could independently be attributed to channels other than standardization. This subsection discusses alternative interpretations.

7.2.1 Capital Supply Shock

We expect that if firms are going public because they need capital for investment projects, delay will lead to increased leverage and decreased investment, with potentially negative subsequent effects on performance. However, the impact on standardization seems unrelated to the infusion of capital when a firm goes public. First, delay generates no traces of financial constraints. We find no effect of delay on overall investment, leverage, employment, or payroll. Table 10 shows the absence of any effect on investment, leverage, and IPO proceeds. We also find no effect of delay on employment.[34] Table 10 indicates that firms in China are not going public because they are in dire need of capital. However, they do wind up slightly cash poorer after listing (columns 7-9).

Also, not a single one of the 425 firms in our primary estimation sample chose to go public abroad rather than wait for the IPO suspension to end. Approval required substantial

[34]The dependent variable is the change in the firm's number of employees between the IPO year and the following year as the dependent variable. We use the change because this variable is not available for years prior to IPO.

investment, but this was sunk, and we expect that firms desperately in need of capital would have gone public in Hong Kong or elsewhere. Together with our alternative specifications centered on or after listing, our findings indicate that public market, by providing an avenue for liquidity and entrepreneurial exits, fosters standardization.

7.2.2 Window Dressing

While window dressing instead of standardization can explain the impact of delay on patenting activities and earnings, it is hard to explain the patterns we observe in terms of leadership entrenchment and information asymmetry, it also does not explain the interactions with VC backing.

In fact, we find delayed firms have fewer discretionary accruals (Table 1 columns 1-3). This suggests that window dressing is present and delayed firms window dress less around listing, as predicted by the model. However, window dressing alone cannot fully explain our findings related to measures to mitigate agency frictions and information asymmetry, which are more closely related to the enduring standardization process.

7.2.3 Standardization and Governance

Firm standardization is closely related to corporate governance, but it is a broader process. Governance alone is challenged to explain our effects on patenting, for example. We also find no relationships between delay and board size or board director age and gender. The number of independent directors is considered in Table 11 columns 4-6. Directionally, delay has a negative effect, but it is never significantly different from zero. The results do show that VC-backed firms have more independent board directors on average, consistent with their association with superior corporate governance in U.S. settings (e.g. Baker & Gompers 2003, Kaplan et al. 2009).

8 Conclusion

The role of public markets in firm professionalization is difficult to study; the ideal experiment would observe the same economy with and without public markets. While imperfect, China's IPO suspensions provide a setting close to this experiment in the real world, in an important economy. From a measurement perspective, there is no "smoking gun" test for firm standardization. However, our findings support a story in which listing delay stunts the standardization process of the firm. This sheds light on how a firm's financing, organization, and activity jointly evolve (Zingales 2000).

We show that a reduction in timely access to public markets negatively affects measures associated with committing a firm's going-concern value to public investors, mitigating agency conflicts, and reducing informational asymmetry. Our findings are strongly consistent with a theoretical framework based on firms' long-term standardization. They cannot be fully explained by window dressing behaviors around IPO, the capital infusion effect of listing, or regressed corporate governance.

We also demonstrate how the negative effects of delay on standardization vary with firms' source of private equity. We also present suggestive evidence that lack of access to public markets can have a chilling effect on contemporaneous VC investment. Finally, our paper helps inform China's ongoing regulatory reform by providing empirical measures of the impact of policy-driven listing delays on a wide range of firm outcomes.

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Table 1: Summary Statistics

Panel 1: IPO Categorical Data

	N
IPOs in Shanghai/Shenzhen (2004-2015)	1,567
IPOs in Shanghai	280
IPOs in Shenzhen	1,269
Approved in 12 months before an IPO suspension announced	425
Listed in 12 months after an IPO suspension ended	529
State owned	109
Not state owned	1,440
Venture backed	636
Private Foreign VC director on board	33
State-backed Chinese VC director on board	150
Private Chinese VC director on board	206
Not venture backed	913
CEO Status (collected for firms in estimation sample)	
CEO at IPO was firm founder	282
CEO replaced in 3 yrs before IPO	75
CEO replaced in year before IPO	38
Hired CFO by year after IPO	393

Panel 2: Continuous IPO Data

Delay (Listing less approval date, months)	N	Mean	Median	S.d.	Min	Max
Whole sample	1563	4.3	2.3	5.8	0.43	43.4
Estimation sample	421	8.7	4.0	9.0	0.63	38.4
Market cap at listing (million RMB)	1460	684	143	5374	21.4	160000
IPO proceeds (million RMB)	1549	200	79.3	861	11.4	19236
Company age at listing (years)	1421	11.3	10.0	5.9	1.0	48
Price-to-book ratio first day of trading	1483	14.1	11.6	10.4	1.27	108.3
IPO underpricing	1390	-.78	-.80	0.12	-.97	2.46
VC ownership						
Private foreign (if >0)	66	0.16	0.15	0.09	0.02	0.35
State-backed Chinese (if >0)	257	0.11	0.07	0.09	0	0.58
Private Chinese (if >0)	441	0.11	0.08	0.1	0	1.03
Number of IPO co-managers (of underwriting syndicate)	1541	1.63	1	2.08	1	27

Panel 3: Patent outcome variables

	N	Mean	Median	S.d.	Min	Max
Annual invention patent applications...						
in year before approval	341	4.52	1	11.5	0	142
in approval year	341	4.77	1	10.66	0	146
in approval year and ultimately granted	341	2.6	1	7.62	0	122
in approval year and ultimately rejected	341	2.16	0	4.38	0	32
in IPO year	341	5.04	1	11.25	0	146
in year after IPO	341	6.03	2	15.09	0	237
in 2nd year after IPO	341	7.86	2	24.63	0	313
in 3rd year after IPO	341	8.52	2	30.31	0	480
ever after IPO year	341	85.39	20	342.51	0	5507
Utility & design patent apps in appr. year	341	12.0	3	30.4	0	316
Utility & design patent apps in IPO year	341	11.96	3	30.43	0	316
Monthly invention patent applications...						
in whole sample	42685	0.8	0	5.74	0	290
pre-IPO approval	15261	0.65	0	3.85	0	195
during delay	3592	0.6	0	2.8	0	56
post-IPO	23832	0.92	0	6.96	0	290

Note: This table describes IPOs on the Shenzhen and Shanghai exchanges. "Whole sample" indicates all IPOs on these exchanges between 2004 and 2015. "Estimation sample" refers to IPOs approved in the 365 days prior to an IPO suspension announcement.

Panel 4: Compensation[†]

	N	Mean	Median	S.d.	Min	Max
ΔCEO salary$_{t=1,0}$	405	-7.98	7	445	-3239	3860
ΔCFO salary$_{t=1,0}$	386	32.2	17.1	321	-1676	5072
ΔAll manager salaries$_{t=1,0}$[‡]	415	325	207	1685	-15000	15269
ΔPayroll$_{t=1,0}$	417	106	12.5	890.4	-79.5	16865
Days to CEO stock option plan introduction	92	1443	1199	856	274	4100

Panel 5: Board Structure & Executive Age in year after IPO

Num board members	421	9.33	9	2.11	5	17
Num independent board members	421	3.43	3	0.86	2	8
Average age of executives	421	44.52	44.5	3.86	34.67	56.6
Average age of board members	421	49.1	48.67	3.95	37.56	63.57

Panel 6: Financial Variables in year after IPO

	N	Mean	Median	S.d.	Min	Max
Total investment[±]	421	0.21	0.17	0.26	0	3.02
PPE Investment	421	0.14	0.11	0.12	0	1.12
PPE Investment in 2nd year after IPO	421	0.1	0.08	0.09	0	0.53
Leverage	418	0.77	0.44	1.66	0.03	28.8
Return on sales	416	0.21	0.16	0.55	0.01	11.2
Abnormal return[‡]	421	-4.08	0.84	66.8	-1220	279
Volatility (std dev returns 1st 100 days)	421	0.08	0.06	0.07	0.02	0.63
Market share[*]	412	0.01	0	0.04	0	0.57
Revenue	413	5381	572	45003	64.6	840000
Earnings[‡‡]	418	644	70.1	7137	5.83	140000
Cash/Assets	418	0.38	0.36	0.19	0.02	0.92

[†]Compensation variables ΔY_j calculated: $\Delta Y_j = Y_{(IPO+1)} - Y_{IPO}$. All from cash flow statement, in 000s nominal RMB, except payroll, which is in millions.[±]Investment and leverage variables calculated as % total assets. [‡]Buy-and-hold stock return less value-weighted market return for the first year after IPO. [‡‡]Equivalent to net income, in millions of nominal RMB. [*]Revenue of firm i in year t scaled by total revenue of industry in year t; Industry is CSRC industry. Take 2 digits if it is manufacturing industry, 1 digit otherwise.

