

# Shanghai Stock Exchange's Science and Technology Innovation Board: A Review

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**Abstract:** *This study reviews one of China's newest stock markets: Shanghai Stock Exchange's Science and Technology Innovation Board (STAR market). China's STAR market is among its newest stock market, which was officially launched in June 2019, and whose index was released in July 2020. It has attracted extensive attention from market players but almost no coverage from academia. This study fills in this gap by conducting a review of this stock market, including its institutional background, its regulations, and a series of indicators on corporate finance and equity pricing. This study finds that the launch of China's STAR market has its institutional background, including helping economic transition, building multi-layer capital markets, responding to the deteriorating external environment against the background of the US-China trade and technology war, and deleveraging the Chinese economy. The STAR market has made some important reform initiatives in areas such as listing criteria, pricing mechanisms, and delisting. As a result, the STAR market is distinguished from China's other stock. These unique features mean that the STAR market does not simply provide a new dataset, but may potentially provide more interesting insights than simple replications of previous studies. Most importantly of all, this study provides an agenda for future research. For practitioners, this study provides some new information on investing in this market.*

**Keywords:** Shanghai Stock Exchange Science and Technology Innovation Board; SSE STAR market; Review

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## Introduction

On 23 July 2020, China's SSE STAR market, which is officially called the Shanghai Stock Exchange Science and Technology Innovation Board, launched its index. Figure 1 compares the performance of China's STAR market with that of China's other markets and the NASDAQ market from 31 December 2019 to 28 August 2020<sup>1</sup>. All indices have been standardized, i.e., the initial values have been set as 100. The CSI 300 index is an index replicating the performance of the top 300 stocks traded on the Shanghai Stock Exchange and Shenzhen Stock Exchange. The SME Composite Index comprises the 100 largest and most liquid stocks listed and traded on the Shenzhen Stock Exchange Small- and Medium-sized Enterprise (SME) Board Market. The ChiNext Index comprises the 100 largest and most liquid stocks listed and traded on the ChiNext Market, a NASDAQ-style board of the Shenzhen Stock Exchange and a peer of the STAR market. The NASDAQ Composite includes almost all stocks listed on the Nasdaq stock market.

<sup>1</sup> In this study, China's stock markets refer to those based in Mainland China, and exclude Hong Kong Stock Markets. The start date of the STAR Index is 31 December 2019.

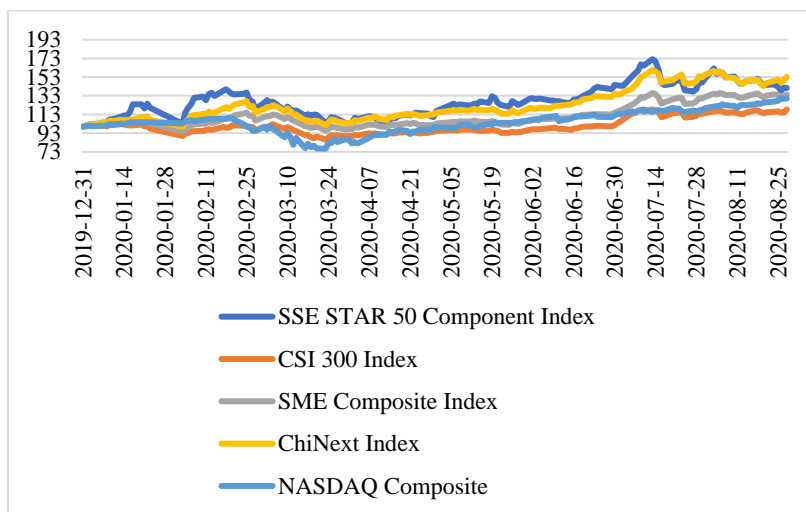


Figure 1. Stock Markets Performance: STAR vs others: 31 December 2019 – 28 August 2020

Source: Wind<sup>2</sup>.

Figure 1 shows that China’s STAR market has been consistently performing very well. In China, the STAR index has outperformed other major indices such as CSI 300 and SME Index, and most times performed better than ChiNext. From 31 December 2019 to 28 August 2020, it has also outperformed another important benchmark, the tech-focused NASDAQ Index<sup>3</sup>.

China’s STAR market is among its newest stock markets. It was announced by President Xi Jinping during the China International Import Expo on 5 November 2018. On 23 January 2019, China’s Central Comprehensively Deepening Reforms Commission approved the plan and guidelines for the STAR Market. On 1 March 2019, the China Securities Regulatory Commission and Shanghai Stock Exchange (SSE) released key rules and guidelines for the STAR market. On 13 June 2019, the SSE STAR market was officially launched. On 22 July 2019, the first group of 25 companies was listed on the SSE STAR market.

China’s STAR market mainly targets high-tech industries and strategic emerging industries<sup>4</sup> such as: new-generation information technology, high-end equipment, new materials, new energy, energy conservation & environmental protection, and biomedicine. It promotes the deep integration of the internet, big data, cloud computing, artificial intelligence, and manufacturing. It also encourages medium and high-end consumption and drives reforms on quality, efficiency, and power<sup>5</sup>. One notable example is China’s biggest chipmaker, Semiconductor Manufacturing International Corp (SMIC). SMIC was suddenly delisted from the New York Stock Exchange on 3 June 2019 (SCMP, 2019), and was listed on the STAR market in July 2020, and has raised as much as RMB 53 billion (equivalent to US\$ 7.6 billion). It is China’s biggest initial public offering (IPO) since July 2010 (SCMP, 2020).

