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EXCHANGE STRATEGIES OF CHINA TECHNOLOGY SECTOR COMPANIES: CURRENT APPROACHES OF DIGITAL COMPANIES

The Chinese stock market is expanding rapidly due to the growth of technology companies. In 2023, Chinese companies raised RMB 143.9 billion through initial public offerings (IPOs) through STAR Market IPOs, exceeding the combined number of IPOs on European and American platforms. The article examines the new IPO algorithm on the Shanghai Stock Exchange, which gives advantages to digital companies to access financial markets, analyzes the stock price movements of several companies that went public before the COVID-19 pandemic, and also presents cases from the consulting portfolio of Yinchuan Phoenix Tianyu Venture Capital Fund.
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БИРЖЕВЫЕ СТРАТЕГИИ КОМПАНИЙ ТЕХНОЛОГИЧЕСКОГО СЕКТОРА КИТАЯ: СОВРЕМЕННЫЕ ПОДХОДЫ ЦИФРОВЫХ КОМПАНИЙ

Китайский фондовый рынок быстро расширяется за счет роста технологических компаний. В 2023 г. китайские компании привлекли 143,9 млрд юаней посредством первичных публичных размещений акций (IPO) через IPO STAR Market, что превышает общее количество IPO на европейских и американских платформах. В статье рассматривается новый алгоритм IPO на Шанхайской фондовой бирже, который дает преимущества цифровым компаниям при доступе к финансовым рынкам, анализируется движение цен на акции нескольких компаний, вышедших на биржу до пандемии COVID-19, а также представлены кейсы из консалтингового портфолио фонда венчурного капитала Иньчуань Феникс Тяньуй.
Ключевые слова: фондовый рынок Китая, первичное публичное размещение акций, цифровая экономика, цена акции, венчурный капитал
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Introduction

Currently, the stock market of the People's Republic of China (PRC), associated with the digital economy and technology companies, is in a state of rapid growth. According to a report from the analytical agency KPMG for 2023, companies raised more than $59.3 billion in initial offerings [1]. Initial public offerings

(IPOs) in China have received a boost from the lifting of stringent restrictions due to the COVID-19 pandemic and the new simplified listing regime on the Shanghai (SSEC) and Shenzhen Stock Exchanges (SZSE).

It's important to note that the stock market's performance is influenced by various factors, including economic policies, market sentiment, and global economic conditions. This growth also reflects investor confidence and interest in China's digital economy and technology sectors. This trend could potentially signify significant opportunities for both domestic and international investors interested in participating in the Chinese market.

The situation on traditional sites for initial placement has changed towards a decrease in their volumes. On the American trading floors NYSE and NASDAQ, the volume of initial offerings in 2023 amounted to $ 22.3 billion. Despite a certain recovery in volumes compared to the first and second half of 2022, this figure lags significantly behind the PRC stock exchanges. Importantly, US volume growth in H1 2023 was largely driven by a single $4.4 billion IPO in May (Kenvue Inc.), which accounted for nearly half of total US IPO proceeds year to date. The offering, which was the largest U.S. IPO since November 2021, rose 22.3 % on its first day of trading. In contrast, China's marketplaces will see significant changes in 2023 that will allow companies to quickly access investment.

This contrast underscores the dynamic nature of global financial markets and the shifting patterns of investment activity. It's essential for investors to stay informed about these market dynamics and consider the implications for their investment strategies. Each market presents its unique opportunities and risks, and investors should carefully analyze these factors before making any investment decisions.

Table 1 provides a comparative analysis of IPO results in 2023 compared to 2022 on the 5 leading trading platforms in the world.

Table 1

**Comparative analysis of IPO results in 2023 compared
to 2022 on the 5 leading trading platforms in the world**

Position	Stock exchange and IPO amounts	
	Fiscal Year 2023	Fiscal Year 2022
1st	Shanghai Stock Exchange USD 31.3B	Shanghai Stock Exchange USD 56.5B
2nd	Shenzhen Stock Exchange USD 22.0B	Shenzhen Stock Exchange USD 31.1B
3rd	NASDAQ Stock Exchange USD 12.5B	Hong Kong Stock Exchange USD 12.8B
4th	New York Stock Exchange USD 9.8B	Korea Stock Exchange USD 11.3B
5th	National Stock Exchange of India USD 6.9B	Frankfurt Stock Exchange USD 9.1B

S o u r c e: [1].

This article examines approaches to financing Chinese technology companies in an increasingly competitive digital economy. In addition, measures of state support during the preparation, support, initial placement and its support are considered using the example of venture funds of the People's Republic of China, cases from the practice of the venture company Yinchuan Phoenix Tianyu Venture Capital Fund (hereinafter referred to as Yinchuan VCF), as well as other companies that have exited for an IPO before the COVID-19 pandemic.

Literature Review

Scientific sources related to the financing of technology companies in the digital economy can be divided into several groups.

The first group includes research papers by finance and economics experts. These papers offer detailed analysis and insights into various aspects of IPOs within the digital economy. They cover topics like pricing mechanisms, investor behavior, and the broader impact of IPOs on the stock market. Such scholarly work often forms the basis for understanding the theoretical underpinnings and practical implications of IPOs in the digital space.