Panel 8: Venture capital investment data from PCRI

	N	Mean	Median	S.d.	Min	Max
Monthly						
Early stage VC investment in Chinese portfolio companies (nominal mill USD)	238	683	268	1218	0	8008
Later stage VC investment in Chinese portfolio companies (nominal mill USD)	240	726	354	1034	0	6881
VC investment by China-located General Partners (nominal mill USD)	240	70	0	222	0	2051
Early stage VC investment in Chinese portfolio companies (real mill 2010 RMB)	233	3774	2014	5267	0	35638
Later stage VC investment in Chinese portfolio companies (real mill 2010 RMB)	234	4812	2409	6241	0	37198
Early stage VC investment in rest-of-world portfolio companies (nominal mill USD)	240	8813	6492	6791	1095	40536
Later stage VC investment in rest-of-world portfolio companies (nominal mill USD)	240	12585	9023	11876	1559	100000
Weekly						
Early stage VC investment in Chinese portfolio companies (nominal mill USD)	958	74	201	4	0	2343
Later stage VC investment in Chinese portfolio companies (nominal mill USD)	960	181	400	43	0	4925
VC investment by China-located General Partners (nominal mill USD)	960	112	3137	0	0	97195
Early stage VC investment in Chinese portfolio companies (real mill 2010 RMB)	935	415	1123	30	0	13048
Later stage VC investment in Chinese portfolio companies (real mill 2010 RMB)	936	1203	2453	342	0	26595
Early stage VC investment in rest-of-world portfolio companies (nominal mill USD)	960	1017	1288	667	19	21872
Later stage VC investment in rest-of-world portfolio companies (nominal mill USD)	960	3146	3690	2227	60	52327

Note: This panel contains summary statistics of the venture capital data from the Private Capital Research Institute (PCRI) used to analyze the suspensions' effect on contemporaneous Chinese VC investment. Rounded to nearest whole number.

Panel 9: Monthly venture capital investment data from pedata.cn & SDC

	N	Mean	Median	S.d.	Min	Max
Data from pedata.cn						
Number of early stage VC deals in Chinese portfolio companies	127	52.4	30	47.6	3	240
Number of later stage VC deals in Chinese portfolio companies	127	90.9	80	56.6	3	342
Number of VC deals in Chinese portfolio companies by GPs located in mainland China	127	151.7	144	120.5	1	536
Number of VC deals by top US VCs in mainland Chinese portfolio companies	127	12.6	10	9.3	0	51
Data from ThompsonOne VentureXpert						
Number of VC deals by top US VCs in US companies(see panel 8)	226	63.5	62	21.2	19	137

Note: This panel contains summary statistics of the venture capital data used to analyze the suspensions' effect on contemporaneous Chinese VC investment. Sources of data are pedata.cn, which begins in 2005, and SDC ThompsonOne VentureXpert. "Top" US VCs are the members of the Preqin top 30 IRR/Multiple lists during the sample period that have more 2 or more investments in China.

Panel 10: "Elite" US VCs Active in China

Firm Name	# Investments in Chinese portfolio companies 2005-2015 (from pedata.cn)
Accel	5
Benchmark Capital	2
Charles River Ventures	3
Draper Fisher Jurvetson (DFJ)	83
Founders Fund	3
General Catalyst	7
Google Ventures	5
Greylock Partners	3
IDG Capital	559
Kleiner Perkins Caufield Byers (KPCB)	139
Matrix Partners	228
New Enterprise Associates (NEA)	39
Sequoia	513
Venrock	10

Note: This panel contains the list of venture capital (VC) firms that form the "Top" US VCs group. They are the members of the Preqin top 30 IRR/Multiple lists during the sample period that have more 2 or more investments in China.

Table 2: T-tests for difference of means by delay status

	Low Delay			High Delay						
	N	Mean	S.d.	N	Mean	S.d.	Diff†	2-tailed p-value	p-value (lower)	p-value (upper)
Invention patent applications...										
ever before approval year	171	12.0	49.0	170	18.0	44.7	-6.08	0.23	0.12	0.88
ever before approval year and ultimately granted	171	8.02	35.5	170	12.4	29.9	-4.33	0.22	0.11	0.89
ever before approval year and ultimately rejected	171	3.94	14.3	170	5.69	17.1	-1.75	0.30	0.15	0.85
Utility and design granted patent applications ever before approval year	171	17.8	63.9	170	38.1	157.4	-20.3	0.12	0.06	0.94
Market cap at listing	205	521	2341	216	365	1408	155	0.41	0.80	0.20
IPO proceeds	205	213	827	216	144	526	68.5	0.31	0.85	0.15
Company age at listing	205	10.02	4.96	216	10.90	5.00	-0.88	0.07	0.04	0.96
CEO at listing is founder	205	0.67	0.47	216	0.67	0.47	0.01	0.89	0.56	0.44
CEO change in 3 years before IPO	205	0.17	0.37	216	0.19	0.39	-0.02	0.52	0.26	0.74
IPO underpricing	198	-0.76	0.10	207	-0.79	0.059	0.039	0.00	0.99	0.00
Financials 2 years prior to IPO year										
Total investment	189	0.18	0.20	194	0.17	0.42	0.02	0.64	0.68	0.32
Return on sales	204	0.17	0.12	214	0.16	0.12	0.01	0.62	0.69	0.31
Revenue	202	5329	40612	211	2080	11987	3249	0.27	0.87	0.13
Earnings	204	880	9397	214	210	723	670	0.30	0.85	0.15
Leverage	203	2.01	5.60	214	1.26	1.16	0.75	0.06	0.97	0.03

Note: This table summarizes t-tests for differences of means across low and high delay for pre-IPO approval year patent applications, and firm characteristics at IPO. Delay is separated at the median of 4 months.

Table 3: Effect of delay on invention patent applications

Panel 1: IPO Year

Dependent variable: # invention patent apps in IPO year

		OLS	High delay	Role of VC†	IV for delay w/ approval date**
	(1)	(2)	(3)	(4)	(5)
Delay (months)	-.093***	-.69***		-.082**	-.24**
	(.031)	(.25)		(.035)	(.12)
Delay $\in$ 25-75 pctile*			-.53***		
			(.18)		
Delay >75 pctile			-.76*		
			(.42)		
Delay (months)·VC-backed				-.024	
				(.026)	
VC-backed	.34	.74	.3	.54**	.19
	(.21)	(1.2)	(.23)	(.22)	(.19)
Controls	Y		Y	Y	N
Industry f.e.	Y		Y	Y	N
Year f.e.	Y		Y	Y	Y
N	341	341	341	341	341
pseudo-R^2	0.064	.18	0.064	0.062	-
First stage F-test$^{\pm}$					69

Note: This table contains regression estimates using negative binomial variants of of Equation 1. Sample limited to firms approved in the 12 months prior to an IPO suspension. †SOEs excluded. *The 75th percentile of delay is 12.8 months. Controls are total investment that year, age, market cap, IPO proceeds, pre-listing granted inv. patents, and indicators for being state-owned, VC-backed, and the exchange (SH/SZ). $^{\pm}$The F-statistic for the excluded instrument (delay) being significantly different from zero. Errors clustered by industry-quarter. ** The exponential conditional mean model with endogenous variables, implemented in Stata with ivpoisson; while there is no direct weak instrument test, we use the F-statistic from the first stage since the reduced form for the endogenous explanatory variable is linear. *** indicates p-value<.01.

