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The impact of IPO approval on the price of existing stocks: Evidence from China

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ABSTRACT

This paper investigates whether initial public offering (IPO) announcements have any price impact on existing stocks in China. Using the Chinese IPO approval regime as a natural experiment, we find that IPO approval announcements have a negative price impact on stocks. This price effect appears to be a drift in equilibrium prices and is more pronounced on stocks that are more correlated with the IPO. These findings support an expectation-based downward-sloping demand curve hypothesis. We also document negative price reactions around the IPO listing day, which is consistent with the findings by previous authors. Further evidence rules out the signal effect of IPO approval announcements. In sum, IPO approvals can influence prices of other stocks by shaping the expectation of a change in the supply-demand equilibrium without actual trading of IPO shares.

1. Introduction

Whether IPOs have a negative price impact on existing stocks is an important issue that has both theoretical and practical implications for market participants and regulators. Braun and Larrain (2009) examine this issue using IPO listing events from 22 developing countries, finding that an IPO has a negative impact on its close substitutes, defined as those stocks whose price movements are highly correlated with the return of the IPO firm's industry. Shi et al. (2018) further find that sizable IPOs in China have a negative price impact on the entire market rather than on just the close substitutes of IPOs. Both studies conduct analyses for the IPO listing month or around the IPO listing day and are based on the actual trading of IPO shares. We extend the examination to IPO approval announcements to determine whether a credible announcement of a forthcoming IPO, per se, would negatively affect the price of existing stocks that are close substitutes for that IPO's shares.

According to Scholes (1972) and Mikkelson and Partch (1985), the demand curve for stocks should be downward sloping if firms in the market are not perfect substitutes for each other. An increase in supply in the form of new shares would negatively influence the equilibrium price of stocks that are close substitutes for the IPO stock. Braun and Larrain (2009) argue that the main mechanism for the negative cross-stock effect of an IPO is portfolio rebalancing. To absorb the new IPO shares, investors have to rebalance their portfolios by selling some existing shares that are close substitutes for the IPO shares, so the prices of these close substitutes go down. Shi et al. (2018) argue that investors in China speculate on significant IPO underpricing by selling some

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existing shares to create liquidity for purchasing IPO shares, which would result in a transitory negative price impact on existing stocks. Both arguments are consistent with the downward-sloping demand curve hypothesis, which holds that in a market with various imperfections, an increase in supply in terms of IPOs depresses the demand for their close substitutes, and thus their prices. The portfolio rebalance argument implies a drop in the equilibrium price that should be long lasting if it does not cause a temporary liquidity shortage, while the speculation argument implies a temporary downward price pressure which should be reversed relatively quickly. However, both arguments are based largely on the actual trading of IPO shares. If the demand curve for stocks is downward sloping, a pure expectation of supply increase in IPO shares should decrease the demand and thus the equilibrium price for that IPO's substitutes. This happens without the actual trading of IPO shares. In fact, in an efficient market, a major portion of price adjustment should occur upon the release of credible IPO news, and the price adjustment due to the change in expectation cannot be explained by portfolio rebalance or speculation on IPO underpricing, as no IPO shares are available for trading during that time.

The IPO approval regime in China allows us to do a natural experiment to investigate the IPO announcement effect on the price of existing stocks. Such an investigation can distinguish the pure IPO expectation effect from the price pressure effect and the portfolio rebalance effect. The Chinese IPO approval regime is distinctive in that investors can expect with certainty an increase in supply of IPO shares at the IPO approval announcements. In the U.S., firms have more control over the IPO process and can withdraw an IPO at any time before share issuance, while IPO approvals in China will lead to new share supplies almost for sure because obtaining IPO approval is substantially more difficult; indeed, no Chinese firm has voluntarily withdrawn its IPO after obtaining approval. On the other hand, the interval between an IPO approval and actual listing in China ranges from a month to a year, with a median of 2.5 months. This interval is typically long enough to avoid any possible confounding effect caused by actual trading in the IPO shares.

In addition, the IPO approval regime in China can help us rule out market timing as an explanation for the price decline for stocks closely related to the IPO, especially for stocks in the same industry as the IPO firm. Market timing is a common practice for firms planning their IPOs worldwide. Since managers of IPO firms have better information about their own firms and industries, they can time the market and issue shares when investors are overly optimistic (Ritter, 1991) or when the industry has a higher valuation (Pagano et al., 1998). Thus, IPOs may signal overvaluation of the industry that the IPO firm is in, and investors can infer a price reversal for stocks in that industry after the IPO announcement. This, in turn, can lead to a downward adjustment in the prevailing prices of related stocks (Baker and Wurgler, 2000) even if the demand curve for these stocks is flat. However, the IPO approval process in China is largely exogenous to IPO firms and the entire process to get approval is long and uncertain.[1] It is almost impossible for managers to time the market in any meaningful way. If we detect a negative impact on existing stocks that are close substitutes to the IPO around the day of the approval announcement in such a setting, it lends clear support to our hypothesis that a pure expectation of a forthcoming IPO can decrease the demand for an IPO's close substitutes, and thus, lower their equilibrium price.

Using a sample of 1056 IPOs introduced in the Chinese A-share market between 2004 and 2014, this study documents robust evidence that the expectation of new share supply can explain the negative price responses of *other* stocks around the time of IPO approvals. Consistent with Braun and Larrain (2009), we find that stocks that covary highly with an IPO experience a price decline around the IPO approval announcement. One unit closer to the IPO in terms of return covariance ranking reduces the industry CAR(−10, 1) by around three basis points, and the magnitude of this price decline monotonically increases as the window lengthens to 30 trading days following the IPO approval announcement. Furthermore, evidence shows that larger IPOs have greater price impacts on other stocks as they can cause a larger change in supply-demand equilibrium. To obtain a complete picture, we also examine the price effect around the IPO listing day. Consistent with Shi et al. (2018), we find a negative price effect on an IPO's close substitutes around IPO listing days. There is some evidence that the price decrease associated with IPO issuance is reversed after five trading days following the listing.

Furthermore, we conduct tests to exclude the possibility of the information (signal) hypothesis as the main explanation to the negative IPO price effect on existing stocks. Previous authors (Akhigbe et al., 2003; Hsu et al., 2010) point out that an IPO may signal fiercer competition in the product market for other firms in the same or related industries. This signal of fiercer competition can lead to a decline in the stock price of a given IPO's close substitutes. In other words, the price decline may be due to the change in competition prospects in the product market rather than a downward demand curve for existing stocks. Braun and Larrain (2009) do not address this issue; we address it by using an alternative sample to examine if there exists an "only-game-in-town" effect.

Hong et al. (2008) document an "only-game-in-town" effect, which is defined as follows: when a local market has fewer stocks, the prices of these local stocks tend to be higher due to less competition for local investments. Using changes in the total demand-supply profile in an IPO's province to replace an industry portfolio as a proxy for IPO substitutes, we find that *existing* stocks located in the same province as an approved IPO experience a price decline following the approval announcement. This evidence confirms that the downward-sloping demand curve drives adjustments in the market equilibrium prices of substitutable stocks, as an IPO is less likely to convey a negative product-specific signal for all firms domiciled in its home province. Our results are robust even after we exclude the possible colocation effect that firms in similar industries tend to locate in the same province.

Overall, our findings provide a more complete picture of the price effect of IPOs on their close substitutes. We show that the expectation of an IPO, per se, can result in price adjustments for IPO substitutes. In fact, the magnitude of the price adjustment around the IPO approval announcement is roughly on par with what is observed during the listing period. If we focus solely

[1] A detailed description of the IPO process in China appears in Section 2.

on the IPO price effect around IPO issuance, we will miss a significant portion of the IPO price effect. In addition, the price adjustment around the approval announcement appears to be long lasting, which indicates a change in equilibrium price. Furthermore, greater price changes are documented for the approval of larger IPOs for a given level of covariance, suggesting a greater price adjustment is associated with a larger change in supply-demand conditions.

Our study is related to the vast literature on the price impact of various supply shocks. Earlier work has examined how stock prices would respond to seasoned equity offerings, block sales, share repurchase, IPO lockup expiration, and so on, and find that all these supply shocks result in at least some price impact on these stocks' own prices.[2] However, relatively few papers have looked at the price impact of supply shocks on other stocks in the market, with some exceptions like Braun and Larrain (2009) and Shi et al. (2018).

Our study contributes to the extant literature in two ways. First, we supplement the studies on cross-stock IPO price effects by providing evidence that a pure expectation of a forthcoming IPO, without actual trading in that IPO's shares, can affect existing stocks that are close substitutes for the IPO's shares. This is very different from the portfolio rebalance and speculation on IPO underpricing mechanisms documented in previous studies. Second, we rule out the alternative hypothesis that an IPO signals fiercer competition in the product market of the relevant industries and thus reduces industry portfolio returns. By using geographic portfolios, we show that the IPO price effect around the approval announcement is indeed driven by the expectation of future changes in the demand-supply profile of existing stocks.

The next section provides background information and discusses the relevance of the Chinese IPO approval regime. The hypothesis development, sample construction, and research method are elaborated in Section 3. Section 4 presents the empirical results regarding the price impact of IPO approvals on other stocks in the market. Section 5 further uses an alternative proxy for IPO close substitutes to test that the downward-sloping demand curve for stocks is the cause of the price decline of IPO substitutes. Section 6 extends the test to IPO rejection cases, and Section 7 concludes the paper.

2. The Chinese IPO approval regime

In many financial markets, firms can file for IPOs when operational conditions or the market situation or both are in their favor. It only takes 59 days on average for a firm to move from completing IPO registration to being listed in Hong Kong.[3] In contrast, the Chinese IPO market has adopted an approval regime in which the China Securities Regulatory Commission (CSRC) sets the selection criteria, establishes compulsory procedures for potential IPO issuers, and makes the approval decision. Chinese firms have to go through a long and uncertain procedure before shares can ultimately be issued. Therefore, they cannot time their IPOs.

The initial phase of a Chinese IPO is the pre-filing reorganization, in which the firm is required to reorganize the corporation following CRSC requirements before becoming eligible to file an IPO application. This reorganization period can be time consuming, with an average time of 1150 days, or roughly three years (Zeng et al., 2016). It is also quite uncertain whether a firm will even successfully complete the reorganization. Thus, the market cannot form any meaningful expectation of whether and when an IPO will happen during this initial stage.

After a firm completes the reorganization, it enters the next stage: filing the actual IPO application and waiting for approval. Firms must file an IPO application with the CSRC first, then wait to be examined at the issuing examination committee meeting of the CSRC. Normally, there is a long queue of filed firms waiting to be examined. It is common for a firm to wait one or two years before being included in an issuing examination committee meeting, with the longest waiting time being more than 1000 days.[4] Many firms are required to clarify issues found in their application materials and supply new materials, which may prolong the waiting time. Some can even be removed from the queue if serious problems are found when CSRC staffs examine the application materials before sending them to the issuing examination meeting. Thus, simply filing an IPO application does not in itself contain enough information as to whether and when a firm will obtain IPO approval. However, for firms ultimately sent to the issuing examination meeting, the approval rate is about 85% during our sample period. Given the growing number of firms in the queue and the fact that many firms were disqualified before their applications reached the issuing examination committee, the actual approval rate should be much lower than 85%.Using the total number of IPOs approved in a year divided by the average number of firms in the queue in that year gives an estimated approval rate of less than 20%.[5] While the approval rate using the number of queuing firms as the denominator may understate the actual approval rate, it is safe to say that filing an application does not indicate a high chance of being listed in the next few years.

