# RELATIONSHIP AMONG INTEREST RATE, MONEY SUPPLY, AND STOCK PRICE: EVIDENCE FROM CHINA AND THE U.S.

by

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Dalhousie University is located in Mi'kma'ki, the
ancestral and unceded territory of the Mi'kmaq.
We are all Treaty people.

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# ABSTRACT

The relationship between macroeconomic indicators and the stock market has always been a hot topic in the field of financial economics. This thesis analyzes the relationship between stock indices, interest rates, and money supply in China and the U.S. A long-term cointegration relationship is established for the two countries, based on various Johansen's cointegration tests and vector-error correction modeling.

This thesis also examines the banking sector's response to the COVID-19 pandemic through a panel regression model with dummy variables for the pandemic period, January 2020 to December 2021. I found there was a significant positive impact of macroeconomic cointegration on Chinese banking stocks, whereas the U.S. banking stocks show a negative but insignificant correlation. The pandemic had a notably negative impact on the Chinese banking sector, but an insignificant impact on the U.S. banking sector.

# ACKNOWLEDGEMENTS

This thesis is dedicated to my beloved parents, who have inspired and supported me. In moments when the path seemed impossible to find, they were there to guide me, offering their unwavering moral, spiritual, emotional, and financial support. Their love has shaped me into the person I am today, and I am forever grateful for that.

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# CHAPTER 1 INTRODUCTION

## 1.1 BACKGROUND

In the complex tapestry of the global economy, interest rates and monetary supply have a significant influence on financial markets and people's lifestyles across the world. This influence is particularly pronounced during unexpected macroeconomic disasters, such as the COVID-19 pandemic outburst in December 2019, which brought about a new era of economic complexity. Governments worldwide had to adjust their monetary policies in response, such as interest rates for borrowing money. The changes in interest rates have a ripple effect on national economies, impacting everything from individual savings and consumption to corporate investment strategies and banking sector dynamics. Furthermore, the impact of interest rates is reflected in the fluctuations of stock market indices. A vivid example of this dynamic is the case of Silicon Valley Bank, which invested heavily in long-term U.S. Treasury bonds (J.P. Morgan Private Bank, 2023). Frequent adjustments in U.S. interest rates led to significant investment losses for the bank, causing panic among depositors and eventually resulting in a run on the bank and bankruptcy. This case showed the critical role of banks in maintaining macroeconomic stability. As a cornerstone of the financial system, the stability of the banking sector is essential for the overall stability of the financial system. A loss of confidence in the banking system, particularly after a macroeconomic crisis resulting in economic decline, can trigger a recession or even a vicious cycle of economic decline. Therefore, governments worldwide actively seek effective strategies to promote continuous and stable development in the banking sector. Many countries have established regulatory frameworks and institutions, like central banks and deposit insurance schemes, to oversee and protect the banking sector. The goal is to ensure banks operate safely and responsibly and to provide a safety net in case of failures. This effort is vital to ensure the financial system's stability and the economy's healthy growth.

My study focuses on the impact of interest rates and monetary policy on China and the United States' economic stability and stock markets. I choose China and the United States because they play significant roles in the global economy. These two countries represent opposite extremes of the economic spectrum, with China being the largest developing country and the United States being the greatest developed country. This makes them ideal for analyzing the impact of interest rates and monetary policy on economic stability and stock markets. As of 2023, the United States stands as the world's largest economy, boasting a nominal GDP of approximately $26.95 trillion. China is second with a nominal GDP of $17.7 trillion. However, when considering purchasing power parity (PPP), China's GDP surges to $32.9 trillion, surpassing that of the U.S., which underscores China's significant role in the global economy. Together, these two nations constitute a substantial share of global economic activity, with exact percentages fluctuating but unequivocally indicative of their combined influence on global trade, investment flows, and financial market dynamics.

## 1.2 MOTIVATIONS

The motivation for my research is rooted in two primary concerns that have emerged in the global financial landscape, particularly post-COVID-19. The first concern is the stock market, which suffered a sharp decline in early 2020. My research aims to explore whether changes in interest rates could be a contributing factor to these declines. By understanding the role of interest rates in the post-COVID economic environment, I seek to offer insights that could help stock markets recover and thrive. This study presents a unique opportunity to analyze the resilience and responsiveness of financial markets by investigating the relationship between interest rates, monetary policy, and stock market performance during the global crisis.

The second concern is the impact of interest rates on the banking sector. The banking industry plays a crucial role in the financial system, making examining how interest rates affect bank stock prices essential. As the banking sector's stability is vital for economic recovery post-COVID and the long-term growth and stability of the global economy, this study will investigate the direct and indirect impacts of interest rate changes on the banking sector, focusing on stock valuations. The study's findings are expected to provide valuable recommendations for stabilizing bank stock prices, which are essential for maintaining investor confidence and ensuring the smooth functioning of financial markets.

## 1.3 Research Questions

The objective of my thesis is to analyze the relationship among interest rates, monetary policy, and economic stability in China and the United States. I will address three key research questions to achieve this. The first question focuses on how interest rates and money supply impact the stock market indexes of both countries. I aim to determine if any significant movements in stock market valuations are linked with shifts in these monetary policy tools, considering the unique economic environments and policy frameworks of both nations. The second question compares the impact of interest rates and money supply on China's and the United States' stock market indexes before and after the COVID-19 pandemic. This part of the research analyzes the differential effects of monetary policy on the stock market indices, to understand how financial markets evolve during global economic disruptions. The third question investigates the specific impact of changing interest rates on banks' stock prices in both China and the USA. As banks play a significant role in the financial system, I aim to determine the sensitivity of bank stock prices to interest rate adjustments. This will help us assess the banking sector's vulnerability to monetary policy changes and come up with strategies to enhance its stability.

## 1.4 Thesis Structure

This dissertation explores the impact of interest rates and monetary policies on the economic stability and stock markets of China and the United States. It consists of five main chapters that cover different aspects of the research. Chapter 1 introduces the topic and explains the study's scope, relevance, and purpose. It sets the stage for a detailed examination of the crucial role that interest rates and monetary policies play in shaping the economic landscape of these two countries.

Chapter 2 provides a literature review summarizing previous research on interest rates, monetary policy, economic stability, and stock markets, specifically in the banking sector. It examines theoretical frameworks and empirical findings from previous studies, providing insights into how these factors have been analyzed and understood in various economic contexts.

Chapter 3 describes the conceptual framework used in this research and explains the methodology employed to investigate the research questions. This chapter also details the methodological approaches used for data analysis, such as econometric models and statistical techniques.

Chapter 4 discusses the empirical findings and interprets the results. This chapter thoroughly examines the impacts of interest rates and monetary policies in China and the United States, comparing their effects. It also outlines the data sources and types collected, such as stock market indices, interest rates, and other relevant economic indicators from both countries. The discussion interprets these findings, linking them to the theoretical frameworks and previous research explored in the literature review. This chapter aims to explain how interest rates and monetary policy influence economic stability and stock markets in both countries.

Finally, Chapter 5 is a brief conclusion that summarizes the key findings of the research and discusses their implications for policymakers, investors, and financial analysts. This chapter highlights the thesis' contributions to the existing research outcome in the field, identifies areas for further research, and considers the thesis research limitation.

# CHAPTER 2 LITERATURE REVIEW

## 2.1 INTRODUCTION

This chapter reviews major research achievements in the relationship among interest rates, money supply, and stock prices. The Efficient Market Hypothesis, Dividend Discount Model, Capital Asset Pricing Model, and Arbitrage Pricing Theory are discussed. The definitions and importance of interest rates and stock prices are highlighted, along with their roles in different economic contexts and how they influence each other. Empirical evidence from various studies is analyzed to understand their interaction in both developed and developing economies. This chapter lays the foundation for a detailed investigation into the complex interplay between interest rates, monetary supply, and stock prices.

## 2.2 THEORETICAL FRAMEWORK

### 2.2.1 Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH), as expounded by Fama (1965), posits a paradigm where stock prices instantaneously and accurately reflect all available information. This hypothesis delineates three forms of market efficiency: weak, semi-strong, and strong, each implying varying degrees of information absorption into stock prices. The core premise is that exploiting market inefficiencies for abnormal gains is implausible, as prices in an efficient market already encapsulate all known information. In the context of interest rate fluctuations, the EMH implies a rapid assimilation of interest rate changes into stock valuations. This immediate reflection suggests a diminished potential for arbitrage opportunities based on interest rate predictions or movements. Particularly in developed markets, where efficiency is presumed to be at its zenith, the responsiveness of stock prices to interest rate changes is expected to be more pronounced compared to those in developing markets. Despite its foundational status in financial economics, EMH has been subjected to scrutiny, particularly regarding its assumptions of rational market behavior and homogeneous information interpretation among investors. Behavioral finance research indicates that psychological biases and irrational decision-making can lead to market anomalies, thereby challenging the infallibility of EMH in real-world market scenarios (Ball, 2009; Ţiţan, 2015).

### 2.2.2 Dividend Discount Model in Stock Price Valuation

A quantitative method called the dividend discount model uses the present value of all future dividend payments to estimate a company's stock price. According to Gordon (1959), this method is predicated on the idea that the stock price at this time is equal to the total of all discounted future dividends. After discounting, all future cash flows from the stock—aside from dividends—will have an impact on the stock's current price.

A company's future cash flows, the price of its stock, and its future borrowing expenses, will be impacted by policy revisions to interest rates. The DDM model predicts that a drop in interest rates for loans and one-year deposits would lead to a drop in the cost of borrowing for businesses or the amount of interest that must be paid. As a result, expected profits will rise, increasing the stock's current value. An increase in interest rates will result in higher borrowing expenses for the corporation when the interest rates on one-year deposits and loans are elevated. As a result, the company's projected profits will decline, which would eventually cause the stock's current value to decrease. The Dividend Growth Model proved to be a dependable measure of stock price valuation, even in an era heavily affected by the global financial crisis (Mugoša and Popović, 2015).

Gehr (1992) pointed out that DDM has some biases. The accuracy of DDM's prediction of a stock's intrinsic value depends on current interest rates and dividends per period. If the prediction deviates, it may have an impact on investors' decisions. Among them, the discount rate is changed to the market interest rate. If interest rate is market driven, then the discount rate itself includes the market's impact on stock prices and the prediction will be more accurate. However, if governments intervene on interest rate, the intrinsic value of stocks predicted by the discount rate will be biased.

### 2.2.3 Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM), developed by Sharpe (1964), Treynor (1961), and Lintner (1965), offers a linear relationship between the expected return of an asset and its systemic risk, quantified by beta. This model is a cornerstone of modern portfolio theory, providing a mechanism to calibrate the expected return on an asset based on its inherent risk relative to the broader market. CAPM's relevance to the dynamics of interest rates and stock prices is pivotal.

The model suggests that an elevation in interest rates, which augments the risk-free rate, necessitates a recalibration of expected returns on equities. This recalibration alters the risk-return equilibrium, potentially prompting a strategic shift in stock investment portfolios, particularly in markets characterized by higher volatility. However, the CAPM has faced criticism and debate, as highlighted by Jagannathan and McGrattan (1995) and Fama and French (1996). One key limitation is its assumption of a single-factor model (market risk) to explain asset returns, which may not capture the multifaceted nature of market dynamics. In addition, it should be noted that the model assumes a linear relationship between risk and return, which may not always be applicable in real-world situations.

