The Impact of Delay in Going Public: Evidence from China*

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Abstract

Chinese securities regulators have suspended IPO activity on numerous occasions, often as a response to bearish markets. The suspensions were unexpected and of uncertain duration, lasting up to fifteen months. We examine the effect of indeterminate listing delay among firms already approved to IPO. We find that suspension-induced delay has strong, immediate negative effects on patent applications and fixed tangible investment. After listing, these effects endure and are accompanied by a lower market-to-book ratio, higher stock price volatility, and larger increases in CEO pay. The results suggest that by increasing uncertainty and reducing access to capital, disruptions to the IPO process chill investment in innovative and risky projects.

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1 Introduction

The effect of going public on firm outcomes is an important question in empirical corporate finance. The literature has examined how IPOs affect the private benefits of control (Doidge et al. 2009), innovation (Bernstein 2015, Acharya & Xu 2017), investment (Pagano et al. 1998, Asker, Farre-Mensa & Ljungqvist 2014, Gilje & Taillard 2016), profitability (Pástor, Taylor & Veronesi 2009), and product markets (Chemmanur, He & Nandy 2009), among other topics. In many cases, researchers compare public firms with observably similar private firms. Bernstein (2015) compares firms that withdrew their IPO registrations because of poor market conditions with firms that conducted IPOs in better times. The literature has faced a twofold challenge using data from the U.S. and other developed markets. First, IPO timing is usually highly endogenous to firm and market conditions. Second, public markets are continually available at least in theory to essentially all large firms, which choose whether not to partake.

This paper takes a novel approach to identifying the effect of access to public markets. Specifically, we examine the effect of IPO delay among firms that ultimately go public. Two facets of the IPO system in China offer identification through listing delay that is exogenous to firm-specific factors. First, firms in China have little ability to time the IPO market. IPO approval takes multiple years in normal, non-suspension times, and once approved, firms wait between three and four months to list. Second, regulators suspended all IPO activity on four occasions between 2004 and 2014, stranding a group of approved firms. While related to the state of the market (see Figure 1), the suspensions were not scheduled, and are widely viewed as unexpected. Affected firms faced a longer time between approval and listing as well as greater uncertainty about when they would list.

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. Because IPOs are rationed into

the market during normal times, after a suspension delayed firms often had substantially longer delays than the suspension lengths of between six and fifteen months. We have strong evidence that suspension-induced delay between approval and listing is reasonably exogenous to firm-specific factors. We verify this for the final suspension, when the queue was observable, and we show that our main results are robust to instrumenting for delay with the approval date. Thus the suspensions provide quasi-experimental variation in access to public capital.

We first 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 and firm variables such as state ownership, size, and industry. Our main conclusions are drawn from models that compare public firms that were approved to IPO around the same time, but experienced varying suspension-induced delay prior to listing. We also compare public firms that listed around the same time, but experienced varying delay. Finally, we consider the effect of delay on firms during the delay period, but caution that these results reflect comparing public and private firms that were approved around the same time.

We have three main findings. First, delay negatively affects patent applications. Patent data are often used to measure innovation. In a related paper, Bernstein (2015) finds that going public reduces patent citations, a measure of innovation quality. He finds no effect of going public on the number of patents, which is often used to measure innovation quantity. We focus on patents as a proxy for innovation effort. Applying for a patent is also an act of disclosure, reflecting the firm's intent to codify and commercialize its technology. We find that the negative effect of delay on patent applications 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. 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. We find similar effects within granted and rejected patent applications, and across state-owned and private firms.

Second, we find strong negative effects on plant, property and equipment (PPE) investment, both during the delay period and after IPO. This represents investment in illiquid, tangible, fixed assets. (We do not examine R&D investment because coverage is inadequate and the data quality is questionable.) Delay also leads to a lower price to book ratio, suggesting that it reduces the firm's growth prospects (assets-in-place do not grow more for delayed firms).[1] These suggest that delay reduces value-creating investment.

Third, we find that delay increases measures associated with market uncertainty about the firm, suggesting that beyond the effect of simply delaying access to public capital, uncertainty about the timing of access is costly. It leads to higher stock price volatility after listing. It also is associated with more co-managers being added to the underwriting syndicate, consistent with greater information needs about the firm. Further, delayed firms tend to increase their CEO's salary between the IPO year and the following year. This may reflect firms having to pay the CEO more for having undergone a period of uncertainty about the firm and his own windfall.[2]

There is no effect of delay on post-IPO leverage, cash, earnings, or employment. This may reflect the fact that firms going public on the main Chinese exchanges are relatively mature and profitable, because of regulatory listing requirements. Supporting this hypothesis, delayed firms with pressing capital needs seem likely to have gone public in Hong Kong or elsewhere. In fact, none of the 425 firms in our primary estimation sample went public abroad. Essentially all waited for the suspension to end.

In sum, we show that listing delay has pernicious effects on the quantity of innovation effort and on illiquid investment. This is evidence that public equity financing is especially important for funding innovative and risky projects. Firms may view such projects as marginal, but from a social perspective they may be the firm's most valuable investment, for example through knowledge spillovers (Bloom et al. 2013, Greenstone et al. 2008, Jones

[1] Given China's extreme underpricing, which appears to have regulatory and behavioral explanations, we do not use underpricing in a formal test.

[2] The effects of delay that we observe do not seem related to corporate governance. We find no effects on board-related measures, and we find that delay is associated with fewer discretionary accruals, suggesting if anything less window dressing and perhaps better governance among the delayed firms.

& Williams 1998).

Our results complement Brown, Fazzari & Petersen (2009) and Acharya & Xu (2017). The former argue that increased equity financing drove the U.S. R&D boom of the late 1990s. With panel data on public U.S. firms, they regress R&D spending on new stock issues and controls. They use lagged new stock issues as instruments for contemporaneous ones. Acharya & Xu (2017) match private and public U.S. firms. They find that industries whose firms tend to be more dependent on external finance are more innovative. Our approach differs substantially. First, we focus on the extensive margin of access to public markets. Second, we use a quasi-experimental approach. Third, we begin by examining the effect of access to public markets on a wide array of potentially relevant outcomes, and conclude that investment in innovative, risky projects is the dimension most affected.

Our results may initially appear to contrast with Bernstein (2015), who finds that innovation quality (number of citations) declines after IPO, while quantity (number of patents) is unaffected. We find that delay in access to public markets negatively affects innovation quantity. Quantity is unaffected in Bernstein's data perhaps because the more mature private equity sector in the U.S. adequately funds innovation before the IPO. Bernstein argues that the more subtle mechanism of managerial agency problems explains the decline in innovation quality after IPO.

An empirical concern is that because suspensions correlate with poor market conditions, the market rather than delay may explain the effects we observe. However, our main approach compares firms just after listing, controlling for the year of listing. The effect of delay is thus unlikely to be confounded by market conditions. Also, our main results are robust to using only the 2012-2014 suspension, which occurred under relatively stable market conditions, and to defining the sample as firms that listed in the year following the end of a suspension.

A second empirical concern is that politically connected firms are able to jump the queue and list first. After 2012, we can verify that this is not the case as the queue became

observable. More importantly, queue-jumping by politically connected or state-owned firms should bias our results against finding a detrimental effect of delay. There is abundant literature showing that politically connected Chinese firms underperform, including Fan et al. (2007), Dollar & Wei (2007), Chen et al. (2016), Whited & Zhao (2016), and Piotroski & Zhang (2014). If these firms have less delay because they jump the queue, it is even more striking to find that delay leads to underperformance.

An implicit assumption in our conclusion is that the suspensions created uncertainty. While there was little doubt that eventually China would permit more IPOs, market participants did not know when the suspensions would end.[3] We also hypothesize that suspensions expected to be short-lived should not affect 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.

Private firm innovation is crucial to China's ongoing effort to shift growth away from low value-added exports and infrastructure investment. In focusing on China, we join a nascent empirical literature on China's financial markets, including Derrien et al. (2016), Chemmanur, Hu & Wu (2016), and Michaely & Qian (2017). Our findings reveal a dark side of government intervention in IPO markets. While we cannot speak to the overall welfare effects of the IPO suspensions, Packer et al. (2016) find no evidence that they stabilized the market, as regulators hoped.

While China's economic institutions are unique, there is growing evidence that its stock markets serve a similar purpose as those elsewhere; to finance new projects and to create liquidity for insiders. Since the early 2000s, Chinese private equity, patenting activity, and stock price informativeness have all borne increasing similarity to the U.S. and Europe

[3]We have anecdotal and industry press evidence that this was the case, presented in Section 2.

(Guo & Jiang 2013, Fang et al. 2016, Zhou et al. 2016, and Carpenter, Lu & Whitelaw 2016). Therefore, our findings may extend beyond China, providing new evidence about the importance of predictable public markets to value-creating investment, and thus contributing to the literature on the role of financial markets in economic development (Subrahmanyam & Titman 1999, King & Levine 1993, Rajan & Zingales 2001).

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). 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*a*). 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.

Privately owned firms have been instrumental to China's growth. Recognizing the importance of private firms, especially in technologically advanced industries, 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. They are increasingly turning to public equity.

In 1990, China 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. 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.

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.[4] 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.[5] This paper focuses on how public markets enable these private firms to access the resources they need to grow.

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. Ensuring "market stability" is one of the main objectives of China's IPO policy. The CSRC worries that investors

[4] 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.

[5] 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/).

substitute IPOs for existing listed stocks, and thus more IPOs will put downward pressure on incumbents' valuations. as Braun & Larrain (2008) document in 22 emerging markets. However, given that IPO activity in China is rather small relative to the total capitalization (even during the 2015 IPO boom, monthly issuance is at most 0.06% of total Shanghai and 0.14% of Shenzhen market capitalized values), there is no convincing evidence that IPO volume affect equity price movements (Packer et al. 2016).

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 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]

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

[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/.

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 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

[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.

[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.

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 will 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 ration IPOs more slowly.

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).

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 2016, there have been nine major IPO suspensions. Our data allows us to analyze five of them from 2004-2014, which lasted between six and fifteen months. 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

[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.

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] Further, once each suspension began, market participants did not know when it would end.[14]

The delay itself is costly, because of the time value of money, lost market and strategic opportunities (e.g. to make acquisitions or large investments using public funds).[15] Further, the uncertainty about when the firm would list during IPO suspensions may be costly itself, causing the firm to pause value-creating activities. For a discussion of the cost of uncertainty in external financing from the public market, see Almeida et al. (2011) and Wang & Zhu (2013).

In sum, the suspensions and three institutional features make China an ideal setting to study how access to public markets affects the firm. The three features are: (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; and (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.

