

# Chinese High-tech SMEs and IPOs in STAR

Zhiyi Chen<sup>1,†</sup>, Fengyi Qin<sup>2,†</sup>, Xi Zhang<sup>3,†</sup>, Yingqing Zhou<sup>4,\*</sup>, †

<sup>1</sup> School of Finance, Nankai University, Tianjin, 300350, China

<sup>2</sup> Alliance Manchester Business School, University of Manchester, Manchester, M13 9PL, United Kingdom

<sup>3</sup> College of Arts & Sciences, Boston University, Boston, 02215, United States

<sup>4</sup> School of Business, University of Sydney, Sydney NSW 2006, Australia

\*Corresponding author. Email yzho3991@uni.sydney.edu.au

† These authors contributed equally

## ABSTRACT

To support the development of high-tech industries, the Shanghai Stock Exchange STAR Market was launched on July 22, 2019. Due to the China-US trade war, which is essentially a technological war, there is a more urgent need for China to have technological innovation and the evolution of science and technology to rejuvenate the nation. Chinese government implements various policies to benefit the development of small and medium-sized innovation and technology companies listed on the STAR Market. This paper tests the promotion effect of IPOs in operating revenue using a sample of 68 listed companies in the STAR Market. The ordinary least squares regression is performed to analyze data with some controlling variables to exclude the effects of some other factors including momentum, capital structure, size, etc. We find common patterns of the leverage level and the pre-IPO revenue growth among sample SMEs. Our results over the period 2016-2020 evidence that the IPO might not be a significant explanatory factor for those listed firms' revenue growths.

**Keywords:** IPO, High-tech SMEs, Chinese SSE STAR Market, Revenue Growth

## 1. INTRODUCTION

### 1.1. Background

Given the background of the China-US trade war which has gradually evolved into a technological war, concerns are raised about the future development of Chinese independent innovation in science and technology. The development of Chinese science and technology has been dampened by the trade war in the short term. There is an urgent need for China to properly address the challenge and to further promote the openness of innovation strategy. It is also necessary to allow the markets to flourish and realize the continuous and steady increase in the national scientific and technological innovation strength. In addition, China is now experiencing a transition phase shifting from a labor-intensive industry structure to a capital-intensive industry structure. There are increasing labor-intensive industries moving from China to other markets like Southeast Asia. To achieve healthy and sustainable economic growth, the Chinese government implements supply-side reforms and the strategy of rejuvenating the country through science and technology development. Therefore, China decided to establish a science and

technology innovation board following the pilot registration-based IPO system at the Shanghai Stock Exchange (SSE).

### 1.2. The STAR Market

The Shanghai Stock Exchange STAR Market (SSE STAR Market), officially known as the Shanghai Stock Exchange Science and Technology Innovation Board, was launched on July 22, 2019, and has become a trending topic in the Chinese financial market these years. The STAR is designed to promote the development of Chinese technology and innovation industries, holding a similar motivation as the Nasdaq Stock Market. Chinese government implements many policies to boost the development of small- and medium-sized innovation and technology companies listed on the STAR. However, so far there are not many papers testing the effects of these new policy experiments related to the STAR. Thus, this paper aims to explore whether the stimulating policy in China and the IPOs on the STAR Market can make a huge role in promoting the growth of listed companies.

## 2. LITERATURE REVIEW

According to Fourati and Affes's research on determinants in the decision of capital structure for new entrepreneurial activities, a high level in external debt has a huge possibility to be found for firms having legal form in the incorporation. However, in a situation where has the lowest human capital, the entrepreneurial activities in more human capital prefer to be financed by internal finance, instead of external debt. [1]

Didier et al. research the relationship between issuing securities and firm overall growth at the micro level using a comprehensive dataset over the period 1991-2016. The results show that firms choosing to issue securities grow faster than non-issuers and boost their production capabilities through promoting their human capital, physical capital, and intangible capital. Besides, the increase in growth rates associated with equity issuances is larger than those associated with bond issuances. [2]

Fang et al. research the relationship between stock liquidity and firm performance, finding that firms with high liquidity stocks have better performance as measured by the firm market-to-book ratio. Fang et al. conclude that the stock liquidity improves firm performance through a feedback effect where liquidity stimulates the entry of informed investors who make prices more informative to stakeholders, and liquidity also improves firm performance by increasing the efficiency of performance-sensitive managerial compensation. [3]

As for the high-technology companies, there are some surveys based on real-world samples.