The second group consists of industry reports and studies by financial institutions. Reports and studies by financial institutions and consulting firms provide valuable data and market trends concerning IPOs. They focus on aspects like IPO performance across sectors and regions, success rates, and the factors that influence IPO pricing. These sources are crucial for practitioners seeking up-to-date information on market dynamics.

The third group of papers include various articles and publications by regulators and exchanges. Sources from regulators and stock exchanges offer insights into the regulatory framework surrounding IPOs. They detail disclosure requirements, registration processes, and listing rules, providing guidance for companies contemplating going public and for investors participating in IPO events. These sources play a vital role in ensuring compliance and fostering transparency in IPO activities.

Another group of publications are academic sources including case studies and empirical studies. Academic sources encompass case studies and empirical research that delve into specific IPOs and their performance. These studies scrutinize factors such as company characteristics, market conditions, and investor sentiment to uncover the determinants of IPO performance and long-term stock returns. Insights from such studies contribute significantly to understanding the real-world implications of IPO decisions.

Finally, the last group is devoted to academic literature on behavioral aspects of IPOs. Research on the behavioral aspects of IPOs investigates the psychological factors influencing investors' decision-making during the IPO process. Understanding these behavioral aspects can shed light on market anomalies, investor biases, and the overall dynamics of IPO pricing and performance.

T. Loughran and J. Ritter's research on the long-term performance of initial public offerings (IPOs) presents significant insights into the post-IPO dynamics of newly listed companies [2]. Their study, which challenges the widely held belief that IPOs represent a lucrative investment opportunity, indicates that, on average, IPOs tend to underperform comparable companies in the market over a period of three to five years. This finding suggests that investors should exercise caution when considering investing in IPOs, given the long-term performance trends elucidated by the authors [3].

Furthermore, Ritter's analysis of differences in market structures between European and American IPO markets underscores the impact of regulatory frameworks, listing requirements, underwriting practices, and investor behavior on the distinct characteristics of IPOs in these regions [4].

The contrasting findings presented by V. Drobets, M. Kammermann, and U. Welchli [5] regarding the dynamics of initial public offerings (IPOs) in Switzerland offer a compelling perspective on the performance of newly listed companies in European markets. Their analysis of IPOs in Switzerland reveals an average initial market-adjusted return of 34.97 %, indicating a markedly different trend from the underperformance observed in the American market, as highlighted by T. Loughran and J. Ritter's research.

The momentum and comprehensive nature of these reforms signify China's efforts to create a more dynamic and investor-friendly environment for IPOs, particularly in the science and technology sectors, while aligning with global best practices. These initiatives are likely to enhance the availability of funding for innovative companies and contribute to the robust growth and competitiveness of China's capital markets [6].

Additionally, the piloting of the registration system and the heightened priority for reform in the main sections of the SSEC and SZSE signify the Chinese authorities' dedication to building a more transparent, efficient, and market-oriented IPO process in line with international standards. These efforts are poised to encourage greater participation from domestic and international investors, further boosting the vibrancy and attractiveness of the Chinese IPO market [7].

The slowdown in the A-share IPO market in 2023, while still maintaining its position as a leading global exchange, suggests a nuanced trend in the dynamics of the Chinese IPO landscape. This deceler-

ation may stem from various factors, such as regulatory changes, market conditions, investor sentiment, or broader economic constraints, impacting the pace of initial public offerings [8]. Despite the slow-down, the A-share market's continued prominence atop the global exchange rankings underlines its resilient position and strategic importance in the global financial arena. This achievement underscores the strong reputation, investor confidence, and market depth of the A-share market despite the temporary deceleration in new IPO activity. The annual results of main IPO places for digital companies in China are available in Table 2.

Table 2

The annual results of main IPO places for digital companies in China

Shanghai Stock Exchange			
2023		2022	
Raised Amount (RMB)	Amount of Deals	Raised Amount (RMB)	Amount of Deals
66.9	41	145.1	40
STAR Market			
2023		2022	
Raised Amount (RMB)	Amount of Deals	Raised Amount (RMB)	Amount of Deals
143.9	67	252.7	123
Shenzhen Stock Exchange			
2023		2022	
Raised Amount (RMB)	Amount of Deals	Raised Amount (RMB)	Amount of Deals
25.8	23	39.6	43
ChiNext			
2023		2022	
Raised Amount (RMB)	Amount of Deals	Raised Amount (RMB)	Amount of Deals
122.3	110	179.6	148
Beijing Stock Exchange			
2023		2022	
Raised Amount (RMB)	Amount of Deals	Raised Amount (RMB)	Amount of Deals
15.0	77	16.9	83

S o u r c e: investing.com.

The concept of delayed demand in relation to the post-pandemic situation in 2022 is an important consideration in the economic and business context. The COVID-19 pandemic resulted in significant disruptions to supply chains, consumer behavior, and overall economic activity. As the situation began to stabilize and restrictions eased in 2022, a pent-up demand for goods and services that were postponed or delayed during the height of the pandemic period is expected to resurface.