[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]For example, see http://finance.ce.cn/rolling//201310/01/t20131001_1574723.shtml and http://workingcapitalreview.com/2015/12/chinas-long-ipo-process-hinders-more-than-just-stock-offerings/. Also, Packer et al. (2016) show that past aggregate market return is the most significant factor correlated with IPO volume control.

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

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.

All firms in our sample ultimately do go public.[16] We compare firms approved prior to the suspension start, 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 twelve months 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. Our key assumption is that delay is exogenous among firms approved in a window prior to a suspension. Interviews with market participants, the observable queue post-2012, and t-tests (summarized in Section 4) lead us to believe this is the case.[17] As with any quasi-experimental strategy, and

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

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.

Note that queue-jumping by politically connected or state-owned firms should bias our results against finding a detrimental effect of delay. There is abundant literature showing that politically connected or state-owned firms underperform relative to their counterparts, including Fan et al. (2007), Dollar & Wei (2007), Chen et al. (2016), Whited & Zhao (2016), and Piotroski & Zhang (2014). If these firms have less delay because they jump the queue, it is even more striking to find that delay leads to underperformance.

3.2 Specification

Our primary specification estimates variants of Equation 1

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

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. However, we also examine some variables during the delay period, to better understand the timing of the effects 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).

An empirical concern is that because suspensions correlate with poor market conditions, it may be that delayed firms, once listed, have not yet recovered from the adverse market and thus exhibit negative outcomes unrelated to delay. Our vector of listing year

ments, 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.

fixed effects, $\mathbf{Y}_t$, controls for aggregate market conditions in the year, which is the frequency at which we observe outcomes. We are primarily comparing firms just after listing, controlling for the year of listing. Thus if market conditions but not delay (i.e. whether public or not) affect outcomes, we expect that two firms that listed in the same year, one with a short delay period and one with a long delay period, would experience similar negative effects. Both firms experienced the same recent market conditions and both recently listed, but one experienced delay.

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. Our primary specifications cluster errors by industry and listing quarter.

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.

We also instrument for the months of delay using the month of IPO approval (that is, with month fixed effects). We do not show the results from the first stage due to the large number of coefficients. The first-stage F-statistic for the excluded instrument (delay) being significantly different from zero is 692, indicating a very strong instrument.

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

In this section, we first describe our data sources. Then, we test for ex-ante differences by delay status. Third, we discuss the variables we use as outcomes.

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 two reasons. First, they are relatively new. Second, there is less financial data available from the commercial databases for firms listed on these boards.

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")

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 weekly PCRI data. For each investment stage, we observe investment values in US dollars and the number of deals. Each of these is in turn broken into two time series; China and the rest of the world. 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

provides information on investment periods, amounts, and share holdings for the major stockholders.

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.

4.2 Ex-ante differences by delay

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.

4.3 Outcomes studied

Our main empirical analysis focuses on firm outcomes at or in the year after the IPO, so as not to confound the effect of listing with that of delay. We also examine effects during the delay period to shed light on the effect immediacy.

Innovation effort

Patent applications are an effort to embed the firm's intellectual property in formal documentation that enables the firm to monopolize it for a period of time. Patent grants are typically used as a measure of innovation quantity, but they represent the subset of its innovation that the firm chooses to codify, disclose, and protect (Kortum & Lerner 2001, Rajan 2012).

Patent applications in China have increased dramatically since China established formal patent law 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 akin 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. Applications for these latter two types are essentially never rejected. Invention patent protection lasts twenty years from the application, while protection for the other two types of patents lasts ten years (Xie & Zhang 2015). We use five patent measures: total, granted, and rejected invention patent applications, and design and utility patent applications. Our sample sizes for patent measures are smaller than for other variables, because we were not able to link all firms to patent data.

Fang et al. (2016) show that while average quality may differ across countries, patents generally serve the same purpose in China as they do in the U.S., and firm patenting behavior is similar across the two countries. For example, in both countries, within-firm increases in

patent stocks are associated with higher productivity, exports, and new product revenue. Interestingly, they 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.

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 total assets at the fiscal year-end. Cash is also scaled by assets. Total investment has three components: financial investment, acquisition investment, and plant, property, and equipment investment.[20]

Compensation

A CEO typically experiences a windfall payout after the IPO (typically after a lock-up period). In a suspension, this payout is delayed, and the CEO faces uncertainty not only about when the payout will occur, but market conditions when the firm does ultimately go public. If this uncertain delay is costly, the firm may need to increase the CEO's compensation. We examine CEO compensation in the context of overall payroll and compensation to managers.[21] Delay may exacerbate agency issues as well, so a positive effect of delay on compensation may also reflect greater CEO entrenchment in this case.

[20]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.

[21]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.

Firm price and performance

We examine a number of measures that reflect value creation and firm performance. First, we examine the price to book ratio on the first day of trading and in subsequent years, as a measure of value creation. Second, we examine uncertainty about the firm through its stock price volatility after listing. Third, we consider earnings (net profit in millions of nominal RMB), following Fan et al. (2007). Finally, we consider revenue, return on sales, abnormal return, and market share.[22]

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.

[22]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.

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.

Governance

We examine two types of governance measures: evidence of window dressing behavior, and board characteristics. First, a commonly used accounting measure for window dressing is the volume of discretionary accruals. This 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 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), Kothari et al. (2005), and Brau & Fawcett (2006).

Expansion of the board, greater board diversity, and more independent board directors are often associated with better corporate governance, and we are interested to see if they are affected by delay. However, we will be cautious in interpreting any results, as evidence on the 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).

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.[23] 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).

5 Results

Patent applications

Suspension-induced listing delay significantly reduces patent applications both during delay and for years after listing. These are our strongest and most interesting results, and we focus our reporting here. Importantly, our results are distinct from Bernstein (2015), who finds that public firms tend to have fewer patent citations, but not a lower volume of granted patents. Our results are not inconsistent with his - indeed, Appendix Figure A1 shows a decline in granted invention patent applications around the IPO year (we unfortunately cannot observe citations). Our novel finding is that delay reduces both granted and rejected patent applications during delay and after IPO. The average negative IPO effect is exacerbated

[23] 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.

among 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, using a negative binomial model except in column 2.[24] Column 1 finds that an extra month of delay reduces patent applications by about 10%, and the OLS model in column 2 indicates that a month of delay reduces patents by 0.69, relative to a mean of 4.8. The table also contains a number of alternative specifications, including the IV (column 5).

We find significant negative effects of months of delay on patenting throughout the four years after IPO. This is shown visually in Figure 6-9. Figure 6 shows 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" (see below). It is comforting that firms ultimately affected by

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

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.[25] 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 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.

Results using monthly data (Equation 2) ever after IPO approval are 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). The coefficient on being after the IPO is always large and strongly negative, consistent with our annual results that application activity on average declines after listing.

Robustness tests 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

[25] 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.

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. 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. 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).

We also considered a number of cross-sectional sources of variation. 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 stronger in high-tech sectors, at -.55 (column 6), but is also present for non-high-tech firms (-.37, in column 7). We also examined size, and found a slightly larger effect for firms with above median market capitalization (not shown).

Investment

We also find strong negative effects of delay on PPE investment, shown in Table 4. Our primary result is that among public firms, in the year following the IPO, an additional month of delay reduces investment by .0022 million RMB, or about 1.5% of the mean (column 4). Having above the 75th percentile of delay reduces investment by 0.012, or 8.6% of the mean (column 5). Column 7 shows that the results are robust to the IV strategy. In the year after IPO approval, we find a somewhat larger effect, corresponding to 5% of the mean (note this combines public and private firms). Finally, while the coefficient remains negative in the

second year after IPO, it is not significant. When we focus on firms listed in the year after a suspension (not shown), we find a similar negative effect, but it is just barely insignificant at conventional levels.

Performance

The price to book (P/B) ratio is a proxy for market expectations about the firm's assets in place. Table 5 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. This effect is especially strong for the most delayed quartile, which has a third lower P/B than the mean (column 2). We also find strong effects in the IV (column 4) and in the sample of firms that listed in the years after the end of the suspensions (column 5). The negative effect endures in the second year after IPO, though it loses significance in the linear specification. These results suggest that delay reduces the relative growth value of a firm's assets.

Delay also increases stock price volatility, a measure of market uncertainty about the firm. We measure this as the standard deviation of returns in the 100 days after listing. The results, in Table 5 columns 6-10, find that an extra month of delay increases volatility by 0.0023, about 3% of the mean. While this result does not remain significant with the IV, it does persist in the sample of firms listed in the year after the suspensions. We find no significant effects on ROS or earnings, but in both cases the coefficients are negative and fairly large in magnitude (not shown for brevity). We also find no effect on market share or the number of employees.[26]

Compensation

A firm may have to pay its CEO more in order to retain him during the delay period. Table 6 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

[26]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.

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 do not observe compensation prior to the IPO, unfortunately.

We find no effects of delay on CFO salary, all managers' salaries (which includes lower-level supervisors), or overall payroll (Table 6 columns 4-6). This is consistent with delay increasing uncertainty, but not necessarily causing major operational changes.

Underwriting Syndicate

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 precise estimate. A robustness test is in Appendix Table A2, 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.

Window Dressing and Governance

Window dressing is almost certainly at play, and may help explain the run-up in patent applications that we observe two years prior to the firm's approval (Figure 10). We might expect that because delayed firms have to maintain a certain standard under the CSRC's watch as they wait to list, they might make suboptimal use of resources to maintain short-term performance, at the expense of longer-term performance.

There are three issues with this hypothesis, however. First, we observe patent applications drop precipitously during the delay period; if patenting reflected window dressing, and this continued during delay, we would not expect the drop. Second, window dressing cannot explain the persistent effects we observe after the IPO. Third, when we examine the variable commonly used to measure window dressing, discretionary accruals, we find that delayed firms have lower discretionary accruals in the year after IPO (Table 8 columns 1-3). We also do not find any relationships between delay and board variables, including independent board members (Table 8 columns 4-6), board size, director age, or director gender (these latter variables are not show for brevity).

While this is tentative evidence that window dressing does not explain our initial results, the accruals results may reflect firms having exhausted window dressing resources during delay (we do not observe them before the IPO), and having less flexibility to use them after the IPO. Given the caveats to board characteristics described in Section 4, we certainly do not rule out window dressing or worse governance as being a possible negative effects of suspension-induced delay. That said, we emphasize the longer term effects on real outcomes that suggest uncertain delay imposes meaningful costs.

Capital structure and new financing

The most obvious place to look for an effect is in the firm's capital structure. We expect that if firms are going public because they need capital for investment projects, and delay increases financial constraints, it might lead to increased leverage. Contrary to this hypothesis, Table

9 shows that there is no measurable effect of delay on leverage, IPO proceeds, or cash in the year following the IPO. The coefficient on IPO proceeds is negative and significant in some specifications, but not in our preferred models shown here. Similarly, we find no effect on the first two variables in the year following approval (this sample includes both public and non-public firms.)