### 2.2.4 Arbitrage Pricing

The Arbitrage Pricing Theory (APT), developed by Ross (1976) and further explored by Solnik (1983) and Bansal and Viswanathan (1993), presents an alternative to the CAPM. APT suggests that the expected return of a financial asset can be modeled as a linear function of various macroeconomic factors and market indices, extending beyond mere market risk. APT's multifactorial framework is particularly relevant in analyzing the impact of interest rate changes on stock valuations. The theory proposes that stock prices are influenced not just by market risk but also by a range of economic variables, including interest rates.

Solnik (1983) highlights this perspective, allowing for a more detailed analysis of how different sectors may respond variably to shifts in interest rates. Bansal and Viswanathan

(1993) further discuss the practical application of APT in real-world scenarios, underscoring its effectiveness in predicting stock price movements in response to changes in interest rates. This insight is especially valuable for investors and policymakers, providing a deeper understanding of how monetary policy impacts various segments of the stock market. However, APT faces challenges in empirically identifying and quantifying the specific macroeconomic factors that significantly affect asset prices, as noted by Roll and Ross (1980). Additionally, the theory's assumption of non-existent arbitrage opportunities is a condition rarely found in actual market environments, as pointed out by Bansal and Viswanathan (1993). These limitations indicate that while APT offers a sophisticated and comprehensive approach to asset pricing, its practical implementation is marked by complexities.

## 2.3 INTEREST RATE MECHANISMS: CHINA VS. U.S

In China, interest rates can be classified into three categories based on their flexibility with market rules—official interest rates, public interest rates, and market interest rates. The official interest rate, also known as the benchmark interest rate, is designated by the People's Bank of China, and it serves as the primary benchmark for financial institutions and commercial banks when borrowing from or lending to the central bank. Adjusting the official interest rate is a crucial policy tool for macroeconomic control in China. Public interest rates are determined by private financial sectors, not government departments. For instance, the Banking Association can determine the public interest rate for its industry. Market interest rates, also known as financial market interest rates, are free to change according to market rules. These rates have a significant impact on financial markets and systems, and changes in them affect other interest rates as well. Market interest rates reflect how market forces impact interest rates, while official and public interest rates reflect non-market forces' impact on interest rates to varying degrees. Currently, China mainly adopts official interest rates. Most interest rates are set by the People's Bank of China and are used after approval by the State Council (Cheung et al., 2008).

Interest rates in the United States are primarily determined by market dynamics, with the Federal Reserve playing a significant role in influencing rates through its monetary policy (Friedman et al., 2000). The key interest rate categories include Federal Funds, Prime, and Market Interest Rates. The federal funds rate, the overnight lending rate between banks, is set by the Federal Open Market Committee (FOMC) and is a benchmark for many other interest rates. It impacts everything from borrowing costs to stock valuations and is a critical reference for consumer loans and mortgages (Martin, 2017). On the other hand, market interest rates reflect broader economic conditions, including inflation expectations and the economic outlook, and emerge from various financial instruments' supply and demand dynamics, such as government and corporate bonds. In the U.S., the Federal Reserve's monetary policy works with market forces to influence interest rates, with the Fed adjusting the federal funds rate to manage economic growth and inflation.

## 2.4 REVIEW OF EMPIRICAL EVIDENCE

### 2.4.1 Interest Rate and Stock Price

In a comprehensive study, Harasty and Roulet (2000) examined 17 developed nations and discovered that, except for the Italian market, stock prices are cointegrated with each nation's earnings (a proxy for dividends) and long-term interest rates. Building upon the theme of macroeconomic influences on stock markets, Spyrou (2001) investigates the connection between stock returns and inflation specifically for Greece's developing economy. Spyrou (2001) finds a negative relationship between inflation and stock returns that is consistent with Kaul's (1990) findings. However, this relationship does not become insignificant until 1995.

Further expanding on the relationship between inflation and stock returns, Gautam Kaul (2009) utilizes an empirical analysis of historical stock return data across different monetary regimes to understand the relationship between stock returns and inflationary expectations. It presents post-war evidence from four countries, showing a direct connection between these relations and the central banks' operating targets, such as money supply and interest rate adjustments. The findings particularly highlight that the typically negative relations between stock returns and changes in expected inflation are significantly more pronounced during periods when central banks primarily focus on interest rate targets.

In a different approach, Hamrita and Trifi (2011) applied a wavelet multi-scaling approach using the maximum overlap discrete wavelet transform (MODWT) to explore the relationship among interest rates, exchange rates, and stock prices in the U.S. from January 1990 to December 2008. The study utilized monthly data for the interest rate of American Treasury securities, the exchange rate between USD and EURO, and the closing S&P500 index as an indicator of stock price fluctuation. The study's findings revealed that the relationship between interest rates and exchange rates was not significantly different from zero at all scales, suggesting independence between these series. However, the relationship between interest rate returns and stock index returns was significantly different from zero at the highest scales, indicating that interest rate returns lead stock index returns at longer horizons. Additionally, there was evidence of bidirectional causality between exchange rates and stock index only at longer horizons, demonstrating the complex and scale-dependent nature of these financial variables' relationships.

Stoica et al. (2014) analyze the responses of capital markets in Central and Eastern Europe to domestic and international short-term interest rate shocks. Utilizing a four-variable structural vector error correction model (SVECM) identified through permanent-transitory restrictions, their study covers monthly time series data from January 2003 to June 2012. The findings reveal a pronounced sensitivity of stock markets in the Central and Eastern European region to international interest rate fluctuations over domestic rate changes. Specifically, a significant negative correlation is observed between interest rates and stock market indexes in the Czech Republic, Hungary, Poland, and Romania. In contrast, for nations like Bulgaria, Latvia, and Lithuania, which lack monetary policy autonomy, the study validates only the inverse relationship between foreign interest rates and stock price indices.

Liu and Chen (2016) conducted a study to investigate the relationships and volatility spillovers among house prices, interest rates, and stock market prices in Taiwan. The study used monthly data from January 1985 to December 2009 and employed the Smooth

Transition Vector Error Correction GARCH (STVEC-GARCH) model. The research found significant interactive effects between the variables, specifically noting the substantial influence of changes in house prices on banks' nonperforming loans. It also found that changes in interest rates directly impact the ability of individuals and businesses to pay loan interest. The results showed nonlinear and co-integrated relations among these variables, with housing prices leading stock market returns when influenced by interest rates. Furthermore, the volatility of stock market returns significantly impacts interest rates.

Interestingly, in a most recent study, Hager and Nitschka (2023) investigate the reaction of Swiss asset prices, including stock prices and interest rates, to scheduled policy decisions of the European Central Bank (ECB). The study focuses on the influence of various ECB policy instruments on these assets. Over the sample period from 2004 to 2023, it was observed that Swiss stock prices and interest rates of different maturities did not significantly respond to ECB policy shocks. Employing local projections, the study finds that ECB policy surprises, particularly those related to its target policy rate, forward guidance, and asset purchases, tend to move Swiss interest rates and stock prices in a similar direction.

A study by Ali (2014) examines interest rate data at the relevant times and the closing stock prices on the Karachi Stock Exchange at the end of each month from January 2004 to December 2013. This study investigates the effects of interest rates on the Karachi stock market using correlation, regression analysis, and descriptive analysis. The study's findings demonstrate that interest rates have a considerable influence on stock market prices and that political developments have a significant impact on how well the Pakistani stock market performs.

While the Pakistani market exhibits specific trends, similar investigations in other developing economies like Bangladesh reveal different aspects of the interest rate-stock price relationship. In their research, Uddin and Alam (2010) looked for proof of market efficiency in Bangladeshi stocks based on monthly data from May to June 1992 and in the Dhaka Stock Exchange (DSE) based on daily aggregate price index from 1994 to 2005. The DSE index deviated from the random walk model in a 2004 test of the stationarity of market returns, suggesting that the DSE was inefficient in a weekly format.

Furthermore, the study's findings indicate that, in this instance of an inefficient market, there is a linear relationship between interest rates and stock prices, as well as between stock prices and growth in interest rates.

Moving from Bangladesh to India, the dynamics of interest rates and stock prices continue to show varied patterns, as demonstrated in the study by Shruti and Swati (2016), who selected India's quarterly interest rate and exchange rate data from 1996 to 2014 to study the linkage relationship between variables. The results show that exchange rate fluctuations caused by changes in interest rates cannot be explained through capital flow channels. However, this study finds that interventions in exchange rates may not necessarily cause fluctuations in interest rates.

As the research expands to include various developing countries, the complexity and diversity of the relationship between interest rates and stock prices becomes increasingly apparent. The study by Okpara and Odionye (2012) examines the relationship between exchange rates and stock prices in the Nigerian economy, using ADF and PP tests, multivariate cointegration, and vector error correction models (VECM) with pairwise Granger causality tests. The study finds that stock prices can influence exchange rates, suggesting that the stock market can be a leading indicator of currency movements. The study also highlights the negative impact of exchange rates on stock prices and the importance of segment-specific analysis. Additionally, it reveals that most of the forecast error variance in stock prices could be attributed to internal market information rather than external shocks.

Another study conducted by Udegbunam and Oaikhenan (2012) examined the sensitivity of prices in the Nigerian stock market to interest rate risk using the duration and convexity model. Duration measures the sensitivity of a financial asset's price to changes in interest rates while convexity accounts for the rate of change of duration concerning yield changes. The researchers used a non-linear stock price model that considered interest rate duration, convexity measures, and other control variables. The results showed that stock prices in the Nigerian market were sensitive to interest rate changes. Specifically, the study found that both interest rate duration and convexity measures had strong but opposite effects on stock prices, leading to a net negative impact of interest rate changes on stock prices.

Apart from the analyses for individual countries, broader studies encompassing major economies like China and the United States shed light on the global interplay among monetary supply, exchange rates, and interest rates. Kang et al. (2016) explored the relationship between money supply and the U.S. dollar by studying the financial markets of China and the United States. The study found that the impact of China's money supply on the Sino-U.S. exchange rate is dynamic and time-varying, that is, the relationship and degree of correlation between the two will change with time. Su et al. (2017) studied the relationship between money supply and exchange rate from 1999 to 2015 and found there was a unidirectional relationship between the two. However, when they studied it again using a rolling window, they found the two had a bidirectional causal relationship. This result shows that exchange rate marketization and improvement of monetary policy can promote two-way influence between the two.

### 2.4.2 Money Supply and Stock Price

In developed economies, the relationship between money supply and stock prices is often perceived through a strong correlation, where changes in money supply are believed to influence stock price levels directly. This perspective is supported by the research of Hashemzadeh and Taylor (1988), who employed the Granger–Sims causality test to explore this relationship. Their study reveals a bidirectional causality between stock prices and money supply, suggesting a mutual influence. However, they also found that the connection between stock prices and interest rates is more complex, predominantly showing causality flowing from interest rates to stock prices. This research underscores the limitations of models focusing on single causative factors and advocates for using simultaneous equation systems that incorporate money supply alongside other macroeconomic variables for more accurate stock price predictions.