The main hypothesis of this paper (*H1*) is based on the fact that the post-pandemic economic recovery in 2022 will lead to a significant surge in delayed demand across various sectors, resulting in measurable impacts on stock rates of companies, with covariance, cointegration, and regression analyses revealing synchronized responses among stocks to the phenomenon of delayed demand.

The second hypothesis for the study (*H2*) states that companies going public underestimate the price of shares for a successful placement. This hypothesis is derived from a review of the most cited scientific sources and suggests that companies engaging in initial public offerings (IPOs) consistently undervalue the price of their shares in order to ensure a successful placement in the market. The hypothesis implies that there may be a systematic tendency for companies to set the offer price of their shares below their true or appraised value in order to generate more investor interest, drive higher subscription rates, and achieve a successful IPO. This phenomenon can lead to the traditional concept of the "winner's curse" where winning bidders in IPO auctions overpay for shares due to the undervaluation.

Methodology

When analyzing the impact of post-pandemic economic recovery on newly IPO-ed companies, especially focusing on delayed demand, certain methods become more suitable for retrospective analysis. Considering the context of IPO-ed companies and their response to delayed demand, the following methods would be particularly relevant:

1. Regression Analysis:

Suitability: Regression analysis is valuable for quantifying the impact of delayed demand on the stock rates of newly IPO-ed companies.

Reasoning: By running regression models, researchers can analyze how changes in delayed demand variables relate to changes in stock rates, providing insights into the specific effects and predicting potential future trends.

2. Covariance Analysis:

Suitability: Covariance analysis can help assess the relationship between the stock rates of newly IPO-ed companies and the phenomenon of delayed demand.

Reasoning: By examining how the stock rates of these companies move in relation to each other and to overall market trends, covariance analysis can reveal if there are synchronized responses among these stocks to the delayed demand phenomenon.

3. Cointegration Analysis:

Suitability: Cointegration analysis is useful for determining long-term relationships between stock rates of IPO-ed companies and delayed demand factors.

Reasoning: By assessing cointegration, researchers can identify if the stock rates of newly IPO-ed companies and delayed demand variables move together in the long run, indicating a lasting connection or synchronization between them.

At the first stage, regression analysis was carried out using the multiple regression method to determine the possible dependence of the value of two, three and four shares on a certain date and the SSEC Index using the formula

$$Y = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon, \qquad (1)$$

where β_0, β_1, β_2, β_3 and β_4 are the regression coefficients for each independent variable, and β is the random error.

For each of the regression analysis methods, the SSEC Index forecast quote was calculated based on the obtained coefficients for each of the companies under consideration using formula:

$$R_{\text{calc}} (k, t) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4, + \varepsilon, \qquad (2)$$

where X_1 — company 1 quote index; X_2 — quote index of company 2; X_3 — company 3 quote index; X_4 — company 4 quote index; β_0 is the intercept term, and β_1, β_2, β_3 and β_4 are the regression coefficients for each independent variable.

After this, the error (error) between the real and calculated CAT bond rate was calculated, and the maximum and average error for the entire analyzed period was determined using formula (3).

$$\varepsilon = |R_{\text{calc} (k,t)} R k,t|, \qquad (3)$$

where ε is a random error; R_{calc}— calculated values of the SSEC index; R is the actual value of the SSEC index.

The relationship between the SSEC Composite Index and the shares of selected companies was determined using correlation and regression analysis. Correlation analysis was performed to determine the strength and direction of the relationship between the two variables. Regression analysis was carried out using the least squares method to study the relationship between the SSEC Composite Index quotes and the shares of the selected companies. The dependent variable was the stock return of the selected companies, and the independent variable was the SSEC Composite Index, determined based on the methodology of the Shanghai Stock Exchange [2].

Next, analysis of covariance was performed. The covariance between two variables, x and y, can be mathematically defined as the average of the product of the deviations of each variable from their respective means. This is represented as $COV(a, b)$. The formula for covariance is:

$$Cov\,(a,b) = \frac{(R_a - Avg_a)\cdot(R_b - Avg_b)}{Sample\ \text{size} - 1}, \tag{4}$$

The magnitude of the covariance value does not directly reveal the strength of the relationship. Larger positive or negative covariance indicates a stronger linear relationship between variables. However, the magnitude of the value is dependent on scale, making it difficult to compare covariances between different data sets.

Finally, the rates of selected stocks were compared with SSEC stock exchange rate using cointegration method. Cointegration assesses the relationship between non-stationary time series variables to determine if they move together in the long run, despite potential short-term fluctuations. A significant cointegration relationship between two variables implies a lasting connection, where they share a common stochastic trend. Cointegration analysis involves statistical tests to determine the long-term relationship between non-stationary time series variables. The most common method used for cointegration analysis is the Engle-Granger [3] method, which involves certain formulas and steps.