We believe that these null results reflect the fact that the firms are mature and profitable enough that these measures are unaffected. Instead, it is the margin of innovative value creation that is affected. As explained above, firms going public on the main boards are in a Goldilocks position. They are less constrained than young, unprofitable firms that go public in the U.S. 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 investment, but this was sunk, and we expect that firms desperately in need of capital would have gone public in Hong Kong or elsewhere. At the same time, the exceedingly high valuations in China were likely a powerful inducement to wait.

Yet the firms are not completely unconstrained, and the lack of access to low-cost capital during delay is an important driver of our effects. Cong & Ponticelli (2016*b*) show that the Chinese government regulates total credit supply and sets borrowing rates at non-trivial levels. While SOEs are advantaged in accessing credit, they are by no means unconstrained and in most cases will find that financing in public markets is considerably cheaper than borrowing from banks, in part because the equity valuation multiples in the Chinese market are extremely high.[27] Therefore, we believe that both the capital supply and uncertainty channels explain why risky investment is foregone among delayed firms.

Effect by VC financing

For most of the measures, we do not find that delay is more or less deleterious for VC-backed companies. The exception is patenting, where we find in our monthly specification

[27] Also,, SOEs do not receive tax benefits of debt, and they are less concerned with dilution, so long as the state retains majority control.

that VC-backed firms largely drive the overall effect (Table 3 panel 2 column 5). 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 VCs appear to mitigate the effects of delay on underwriting syndicate size and especially CEO compensation (Table 6 column 3). Foreign VCs may have more experience with corporate governance. These effects may reflect selection, but the results present a Chinese counterpart to Hellmann & Puri (2002), Baker & Gompers (2003), and Hochberg (2012), who find that VC funding in the U.S. is associated with firm professionalization.

6 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.

6.1 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 3 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.

$$VC\ China_t = \alpha + \beta_1 \left(1 \mid IPO\ Suspension_t\right) + \gamma_1 SH\ Index_t + \gamma_2 SZ\ Index_t + \gamma_3 VC\ ROW_t + \varepsilon_t \tag{3}$$

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.

6.2 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 compa-

nies. 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 10 confirms this visual evidence in regression estimates, using versions of Equation 3. 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 10 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 A3 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 A4 panel 2 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 A5. 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 A5 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 10.

We conduct several robustness tests in Appendix Table A6. 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 A7, 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 Conclusion

The role of public markets in corporate outcomes 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. We find that delay has strong, negative effects on measures of innovation, investment, and positive effects on proxies for market uncertainty about the firm.

These negative effects exist among firms that are not especially financially constrained, and are not accompanied by potential signs of distress such as dramatically increased leverage or decreased cash. It seems that denying firms access to low cost capital, and increasing uncertainty in their financing, negatively affects the type of firm investment that may be most marginal from the firm's perspective, but is likely the most valuable from a social perspective, especially through knowledge spillovers (e.g. Bloom et al. 2013, Greenstone et al. 2008, Jones & Williams 1998).

Private firm innovation is crucial to China's ongoing effort to shift growth away from low value-added exports and infrastructure investment. Our results suggest that from the perspective of firms seeking public financing, China's policymakers should foster predictable IPO markets in which firms can list. We must caveat this conclusion by noting that we do not evaluate the social welfare impacts of the suspensions; it is possible that suspending IPOs averted market crashes or had other benefits, however unlikely this may seem.

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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 (except where noted)

	N	Mean	Median	S.d.	Min	Max
Total investment[±]	421	0.21	0.17	0.26	0	3.02
PPE Investment in year after IPO approval	421	0.12	0.09	0.12	0.00	0.95
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: Year after IPO

Dependent variable: # invention patent apps in year after IPO

		OLS	High delay	Role of VC†	IV for delay w/ approval date**
	(1)	(2)	(3)	(4)	(5)
Delay (months)	-.093***	-.69***		-.082**	-.67*
	(.031)	(.25)		(.035)	(.39)
Delay $\in$ 25-75 pctile*			-.53***		
			(.18)		
Delay >75 pctile			-.76*		
			(.42)		
Delay (months)·VC-backed				-.024	
				(.026)	
VC-backed	.34	.74	.3	.54**	.74
	(.21)	(1.2)	(.23)	(.22)	(1.2)
Controls	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y
N	341	341	341	341	341
pseudo-R^2	0.064	.18	0.064	0.062	.18
First stage F-test$^{\pm}$					692

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***	-.74**	-.048	-.04***
	(.0095)	(.027)	(.04)	(.35)	(.039)	(.013)
Delay thus far (months)^2		.0017*	.0057***		-.00065	
		(.00086)	(.0014)		(.0015)	
Post-IPO	-.37***	-.51***	-2.3***	-.77	-.45**	-.31**
	(.14)	(.18)	(.26)	(.56)	(.21)	(.16)
Delay thus far (months)·VC-backed					-.097**	
					(.048)	
VC-backed	.33	.33	.15	.27	.6***	.29
	(.35)	(.35)	(.21)	(.31)	(.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±				11,000		

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 3: Robustness tests

Dependent variable: # invention patent applications in year after IPO

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

Dependent variable:	# invention patent applications in approval year		# granted invention patent apps year before approval	Share invention patent apps rejected in approval year	Excluding 2008-09 suspension
Sample:	High-tech	Not high-tech	All	All	All
	(6)	(7)	(8)	(9)	(10)
Delay (months)	-.55**	-.37**	.041	.013	-.47**
	(.26)	(.14)	(.029)	(.017)	(.19)
Controls	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y
N	134	203	341	341	235
R^2	.14	.23	.1	.14	.16

Note: This table contains regression estimates using OLS 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 PPE Investment

Dependent variable: PPE investment in:	year after IPO approval			year after IPO				2nd year after IPO
			Role of VC†			Role of VC†	IV**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Delay (months)	-.0054**		-.0059**	-.0022***		-.0022***	-.002**	-.0015
	(.0023)		(.0024)	(.00064)		(.00061)	(.00099)	(.001)
VC-backed	-.017	-.017	-.025	.0034	.0038	.0031	.003	.0092
	(.012)	(.012)	(.02)	(.0071)	(.007)	(.0072)	(.0067)	(.006)
Delay (mo)·VC-backed			.0012			.000029		
			(.0019)			(.00078)		
Delay >75 pctile		-.02			-.012**			
		(.018)			(.006)			
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	362	362	362	418	418	418	418	411
R^2	.17	.17	.18	.33	.33	.33	.17	.14
First stage F-test$^{\pm}$							392	

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 PPE investment in the year prior, pre-listing year successful invention patent applications, 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. †SOEs omitted. Errors clustered by industry-quarter. ††Standard deviation of first 100 days' returns after IPO. $^{\pm}$The F-statistic for the excluded instrument (delay) being significantly different from zero. Errors clustered by industry-quarter. ** IV for delay using approval date. Implemented via 2SLS. *** indicates p-value<.01.

Table 5: Effect of suspension-induced IPO delay on price

Dependent variable†:	First day price/book					Stock price volatility††				
			Role of VC†	IV**	Listed year after end suspension			Role of VC†	IV **	Listed year after end suspension
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Delay (months)	-.28**		-.3***	-.27**	-.18***	.0023***		.0045*	.0031	-.00048**
	(.11)		(.11)	(.13)	(.062)	(.00085)		(.0026)	(.0029)	(.00023)
VC-backed	.74	.81	.81	.74	.93	.0037	.0029	.014	.0041	.0042
	(.87)	(.89)	(1.2)	(.81)	(.84)	(.0058)	(.0059)	(.01)	(.0058)	(.0037)
Delay (months)·VC-backed			-.002					-.00087		
			(.083)					(.00058)		
Delay >75 pctile		-5.1***					.022			
		(1.7)					(.016)			
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry f.e.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	403	403	403	403	507	418	418	331	418	520
R^2	.34	.34	.3	.33	.5	.44	.43	.52	.42	.37
First stage F-test±				345.5					391.9	

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, except in columns 5 and 10, where it is limited to firms listed in the year following the end of a suspension. Controls are pre-listing year successful invention patent applications, 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. †SOEs omitted. Errors clustered by industry-quarter. ††Standard deviation of first 100 days' returns after IPO. ±The F-statistic for the excluded instrument (delay) being significantly different from zero. Errors clustered by industry-quarter. ** IV for delay using approval date. Implemented via 2SLS. *** indicates p-value<.01.

Table 6: Effect of suspension-induced IPO delay on compensation

Dependent variable: Change between years 1 and 2 after IPO in:	CEO salary			CFO salary	All manager salaries‡	Total payroll
	(1)	(2)	(3)	(4)	(5)	(6)
Delay (months)	8.5**	8*	8.9**	.1	7.8	-25
	(4.2)	(4.1)	(4.3)	(3.3)	(16)	(27)
Delay·VC-backed		3.7				
		(4.8)				
VC-backed		-24				
		(55)				
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
Industry f.e.	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y
N	402	402	402	384	412	414
R^2	.17	.17	.18	.69	.35	.19
First stage F-test						

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 7: Effect of suspension-induced IPO delay on underwriting syndicate size

Dependent variable: Number of IPO co-managers in underwriting syndicate

		Negative binomial	High delay	IV for delay w/ approval date	Role of VC†	
	(1)	(2)	(3)	(4)	(5)	(6)
Delay (months)	.04*	.025***		.069***	.053***	.042*
	(.023)	(.008)		(.027)	(.015)	(.024)
Delay >75 pctile*			.92*			
			(.51)			
Delay (months)·VC-backed					-.0077	
					(.0053)	
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
Industry f.e.	Y	Y	Y	Y	Y	Y
Year f.e.	Y	Y	Y	Y	Y	Y
N	414	414	414	414	330	414
R^2	.58	.23	.58	.58	.82	.58
		(pseudo)				
First stage F-test±				467		

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. †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 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
	(.0012)		(.0012)	(.0054)		(.0051)
Delay >75 pctile		-.06*			-.0013	
		-0.032			(.061)	
Delay (months)·VC-backed			.0014			-.0038
			(.0012)			(.0028)
VC-backed	-.0069	-.0061	-.02	.051*	.052*	.083*
	(.011)	(.01)	(.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.