Panel 2: Ever after IPO approval

Dependent variable: # invention patent applications in month

		Delay demeaned‡	Negative binomial	IV for delay w/ approval date	Role of VC†	Role of IPO
	(1)	(2)	(3)	(4)	(5)	(6)
Delay thus far (months)	-.036***	-.074***	-.29***	-1.7**	-.048	-.04***
	(.0095)	(.027)	(.04)	(.71)	(.039)	(.013)
Delay thus far (months)^2		.0017*	.0057***		-.00065	
		(.00086)	(.0014)		(.0015)	
Post-IPO	-.37***	-.51***	-2.3***	-14**	-.45**	-.31**
	(.14)	(.18)	(.26)	(6.3)	(.21)	(.16)
Delay thus far (months)·VC-backed					-.097**	
					(.048)	
VC-backed	.33	.33	.15	.47	.6***	.29
	(.35)	(.35)	(.21)	(.41)	(.18)	(.36)
Delay total						-.18
						(.15)
Post-IPO·Delay total						-.0076
						(.013)
Controls	Y	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y	Y
Listing year f.e.	N	N	N	Y	Y	N
Listing quarter f.e.	Y	Y	Y	N	N	Y
N	27224	27224	27224	27224	27224	27224
R^2	.057	.058	.063	-	.045	.058
			(pseudo)			
First stage F-test±				293		

Note: This table contains regression estimates of months so far of delay and delay total on patent applications ever after IPO approval, including after IPO. We use variants of Equation 2. OLS except column 3. Sample limited to firms approved in the 12 months prior to an IPO suspension. ‡Delay is demeaned to better understand the non-linearity; this shows that patent applications are downward sloping and convex in delay. †State-owned enterprises (SOEs) omitted. Controls are total investment that year, age, market cap, IPO proceeds, pre-listing granted inv. patents, and indicators for being state-owned, VC-backed, and the exchange (SH/SZ). ±F-statistic for the excluded instrument (delay) being significantly different from zero. Errors clustered by firm, except in column 6 where we use two-way firm and listing quarter clusters. *** indicates p-value<.01.

Panel 4: Robustness checks in approval year

Dependent variable: # invention patent applications in approval year

Sample:	Listed year after end of suspension	Approved in 6 mo. before IPO suspension	All	Shenzhen only	2012-14 suspension only
	(1)	(2)	(3)	(4)	(5)
Delay (months)	-.18**	-.39***	-.5***	-.39**	-.52**
	(.083)	(.12)	(.19)	(.19)	(.21)
Controls	Y	Y	N	Y	Y
Industry f.e.	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y
N	430	171	341	301	180
R^2	.14	.16	.08	.13	.12

Panel 5: Robustness checks on subsamples

Dependent variable:	# invention patent applications in approval year		# granted invention patent apps year before approval	Excluding 2008-09 suspension
Sample:	High-tech	Not high-tech	All	All
	(6)	(7)	(8)	(9)
Delay (months)	-.55**	-.37**	.041	-.47**
	(.26)	(.14)	(.029)	(.19)
Controls	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y
N	134	203	341	235
R^2	.14	.23	.1	.16

Note: This table contains regression estimates using variants of Equation 1. Controls are pre-listing year successful invention patent applications, investment (PPE) in listing year, age, market cap, IPO proceeds, and indicators for being state-owned, VC-backed, and the exchange (SH/SZ). Errors clustered by industry-quarter. *** indicates p-value$<$.01.

Table 4: Effect of suspension-induced IPO delay on governance

Dependent variable:	Change between years 1 and 2 after IPO in...						Days to CEO stock option plan		
	...CEO salary			...CFO salary	...All manager salaries‡	...Total payroll		IV for delay w/ approval date	Role of VC†
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Delay (months)	8.5**	8*	8.9**	.1	7.8	-25	32**	128**	26*
	(4.2)	(4.1)	(4.3)	(3.3)	(16)	(27)	(14)	(55)	(14)
Delay·VC-backed		3.7							13
		(4.8)							(29)
VC-backed		-24					-486***		-584***
		(55)					(125)		(183)
Delay·Foreign VC			-30*						
			(17)						
Delay·Govt VC			-2						
			(9.7)						
Delay·Priv Chinese VC			8.6						
			(9.7)						
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y	Y	N	N	N
Year f.e.	Y	Y	Y	Y	Y	Y	N	N	N
N	402	402	402	384	412	414	75	75	75
R^2	.17	.17	.18	.69	.35	.19	.21	-	.22
First stage F-test								13.7	

Note: This table contains regression estimates using variants of Equation 1. Sample limited to firms approved in the 12 months prior to an IPO suspension. ‡Includes supervisors (i.e. broader than top level executives). † State-owned enterprises (SOEs) omitted. Controls are pre-listing year successful invention patent applications, investment (PPE) in listing year, age, market cap, IPO proceeds, and indicators for being state-owned, VC-backed, and the exchange (SH/SZ). Individual foreign, gov't and private Chinese VC backing effects are included in column 3 but not reported. Errors clustered by industry-quarter. *** indicates p-value<.01.

Table 5: Effect of delay mediated by CEO status on firm earnings

Dependent variable:	Earnings IPO year +1			Earnings IPO year +2		
	(1)	(2)	(3)	(4)	(5)	(6)
Delay (months)·Founder-as-CEO	-12***			-30**		
	(3.7)			(14)		
Delay (months)·CEO replaced in 3 yrs before IPO		-2.4			-.8	
		(3.9)			(17)	
Delay (months)·CEO replaced in year before IPO			-1.1			-10
			(4.8)			(20)
Delay (months)	7.4	3.5	3.2	15	7.3	9.3
	(6.5)	(6.3)	(6)	(20)	(16)	(17)
Founder-as-CEO	178***			337**		
	(64)			(155)		
CEO replaced in 3 yrs before IPO		-1.7			-31	
		(69)			(243)	
CEO replaced in year before IPO			-2.4			-.8
			(3.9)			(17)
Earnings in IPO year -1	.88***	.88***	.88***	.74***	.74***	.74***
	(.0017)	(.0017)	(.0015)	(.0038)	(.0035)	(.0035)
Controls	Y	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y
N	413	413	413	352	352	352
R^2	1	1	1	.99	.99	.99

Note: This table contains regression estimates using variants of Equation 1. Sample limited to firms approved in the 12 months prior to an IPO suspension. Earnings are net income. Founder-as-CEO is an indicator for the CEO at the time of IPO being a founder of the firm. Controls are pre-listing year successful invention patent applications, investment (PPE) in listing year, age, market cap, IPO proceeds, and indicators for being state-owned, VC-backed, and the exchange (SH/SZ). γ_t are listing year fixed effects. Errors clustered by industry-quarter. *** indicates p-value$<$.01.

Table 6: Effect of delay on CFO hiring

Dependent variable: 1 if hired CFO by year after IPO

				IV for delay w/ approval date	Role of VC†
Model:			OLS		
	(1)	(2)	(3)	(4)	(5)
Delay (months)	-.098*		-.013**	-.06*	-.19***
	(.056)		(.0064)	(.034)	(.055)
Delay >75 pctile		-1.9*			
		(1.1)			
Delay (months)·VC-backed					.079
					(.055)
VC-backed	.17	.23	-.00007	.043	-.75
	(.62)	(.6)	(.026)	(.26)	(.86)
Controls	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y
N	385	385	330	385	273
Pseudo-R^2	.2	.2	0.16 (R^2)	-	.29
First stage F-test$^{\pm}$				479	

Note: This table contains regression estimates using variants of Equation 1. Sample limited to firms approved in the 12 months prior to an IPO suspension. Model logit for CFO, and negative binomial for board, except where noted. †SOEs omitted. *The 75th percentile of delay is 12.8 months. Controls are total investment that year, age, market cap, IPO proceeds, pre-listing granted inv. patents, and indicators for being state-owned, VC-backed, and the exchange (SH/SZ). γ_t are listing year fixed effects. ‡Individual foreign, gov't and private VC effects included in columns 6-7 but not reported. $^{\pm}$To direct weak instrument test, but as reduced from for the endogenous explanatory variable is linear, we use the F-statistic from the first stage. Errors clustered by industry-quarter. *** indicates p-value$<$.01.