Li and Wu (2008) further examine the interplay between stock market dynamics and macroeconomic variables in developed Asian economies, including Taiwan, Hong Kong, Singapore, and South Korea. Utilizing data from 1997 to 2007, their study employs ADF tests, Johansen's cointegration tests, and Granger causality tests. They find a long-term equilibrium between macroeconomic policies (like money supply and budget deficit) and stock prices. However, they note that stock prices do not rapidly adjust to monetary or fiscal policy changes in the short term, indicating a certain level of market inefficiency in response to macroeconomic policies.

Sova and Lukianenko (2020) provide an in-depth analysis using vector autoregressive models to understand how monetary policy impacts stock market indices across various economies from 2002 to 2017. Their findings indicate that monetary policy significantly influences stock markets in developed countries, while the response in developing countries is less pronounced. This suggests that monetary policies stimulating stock markets are more effective in developed economies, highlighting the diverse economic dynamics across different regions.

Shi (2012) focuses on the relationship between money supply and stock prices in China, using time series analysis with data spanning June 1997 to December 2011. The study reveals that while variations in stock prices significantly impact the money supply, the influence of changes in money supply on stock prices is not as pronounced. This suggests that stock prices in China are more influenced by internal market dynamics than by external monetary supply factors. The study implies that the influence of stock prices should be considered for effective monetary regulation.

He (2017) investigates the interrelations between money supply (M2) and macroeconomic variables in China from 2000 to 2016, employing a vector auto regression (VAR) model. The study concludes that increases in real GDP and inflation rate lead to an increase in money supply, whereas a rise in interest rates results in a decrease. A positive correlation is observed between the money supply and the stock price index in China.

A study by Hirota (2023) develops a model to analyze the effect of money supply on stock prices, particularly in scenarios characterized by diverse investor opinions and market frictions. The research demonstrates that fluctuations in money supply can significantly influence stock prices, leading to either overpricing or underpricing, depending on the level of money in the economy. This model challenges the traditional discounted cash flow model, suggesting that stock prices can deviate from fundamental values due to monetary factors and do not just reflect future economic prospects. This finding is particularly relevant in understanding stock market behaviors during the

COVID-19 pandemic, when increased money supply from quantitative easing policies may have contributed to rising stock prices despite a stagnant economy.

These diverse studies collectively indicate that the relationship between money supply and stock prices varies significantly across economic contexts. In developed countries, monetary policy has a more direct impact on stock markets. However, research has shown that the relationship is more complex than previously thought, with factors like interest rates also playing a significant role. In contrast, in developing economies like China's, stock prices are influenced by a complex interplay of internal market forces and external monetary policies. While variations in stock prices can significantly impact the money supply, changes in money supply have a less pronounced effect on stock prices.

## 2.5 The Relationship Between Interest Rate and Bank Share Price

These diverse studies collectively indicate that the relationship between money supply and stock prices varies significantly across economic contexts. In developed countries, monetary policy has a more direct impact on stock markets. However, research has shown that the relationship is more complex than previously thought, with factors like interest rates also playing a significant role. In contrast, in developing economies like China's, stock prices are influenced by a complex interplay of internal market forces and external monetary policies. While variations in stock prices can significantly impact the money supply, changes in money supply have a less pronounced effect on stock prices.

The relationship between interest rate fluctuations and bank share prices is particularly complex. Interest rate changes impact bank profitability and risk profiles, influencing investor sentiment towards bank stocks. The Chinese banking sector, deeply intertwined with government policies and economic reforms, exhibits unique patterns. For instance, the dynamic impact of financial market reforms in China demonstrates how regulatory changes and interest rate adjustments can significantly affect stock prices. Empirical studies focusing on the Chinese market highlight these unique correlations—the distinct characteristics of China's financial system compared to the western economies. This interwoven relationship among macroeconomic policies, banking sector development, and stock market dynamics in China provides a rich backdrop for understanding how interest rate variations impact bank share prices, offering insights into the broader implications for the financial market and economic policy formulation. Therefore, this paper will also investigate the relationship between the banking sector and corporate stock prices, which are closely tied to interest rates. This provides a microeconomic perspective, examining how the banking sector's performance and interest rate fluctuations impact corporate stock valuations. This dual approach offers a comprehensive view of the interplay between macroeconomic policies, banking sector development, and stock market dynamics.

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Merton (1973) analyzes how fluctuations in interest rates and exchange rates affect the prices of bank stocks. Given the relationship between interest rates and investment opportunities, interest rate risk is considered as a potential off-market factor that affects stock investments. Investors demand an extra risk premium to compensate for the potential volatility in interest rates and exchange rates. To investigate if interest rates or exchange rates influence stock pricing, Sweeney and Warga (1986) used the APT model. In a state of equilibrium between supply and demand for stocks, interest rates and exchange rates play an important part in determining the stock prices of large financial institutions, such as commercial banks.

Elyasiani and Mansur (1998) used a GARCH-M model to study the role of interest rates and their volatility in bank stock returns. This model eliminated the limitations of collinearity, independence, and conditional variance in previous models. Hypothesis, ARCH, GARCH and volatility recovery effects are all significant in empirical research. Interest rates and interest rate volatility are directly related to bank stock price distribution. The volatility of all bank portfolios is very persistent, and this persistence of volatility has an important impact on bank portfolios. Using OLS and GARCH models, Kasman et al. (2011) examined the effects of interest rate and exchange rate fluctuations on the daily trading prices of Turkish bank stocks from 1999 to 2009. Based on the findings, it is evident that bank stock prices are greatly influenced by interest rates and exchange rates. It becomes evident that bank stock volatility is primarily influenced by interest rate volatility and exchange rate volatility, as demonstrated by the negative impact. Additionally, compared to interest and exchange rates, changes in bank stock prices are more sensitive to market indexes, suggesting that market indexes are crucial in defining the mechanism underlying bank stock prices. Through off-balance sheet operations and efficient risk management procedures, banks can lower their exposure to interest rate risk and exchange rate risk. However, the lack of risk-avoiding instruments and approaches typically leads to financial crises for financial institutions in emerging economies.

# CHAPTER 3 METHODOLOGY

## 3.1 Cointegration Analysis Methodology

A major concern of economic theory is that there are usually long-run relationships among non-stationary variables, such as stock market prices and macroeconomic indicators. Vector auto-regression analysis provides spurious results. However, if these variables are 'co-integrated,' a standard regression analysis can indeed generate meaningful results, which helps with economic decision making. Engle and Granger (1987) showed that the regression analysis between two non-stationary time series can produce highly consistent unknown model parameters if they are co-integrated. A vector of non-stationary time series, $\boldsymbol{Y_t}$, is co-integrated, if there exists a vector, $\boldsymbol{B}$, such that the linear combination of the vector process, $\boldsymbol{B' \cdot Y_t}$, is a univariate stationary time series.

### 3.1.1 Unit Root Test

To examine the existence of co-movement between the stock price and the selected macroeconomic variables, I need to test whether each of the individual time series is non-stationary. These tests can be established using either the augmented unit root test (ADF) developed by Dickey and Fuller (1979) or the stationarity test (KPSS) developed by Kwiatkowski et al. (1992).

The ADF test of a univariate time series, $\boldsymbol{y_t}$, is based on the following general model,

$$\boldsymbol{y_t = c + d \cdot t + a y_{t-1} + b_1 \cdot \Delta y_{t-1} + \cdots + b_p \cdot \Delta\, y_{t-p} + \epsilon_t} \qquad (1)$$

where $\boldsymbol{\Delta y_t = y_t - y_{t-1}}$. The null and alternative hypotheses are specified as

$$\boldsymbol{H_0 : a = 1} \quad \textbf{against} \quad \boldsymbol{H_1 : a < 1}.$$

There are several variants of the test that, appropriate for series with different growth characteristics, restrict the drift, c, and deterministic trend coefficients, d, to be 0. Lagged differences, $\Delta \boldsymbol{y}_{t-k}$, $\boldsymbol{k} = \mathbf{1}, \cdots, \boldsymbol{p}$, augment the test to account for serial correlations in the innovation process $\boldsymbol{\epsilon}_t$. It is expected the level data is a unit root process, indicating non-stationarity, while the first-order difference of the time series is stationary.

The KPSS test is based on the following model,

$$\boldsymbol{y}_t = \boldsymbol{c}_t + \boldsymbol{d} \cdot \boldsymbol{t} + \boldsymbol{u}_{1t} \quad (2)$$

$$\boldsymbol{c}_t = \boldsymbol{c}_{t-1} + \boldsymbol{u}_{2t} \quad (3)$$

where $\boldsymbol{u}_{1t}$ is a stationary process and $\boldsymbol{u}_{2t} \sim \boldsymbol{iid}(\mathbf{0}, \boldsymbol{\sigma}^2)$. The null and alternative hypotheses are

$$\boldsymbol{H}_0 : \boldsymbol{\sigma}^2 = \mathbf{0} \quad \textbf{against} \quad \boldsymbol{H}_1 : \boldsymbol{\sigma}^2 > \mathbf{0}.$$

If the null hypothesis fails to be rejected, the random walk process $\boldsymbol{c}_t$ is a constant and the process $\boldsymbol{y}_t$ is then (trend) stationary. In other words, the null hypothesis is that the time series is stationary against the alternative that $\sigma^2 > 0$, which introduces the unit root in the random walk process $\boldsymbol{c}_t$. For the level data, I expect the null hypotheses not to be rejected, while the null hypotheses for the first-order differences are to be rejected at a significant level. Both procedures are coded in Matlab.

### 3.2 Testing for Cointegration Relationships

I apply one of the most popular cointegration testing procedures: Johansen (1991) tests for the China and the United States datasets.

The Johansen test, named after Søren Johansen, is a statistical method used to assess co- integration among several time series. The purpose of the test is to determine whether there exists a long-run co-integrating relationship among multiple time series of integration rank 1. Unlike the Engle–Granger (1987) test, which focuses on a single cointegration relationship, the Johansen test allows for multiple co-integrating relationships. The test can be performed in two ways: using trace test or the maximum eigenvalue test.

If the time series are non-stationary at level and when the variables are integrated of same order, the Johansen test of cointegration developed by Johansen and Juselius (1990) can be applied to obtain the number of co-integrating vectors. The Johansen–Juselius multivariate cointegration model can be expressed as:

$$\Delta \boldsymbol{Y_t} = \boldsymbol{c_1} + \boldsymbol{d_1} \cdot \boldsymbol{t} + \boldsymbol{A}(\boldsymbol{B}'\boldsymbol{Y_{t-1}} + \boldsymbol{c_0} + \boldsymbol{d_0} \cdot \boldsymbol{t}) + \boldsymbol{b_1}\Delta \boldsymbol{Y_{t-1}} + \cdots + \boldsymbol{b_q}\Delta \boldsymbol{Y_{t-q}} + \boldsymbol{\epsilon_t} \tag{4}$$

where **A** and **B** are full rank of size $\mathbf{N} \times \mathbf{r}$ matrices, and r is the rank of cointegration. For maximum likelihood estimation, it is assumed that $\boldsymbol{\epsilon_t}$ is identically and independently distributed with covariance matrix $\boldsymbol{\Omega}$. The test can be conducted in the following five specific forms with constant intercepts and trends for the cointegration and the level data.