Table 9: Effect of suspension-induced IPO delay on capital structure

Dependent variable (in year after IPO):	Leverage		IPO Proceeds		Cash/Assets	
	(1)	(2)	(3)	(4)	(5)	(6)
Delay (months)	.001	.0018	-1.4	-1.1	-.0048	
	(.0048)	(.0049)	(2.9)	(3)	(.0033)	
VC-backed	.00026	.039	-6	8.4	.017	.018
	(.037)	(.055)	(13)	(18)	(.017)	(.018)
Delay (months)·VC-backed		-.0048		-1.8		
		(.0041)		(1.6)		
Delay >75 pctile						-.1**
						(.043)
2 dependent variable lags	Y	Y	N	N	N	N
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	415	415	418	418	414	414
R^2	.7	.7	.95	.95	.35	.35

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 10: 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

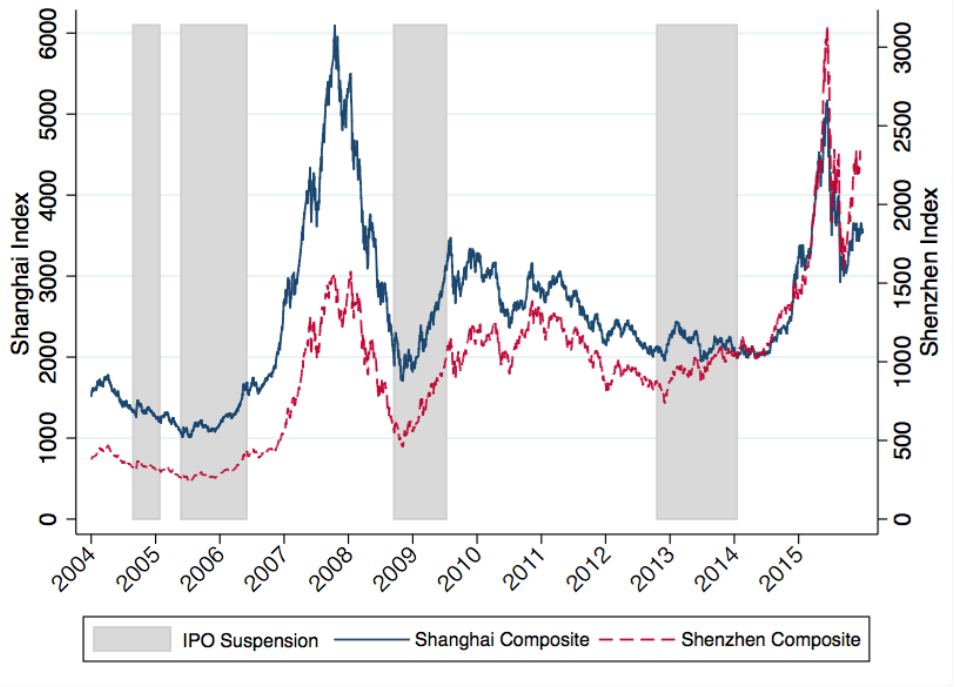
Panel 2: Later Stage VC Investment

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.

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

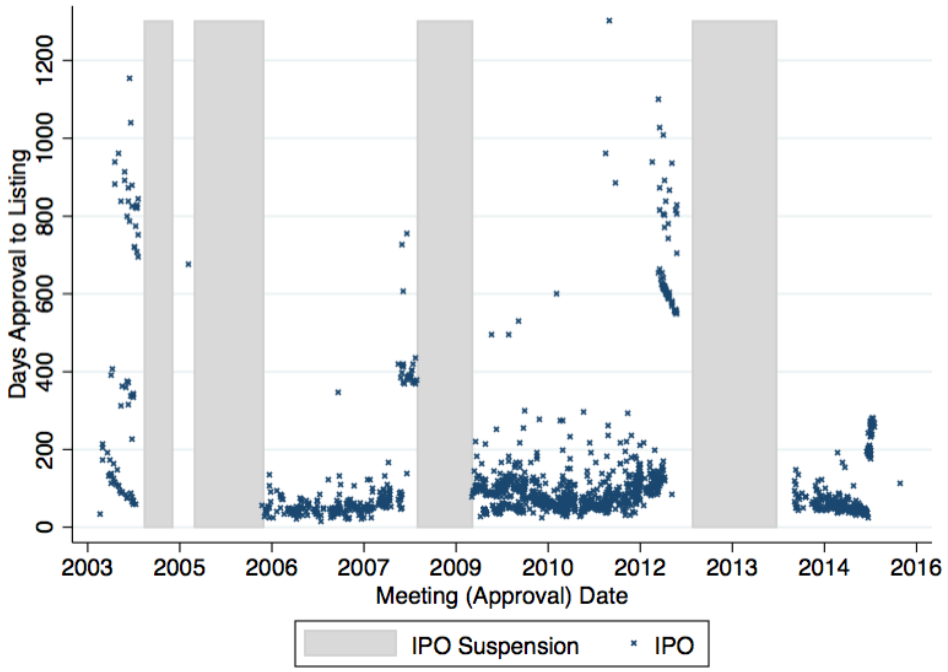
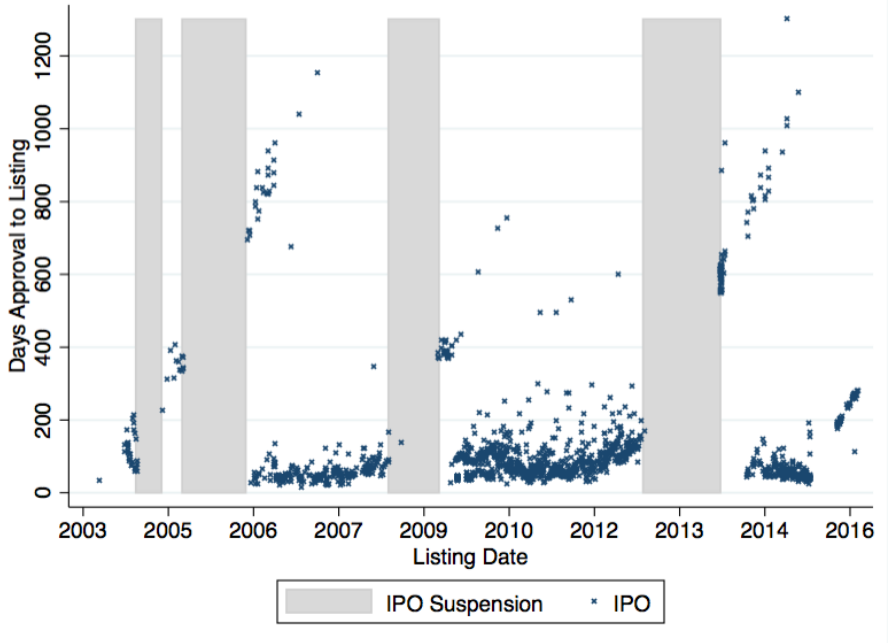


Figure 3: China IPO listing dates & delay between approval and listing



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)

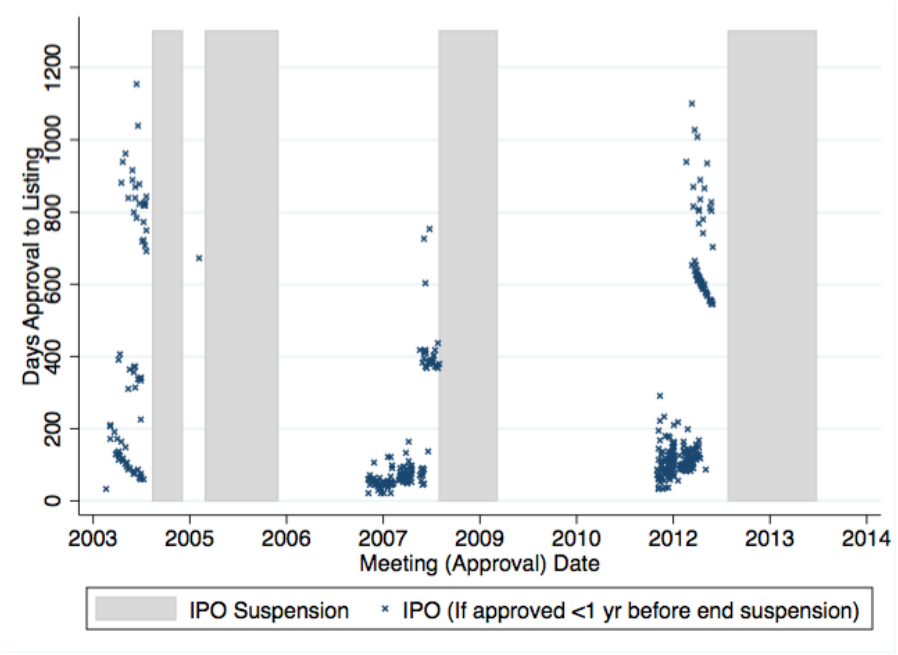
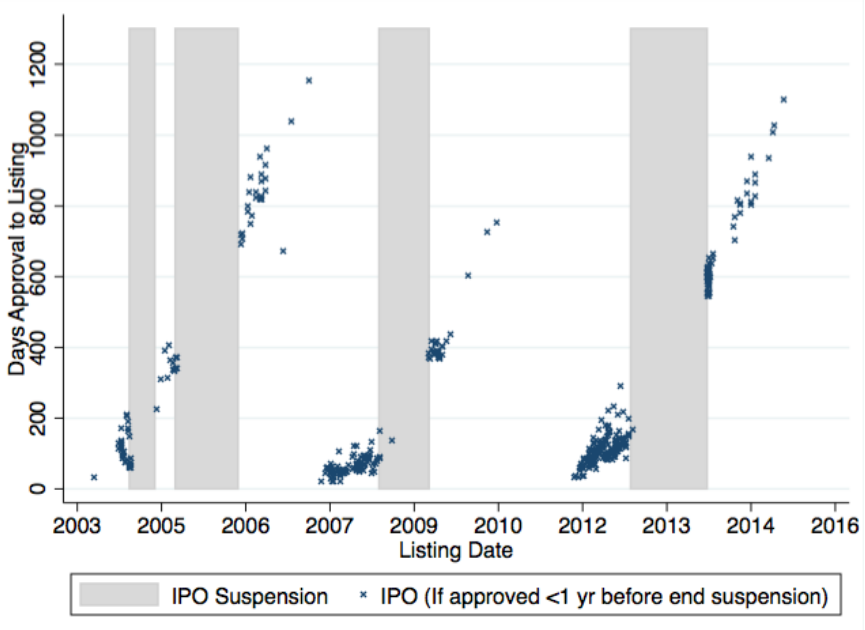


Figure 5: China IPO listing dates & delay between approval and listing (if approved within one year before the start of an IPO suspension)