Table 7: Effect of suspension-induced IPO delay on uncertainty

Dependent variable:	Number of IPO co-managers in underwriting syndicate						Stock price volatility††		
		Negative binomial	High delay	IV for delay w/ approval date	Role of VC†			IV	Role of VC†
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Delay (months)	.04*	.025***		.069***	.053***	.042*	.0023***	.0054*	.0045*
	(.023)	(.008)		(.027)	(.015)	(.024)	(.00085)	(.003)	(.0026)
Delay >75 pctile*			.92*						-.00087
			(.51)						(.00058)
Delay (months)·VC-backed					-.0077		.0037	.0052	.014
					(.0053)		(.0058)	(.0056)	(.01)
Delay >75 pctile·VC-backed									
VC-backed	.15	.13	.14	.16	-.01				
	(.22)	(.13)	(.22)	(.21)	(.083)				
Delay (mo)·Foreign VC‡						-.053**			
						(.024)			
Delay (mo)·Govt VC						-.014			
						(.024)			
Delay (mo)·Private Chinese VC						-.021			
						(.02)			
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	414	414	414	414	330	414	418	418	331
R^2	.58	.23 (pseudo)	.58	.58	.82	.58	.44	.42	.52
First stage F-test±				467				482	

Note: This table contains regression estimates using variants of Equation 1. The model is OLS except in column 2. Sample limited to firms approved in the 12 months prior to an IPO suspension.††Standard deviation of first 100 days' returns after IPO. †SOEs omitted. *The 75th percentile of delay is 12.8 months. Controls are pre-listing year successful invention patent applications, total investment that year, age, market cap, IPO proceeds, and indicators for being state-owned, VC-backed, and the exchange (SH/SZ). ‡Individual foreign, gov't and private Chinese VC backing effects are included in column 6 but not reported. ±The F-statistic for the excluded instrument (delay) being significantly different from zero. Errors clustered by industry-quarter. *** indicates p-value<.01.

Table 8: Effect of suspension-induced IPO delay on performance

Dependent variable†:	First day price/book			Price/book 2nd year after IPO		PPE investment		
						2nd year after IPO		3rd year after IPO
		Role of VC†						Role of VC†
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Delay (months)	-.28**	-.24***		-.024		-.003***	-.003***	-.0018*
	(.11)	(.066)		(.031)		(.00083)	(.00082)	(.001)
VC-backed	.74	.11	.72	-.22	-.22	-.0034	-.0066	.006
	(.87)	(1.4)	(.91)	(.25)	(.25)	(.0085)	(.01)	(.0063)
Delay (months)·VC-backed		-.0041					.00039	
		(.089)					(.00079)	
Delay ∈ 25-75 pctile*			-1.5		.067			
			(1.3)		(.43)			
Delay >75 pctile			-6.2***		-.94**			
			(2)		(.44)			
2 dependent variable lags	N	N	N	N	N	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y	Y	Y
N	415	415	328	410	410	384	384	380
R^2	.7	.7	.43	.52	.52	.22	.22	.18

Note: This table contains regression estimates using variants of Equation 1. The sample is restricted to firms approved within the year (365 days) prior to suspension announcement (2004-2015). Controls are pre-listing year successful invention patent applications, investment (PPE) in listing year, age, market cap, IPO proceeds (except in columns 3-4), and indicators for being state-owned, VC-backed, and the exchange (SH/SZ). γ_t are listing year fixed effects. †SOEs omitted. Errors clustered by industry-quarter. *** indicates p-value<.01.

Table 9: IPO Suspensions and Contemporaneous VC Investment

Panel 1: Early Stage VC Investment

Dependent variable: Weekly early stage VC investment in Chinese portfolio companies*

						Excluding 2009 suspension	
Standard error model:		Newey-West		Robust		NW	Robust
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
IPO suspension in effect	-67***	-26	-25	-26*	-25*	-27	-27*
	(18)	(17)	(15)	(15)	(14)	(20)	(16)
Shenzhen index†		.37***		.37***		.37***	.37***
		(.061)		(.054)		(.062)	(.054)
Shanghai index†		-.084***		-.084***		-.084***	-.084***
		(.02)		(.019)		(.021)	(.019)
China index††			.11***		.11***		
			(.022)		(.014)		
VC inv. rest of world‡		-.0034	-.0016	-.0034*	-.0016	-.0044	-.0044*
		(.0024)	(.0026)	(.0021)	(.0023)	(.0028)	(.0024)
N	960	860	915	860	915	820	820
R^2	.0053	.12	.066	.12	.066	.12	.12

Panel 2: Later Stage VC Investment

Dependent variable: Weekly later stage VC investment in Chinese portfolio companies*

						Excluding 2009 suspension	
Standard error model:		Newey-West		Robust		NW	Robust
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
IPO suspension in effect	-111***	-56**	-53***	-56***	-53***	-64**	-64***
	(23)	(24)	(20)	(17)	(15)	(28)	(19)
Shenzhen index†		.45***		.45***		.46***	.46***
		(.093)		(.095)		(.094)	(.096)
Shanghai index†		-.038		-.038		-.04	-.04
		(.028)		(.03)		(.029)	(.03)
China index††			.22***		.22***		
			(.032)		(.029)		
VC inv. rest of world‡		-.0014	.0005	-.0014	.0005	-.00079	-.00079
		(.0072)	(.0063)	(.0076)	(.0067)	(.0093)	(.0099)
N	960	860	915	860	915	820	820
R^2	.012	.2	.17	.2	.17	.2	.2

Note: This table shows OLS estimates of the relationship between VC investment and IPO suspensions, using variants of: $VC_m = \alpha + \beta_1 (1 \mid IPO\ Suspension_m) + X_m + \varepsilon_m$. *Data from PCRI; nominal USD value of early stage VC investment in mainland China companies. †Monthly average of daily closing price for Shenzhen/Shanghai composite. ††Monthly overall China market index. ‡Monthly VC investment in all portfolio companies located outside of China (source: PCRI). Newey-West standard errors, with optimal lag of 4 (identified using lag order selection statistics via Stata's varsoc command). *** indicates p-value<.01.

Table 10: Effect of suspension-induced IPO delay on capital structure

Dependent variable (in year following IPO):	Leverage		Total Investment		IPO Proceeds		Cash/Assets		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Delay (months)	.001	.0018	-.001	-.0021	-1.4	-1.1	-.0048		-.0053***
	(.0048)	(.0049)	(.0036)	(.0033)	(2.9)	(3)	(.0033)		(.0011)
VC-backed	.00026	.039	-.015	-.062	-6	8.4	.017	.018	.058**
	(.037)	(.055)	(.032)	(.044)	(13)	(18)	(.017)	(.018)	(.025)
Delay (months)·VC-backed		-.0048		.006		-1.8			-.0017
		(.0041)		(.0047)		(1.6)			(.0028)
Delay $\in$ 25-75 pctile*								.0012	
								(.025)	
Delay >75 pctile								-.1**	
								(.05)	
2 dependent variable lags	Y	Y	Y	Y	N	N	N	N	N
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	415	415	328	328	418	418	414	414	414
R^2	.7	.7	.43	.44	.95	.95	.35	.16	.37