- 'H2': There are no intercepts or trends in the co-integrated series, and there are no deterministic trends in the levels of the data.
- 'H1*': There are intercepts in the co-integrated series, and there are no deterministic trends in the levels of the data.
- 'H1': There are intercepts in the co-integrated series and there are deterministic linear trends in the levels of the data.
- 'H*: There are intercepts and linear trends in the co-integrated series and there are deterministic linear trends in the levels of the data.
- 'H': There are intercepts and linear trends in the co-integrated series and there are deterministic quadratic trends in the levels of the data.

In the present investigation, the null hypothesis for cointegration tests asserts that there exists a cointegration relationship between the stock market indices in China and the United States, and the interest rate and money supply. If the null hypothesis is rejected, it would suggest that there is no enduring equilibrium relationship between the stock market indices and the other macroeconomic indicators in the two countries.

The null hypothesis for the Johansen cointegration test is that the number of cointegration relationships (r) is less than or equal to a specified number (k); r represents the cointegration rank, which is the number of cointegrating relationships, and k is the specified number that r is being compared to in the hypothesis. This is formally represented as:

$$H_0: r \leq \mathrm{k}$$

## 3.3 VECTOR-ERROR CORRECTION MODEL

A vector-error correction model (VECM) is applied for analysis of nonstationary and co-integrated multiple time series. The general form of the model is

$$\boldsymbol{\Delta Y_t = c_1 + d_1 \cdot t + A(B'Y_{t-1} + c_0 + d_0 \cdot t) + b_1 \Delta Y_{t-1} + \cdots + b_q \Delta\, Y_{t-q} + \beta X_t + \epsilon_t} \qquad (5)$$

where $\boldsymbol{X_t}$ is a set of predictive variables and the other parameters are defined as in equation (4). The key difference between a VECM and a VARM lies in the error-correction term for the level data:

$$\boldsymbol{B'Y_{t-1} + c_0 + d_0 \cdot t}.$$

which represents a long-run equilibrium relationship. The error-correction term captures the deviations from the equilibrium relationship and is added to a VARM model to compensate for the “losses” in the VARM process for prediction and model stability. The model has the same format as model (4) used for the cointegration test, but with predictive variable, $\boldsymbol{X_t}$.

- Constant: numseries-by-1 vector of constants(intercepts), denoted as c in the VEC equation.
- Adjustment: numseries-by-r matrix of cointegration adjustment speeds, denoted as A in the VEc equation. when Adjustment is fully specified, its rank must be r.
- Cointegration: numseries-by-r cointegration matrix, denoted as B in the VEC equation. When Cointegration is fully specified, its rank must be r.
- Impact: numseries-by-numseries impact (long-run level) matrix. Where Impact is fully specified, its rank must be r. The default is Adjustment*Cointegration, denoted as A*B' in the VEC equation.
- Short Run: Short run coefficients associated with response changes, denoted as B1, B2,...,Bq in the VEC equation. When specified without corresponding Lags (see below), ShortRun is a (p-1)-element cell vector of numseries-by-numseries

coefficient matrices B1，B2，...，Bq at lags 1，...，q= p-1. When specified with Lags ShortRun is a commensurate length cell vector of coefficients associated with the lags in Lags.

- Lags: Vector of unique, positive, integer lags associated with the short-run cell vector of coefficients. The default is a vector of integers 1, 2, ..., p-1 the same length as ShortRun.
- Trend: numseries-by-1 vector of linear time trends, denoted as Tin the VEC equation.
- Beta: numseries-by-numpreds regression coefficient matrix associated with numpreds predictors in x(t), denoted as Din the VEC equation.
- Covariance: numseries-by-numseries positive definite covariance matrix of the innovations e(t).

The null hypotheses is:

$H_0$: The coefficients on the error correction terms are equal to zero.

This means that the hypothesis is testing whether the short-run deviations from the long-run equilibrium have no effect on the change in the dependent variable. If we reject this null hypothesis, it implies that there are significant error correction terms, which means that the variables in the model are adjusting in response to disequilibrium from the long-run path.

## 3.4 A Panel-Data Regression Model for the U.S. and Chinese Banking Stock Returns

Given the potential influence of macroeconomic shocks on the financial sector, such as the COVID-19 pandemic, the study's investigation into the connection between bank stock prices and interest rates is particularly pertinent.

### 3.4.1 Analyzing the Effect of the Pandemic on Bank Stock Prices

To assess the impact of the pandemic on bank stock returns, this thesis develops various regression models with dummy variables for the selected U.S. and Chinese banking stocks, including firm specific data (PE, EPS, and NAV) and the cointegration relationships of the U.S. and Chinese macro indictors. The dummy variable for the COVID-19 period is specified from January 2020 to December 2021. The model is structured as follows:

$$R_{ti} = \beta_0 + \beta_1 M_t + \beta_2 C_t + \beta_3 P_{ti} + \beta_4 E_{ti} + \beta_5 N_{ti} \qquad (6)$$

where $R_{ti}$ is the return of stock $i$ at time $t. M_t$ is the cointegration factor as defined in equation (4). $C_t$ is COVID-19 dummy variable. $P_{ti}$ refers to the price earnings (P/E) ratio of stock $i$ at time $t$, $E_{ti}$ represents the earnings per share (EPS) at time $t$ for stock $i$, and is the net asset value (NAV) at time $t$ for stock $i$.

By analyzing the regression results, the study will gain insights into how the pandemic, as represented by the COVID dummy variable, $C_t$, has affected bank stock prices. Then the coefficient of $C_t$ indicates the direction and magnitude of this relationship. A significant positive value suggests that the pandemic has positively impacted bank stock returns, while a significant negative value indicates a detrimental impact. The model aims to capture the changes in bank stock returns attributable to shifts in the macroeconomic environment brought on by the pandemic. The null hypothesis is

$H_0{}'$: The cointegration relationship among interest rate, money supply, and stock index have a positive significant relationship with bank stock price.

### 3.4.2 Panel Data Regression

In this research, I selected quarterly stock prices from 13 Chinese commercial banks and 22 American commercial banks. I will analyze quarterly panel data of banking corporations using a multivariate regression model and corresponding control variables to identify the factors that affect bank stock prices.

The dependent variable is the bank stock price, while the independent variables are the interest rate, money supply, and stock index. I have also included control variables such as the P/E ratio, EPS, and NAV.

In addition to examining the effect that the pandemic has had on the stock prices of the banking industry by establishing the dummy variable *Covid*, I will also establish a dummy variable *D* to differentiate between China and the USA. The interaction term of the dummy variable is set so that a comparison can be made between the banking stock prices of China and the United States, based on the cointegration connection, to determine which country's banking stock prices were strongly influenced by the pandemic. The model is structured as follows:

$$R_{ti} = \beta_{i0} + \beta_{i1}M_t + \beta_{i2}C_t + \beta_{i3}P_t + \beta_{\mathrm{i}4}E_t + \beta_{\mathrm{i}5}N_t + \beta_{i6}D_t + \beta_{i7}D_t * Covid \qquad (7)$$

In this model, I construct a panel regression model with an additional dummy variable *D*, coding China as 1 and the U.S. as 0. The interaction between *D* and COVID-19 is included to examine whether Chinese and United States' bank stocks were hit by the pandemic. The null hypothesis is

$H_0{''}$: Chinese banks suffer more damages from COVID-19 than U.S. banks.

# CHAPTER 4 DATA AND EMPIRICAL RESULTS

## 4.1 DATA COLLECTION AND VARIABLE CONSTRUCTION

The Shanghai Stock Exchange (SSE) composite index and the Standard and Poor's (S&P 500) composite index are selected as proxies for stock market performance in China and the United States, respectively. The SSE composite is a benchmark market-capitalization weighted equity index, composed of A- and B-shares on the Shanghai Stock Exchange, the largest stock exchange in mainland China. The S&P 500 price index represents a broad stock market, which takes 98% of equity shares in the United States.

The China Shanghai Interbank Offered Rate (SHIBOR) and the one-month London Interbank Offered Rate (LIBOR) are selected for the lending and borrowing one-month rates for China and the United States. The consumer price indices for the two countries are used in this research as these are major co-movement macroeconomic indicators for stock market performance. I use monthly datasets to test my model, as this timeframe provides a robust analysis. The period for this study is March 2014 through September 2023. I further add a dummy variable to identify the COVID-19 period, which spans January 2020 to December 2021. I expect the estimated coefficient of the dummy variable will be significant in the China datasets. These datasets are retrieved from EIKON and Datastream.

To further investigate the relation between the stock market performance and the selected macroeconomic indicators, I select 13 banking stocks from China and 22 from the United States. The banking stocks are collected from CSMAR, and the banking stock prices are collected from EIKON and Datastream.

*Table 1: Variable Measurement*

| VARIABLE | MEASUREMENT |
|---|---|
| CH-LOG STOCK | logarithmic Shanghai stock composite index |
| CH-LOG MONEY | logarithmic Chinese money supply (M2) |
| CH–INTEREST-RATE | Chinese government benchmark 30-year yield. |
| US-LOG STOCK | logarithmic S&P 500 price index |
| US-LOG MONEY | logarithmic U.S. money supply (M2) |
| US–INTEREST-RATE | U.S. government benchmark 30-year yield |
| EXCHANGE RATE | Chinese yuan to the U.S. dollar |

When setting variables, I follow the methodology proposed by Caporale et al. (2024) and Wong et al. (2004), except for interest and exchange rates, which are not processed logarithmically in this paper. Logarithmic transformation is commonly used to transform data, which helps to align data presentation with my desired assumptions and improve statistical inferences. Furthermore, logarithmic transformation is particularly useful when dealing with large values such as stock market indices and money supply, as compared to interest and exchange rates, as it enables convenient subsequent testing without altering the nature and correlation of the data.

## 4.2 Sample Statistics

Based on the descriptive statistics from Table 2, I can deduce some insights about the core interest rate variable after logarithmic transformation. With an average of 3.777 and a standard deviation of 0.4492 for China's interest rates, compared to an average of 2.7606 and a standard deviation of 0.6674 for the United States, it is evident that interest rates in the U.S. exhibit greater volatility than those in China. This fluctuation variance is consistent with each country's broader economic characteristics. The United States, characterized by its market-oriented economy, often experiences more dynamic inflation patterns than China. The Federal Reserve closely monitors inflation trends and adjusts interest rates accordingly. Because inflation expectations in the U.S. can change rapidly, this can lead to pronounced fluctuations in interest rates. In contrast, with its more managed approach to the economy, China may have less frequent and less volatile changes in interest rates, reflecting a different macroeconomic management style.