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

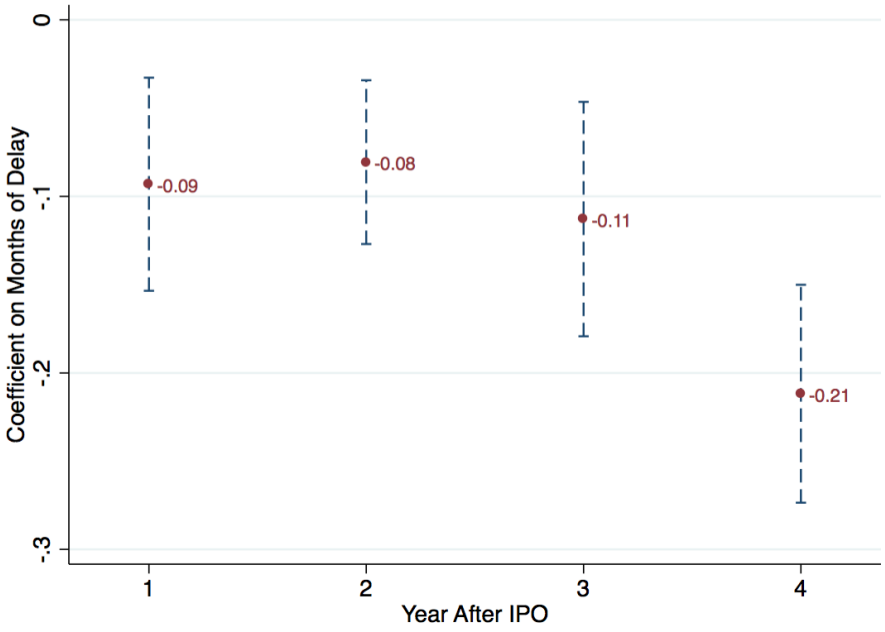
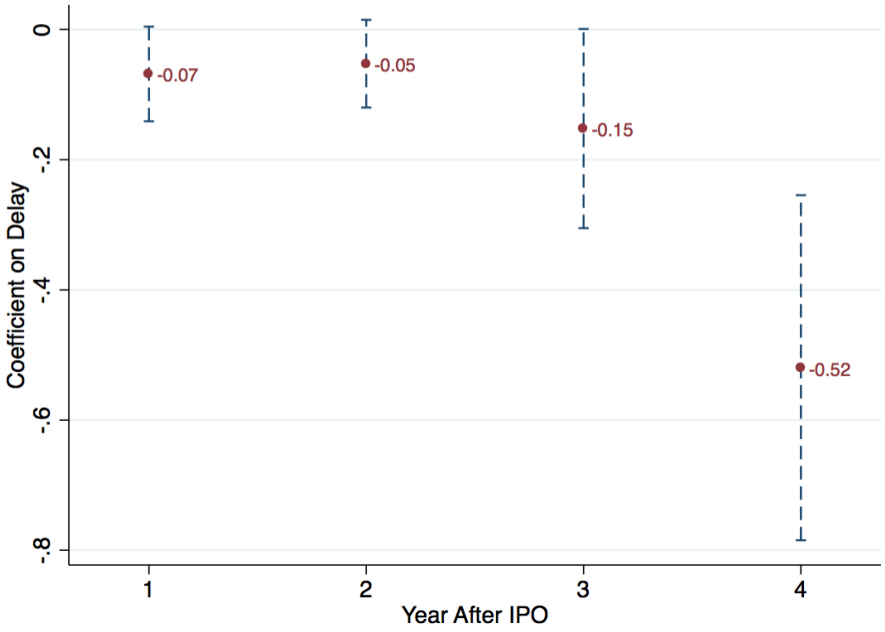


Figure 7: Long term effect of delay on granted invention patent applications



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

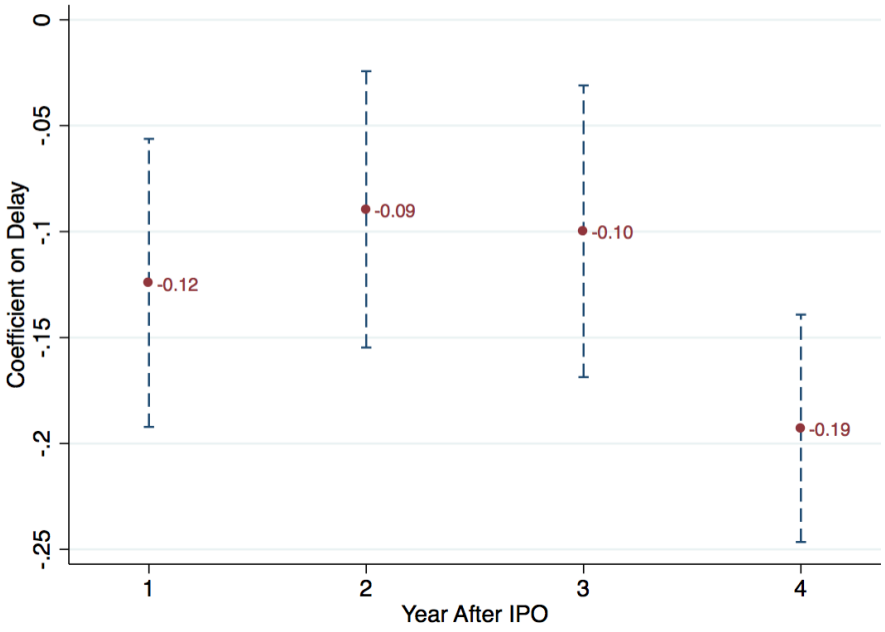
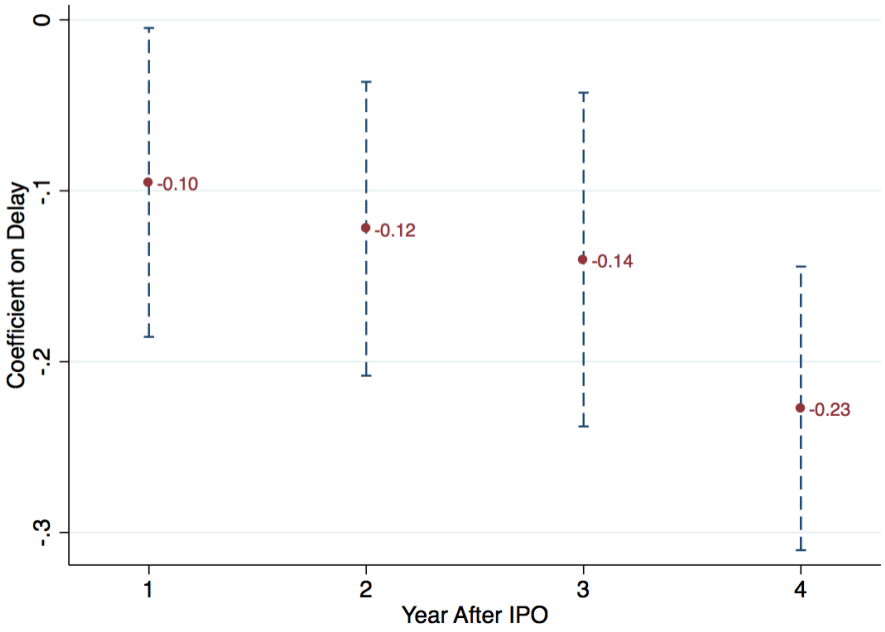
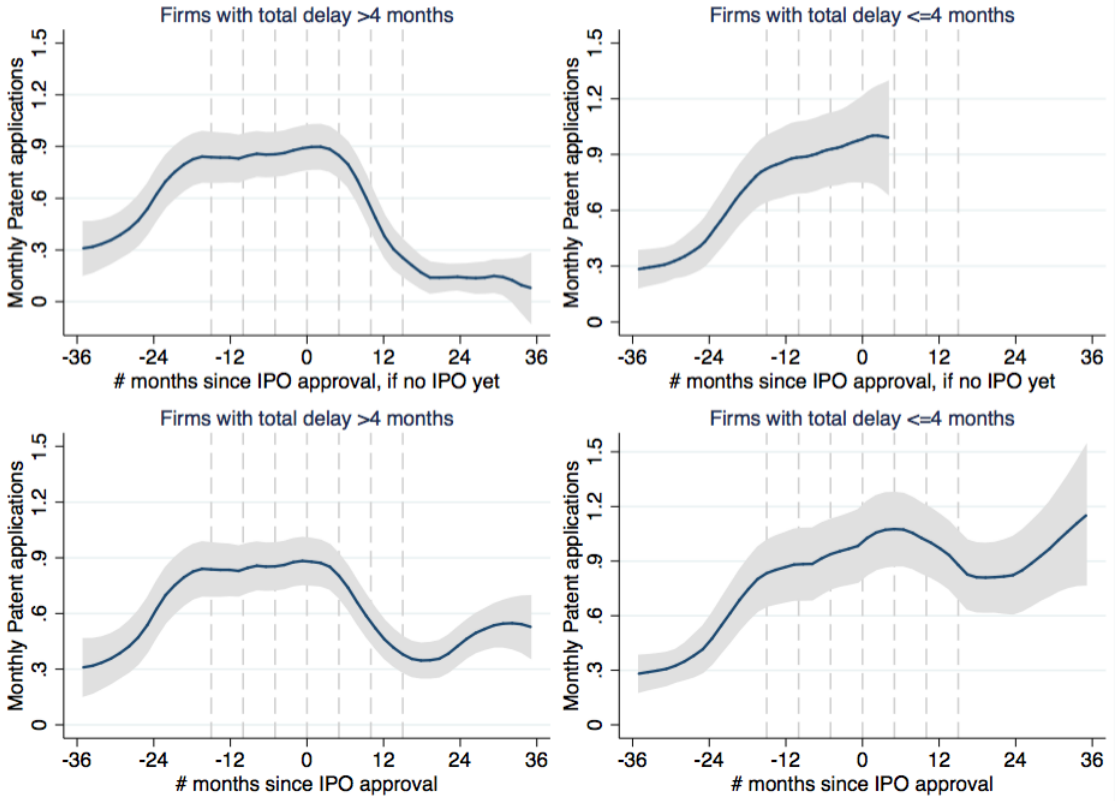