While the STAR market is quite new and has attracted extensive attention from market players, there are almost no academic studies on this market. This study fills in this gap by conducting a review of China’s STAR market, including its institutional background, its regulations, and a series of indicators on corporate finance and equity pricing. By adopting qualitative methods, including descriptive statistics, reviews of policy documents, and academic literature, this study finds that the launch of China’s STAR market has its institutional background, including helping economic transition, building multi-layer capital markets, responding to the deteriorating external environment against the background of the US-China trade and technology war, and deleveraging the Chinese economy. The STAR market has made some important reform initiatives in areas such as listing criteria, pricing mechanisms, and delisting. As a result, the STAR market is distinguished from China’s other stock markets in a series of corporate finance and equity pricing indicators.

<sup>2</sup> Wind (<https://www.wind.com.cn/en/>). Wind is the most widely used Chinese economic and financial data and information provider. It serves more than 90% of the financial firms in the Chinese market, and 75% of the qualified foreign institutional investors in China.

<sup>3</sup> It should be noted that the value of a stock market is not merely judged by its index performance. Also, a long-term horizon may provide a better comparison.

<sup>4</sup> The emerging industries are defined as industrial sectors, usually based on new products, services, technologies, or ideas, which are at an early-stage development and are characterised by high growth rates and market potential (PwC, 2012).

<sup>5</sup> Source: SSE STAR market. see <http://star.sse.com.cn/en/gettingstarted/overview/>

Correspondingly, these unique features mean that the STAR market does not simply provide a new dataset, but may potentially provide more interesting insights than simple replications of previous studies. From the viewpoint of practitioners, this study provides some new information on investing in this market.

The structure of this paper is as follows. Section 1 discusses the institutional background of establishing the STAR market. Section 2 reviews the STAR market from three perspectives: regulations, corporate finance, and equity pricing. Section 3 presents a future research agenda for academics. Section 4 concludes this paper.

## 1. Institutional Background

The launch of China's STAR market has its institutional background. In this section, four factors are analysed, i.e., economic transition, multi-layer capital markets, changing external environment, and deleveraging.

First, the launch of China's STAR market is part of China's strategy of economic transition. Back in 2010, the Chinese government for the first time mentioned its intention of accelerating the cultivation and development of strategic emerging industries (State Council, 2010). In 2016, the Chinese government issued a development plan on strategic emerging industries including Information Technology (IT), high-end equipment and new materials industry, biological industry, new energy vehicles, new energy, and energy-saving and environmental protection industries, and digital creative industry (State Council, 2016). According to Liu (2018), the Chinese manufacturing industry made some progress at the beginning of the 21<sup>st</sup> century but did not improve further or even deteriorate. Although China has gradually increased its expenditure on research and development (R&D) as a percentage of GDP, it still lags behind other major manufacturing economies. Furthermore, China's comparative advantage in low-cost labour is diminishing. Liu (2018) concluded that the major option for the Chinese government to improve economic growth may be the implementation of policies to step up industrial upgrading. In response to these problems, the Chinese government launched Made in China 2025, a ten-year strategic plan to comprehensively upgrade China's manufacturing industry. China's plan of developing strategic emerging industries is part of its broad strategy of industrial upgrading.

At the same time, China's stock markets do not match the need for economic transition. For example, regarding the US market, 7 of the US top 10 market capitalization firms belong to technology hardware and facilities, and software and services. The IT sector accounts for 33.1 percent of the whole US market capitalization<sup>6</sup>. Regarding China, the top 10 market capitalization firms are either (state-owned) banking and financial service, liquor manufacturing, or energy sectors. The IT sector only accounts for around 5.6 percent<sup>7</sup>. One main obstacle is the high listing standards of other stock markets, such as the mainboard markets in Shanghai and Shenzhen, the SME Market, or ChiNext. The tech-focused STAR market will help China's industrial upgrading and economic transition.

Second, following the logic discussed previously, the launch of the STAR market is also part of the Chinese authorities' endeavour of establishing multi-layer capital (stock) markets aiming to improving the efficiency of market allocation of China's economic factors. So far, there are four layers of stock markets in China. The lowest level, i.e., the fourth board, includes 31 regional stock markets. They primarily facilitate financing and equity transactions for local (provincial) businesses. The third board is the National Equities Exchange and Quotations (NEEQ). These two are both Over-The-Counter (OTC) markets, and the rest are exchange-based markets. The second board includes Shenzhen-based ChiNext and Shanghai-based STAR markets. The mainboard includes Shanghai and Shenzhen stock markets and the Shenzhen-based SME markets.

These different boards have different requirements and positionings. Regarding requirements, listing on the mainboard markets is of the strictest and highest standards in terms of financial and market capitalization indicators. Regarding positionings, the mainboard markets mainly target mature industries. The third and fourth board markets have much less industry requirements. The second board markets primarily target technology-related firms. While ChiNext has a negative and positive list of industries, the STAR market has a very specific positioning of 6 sectors as discussed at the beginning of this paper. Table 1 shows the industry distribution of the firms (to be) listed on the STAR market. They primarily concentrate on emerging industries.

