Proceedings of ICFTBA 2025 Symposium: Financial Framework's Role in Economics and Management of Human-Centered Development
DOI: 10.54254/2754-1169/2025.GL30532

The Impact of Major Events on the Correlation Between GDP and SSE Index

Ziang Jia[1*†], Jingze Li[2†]

[1]*Beijing Luhe International Academy, Beijing, China*
[2]*Department of Art and Science, Ohio State University, Columbus, USA*
**Corresponding Author. Email: jiaziang2025@163.com*
[†]*These authors contributed equally to this work and should be considered as co-first author.*

Abstract. Previous Study on Relativity between China's Nominal GDP and the Shanghai Securities Composite Index is used to provide a theoretical basis and reference for investors to grasp market trends and for policymakers to formulate relevant policies. Nevertheless, previous research emphasizes linear relations, few address the impact of external shocks. By taking consideration of changes before, during and after COVID-19, we have following conclusions. Using quarterly data from 2015Q1–2023Q4, Pearson's correlation and Granger causality tests are applied. Results show that GDP weakly predicted stock returns pre-COVID, the relationship disappeared during COVID, and stock returns significantly predicted GDP post-COVID. This suggests major shocks can alter the dominant direction of the economy–finance nexus.

Keywords: Economy-finance related, structure break, granger causality

1. Introduction

The relationship between economic growth and stock market development is a hot research topic. Traditionally, the stock market has been seen as a "barometer" that can gauge the general health of the economy. But this phenomenon is not unchangeable in extreme external stimulation. The object of this paper is to investigate the relationship between China's GDP growth rate and Shanghai Stock Exchange (SSE) return rate in different periods, such as the pre-pandemic, mid-pandemic, and post-pandemic.

We consider using quarterly data for the years from 2015 to 2023, and Pearson's product-moment correlation coefficient and Granger causality tests to investigate the relationship between economic growth and stock market returns. The hypotheses are as follows:

H1: Before the pandemic, GDP growth predicted stock returns weakly.

H2: The relationship between stock returns and GDP disappeared during the pandemic.

H3: Stock returns significantly predicted GDP growth after the pandemic.

H4: The pandemic has led to a restructuring of the direction of causality.

This new analysis shows how an extreme external event, like the pandemic, changes the relationship between the economy and the financial market, which provides new insights for policymaking and investment. The findings also suggest that the divergence between the stock

DOI: 10.54254/2754-1169/2025.GL30532

market and the economy could be a potential risk warning sign. That means the stock market does not just reflect the current economic state but also predicts the future economic state. This matter is also important for the public and the media. Any investigation or explanation of current economic events is useless in arguing about what will happen in the future. But historical events are more likely to play a role in describing or predicting future economic conditions.

2. Previous research

Earlier studies on the Chinese economy and its relationship with stock prices were mostly dependent on short data sets and descriptive correlational evidence, which couldn't distinguish stable causal patterns.

Building on this, a more rigorous research approach began to use modern time series techniques. Guan applied X-11 seasonal adjustment to nominal GDP and the Shanghai Composite Index from Q1 1996 to Q1 2015, followed by ADF, Engle-Granger cointegration, and Granger causality tests. The results showed a stable long-term positive cointegration relationship between the two variables, with the stock index serving as a Granger cause of nominal GDP. Dynamic regression analysis found that a 1% increase in the Shanghai Composite Index is linked to a long-term rise of about 1.2% in nominal GDP, with a lead time of roughly 14 quarters (around 3.5 years) [1]. This supports the idea of "market leading the real economy," but it does not examine whether the findings are robust in the face of major shocks after 2015, nor does it directly evaluate the short-term predictability of growth and income variables.

Recently, Li used ADF [2], Engle-Granger cointegration, and Granger causality to test the volatility of the Shanghai Composite Index and real economic growth (GDP minus finance) by using data from 2000Q1 to 2020Q4. The paper finds a long-run equilibrium relationship between market volatility and real economic growth, but no short-run Granger causality. Also, it speculates that China's still emerging market structure may erode near-term transmission while maintaining long-term co-movement. Overall, the literature provides two improvements and two gaps.