Figure 9: Long term effect of delay on design and utility patent applications



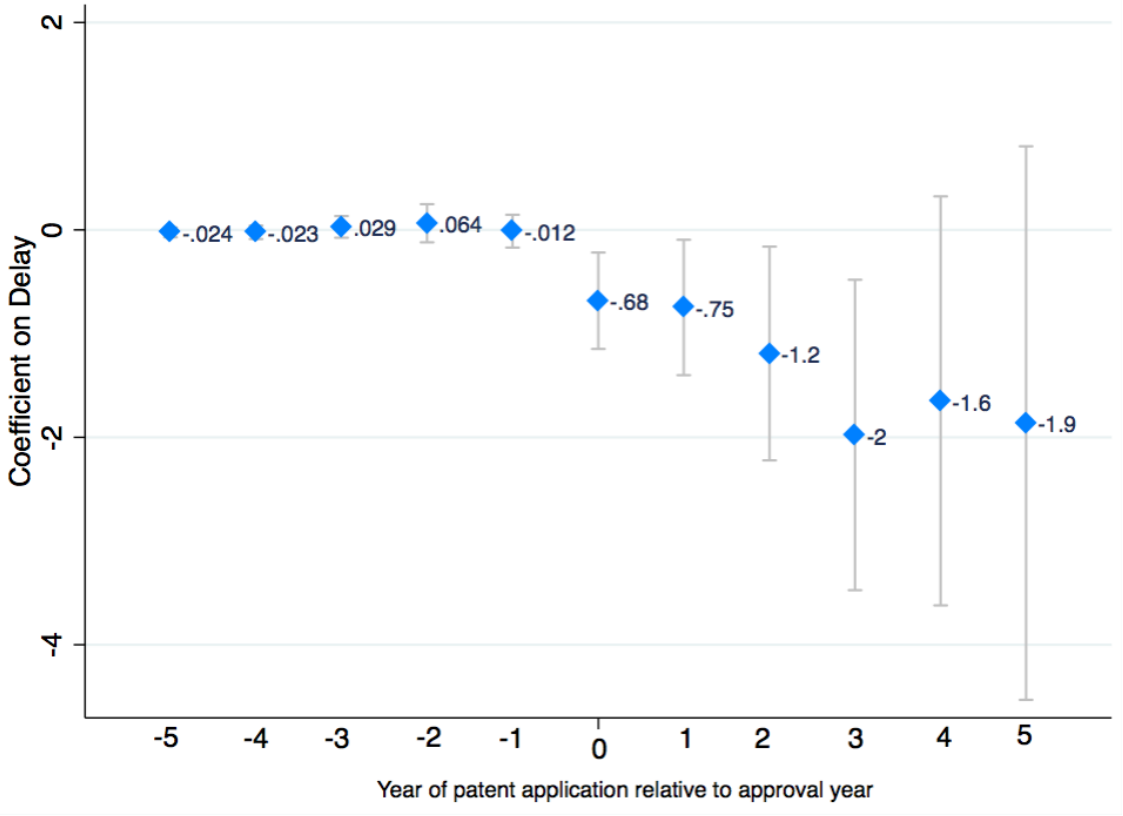
Note: The figures above show the coefficients from regressing rejected invention and design and utility patent applications in a give year after IPO on months of delay between approval and IPO. The specification is Equation 1.

Figure 10: Average monthly invention patent applications around IPO approval



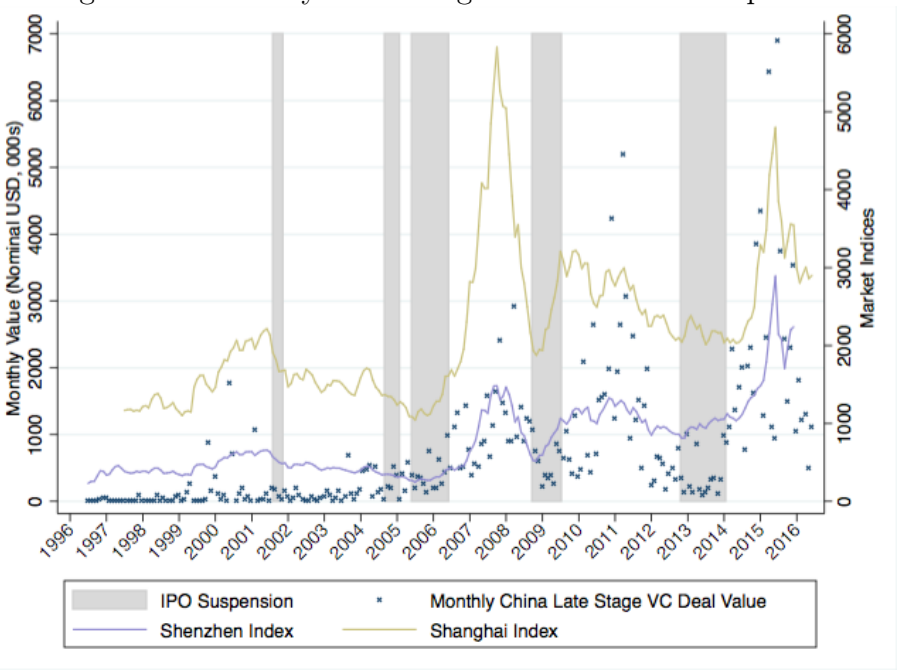
Note: This figure shows invention patent applications by the month around the committee approval date. We sort firm-months around the month that a firm was approved to IPO, within the sample of 425 firms that were approved in the year prior to an IPO suspension announcement (our primary estimation sample). 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)



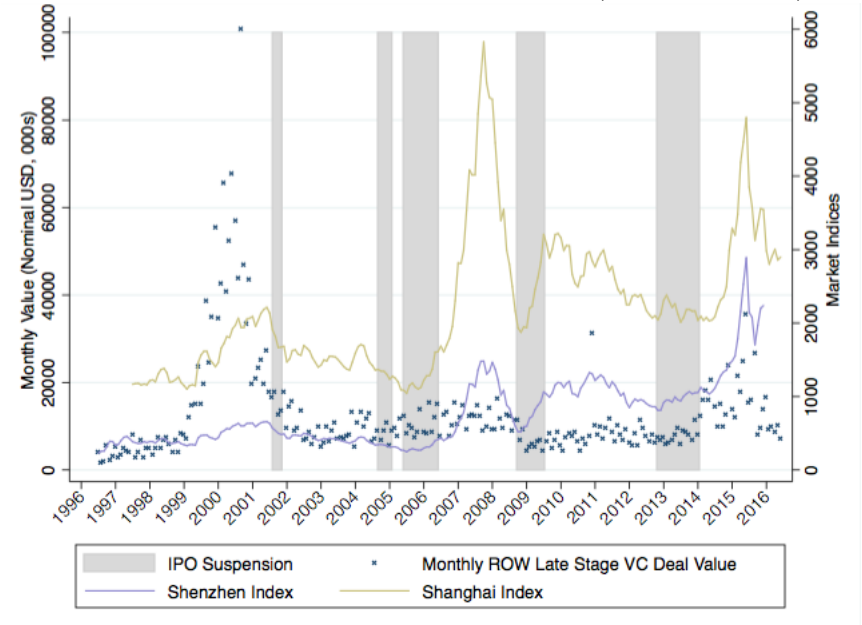
Note: This figure shows the coefficients on months of delay between approval and IPO on invention patent applications by year around the committee meeting (approval) date. Estimating the effect of delay prior to the approval is a placebo test; the patent filings prior to approval precede the delay, so 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.

Appendix to How Public Markets Foster Firm Standardization: Evidence from Chinese IPOs

(for Online Publication)

Table A.1: IPO Suspensions

Suspension start - end	Rationale	Details
1994/7/21-1994/12/7	Aggregate market condition	The stock market downturn continued for one and a half years with investors losing confidence in the market. By the end of July 1994, SSE Composite Index [-5.77%] fell to 325 points and saw a decline as high as 79.09% in the stock market only within 18 months.
1995/1/19-1995/6/9	Aggregate market condition	In the beginning of 1995, market funds were mostly concentrated in the bond futures. Due to lack of funds in the stock market, the closing stock market downturn in 1994 continued with daily transaction volume of several hundred thousand yuan and stock indexes fluctuating in a small range for a long time.
1995/7/5-1996/1/3	Aggregate market condition	From 1995 to the beginning of 1996, broad stocks once again headed back into the doldrums. After a continuous decline, stock indexes finally began to stabilize in January 1996 with the lowest point reaching 512 points.
2001/7/31-2001/11/2	Unloading of state-owned public shares	On July 26th, 2001, the reduction of state-owned shares was officially implemented in the IPOs. The stock market witnessed a decline until January 29th, 2002 with stock indexes falling to 1339 points.
Sept 9, 2004 to Feb 3, 2005	Changes in IPO book building process.	In December 2004, The China Securities Regulatory Commission issued the Notice on Several Issues on the Trial Implementation of the Inquiry System for Initial Public Offering of Stocks. Before the launching of this scheme, the IPOs were all suspended.
June 7 , 2005 to June 19 2006	Shares reform	Influenced by the Split-Share Structure Reform, the IPOs were suspended for one year.
Dec 15, 2008 to July 10, 2009	Global Financial crisis and prolonged decline in market index.	The United States Subprime Mortgage Crisis triggered the international financial crisis, which resulted in a record low of 1802.33 points of A shares on September 18th, 2008. Under this context, the IPOs witnessed a suspension again.
Nov 2, 2012 to Jan 17, 2014	Bearish market conditions	Bearish market conditions despite the fact that indexes in Europe and in the US are performing well; CSRC started the biggest inspection of financial reporting for IPO firms.
July 4, 2015 to Dec 9, 2015	Stock market crash and extreme volatility.	The A-share market has experienced instable plunges since June 2015 and dropped to 3,800 points from 5,100 points in 20 days. To boost the market, the regulators launched several measures including reopening the IPO.

Note: Sourced from CSRC Officially Designated Media Outlet. 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. See also Finance Daily, http://www.mrcjcn.com/n/49812.html.

Table A.2: Effect of delay on the number of IPO co-managers, among firms listed in year after an IPO suspension

		Negative binomial	Delay indicators	IV for delay w/ approval date	Role of VC†		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Delay (months)	.045***	.019***		.046***	.031*	.05***	
	(.012)	(.0035)		(.013)	(.016)	(.014)	
Delay >75 pctile			.95***				.6**
			(.28)				(.3)
Delay (months)·VC-backed						-.026*	
						(.014)	
Delay >75 pctile·VC-backed							-.6
							(.36)
VC-backed	-.055	-.053	-.077	-.056	.22		.24
	(.15)	(.089)	(.15)	(.14)	(.17)		(.29)
Delay (mo)·Foreign VC‡						-.038*	
						(.019)	
Delay (mo)·Govt VC						-.018	
						(.016)	
Delay (mo)·Private Chinese VC						-.02	
						(.017)	
Controls	Y	Y	Y	Y	Y	Y	N
Industry f.e.	Y	Y	Y	Y	Y	Y	N
Year f.e.	Y	Y	Y	Y	Y	Y	Y
N	520	520	520	520	411	520	411
R^2	.66	.22 (pseudo)	.66	.66	.85	.66	.15
First stage f-test±				465			

Note: This table contains regression estimates using variants of: $InvPatentApps_{jt} = \alpha + \beta_1 MonthsDelay_j + \gamma_t + \delta' \mathbf{V}_j$. The model is OLS except in column 2. Sample limited to firms approved in the 12 months prior to an IPO suspension. †These regressions omit state-owned enterprises (SOEs); they show the relationship between delay and venture capital (VC) within private firms. *The 75th percentile of delay is 12.8 months. Controls $\mathbf{V}_j$ 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). γ_t are listing year fixed effects. ‡Individual foreign, gov't and private Chinese VC backing effects are included in columns 6-7 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 A.3: Effect of IPO Suspensions on Contemporaneous VC Investment (Real RMB)