Once an IPO is approved, the firm can move on to prepare share issuance. Due to the difficulty in obtaining approval, firms never withdraw their IPOs, except in the very rare cases where they are found to have conducted fraud after approval and are forced to end the IPO process.[6] During our sample period, 61% and 88% of IPO firms issued shares within three and six months after their IPO approval announcements, respectively.[7] Therefore, the IPO approval announcement contains near-certain

[2] See, for example, Balwell (1992); Chang et al. (2014); Hess and Frost (1982); Holthausen et al. (1990); and Ofek and Richardson (2000).

[3] This information is obtained in a public speech by Mr. Chuang Xin Zhong, Vice-director of the Stock Exchange of Hong Kong (SEHK), Mainland Development Division, and can be found from the Chinese news at this link: http://finance.ifeng.com/a/20140611/12518876_0.shtml.

[4] Data regarding waiting times were collected from the CSRC website.

[5] Since the CSRC only provides queuing data for the most recent year, we resort to newspapers to get the queuing data, hence, the estimation is rough.

[6] In the entire history of the Chinese IPO up to the end of 2015, only six firms had been forced to withdraw their offerings after being granted IPO approval because the CSRC found evidence of misreporting in their financial statements.

[7] Data source: CSMAR.

Table 1
IPO events across industries, provinces, and years.
This table shows the distribution of all 1056 IPOs in our sample across 10 industries over years, and 31 provinces. The IPO samples cover all IPOs during the period 2004–2014 in the Chinese A-share market.

Panel A. Distribution of IPOs across years and industries

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Materials	11	1	10	18	19	22	52	38	16	0	0	187
Industrials	10	0	14	24	13	43	86	60	34	0	0	284
Utilities	3	0	1	0	0	2	2	1	1	0	0	10
Financials	2	0	3	11	3	3	4	4	0	0	0	30
Consumer discretionary	17	0	9	9	10	15	37	33	23	0	1	154
Energy	3	0	1	5	3	2	7	5	2	0	0	28
Consumer staples	1	0	3	2	4	7	23	8	6	0	1	55
Information technology	5	0	2	17	15	31	63	56	42	0	1	232
Health Care	5	0	2	3	6	13	18	20	7	0	0	74
Telecom	0	0	0	1	0	0	1	0	0	0	0	2
Total	57	1	45	90	73	138	293	225	131	0	3	1056

Panel B. Distribution of IPOs across provinces

Province	Number of IPOs	Percentage of whole sample
Anhui	30	2.84
Beijing	127	12.03
Chongqing	11	1.04
Fujian	42	3.98
Gansu	5	0.47
Guangdong	208	19.7
Guangxi	6	0.57
Guizhou	6	0.57
Hainan	6	0.57
Hebei	15	1.42
Henan	29	2.75
Heilongjiang	4	0.38
Hubei	20	1.89
Hunan	25	2.37
Jilin	7	0.66
Jiangsu	137	12.97
Jiangxi	10	0.95
Liaoning	16	1.52
Inner Mongolia	4	0.38
Ningxia	1	0.09
Qinghai	2	0.19
Shandong	63	5.97
Shanxi	6	0.57
Shaanxi	15	1.42
Shanghai	62	5.87
Sichuan	32	3.03
Tianjin	13	1.23
Tibet	2	0.19
Xinjiang	9	0.85
Yunnan	6	0.57
Zhejiang	137	12.97

information of a new share supply, and the market can form an expectation about future changes in demand-supply conditions. As mentioned earlier the shortest interval between approval and listing is about one month, which is long enough to help separate the expectation-based explanation from IPO share trading-based explanations.

In short, China's IPO approvals are exogenous to applying firms.[8] Investors cannot infer a price reversal resulting from a decline in firm performance or the correction of overvaluation after listing for the IPO firm and its close substitutes. Hence, the market timing hypothesis can be ruled out in our empirical setup.

[8] Since IPO approval pace is subject to the discretion of the CSRC, it is possible that the CRSC itself might time the market and approve more IPOs when the market is booming and suspend or limit approvals during market downturns. In fact, CSRC has imposed nine moratoriums on IPOs since 1994, all during market downturns or troughs. After those moratoriums, the renewal of IPO approvals signals benign market prospects and should be accompanied by positive price effects on existing stocks because IPO approvals after a moratorium signal confidence on the part of the CSRC. However, such market timing should be biased *against* our expectation of finding a negative IPO effect on other stocks.

Table 2
Summary statistics of industry covariance rankings.
This table lists the summary statistics of the covariance ranking scores for each industry. The industries correspond to the 10 industry classifications defined in Wind Info. For each IPO in the sample, we rank all 10 industries according to their return covariance with the IPO industry. The score 1 indicates the lowest covariance ranking while 10 the highest. The return covariances are estimated using monthly returns on industry portfolios 36 months prior to the IPO event day.

Industry	Mean	Median	Min.	Max.	No. of Obs.
Materials	9.16	10	1	10	1056
Telecommunication services	1.59	1	1	10	1056
Industrials	6.46	7	2	8	1056
Utilities	5.92	6	1	9	1056
Financials	2.95	2	2	10	1056
Consumer discretionary	8.46	9	4	9	1056
Energy	5.25	4	2	10	1056
Consumer staples	3.82	3	1	10	1056
Information technology	6.22	5	1	10	1056
Health care	5.16	5	1	10	1056

3. Research method and sample construction

3.1. Hypothesis development and empirical design

When stocks have a perfectly elastic demand curve, the market equilibrium price of stocks will not be affected by supply shocks. However, due to various market frictions,[9] the demand curve of stocks slopes downward (Kraus and Stoll, 1972; Wurgler and Zhuravskaya, 2002). Thus, a supply shock in the form of an IPO may change the current equilibrium price of stocks that are close substitutes for that IPO. According to Scholes (1972) and Mikkelson and Partch (1985), when the new share supplies represent a closer substitute for existing stocks, the price reaction of existing stocks is greater. Consistent with this conclusion, Braun and Larrain (2009) show that stocks having higher covariance with the IPO's industry are associated with larger price declines during the IPO month.

In an efficient market, the prices of stocks will react once the news of a supply shock is released. As noted above, the exogenous approval regime in China makes IPO approval a very good forecast of future IPO issuance. In other words, IPO approval announcements per se forecast changes in the supply of IPO shares and the demand for IPO substitutes, which leads to adjustments in market equilibrium prices, even without trading having begun. Since such expectation-driven price adjustment is largely unaffected by speculation on IPO underpricing or a temporary liquidity shortage, there should be no price reversal. Thus, we have the following two hypotheses:

H1. Existing stocks that are highly substitutable by an IPO should experience price decreases upon the announcement of IPO approval: the greater the substitutability between existing stocks and the IPO, the larger their price decline.

H2. The price reaction around IPO approval announcements tends to be an adjustment toward a new equilibrium level with no price reversal because it reflects market expectation of the new demand-supply equilibrium.

To test these hypotheses, we first estimate the following baseline regression model:

$$\begin{aligned} CAR_{ij} &= \alpha + \beta_1 * COV_{ij} + \beta_2 * SIZE_{ij} + \beta_3 * BTM_{ij} + \gamma * IPO_i + \epsilon_{ij}, \qquad CAR_{i,j} \\ &= \alpha + \beta_1 * COV_{i,j} + \beta_2 * SIZE_i + \beta_3 * BTM_i + \gamma * IPO_j + \epsilon_i, \end{aligned} \tag{1}$$

where CAR_{ij} represents the cumulative abnormal returns of industry portfolio i around IPO_j's event (IPO approval). The portfolio returns are the value-weighted returns of all listed stocks in industry i. CAR_{ij}, is obtained from a market model that is estimated from 220 to 20 trading days prior to the event day. The CAR window varies from 10 days before to 30 days after the approval day. COV_{ij} measures the extent of the substitution between IPO_j's industry portfolio and industry portfolio i. Following Braun and Larrain (2009), we utilize return covariance between each industry i and the industry of approved IPO_j as a proxy for the substitutability between the two portfolios. Return covariance is calculated using monthly industry portfolio returns over the 36 months prior to the event month. We then rank all industries along their covariances with the industry of IPO_j to form the variable COV_{ij}. All firms are classified into 10 industries in the Wind Database. A value of COV_{ij} equal to 1 indicates the lowest return covariance between industry i and the industry of IPO_j, meaning that stocks in industry i are least substitutable by the IPO stock. In contrast, a value of COV_{ij} equal to 10 means that the IPO is most substitutable for stocks in that industry.

We control for industry size (SIZE) and book-to-market ratio (BTM) in the regression, as they are common risk factors proposed by Fama and French (1993) to capture the size effect and value premiums in the cross-section of stock returns. Following Braun and Larrain (2009), for each IPO_j, we use the natural logarithm of the aggregated flow of stock market capitalization of all stocks in an industry to gauge SIZE and the natural logarithm of the value-weighted BTM of all stocks in the industry to capture the value factor. IPO dummies are included to capture the IPO-specific fixed effect. For comparison, we also examine whether IPOs negatively impact the price of their close substitutes around the listing day.

[9] A lack of perfect substitutes, arbitrage risks, heterogeneous investor preferences, etc.

Table 3
Summary statistics and correlations of key variables.
This table reports summary statistics of the key variables used in the empirical analysis in Panel A and the correlation matrix of these variables in Panel B. CAR denotes the cumulative abnormal return on the industry portfolios around the IPO approval day. The industry portfolio return is the value-weighted return of all listed stocks in the same industry. Abnormal returns are calculated using the market model, which is estimated from 220 to 20 trading days prior to IPO approval day, while the market return is the value-weighted return of all stocks listed in the Chinese A-share market. COV is the ranking for the return covariance between an industry portfolio and the industry of each IPO, which is estimated from monthly returns over the 36 months prior to the month of IPO approval. SIZE is the natural logarithm of the aggregated tradable share market capitalization of all stocks in an industry, while BTM is the natural logarithm of the value-weighted book-to-market ratio of all stocks in an industry. RS (relative size) is the previous yearend book value of equity of the IPO firm over the aggregated book values of all existing stocks in each industry as of the yearend prior to the IPO approval.