<sup>6</sup> The date is 28 August 2020. The Top 10 US market cap firms are Apple, Microsoft, Amazon, Alphabet -C, Alphabet -A (the company formerly known as Google. The difference between C and A is whether there are voting rights), Facebook, VISA, Johnson & Johnson, Walmart, and Master Card. Source: Wind

<sup>7</sup> The date is as 28 August 2020. The top 10 Chinese firms are Kweichow Moutai, Industrial and Commercial Bank of China, Ping An Insurance, China Construction Bank, Agricultural Bank of China, China Life Insurance, China Merchants Bank, Wuliangye, Bank of China, and China Petroleum. Source: Wind

Table 1. The Industry Distribution of (to be) Listed Firms on STAR market (as of 28 August 2020)

Broad Theme	Theme details	Number of Firms
A new generation of information technology industry	Electronic core industry	67
	A new generation of information technology industry	2
	artificial intelligence	5
	Internet and cloud computing, big data services	10
	Emerging software and new information technology services	52
	Next Generation Information Network Industry	19
New Energy Vehicles Industry	New energy vehicle device and accessories manufacturing	6
	New energy vehicle related facilities manufacturing	1
	New energy vehicle related services	1
New energy industry	Wind Energy Industry	2
	Solar industry	5
	Smart grid industry	5
New Material Industry	Advanced non-ferrous materials	8
	Advanced petrochemical new materials	19
	High-performance fibres and products and composite materials	2
	Advanced inorganic non-metallic materials	5
	Advanced steel materials	3
	Cutting-edge new materials	8
Related service industry	New technology and innovation and entrepreneurship services	3
	Other related services	1
Digital Creative Industry	Digital creative technology equipment manufacturing	1
Biological industry	Biological agriculture and related industries	4
	Biomedical Industry	52
	Biomedical Engineering Industry	35
	Other biological industries	3
	Biomass Energy Industry	1
Energy saving and environmental protection industry	Resource recycling industry	3
	Energy-efficient industry	6
	Energy saving and environmental protection industry	1
	Advanced environmental protection industry	12
High-end equipment manufacturing industry	Ocean Engineering Equipment Industry	1
	Intelligent manufacturing equipment industry	49
	Satellite and application industry	4
	Aviation equipment industry	6
	Rail transit equipment industry	5

Source: Wind.

Third, the launch of China's STAR market is also related to China's changing external environment. By launching the Made in China 2025 program, the Chinese government aims to greatly improve the competitiveness of the Chinese manufacturing industry and enable China to become the world's manufacturing powerhouse. As a response, the Trump administration has waged a technological war against China, including trade sanctions, investment control, export control, and restrictions on the exchange of technological personnel (Sun, 2019). China's strategy of reducing the technological gap between domestic and foreign competitors and accelerating the learning process by outward acquisitions is hitting obstacles (Liu, 2018). Under such a situation, it becomes very important to have a healthy domestic financing system (especially the equity market) for these high-tech firms. The STAR market will play such roles as channelling investments into the high-tech sector, risk transfer, and price discovery.

Fourth, the STAR market will aid in the deleveraging of the Chinese economy. China's financial repression and its banking-centric (credit-driven) financing model are the fundamental causes of the rapid accumulation of Chinese non-financial corporate debts. The direct solution is to expand equity financing. At this stage, equity financing has been marginal. For example, as of the end of 2019, equity financing only accounts for around 2.9 percent of China's total social financing<sup>8</sup> (in stock). The STAR market will help deleverage the Chinese economy by raising equity financings.

<sup>8</sup> Total social financing refers to the aggregate volume of funds provided by China's financial system to the real economy within a given time-frame. Source: Wind, People's Bank of China (China's central bank)

## 2. The Star Market

In this section, a comparative analysis between the STAR market and China's other markets, especially ChiNext, is conducted. Besides regulations<sup>9</sup>, a series of indicators and issues related to corporate finance and equity pricing are discussed.

### 2.1. Regulations

First, regarding listing criteria, the STAR market for the first time does not require a positive net profit. As of 28 August 2020, among all (to be) listed firms, 353 are profitable while 49 are not. This arrangement is consistent with the characteristics of emerging industries. Following this reform, the ChiNext has accordingly revised its listing rules by also considering applications from non-profitable firms. At the same time, China's other stock markets all require profitability. Also, the STAR market does not have requirements for the IPO PE (price over earnings per share) ratio. Following this reform, the ChiNext has also abolished this hidden requirement of PE ratio, which is around 23 and has been applied by China's Mainboard markets. These market-driven reforms, initialized by the STAR market, will help the development of China's tech sector and improve stock markets' function of price discovery.

Second, same as all other markets, the STAR market also adopts the T+1 trading mechanism, i.e., the settlement date is 1 day after the purchase of a security. The STAR market does not constitute a substantive reform because this mechanism has existed in China since its inception. Zhang (2020) found that this can cause negative overnight returns whereas those under the T+0 trading mechanism all have around 0 or positive overnight returns. Zhang (2020) further found that the T+1 trading mechanism has greater impacts on stocks with more divergent investor opinions, higher risk, more individual investor percentages, higher arbitrage restrictions, and less liquidity. The T+1 trading rule distorts the price generation mechanism of stocks in China.

Third, the STAR market has made some major progress in reforming the pricing mechanism. For example, there are no price limits during the first 5 trading days, and only  $\pm 20$  percent from the sixth trading day. Following the reform initiative from the STAR market, the ChiNext has also changed its rules to  $\pm 20$  percent from the previous  $\pm 10$  percent. As for the mainboard markets, including the SME market, the price limit is  $\pm 44$  percent during the first trading day, and  $\pm 10$  percent afterward. The effects may be profound, and subject to further studies in the future (see further discussion in Subsection 4.1).

Fourth, regarding delisting rules, the STAR market stipulates four types of conditions that can incur delisting, including breaking the law, infrequent trading, poor financial performance, and serious compliance issues. Following this reform, the ChiNext has also expanded its delisting rules from only financial indicators to the rest. At the same time, delisting has been very rare in China's mainboard markets. For example, only 123 shares have been delisted among 3,979 Chinese shares since 1999. More delisting will help improve the efficiency of Chinese stock markets' role in resource allocation.