***Table 2: Sample Statistics for Chinese and U.S. data***

| Statistic | CH_logStock | CH_logMoney | CH_Interest | US_logStock | US_logMoney | US_Interest | Exchange_Rate |
|---|---|---|---|---|---|---|---|
| Mean | 8.0373 | 12.1215 | 3.7777 | 7.9608 | 9.6483 | 2.7606 | 6.6315 |
| Standard deviation | 0.1403 | 0.2616 | 0.4492 | 0.2926 | 0.2253 | 0.6674 | 0.3082 |
| Skewness | -0.7785 | -0.0247 | 0.5220 | 0.1693 | 0.3078 | -0.1672 | -0.1385 |
| Kurtosis | 5.1423 | 1.9378 | 3.0318 | 1.6948 | 1.5760 | 2.8549 | 1.9085 |
| | 1.0000 | 0.3184 | -0.3659 | 0.3726 | 0.3554 | -0.2347 | -0.0267 |
| | 0.3184 | 1.0000 | -0.7109 | 0.9549 | 0.9641 | -0.0153 | 0.5931 |
| | -0.3659 | -0.7109 | 1.0000 | -0.5936 | -0.6792 | 0.0372 | -0.5680 |
| Correlation | 0.3726 | 0.9549 | -0.5936 | 1.0000 | 0.9681 | -0.0943 | 0.4010 |
| | 0.3554 | 0.9641 | -0.6792 | 0.9681 | 1.0000 | -0.1064 | 0.4271 |
| | -0.2347 | -0.0153 | 0.0372 | -0.0943 | -0.1064 | 1.0000 | 0.0283 |
| | -0.0267 | 0.5931 | -0.5680 | 0.4010 | 0.4271 | 0.0283 | 1.0000 |

Table 2 presents the sample statistics. From the perspective of the money supply, the average of China's logarithmic money supply (Ln (money supply)) stands at 12.1215 with a standard deviation of 0.2616. At the same time, the U.S. has an average of 9.6483 and a standard deviation of 0.2253. These figures suggest that China has traditionally used monetary policy, explicitly manipulating the money supply, as a tool for macroeconomic adjustment. In contrast, the U.S. advocates for the market to play a more significant role in self-adjustment. China’s and the U.S.'s underlying economic policies and financial structures influence these observed differences. China's central bank, the People's Bank of China, has a more direct and immediate influence on its economy by controlling money supply and interest rates. In contrast, the U.S. Federal Reserve operates in a more market-driven environment where interest rates are more sensitive to market forces, including investor expectations and economic indicators.

These differences reflect the distinctive economic governance models of the two nations. China's approach indicates a centralized model where the government strongly influences financial markets. In contrast, the U.S. model underscores the principles of market determinism and the Federal Reserve's role as a responsive entity to economic changes rather than a controlling force.

## 4.3 STATIONARITY TESTS FOR THE MACRO VARIABLES

I have two opposing null hypotheses for the time series data based on the methodology described for the ADF and KPSS tests. The ADF test has a null hypothesis that a unit root is present, implying non-stationarity of the data series. On the other hand, the KPSS test assumes the opposite—that the time series is stationary under the null hypothesis. According to Table 3, the p-values for the first three columns corresponding to the ADF tests are all greater than the significance level of 0.05. This indicates that I cannot reject the null hypothesis for the ADF test, suggesting that all variables are non-stationary at their levels. Simultaneously, the KPSS test results, as shown in the fourth and fifth columns of Table 3, have p-values of 0.01, which is less than the significance threshold of 0.05. This means that the KPSS test rejects its null hypothesis of stationarity, corroborating the ADF test results that the variables are non-stationary. Given the concurrence between the ADF and KPSS test results, it is evident that all variables in question require differencing to achieve stationarity. Thus, to proceed with the time series analysis, I will perform a first differencing of the variables to obtain a stationary series suitable for further econometric modeling. This process, known as achieving "integration of the same order," is necessary before analyzing the time series data for cointegration and causal relationships.

***Table 3: Parameter estimates and their p-values of the ADF and KPSS tests for the original level data with various models***

| | *ADF-AR* | *ADF-ARD* | *ADF-TS* | *KPSS-TS* | *KPSS-No TS* |
|---|---|---|---|---|---|
| *CH-log Stock* | 1.0004 | 0.8741 | 0.8760 | 7.9610 | 8.0373 |
| | (0.84941) | (0.014504) | (0.10491) | (0.01) | (0.01) |
| *CH-log Money* | 1.0007 | 0.9992 | 0.8417 | 11.6671 | 12.1215 |
| | (0.999) | (0.92621) | (0.10932) | (0.01) | (0.01) |
| *CH-Interest* | 0.9943 | 0.9350 | 0.9004 | 4.3217 | 3.7777 |
| *Rate* | (0.062909) | (0.11917) | (0.20669) | (0.01) | (0.01) |
| *US-log Stock* | 1.0010 | 0.9888 | 0.8475 | 7.4703 | 7.9608 |
| | (0.98537) | (0.81256) | (0.13066) | (0.01) | (0.01) |
| *US-log Money* | 1.0006 | 0.9975 | 0.9945 | 9.2684 | 9.6483 |
| | (0.999) | (0.83984) | (0.98734) | (0.01) | (0.01) |
| *US-Interest Rate* | 1.0009 | 0.9703 | 0.9744 | 2.7979 | 2.7606 |
| | (0.6996) | (0.74127) | (0.95635) | (0.01) | (0.01) |
| *Exchange Rate* | 1.0013 | 0.9604 | 0.9399 | 6.3231 | 6.6315 |
| | (0.92062) | (0.53457) | (0.6722) | (0.01) | (0.01) |

*ADF is the augmented Dickey–Fuller test; KPSS is KPSS test. The terms AR, ARD, and TS refer to different types of models used in time series analysis. AR is Autoregressive model, without a constant and a time trend. ARD is Autoregressive model with drift, without a constant but with a time trend. TS is Full model, incorporating lags of the dependent variable up to order* $p$*, where the number of lags (p) is determined by the Bayesian Information Criterion (BIC) or Akaike Information Criterion (AIC). The null hypothesis of ADF is* $H_0 : a = 1$ *against* $H_1 : a < 1$*. The null hypothesis of KPSS is* $H_0 : \sigma^2 = 0$ *against* $H_1: \sigma^2 > 0$*.*

After the data have been first-differenced, the results of the ADF tests displayed in the first three columns of Table 4 indicate that all p-values are less than 0.05. This suggests that the first-differenced data do not have a unit root, signifying that the series has achieved a state of stationarity. Furthermore, the KPSS test results, with p-values greater than 0.05, support the acceptance of the null hypothesis, indicating that the first-differenced data are stationary. This outcome is consistent with the findings from the ADF tests.

Therefore, the subsequent analyses in this study will employ the first-differenced data to conduct cointegration tests, which require that the series used in the analysis are stationary. The consistency of results from ADF and KPSS tests on the first-differenced data lends confidence to the proceeding steps in the study's econometric modeling.

***Table 4: Parameter estimates and their p-values of the ADF and KPSS tests for the first-order difference with various models***

| | *ADF-AR* | *ADF-ARD* | *ADF-TS* | *KPSS-TS* | *KPSS-NoTS* |
|---|---|---|---|---|---|
| *CH-log Stock* | 0.1923 | 0.1889 | 0.1788 | 0.0148 | 0.0037 |
| | (0.001) | (0.001) | (0.001) | (0.1) | (0.1) |
| *CH-log Money* | 0.3691 | -0.2476 | -0.2478 | 0.0081 | 0.0080 |
| | (0.001) | (0.001) | (0.001) | (0.1) | (0.1) |
| *CH-Interest Rate* | 0.1484 | 0.1306 | 0.1277 | -0.0325 | -0.0184 |
| | (0.001) | (0.001) | (0.001) | (0.0971) | (0.1) |
| *US-log Stock* | -0.1002 | -0.1360 | -0.1360 | 0.0078 | 0.0077 |
| | (0.001) | (0.001) | (0.001) | (0.1) | (0.1) |
| *US-log Money* | 0.8121 | 0.7401 | 0.7387 | 0.0063 | 0.0054 |
| | (0.001) | (0.0025) | (0.0106) | (0.01) | (0.0244) |
| *US-Interest Rate* | -0.0206 | -0.0219 | -0.0551 | -0.0593 | 0.0073 |
| | (0.001) | (0.001) | (0.001) | (0.1) | (0.0688) |
| *Exchange Rate* | 0.2231 | 0.2149 | 0.2148 | 0.0078 | 0.0092 |
| | (0.001) | (0.001) | (0.001) | (0.1) | (0.1) |

*ADF is the augmented Dickey–Fuller test; KPSS is KPSS test. The terms AR, ARD, and TS refer to different types of models used in time series analysis. AR is Autoregressive model, without a constant and a time trend. ARD is*

*Autoregressive model with drift, without a constant but with a time trend. TS is Full model, incorporating lags of the dependent variable up to order* $p$*, where the number of lags (p) is determined by the Bayesian Information Criterion (BIC) or Akaike Information Criterion (AIC). The null hypothesis of ADF is* $H_0 : a = 1$ *against* $H_1 : a < 1$*. The null hypothesis of KPSS is* $H_0 : \sigma^2 = 0$ *against* $H_1 : \sigma^2 > 0$*.*

Under the ADF tests with 'AR', 'ARD', and 'TS', the p-values are all less than 0.01, indicating that the first-order differenced data are all stationary. Under the KPSS tests with 'TS' and 'NoTS', the null hypotheses for all variables are not rejected except US-Log Money, indicating stationarity. However, US-Log Money may have higher rank integration than 1, but it is not an issue in the cointegration analysis if the integrated residual is stationary.

## 4.4 Cointegration Tests for the Macro Data

In this section, I selected the stock index as the dependent variable to explore the cointegration relationships in the macroeconomic data for both the U.S. and Chinese datasets. After conducting the necessary analyses, I decided to focus on the Johansen cointegration test results.

### 4.4.1 Tests for the Chinese Dataset

With the five model forms and possible short run of lags 0, 1, and 2, Table 5 presents the p-value of the tests for the Chinese datasets.

***Table 5: p-values of the Johansen tests for the Chinese data***

| *Model* | *Number of lags: 0* | | | *Number of lags: 1* | | | *Number of lags: 2* | | |
|---|---|---|---|---|---|---|---|---|---|
| *Form* | Rank 0 | Rank 1 | Rank 2 | Rank 0 | Rank 1 | Rank 2 | Rank 0 | Rank 1 | Rank 2 |
| *H2* | 0.0010 | 0.0167 | 0.5416 | 0.0010 | 0.0104 | 0.2111 | 0.0010 | 0.0546 | 0.4712 |
| *H1** | 0.0010 | 0.0123 | 0.1138 | 0.0010 | 0.0053 | 0.0444 | 0.0010 | 0.0248 | 0.1388 |
| *H1* | 0.1080 | 0.4981 | 0.5275 | 0.0444 | 0.2816 | 0.5828 | 0.1111 | 0.4602 | 0.6821 |
| *H** | 0.0047 | 0.1818 | 0.4220 | 0.0253 | 0.1242 | 0.1535 | 0.0634 | 0.1972 | 0.2961 |
| *H* | 0.0010 | 0.0251 | 0.0093 | 0.0045 | 0.0130 | 0.0029 | 0.0116 | 0.0246 | 0.0051 |

*The null hypothesis of Johansen tests is H0:* $r \leq k$*.* $r$ *represents the cointegration rank, which is the number of cointegrating relationships, and k is the specified number that r is being compared to in the hypothesis.*

From Table 5, the null hypothesis for the China dataset is rejected at the 5% significance level for all Johansen model forms with lag 0, for cointegration rank 0, 1, and 2, indicating there is a strong cointegration. To determine the optimal cointegration rank and lag level, I use the AIC criterion:

$$\boldsymbol{AIC = -2 \times loglikelihood + 2 * Number\ Of\ Parameters.}$$

Table 6 presents the AIC values for the various cointegration tests.