Investigating a sample of companies from high-tech sectors in transition country (Russia), Spitsin et al. investigate that profitability reduces leverage, while the growth of firms (assets growth or sales growth) imposes a higher share of borrowed capital, and the size of a firm increases its dependence on debt financing. The results have shown that the most fast-growing high-tech companies require an increase in debt capital and deterioration in the capital structure and financial stability. [4]

A study by Serrasqueiro et al. found that capital structure decisions of Portuguese high-tech SMEs are closer to the predictions of the Pecking Order Theory than those of the non-high-tech SMEs. Debt levels tend to be positively correlated with firm size and tangible assets base on firms' growth stage, and older and more profitable high-tech SMEs reduce their debt funding. When internal financing is exhausted, high-tech SMEs that have used venture capital issue equity for financing their growth opportunities without the additional support of debt, suggesting a modified version of the Pecking Order Theory. [5]

Another study by Kedzior et al. also examines the capital structure determinants using a sample of high-tech companies from emerging markets (Polish). Their results

show that companies whose innovation investment is based on external technology acquisition can attract external financing, while the investment based on R&D activity may not attract external capital. Therefore, policy-makers in emerging markets need to consider this finding and make stimulating policies for the R&D process to gain enough financial support. [6]

Nasdaq is believed as the pioneer of the technology stocks listing market, which is meaningful to research.

Hua investigates the development history and differences in the market of Nasdaq to explain why the Nasdaq market became one of the largest global trading markets. He mainly introduces three levels of the Nasdaq stock market, namely Global Select Market, Global Market, and Capital Market. He further illustrates the evolution of Nasdaq's internal stratification. Nasdaq established diversified listing standards to adapt to different requirements for various enterprises. With all the positive effects brought from the Nasdaq market, it provides a feasible stage of the market for every company. [7]

Sanger and McConnell discussed the events that happened in the New York Stock Exchange during 1966-1977. This period showed the pre-Nasdaq period and the establishment of the Nasdaq market. They conclude that before the establishment of the Nasdaq market on the NYSE, the overall average of stock earning was significantly positive, which was quite abnormal in response to the listing announcement. Oppositely, after the establishment of Nasdaq, the earnings of stock are lower than the pre-Nasdaq period. Moreover, empirical methods are insensitive to explaining the anomalies that appear in the Nasdaq market. [8]

Also, there are some related studies based on the Chinese high-technology market.

The study of Hu et al. uses a sample of Chinese publicly listed high-tech companies to conclude that these firms' R&D investment is significantly dependent on internal cash flow. The results suggest that the financial developments in both credit and equity markets can have comparatively more access to external financing resources and more active R&D activities, and potentially realize the innovation potentials for the sample of high-tech companies. The effects are most significant in the financially advanced East region of China. [9]

Xiao found that self-financing and informal financing from individual investors and private firms are consistently acting as a substitute for more formal funding for all firms throughout all stages of business development, particularly at the early stage. However, the survey evidence suggests that the informal funding resources can only support short-term investments, failing to provide medium and long-term investments in radical innovation in particular necessary to face the challenge of achieving technological competitiveness and long-term success and growth amongst those Chinese high-tech SMEs. [10]

### 3. THE STAR MARKET AND THE NASDAQ STOCK MARKET

#### 3.1. Nasdaq and STAR listing rules

The STAR Market has been touted as “Nasdaq of China”. As a platform for accelerating the development of technology-based enterprises and providing financing for high-technology or innovation enterprises, STAR has some similarities with Nasdaq. Reviewing the regulatory policies of Nasdaq may bring some insights into the current implementation and future development of the initial listing policies on the STAR Market. One main goal of this paper is to determine whether the Chinese government gives an encouraging environment and provides substantially supportive policies for those high-tech or innovative SMEs.