### 2.2 Corporate Finance

Table 2 compares various corporate-related indicators of the STAR market with China's other exchanged-based stock markets. These indicators include IPO indicators, financial and operating indicators such as profitability ratios, liquidity ratios, debt ratio and especially R&D ratio, and corporate governance indicators.

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<sup>9</sup> According to Chinese authorities, the STAR market uses a registration-based IPO system, which differs from the approval system used by other markets. At this stage, it seems that it is difficult to assess the essence of this system. It may be better to leave this issue for future research.



Table 2. Corporate Indicators: STAR vs China's Other Exchanged-based Stock Markets

	A. IPO				B. Financial and Operating Indicators (Unit: %)								
	PE Ratio (x)	IPO fee (%)	1st Day Return - Median (%)	First 5 Days Return - Median (%)	Return on Equity (ROE)	ROE after deducting non-recurring gains and losses	Earnings Before Interest and Tax (EBIT) on Total Assets	Return on Assets (ROA)	Debt Ratio	Current Ratio	Quick Ratio	R&D Expenditure over Operating Revenue	R&D Staff
Main Board - Shanghai	23.0	9.4	44.0	5.2	10.6	9.9	5.2	1.5	85.9	1.2	0.7	0.0124	/
Main Board - Shenzhen			128.9	-2.1	7.2	6.5	4.0	1.9	73.1	1.2	0.7	0.0218	/
SME Market	23.0	10.3	44.0	1.8	5.7	3.9	4.4	2.0	65.5	1.3	0.9	0.0332	/
ChiNext	23.0	12	44.0	50.9	3.2	2.2	3.3	1.8	44.8	1.6	1.3	0.0527	/
STAR	44.2	9.8	128.8	-5.5	12.3	10.9	8.4	7.5	34.1	2.7	2.4	0.0724	22.8

Table 2. Corporate Indicators: STAR vs China's Other Exchanged-based Stock Markets - Continued

	C. Corporate Governance			
	% of Independent Director	% of CEO compensation over revenue (1/ million)	% of Largest Shareholder Ownership	% of Institutional Ownership
Main Board - Shanghai	36.4	223.7	36.8	44.8
Main Board - Shenzhen	36.4	229.3	32.9	48.2
SME Market	36.4	311.2	31.2	34.4
ChiNext	37.5	656.5	28.5	26.6

Source: Wind.

Note:

A. IPO indicators

- All data sets are from 2016. The main consideration is since Shenzhen Stock Exchange – Main Board almost did not have IPOs since 2016, the use of full sample data will certainly be biased towards the earlier data.
- PE ratio is defined as the ratio of IPO price over earnings per share; IPO fee is defined as the ratio of IPO fee over funds raised
- As the result of extremely high Kurtosis value (not reported, but available upon request), the median rather than mean value of IPO PE ratio is used. IPO fee data are mean values

B. Financial and Operating Indicators:

- B shares, which are equity shares issued by Chinese firms but traded in foreign currency (only 94 as of August 2020), are excluded from calculation. This study generally examines only A shares or domestic shares, which are denominated in Renminbi (Chinese currency)
- The reporting date is end of 2019
- The method used is aggregated method rather than arithmetic mean, i.e., the aggregated financial indicators of all shares in a particular market
- Debt Ratio is defined as the ratio of total debts over total assets
- Current ratio measures a company's ability to pay off its current liabilities (payable within one year) with its current assets such as cash, accounts receivable and inventories
- Compared with Current Ratio, quick ratio excludes inventories when calculating current assets

C. Corporate Governance Indicators:

- The reporting date is end of 2019
- Data on independent director ratio and CEO compensation ratio are both median values. Ownership data are mean values
- The denominator of the fraction of institutional ownership is tradeable shares rather than all shares
- Institutional investors include mutual fund, brokerage firms, Qualified Foreign Institutional Investor (QFII), insurance company, social security fund, enterprise annuity, trust company, finance company, general legal person, non-financial listed company, and Hong Kong-Mainland China stock connect.

Regarding IPO indicators, Table 2 shows that the STAR market's IPO PE ratio is much higher than those of other stock markets. The latter are all 23, which is the hidden rule of IPO PE ratio from the China Securities Regulatory Commission (CSRC). While there are no convincing explanations for the existence of 23, it shows the power of regulatory intervention into Chinese stock markets' pricing. The STAR market has for the first time changed this rule, and adopted a more market-driven pricing mechanism. In order to implement this pricing mechanism, the regulatory authority for the first time stipulates that underwriters should use their own funds to invest in 2 – 5 percent of shares issued by the IPO firms, and these shares will be restricted for sale for 24 months (SSE, 2019). The main purpose is to have the underwriters' pricing ability more closely

associated with their own benefits. Furthermore, in view of the nature of emerging industries, a higher IPO PE ratio also makes more sense. The IPO fee ratio data from the STAR market does not show significant differences from other stock markets.

Regarding the IPO return indicator, the first-day returns for the Shanghai mainboard market, SME market, and ChiNext are all 44.0 percent. This is consistent with the regulatory requirement, i.e., the first-day price cap is 44.0 percent. As the Shenzhen mainboard market is mainly based on much older data (before 2016), its daily return information is not very comparable. The first-day return for the STAR market is 128.8 percent, showing a strong first-day performance after the first-day price cap regulation was lifted. However, the STAR market's first 5 days return is the lowest among all China's stock markets. This brings up the (not so) long-run underperformance issue of IPO, which can be investigated further in the future.