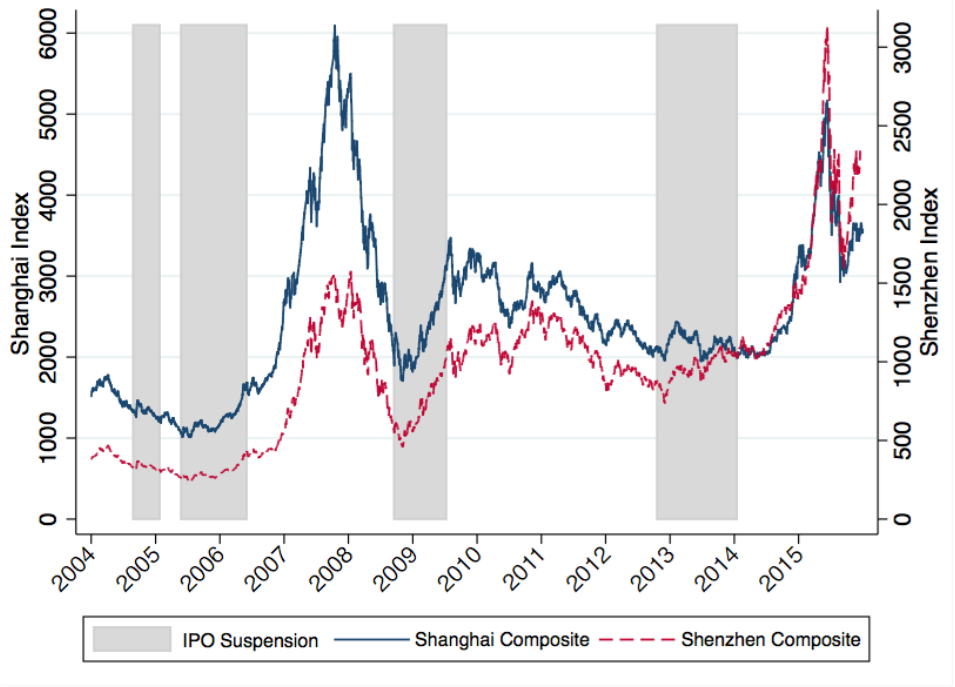
Note: This table contains regression estimates using variants of Equation 1. The sample is restricted to firms approved within the year (365 days) prior to suspension announcement (2004-2015). Controls are pre-listing year successful invention patent applications, investment (PPE) in listing year, age, market cap, IPO proceeds (except in columns 3-4), and indicators for being state-owned, VC-backed, and the exchange (SH/SZ). *** indicates p-value<.01.

Table 11: Effect of suspension-induced IPO delay on accruals and board

Dependent variable:	Discretionary accruals in year after IPO†			# independent board members in year after IPO		
	(1)	(2)	(3)	(4)	(5)	(6)
Delay (months)	-.0038***		-.0041***	-.0041		-.0034
	-0.0012		-0.0012	(.0054)		(.0051)
Delay ∈ 25-75 pctile*		-.012			.0073	
		(.017)			(.033)	
Delay >75 pctile		-.06*			-.0013	
		-0.032			(.061)	
Delay (months)·VC-backed			0.0014			-.0038
			-0.0012			(.0028)
VC-backed	-0.0069	-0.0066	-0.02	.051*	.053*	.083*
	-0.011	-0.01	-0.017	(.029)	(.029)	(.045)
Controls	Y	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y
N	304	304	304	418	418	418
R^2 / Pseudo-R^2	0.25	0.24	0.25	0.012	0.012	0.012

Note: This table contains regression estimates using variants of Equation 1. Sample limited to firms approved in the 12 months prior to an IPO suspension. Model logit for CFO, and negative binomial for board, except where noted. †Discretionary accruals calculated using a matched Jones model with intercept; results similar with alternative measures, including non-matched and without intercept. *The 75th percentile of delay is 12.8 months. Controls are total investment that year, age, market cap, IPO proceeds, pre-listing granted inv. patents, and indicators for being state-owned, VC-backed, and the exchange (SH/SZ). For columns 1-3, we also include 2 lags of discretionary accruals. γ_t are listing year fixed effects. ‡Individual foreign, gov't and private VC effects included in columns 6-7 but not reported. ±To direct weak instrument test, but as reduced from for the endogenous explanatory variable is linear, we use the F-statistic from the first stage. Errors clustered by industry-quarter. *** indicates p-value<.01.

Figure 1: Shanghai and Shenzhen Composite Indices (Daily 2004-2015)



Note: This figure shows the daily Shanghai and Shenzhen composite indices daily close (SHCOMP:IND and SZCOMP:IND in Bloomberg, respectively).

Figure 2: China IPO approval dates & delay between approval and listing

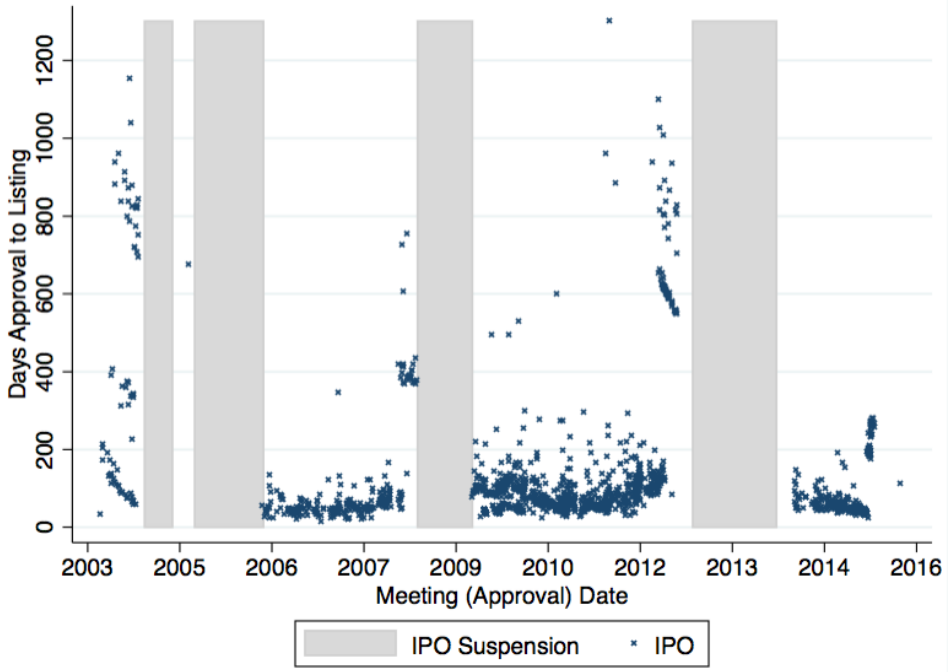
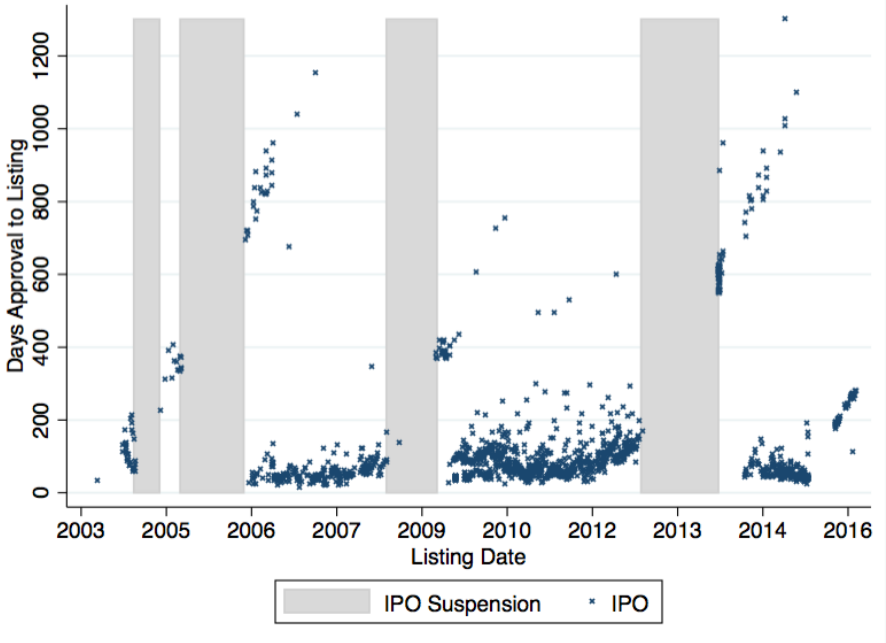


Figure 3: China IPO listing dates & delay between approval and listing



Note: Each point in the above figures is a unique IPO. All IPOs on Shanghai and Shenzhen exchanges included. Periods in which the government suspended IPO activity shaded.