Nasdaq offers three different tiers, namely the Nasdaq Global Select Market, the Nasdaq Global Market, and the Nasdaq Capital Market, each with its own listing criteria. According to the Nasdaq Initial Listing Guide (2021), companies need to meet specified requirements in terms of financial performance, liquidity, and corporate governance in order to be approved to be listed in any of these tiers. These three are targeted at different levels of company market capitalization and thus have distinctively stringent criteria. Nevertheless, as the STAR Market encourages the listing of SMEs, for conducting a better analysis of comparison, this paper will not take the Nasdaq Global Select Market into consideration, which is an index of companies with relatively large market capitalization.

The process of applying for Nasdaq listing is seemed convenient and easy in which the applicant only needs to fill in the electronic application form through the online portal to provide related information about the company. After submitting the form, the applicant can contact their listing analyst within a few working days. The corporate governance requirements are the same for listing on different tiers, while the financial and liquidity rules are different. Specifically, the Nasdaq Global Market lists four standards referring to income, equity, market value, and total assets or total revenue. The applicant companies must satisfy all of the criteria under at least one of these four standards. As for the Nasdaq Capital Market, the requirements are less stringent, and companies need to meet all criteria under at least one of three standards including equity, the market value of listed securities, and net income. Compliance with all the listing requirements cannot guarantee a successful initial listing, and extra conditions might be applied if necessary to protect investors and the public interest.

China's STAR Market has many encouraging policies to achieve the main goal of the 14<sup>th</sup> Five-Year plan (the plan) (2021) which is to make Shanghai become an important center of science and technology development

and innovation by 2025. The government in Shanghai tries to implement supportive policies and to provide encouraging services for high-technology innovation and entrepreneurship. For example, the provision of financial supports through a more convenient availability to the capital market can facilitate the positive relationship between financial development and technical innovation. The plan pointed out that to realize the ultimate object by 2025, the ratio of social R&D expenditure to the GDP of Shanghai will be around 4.5%, and the ratio of basic research expenditure to social R&D expenditure will be approximately 12%, triggering a strong incentive for the government's financial supports.

For promoting and regularizing the development of the SSE STAR Market, the Chinese government and SSE prescribed many policies and regulatory requirements of going public, the most recent one is 'Interim Provisions on the Application and Recommendation of the Issuance and Listing of Enterprises on the Science and Technology Innovation Board of the Shanghai Stock Exchange' (2021), which prohibited real estate companies and companies that are mainly engaged in finance and investment business from listing on STAR, reflecting a friendly and tailored environment for high-tech SMEs. Also, once the core technology owned by the companies is seemed to be globally leading and shows a great significance to the national strategy, the listing on the STAR Market does not necessarily need to satisfy all of the financial requirements. This clause provides substantial support for those high-tech growth companies and start-ups that have an outstanding capability of technology and innovation but do not have strong financial performance.

#### 3.2. Comparison

The STAR has been considered as China's equivalent and a new challenge to the Nasdaq. Similar to Nasdaq, the STAR aims to lead future technological reforms and focuses on supporting high-technology industries, such as cutting-edge equipment, new materials, new energy, biological medicine, and environmental protection materials. Following the lead of Nasdaq, STAR launched a more friendly listing standard, targeting at helping small- and medium-sized innovation and technology enterprises. Moreover, it is known that the registration system, which is a mark of the maturity of the capital market, is the most typical in the United States and Japan. It is the first time for China's stock market to adopt a registration system on the STAR Market, which has made substantial headway towards the innovation of China's capital market.

However, there are some differences between the STAR and Nasdaq, and the comparative analysis has important reference significance for the newly established STAR. Firstly, the distinctive tiers of Nasdaq separately comprise listed companies with different levels of market capitalization to form an internal multi-level market system to promote the continuous development of business

scale and to spread risks, whereas the STAR Market only concentrates on the listing of SMEs. Secondly, Nasdaq is a global market made up of America-based and international stocks, while the more native STAR Market merely includes China-based stocks. Moreover, the initial listing process on the Nasdaq Market is that companies need to submit application materials to Nasdaq Listing Qualification Staff, and then the company can be listed as long as being accepted. In comparison, the listing process of the STAR Market under the registration system is that the Listing Committee of the SSE declares all materials of the reporting company at first. Then they submit the material to the Securities Supervision Commission (SSC). The SSC will consider the views from the Listing Committee and issue the opinion on whether to approve the listing. Only after the approval can the company register with the SSC.