Regarding financial and operating indicators, first, the profitability indicators such as ROE, ROE after deducting non-recurring gains and losses, ROA, and EBIT Ratio all show the outperformance of the STAR market. However, as the sample data from the STAR market are all newly listed firms, the long-run performance may matter more. This is an issue subject to more research in the future (see more discussion in Subsection 4.1). Second, debt ratio data show that the STAR market has significantly less debt than other stock markets. This may be because these emerging industry firms are more difficult at obtaining loans than those from traditional industries. Third, liquidity indicators (current ratio and quick ratio) show that the firms listed on the STAR market have a better liquidity position than those listed on other markets. Fourth, the R&D indicators show some distinctive features of the STAR market. Those firms listed on the STAR market have a much higher percentage of R&D expenditure over operating revenue than those listed on other markets. This is exactly what the STAR market is positioned as. Furthermore, these firms listed on the STAR market have a very high fraction of R&D staff (22.8 percent in 2019). While data is not available for firms listed on other markets, nevertheless, this number is big.

Regarding corporate governance indicators, the STAR market shows its conformity and uniqueness as well if compared with other markets. For example, independent directors only account for one-third, which is not significantly different from others. At the same time, this is still in compliance with the requirements of the CSRC, i.e., 'The board of directors of a listed company should include at least one-third of independent directors' (CSRC, 2001). The average size of the largest shareholder ownership is 32.0 percent, which seems not to be significantly different from others either. In fact, in the Chinese stock markets, diffused ownership is very rare. From this point of view, the STAR market is not exceptional. However, the STAR market has the highest fraction of CEO compensation over revenue. This difference may be related to the identity of the ultimate owner. Based on descriptive statistics, the STAR market has the highest fraction (94.2 percent)<sup>10</sup> of privately-controlled firms (POEs). China's state-owned enterprises have introduced a two-tier compensation system from 2013, i.e., one for Party/state-appointed personnel who enjoy reasonable salary together with job security, and the other for professional managers who will be remunerated with a competitive salary. As a result, the CEO compensation of SOEs may be much lower than those of POEs. The CEO compensation of firms listed on the STAR market is more market-driven than others. Nevertheless, this is an issue subject to further research in the future (more discussion in Section 4.1). Lastly, the institutional ownership of firms listed on the STAR market is much lower than those listed on other markets.

### 2.3 Equity Pricing

Table 3 (see in Appendix) shows a series of equity pricing indicators of the STAR market, and a comparison with China's other exchange-based stock markets. These indicators include valuation indicators such as market capitalization (market cap), P/E (price over earnings per share) ratio, P/B (price over book value per share) ratio, P/S ratio (price over sales per share), and P/CF (price over cash flow per share) ratio, risk indicator (volatility) and trading indicator (turnover ratio).

Regarding valuation indicators, the STAR market is at this stage the smallest, but maybe because of the relatively smaller number of listed firms. The Market Cap – Mean indicator shows that its average firm size is already bigger than those from the SME market and ChiNext, and comparable to those from Shenzhen – Mainboard.

<sup>10</sup> This fraction is just 52.5 percent on Shanghai Stock Exchange – Mainboard. At each board/market, there are a small number of firms controlled by foreign entities. They can be either state-owned enterprises or individuals. There are also a few collectively-controlled firms and university-controlled firms. They are all excluded from calculations. As these numbers are small, these exclusions do not significantly affect the fraction comparison.

Other valuation indicators further confirm the overvaluation of the STAR market. For example, the P/E ratio, P/B ratio, and P/S ratio all show that the STAR market is much higher than others, including the mainboard markets, SME market, and its tech peer ChiNext market. However, the P/CF ratio from the STAR market is the lowest. As the STAR firms are mainly at their early or growth stage, they may not be able to generate enough net cash flow (either because of low level of operating cash inflow, high investment outflow, low level of debt financing cash inflow, or a combination of them). Investors would still like to pay a higher valuation for these shares, expecting a better performance in the future.

At the same time, the STAR market’s volatility is the highest, reflecting the high-risk nature of tech stocks as the result of the uncertainty of earnings growth, regulatory scrutiny, and external shock from the US-China technology war. The share turnover data shows that the STAR market has the greatest liquidity.

A notable phenomenon is the existence of due-listing shares, i.e., simultaneously listed on the STAR market and Hong Kong Stock Exchange. So far, there are 6 due-listed shares, including Semiconductor Manufacturing International Corporation (SMIC, a Chinese partially state-owned semiconductor foundry company, and the largest in Mainland China), Shanghai Fudan-Zhangjiang Bio-Pharmaceutical (Fudan Zhangjiang, a manufacturer and distributor of biomedical products), Shanghai Haohai Biological Technology (Haohai Bio, a manufacturer and distributor of biological products), CanSino Biologics (CanSino Bio, a vaccine company), Shanghai Junshi Biosciences (Junshi Bio, a biopharmaceutical company), and China Railway Signal & Communication (China CRSC, a company specializing in train control systems such as signals). Figure 2 shows the AH Premium (percent), defined as the difference between A share price and H share price<sup>11</sup> over the H share price.

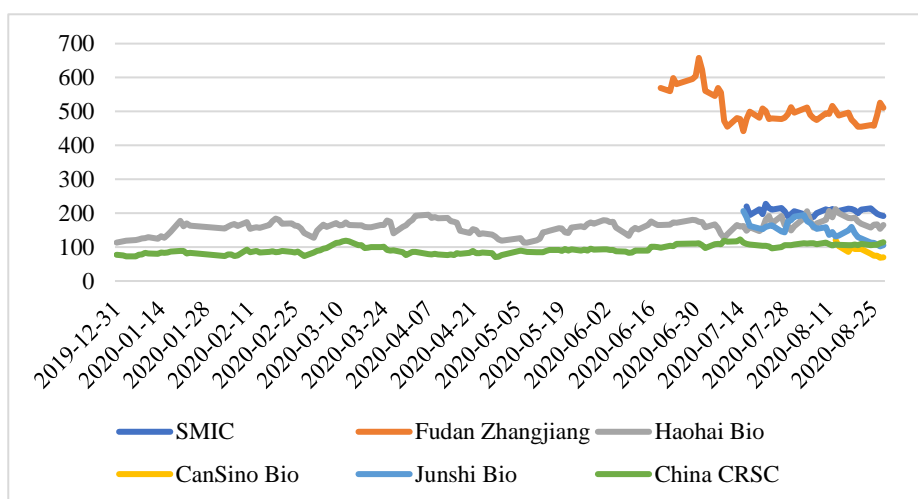


Figure 2. AH Premium from the STAR Market (Unit: %): 31 December 2019 – 28 August 2020

Source: Wind.