After selecting the pairs of stocks, which are considered to be cointegrated, we calculate the normalized price distance (5)

$$NPD = \sum_{t=1}^{T} = (p_{1t} - p_{2t})^2, \tag{5}$$

where the normalized price p_{1t} of stock 1 is given by $p_{1t} = p_{1t}/p10$. The normalized prices of stock 2 are calculated similarly.

On the next step we make the Least Squares (LS) regression:

$$z_t = y_{1t} - \gamma^{y2t} = \mu + \epsilon^t, \tag{6}$$

where μ represents the equilibrium value and ϵt is a zero-mean residual. Equivalently, it can be written as $y_{1t} = \mu + \gamma^{y2t} + \epsilon^t$ which now has the typical form of linear regression. Least squares (LS) regression over T observations (6):

$$\text{mininize}\ \mu,\ \gamma \sum_{t=1}^{T} y_{1t} - (\mu + \gamma_{2t})^2. \tag{7}$$

LS regression is used to estimate the parameters μ and γ, obtaining the estimates.

If y_{1t} and y_{2t} are equal to I and are cointegrated, then the estimates converge to the true values as the number of observations goes to infinity [4]. Using the estimated parameters μ and γ, we can compute the residuals

$$\epsilon^t = y_{1t} - \gamma y_{2t} - \mu. \tag{8}$$

Then, one has to decide whether the spread is stationary, i.e., ϵ^t is stationary. In practice, the estimated residuals are used ϵ^t. Interpretation of the results is the following: if the residuals are stationary, it indicates the presence of cointegration between the variables.

Selection of stocks for analysis

According to report of PwC for 2022, the top ten IPOs in China accounted for 24 % of the total funds from IPOs in 2022 (2021: 29 %) [8].

Over the last five years, Hong Kong and Shanghai have consistently hosted the largest IPOs in China. The ability of these two markets to absorb large IPOs demonstrates the significant capital pool available in China. In 2022, 2 IPOs each raised over USD 3 billion, compared to 6 in 2021 and 5 in 2020.

Average deal sizes of the top ten IPOs were USD 2.4 billion, 35 % lower than 2021 and 29 % lower than 2020. Shanghai led the way for larger IPOs, hosting the secondary listing of China Mobile Limited, which raised USD 7.5 billion alone (see table 3).

Table 3

Top 10 IPOs in 2022 in China

Company	Funds raised (USD million)	Stock Exchange
China Mobile Ltd	7.527	Shanghai
CNOOC Ltd	4.676	Shanghai
China Tourism Group Duty Free Corporation Ltd	2.359	Hong Kong
Tianqi Lithium Corporation	1.726	Hong Kong
Shanghai United Imaging Healthcare Co., Ltd	1.591	Shanghai
Hygon Information Technology Co., Ltd	1.564	Shanghai
Jinkosolar Co..Ltd	1.448	Shanghai
CALB Co Ltd	1.296	Hong Kong
ASR Microelectronics Co., Ltd	997	Shanghai
Hubei Wanrun New Energy Technology Co., Ltd	925	Shanghai
Total	24.109 (24 %)	

S o u r c e : developed by author's using data retrieved from [investing.com].

In the context of analyzing delayed demand in IPOs at the Shanghai Stock Exchange, the selection of China Mobile Ltd and JinkoSolar Co., Ltd proves to be highly significant.

China Mobile Ltd stands out due to its market dominance as the leading mobile services provider in China, boasting a substantial market share and a significant presence in the telecommunications industry. This market prominence would have naturally attracted a notable level of investor interest, both from institutional and retail investors. Moreover, as a major state-owned enterprise, China Mobile Ltd's IPO would likely have been subject to stringent regulatory scrutiny and potentially faced unique challenges related to government policy and market sentiment. Therefore, any delayed demand experienced during its IPO would provide valuable insights into the impact of market and regulatory dynamics on investor behavior, making it an excellent case for analysis.

On the other hand, Jinko Solar Co., Ltd's significance lies in its operation within the renewable energy sector, particularly in solar technology. Given the growing focus on clean energy solutions, Jinko Solar's position as a key player in the renewable energy sector makes its IPO noteworthy for analyzing investor sentiment and demand. The IPO would offer a unique lens to examine how industry trends can influence IPO demand and pricing, considering the increasing attention on renewable energy both in China and globally. Furthermore, the IPO of a company operating in the renewable energy space may have been influenced by broader economic and policy factors, adding depth to the analysis of delayed demand in this context. Therefore, examining the IPO and potential delayed demand for Jinko Solar Co., Ltd could offer valuable insights into investor behavior and perceptions related to the renewable energy sector.

In light of the main hypothesis (*H1*), which posits that the post-pandemic economic recovery in 2022 will trigger a substantial surge in delayed demand across various sectors, leading to measurable impacts on stock rates of companies, it is essential to substantiate how the selection of China Mobile Ltd and Jinko Solar Co., Ltd aligns with this hypothesis.

The selection of China Mobile Ltd for analysis directly aligns with H1, as the company's stature in the telecommunications industry positions it to be significantly affected by post-pandemic economic recovery. The surge in delayed demand within such a critical sector has the potential to generate substantial impacts on stock rates. Additionally, the covariance, cointegration, and regression analyses will shed light on how China Mobile Ltd's stock responds to the phenomenon of delayed demand, thereby validating the hypothesis.