Panel A: Summary statistics of key variables

Variable	N	Mean	Min	p25	Median	p75	Max	St. dev
SIZE	10,560	20.2485	16.3502	19.4693	20.3656	21.0883	22.4239	1.2053
BTM	10,560	0.0668	−1.1281	−0.4576	−0.1002	0.4859	2.4641	0.7820
COV	10,560	5.5000	1.0000	3.0000	5.5000	8.0000	10.0000	2.8724
RS	10,560	0.0046	0.0000	0.0002	0.0007	0.0016	0.1781	0.0210
CAR[−10,1]	10,560	0.0005	−0.2229	−0.0194	−0.0005	0.0189	0.3043	0.0371
CAR[−10,3]	10,560	0.0007	−0.2312	−0.0205	−0.0004	0.0205	0.2767	0.0401
CAR[−10,5]	10,560	0.0004	−0.2277	−0.0227	−0.0010	0.0226	0.2484	0.0430
CAR[−10,10]	10,560	0.0003	−0.2478	−0.0254	−0.0005	0.0256	0.3043	0.0495
CAR[−10,20]	10,560	0.0006	−0.3500	−0.0318	−0.0010	0.0327	0.5465	0.0606
CAR[−10,30]	10,560	0.0018	−0.4106	−0.0352	0.0003	0.0378	0.5453	0.0698
CAR[−5.1]	10,560	0.0005	−0.1795	−0.0143	−0.0004	0.0137	0.2454	0.0281
CAR[−5.3]	10,560	0.0008	−0.1794	−0.0159	−0.0005	0.0162	0.2255	0.0313
CAR[−5.5]	10,560	0.0005	−0.1965	−0.0186	−0.0007	0.0177	0.2461	0.0345
CAR[−5.10]	10,560	0.0003	−0.2219	−0.0222	−0.0009	0.0217	0.3345	0.0419
CAR[−5.20]	10,560	0.0006	−0.2855	−0.0294	−0.0013	0.0292	0.4877	0.0546
CAR[−5.30]	10,560	0.0019	−0.3462	−0.0325	−0.0001	0.0346	0.4865	0.0646
CAR[−3.1]	10,560	0.0004	−0.1301	−0.0121	−0.0006	0.0120	0.2120	0.0237
CAR[−3.3]	10,560	0.0007	−0.1569	−0.0140	−0.0004	0.0137	0.1843	0.0274
CAR[−3.5]	10,560	0.0004	−0.1853	−0.0163	−0.0008	0.0156	0.1808	0.0306
CAR[−3.10]	10,560	0.0002	−0.2141	−0.0207	−0.0006	0.0197	0.2926	0.0384
CAR[−3.20]	10,560	0.0005	−0.2505	−0.0275	−0.0008	0.0275	0.3855	0.0518
CAR[−3.30]	10,560	0.0018	−0.3112	−0.0323	−0.0000	0.0336	0.4746	0.0623
CAR[−1.1]	10,560	0.0002	−0.1136	−0.0094	−0.0004	0.0087	0.2247	0.0181
CAR[−1.3]	10,560	0.0004	−0.1310	−0.0114	−0.0003	0.0111	0.1970	0.0232
CAR[−1.5]	10,560	0.0001	−0.1481	−0.0142	−0.0007	0.0130	0.2013	0.0273
CAR[−1.10]	10,560	−0.0000	−0.1924	−0.0187	−0.0007	0.0173	0.3016	0.0355
CAR[−1.20]	10,560	0.0002	−0.2651	−0.0262	−0.0007	0.0263	0.3193	0.0494
CAR[−1.30]	10,560	0.0015	−0.3699	−0.0302	0.0004	0.0316	0.5066	0.0601

Panel B: Pearson correlation coefficient matrix

	SIZE	BTM	COV	RS	CAR [−10,1]	CAR [−10,3]	CAR [−10,5]	CAR [−10,10]	CAR [−10,20]	CAR [−10,30]	CAR [−5.1]	CAR [−5.3]	Car [−5.5]
SIZE	1												
BTM	0.058	1											
COV	0.233	−0.292	1										
RS	−0.200	0.011	−0.041	1									
CAR[−10,1]	−0.057	0.062	−0.053	0.028	1								
CAR[−10,3]	−0.065	0.070	−0.058	0.028	0.936	1							
CAR[−10,5]	−0.064	0.082	−0.060	0.033	0.879	0.945	1						
CAR[−10,10]	−0.064	0.079	−0.061	0.039	0.779	0.825	0.878	1					
CAR[−10,20]	−0.065	0.067	−0.055	0.042	0.659	0.696	0.747	0.846	1				
CAR[−10,30]	−0.073	0.044	−0.051	0.038	0.576	0.605	0.644	0.738	0.888	1			
CAR[−5.1]	−0.047	0.038	−0.052	0.030	0.780	0.715	0.666	0.586	0.508	0.445	1		
CAR[−5.3]	−0.058	0.050	−0.059	0.030	0.716	0.816	0.770	0.662	0.568	0.494	0.891	1	
CAR[−5.5]	−0.056	0.066	−0.060	0.036	0.653	0.751	0.842	0.731	0.634	0.544	0.804	0.913	1
CAR[−5.10]	−0.056	0.063	−0.060	0.042	0.558	0.625	0.706	0.884	0.757	0.659	0.672	0.745	0.825
CAR[−5.20]	−0.057	0.052	−0.052	0.044	0.453	0.504	0.574	0.711	0.924	0.823	0.548	0.603	0.674
CAR[−5.30]	−0.066	0.029	−0.048	0.038	0.387	0.427	0.481	0.604	0.802	0.943	0.467	0.510	0.562
CAR[−3.1]	−0.042	0.033	−0.046	0.024	0.656	0.599	0.545	0.470	0.412	0.364	0.867	0.770	0.678
CAR[−3.3]	−0.054	0.046	−0.053	0.024	0.585	0.717	0.667	0.561	0.485	0.422	0.742	0.894	0.805
CAR[−3.5]	−0.053	0.065	−0.054	0.031	0.527	0.654	0.759	0.651	0.568	0.486	0.660	0.808	0.914
CAR[−3.10]	−0.052	0.061	−0.055	0.038	0.443	0.529	0.619	0.826	0.708	0.618	0.536	0.636	0.730
CAR[−3.20]	−0.054	0.049	−0.047	0.040	0.354	0.417	0.493	0.647	0.887	0.793	0.432	0.504	0.584
CAR[−3.30]	−0.064	0.025	−0.043	0.035	0.299	0.349	0.405	0.541	0.760	0.916	0.364	0.419	0.479
CAR[−1.1]	−0.035	0.036	−0.046	0.020	0.543	0.509	0.466	0.389	0.342	0.294	0.699	0.639	0.565
CAR[−1.3]	−0.049	0.049	−0.051	0.019	0.443	0.630	0.592	0.485	0.417	0.355	0.534	0.765	0.696
CAR[−1.5]	−0.046	0.068	−0.052	0.028	0.383	0.552	0.688	0.581	0.506	0.425	0.452	0.661	0.812

Table 3 *(continued)*

Panel B: Pearson correlation coefficient matrix

	SIZE	BTM	COV	RS	CAR [−10,1]	CAR [−10,3]	CAR [−10,5]	CAR [−10,10]	CAR [−10,20]	CAR [−10,30]	CAR [−5.1]	CAR [−5.3]	Car [−5.5]
CAR[−1.10]	−0.047	0.063	−0.052	0.036	0.318	0.432	0.543	0.778	0.666	0.576	0.358	0.499	0.625
CAR[−1.20]	−0.050	0.049	−0.044	0.038	0.256	0.337	0.426	0.595	0.858	0.765	0.293	0.393	0.494
CAR[−1.30]	−0.060	0.024	−0.040	0.033	0.215	0.279	0.346	0.493	0.728	0.895	0.246	0.323	0.399

	CAR [−5.10]	CAR [−5.20]	CAR [−5.30]	CAR [−3.1]	CAR [−3.3]	CAR [−3.5]	CAR [−3.10]	CAR [−3.20]	CAR [−3.30]	CAR [−1.1]	CAR [−1.3]	CAR [−1.5]	CAR [−1.10]	CAR [−1.20]	CAR [−1.30]
SIZE															
BTM															
COV															
RS															
CAR[−10,1]															
CAR[−10,3]															
CAR[−10,5]															
CAR[−10,10]															
CAR[−10,20]															
CAR[−10,30]															
CAR[−5.1]															
CAR[−5.3]															
CAR[−5.5]															
CAR[−5.10]	1														
CAR[−5.20]	0.806	1													
CAR[−5.30]	0.684	0.868	1												
CAR[−3.1]	0.556	0.458	0.393	1											
CAR[−3.3]	0.642	0.522	0.443	0.856	1										
CAR[−3.5]	0.744	0.611	0.510	0.743	0.888	1									
CAR[−3.10]	0.943	0.762	0.647	0.589	0.686	0.787	1								
CAR[−3.20]	0.740	0.967	0.841	0.470	0.539	0.626	0.782	1							
CAR[−3.30]	0.618	0.827	0.976	0.397	0.450	0.513	0.654	0.857	1						
CAR[−1.1]	0.448	0.371	0.309	0.816	0.719	0.627	0.481	0.385	0.316	1					
CAR[−1.3]	0.539	0.437	0.361	0.624	0.865	0.777	0.582	0.456	0.371	0.793	1				
CAR[−1.5]	0.650	0.535	0.436	0.507	0.731	0.894	0.691	0.551	0.441	0.658	0.857	1			
CAR[−1.10]	0.877	0.707	0.595	0.386	0.537	0.675	0.934	0.728	0.603	0.485	0.617	0.745	1		
CAR[−1.20]	0.673	0.930	0.807	0.312	0.419	0.530	0.713	0.964	0.824	0.379	0.470	0.575	0.756	1	
CAR[−1.30]	0.556	0.789	0.950	0.263	0.345	0.428	0.590	0.819	0.975	0.307	0.377	0.456	0.619	0.845	1

3.2. Sample construction

We collect approval information for all IPOs in the Chinese A-share market between 2004 and 2014 from Wind Info. For each IPO, we identify both the IPO approval day and the listing day as the IPO event days. We also collect daily stock returns on all A-share stocks and form10 value-weighted industry portfolios following the industry classification in WindInfo. We calculate the value-weighted industry portfolio returns using daily closing prices and market capitalization based on tradable shares. After matching the IPO event days with industry portfolio returns, our final sample consists of 1056 IPOs from all 10 industries over the entire sample period. Our sample begins in 2004 because approval data are only available starting that year. Table 1 presents the distribution of all IPO approvals in our sample across industries, provinces, and years. Summary statistics of the return covariances between all industries are listed in Table 2; they are quite comparable to those reported in Braun and Larrain (2009).

Table 3 reports the summary statistics and correlations of all variables included in Eq. (1). It is worth noting in Panel A that there are considerable cross-sectional variations in CARs on industry portfolios around the approval day. For instance, the mean CAR between 10 trading days prior to and 10 days after IPO approval day CAR(−10, 10) is close to zero, while the maximum CAR(−10, 10) is 30.4% and the minimum CAR(−10, 10)is −24.78%. For CARs over alternative windows, a similar pattern can be observed. This suggests that different industries react heterogeneously to IPO approvals. In empirical tests, we convert units of CARs into percentage points. Pearson correlations of key variables reported in Panel B show that COV and all CARs are negatively correlated. Also the correlation coefficients between regressors are generally low.