Figure 4: China IPO approval dates & delay between approval and listing (if approved within one year before the start of an IPO suspension)

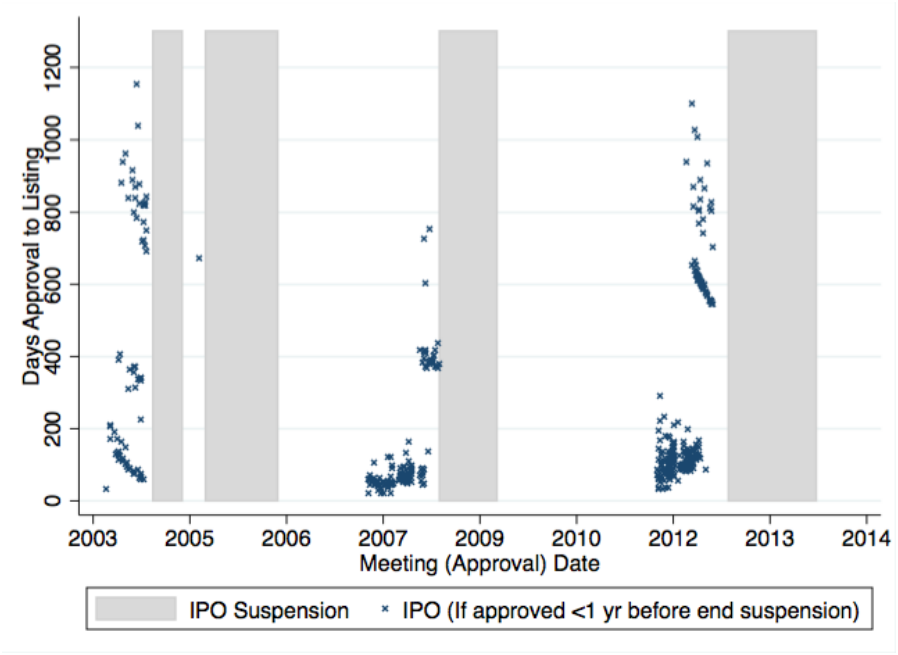
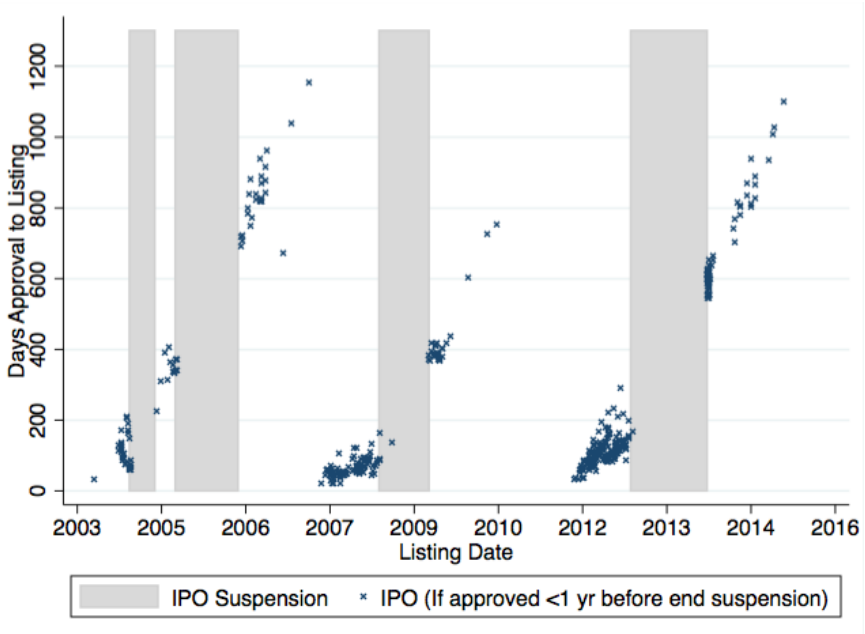


Figure 5: China IPO listing dates & delay between approval and listing (if approved within one year before the start of an IPO suspension)



Note: Each point in the above figures is a unique IPO. All IPOs on Shanghai and Shenzhen exchanges included. Periods in which the government suspended IPO activity shaded.

Figure 6: Long term effect of delay on invention patent applications

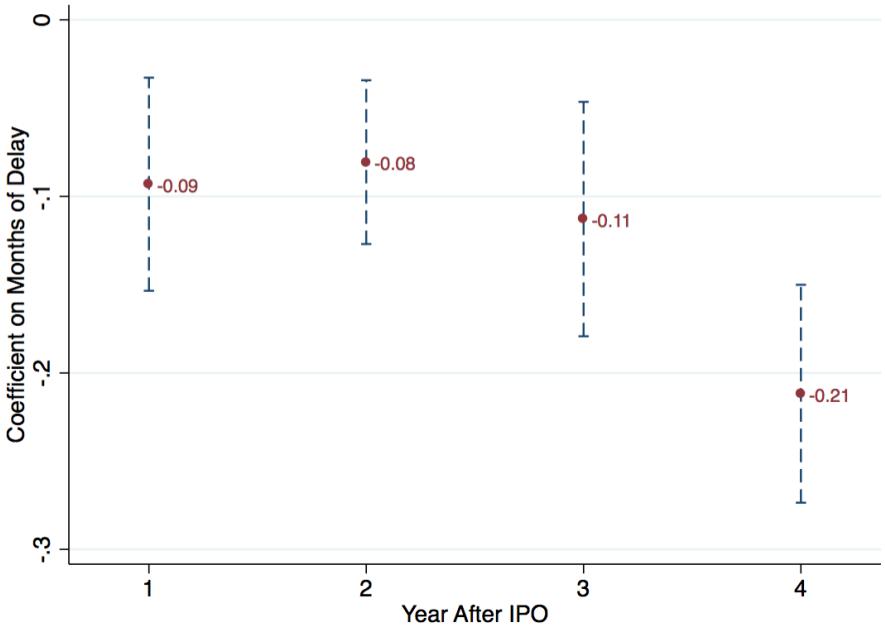
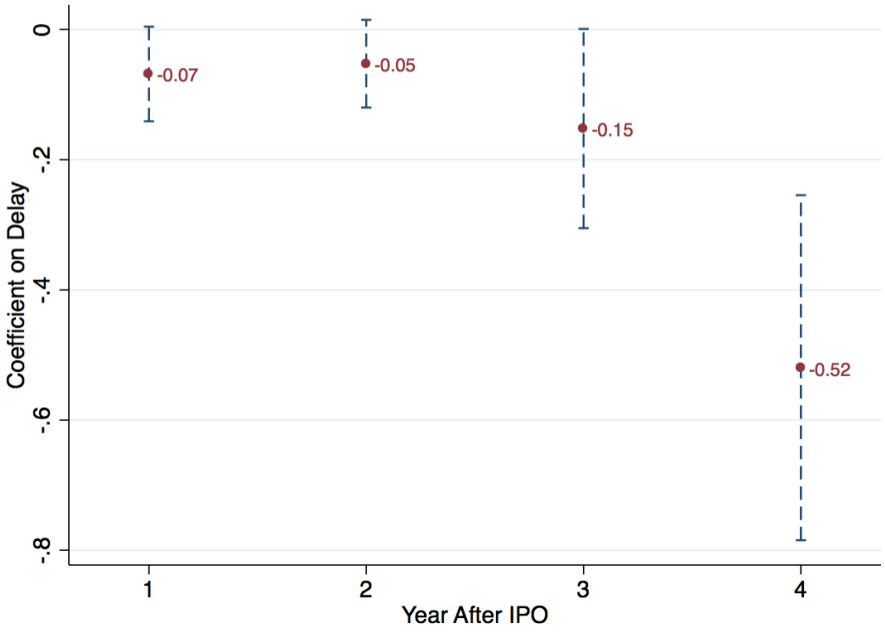


Figure 7: Long term effect of delay on granted invention patent applications



Note: The figures above show the coefficients from regressing invention and granted invention patent applications in a give year after IPO on months of delay between approval and IPO. The specification is Equation 1.