Furthermore, as mentioned above, the listing requirements on Nasdaq are more rigorous about financial and liquidity requirements. Conversely, companies do not necessarily have to accomplish all financial criteria of listing on the STAR Market, given that they can demonstrate an acknowledged significance and leading role in the cutting-edge science or China's development strategy. Lastly, one important purpose of launching Nasdaq is to power the world's securities transactions and to aid capital flows towards quality assets. Today's Nasdaq is the product of continuous reform, innovation, and development. Nevertheless, the launch of the STAR Market is more likely a product of government policies. The establishment will become a pilot field for China's capital market reform, the promotion of high-quality economic development, and the implementation of the registration system. It is aimed at cultivating the key technology areas, participating actively in the Fourth Industrial Revolution, and achieving the target of 'Made in China 2025'.

Although the policies are designed to promote the listing and financing of high-tech and innovative SMEs, establishing the STAR Market and piloting the registration system cannot guarantee the expected reform achievements. Therefore, the following part will examine the effect of the relevant policy from the aspect of whether the IPO on the STAR Market can promote the company's revenue growth.

## **4. ANALYSIS OF STAR IPO AND REVENUE GROWTH**

### **4.1. Sample**

As the operation of STAR Market began on July 22, 2019, the sample covers 68 Chinese high-tech SMEs that were publicly listed in STAR during 2019. The listing

motivation of high-tech SMEs is to raise capital for funding high R&D costs and capital expenditure and thus support future development. Those SMEs are reluctant and unable to access enough financing through credit markets due to the fluctuation in revenue streams, high financial risk, and immature business scale. To reach a relatively fair result without extreme abnormal values, listed companies with extremely volatile revenue growth are excluded.

### **4.2. Variables**

To investigate the capital structure of corporates listed in the STAR Market and its promotion of business growth, a model of revenue growth analysis is constructed. The dependent variable is the 19/20 operating revenue growth rate. Increased opportunities and public awareness through listing may lead to an increase in market share and revenue. Operating revenue eliminates the influence of some extra irrelevant variables to some extent, and the revenue growth rate can effectively reflect the development prospect of firms. All data and records used in our testing are extracted from the Wind database.

$X_1$  is the geometric average operating revenue growth rate over the three years (2016-2019) before the listing. This variable is chosen to cover some other related factors that are not testing focus and consider the cases in which revenue growth is caused by internal funds, momentum factors, natural expansion and development, and intrinsic growth patterns.

$X_2$  is the ratio of the initial offering amount to the market capitalization as of March 31, 2020, which is a rational value after the first financial reporting of those listed firms. It might be inevitable that the management of entities tends to artificially enhance the earnings reports and therefore entities' market value will be possibly overrated, and a continuous increase in earnings will raise the stock price and market valuation. The data of March 31, 2020, which is three months exceeding the fiscal year-end (December 31), is tending towards stability and reflects relatively real financial levels of companies. This ratio measures how effectively the IPO can generate a short-term stabilizing market capitalization.

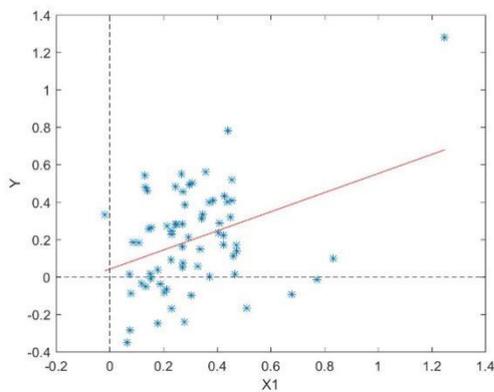
Fast-growing high-tech SMEs tend to have more access to borrowed capital for fundraising. To control the promotion of revenue growth solely through debt financing,  $X_3$  is the most recently available debt ratio using records from June 2021 interim reports, measuring the leverage level of those SMEs. The average debt ratio of sample firms is relatively low, jointly caused by the high credit risk and the lack of accessible source of debt funding.