Panel 1: Early Stage VC Investment

Dependent variable: Weekly early stage VC investment (real 2010 RMB) in Chinese portfolio companies*				Excluding 2009 suspension
	(1)	(2)	(3)	(4)
IPO suspension in effect	-228***	-51	-49	-44
	(62)	(62)	(56)	(75)
Shenzhen index†		2***		2***
		(.28)		(.29)
Shanghai index†		-.42***		-.42***
		(.11)		(.11)
China index††			.62***	
			(.08)	
VC investment rest of world‡		.0078***	.0094***	.0077***
		(.0025)	(.003)	(.0025)
N	935	859	914	819
R^2	.0064	.29	.17	.29

Panel 2: Later Stage VC Investment

Dependent variable: Weekly later stage VC investment (real 2010 RMB) in Chinese portfolio companies*				Excluding 2009 suspension
	(1)	(2)	(3)	(4)
IPO suspension in effect	-647***	-259**	-270**	-291**
	(120)	(118)	(108)	(127)
Shenzhen index†		2***		2***
		(.54)		(.55)
Shanghai index†		.12		.11
		(.19)		(.19)
China index††			1.3***	
			(.16)	
VC investment rest of world‡		.0048	.0038	.0048
		(.004)	(.0039)	(.004)
N	936	860	915	820
R^2	.011	.17	.16	.17

Note: This table contains OLS regression estimates of the relationship between VC investment and whether the government has suspended IPOs. Data is monthly. We use variants of: $VC_m = \alpha + \beta_1 (1 \mid IPO\ Suspension_m) + X_m + \varepsilon_m$. *Data from PCRI; value of early stage VC investment in portfolio companies that are located in mainland China; this variable is converted to nominal RMB by month, then converted into real terms using the WEO China consumer price index. Early stage = seed, early stage, VC not otherwise specified; Later stage = growth equity. †Monthly average of daily closing price for the Shenzhen/Shanghai composite index. ††Monthly overall China market index, based on Shanghai and Shenzhen indices. ‡Monthly VC investment in all portfolio companies located outside of China (source: PCRI). Errors robust. *** indicates p-value<.01.

Table A.4: Effect of IPO Suspensions on Contemporaneous Monthly VC Investment, Newey-West Standard Errors

Panel 1: Early Stage VC Investment

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

				Excluding 2009 suspension	
	(1)	(2)	(3)	(4)	(5)
IPO suspension in effect	-435***	-173	-157	-62	-164
	(128)	(120)	(105)	(109)	(141)
Shenzhen index†		2.2***			2.2***
		(.4)			(.4)
Shanghai index†		-.4***			-.4***
		(.12)			(.12)
China index††			.82***	.85***	
			(.16)	(.16)	
VC investment rest of world‡		-.0011	-.023*	-.026**	-.0015
		(.0089)	(.012)	(.012)	(.0091)
N	240	222	234	224	212
R^2	.02	.42	.29	.29	.43

Panel 2: Later Stage VC Investment

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

				Excluding 2009 suspension	
	(1)	(2)	(3)	(4)	(5)
IPO suspension in effect	-436***	-202*	-198**	-168*	-221*
	(110)	(109)	(91)	(98)	(129)
Shenzhen index†		1.7***			1.7***
		(.38)			(.38)
Shanghai index†		-.11			-.11
		(.11)			(.11)
China index††			.86***	.86***	
			(.13)	(.13)	
VC investment rest of world‡		.0079	-.0073		.0082
		(.012)	(.0093)		(.012)
N	240	222	234	224	212
R^2	.028	.47	.4	.4	.48

Note: This table contains OLS regression estimates of the relationship between VC investment and whether the government has suspended IPOs. Data is monthly. We use variants of: $VC_m = \alpha + \beta_1 (1 \mid IPO\ Suspension_m) + X_m + \varepsilon_m$. *Data from PCRI; this variable is the value in nominal USD of early stage VC investment in portfolio companies that are located in mainland China. Early stage = seed, early stage, VC not otherwise specified; Later stage = growth equity. †Monthly average of daily closing price for the Shenzhen/Shanghai composite index. ††Monthly overall China market index, based on Shanghai and Shenzhen indices. ‡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 A.5: Effect of IPO Suspensions on Contemporaneous Investment by China-located VCs and top US VCs

Panel 1: China-Located VCs; all models use Newey-West standard errors

Dependent variable:	Monthly # VC deals by mainland China GPs[††]	Monthly VC investment (USD) by mainland China GPs[††]		
		Early stage	Later stage	All Excluding 2009 suspension
	(1)	(2)	(3)	(4)
IPO suspension in effect	-1.4*	-81	-146***	-37*
	(.76)	(52)	(53)	(19)
Shenzhen index[†]	.0053	1.3***	1.2***	.18*
	(.0043)	(.22)	(.2)	(.092)
Shanghai index[†]	.00026	-.27***	-.19***	-.017
	(.0013)	(.067)	(.064)	(.028)
N	222	222	222	212
R^2	.08	.52	.56	.11

Panel 2: Elite US VCs active in China; all models use Newey-West standard errors

Dependent variable: Monthly # VC deals in mainland Chinese companies by elite US VCs[‡]

				Excluding 2009 suspension
	(1)	(2)	(3)	(4)
IPO suspension in effect	-3.3*	-3.8*	-3.4	-2.2
	(1.9)	(2.2)	(2.3)	(2.1)
Shenzhen index[†]	.015***			.015***
	(.0041)			(.0042)
Shanghai index[†]	-.0042***			-.0039***
	(.0014)			(.0014)
China index[††]		.002	.0023	.002*
		(.0012)	(.0015)	(.001)
Monthly # VC deals by top US VCs in US companies			.039	
			(.047)	
N	127	127	124	117
R^2	.27	.092	.1	.125

Note: This table contains OLS regression estimates of the relationship between VC investment and whether the government has suspended IPOs. Data is monthly. We use variants of: $VC_m = \alpha + \beta_1 (1 \mid IPO\ Suspension_m) + X_m + \varepsilon_m$. [†]Monthly average of daily closing price for the Shenzhen/Shanghai composite index. [††]Data from PCRI. [‡]Data from pedata.cn (sample smaller as data starts in 2005). 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 A.6: Robustness Tests of Effect of IPO Suspensions on Contemporaneous VC Investment, Newey-West Standard Errors

Dependent variable:	Placebo test VC investment rest of world‡		Alternative data source: Monthly number of VC deals in China* Total	By mainland GPs	Early stage	Later stage
	(1)	(2)	(3)	(4)	(5)	(6)
IPO suspension in effect	-1119	-1147	-29*	-31*	-2.7	-26**
	(1426)	(1408)	(15)	(18)	(8.3)	(11)
Shenzhen index	-2.1		.18***	.29***	.11***	.082***
	(3.1)		(.034)	(.043)	(.021)	(.021)
Shanghai index	3.1		-.051***	-.094***	-.035***	-.019***
	(2.1)		(.009)	(.011)	(.0061)	(.0065)
China index		2.7**				
		(1.2)				
N	222	234	127	127	127	127
R^2	.043	.037	.42	.49	.4	.29

Note: This table contains OLS regression estimates of the relationship between VC investment and whether the government has suspended IPOs. Data is monthly. We use variants of: $VC_m = \alpha + \beta_1 (1 \mid IPO\ Suspension_m) + X_m + \varepsilon_m$. *Data from pedata.cn. This variable is the monthly number of VC deals in mainland Chinese portfolio companies. ‡Monthly VC investment (nominal USD) 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 A.7: Effect of IPO Suspensions on Contemporaneous Monthly Aggregate Bank Lending to Non-Financial Firms, Newey-West Standard Errors

Dependent variable: Monthly aggregate bank lending to non-financial firms in China*

	(1)	(2)
IPO suspension in effect	1358.68	1234.41
	(825.68)	(822.80)
Shenzhen index†	2.166***	
	(.602)	
Shanghai index†	-1.216***	
	(.265)	
China index††		-0.544.
		(.467)
N	108	108
R^2	.16	.07

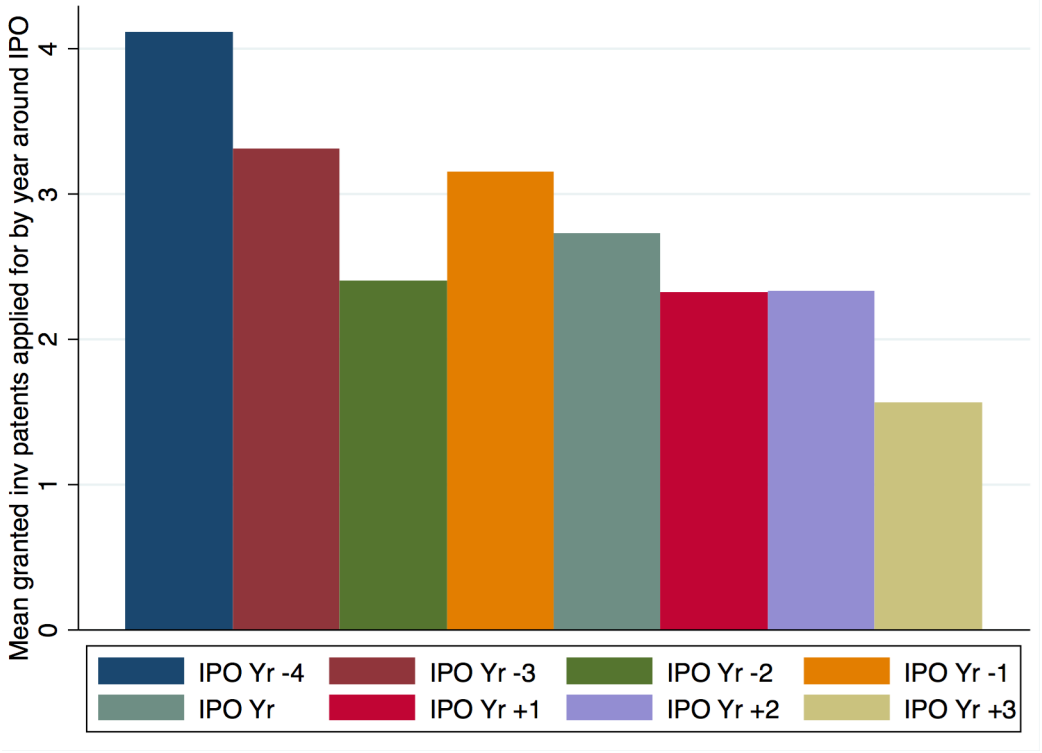
Note: This table contains OLS regression estimates of the relationship between bank lending and whether the government has suspended IPOs. Data is monthly. We use variants of: $VC_m = \alpha + \beta_1 (1 \mid IPO\ Suspension_m) + X_m + \varepsilon_m$. *Data from WIND; this variable is the value in nominal USD †Monthly average of daily closing price for the Shenzhen/Shanghai composite index. ††Monthly overall China market index, based on Shanghai and Shenzhen indices. 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 A.8: Effect of delay on contemporaneous invention patent applications, among firms approved to IPO in year prior to an IPO suspension