Figure 8: Long term effect of delay on rejected invention patent applications

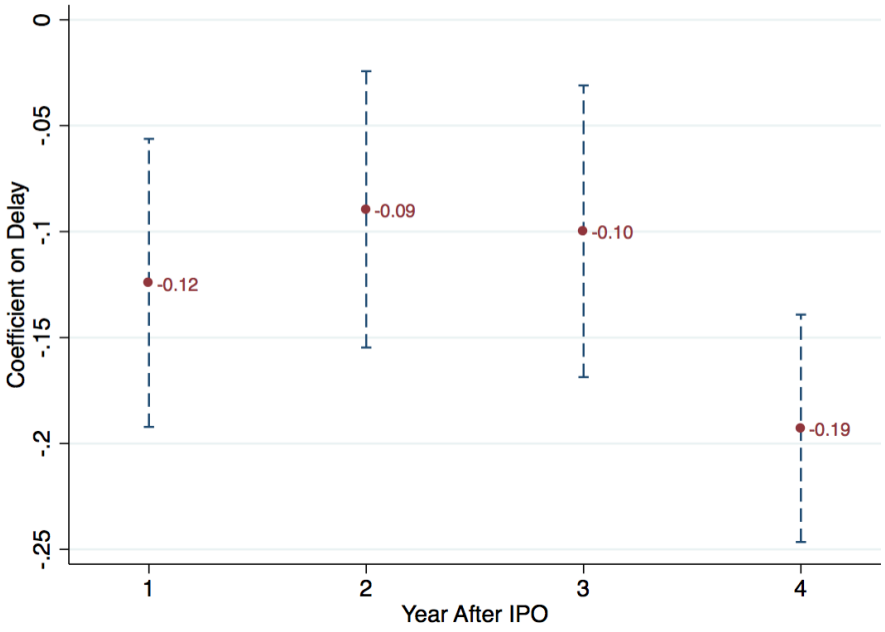
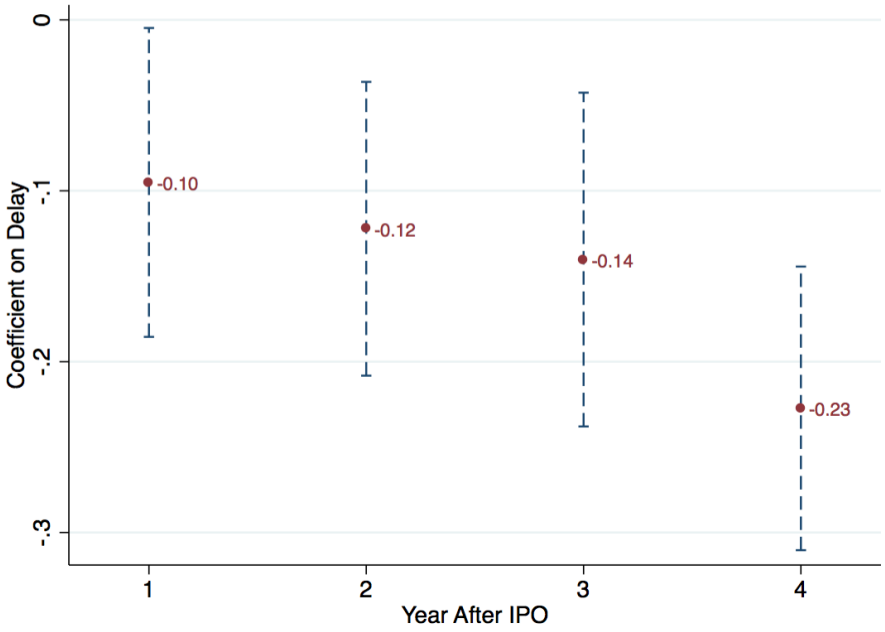
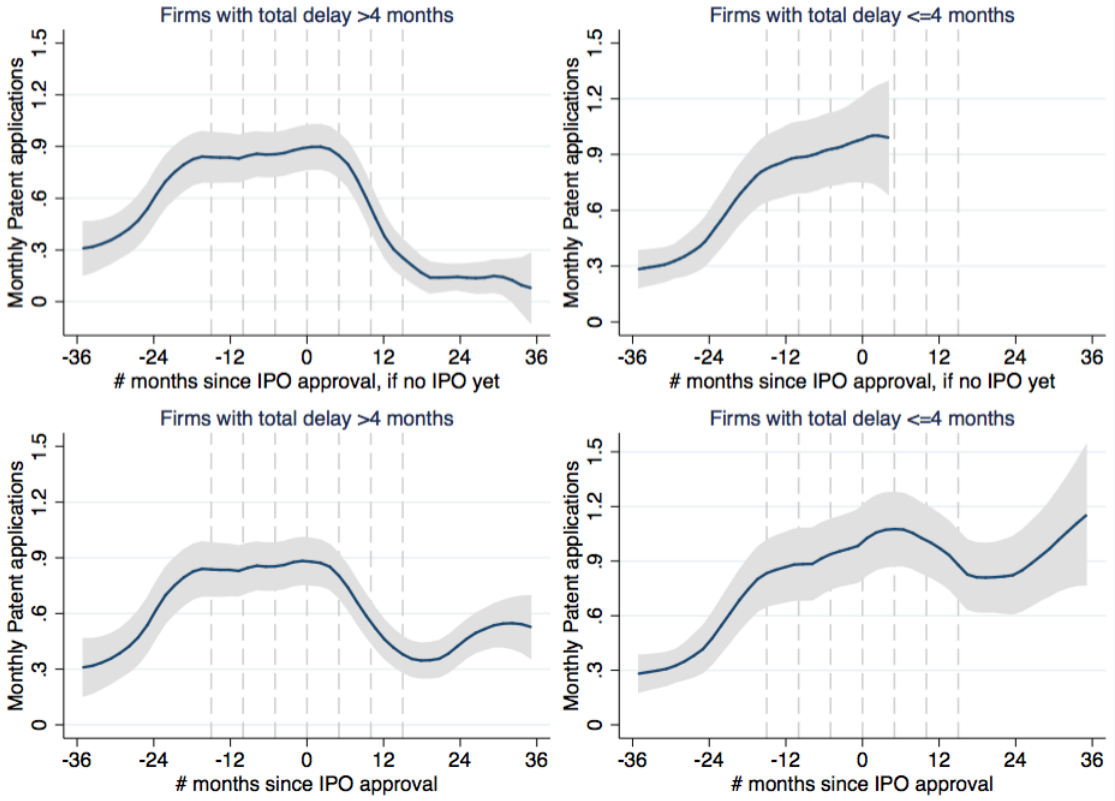