**Table 1.** Summary Statistics for three dependent variables

	$X_1$	$X_2$	$X_3$
Mean	0.3095	0.1337	0.2241
Standard deviation	0.1982	0.0682	0.1507
T-mean	12.8743	16.1600	12.2574

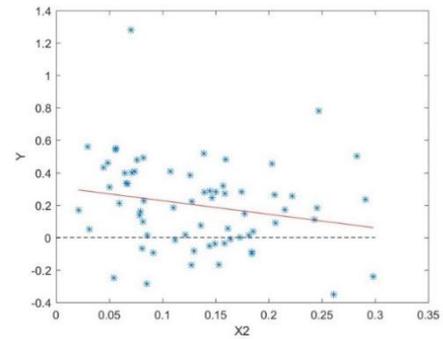
**4.3. Summary Results**

Figure 1 shows the relationship between the operating revenue growth rate of 2016-2019 and that of 2020, testing the momentum of firm growth. From the scatter plot, a minority of sample firms (16 firms) have negative operating revenue growth rates in 2020 while having positive 2016-2019 average growth rates. Only one company shows a positive growth rate in 2020 with a negative historical average growth rate. Most of the high-tech firms listed in the STAR Market manifest a considerable tendency of expansion. Besides, it is found that the revenues of a corporation named *Raytron Technology Co.* grow with rates higher than one hundred per cent both over 2016-2019 and in 2020. Regarding to the regression, overall, there is a positive correlation between past performance and current growth. That is, high-tech SMEs tend to have the momentum to remain the trend of operating revenue growth.

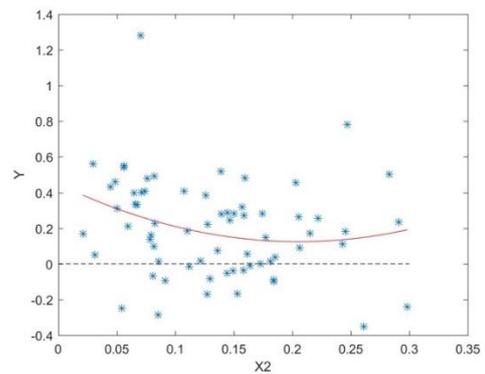


**Figure 1** Scatter plot of  $X_1$  and  $Y$

The promotion effect of IPOs in the STAR Market to corporation revenue growth is tested in Figure 2 and Figure 3. The slope of the regression fitting line in Figure 2, which shows the one-time regressing results, is negative, revealing that a relatively high ratio of initial offer amount to market capitalization might not encourage revenue growth. The quadratic regressing results shown in Figure 3 demonstrate that there may not be an optimal initial offering amount relative to market capitalization for listed firms. Besides, the  $X_2$  ratio is between 0 to 0.3 for most enterprises.

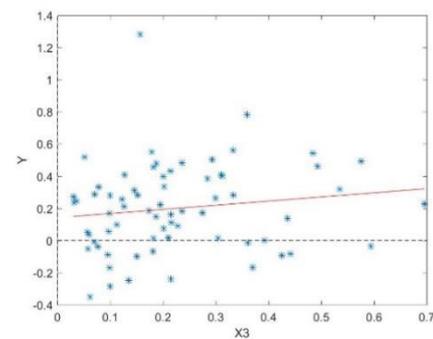


**Figure 2** One-time regression of  $X_2$  and  $Y$



**Figure 3** Quadratic regression of  $X_2$  and  $Y$

To test whether the leverage level is a revenue driver, a regression (Figure 4) was constructed to show the relationship between debt ratio and revenue growth. Most firms (more than 80 per cent) have debt ratios in the range of 0 to 0.35, indicating a commonly average level. According to the linear regression result, firms tend to gain moderately higher operating revenue with higher debt levels, but the effect is not as distinct as expected.



**Figure 4** Scatter plot of  $X_3$  and  $Y$

Figure 5 and Figure 6 provide evidence of the correlation between  $X_1$  and  $X_2$ , and  $X_1$  and  $X_3$  respectively. The previous sales growth rate of most firms is between 0 to 0.5 and referring to the scatter plots, there are no obvious links, and thus, no significant multicollinearity between these two sets of explanatory variables. Evidence from Figure 6 suggests that the moderate improvement effect of debt level to revenue growth is not caused by any correlation between debt ratio and historical average revenue growth.