4. Empirical results

4.1. Price impact around IPO approvals

This section presents and discusses the empirical results of the IPO price impact around IPO approval day. Column 1 of Panel A in Table 4 presents the estimation results for Eq. (1) with CAR(−10, 1) as the dependent variable. We see that the estimated coefficient of COV, the covariance between an industry portfolio and the IPO industry, is −0.03 and statistically significant at the 10% level, indicating that a higher substitutability between the IPO and the industry portfolio leads to a lower CAR for that industry, which is consistent with H1. In addition, both SIZE and BTM enter the regression with the expected sign and statistical significance at the 1% level. We repeat the regression with longer CAR windows—CAR(−10, 3), CAR(−10, 5), CAR(−10, 10), CAR(−10, 20), and CAR(−10, 30)—and report the results in Columns 3, 5, 7, 9, and 11, respectively. There is clearly no price reversal, as the estimated coefficient for COV monotonically decreases with the lengthening of the CAR window, while the statistical significance increases in general. The estimated coefficient for CAR(−10, 30) is −0.065, which is statistically significant at the 5% level. The estimated coefficients for SIZE and BTM are qualitatively the same as those in Column 1. These results indicate that moving one rank closer to the IPO in terms of covariance ranking reduces CAR(−10,1) on stocks in that industry portfolio by three basis points. This magnitude is quite comparable to Braun and Larrain (2009) that documents one unit moving closer to the IPO in the covariance ranking drives stocks' prices down by 3.8 basis points. Since we have 10 ranks of covariance, this 3 basis points per level means that stocks having the highest COV with the IPO will suffer a 27-basis point loss in abnormal returns compared to stocks with the lowest COV with the IPO. When the CAR window is extended from 10 days before the approval to 30 days after, the difference between highest versus lowest increases to 58.5 basis points. Such a magnitude is economically significant, as the round-trip transaction cost for stocks has been no more than 35 basis points in recent years, indicating possible arbitrage opportunities.[10]

Braun and Larrain (2009) point out that the cross-stock impact of an IPO depends not only on COV, but also on the size of the IPO. They address this issue by only including IPOs with a size above certain threshold in their sample. This is not necessarily an effective way to address the issue. However, to include the relative IPO size in the regression, we need to deal with two empirical difficulties. First, since industry size is already controlled in the regression, further including the IPO size divided by each industry size as the proxy for relative size (RS) of an IPO in the regression will result in a strong and mechanically negative relationship between SIZE and RS, i.e. the larger the SIZE, the smaller the RS for each IPO. This may dominate the cross sectional difference in IPO size. Second, we expect RS to have a negative impact on CAR for a given level of COV. Without control for COV, RS is not necessarily expected to have a negative relationship with CAR.

To reduce the multicullinearity (or the mechanically negative relationship) between SIZE and RS, we compute the relative size (RS) of an IPO using the book value rather than the market value, as SIZE is proxied by an industry's market capitalization.[11] Specifically:

$$RS_{ij} = \frac{IPO_j}{Industry_i}, \quad \text{(where } i = 1, \ldots, 10 \text{ including } j\text{)} \tag{2}$$

where IPO_j represents the book value of the equity of IPO firm j as of the pre-IPO yearend, and Industry i represents the book value of equity of the i^{th} industry at the same yearend. We use RS_{ij} to proxy the supply shock of IPO_j to industry i.[12] Its correlation coefficient with SIZE is about −0.2 (see Panel B of Table 3).

To examine the relative supply effect of an IPO on the CAR for each given level of COV, we include not only RS but also the interactive term RS*COV in the regression. In fact, our focus is not on RS itself but on the interactive term, and we expect the coefficient for the interactive term to be negative and statistically significant. That is, for a given level of COV, the larger (smaller) the forthcoming IPO relative to an industry, the larger (smaller) the IPO approval is likely to increase the supply, and thus leads to a larger (smaller) decline in the industry portfolio return. We repeat the Eq. (1) analysis by including RS and the interactive term between RS and COV in the following model:

$$CAR_{ij} = \alpha + \beta_1 * COV_{ij} + \beta_2 * RS_{ij} + \beta_3 * RS_{ij} * COV_{ij} + \beta_4 * SIZE_{ij} + \beta_5 * BTM_{ij} + \gamma * IPO_j + \epsilon_{ij} \tag{3}$$

where CAR_{ij} denotes the cumulative abnormal return (in percent) on industry portfolio i starting from 10 trading days prior to IPO_j's approval day up to 30 trading days after. RS_{ij} is the relative size of IPO_j to each of the 10 industry. COV, SIZE, and BTM capture return covariance, industry size, and value characters, respectively, and are defined as in Eq. (1).

The estimation results are also reported in Panel A of Table 4: columns 2, 4, 6, 8, 10, and 12 present the estimation for various CAR windows. It is clear that the inclusion of interaction between the relative IPO size and COV does not affect our primary results: while COV still has a negative influence on CARs, the interactive term also has a negative coefficient in general after the approval. This finding is consistent with the downward sloping curve hypothesis in that larger IPO supply shocks bring a more negative price impact on industrial portfolios for a given level of COV around the approval day. The estimate for RS is positive and sometimes significant, which could be due to its mechanical relationship with SIZE and is not something of our concern. The estimates for SIZE and BTM are qualitatively the same as those reported in columns 1, 3, 5, 7, 9, and 11. Therefore, the argument that the cross-stock effect should be more negative for greater IPO supply shocks is also supported.

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[10] To ensure that this negative price reaction of industrial portfolios is not driven by the IPO's own industry alone, we also repeat the test by excluding IPOs' own industries from the sample. The results are qualitatively similar. For brevity we did not include this table in the paper but the results are available upon request. We would like to thank the referee for this suggestion.

[11] For each IPO, the RS is the IPO size divided by the industry size. Since the IPO size is the same for all 10 industries, the RS variation for a particular IPO is decided by the industry size. By definition, this is inversely related to SIZE, which is a Fama-French factor controlled in the regression, and results in a mechanical negative relationship between RS and SIZE for each IPO, which may dominate the cross-sectional difference in IPO size.

[12] Using the book value of total assets rather equity to compute RS, the results are qualitatively the same.

We further repeat the Panel A regressions using CARs calculated for windows starting five, three, and one day(s) prior to the approval announcement. The results shown in Panels B, C, and D of Table 4 are all qualitatively the same as those presented in Panel A.[13]

Overall, the results shown in Table 4 are very much consistent with our H1 and H2. The announcement of an IPO approval has a significant and negative price impact on stocks that are close substitutes of the IPO. Stocks having a higher covariance with the IPO suffer more around the approval announcement, and there is no evidence of a price reversal up to 30 trading days after the IPO approval announcement.[14] These results hold even after we control for the relative size of an IPO. We believe that the price reaction of existing stocks reflects an adjustment in the equilibrium price level that incorporates the information of forthcoming changes in supply and demand upon IPO approvals.

4.2. Price effect around listing days

Around the IPO listing day, investors can actually rebalance their portfolios and speculate on high IPO underpricing by selling existing stocks and buying IPO shares. This is likely to cause a temporary liquidity shortage in the market and produce downward price pressure on existing stocks, especially those stocks that are close substitutes to the IPO stock. Once liquidity is restored, we should see a price reversal as speculators buy back the shares that they had earlier sold. Shi et al. (2018) find that IPOs have a negative but transitory price impact on the market as a whole around listing day in China. They also find the price decline for the market is positively related to the IPO size. We further examine whether an IPO's impact on its close substitutes is also negative and transitory around listing days. We repeat the regressions for Eqs. (1) and (3) with CAR calculated around the listing day and report the results in Table 5.

As we see in Panel A of Table 5, the estimated coefficient for COV is negative and significant for CAR(−10, 1), CAR(−10, 3), and CAR(−10,5) regressions. For the CAR(−10, 1) regression shown in Column 1, one rank higher in terms of covariance with the IPO shares is associated with a 3.3-basis point decrease in abnormal returns, implying that the most affected stocks will experience a 29.7-basis point shortfall in abnormal return, compared to the least affected stocks during the 12-day period. Such a magnitude is roughly on par with that reported for the approval announcement. The CAR declines further as the window lengthens to five days after the listing. One rank higher in terms of covariance with the IPO shares is now associated with a 4.3-basis point CAR decrease during the (−10, 5) window, which results in a 38.7-basis point return differential between the stocks that are most and least affected. However, for windows beyond (−10, 5) days, the estimated coefficient for COV becomes statistically insignificant with a monotonic decreasing magnitude, which is consistent with the price reversal argument.

When RS and the interaction between COV and RS are included in the regression, the estimates for COV in various CAR windows become positive and many are even statistically significant. However, the estimates for the interaction term are largely negative and significant as expected. Also the magnitude of the estimates for the interaction term is much larger than that for RS. This seems to suggest that the IPO impact on other stocks around listing day is jointly determined by the IPO size and the covariance. Shi et al. (2018) show that the zealous speculation on the heavy IPO underpricing in China is the main reason for the price decline of the whole market. To speculate on the high IPO underpricing, investors may even sell stocks that are non-substitutes for the IPO stock. A larger IPO may cause more selling of other stocks. Therefore, COV, by itself, may not have the expected impact on CAR once we control the relative IPO size during the listing period. However, given the size of an IPO relative to the industry size, COV still have a negative impact on CAR around the listing day. However, there seems no indication of price reversal as the interaction term is negative and significant up to 30 days after the listing. We further change our CAR window starting day from ten days to five, three, and one day(s) prior to the listing and repeat the Panel A regressions. The results are largely the same, as shown in Panels B, C, and D of Table 5, respectively. Similar to the results reported in Table 4, the estimated coefficient for SIZE is mostly negative and significant across all CAR windows but the estimated coefficient for BTM becomes mostly insignificant.

Our findings in Table 5 provide evidence that the IPO price effect on a firm's close substitutes around listing day is heavily influenced by the relative size of an IPO and the speculative trading on IPO. Overall, our results in Tables 4 and 5 indicate that an IPO has a negative price effect on its close substitutes around approval day as well as listing day but the price reversal story associated with IPO listing is not strongly supported.

5. Downward-sloping demand curve or signaling

It is possible that an IPO approval may signal a change in competition in IPO-related industries, because the IPO firm would have the competitive advantage over existing firms in terms of new funding. Akhigbe et al. (2003) and Hsu et al. (2010) show that firms in the same industry as the IPO can expect fiercer product market competition and face more serious financial constraints and that firms in industries upstream and downstream from the IPO's industry may also face an altered product market. These industries are likely to have a high covariance with the IPO firm. Hence, the signal hypothesis could offer a competing explanation that is not based on the downward-sloping demand curve for stocks to the price decline associated with IPO substitutes around IPO approval or listing. To rule out this signal hypothesis, we replace industry portfolios with geographic portfolios. The signal hypothesis should be less relevant for geographical portfolios, as firms located in a province are more likely to distribute

[13] When the IPO's own industry excluded the results are largely the same although a bit weaker.

[14] We do not examine CAR windows longer than 30 days after IPO announcements, as they may include confounding events such as IPO subscriptions and listings. Nevertheless, an examination of CARs up to 60 days after the announcements still shows no price reversal. These results are available upon request.

Table 4
The IPO price effect around IPO approval.
This table reports the results of the stock price response of various industry portfolios to IPO approval announcements using the following regression:

$$CAR_{ij} = \alpha + \beta_1 * COV_{ij} + \beta_2 * RS_{ij} * COV_{ij} + \beta_3 * SIZE_{ij} + \beta_4 * BTM_{ij} + \gamma * IPO_j + \epsilon_{ij}.$$

The dependent variable CAR_{ij} denotes the cumulative abnormal return (in percent) of industrial portfolio *i* starting from ten, five, three, and one trading day(s) prior to IPO_j's approval day up to 30 trading days thereafter. COV_{ij} is the ranking for the return covariance between an industry portfolio *i* and the IPO industry *j*, which is estimated from monthly returns over the 36 months prior to the month of IPO approval. $SIZE_{ij}$ is the natural logarithm of the aggregated tradable share market capitalization of all stocks in industry i while BTM_{ij} is the natural logarithm of the value-weighted book-to-market ratio of all stocks in industry i corresponding to each IPO_j, respectively. RS_{ij} (relative size) is a firm's pre-IPO book value of equity to the aggregated book value of equity of all stocks in each industry:

$$RS_{ij} = \frac{IPO_j}{Industry_i}, \quad \left(\text{for } IPO_{j's} \text{own industry}, i = j\right)$$

where IPO_j represents the book value of equity of IPO_j as of the pre-IPO yearend, and Industry *i* represents the book value of equity of listed firm in industry i as of the same yearend. IPO_j is the fixed effect for IPO_j. The regressions are estimated using ordinary least squares (OLS) with robust standard errors clustered by IPO event: *t*-values are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10%levels, respectively.