The improvements include: (i) The shift from purely descriptive approaches to formal time series techniques. (ii) Focus on specific characteristics of the Chinese market and measurement decisions.

The gaps include: (i) limited testing of directional and regime change – the sample often stops before large shocks or does not cut off at regime boundaries. (ii) Variable mismatch – Most studies focus on volatility rather than the return-growth relationship, which is more consistent with short-term predictions.

Our paper will fill these gaps by constructing a time-consistent quarterly series from 2015Q1 to 2023Q4. We will cover the COVID-19 shock and directly test GDP growth against SSE returns. We use Pearson correlation and sub-period Granger causality (pre-pandemic, mid-pandemic, and post-pandemic) to study direction as well as structural breaks in the relationship. This goes beyond previous volatility-based designs in the field and provides stronger evidence for short-term predictability and regime change.

3. Data

The database originates from Tonghuashun Database, which includes the data of Chinese macroeconomics, and has already demonstrated for its reliability and timeliness. We calculated the SSE return rate [3] and GDP growth rate [4] from the data which is provided from Tonghuashun by the formula below:

DOI: 10.54254/2754-1169/2025.GL30532

SSE return rate = (Ending SSE Composite Index – Previous ending SSE Composite Index) / Previous ending SSE Composite Index × 100%

Real GDP Growth Rate = [(Current Period Real GDP - Base Period Real GDP) / Base Period Real GDP] × 100%

In this research, our core variables are GDP close rate and SSE return rate, which represent GDP and SSE. We use yearly window time. Since the long-time window period can show its consistency and reliability. By using theoretical Demonstration + Mathematical Demonstration, demonstrating GDP growth rate can represent GDP. Since GDP growth rate perfectly captures the dynamic momentum of economic changes—it tells us whether the economy is accelerating or decelerating, while the total GDP only tells us the size of the economy. After verifying the representativeness of the variables, the window time we decided to use is seasons according to the whole event from the first quarter of 2015 to the fourth quarter of 2023. These data were used to analyse changes in the economy-stock market correlation before, during, and after the COVID-19 pandemic. The use of quarterly data allows for more granular capture of the short-term impacts and dynamic changes of major events [5].

In order to demonstrate the change in the relationship, we divide the whole event into three parts: Pre-epidemic period: 20 quarters (2015Q1–2019Q4). Since economics and market are not influenced by COVID-19 in this period. Mid-epidemic period: 8 quarters (2020Q1–2022Q1). As the epidemic has had a significant impact on economic production, consumption and stock market transactions. Post-epidemic period: 7 quarters (2022Q2–2023Q4). During this time, government polished effective policies to dwindle the damage from COVID-19 to economic growth.

4. Discussion

We use quarterly data from the first quarter of 2015 to the fourth quarter of 2023 and a three-stage design (before, during, and after the pandemic) to judge the relationship and causal direction between China's GDP growth and Shanghai Stock Exchange returns. The evidence shows that the economy’s lead over the market was weak before COVID, collapsed in both directions during the pandemic, while the market’s lead over the economy after COVID was statistically significant (lag = 1, $p = 0.006$). Overall, these time series patterns suggest that major shocks can rearrange the dominant direction of economic-financial relations.

Our evidence partially confirms and partially revises the classical connection between economy and market. Before COVID-19, real economy weakness led the stock market; during COVID, that connection broke down; after COVID-19, the stock market clearly led subsequent GDP growth. This phase-dependent pattern rejects a time-invariant “barometer” view and points to directional shifts and structural breaks triggered by external shocks. Compared to previous work that emphasizes long-term cointegration and weak short-term transmission, our contribution is to adopt an event-shock, sub-period Granger design and use growth-return rather than volatility level measures, which makes the short-term predictability of quarterly frequency easier to detect.