***Table 6: Negative AIC values for the Johansen tests for the Chinese data***

| *Model Form* | *Number of lags: 0* | | | *Number of lags: 1* | | | *Number of lags: 2* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Rank 0 | Rank 1 | Rank 2 | Rank 0 | Rank 1 | Rank 2 | Rank 0 | Rank 1 | Rank 2 |
| *H2* | 1180.3 | 1249.3 | 1251.5 | 1177.1 | 1238.3 | 1240.8 | 1178.8 | 1217.3 | 1216.3 |
| *H1** | 1180.3 | 1247.3 | 1250.5 | 1177.1 | 1236.3 | 1239.8 | 1178.8 | 1215.3 | 1217.0 |
| *H1* | 1252.8 | 1259.7 | 1255.0 | 1241.0 | 1248.9 | 1246.6 | 1219.1 | 1225.2 | 1221.4 |
| *H** | 1252.8 | 1270.2 | 1270.3 | 1241.0 | 1250.2 | 1249.3 | 1219.1 | 1226.4 | 1225.1 |
| *H* | 1249.2 | 1268.3 | 1268.3 | 1236.6 | 1246.3 | 1247.3 | 1214.4 | 1222.4 | 1223.1 |

*The null hypothesis of Johansen tests is H0: $r \leq k$. r represents the cointegration rank, which is the number of cointegrating relationships, and k is the specified number that r is being compared to in the hypothesis.*

Based on the AIC criterion, the optimal model form is H*, and the optimal number of lags is 0 with a cointegration rank of 2. The corresponding AIC is -1270.3. However, I set the cointegration rank to be 1 to be consistent with the test result of the U.S. data, as the AIC difference between rank 1 and rank 2 is only 0.1.

As defined in the previous section, the estimated parameters are

$$\boldsymbol{B} = [-\mathbf{6.1529}, \quad -\mathbf{46.1343}, \ -\mathbf{0.3981}], \quad \boldsymbol{c_0} = \mathbf{590.4651}, \quad \boldsymbol{d_0} = -\mathbf{0.3981}$$

which indicates a negative cointegration of the stock market with both money supply and interest rate in the Chinese market.

Figure 1 depicts the cointegration relationship for the Chinese data.

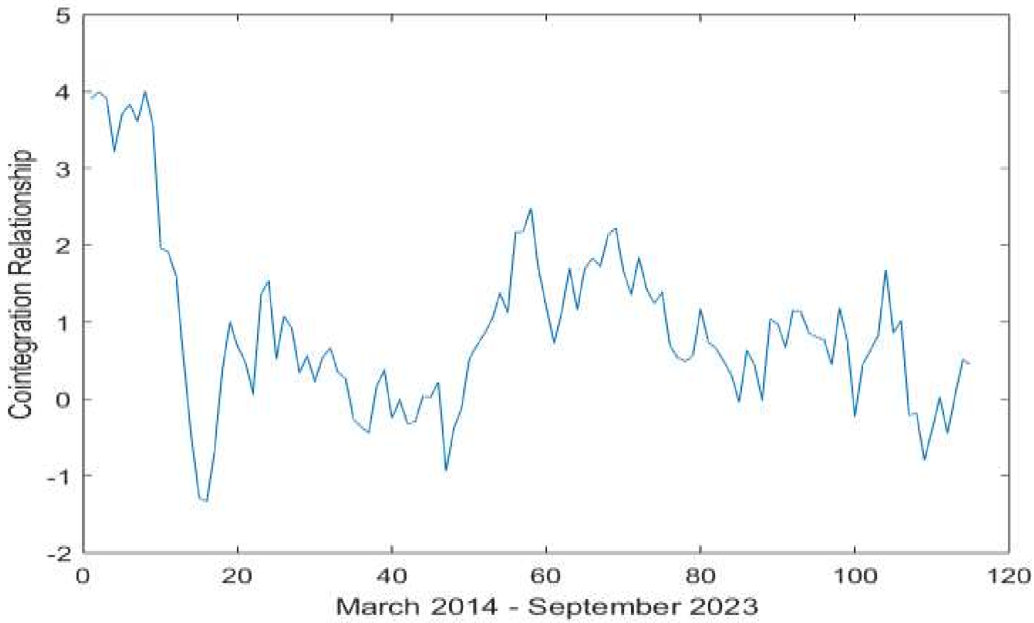


Figure 1 The Cointegration Time Series for China

### 4.4.2 Tests for the U.S. Dataset

***Table 7: p-values of the Johansen tests for the U.S. data***

| *Model Form* | *Number of lags: 0* | | | *Number of lags: 1* | | | *Number of lags: 2* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Rank 0 | Rank 1 | Rank 2 | Rank 0 | Rank 1 | Rank 2 | Rank 0 | Rank 1 | Rank 2 |
| *H2* | 0.0010 | 0.4089 | 0.8661 | 0.0040 | 0.6313 | 0.7953 | 0.0010 | 0.7146 | 0.9743 |
| *H1** | 0.0010 | 0.1567 | 0.2381 | 0.0043 | 0.1692 | 0.4544 | 0.0010 | 0.3617 | 0.4840 |
| *H1* | 0.0010 | 0.0388 | 0.0186 | 0.0439 | 0.0914 | 0.1189 | 0.0035 | 0.1623 | 0.0938 |
| *H** | 0.0010 | 0.3607 | 0.3676 | 0.2070 | 0.3497 | 0.3936 | 0.0203 | 0.5480 | 0.4474 |
| *H* | 0.0010 | 0.1699 | 0.0696 | 0.1003 | 0.1392 | 0.0278 | 0.0062 | 0.3257 | 0.0356 |

*The null hypothesis of Johansen tests is H0: $r \leq k$. r represents the cointegration rank, which is the number of cointegrating relationships, and k is the specified number that r is being compared to in the hypothesis.*

From Table 7, the null hypothesis for the U.S. dataset is rejected at the 5% significance level for all Johansen model forms with lag 0, for cointegration rank 0. However, the null hypothesis for the rank 1 test is not rejected at the 10% significance level for Johansen forms H2, H1*, H*, and H, except for form H1, which has a p-value of 0.0388, indicating strong cointegration at rank 1. Again, I can use the AIC criterion for model selection.

***Table 8: Negative AIC values for the Johansen tests for the U.S. data***

| *Model Form* | *Number of lags: 0* | | | *Number of lags: 1* | | | *Number of lags: 2* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Rank 0 | Rank 1 | Rank 2 | Rank 0 | Rank 1 | Rank 2 | Rank 0 | Rank 1 | Rank 2 |
| *H2* | 1154.8 | 1247.5 | 1242.1 | 1281.5 | 1297.5 | 1290.2 | 1258.1 | 1288.7 | 1280.8 |
| *H1** | 1154.8 | 1245.8 | 1242.5 | 1281.5 | 1295.8 | 1293.8 | 1258.1 | 1288.1 | 1283.7 |
| *H1* | 1192.2 | 1241.9 | 1240.6 | 1289.7 | 1294.2 | 1293.5 | 1270.1 | 1285.8 | 1282.9 |
| *H** | 1192.2 | 1252.2 | 1249.2 | 1289.7 | 1293.2 | 1290.6 | 1270.1 | 1287.1 | 1282.2 |
| *H* | 1190.2 | 1252.1 | 1251.2 | 1287.6 | 1292.7 | 1290.8 | 1267.9 | 1286.5 | 1282.4 |

*The null hypothesis of Johansen tests is H0: $r \leq k$. r represents the cointegration rank, which is the number of cointegrating relationships, and k is the specified number that r is being compared to in the hypothesis.*

Based on the AIC, the optimal number of lags is 1, and the optimal cointegration rank is 1 with Johansen model form H2, which corresponds to AIC value of -1297.5. The estimated cointegration parameters are

$$B = [-2.9013, \quad 9.7167, \quad 1.9277], \qquad c_0 = -74.9021, \quad d_0 = -0.0424$$

which indicates that, unlike the Chinese market, the stock market has a long-term positive cointegration with both money supply and interest rate.

Figure 2 depicts the cointegration relationship for the U.S. data.

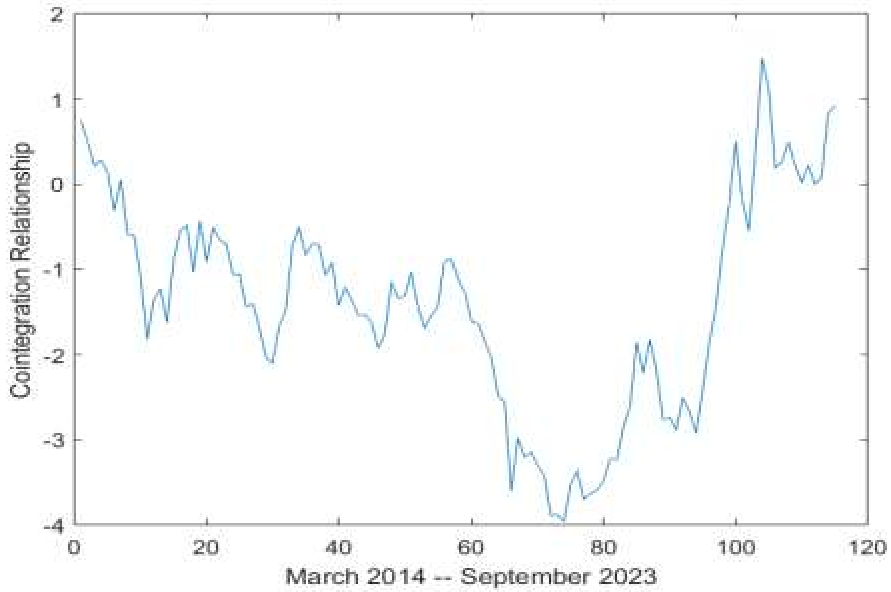


Figure 2  The Cointegration Time Series for the U.S.