Panel A	CAR[−10,+1]		CAR[−10,+3]		CAR[−10,+5]		CAR[−10,+10]		CAR[−10,+20]		CAR[−10,+30]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
COV	-0.030^{*}	−0.026	-0.032^{*}	−0.029	-0.032^{*}	−0.028	-0.048^{**}	-0.043^{*}	-0.055^{**}	-0.048^{*}	-0.065^{**}	-0.060^{*}
	(−1.80)	(−1.58)	(−1.81)	(−1.60)	(−1.64)	(−1.45)	(−2.14)	(−1.85)	(−1.98)	(−1.75)	(−2.01)	(−1.85)
RS		0.801^{**}		0.694^{**}		0.798^{***}		1.452^{**}		1.177		0.426
		(2.09)		(2.38)		(2.61)		(2.24)		(1.10)		(0.33)
RS*COV		-0.246^{*}		-0.215^{*}		-0.285^{**}		-0.525^{***}		-0.640^{***}		-0.585^{**}
		(−1.89)		(−1.83)		(−2.35)		(−3.25)		(−2.93)		(−2.24)
SIZE	-0.188^{***}	-0.188^{***}	-0.245^{***}	-0.246^{***}	-0.249^{***}	-0.249^{***}	-0.218^{***}	-0.217^{***}	-0.251^{***}	-0.255^{***}	-0.346^{***}	-0.357^{***}
	(−3.44)	(−3.43)	(−4.10)	(−4.07)	(−3.95)	(−3.94)	(−3.00)	(−2.99)	(−2.75)	(−2.79)	(−3.31)	(−3.40)
BTM	0.259^{***}	0.261^{***}	0.322^{***}	0.325^{***}	0.427^{***}	0.422^{***}	0.444^{***}	0.443^{***}	0.456^{***}	0.453^{***}	0.320^{**}	0.316^{**}
	(2.98)	(3.00)	(3.43)	(3.44)	(4.15)	(4.14)	(3.79)	(3.79)	(3.26)	(3.24)	(2.03)	(2.01)
Constant	4.011^{***}	3.994^{***}	5.235^{***}	5.204^{***}	5.413^{***}	5.222^{***}	4.011^{***}	4.628^{***}	5.235^{***}	5.486^{***}	5.413^{***}	7.754^{***}
	(3.67)	(3.64)	(4.16)	(4.32)	(2.97)	(4.14)	(3.67)	(3.20)	(4.16)	(3.01)	(2.97)	(3.70)
IPO fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R Squared	0.109	0.110	0.110	0.114	0.099	0.112	0.109	0.110	0.110	0.102	0.099	0.087
Number of obs.	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560

Panel B	CAR[−5,+1]		CAR[−5,+3]		CAR[−5,+5]		CAR[−5,+10]		CAR[−5,+20]		CAR[−5,+30]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
COV	-0.032^{**}	-0.030^{**}	-0.035^{**}	-0.033^{**}	-0.034^{**}	-0.032^{**}	-0.051^{***}	-0.046^{**}	-0.058^{**}	-0.052^{**}	-0.068^{**}	-0.064^{**}
	(−2.56)	(−2.40)	(−2.55)	(−2.43)	(−2.27)	(−2.11)	(−2.69)	(−2.41)	(−2.33)	(−2.11)	(−2.31)	(−2.18)
RS		0.533^{*}		0.426^{*}		0.529^{**}		1.183		0.908		0.157
		(1.79)		(1.81)		(1.99)		(1.61)		(0.82)		(0.12)
RS*COV		-0.156^{*}		−0.125		-0.196^{**}		-0.436^{***}		-0.551^{***}		-0.496^{**}
		(−1.78)		(−1.61)		(−2.53)		(−3.05)		(−3.04)		(−2.29)

SIZE	−0.115***	−0.114***	−0.173***	−0.172***	−0.175***	−0.175***	−0.143**	−0.142**	−0.176**	−0.181**	−0.272***	−0.283***
	(−2.65)	(−2.63)	(−3.49)	(−3.47)	(−3.29)	(−3.29)	(−2.21)	(−2.20)	(−2.08)	(−2.13)	(−2.77)	(−2.87)
BTM	0.095	0.095	0.159**	0.159**	0.256***	0.256***	0.278***	0.278***	0.290**	0.287**	0.154	0.150
	(1.53)	(1.53)	(2.34)	(2.33)	(3.29)	(3.29)	(2.88)	(2.87)	(2.32)	(2.29)	(1.07)	(1.04)
Constant	2.559***	2.525***	3.763***	3.736***	3.766***	3.754***	3.189**	3.160**	3.926**	4.018**	6.059***	6.285***
	(2.95)	(2.91)	(3.81)	(3.78)	(3.55)	(3.53)	(2.47)	(2.45)	(2.33)	(2.38)	(3.11)	(3.21)
IPO fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R Squared	0.116	0.117	0.120	0.121	0.112	0.113	0.110	0.113	0.103	0.106	0.087	0.089
Number of obs.	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560

Panel C	CAR[−3,+1]		CAR[−3,+3]		CAR[−3,+5]		CAR[−3,+10]		CAR[−3,+20]		CAR[−3,+30]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
COV	−0.023**	−0.022**	−0.025**	−0.025**	−0.025*	−0.024*	−0.042**	−0.037**	−0.049**	−0.044*	−0.059**	−0.056*
	(−2.18)	(−2.06)	(−2.12)	(−2.04)	(−1.89)	(−1.77)	(−2.38)	(−2.12)	(−2.05)	(−1.85)	(−2.05)	(−1.95)
RS		0.299		0.192		0.296		0.950		0.675		−0.076
		(0.97)		(0.81)		(1.05)		(1.29)		(0.61)		(−0.06)
RS*COV		−0.108		−0.077		−0.148**		−0.388***		−0.503***		−0.448**
		(−1.43)		(−1.18)		(−2.11)		(−2.76)		(−2.79)		(−2.09)
SIZE	−0.089**	−0.089**	−0.147***	−0.147***	−0.149***	−0.150***	−0.117*	−0.117*	−0.150*	−0.156*	−0.246***	−0.258***
	(−2.41)	(−2.40)	(−3.32)	(−3.31)	(−3.08)	(−3.09)	(−1.94)	(−1.95)	(−1.84)	(−1.91)	(−2.62)	(−2.74)
BTM	0.071	0.070	0.134**	0.134**	0.232***	0.232***	0.254***	0.253***	0.265**	0.263**	0.130	0.125
	(1.41)	(1.41)	(2.39)	(2.39)	(3.54)	(3.53)	(2.97)	(2.96)	(2.26)	(2.24)	(0.94)	(0.91)
Constant	1.973***	1.964***	3.176***	3.175***	3.180***	3.193***	2.602**	2.599**	3.340**	3.457**	5.473***	5.725***
	(2.67)	(2.65)	(3.60)	(3.59)	(3.29)	(3.30)	(2.16)	(2.17)	(2.06)	(2.13)	(2.93)	(3.06)
IPO fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R Squared	0.119	0.119	0.123	0.124	0.114	0.115	0.112	0.114	0.104	0.106	0.086	0.087
Number of obs.	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560

Panel D	CAR[−1,+1]		CAR[−1,+3]		CAR[−1,+5]		CAR[−1,+10]		CAR[−1,+20]		CAR[−1,+30]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
COV	−0.020**	−0.019**	−0.022**	−0.022**	−0.022*	−0.021*	−0.038**	−0.035**	−0.045**	−0.041*	−0.056**	−0.053*
	(−2.42)	(−2.35)	(−2.07)	(−2.06)	(−1.76)	(−1.70)	(−2.36)	(−2.13)	(−2.02)	(−1.85)	(−2.03)	(−1.96)
RS		0.080		−0.028		0.076		0.730		0.455		−0.296
		(0.32)		(−0.12)		(0.25)		(0.93)		(0.40)		(−0.22)
RS*COV		−0.055		−0.024		−0.095*		−0.335**		−0.450***		−0.395**
		(−1.26)		(−0.60)		(−1.92)		(−2.51)		(−2.77)		(−2.07)
SIZE	−0.047*	−0.047*	−0.104***	−0.105***	−0.106**	−0.108**	−0.074	−0.076	−0.107	−0.114	−0.203**	−0.216**
	(−1.66)	(−1.68)	(−2.75)	(−2.77)	(−2.50)	(−2.53)	(−1.34)	(−1.37)	(−1.39)	(−1.47)	(−2.27)	(−2.40)
BTM	0.057	0.056	0.120**	0.120**	0.218***	0.217***	0.240***	0.239***	0.251**	0.248**	0.116	0.111
	(1.50)	(1.49)	(2.54)	(2.53)	(3.78)	(3.77)	(3.09)	(3.08)	(2.28)	(2.25)	(0.87)	(0.84)
Constant	1.063*	1.075*	2.267***	2.286***	2.270***	2.304***	1.693	1.710	2.431	2.568*	4.564**	4.835***
	(1.90)	(1.91)	(3.00)	(3.02)	(2.67)	(2.70)	(1.53)	(1.55)	(1.58)	(1.67)	(2.55)	(2.69)
IPO fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R Squared	0.114	0.114	0.124	0.124	0.118	0.118	0.116	0.118	0.108	0.110	0.088	0.089
Number of obs.	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560

Table 5
The IPO price effect around listing day.
This table reports the results of the stock price response of various industry portfolios to IPO listing, using the following model:

$$CAR_{ij} = \alpha + \beta_1 * COV_{ij} + \beta_2 * RS_{ij} * COV_{ij} + \beta_3 * SIZE_{ij} + \beta_4 * BTM_{ij} + \gamma * IPO_j + \epsilon_{ij}.$$

The dependent variable CAR_{ij} denotes the cumulative abnormal return (in percent) of industrial portfolio i starting from ten, five, three, and one trading day(s) prior to IPO_j's listing day up to 30 trading days thereafter. COV_{ij} is the ranking for the return covariance between industry portfolio i and the IPO industry *j*, which is estimated from monthly returns over the 36 months prior to the month of IPO listing. $SIZE_{ij}$ is the natural logarithm of the aggregated tradable share market capitalization of all stocks in industry *i* while BTM_{ij} is the natural logarithm of the value-weighted book-to-market ratio of all stocks in industry *i* corresponding to each IPO_j, respectively. RS_{ij} (relative size) is a firm's pre-IPO book value of equity to the aggregated book value of equity of all stocks in each industry:

$$RS_{ij} = \frac{IPO_j}{Industry_i}, \quad \left(\text{for } IPO_{j's} \text{ own industry}, i = j\right)$$

where IPO_j represents the book value of equity of IPO_j as of the pre-IPO yearend, and Industry *i* represents the book value of equity of all listed firms in industry i as of the same year end. IPO_j is the fixed effect for IPO_j. The regression is estimated using ordinary least squares (OLS) with robust standard errors clustered by IPO event. *t*-values are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10%levels, respectively.