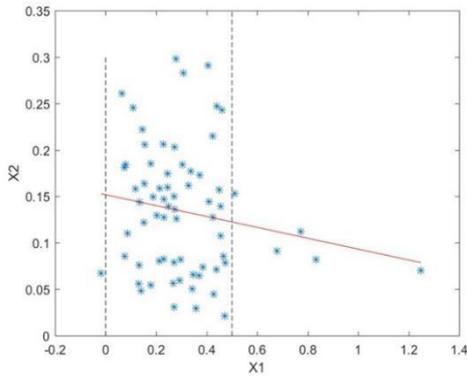


Figure 5 Scatter plot of  $X_1$  and  $X_2$

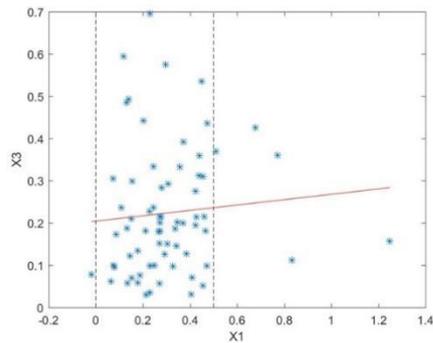


Figure 6 Scatter plot of  $X_1$  and  $X_3$

The scattered distribution in Figure 7 is likely to suggest that there is a rare linear relationship between  $X_2$  and  $X_3$ , which rejects multicollinearity.

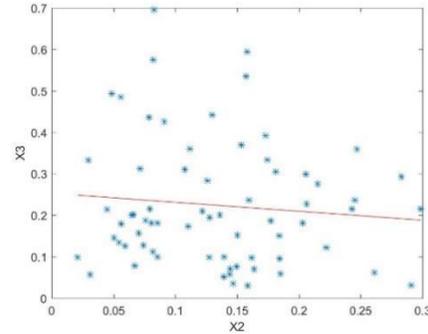


Figure 7 Scatter plot of  $X_2$  and  $X_3$

Table 2 summarizes regression to explain IPOs and capital structure on corporation growth concerning increased revenue. Table 3 is the results of the robust test. The reported explanatory variables are sequentially included in the regression models. It is concluded from the results that IPOs do not have a material impact on high-tech SMEs revenue growth as we expected. In addition, the last model  $Y = X_1 + X_2 + X_2^2 + X_3$  has the highest adjusted R-square, which shows better fitting results than other models, even proving that the quadratic debt ratio may be one of the rational explanatory variables in the models.

Table 2. Linear regression fitting results

Model	Coefficient					R-square	Adjusted R-square
	Alpha	$X_1$	$X_2$	$X_3$	$X_2^2$		
1 $Y = X_1$	0.0412	0.5109				0.1384	0.1253
2 $Y = X_1 + X_2$	0.1326	0.4757	-0.6025			0.1605	0.1347
3 $Y = X_1 + X_2 + X_3$	0.0902	0.4661	-0.5680	0.1817		0.1705	0.1316
4 $Y = X_1 + X_2 + X_2^2 + X_3$	0.2122	0.4525	-2.5954	0.1929	6.7129	0.1874	0.1358

Table 3. Robustness test results

Model	Alpha		$X_1$		$X_2$		$X_3$		$X_2^2$	
	Coeff.	T-stats	Coeff.	T-stats	Coeff.	T-stats	Coeff.	T-stats	Coeff.	T-stats
1	0.1396	2.14	0.1490	0.77						
2	0.2602	2.77	0.0874	0.45	-0.7724	-1.69				
3	0.2041	1.94	0.0724	0.37	-0.7066	-1.53	0.2343	1.12		
4	0.3484	2.36	0.0446	0.23	-3.1439	-1.74	0.2531	1.23	8.4272	1.46