Results of calculations

The IPO dates of China Mobile Ltd on January 6, 2022, and Jinko Solar Co., Ltd on January 27, 2022, provide a specifically delineated period for conducting regression analysis in relation to the hypotheses established in the study. The pre-IPO period before January 6, 2022, for China Mobile Ltd allows for an analysis of the trends and performance of the company's stock leading up to its IPO date. This understanding of the stock behavior beforehand is essential for evaluating the impact of delayed demand post-IPO. Similarly, the pre-IPO period before January 27, 2022, for Jinko Solar Co., Ltd enables an assessment of the stock's performance and market dynamics before going public, providing a baseline for evaluating the implications of underestimated share prices.

The post-IPO period from January 6, 2022, tonwards for China Mobile Ltd and from January 27, 2022, onwards for Jinko Solar Co., Ltd, facilitates tracking the stock performance and response to market conditions after the IPO. Regression analysis during this phase can reveal how delayed demand influences stock rates post-IPO, supporting Hypothesis 1 and validating the underestimation of share prices hypothesis (Hypothesis 2) and its effects on stock. Therefore, the IPO dates of the two companies offer a specifically delineated period for conducting regression analysis, encompassing the periods before and after the respective IPO dates. This approach contributes to a comprehensive evaluation of the impact of delayed demand on stock rates and the pricing strategies during IPOs.

Step 1. Corellation analysis

Upon getting the historical data for China Mobile (600941), Jinko Solar (688223) and SSE Composite Index from open sources, these data were processes with correlation analysis tool in Microsoft Excel. The results are available in table.

Table 4

Results of correlation analysis

	China Mobile (600941)	Jinko Solar (688223)	SSE Composite
China Mobile (600941)	1		
Jinko Solar (688223)	− 0.655546674	1	
SSE Composite	− 0.361584821	0.413996715	1

S o u r c e: developed by author's using data retrieved from [investing.com].

The correlation coefficient of −0.6555 indicates a moderately strong negative correlation between the two stocks. This negative correlation suggests that the stock rates of China Mobile Ltd and Jinko Solar Co., Ltd have exhibited opposing movements over the time period analyzed. When one stock's rate has increased, the other stock's rate has tended to decrease, and vice versa.

The correlation between China Mobile (600941) and the SSE Composite is -0.3616, indicating a moderate negative correlation. On the other hand, the correlation between Jinko Solar (688223) and the SSE Composite stands at 0.414, signifying a mild positive correlation. An R-squared value of -0.65 is not within the typical range of 0.8 to 1 for a coefficient of determination. In this case, a negative R-squared value implies that the model does not fit the data well or that the chosen independent variables, SSE: 600941 and SSE: 688223, are not suitable for explaining the variability in the dependent variable, SSEC Index. A negative R-squared value of −0.65 signals a lack of fit between the chosen independent variables and the SSEC Index. Further analysis and revision of the model are warranted to better understand the relationship between these variables and ensure a more accurate representation of the data. These correlations suggest that the stock rates of China Mobile Ltd have shown a tendency to move in the opposite direction of the overall SSE Composite, while Jinko Solar Co., Ltd has exhibited a mild positive relationship with the SSE Composite. China Mobile Ltd and Jinko Solar Co., Ltd exhibit a moderately strong negative correlation, indicating opposing movements in their stock rates over the analyzed period. Both stocks show distinct correlations with the SSE Composite, with China Mobile demonstrating a moderate negative relationship and Jinko Solar showing a mild positive correlation.

Step 2. To prove and to visualize their results, we have processed the median values of the rates with Microsoft Power BI (see Figure).

Median of 600941, Median of 688223 and Median of SSE Composite by Year and Quarter

● Median of 600941 ● Median of 688223 ● Median of SSE Composite
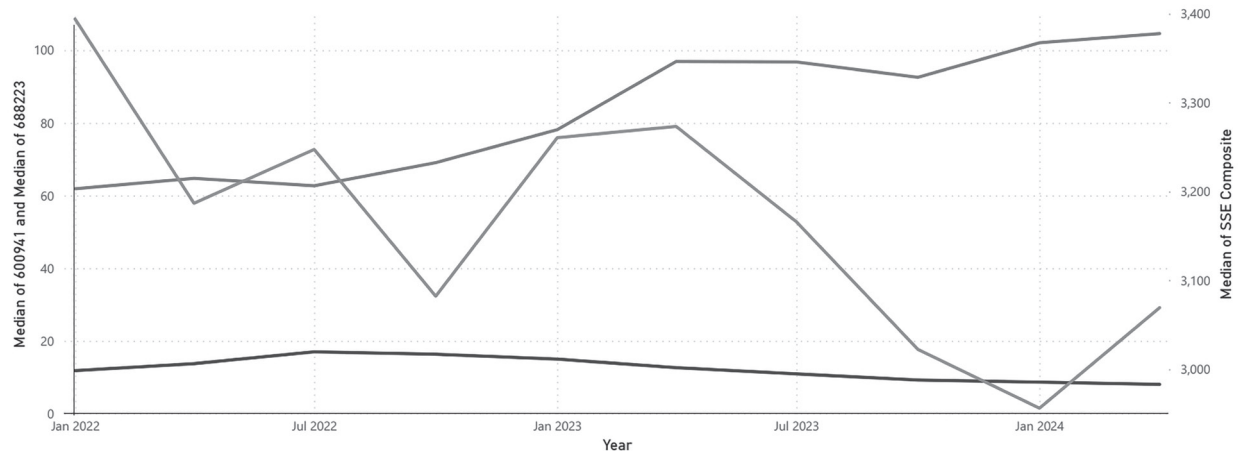