Panel A	CAR[−10,+1]		CAR[−10,+3]		CAR[−10,+5]		CAR[−10,+10]		CAR[−10,+20]		CAR[−10,+30]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
COV	−0.033**	0.032**	−0.034**	0.038**	−0.043**	0.047***	−0.021	0.062***	0.007	0.047*	−0.004	0.034
	(−2.15)	(2.09)	(−2.10)	(2.27)	(−2.45)	(2.62)	(−1.00)	(2.92)	(0.25)	(1.68)	(−0.13)	(1.02)
RS		0.141		0.140		0.173		0.644		0.259		0.307
		(0.61)		(0.58)		(0.56)		(1.36)		(0.38)		(0.41)
RS*COV		−0.146*		−0.219**		−0.239***		−0.360**		−0.506***		−0.398**
		(−1.65)		(−2.43)		(−2.67)		(−2.36)		(−2.88)		(−2.53)
SIZE	−0.113**	−0.204***	−0.124**	−0.278***	−0.181***	−0.279***	−0.196***	−0.235***	−0.322***	−0.371***	−0.309***	−0.349***
	(−2.18)	(−4.14)	(−2.23)	(−5.27)	(−3.00)	(−4.82)	(−2.86)	(−3.57)	(−3.73)	(−4.47)	(−3.07)	(−3.66)
BTM	0.068	−0.0234	0.109	−0.034	0.114	−0.055	0.118	0.004	0.086	0.079	0.135	0.125
	(0.90)	(−0.33)	(1.35)	(−0.45)	(1.29)	(−0.67)	(1.15)	(0.04)	(0.67)	(0.63)	(0.91)	(0.88)
Constant	2.515**	4.099***	2.731**	5.647***	3.989***	5.611***	4.172***	4.577***	6.683***	7.486***	6.444***	7.092***
	(2.44)	(2.46)	(2.48)	(2.73)	(3.31)	(3.12)	(3.08)	(3.37)	(3.89)	(2.20)	(3.21)	(1.62)
IPO fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R Squared	0.100	0.102	0.095	0.103	0.094	0.105	0.095	0.101	0.091	0.091	0.083	0.085
Number of obs.	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560

Panel B	CAR[−5,+1]		CAR[−5,+3]		CAR[−5,+5]		CAR[−5,+10]		CAR[−5,+20]		CAR[−5,+30]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
COV	−0.020	0.017	−0.022	0.023*	−0.030**	0.032**	−0.007	0.048**	0.020	0.033	0.010	0.020
	(−1.64)	(1.44)	(−1.62)	(1.70)	(−2.07)	(2.13)	(−0.41)	(2.55)	(0.84)	(1.28)	(0.32)	(0.63)
RS		0.220		0.218		0.251		0.722*		0.337		0.386
		(1.27)		(1.32)		(1.10)		(1.71)		(0.52)		(0.53)
RS*COV		−0.116***		−0.189**		−0.209**		−0.330**		−0.476***		−0.367*
		(−2.71)		(−2.49)		(−2.22)		(−2.13)		(−2.76)		(−1.96)
SIZE	−0.027	−0.129***	−0.037	−0.204***	−0.095*	−0.204***	−0.109*	−0.160***	−0.236***	−0.296***	−0.223**	−0.275***
	(−0.64)	(−3.37)	(−0.81)	(−4.72)	(−1.85)	(−4.24)	(−1.84)	(−2.76)	(−3.02)	(−3.86)	(−2.40)	(−3.06)
BTM	0.065	0.007	0.106*	−0.004	0.111	−0.025	0.115	0.035	0.083	0.109	0.133	0.155
	(1.22)	(0.13)	(1.76)	(−0.07)	(1.60)	(−0.37)	(1.30)	(0.39)	(0.72)	(0.95)	(0.96)	(1.16)
Constant	0.639	2.595***	0.855	4.143***	2.113**	4.107***	2.295*	3.073***	4.806***	5.982***	4.567**	5.588***
	(0.78)	(3.39)	(0.93)	(4.80)	(2.05)	(4.29)	(1.94)	(2.67)	(3.09)	(3.91)	(2.46)	(3.14)
IPO fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R Squared	0.115	0.108	0.106	0.109	0.101	0.106	0.098	0.104	0.094	0.095	0.083	0.087
Number of obs.	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560

Panel C	CAR[−3,+1]		CAR[−3,+3]		CAR[−3,+5]		CAR[−3,+10]		CAR[−3,+20]		CAR[−3,+30]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
COV	−0.019*	0.010	−0.020*	0.016	−0.030**	0.025*	−0.006	0.041**	0.021	0.025	0.011	0.012
	(−1.86)	(1.00)	(−1.72)	(1.32)	(−2.18)	(1.82)	(−0.38)	(2.36)	(0.92)	(1.05)	(0.37)	(0.42)
RS		0.265		0.264		0.297		0.768*		0.383		0.431
		(1.32)		(1.22)		(0.95)		(1.66)		(0.59)		(0.60)

Table 5 *(continued)*

Panel C	CAR[−3,+1]		CAR[−3,+3]		CAR[−3,+5]		CAR[−3,+10]		CAR[−3,+20]		CAR[−3,+30]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
RS*COV		−0.079		−0.151		−0.172		−0.293*		−0.439**		−0.330
		(−1.28)		(−1.55)		(−1.46)		(−1.68)		(−2.27)		(−1.57)
SIZE	0.012	−0.105***	0.001	−0.179***	−0.057	−0.180***	−0.071	−0.136**	−0.198***	−0.272***	−0.185**	−0.250***
	(0.33)	(−3.13)	(0.02)	(−4.56)	(−1.20)	(−4.04)	(−1.27)	(−2.48)	(−2.61)	(−3.71)	(−2.06)	(−2.88)
BTM	0.039	−0.012	0.080	−0.023	0.085	−0.044	0.089	0.016	0.057	0.090	0.107	0.136
	(0.85)	(−0.26)	(1.48)	(−0.44)	(1.38)	(−0.75)	(1.09)	(0.19)	(0.52)	(0.83)	(0.80)	(1.05)
Constant	−0.155	2.137***	0.061	3.685***	1.319	3.650***	1.502	2.616**	4.013***	5.525***	3.773**	5.131***
	(−0.22)	(3.19)	(0.07)	(4.68)	(1.39)	(4.12)	(1.34)	(2.41)	(2.66)	(3.78)	(2.10)	(2.97)
IPO fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R Squared	0.116	0.117	0.107	0.119	0.103	0.113	0.100	0.110	0.099	0.098	0.086	0.089
Number of obs.	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560

Panel D	CAR[−1,+1]		CAR[−1,+3]		CAR[−1,+5]		CAR[−1,+10]		CAR[−1,+20]		CAR[−1,+30]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
COV	−0.010	−0.004	−0.011	0.002	−0.020*	0.011	0.002	0.027*	0.030	0.012	0.019	−0.001
	(−1.24)	(−0.45)	(−1.11)	(0.23)	(−1.68)	(0.92)	(0.16)	(1.68)	(1.36)	(0.51)	(0.69)	(−0.04)
RS		0.036		0.035		0.068		0.539		0.154		0.202
		(0.22)		(0.20)		(0.25)		(1.25)		(0.24)		(0.28)
RS*COV		−0.014		−0.086		−0.107		−0.228		−0.374**		−0.265
		(−0.26)		(−1.01)		(−1.02)		(−1.45)		(−2.08)		(−1.35)
SIZE	0.026	−0.029	0.015	−0.104***	−0.043	−0.104***	−0.057	−0.060	−0.184**	−0.196***	−0.171**	−0.175**
	(0.98)	(−1.18)	(0.44)	(−3.15)	(−1.04)	(−2.63)	(−1.11)	(−1.20)	(−2.56)	(−2.82)	(−1.98)	(−2.10)
BTM	−0.019	0.002	0.022	−0.009	0.027	−0.030	0.031	0.029	−0.001	0.104	0.049	0.150
	(−0.55)	(0.05)	(0.47)	(−0.21)	(0.50)	(−0.59)	(0.41)	(0.40)	(−0.01)	(1.00)	(0.37)	(1.18)
Constant	−0.468	0.620	−0.252	2.168***	1.006	2.132***	1.188	1.098	3.699***	4.007***	3.460**	3.613**
	(−0.89)	(1.26)	(−0.37)	(3.29)	(1.22)	(2.70)	(1.16)	(1.10)	(2.58)	(2.88)	(2.01)	(2.18)
IPO fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R Squared	0.105	0.101	0.103	0.112	0.104	0.109	0.101	0.107	0.102	0.096	0.087	0.088
Number of obs.	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560	10,560

across many industries, and a single IPO cannot signal fiercer product competition and tighter financial constraints across all industries.

Hong et al. (2008) suggest[15] that supply and demand conditions in a local market will influence asset prices. They document an "only-game-in-town" effect in that corporations located in regions with fewer stocks compete less for local investors' money and have higher stock prices. Geographic portfolios can thus be used in place of industry portfolios to test the downward-sloping demand curve hypothesis, in that changes in the supply-demand equilibrium in local markets will influence the prices of other stocks located in the same province. If we find the "only-game-in-town" effect, then the signal hypothesis should be of less concern. Moreover, when an IPO is approved or listed, other local stocks' demand-supply profile is altered without necessarily changing their cash flow prospects. Hence, geographical portfolios also help rule out the expectation of changing cash flows affecting stock prices around IPO approvals.

Hong et al. (2008) define RATIO as the ratio between the aggregated book value of all firms headquartered in a region and the aggregate income of all households domiciled in that region to gauge the local market conditions. Given a certain demand level, a lower share supply in the local market, or a lower RATIO, should be associated with higher stock prices in that market, so that RATIO is expected to be negatively related to local stock prices. In this vein, we form provincial portfolios of stocks headquartered in the same province as the approved IPO firm and utilize changes in RATIO to gauge the substitutability of an approved IPO in relation to other local stocks. The change in RATIO is computed as follows:

$$\Delta \text{RATIO}_j = \frac{\text{Exist BV}_j + \text{New BV}_j}{\text{GDP}_j} - \frac{\text{Exist BV}_j}{\text{GDP}_j} = {}^{\text{New BV}_j}\Big/_{\text{GDP}_j}, \tag{4}$$

where Exist BV_j is the aggregated book value of existing listed firms in the province in which the j^{th} IPO firm's headquarter is located as of the previous yearend, GDP_j is the GDP of the province in which j^{th} IPO firm's headquarter is located as of the previous yearend, new BV_j is the sum of the book value of approved IPO firms j as of the previous yearend and the planned IPO proceeds of IPO firm j.[16] ΔRATIO_j is the relative size of an IPO to the size of existing regional economy, measuring the supply shock to the local market caused by IPO_j. ΔRATIO_j is used as a proxy for the substitutability of the approved IPO for the existing local stocks (the relevant provincial portfolio): the more an approved IPO increases the local RATIO, the larger the price decline for existing local stocks.

[15] See footnote 16 in Hong et al. (2008).

[16] Empirically, we also used the book value of approved IPO firm j as of the previous yearend only as BV to calculate change in RATIO, and the results are robust to this alternative measure. These results are available upon request.