Dependent variable:	# invention patent apps in approval year							Role of VC†
		Negative binomial	High delay	IV for delay w/ approval date				
					Exp model**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Delay (months)	-.68***	-.11***		-.78**	-.28**	-.3*	-.7***	
	(.23)	(.031)		(.38)	(.12)	(.17)	(.23)	
Delay ∈ 25-75 pctile*			-3.7**					
			(1.7)					
Delay >75 pctile			-5.7*					
			(2.9)					
Delay (months)·VC-backed						-.27*		
						(.14)		
VC-backed	.34	.3	.28	.32		2.7**		
	(1.2)	(.22)	(1.3)	(1.2)		(1.2)		
Delay (mo)·Foreign VC‡							.23*	
							(.13)	
Delay (mo)·Govt VC							-.089	
							(.19)	
Delay (mo)·Private VC							.0066	
							(.11)	
Controls	Y	Y	Y	Y	N	Y	Y	
Industry f.e.	Y	Y	Y	Y	N	Y	Y	
Year f.e.	Y	Y	Y	Y	Y	Y	Y	
N	341	341	341	341	341	281	281	
R^2	.18	.064 (pseudo)	.18	.18	-	.17	.18	
First stage F-test±				67.5	67.5			

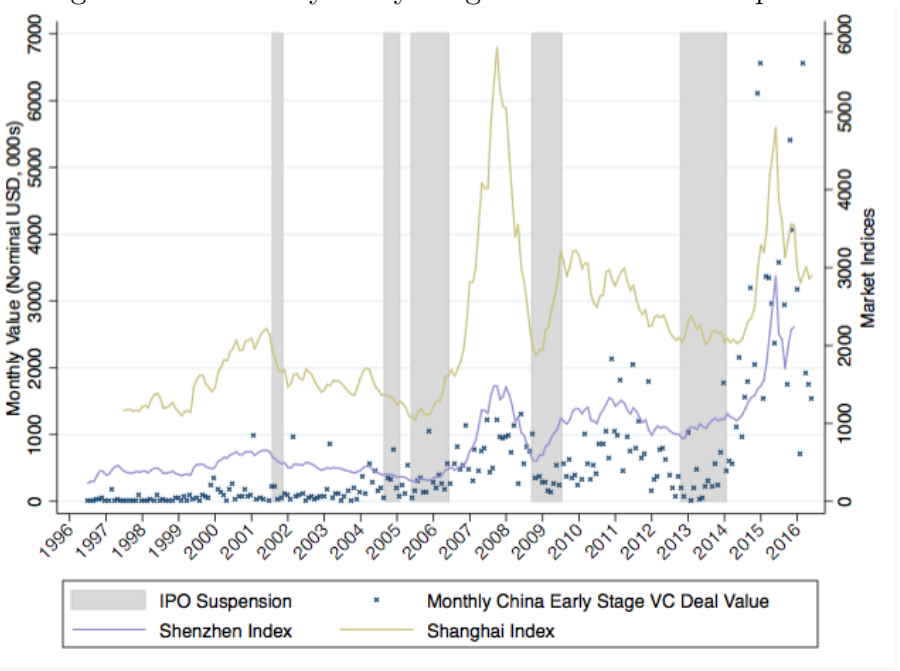
Note: This table contains regression estimates using variants of: $InvPatentApps_{jt} = \alpha + \beta_1 MonthsDelay_j + \gamma_t + \delta' \mathbf{V}_j$. OLS except columns 2 and 5. Sample limited to firms approved in the 12 months prior to an IPO suspension. †State-owned enterprises (SOEs) omitted. *The 75th percentile of delay is 12.8 months. Controls $\mathbf{V}_j$ 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). ‡Individual foreign, gov't and private VC f.e. included but not reported. ± 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. No direct weak instrument test, but as reduced from for the endogenous explanatory variable is linear, we use the F-statistic from the first stage. *** indicates p-value<.01.

Figure A.1: Ultimately successful patent applications by year around listing (IPO year)



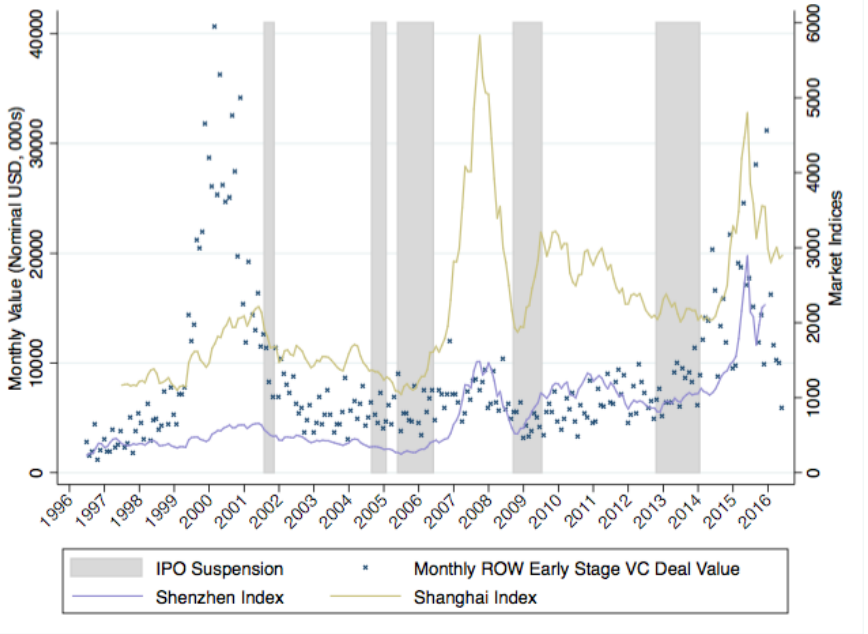
Note: This figure shows the raw means of patenting application behavior by year around the listing (IPO) year for firms in the estimation sample (approved a year before an IPO suspension). Only invention patents are used, and only granted (successful) patents are included. The first bar, for example, shows that in the 4th year prior to the IPO, firms on average apply for 4 ultimately granted invention patents. The final bar shows that in the 3rd year after the IPO, firms on average apply for 1.5 ultimately granted invention patents.

Figure A.2: Monthly Early Stage VC to China Companies



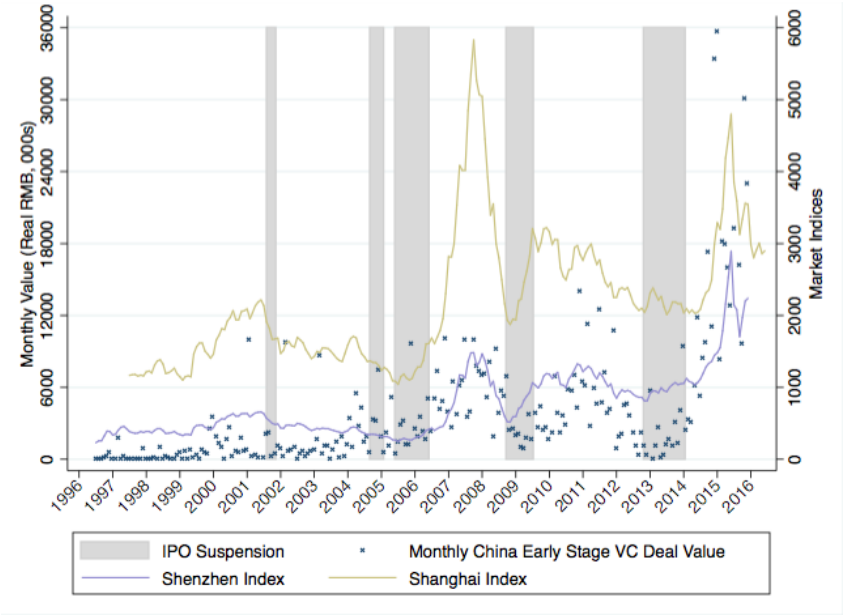
Note: Each point is the monthly value of VC investments in mainland China-based portfolio companies in nominal USD. Only seed and early stage VC investment included.

Figure A.3: Monthly Early Stage VC to Non-China (Rest of World) Companies



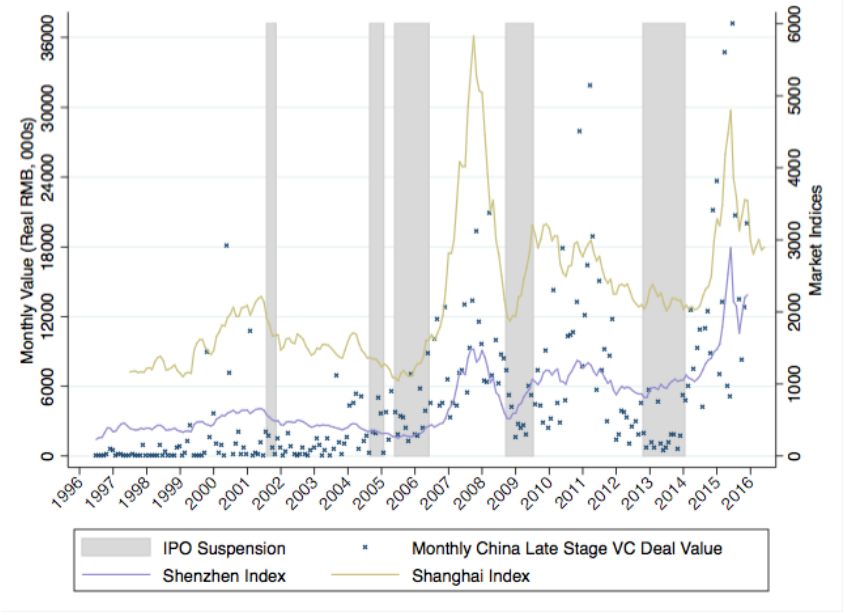
Note: Each point is the monthly value of VC investments in non-China-based portfolio companies in nominal USD. Only seed and early stage VC investment included.

Figure A.4: Monthly Early Stage VC Investment in China Companies (Real 2010 RMB)



Note: Each point in this figure is the total value of VC investments in China-based portfolio companies in a given month in real 2010 RMB. Only seed and early stage VC investment included.

Figure A.5: Monthly Later Stage VC Investment in China Companies (Real 2010 RMB)



Note: Each point in this figure is the total value of VC investments in China-based portfolio companies in a given month in real 2010 RMB. Only growth/expansion stage VC investment included.