## 5. DISCUSSION

According to the results summarized above, there are concentrated distributions and common patterns of average 2016-2019 sales growth before the listing ( $X_1$ ) and leverage level ( $X_3$ ) among those listed SMEs. The company data suggests that tested firms are likely to have a normal growth before listing, which might be forced by the STAR listing requirements. Besides, there is a trend towards a common debt level, revealing a potentially rational capital structure to maximize the company's value. The findings of the regression models are not as significant as we expected that the IPO can play an important role in boosting revenue for those listed high-tech SMEs. The possible explanation might include the weak market efficiency, the short history of the sample SMEs, the lagging of the policy and regulation. Additionally, we may not consider the unique characteristics of high-tech listed companies and related regulatory requirements for listing the STAR Market. The IPO and other financing provide capital resources but may not directly reflect in the sales revenue that also relates to marketing, human capital, customer services, scale-up production, etc. Besides, the fundraising might also not timely influence the revenue growth because of the product's long development cycle before production and generating revenue.

Some prior studies (e.g., Serrasqueiro et al., 2016) found that the problems of asymmetric information faced by SMEs may hinder their access to debt and increase the costs of debt, so equity financing might be a more accessible resource compared to borrowed capital. The growing firms with an urgent need for large financial support should lower the loan burden and increase profitability to maintain high growth rates. The IPO, which possibly provides liquidity for management, can cover previous sunk costs and replace private equity or venture capital, ultimately spreading and alleviating the risks involved in R&D activities and business innovation. The funds enable new business plans and growth project investments to achieve ongoing business and sustainability. Moreover, if the high-tech SME explores a new market to create dominant market-share and develops brand new products with early entrant benefits and more competitive advantages, it will exploit the potential of great growth opportunities and huge revenue. External investors who believe the blueprint for success drawn by managers are willing to provide funds for supporting corporations' expansion and future development.

China decided to establish the STAR Market, rather than lower the requirements of the stock main market, for a market separation. The STAR Market facilitates the divestment of venture capital and serves as a new market that is separate from the main market of SSE. The reason for launching the STAR Market is that the Chinese government tries to avoid the situation in which such high-tech companies with high investment risk affect the other listed companies on the main index and even affect the

whole systematic risk of the main market. There are large amounts of individual investors in the motherboard and are not capable of bearing a high-level risk. However, the STAR Market attracts more investors with the capability of taking high risks, like investment institutions, as it compensates them with the opportunity of getting a risk premium under a high-risk situation.

In comparison, China's audit procedures for company listings are more rigorous than that of the US, which is caused by a shorter history of the Chinese stock market, a less adequate market system, and legislation and regulations. Moreover, the supervision in China relies on the supervision committee of the government and the media, lacking the short-selling companies like Muddy Waters Research to play a reverse supervision role. Due to the limited ability of Chinese administration regulation, the Chinese government needs to consider constructing a more effective social regulatory system.

## 6. CONCLUSION

When the STAR Market was launched in China, it was hailed as the 'Nasdaq of China'. Similar to the requirements of listing on Nasdaq, the STAR Market requires the companies to show a great income, equity, and growth. The purpose of launching the STAR Market for China is to advocate the development of high-technology and encourage the listing and improvement of sci-tech SMEs. For achieving this object, the Chinese government and SSE have issued several favorable policies for the IPOs on the STAR Market. For example, for companies whose core technology or core technical staffs are greatly meaningful to China, even if they cannot meet all the regulatory requirements, it can still be supported or encouraged to be listed on the STAR Market. However, it cannot make sure that these policies play an effective role in reality, and there are not many studies on the effect of those supportive policies. This article tests whether the IPO encourages corporation growth in terms of revenue increase. Our tests exclude the effects of some other factors such as momentum, capital structure, and size via controlling variables and examining the ordinary least squares regression to analyze data. The summary analysis suggests that there are common patterns of pre-IPO revenue growth, which was probably mainly caused by the regulatory requirements of the STAR Market. The findings of our tests on the regression models are puzzling and not significant as we expected that the IPO might be a key revenue driver through fundraising for those high-tech SMEs growth opportunities. We call upon the researchers in the finance field to examine other factors impacting the growth of high-tech or innovative SMEs and other more significant effects of IPOs on the STAR Market on listed enterprises. It is necessary to note that we do not consider the follow-on deals of issuing additional equities and dividends paid.

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