For each IPO event, we calculate CARs for IPO_j's provincial portfolio and pool them together for all IPO events. We then estimate a model similar to Eq. (1) by replacing COV with ΔRATIO:

$$CAR_j = \alpha + \beta_1 * \Delta RATIO_j + \beta_2 * SIZE_j + \beta_3 * BTM_j + \epsilon_j, \tag{5}$$

where CAR_j denotes the CAR for the provincial portfolio around IPO_j's approval day. The portfolio return is the value-weighted returns of all listed stocks in the same province in which the IPO firm is located. $SIZE_j$ and BTM_j are the natural logarithms of the aggregated market capitalization of tradable stocks and the value-weighted book-to-market ratio of all stocks in IPO_j's province, respectively. Since each IPO event corresponds to only one ΔRATIO observation, there is no IPO fixed effect to control.

The estimated results of Eq. (5) for CARs starting 10 days prior to the IPO approval announcement up 30 days after are reported in panel A of Table 6.They are largely consistent with those reported in Panel A of Table 4.The estimated coefficient of ΔRATIO is negative and statistically significant for all CAR windows except CAR(−10,1). A 1% increase in ΔRATIO decreases the provincial CAR(−10,3) by about 50 basis points. The magnitude of estimated coefficients becomes larger and more significant as the CAR window lengthens. The estimates for SIZE and BTM are qualitatively the same as those using industry portfolio CARs as the dependent variable.

It is possible that similar firms may cluster in geographic locations, which is known as the colocation phenomenon. If firms collocate, geographic portfolios may not be able to completely rule out the signal effect, as geographic portfolios would be highly correlated with the industry portfolios. To address the possible colocation of industries across China at the provincial level, we construct provincial portfolios by excluding local stocks that are in the same industry as the IPOs. We repeat the analyses

Table 6
The IPO price effect on provincial portfolios around IPO approval day.
This table reports the results using the following regression model:

$$CAR_j = \alpha + \beta_1 * \Delta RATIO_j + \beta_2 * SIZE_j + \beta_3 * BTM_j + \epsilon_i.$$

CAR_j denotes the cumulative abnormal return (in percent) of the corresponding provincial portfolio starting from 10 trading day(s) prior to IPO_j's approval day until up to 30 trading days thereafter. The provincial portfolio returns in Panel A are the value-weighted returns of all listed stocks headquartered in the same province as the IPO firm j, while the provincial portfolio returns in Panel B are the value-weighted provincial returns excluding firms in the IPO's own industry. The abnormal return of provincial portfolio corresponding to each IPO_j is obtained from the market model, which is estimated over the period from 220 to 20 trading days prior to IPO_j's approval day. $\Delta RATIO_j$ denotes the change in the local market's RATIO, as defined below:

$$\Delta RATIO_j = \frac{\text{Exist BV}_j + \text{New BV}_j}{GDP_j} - \frac{\text{Exist BV}_j}{GDP_j} = {}^{\text{New BV}_j}\!\Big/_{GDP_j},$$

where Exist BV_j is the aggregated book value of all existing public listed firms in the province in which IPO firm *j* has its headquarter as of the previous yearend; New BV_j is the sum of the book value of the approved IPO firm *j* as of the previous yearend and the planned issuing proceeds of IPO firm *j*; GDP_j is the GDP of the province in which the j^{th} IPO firm is located as of the previous yearend; $SIZE_j$ is the natural logarithm of the aggregated tradable share market capitalization of all stocks in the province in which IPO firm *j* has its headquarter, and BTM_j is the natural logarithm of the value-weighted book-to-market ratio of all stocks in the province, both are the previous yearend value. ΔRATIO in percent is used in the regression which is estimated using ordinary least squares (OLS) with robust standard errors. *t*-values are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Provincial portfolios with IPOs' own industry included.

	CAR[−10,+1]	CAR[−10,+3]	CAR[−10,+5]	CAR[−10,+10]	CAR[−10,+20]	CAR[−10,+30]
ΔRATIO	−0.003	−0.006*	−0.006**	−0.013***	−0.015***	−0.011**
	(−1.16)	(−1.68)	(−2.07)	(−3.33)	(−2.94)	(−2.13)
SIZE	−0.152*	−0.181*	−0.194*	−0.334***	−0.473***	−0.560***
	(−1.65)	(−1.82)	(−1.84)	(−2.93)	(−3.19)	(−3.35)
BTM	0.320*	0.413**	0.393*	0.629**	0.753**	0.951***
	(1.70)	(2.04)	(1.84)	(2.56)	(2.43)	(2.82)
Constant	2.829	3.350*	3.563*	6.272***	9.032***	10.777***
	(1.57)	(1.72)	(1.72)	(2.81)	(3.11)	(3.29)
R Squared	0.004	0.007	0.007	0.017	0.018	0.017
Number of obs.	1056	1056	1056	1056	1056	1056

Panel B: Provincial portfolios with IPOs' own industry excluded

	CAR[−10,+1]	CAR[−10,+3]	CAR[−10,+5]	CAR[−10,+10]	CAR[−10,+20]	CAR[−10,+30]
ΔRATIO	−0.004*	−0.006***	−0.008***	−0.014***	−0.015***	−0.013***
	(−1.75)	(−2.84)	(−4.00)	(−3.77)	(−4.56)	(−3.22)
SIZE	−0.059	−0.064	−0.044	−0.193	−0.333**	−0.370**
	(−0.58)	(−0.59)	(−0.34)	(−1.42)	(−2.11)	(−2.05)
BTM	0.287	0.346*	0.309	0.532**	0.589*	0.679**
	(1.48)	(1.66)	(1.39)	(2.08)	(1.88)	(2.00)
Constant	0.947	0.998	0.530	3.456	6.272**	7.025**
	(0.47)	(0.47)	(0.21)	(1.30)	(2.02)	(1.98)
R Squared	0.004	0.005	0.006	0.013	0.014	0.011
Number of obs.	1056	1056	1056	1056	1056	1056

using this provincial portfolio without the IPO industry and report the results in Panel B of Table 6. We see that when stocks in the same industries as the IPOs in provincial portfolios are excluded, the negative IPO price effects on existing local stocks around announcement day remains. This evidence indicates that the IPO price effect on provincial portfolios is not due to the colocation of firms that signals fiercer competition and tighter financial constraints for its peer firms.

We also use Eq. (5) to examine the geographic portfolio CARs around the listing day. Table 7 shows the estimation results, which are largely consistent with the corresponding results reported in Table 5. Specifically, we see a price reversal for CAR, as the estimated coefficient for ΔRATIO is no longer significant beyond the (−10, 5) window. However, the results are weak when using provincial portfolios with stocks in the same industry of IPOs excluded. The estimated coefficients are still negative but not statistically significant. To save space, we do not report the results for the CAR windows starting five, three, and one day(s) prior to approval or listing day. However, they are similar to those reported in Tables 6 and 7.

Overall, the evidence from the geographic portfolios supports the argument that the IPO price effect on its close substitutes is not driven by product market signaling embedded in IPO approval events. This negative price effect on the geographic portfolios lends additional support to our hypotheses, as the signal hypothesis is ruled out as a possible explanation for the negative IPO price effect on its close substitutes. However, the colocation of firms in the same industry may play an important role in affecting CARs around the listing day.

One may also argue that since many Chinese listed companies receive supports from local governments in terms of subsidy, cheap financing, land usage, etc., new IPO firms may compete away government supports for existing listed firms, and thus, depress their value. To further rule out the decline in local government supports as an alternative explanation for the "only-game-in-town" results, we first examine whether the average government support to a local firm has a decreasing trend over the years; we then examine whether there is a negative correlation between the average government support to a local firm and the number of IPOs in a province during our sample period. Due to limited data on corporate cheap financing and land use, and the

Table 7
The IPO price effect on provincial portfolios around IPO listing day.
This table reports the results using the following regression model:

$$CAR_j = \alpha + \beta_1 * \Delta RATIO_j + \beta_2 * SIZE_j + \beta_3 * BTM_j + \epsilon_i.$$

CAR_j denotes the cumulative abnormal return (in percent) on the corresponding provincial portfolio starting from 10 trading day(s) prior to IPO_j's listing day until 30 trading days thereafter. The provincial portfolio returns in Panel A are the value-weighted returns of all listed stocks headquartered in the same province as the IPO firm j, while the provincial portfolio returns in Panel B are the value-weighted provincial returns excluding firms in the same industry as the IPO firm, respectively. The abnormal return of provincial portfolio corresponding to each IPO_j is obtained from the market model, which is estimated over the period from 220 to 20 trading days prior to IPO_j's approval day. $\Delta RATIO_j$ denotes the change in the local market's RATIO, as defined below:

$$\Delta RATIO_j = \frac{\text{Exist BV}_j + \text{New BV}_j}{\text{GDP}_j} - \frac{\text{Exist BV}_j}{\text{GDP}_j} = {}^{\text{New BV}_j}\big/_{\text{GDP}_j},$$

where Exist BV_j is the aggregated book value of all existing public listed firms in the province in which IPO firm j has its headquarter as of the previous yearend; New BV_j is the sum of the book value of the approved IPO firm j as of the previous yearend and the planned issuing proceeds of IPO firm j; GDP_j is the GDP of the province in which the j^{th} IPO firm is located as of the previous yearend; $SIZE_j$ is the natural logarithm of the aggregated tradable share market capitalization of all stocks in the province in which IPO firm j has its headquarter, and BTM_j is the natural logarithm of the value-weighted book-to-market ratio of all stocks in the province, both are the previous yearend value. ΔRATIO in percent is used in the regression which is estimated using ordinary least squares (OLS) with robust standard errors. *t*-values are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A	CAR[−10,+1]	CAR[−10,+3]	CAR[−10,+5]	CAR[−10,+10]	CAR[−10,+20]	CAR[−10,+30]
ΔRATIO	−0.004	−0.004*	−0.005**	−0.004	−0.007	−0.007
	(−1.62)	(−1.64)	(−2.08)	(−1.43)	(−0.96)	(−1.17)
SIZE	0.040	0.011	0.071	0.004	−0.031	−0.274*
	(0.44)	(0.11)	(0.65)	(0.03)	(−0.21)	(−1.68)
BTM	0.238	0.346*	0.257	0.396*	0.694**	0.992***
	(1.42)	(1.92)	(1.31)	(1.69)	(2.46)	(3.32)
Constant	−1.032	−0.489	−1.672	−0.410	0.218	5.012
	(−0.57)	(−0.25)	(−0.77)	(−0.16)	(0.08)	(1.56)
R Squared	0.006	0.007	0.007	0.006	0.011	0.012
Number of obs.	1056	1056	1056	1056	1056	1056
Panel B	**CAR[−10,+1]**	**CAR[−10,+3]**	**CAR[−10,+5]**	**CAR[−10,+10]**	**CAR[−10,+20]**	**CAR[−10,+30]**
ΔRATIO	0.000	−0.001	−0.001	−0.003	−0.003	−0.001
	(0.09)	(−0.12)	(−0.10)	(−0.34)	(−0.45)	(−0.08)
SIZE	0.036	0.037	0.021	−0.099	−0.306**	−0.497***
	(0.40)	(0.40)	(0.21)	(−0.85)	(−2.20)	(−2.87)
BTM	0.152	0.180	0.286	0.584**	0.712***	0.970***
	(0.95)	(1.05)	(1.52)	(2.56)	(2.74)	(3.20)
Constant	−0.821	−0.842	−0.568	1.686	5.812**	9.600***
	(−0.45)	(−0.46)	(−0.28)	(0.73)	(2.12)	(2.79)
R Squared	0.003	0.003	0.005	0.007	0.008	0.012
Number of obs.	1056	1056	1056	1056	1056	1056

introduction of tax reform during our sample period, we only use firm level subsidy data obtained from CSMAR to gauge the support that firms get from local governments.