Figure 2 shows a huge AH premium, which violates the one price law. This market anomaly deserves more research in the future, which is further discussed in Subsection 3.2.

### 3. A Research Agenda

As Carpenter and Whitelaw (2017) claimed, as China’s stock markets continue to grow in global influence and go through many significant reforms, they provide natural experiments and future research areas are ripe. One of the primary goals of China’s stock markets experiment was to help China’s SOE reform through partial privatization, and this objective significantly impacted Chinese stock markets’ development (Allen and Shen, 2012). For example, the Chinese government closely regulates the selection of companies for listing, initial pricing, and the subsequent ownership structure. The launch of the STAR market is different from others. As discussed in Subsection 3.1, the STAR market has been more market-driven than other markets in many areas, such as listing criteria (and industry positioning), pricing, and delisting mechanisms. Generally speaking, the

<sup>11</sup> For information on A share, see Table 2 - Note B. H shares refer to the shares of companies incorporated in Mainland China but traded on the Hong Kong Stock Exchange, and denominated in Hong Kong Dollar.



launch of the STAR market means totally new datasets for Chinese stock markets studies. Many existing studies can be replicated with these new data sets.

As the STAR market is very new, previous studies on this market are very few. Liu (2020) simply mentioned the launch of the STAR market against the background of the US-China trade war, and briefly discussed its significance. Using an event study, Qin, Xiao and Zhang (2019) studied the impact of the STAR market on stock valuations of A-share firms pertaining to STAR related industries, and found that the valuation increased significantly after the reform announcement, and the effect is stronger for non-SOEs and firms with higher R&D capacity. Zhou, Gu, and Lu (2019) investigated the performance of firms listed on the STAR market by looking at both the production and financial markets, and found that these firms' efficiency is low.

In this section, a future research agenda is reviewed covering areas of corporate finance and equity pricing. In particular, some special characteristics of the STAR markets mean that some studies may potentially provide more interesting insights than simple replications.

### **3.1 Corporate Finance**

In this subsection, a series of corporate finance-related issues are discussed. Specifically, they include share listing, market microstructure (price limit), R&D, and corporate governance.

#### *3.1.1 Share Listing*

The first issue is corporate listing choice. As argued by Carpenter and Whitelaw (2017), Chinese firms have a range of potential listing choices, making China a uniquely rich setting for research on the determinants and consequences of corporate listing choice.

For example, Chinese firms can choose to list their shares on the Shenzhen Stock Exchange including Mainboard, SME market and ChiNext, Shanghai Stock Exchange including Mainboard and STAR market, Hong Kong Stock Exchange, New York Stock Exchange, NASDAQ, London Stock Exchange, and Singapore Exchange. Shen (2016) and Carpenter and Whitelaw (2017) found that industrial firms tend to list in China, while technology, media, and telecommunications firms tend to list in the United States. The natural question is: besides the industry factor, what other factors have determined the listing choice of the STAR firms? A few Chinese firms, including JD.com (a Chinese e-commerce company and a major competitor to Alibaba-run Tmall), Ant Group, and SMIC have chosen to be delisted from the US and (to be) listed on the STAR market. The market-driven IPO pricing on the STAR market may be a positive factor. The IPO fee (see Table 2A) together with the compliance fee may be another factor that firms need to consider. A third factor may be related to price informativeness and valuation. Fernandes and Ferreira (2008) found that cross-listing on US exchanges reduces price informativeness for firms from emerging markets. It is probably because gains from expanding the investor base are offset by negative effects of foreign-market discount shocks leaking into local markets and compromising future earnings signals. This issue needs more research in the future.

The second issue is broadly related to the IPO. Specifically, according to Ritter (2003), there are two sub-areas as short-run under-pricing (average first-day returns) and long-run performance.

Regarding short-run under-pricing, Ritter (2003) found that IPOs are under-priced in every (38) country with a stock market. The average first-day return for the Chinese IPO was the largest. Table 2A shows that the IPOs in the STAR market are also significantly under-priced. While it is understandable that Chinese IPOs were under-priced due to the hidden price cap regulation, more explanations for the STAR market's under-pricing are required. According to Carpenter and Whitelaw (2017), there are various theories such as under-pricing compensates uninformed bidders for the winner's curse, compensates investors for firm-value volatility, compensates informed investors for disclosure of information, addresses underwriters' credibility issues, and serves as a signal of good prospects to be recovered in subsequent offers. The STAR market provides a new, but most importantly of all, different data set for empirical studies.