China and the United States have cointegration vectors that are distinct from one another. The correlation between the movements of stock prices and the money supply and interest rates is inversely proportional, but in the U.S., the relationship among these three variables is positive. It is important to note that the stock market is affected by macroeconomic factors in a completely distinct way. The findings of a study conducted by Mann et al. (2004) indicate that overseas stocks are especially susceptible to U.S. interest rates and monetary policies. Because rising interest rates will make businesses feel as though they have lost control over their future profits, this will have a detrimental effect on the index that measures the performance of the stock market. According to the findings of research conducted by Baharumshah and colleagues (2009), macroeconomic and monetary policies in China have a long-term cointegration relationship with the Chinese stock market. At the same time, there is a strong substitution effect, particularly regarding the money supply M2.

## 4.5 VECTOR-ERROR CORRECTION MODELS

Based on the Johansen cointegration test results, I now specify vector-error correction models for China and the U.S. The Chinese dataset can be described using a VECM (3,1,0) and the U.S. dataset using a VECM (3,1,1). To examine how COVID-19 affects these markets, I include a dummy variable as a predictor in the model parameter estimation. Tables 9 and 10 display the estimation results.

***Table 9: 3-Dimensional Rank = 1 VECM (0) Model with 1 Predictor and Linear Time Trend***

| *Parameters* | *Value* | *Standard Error* | *T-Statistic* | *P-Value* |
|---|---|---|---|---|
| $c(1)$ | 16.494 | 3.8681 | 4.2640 | 2.0079e-05 |
| $c(2)$ | 1.357 | 0.5635 | 2.4079 | 0.016044 |
| $(c3)$ | -15.398 | 8.8496 | -1.7400 | 0.081861 |
| $A(1,1)$ | 0.0212 | 0.0051 | 4.2633 | 2.0143e-05 |
| $A\ (2,1)$ | 0.0012 | 0.0007 | 2.3935 | 0.016689 |
| $A\ (3,1)$ | -0.0202 | 0.0116 | -1.7379 | 0.082232 |
| $\Gamma(1,1)$ | -0.0739 | 0.0173 | -4.2633 | 2.0143e-05 |
| $\Gamma(2,1)$ | -0.0060 | 0.0025 | -2.3935 | 0.016689 |
| $\Gamma(3,1)$ | 0.0690 | 0.0397 | 1.7379 | 0.082232 |
| $\Gamma(1,2)$ | -1.3540 | 0.3176 | -4.2633 | 2.0143e-05 |
| $\Gamma(2,2)$ | -0.1107 | 0.0463 | -2.3935 | 0.016689 |
| $\Gamma(3,2)$ | 1.2628 | 0.7266 | 1.7379 | 0.082232 |
| $\Gamma(1,3)$ | -0.0216 | 0.0051 | -4.2633 | 2.0143e-5 |
| $\Gamma(2,3)$ | -0.0018 | 0.0007 | -2.3935 | 0.016689 |
| $\Gamma(3,3)$ | 0.0202 | 0.0116 | 1.7379 | 0.082232 |
| $\beta\ (1,1)$ | -0.0002 | 0.0125 | -0.0177 | 0.985900 |
| $\beta\ (2,1)$ | -0.0010 | 0.0018 | -0.5241 | 0.600190 |
| $\beta\ (3,1)$ | 0.0058 | 0.0286 | 0.2027 | 0.839330 |
| $d(1)$ | 0.0103 | 0.0024 | 4.2633 | 2.0143e-05 |
| $d(2)$ | 0.0008 | 0.0004 | 2.3935 | 0.016689 |
| $d(3)$ | -0.0096 | 0.0055 | -1.7379 | 0.082232 |

*$c$ = Constant, $A$ = Adjustment, $\Gamma$ = Impact, $\beta$ = Beta, $d$ = Trend*

Johansen Model: H*, Effective Sample Size: 114, Number of Estimated Parameters: 9, Maximized logarithmic likelihood: 645.232, AIC: -1272.46, BIC: -1247.84,

$$B = [-3.4073, -62.3973, -0.9976]$$

Cointegration Constant: 760.3913, Innovation trend: 0.4757, and Innovation Covariance Matrix:

$$\begin{bmatrix} 0.0029 & -0.0000 & 0.0023 \\ -0.0000 & 0.0001 & -0.0001 \\ 0.0023 & -0.0001 & 0.0153 \end{bmatrix}$$

Table 9 presents the findings from a 3-Dimensional Rank = 1 VECM (0) Model with 1 Predictor, which is employed to dissect the interrelation between macroeconomic variables, such as interest rate, money supply, and the stock market index in China. The model's estimated parameters show a mixture of both statistically significant and insignificant impacts, with the adjustment coefficients indicating how the stock index realigns to long-term equilibrium after experiencing short-term deviations due to economic shocks. The impact coefficients detail the immediate effects of changes in macroeconomic variables on the stock index. Interestingly, while some impacts, such as $\Gamma(1,1)$, show a negative relationship, others, like $\Gamma(2,1)$, are positive, suggesting a nuanced interaction between these variables. The model's beta coefficients suggest the long-term equilibrium relationships between the variables and have varying significance levels. For instance, β $(2,1)$ lacks statistical significance, indicating that the long-term relationship between some macroeconomic variables and the stock index may not be as strong or direct as the short-term impacts. Additionally, the model incorporates a linear time trend to capture any underlying trends in the data, which might represent the general growth of the economy or the stock market over time. The significance of the $d_1(1)$ coefficient suggests that time itself is a factor in the movement of the stock market index, independent of the macroeconomic variables considered.

This paper concludes that there is a cointegration relationship among China's interest rate, money supply, and stock market index. This conclusion is consistent with that of Hosseini et al. (2011). Hosseini et al. (2011) and the test methods used in this paper are similar based on the Johansen test and VECM, which shows a long-term and short-term cointegration relationship between stock market indices and macroeconomic factors such as interest rate and money supply in China.

***Table 10: 3-Dimensional Rank = 1 VECM (1) Model with 1 Predictor***

| Parameters | Value | Standard Error | T-Statistic | P-Value |
|---|---|---|---|---|
| $A(1,1)$ | -0.0012028 | 0.0048111 | -0.25 | 0.80258 |
| $A(2,1)$ | -0.0010975 | 0.00060979 | -1.7999 | 0.071878 |
| $A(3,1)$ | -0.0646678 | 0.023308 | -2.775 | 0.0055209 |
| $\Gamma(1,1)$ | 0.0003282 | 0.0013128 | 0.25 | 0.80258 |
| $\Gamma(2,1)$ | 0.00029948 | 0.00016639 | 1.7999 | 0.071878 |
| $\Gamma(3,1)$ | 0.017648 | 0.0063598 | 2.775 | 0.0055209 |
| $\Gamma(1,2)$ | 0.00033372 | 0.0013349 | 0.25 | 0.80258 |
| $\Gamma(2,2)$ | 0.00030452 | 0.00016919 | 1.7999 | 0.071878 |
| $\Gamma(3,2)$ | 0.017945 | 0.0064668 | 2.775 | 0.0055209 |
| $\Gamma(1,3)$ | -0.0015999 | 0.0063995 | -0.25 | 0.80258 |
| $\Gamma(2,3)$ | -0.0014599 | 0.00081111 | -1.7999 | 0.071878 |
| $\Gamma(3,3)$ | -0.086032 | 0.031003 | -2.775 | 0.0055209 |
| ShortRun {1} (1,1) | -0.10916 | 0.092349 | -1.182 | 0.2372 |
| ShortRun {1} (2,1) | -0.037194 | 0.011705 | -3.1777 | 0.0014847 |
| ShortRun {1} (3,1) | -0.49039 | 0.44739 | -1.0961 | 0.27303 |
| ShortRun {1} (1,2) | 0.91857 | 0.58327 | 1.5749 | 0.11528 |
| ShortRun{1} (2,2) | 0.57475 | 0.073926 | 7.7747 | 7.5654e-15 |
| ShortRun {1} (3,2) | -4.252 | 2.8257 | -1.5048 | 0.13238 |
| ShortRun {1} (1,3) | -0.025644 | 0.019239 | -1.3329 | 0.18257 |
| ShortRun {1} (2,3) | -0.0042927 | 0.0024385 | -1.7604 | 0.078339 |
| ShortRun {1} (3,3) | -0.0089668 | 0.093206 | -0.096204 | 0.92336 |
| $\beta$ (1,1) | 0.0021559 | 0.013772 | 0.15654 | 0.8756 |
| $\beta$ (2,1) | 0.0039751 | 0.0017455 | 2.2774 | 0.022763 |
| $\beta$ (3,1) | -0.11277 | 0.066717 | -1.6903 | 0.09097 |

*$A$ = Adjustment, $\Gamma$ = Impact, ShortRun = Short run coefficients, $\beta$ = Beta*

Johansen Model: H2, Effective Sample Size: 113, Number of Estimated Parameters: 18.

Maximized logarithmic likelihood: 667.32, AIC: -1298.64, BIC: -1249.55, Cointegration Matrix: [-0.2729, -0.2775, 1.3302],

and Innovation Covariance Matrix:

$$\begin{bmatrix} 0.0017 & -0.0001 & 0.0012 \\ -0.0000 & 0.0001 & -0.0004 \\ 0.0012 & -0.0004 & 0.0406 \end{bmatrix}$$

Table 10 extends the econometric investigation into the stock market by utilizing a 3-Dimensional Rank = 1 VECM (1) Model with 1 Predictor. The parameters estimated in Table 10 suggest that the stock market index responds to macroeconomic variables in both a short- and long-term framework, with unique dynamics that highlight the distinct nature of economic interactions in the U.S. compared to China. The adjustment coefficients in the model, such as $A(1,1)$ and $A(2,1)$, indicate a reversion to equilibrium that may occur at varying rates for different economic shifts. This contrast in adjustment rates might reflect the divergent monetary and fiscal policies prevalent in the U.S. economic system and the different investor behaviors in the U.S. stock market. Furthermore, the impact coefficients, which offer a glimpse into the immediate effect of macroeconomic shifts, present a complex and asymmetric relationship between these variables and the stock market. For instance, the different signs of the impact coefficients underscore that the market's reaction to economic news can be multifaceted, aligning with the asymmetric dynamics noted by Bhuiyan and Chowdhury (2020) in the context of the U.S. and Canada. The short-run coefficients, particularly ShortRun (1) (1,2), shed light on the market's responsiveness to economic fluctuations. A significant negative coefficient may suggest that certain macroeconomic downturns could have a pronounced negative effect on stock market indices. This observation is particularly valuable for short-term traders and policymakers. Comparatively, the trend coefficients offer insights into the long-term directional movements of the stock market, independent of the macroeconomic variables considered in the model.

The data shown in Table 10 shows that there is a cointegration relationship among the U.S.'s interest rate, money supply, and stock market index. These findings are in line with the literature that suggests a complex interplay between macroeconomic factors like interest rates and output and stock market performance, as discussed in studies by Lee (1992), Chiarella et al. (2002), and Mann et al. (2004). Particularly, this table echoes the asymmetry Bhuiyan and Chowdhury (2020) highlighted, revealing that the stock market's reactions are nuanced and vary over different economic cycles. The Johansen Model H2, along with the VECM framework applied in this study, corroborates the presence of cointegration relationships, implying that current economic conditions and past values and trends influence stock indices.