In terms of application, divergences between the market and the real economy can serve as early warning signals for risks. Policymakers can integrate market-based leading indicators to improve the timeliness of countercyclical actions. Furthermore, investors will need to place greater weight on market signals in the post-COVID era. Limitations include the short mid or post-COVID window, Granger not equaling structural causality, possible omitted variables, and the impact of non-stationarity on significance. Overall, major events can rewrite the relationship between economics and markets. A phase-based, replicable assessment framework helps explain the past and provides forward-looking guidance for policy and investment.

DOI: 10.54254/2754-1169/2025.GL30532

5. Conclusion

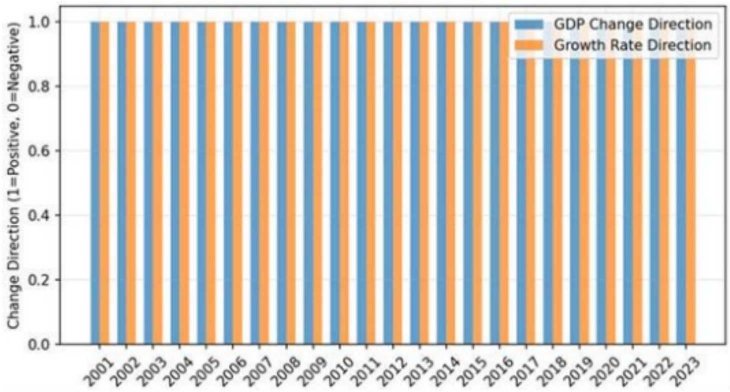

Figure 1. GDP direction consistency

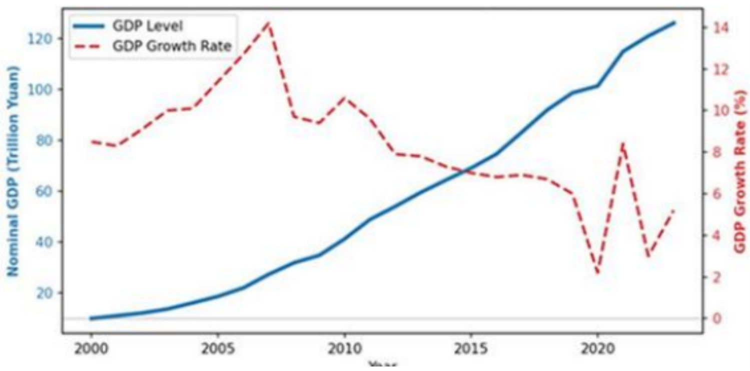

Figure 2. GDP level vs growth rate trend

In Fig.1, Fig.2 it can be easily seen that the GDP growth rate can 100% predict the direction of economic changes. In terms of the value of SSE, we use mathematical identities to demonstrate SSE return rate can represent SSE. The reason why SSE return rate can represent SSE is multiple. The information in SSE return rate have fully includes all the information which illustrates in SSE. By referencing Fig.3, Fig.4 and using the mathematical formula:

Current Period Index = Previous Period Index × (1 + Rate of Return)