Chart with median values of China Mobile (SSE: 600941),
Jinko Solar (SSE: 688223) and SSE Composite
S o u r c e: developed by author's using data retrieved from [investing.com].

Based on the processed median values of the stock rates using Microsoft Power BI, and considering that the median values of China Mobile Ltd and Jinko Solar Co., Ltd did not exhibit significant variations compared to the SSE Composite, the following conclusions can be drawn. The lack of considerable variations in the median values between China Mobile Ltd, Jinko Solar Co., Ltd, and the SSE Composite may indicate alignment in market dynamics. This alignment could signify that external factors impacting the overall market are similarly affecting the individual stock rates of these companies. The stability in median values across the analyzed companies and the SSE Composite implies a level of equilibrium in their stock rate distributions. This consistency in median values may suggest a steady performance or a lack of significant deviations among these entities during the measured period.

Step 3. The next step is regression analysis of these stocks and SSE composite index. The linear regression results are shown in Table 5. The analysis showed that the R-squared was 0.43. This indicator indicates to what extent the value of the SSEC Index variable is determined by the values of the independent variables SSE: 600941 and SSE: 688223. Since this indicator lies quite far from the range $0.8 < R^2 < <1$, this confirms the findings of a weak relationship between the variables.

Table 5

Results of regression analysis

Regression Statistics	
Multiple R	0.430880036
R Square	0.185657605
Adjusted R Square	0.182567122
Standard Error	132.1810957
Observations	530

S o u r c e: developed by author's using data retrieved from [investing.com].

The standard error obtained from the regression is 132, indicating that there is significant variability in the results. To determine the significance of this for the model under consideration, we obtain the calculated values of the SSEC Index variable using the coefficients obtained as a result of regression and the

known values of the variables SSE: 600941 and SSE: 688223, and also calculate the deviations between the known values of the SSEC Index variable and the obtained calculated values.

The average error in the calculated value of the variable is 3.31 %, the maximum error in the calculated value of the SSEC Index variable was 12.93 %. Using a filter, we will select the maximum error values when calculating the SSEC Index variable (Table 6).

Table 6

Maximum difference between SSE Composite actual and calculated values

Date	SSE Composite	SSE: 600941	SSE: 688223	SSE calculated	Error
2/5/2024	2,702.19	103.49	7.7	3051.605155	12.93 %
2/2/2024	2,730.15	101.88	7.93	3057.449063	11.99 %
10/31/2022	2,893.48	67.2	16.3	3235.671483	11.83 %
1/22/2024	2,756.34	96.96	8.83	3078.328486	11.68 %
10/28/2022	2,915.93	66.98	17.17	3249.320311	11.43 %
1/23/2024	2,770.98	95.28	9.21	3086.571839	11.39 %
2/1/2024	2,770.74	100.86	8	3059.991168	10.44 %
2/10/2022	3,485.91	66	9.96	3140.245959	9.92 %

S o u r c e: developed by author's using data retrieved from [investing.com].

When analyzing the maximum error values in the calculated SSEC Index variable, specifically with a maximum error of 12.93 %, it indicates a significant discrepancy between the predicted and actual values. This substantial error suggests the presence of external factors that may have influenced or contributed to this deviation.

Step 4. Cointegration analysis. Performing a cointegration analysis is a valuable next step to understand the long-term relationship between the stock rates of China Mobile Ltd, Jinko Solar Co., Ltd, and the SSEC Index. Cointegration analysis can help identify whether these variables move together in the long run and whether there is a stable equilibrium relationship among them.

Cointegration analysis starts with calculation of slope function between stocks of China Mobile Ltd. and Jinko Solar Co. The slope function represents the rate of change, or steepness, of a linear relationship between two variables. In the context of a linear regression model, the slope function quantifies how the dependent variable changes for a unit change in the independent variable.