The following issue is the long-run performance of IPOs (Ritter, 2003). First, will there be such an issue on the STAR market? Table 2A shows the underperformance of the first 5-days return. When more data spanning a longer time horizon is available, this issue can be further explored. Using datasets from ChiNext, the STAR market's peer, Anderson, Chi, and Wang (2015) found that the average 12-month buy-and-hold abnormal return is -45.7% for those IPOs listed. They attributed this underperformance to a significant deterioration of their operating performance after listing. Second, will the IPO performance be associated with selection issues such as political connections (Piotroski and Zhang, 2014)? Allen, Qian, Shan, and Zhu (2020) found that

problematic IPO and delisting processes lead to adverse selection of firms entering and staying in Chinese stock markets. As the STAR market is adopting a much stricter delisting rule, how this will affect the IPO's long-run performance needs further research.

### 3.1.2 *Price Limit*

Yeh and Yang (2010) analysed the general impacts of price limits on volatility, price distortion, volume, and welfare, and concluded that there are both positive and negative effects, and appropriate price limits help to reduce volatility and price distortion, and increase liquidity and welfare. Using datasets from Egyptian, Thai, and Korean stock exchanges, Farag (2013) examined the effects of the switch from narrow price limits to wider price limits, and concluded that it structurally altered both asymmetric volatility and the day of the week anomaly, and the price discovery mechanism is disrupted. Regarding the Chinese markets, using agent-based simulations, Zhang, Ping, Zhu, Li and Xiong (2016) found that both upper and lower price limits can cause a volatility spillover effect and a trading interference-effect. Furthermore, the process of price discovery will be delayed if upper price limits are imposed on a stock market while no such phenomenon occurs when lower price limits are imposed. Chen, Gao, He, Jiang, and Xiong (2019) found that the price limits mechanism may lead to unintended, destructive market behaviour: large investors tend to buy on the day a stock reaches the upper price limit of 10 percent and then sell on the next day; and their net investment on the limit-hitting day forecasts a stronger long-run price reversal.

As discussed in Subsection 3.1, the STAR market has made some major progress in reforming the pricing mechanisms, including no price limits during the first 5 trading days, and only  $\pm 20$  percent from the sixth trading day. These rules are different from the existing ones, and are a potential area for future research.

### 3.1.3 *R&D and Firm Performance*

While technology is considered as one main driving force of economic growth, the relations between R&D spending and firm performance have been subjected to much debate. Guo, Wang and Wei (2018) conducted a review on such a topic, and found that on one hand, the intensity of R&D spending is found (such as by Armstrong, Davila, and Foster, 2006) to be positively associated with firm operating and financial performance, on the other hand, R&D intensity is also found to be positively associated with return volatility (Chan, Lakonishok, and Sougiannis, 2001), R&D risk dominates benefits (Shi, 2003), and the effect of R&D spending varies according to firms' own characteristics (Eberhart, Maxwell, and Siddique, 2004).

Table 2 shows that the STAR market has the highest fraction of R&D expenditure over operating revenue among all Chinese stock markets. Because the STAR market has a very specific tech-focused industry positioning (see Table 1), and its data on R & D personnel fraction is unique among Chinese stock markets (see Table 2B), it will provide rich data and serve as a good example for studying the effects of R & D spending on firm performance.

### 3.1.4 *Corporate Governance*

Generally speaking, there will be lots of new problems arising from the STAR market. Some preliminary data from Table 2C shows there may be at least two potential areas for further research. One is executive compensation. The other is institutional ownership.

Regarding executive compensation, Conyon and He (2011) found that executive pay and CEO incentives are lower in state-controlled firms and firms with concentrated ownership structures. Table 2C shows that the CEO compensation from the STAR market is much higher than the rest while the concentrated ownership structure is almost the same. This conclusion may need to be further examined by including more factors that affect CEO compensation. Wang and Xiao (2011) and Conyon and He (2011) both found a positive and significant association between executive compensation and firm performance. This conclusion can also be re-examined using data sets from the STAR market. Another related topic is executive political connections (Wu, Li, Ying and Chen, 2018).

Regarding institutional ownership, previous studies have focused on its effects on firm performance (Lin and Fu, 2018). While this is certainly another topic for future research using STAR data, Table 2C shows that the institutional ownership of the STAR market is much smaller than other markets, including its peer ChiNext. The determinants of institutional ownership will be another interesting topic.

### 3.2 Equity Pricing

In this subsection, a series of equity pricing-related issues are discussed. Specifically, they include market integration, market anomaly, government intervention, and cross-sectional patterns returns.

#### 3.2.1 Market Integration

The Chinese stock markets have gradually integrated into world markets. For example, Chevallier, Nguyen, Siverskog, and Uddin (2018) found that the cross-market linkages in the Pacific Basin region have become stronger over time, and China (together with the US) are among the markets that spill over the most shocks to the others. Yao, He, Chen and Ou (2018) attributed this rising integration of Chinese stock markets to some institutional arrangements including QFII, Qualified Domestic Institutional Investor and RMB Qualified Foreign Institutional Investor.

One primary purpose of the STAR market is to mimic the NASDAQ market and help the technology catch-up strategy with the US. In the context of the US-China trade and technology war, one intriguing question is how the STAR market is integrated with global markets, particularly given the interconnection of the global supply chain and value chain, as well as the echoing of China's decoupling from the global economy (Rachman, 2020).

#### 3.2.2 Market Anomaly

While A shares are of identical cash flow and voting rights with H shares, the stock market anomaly mainly refers to the AH premium (see Figure 2) This phenomenon has been in existence for a long time, even after the introduction of the QFII program in 2007, which allows qualified domestic Chinese investors to invest limited amounts outside China, and the introduction of the Shanghai– and Shenzhen–Hong Kong Stock Connect programs in 2014 and 2016, which allow cross-market trading in a selection of stocks including all dual-listed stocks (Carpenter and Whitelaw, 2017). Pong, Gunthorp and Chen (2017) and Bai, Tang and Yiu (2019) found that this premium has become narrower recently. However, Figure 2 shows that, at least for some companies, this premium is still very large.