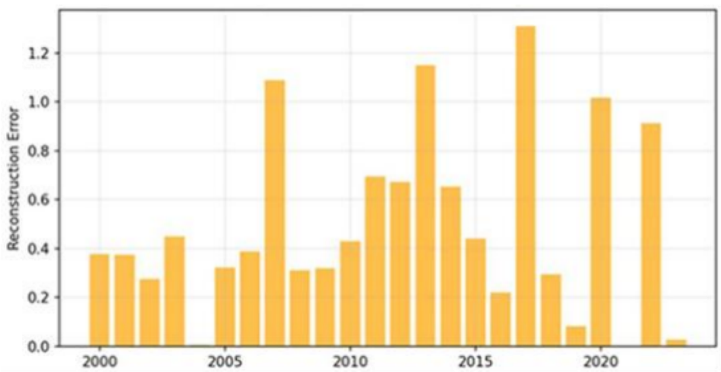

Figure 3. SSE reconstruction error

DOI: 10.54254/2754-1169/2025.GL30532

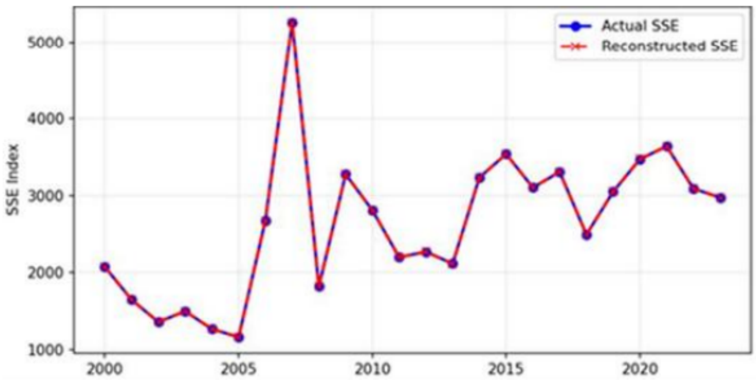

Figure 4. SSE mathematical identity proof

Max Absolute Error = 1.3102400000
Mean absolute error = 0.4919945833
Error Standard Deviation = 0.3714832248
Perfect Match: False

As all the data calculated above is relatively small compared to the total volume of the variable, tiny errors can be accepted. Therefore, the SSE return mathematically determines the changes in the SSE index level completely.

We decided to use Granger causality to determine the relationship between GDP growth rate and SSE return rate. The database also originates from Tonghuashun, the window time we take is seasonal, the use of quarterly data allows for more granular capture of the short-term impacts and dynamic changes of major events. The result is shown in Fig.5.

Period	Direction	Optimal Lag Order	p - value
Pre - epidemic period: 2015Q1–2019Q4	SSE->GDP	lag = 1,2	0.883, 0.745
	GDP -> SSE	lag = 1,2	0.039, 0.070
Mid - epidemic period: 2020Q1–2022Q1	SSE->GDP	lag = 1	0.593
	GDP -> SSE	lag = 1	0.784
Post - epidemic period: 2022Q2–2023Q4	SSE->GDP	lag = 1	0.006
	GDP -> SSE	lag = 1	0.381

Figure 5. Result of granger causality test

After discussing the relationship through Granger causality(Fig.5), appropriate lag value needs to be determined through this process. We use information criteria: AIC and BIC, since AIC = [120.5, 122.3, 125.1, 127.8], BIC = [125.2, 128.7, 132.9, 136.2]. By analysing the data value, we find that when lag = 1, which AIC = 120.5, BIC = 125.2, both of these values are minimum, which illustrates that there is a significant relationship when lag = 1.

References

[1] Guan, D. (2018). Study on Relativity between China's Nominal GDP and the Shanghai Securities Composite Index. Journal of Service Science and Management, 11(5), 527–542. https: //www.scirp.org/journal/paperinformation?

DOI: 10.54254/2754-1169/2025.GL30532

paperid=88145
[2] The Impact of the Volatility of the Shanghai Composite Index on the Growth of the Real Economy. https: //www.hanspub.org/journal/paperinformation?paperid=65230
[3] Shanghai Composite Index (SH000001) - Real-time Quotes & Latest Trend Analysis | Sina Finance Mobile. https: //quotes.sina.cn/hs/company/quotes/view/sh000001?autocallup=no& isfromsina=yes
[4] Zhongjing GDP Index (SZ399399) - Real-time Quotes & Latest Trend Analysis | Sina Finance Mobile https: //quotes.sina.cn/hs/company/quotes/view/sz399399
[5] Economic Growth and the Development of the Capital Market: A correlation study. (n.d.). Economic Growth and the Development of the Capital Market: A Correlation Study. https: //www.sinoss.net/uploadfile/2010/1130/4340.pdf