Next, according to selected methodology, we calculate the intercept between the stocks of China Mobile Ltd. and Jinko Solar Co. The results for the selected period are:

Slope China Mobile Ltd. and Jinko Solar Co. −0.120918837

Intercept 2263.70 %

The slope for the relationship between the stock prices of China Mobile Ltd. and Jinko Solar Co. Ltd. is -0.1209. This value represents the rate of change in the stock price of Jinko Solar Co. Ltd. for a unit change in the stock price of China Mobile Ltd. The negative sign indicates an inverse relationship between these two stocks. Specifically, for every unit increase in the stock price of China Mobile Ltd., the stock price of Jinko Solar Co. Ltd. is expected to decrease by approximately 0.1209 units. The intercept of 2263.70 % represents the expected value of the stock price of Jinko Solar Co. Ltd. when the stock price of China Mobile Ltd. is zero. However, it's important to note that a zero stock price is a hypothetical value and may not have practical significance in this context. The intercept is expressed as a percentage, indicating the baseline position of the stock price of Jinko Solar Co. Ltd. in relation to China Mobile Ltd.

Next step is performing unit root test. The results are the following:

Unit root test

Coefficient　　　　　　− 0.970431977

Standard error　　　　　0.043381983

T-stat　　　　　　　　　− 0.044703786

The coefficient obtained from the unit root test is -0.9704. In the context of unit root tests, this coefficient is typically associated with the autoregressive process. The absolute value of the coefficient being less than 1 is a favorable indication for supporting the stationarity of the variable. The standard error of 0.0434 represents the precision of the coefficient estimate. A lower standard error suggests higher precision in the estimation of the coefficient. The t-statistic, which is calculated as the ratio of the coefficient estimate to the standard error, is -0.0447 in this instance. The t-statistic is commonly used to evaluate the statistical significance of the coefficient estimate. A t-statistic close to zero implies that the coefficient is not significantly different from zero. Based on the t-statistic and the coefficient value, it seems that the variable being tested may not demonstrate significant evidence of non-stationarity.

Step 5. Covariance analysis. The covariance matrix of stocks of China Mobile Ltd, Jinko Solar Co., Ltd, and the SSEC Index provides insight into the relationships and interactions between the variables. Positive covariances indicate a tendency for the variables to move in the same direction, while negative covariances suggest an inverse relationship. The magnitude of the covariances reflects the strength of the relationships between the variables. Larger covariances indicate a stronger relationship, while smaller covariances suggest a weaker connection. The results of analysis are available in Table 7.

Table 7

Covariance matrix

	SSE Composite	SSE: 600941	SSE: 688223
SSE Composite	–	–	–
SSE: 600941	−846.8751438	–	
SSE: 688223	178.8530844	−31.09180657	–

S o u r c e : developed by author's using data retrieved from [investing.com].

Positive covariances indicate a tendency for the variables to move in the same direction, while negative covariances suggest an inverse relationship, providing a clear understanding of the coordination of movements between the variables. The magnitude of the covariances reflects the strength of the relationships between the variables. Larger covariances indicate a stronger relationship, while smaller covariances suggest a weaker connection, offering a quantifiable assessment of the degree of association. In Table 7 there are strong negative relationships between stocks of China Mobile Ltd and SSEC Index, which provide insights into how the stock rates of these companies move in relation to the overall market represented by the SSEC Index, shedding light on the influence of individual stocks on the broader market movements. The positive covariance between Jinko Solar Co., Ltd, and the SSEC Index indicates a tendency for these variables to move in the same direction. This suggests a positive relationship where when the stock rates of Jinko Solar Co., Ltd increase, the SSEC Index is more likely to exhibit an upward movement as well.

This positive covariance signifies a level of synchronization between the performance of Jinko Solar Co., Ltd, and the broader market represented by the SSEC Index. Understanding this covariance can be useful for investors and analysts in assessing the impact of Jinko Solar Co., Ltd on the movements of the SSEC Index and incorporating this information into their investment decisions and risk management strategies.

Discussion

The hypothesis (***H1***) is grounded in the post-pandemic economic recovery of 2022, suggesting that this resurgence will trigger a substantial surge in delayed demand across various sectors, consequently impacting stock rates. Given this, employing covariance, cointegration, and regression analyses to reveal synchronized responses among stocks to the phenomenon of delayed demand is a strategic approach. These

analyses could illuminate the extent to which both China Mobile Ltd and Jinko Solar Co., Ltd react to an increase in delayed demand caused by the economic recovery, offering valuable insights for your investment simulation.

The **H2** asserts that companies going public consistently underestimate the price of their shares. This phenomenon is believed to stem from deliberate undervaluation to ensure a successful placement in the market. Understanding this hypothesis is crucial, as it suggests that the IPO prices might not fully reflect the true or appraised value of the shares. Consequently, investors could potentially benefit from a gap between the IPO offer price and the estimated value of the shares. As you conduct your investment simulation, it's essential to consider how these potential undervaluations might affect your investment strategy for both China Mobile Ltd and Jinko Solar Co., Ltd.

This may be confirmed with the calculated returns from these stock for the first two weeks from IPO are available in Table 8.