Some studies have tried to resolve this puzzle, but questions remain. For example, Chung, Hui and Li (2013) attributed this price difference to parameter uncertainty faced by different investors. Guo, Tang and Yang (2013) found that the differences in corporate governance also matter. Chen, Tian and Yang (2020) found that individual investors' propensity to speculate is significantly associated with AH share price premium. Bai, Tang and Yiu (2019) found that premium levels are significantly related to the industry sector in general.

As the STAR market is tech-focused, this specific industry factor may also matter, which is worth more research in the future. Furthermore, some external shocks may also matter. For example, after it was reported that the Trump administration is considering blacklisting the SMIC (Reuters, 2020), its AH premium reached its peak at 265.3 percent on 7 September 2020.

#### 3.2.3 Government Intervention

Chinese government intervention is visible almost everywhere, such as overcapacity issues in the industrial sector, speculation in the real estate sector, and investment style in stock markets (Liu, 2019). While there are some successful cases, as discussed by Liu (2019), regarding the Chinese stock markets, there are also serious consequences. For example, based on a theoretical model, Brunnermeier, Sockin, and Xiong (2022) found that government intervention programs can become additional factors driving share prices, thus diverting investor attention away from fundamentals to toward government interventions. As a result, while the government intends to reduce share price volatility, the result may be worse by reducing the information efficiency of share prices. Smith (2016) argued that China must adopt more market-oriented reforms in order to remain an economic superpower.

Regarding the STAR market, it is the product of government planning from the very beginning. Following the expansionary monetary policy implemented by the Chinese authorities to respond to the shock from the COVID-19 in 2020, the STAR market entered a 'managed' bull market (as of December 2021). How Chinese government intervention will affect the STAR market needs constant monitoring and further research.

#### 3.2.4 Cross-Sectional Patterns in Returns

Carpenter and Whitelaw (2017) conducted a review on studies on cross-sectional pricing of Chinese stocks, and found that some common factors such as size, liquidity and volatility, and other China-specific factors are

statistically and economically significant predictors of returns in the cross-section. Table 3 shows that the STAR market has its specific features such as highest liquidity and highest volatility as well. Studies on cross-sectional pricing of the STAR shares may produce fruitful results.

#### 4. Concluding Remarks

China's STAR market is its newest stock market, which was officially launched in June 2019, and whose index was launched in July 2020. It has attracted extensive attention from market players, but almost no coverage from academia. This study fills in this gap by conducting a review of this stock market, including its institutional background, its regulations, and a series of indicators on corporate finance and equity pricing. Most importantly of all, this study provides an agenda for future research and makes significant contributions to academia.

The establishment of China's STAR market has institutional roots that include assisting the country's economic transition, developing multi-tier capital markets, responding to the deteriorating external environment in the context of the US-China trade and technology war, and deleveraging the Chinese economy. The STAR market has taken some important reform initiatives in areas including listing criteria, pricing mechanism, and delisting. As a result, the STAR market is distinguished from China's other stock markets by a series of corporate finance and equity pricing indicators. Correspondingly, from the viewpoint of academics, these unique features mean that the STAR market does not simply provide a new dataset, but may potentially provide more interesting insights than simple replications of previous studies.

While this study uses data sets as of August 2020, the conclusions drawn still remain relevant. For example, there are 402 shares in the sample data of this study. This figure has slightly increased to 405 as of 4 April 2022. The financial indicators may need updates. However, their primary purpose is for future research rather than the indicators themselves.

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## Appendix

Table 3. Equity Pricing Indicators: STAR vs China's Other Exchange-based Stock Markets

	A. Valuation										B. Risk	C. Trading
	Market Cap - Aggregated	Market Cap - Mean	P/E Ratio - Aggregated	P/E Ratio - Median	P/B Ratio - Aggregated	P/B Ratio - Median	P/S Ratio - Aggregated	P/S Ratio - Median	P/CF Ratio - Aggregated	P/CF Ratio - Median	Annualized Volatility - Mean	Average Daily Turnover Ratio
Main Board - Shanghai	6,463.1	4.2	15.7	28.4	1.4	2.4	1.4	2.6	3.6	-2.0	46.5	2.7
Main Board - Shenzhen	1,384.8	3.0	29.4	22.5	2.1	1.9	1.9	2.0	192.6	-5.6	46.1	2.2
SME Market	1,981.0	2.1	57.2	32.0	3.6	2.9	3.4	3.1	-184.3	-4.9	50.3	3.5
ChiNext	1,425.6	1.7	120.4	49.5	6.0	4.4	8.4	6.2	-167.3	-8.7	56.9	5.9
STAR	439.6	2.7	127.2	80.3	9.5	7.4	18.0	18.0	-313.0	-10.8	66.0	14.6

Source: Wind.

Note: the date of return indicators is the IPO date. The date of the rest indicators is as of 28 August 2020. Except for market capitalization indicators, whose unit is USD billion, the unit of the rest indicators is per cent. P/E (price over earnings per share) ratio is from the past 12 consecutive months (TTM, Trailing 12 months). P/B Ratio is the ratio of a company's current market price to its book value. P/S (Price/sales) ratio is calculated by dividing the per-share stock price by the per-share revenue. P/CF (Price/cash flow ratio) ratio is calculated by dividing the per-share stock price by the per-share cash flow (net of operating, financing and investment cashflow). The return indicator used in calculating annualized volatility is logarithm term. The time period is between 1 January - 28 August 2020. Daily turnover ratio is calculated by dividing the total number of shares traded over a day by the average number of shares outstanding for a day. The time period is between 1 January - 28 August 2020