For each firm in our sample, we collect data on the annual subsidy from the government and standardize it by the firm sales. We then compute the provincial mean of this standardized firm level subsidy, SUBSIDY, for each year and test if there is a decreasing trend in the mean SUBSIDY for each province over our sample period. Panel A of Table 8 presents the change in the mean firm SUBSIDY over our sample period for each province. It shows that the mean SUBSIDY change is positive for all but three provinces, and even for these three provinces, the negative change in SUBSIDY is not statistically significant. Hence, there is no indication of a decreasing trend in local government support in the form of subsidy across years for all provinces. In fact, the mean subsidy change is positive for most provinces and some are even statistically significant.

We further examine if the mean firm level subsidy is negatively related to the number of local IPOs over the years by computing the Pearson correlation coefficient between the two for every province. The results are reported in Panel B of Table 8. As shown, most provinces have a positive but insignificant correlation coefficient between the mean firm level government subsidy and the number of new IPO firms. We also repeat the trend and the correlation tests using the median firm SUBSIDY in a province and the results are qualitatively the same. Overall, the results in Table 8 suggest that the price reaction of local stocks to IPO approvals is not driven by possible decreasing in local government subsidies to the listed firms. However, these results are only suggestive as the firm level subsidy may not capture all the government support.

6. Extension: Market reactions to IPO rejections

When an IPO application is rejected, the share supply does not change and there should be no price impact of IPO rejections. However, it is possible that investors had expected these IPOs to be approved. In that case, the rejection may lead to a downward adjustment of the expected share supply in the market, and thus, increase the stock price of its close substitutes. We further examine whether the IPO rejection announcement would affect the stock price of the IPO substitutes. The IPO approvals and IPO

Table 8

Changes in firm level government subsidies across provinces over years.

Panel A of this table reports the mean and t-statistics of the average firm level subsidy change in each province over the period 2004–2014. The annual firm level subsidy is calculated as the amount of government subsidy a firm receives divided by its sales. Panel B reports the Pearson correlation coefficient between firm level government subsidy change and annual increase of listed firm number in the same province. ** (*) denotes significance at the 5 (10) percent level.

Province	Panel A Firm level government subsid y change ×100		Panel B Correlation between change in firm level government subsidy and number of IPOs	
	Mean	T value	Correlation coefficient	T value
Anhui	0.058	1.23	−0.019	−0.86
Beijing	0.057	2.15**	0.011	0.74
Chongqing	0.003	0.03	0.001	0.05
Fujian	0.054	1.34	0.010	0.75
Gansu	0.083	1.24	0.011	0.34
Guangdong	0.044	1.67*	0.001	0.07
Guangxi	0.082	2.41**	−0.031	−1.86*
Guizhou	0.034	0.65	0.037	1.41
Hainan	0.093	0.75	−0.009	−0.35
Hebei	0.035	1.09	0.012	1.20
Heilongjiang	0.054	1.03	0.018	1.02
Henan	0.069	1.01	0.032	1.58
Hubei	0.050	1.18	0.037	1.05
Hunan	0.064	1.54	0.010	0.48
Inner Mongolia	0.049	0.74	0.009	0.29
Jiangsu	0.011	0.21	0.003	0.37
Jiangxi	0.081	1.24	−0.018	−1.12
Jilin	0.033	0.35	0.015	0.47
Liaoning	0.068	0.86	0.071	1.54
Ningxia	0.059	0.23	0.093	1.58
Qinghai	−0.282	−1.15	0.043	1.42
Shaanxi	0.069	1.62	0.012	0.88
Shandong	0.005	0.16	0.007	0.43
Shanghai	0.052	0.20	−0.017	−0.60
Shanxi	0.026	0.61	0.025	1.17
Sichuan	0.026	0.55	−0.009	−0.98
Tianjin	−0.054	−0.50	−0.009	−0.62
Tibet	−0.122	−0.40	−0.021	−0.34
Xinjiang	0.089	1.00	−0.014	−0.38
Yunnan	0.042	0.70	0.023	1.00
Zhejiang	0.055	1.46	0.004	0.30

Table 9
Market reactions to IPO rejections.
This table reports the results of the stock price response of various industry portfolios to IPO rejection announcements using the following regression:

$$CAR_{ij} = \alpha + \beta_1 * COV_{ij} + \beta_2 * SIZE_{ij} + \beta_3 * BTM_{ij} + \gamma * IPO_j + \epsilon_{ij},$$

CAR_{ij} denotes the cumulative abnormal returns (in percent) of industrial portfolio *i*, starting from 10 trading day(s) prior to IPO_j's approval day up to 30 trading days after. COV_{ij} is the ranking for the return covariance between an industry portfolio *i* and the IPO industry *j*, which is estimated from monthly returns over the 36 months prior to the month of IPO rejection. $SIZE_{ij}$ is the natural logarithm of the aggregated tradable share market capitalization of all stocks in industry *i* while BTM_{ij} is the natural logarithm of the value-weighted book-to-market ratio of all stocks in industry i corresponding to each IPO_j, respectively; IPO_j is the fixed effect for IPO_j. Panel A reports the results using the sample excluding IPO rejections that are highly correlated with the IPO approvals (with a COV rank above 5) announced on the same day. Panel B reports the results using the sample excluding IPO rejections with IPO approvals in the same industry announced within the entire testing window [−10, 30].The regression is estimated using ordinary least squares (OLS) with robust standard errors clustered by IPO event; *t*-values are reported in parentheses. ***, **, and * correspond to statistical significance at the 1%, 5%, and 10%levels, respectively.

	Panel A						Panel B					
Variables	CAR [−10,+1]	CAR [−10,+3]	CAR [−10,+5]	CAR [−10,+10]	CAR [−10,+20]	CAR [−10,+30]	CAR [−10,+1]	CAR [−10,+3]	CAR [−10,+5]	CAR [−10,+10]	CAR [−10,+20]	CAR [−10,+30]
COV	−0.020	−0.009	−0.014	−0.082	−0.197	−0.182	-0.166^{*}	−0.185	−0.212	−0.173	−0.327	−0.373
	(−0.21)	(−0.10)	(−0.14)	(−0.69)	(−1.28)	(−1.10)	(−1.82)	(−1.60)	(−1.44)	(−0.99)	(−1.36)	(−1.52)
SIZE	0.182	0.144	−0.010	0.200	0.342	0.350	0.098	0.089	−0.223	−0.254	-0.739^{*}	−0.745
	(0.83)	(0.59)	(−0.04)	(0.76)	(1.08)	(1.01)	(0.47)	(0.35)	(−0.79)	(−0.83)	(−1.82)	(−1.54)
BTM	−0.060	0.009	0.095	−0.133	−0.366	−0.015	−0.204	−0.257	−0.167	−0.411	−0.848	−0.620
	(−0.16)	(0.02)	(0.22)	(−0.27)	(−0.60)	(−0.02)	(−0.77)	(−0.85)	(−0.42)	(−0.90)	(−1.33)	(−0.99)
Constant	−3.655	−2.966	0.197	−3.543	−5.840	−6.268	−0.658	−0.327	6.257	6.944	18.150^{**}	18.400^{*}
	(−0.84)	(−0.63)	(0.05)	(−0.68)	(−0.92)	(−0.91)	(−0.17)	(−0.07)	(1.22)	(1.21)	(2.43)	(2.00)
IPO fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R Squared	0.164	0.146	0.182	0.148	0.170	0.184	0.174	0.143	0.186	0.142	0.215	0.246
Number of obs.	700	700	700	700	700	700	410	410	410	410	410	410

rejections are mostly announced together after the IPO issuing examination committee meeting.[17] This creates an empirical challenge that the impact of IPO rejection is overwhelmed by the IPO approvals, especially when both approved and rejected IPOs are from the same or closely related industries.

We adopt two strategies to deal with this challenge. The first is to delete IPO rejection cases having high COV with IPO approvals that are announced on the same day. Specifically, we exclude IPO rejection cases having a COV score with IPO approval cases above 5. For example, on an event day, an IPO from industry i was rejected, and an IPO from industry j was approved. If COV between industry i and industry j ranks between 6 and 10, i.e. the two industries are considered as relatively highly correlated, we exclude this IPO i to mitigate the confounding effect caused by IPO_j's approval. Altogether, we have 316 IPOs rejected during our sample period. However, the above-mentioned screening process leaves us a sample of only 70 IPO rejections. Yet, this approach still cannot totally eliminate the confounding effect caused by IPO approvals overlapped with the other days in the test window. Our second strategy is to exclude IPO rejection cases that have one or more IPO approval(s) in the same industry happening during the entire [−10, 30] test window. This screening leaves us an even smaller sample of 41 IPO rejection cases.

We repeat the industry portfolio analysis using these two samples for the IPO rejection cases. The results are reported in Panels A and B of Table 9, respectively. It is clear that the estimated coefficient for COV is negative but generally insignificant across both panels, indicating that IPO rejection cases do not have a positive price impact on their close substitutes. CARs with alternative windows produce similar results and are available upon request.[18] It can also be argued that IPO rejection cases may affect the estimation results for the approval cases. However, this should be biased against finding our results.

7. Conclusion

This study provides a clearer and more complete picture of the IPO price effect on existing stocks. Previous authors have documented that an IPO has a negative impact on existing stocks, especially its close substitutes, around the IPO issuance, and this price response is largely related to the actual trading of IPO shares. Using the Chinese IPO approval regime, we show that the announcement of IPO approval per se negatively affects the prices of IPOs' close substitutes: the greater the substitutability of an IPO in relation to existing stocks, the larger the negative price impact. In fact, the magnitude of price adjustment in response to an IPO approval is roughly on par with the response to the actual IPO issuance. Hence, a significant portion of the price adjustment in response to an IPO would be missed if focus only on the period around the IPO issuance.

In addition, the underlying mechanism for the price adjustment around IPO approval differs from the mechanism operating around IPO listing. The former is mainly based on the expected change in demand and supply conditions, without actual trading of IPO shares, while the latter is mainly caused by a portfolio rebalancing and speculation which involves the actual trading of IPO shares. Hence, the price adjustment associated with IPO approval reflects the movement toward a new equilibrium, given the expectation of an IPO, and tends to be long lasting, while the price change associated with IPO listing reflects portfolio rebalance and speculation on IPO underpricing to a greater extent; this change tends to be transitory.

Market timing and information signaling that are not connected with the downward-sloping demand curve can also explain the negative price response of IPO substitutes to an IPO approval or listing. Previous authors have not addressed these issues, and we explicitly design tests to rule them out. We also control for other confounding factors such as industry colocation and relative supply of an IPO shock. Hence, our results are cleaner and lend stronger support to the downward demand curve hypothesis.

Our study also has very practical policy implications, as the CSRC is trying to reduce the long IPO waiting period without adversely affecting market prices. Our study suggests that the CSRC should not only pay attention to the IPO price effect around issuance, but also to the price effect around IPO approval day.

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[17] According to Wind Infor, during our sample period, more than 80% of IPO rejections happen on the same day of other IPO approvals, more than 90% of IPO rejections happen within the [−1,1] windows of other IPO approvals.

[18] We have also tried to use an alternative sample with COV score above 7 and non-overlapping window −5 days to 5 days. The results, again, are qualitatively the same: no positive and significant estimate for COV.

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