Figure 9: Long term effect of delay on design and utility patent applications



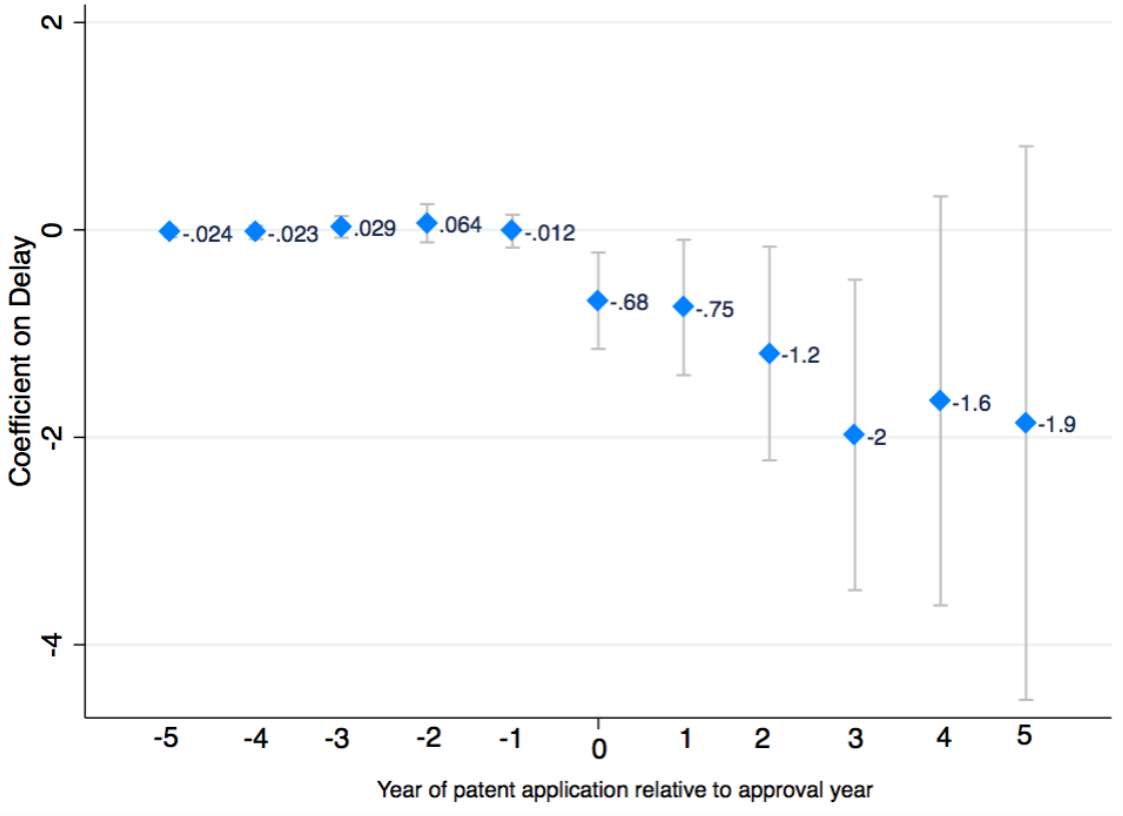
Note: The figures above show the coefficients from regressing rejected invention and design and utility patent applications in a give year after IPO on months of delay between approval and IPO. The specification is Equation 1.

Figure 10: Average monthly invention patent applications around IPO approval



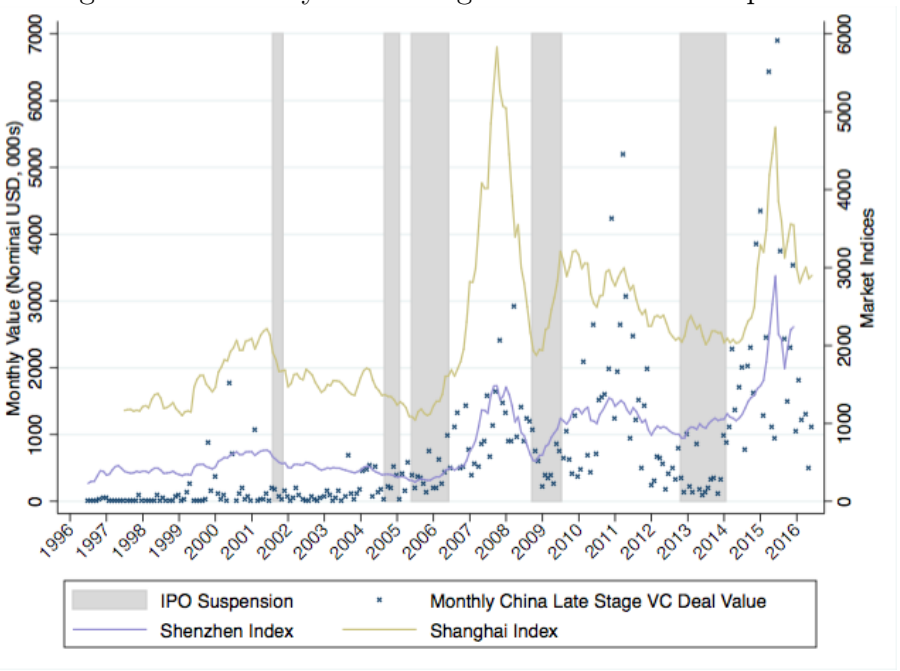
Note: This figure shows invention patent applications by the month around the committee approval date. We sort firm-months around the month that a firm was approved to IPO, within the sample of 425 firms that were approved in the year prior to an IPO suspension announcement (our primary estimation sample). Note that in the top graphs, firms drop out of the sample as they list, and all firms are included at month zero and before. In the bottom graphs, all firms have delay of more than 4 months, but in any given month since IPO approval after the 4th month, some will have listed and some not. We use a local polynomial with Epanechnikov kernel using Stata's optimal bandwidth; 95% confidence intervals shown.

Figure 11: Long term effect of delay on invention patent applications (around IPO approval)



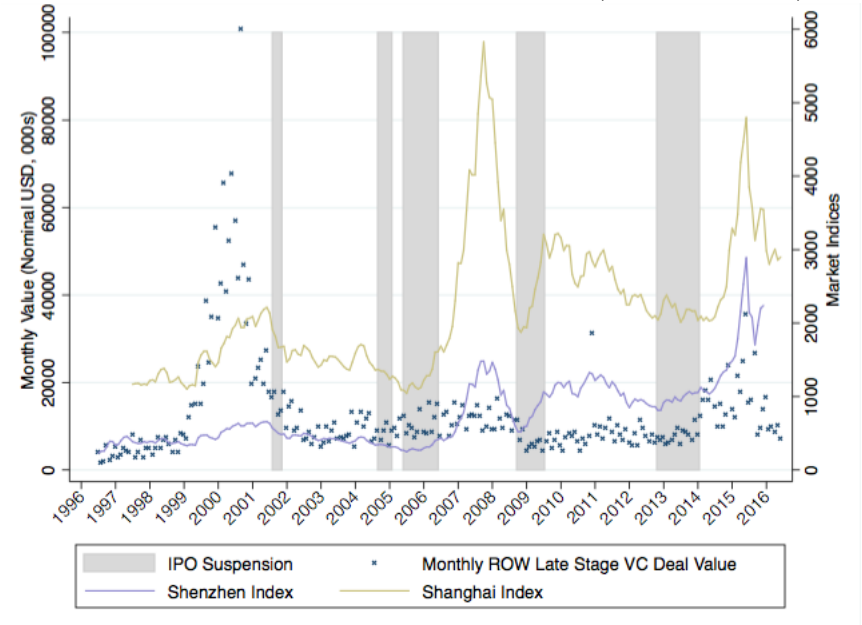
Note: This figure shows the coefficients on months of delay between approval and IPO on invention patent applications by year around the committee meeting (approval) date. Estimating the effect of delay prior to the approval is a placebo test; the patent filings prior to approval precede the delay, so there should be no effect. The year "0" indicates that the model estimates the effect of delay on patent applications in the year in which the committee approved the IPO; "-1" is the effect of delay on patent applications filed the year prior to approval and "1" is the year after. The specification is Equation 1.

Figure 12: Monthly Later Stage VC to China Companies



Note: Each point is the monthly value of VC investments in China-based portfolio companies in nominal USD. Only growth/expansion stage VC investment included.

Figure 13: Monthly Later Stage VC to Non-China (Rest of World) Companies



Note: Each point is the monthly value of VC investments in China-based portfolio companies in nominal USD. Only growth/expansion stage VC investment included.