Table 8

Calculated returns from these stock for the first two weeks from IPO

Date	SSE: 600941	SSE: 688223	Cointegration	X	delta x	Lagged X	Return SSE: 600941	Return SSE: 688223
1/27/2022	57.58	7.7	12.72	5.02				
1/28/2022	57.58	7.93	12.72	4.79	−0.23	5.02	0.00 %	2.99 %
2/7/2022	58.15	16.3	12.72	−3.58	−8.37	4.79	0.99 %	105.55 %
2/8/2022	61.3	8.83	12.72	3.89	7.47	−3.58	5.42 %	−45.83 %
2/9/2022	67.43	17.17	12.72	−4.45	−8.34	3.89	10.00 %	94.45 %
2/10/2022	66	9.21	12.72	3.51	7.96	−4.45	−2.12 %	−46.36 %
2/11/2022	66.61	8	12.72	4.72	1.21	3.51	0.92 %	−13.14 %
2/14/2022	64.01	9.96	12.72	2.76	−1.96	4.72	−3.90 %	24.50 %
2/15/2022	62.9	8.09	12.72	4.63	1.87	2.76	−1.73 %	−18.78 %
2/16/2022	63.5	10.52	12.72	2.20	−2.43	4.63	0.95 %	30.04 %
2/17/2022	61.88	7.94	12.72	4.78	2.58	2.20	−2.55 %	−24.52 %
2/18/2022	62.8	9.41	12.72	3.31	−1.47	4.78	1.49 %	18.51 %
2/21/2022	63.53	11.06	12.72	1.66	−1.65	3.31	1.16 %	17.53 %
2/22/2022	62.3	9.19	12.72	3.53	1.87	1.66	−1.94 %	−16.91 %

S o u r c e: developed by author's using data retrieved from [investing.com].

Differences in prices are listed in table 10. The noteworthy growth in the stock rates of both China Mobile Ltd and Jinko Solar Co., Ltd. since their IPO in 2022 provides valuable insight into the context of the stated hypotheses:

Hypothesis 1 (H1): The substantial increase observed in the stock rates of both companies, with China Mobile Ltd growing by 81.94 % and Jinko Solar Co., Ltd. by 67.79 % since their IPO, aligns with the hypothesis related to the post-pandemic economic recovery in 2022. This remarkable surge in stock rates may indeed reflect the significant impact of delayed demand resulting from the economic recovery. It potentially supports the notion of synchronized responses among stocks to the phenomenon of delayed demand, as posited in the hypothesis.

Hypothesis 2 (H2): The remarkable growth in stock rates is also relevant in relation to the second hypothesis. It suggests that companies may undervalue the price of their shares during an IPO to ensure a successful placement in the market. The considerable rise in stock rates since the IPO date of both China Mobile Ltd and Jinko Solar Co., Ltd. (81.94 % and 67.79 % respectively) raises the question of whether their IPO offer prices underestimated the true or appraised value of their

shares. Further consideration of this dynamic could provide insights into how investors perceive the IPO pricing strategy of these companies and how it may have impacted investor interest and subscription rates (see table 9).

Table 9

**China Mobile Ltd and Jinko Solar Co., Ltd.
stocks price raise in 2022−2024**

	China Mobile Ltd	Jinko Solar Co., Ltd.
Price at IPO	57.58	7.7
Price in April, 2024	104.76	12.92
Difference	81.94 %	67.79 %

S o u r c e: developed by author's using data retrieved from [investing.com].

The significant growth in the stock rates of China Mobile Ltd and Jinko Solar Co., Ltd. since their IPO dates aligns with the hypotheses proposed, providing a real-world context for the economic phenomena and IPO behavior under study. Further analysis based on these observations could yield additional valuable insights for investment strategies and market dynamics.

However, the observation of stocks of China Mobile Ltd and Jinko Solar Co., Ltd not moving in line with the SSE Composite index prompts a critical analysis of the market dynamics and the interrelationships between these variables.

Conclusions

The study should acknowledge the intricate market dynamics where individual stocks such as China Mobile Ltd and Jinko Solar Co., Ltd may demonstrate movements independent of the broader market indices like the SSE Composite. Understanding this nuanced relationship between individual stocks and market indices is crucial for developing effective exchange strategies.

The post-pandemic economic recovery in 2022, as seen through the surge in stock rates of the analyzed companies, underscores the importance of considering external economic factors. These developments indicate the significance of delayed demand and its impact on stock rates, aligning with the paper's discussion of achievements and challenges in the digital economy.

The substantial growth of China Mobile Ltd and Jinko Solar Co., Ltd since their IPO dates, despite not moving in line with the SSE Composite, reflects upon the validity of the hypotheses presented in the paper. This real-world data aligns with the concepts of undervaluation during IPOs and synchronized responses to economic phenomena, enhancing the paper's theoretical underpinning with empirical evidence.

The observed discrepancies between individual stock movements and the market index signal potential investment opportunities based on sector-specific influences, investor sentiment, and company-specific factors. Understanding these dynamics is crucial for crafting effective exchange strategies tailored to the unique characteristics of the China technology sector companies.

To further enrich the analysis of exchange strategies in the tech sector, future research should explore the factors driving divergences between individual stock movements and market indices. Additionally, investigating the implications of IPO pricing strategies on long-term stock performance and evaluating the sectors' resilience and adaptability in the digital economy could provide valuable insights for exchange strategies going forward.

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