### 4.5.1 Model Fits

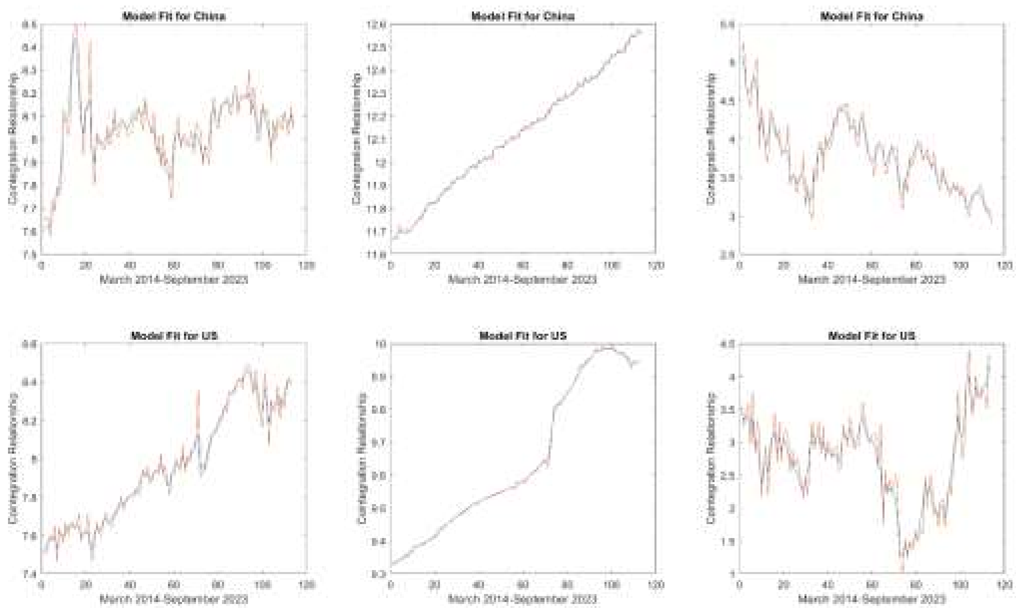


Figure 3 Model Fit

Through charting, this article creates trend charts of the market index, money supply, and interest rate after changing the Johansen test and the VECM model. It is evident from the data presented in Figure 3 that, primarily, the modified model chosen for this article through VECM is a good match for the data presented in this article, and the patterns between variables are almost consistent after integration. Another thing that can be seen from the graph is that there is a relationship of cointegration between China and the USA, which is the most representative example of a developing country and a developed country. It demonstrates that macroeconomic issues have significant long- and short-term effects on the stock markets of nations at various stages of development, which is consistent with the findings of Sirucek (2012). After completing cointegration tests and doing a study of historical macroeconomic data in the United States, it was discovered that there is a statistically significant impact on the index of the stock market.

## 4.6 Models for Bank Stock Returns

In this section, I first present how individual bank stock returns are predicted by factors I discussed in Section 3.4 on methodologies. I will discuss the sensitivity of stock returns on each country's cointegration time series and COVID-19, in addition to bank-specific financial data. Using a panel regression model, I then discuss the impact of the cointegration variable and COVID-19 on both countries' bank stock returns.

The control variables I have selected for my analysis are the price/earnings (P/E) ratio, earnings per share (EPS), and net asset value per share (NAV). The P/E ratio is a standard financial metric that compares the stock price to the annual earnings per share. It helps investors evaluate a company as a worthwhile investment by comparing its P/E ratio to the industry average. A P/E ratio higher than the industry average suggests the stock may be overvalued. Conversely, a lower P/E ratio implies undervaluation and potential investor skepticism (Shen, 2000). EPS is a commonly used metric for a company's profitability. It is calculated by dividing the company's profit by number of outstanding shares. A higher EPS typically indicates greater profitability and is a positive sign of a company's financial performance, which could lead to higher stock prices. EPS is a valuable variable when assessing the impact of macroeconomic indicators on bank stock prices. Studies have shown that EPS is a significant determinant of stock prices, reflecting a company's financial health and earnings quality (Elliott and Hanna, 1996). NAV is a metric that represents a bank's total assets minus its liabilities, divided by the number of shares outstanding. It measures the per-share value of a bank and it is particularly relevant for investment and mutual funds. For investors, a higher NAV indicates a healthy organization with growth potential, which positively influences stock prices. Conversely, a lower NAV may reflect underlying problems and lead to a lower stock price (Frankel and Lee, 1998).

***Table 11: Estimated parameter values for the bank stocks***

| *Bank* | *Intercept* | *Cointegration* | *COVID-19* | *PE* | *EPS* | *NAV* |
|---|---|---|---|---|---|---|
| *China* | -0.0149 | 0.0365 | -0.0330 | 0.0000 | 0.0077 | -0.0006 |
| *(p-value)* | (0.4260) | (0.000) | (0.0025) | (0.9974) | (0.4007) | (0.5545) |
| *U.S.* | -0.0349 | -0.0227 | -0.0431 | 0.0011 | -0.0083 | 0.0005 |
| *(p-value)* | (0.0283) | (0.0002) | (0.0170) | (0.0928) | (0.0085) | (0.0523) |

*PE = price/earnings ratio, EPS = earnings per share, and NAV = net asset value per share. The null hypothesis is H1: The cointegration relationship among interest rate, money supply, and stock index have a positive significant relationship with bank stock price.*

Based on the analysis presented in Table 11 for model (6) in Section 3.4.1, it is found that both the macroeconomic cointegration factor and the COVID-19 dummy exert substantial influence on the banking stock returns in both China and the U.S. However, the macro cointegration factor positively affects Chinese banking stocks, indicating that closer ties among macroeconomic variables, like interest rates and money supply, are associated with higher stock returns. Conversely, this factor significantly negatively impacts U.S. banking stock returns. COVID-19 presents a considerable negative effect on Chinese banking stocks, underscoring a vulnerability in the Chinese banking sector during this period. This impact is contrasted with a less pronounced, insignificant effect on U.S. banking stocks, reflecting a potentially more resilient banking system in the face of the pandemic.

Furthermore, the positive impact of macroeconomic cointegration on the stock prices of Chinese banks has not been sufficient to offset substantial adverse effects experienced during the pandemic. This reveals a relative weakness in the risk resilience of China's banking sector compared to that of the United States. One explanation for this discrepancy may lie in the differences between the countries/ economic and financial systems. Despite China's development as one of the world's fastest-growing economies and its steady progress in diversifying financial assets, it still lags behind the traditional financial supremacy of the United States, which boasts a richer array of financial assets. Consequently, the U.S.’s economic system and banking industry possess a more robust capacity to withstand financial risks.

***Table 12: Estimated parameter values for the panel regression model***

| Intercept | Cointegration | COVID-19 | PE | EPS | NAV | D | D x COVID-19 |
|---|---|---|---|---|---|---|---|
| -0.0012 | 0.0066 | 0.0168 | 0.0007 | -0.0054 | 0.0004 | 0.0070 | -0.0541 |
| (0.9315) | (0.0892) | (0.2402) | (0.2110) | (0.0497) | (0.1487) | (0.6070) | (0.0097) |

*PE = price/earnings ratio, EPS = earnings per share, and NAV = net asset value per share. The null hypothesis is H2: Chinese banks suffer more damages from COVID-19 than U.S. banks.*

To examine the severity of the pandemic's impact on the banking stocks of the two countries, I develop a panel regression model with an additional dummy variable D (China =1, U.S. = 0). I also include the interaction of D and COVID-19 to see whether the Chinese bank stocks were hit harder. Table 12 presents the estimation of the panel regression model (7) in Section 3.4.2. Table 12 shows that the estimated coefficient for the DxCOVID-19 dummy is -0.0541, which is incredibly significant at a 1% significance level. The conclusions drawn from Table 12 agree with those from Table 11, demonstrating that Chinese banking stocks experienced greater volatility in stock prices due to COVID-19 compared to their American counterparts, leading to a substantial impact on China's banking sector.

This heightened sensitivity of Chinese bank stocks may stem from an over-reliance on the macroeconomic growth of overall health, which, in times of macroeconomic crisis, leads to collateral damage with no effective buffering measures in place (Chen & Wang, 2015). Additionally, the nature of the banking sector in China, where the predominant commercial banks are state-owned and thus closely tied to national and governmental affairs, contrasts with the U.S., where commercial banks are primarily privately owned entities (Ding et al., 2024). The ownership structure and the resultant differences in risk exposure and management strategies likely contribute to the varying impacts of the pandemic observed between the two countries' banking sectors.

# CHAPTER 5 CONCLUSION

## 5.1 Conclusion of Study

My thesis explores the relationship among Chinese and American stock market indexes, national interest rates, and money supply from March 2014 to September 2023. During this period, COVID-19 was a disaster that impacted the macro-economy.

The stationarity of the data was tested using both the Augmented Dickey–Fuller (ADF) and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests, which confirmed that the data were stable after first-order differencing. To explore the relationship among these three variables, the study used Johansen's cointegration test and constructed a Vector Error Correction Model (VECM), concluding that there is a cointegrating relationship among China’s and the U.S.'s stock market index, interest rates, and money supply. Although China's stock market is in a high-speed development stage, there is still a gap compared with the mature stock market in the United States. One of the most important reasons is that China's interest rate marketization is incomplete. By setting the time dummy variable, my thesis concludes that the pandemic significantly and negatively impacts the stock market indexes of China and the United States. This finding is consistent with the research conclusions of most scholars, indicating that COVID-19 disrupted the normal economic cycles and progress of various countries. And I discovered that Chinese banking stocks experienced greater volatility in stock prices due to COVID-19 compared to their American counterparts, leading to a substantial impact on China's banking sector.

## 5.2 Suggestions

Based on the conclusions drawn from the above analysis, interest rates and money supply play a key role in the capital market. The following are some development suggestions.

The market economy still has imperfections even though it can self-correct. Strict regulation can deter and stop investor speculation, and relevant government authorities must monitor the stability and well-being of the stock market. The government should work to reduce influence from non-market variables even if it is essential in monitoring the stock market. This is required to stop policies from having an undue impact on the direction of stock prices. The government should be more cautious when regulating the stock market because regulations still have a significant impact on it. This entails advising investors against making impulsive purchases and improving market monitoring and control over market players. Only in the presence of a strong market regulation framework can investors make genuinely rational investments. A growing number of businesses and institutions are choosing to go public to raise capital as China's stock market has expanded. As a result, a link between changes in the stock market and the real economy has emerged. The state should carefully examine the trend of market interest rate adjustments and stock trading activities in the current interest rate marketization environment to prevent the connection impact among the actual economy, securities market, and capital market. Otherwise, hazards would proliferate and escalate.

The reduction of deposit and lending interest rate spreads brought about by interest rate liberalization has created difficulties for bank operations, management, and profitability. To achieve maximum returns, banks should determine and manage the term structure of deposits and the risk returns of loans depending on the revenue they can receive from loans and the expenses associated with maintaining deposits. To lower interest rate risks, banks should, concurrently, aggressively expand their intermediate business ventures, establish departments dedicated to risk prevention and management, transfer risks using financial derivatives, and strengthen risk monitoring. To enhance investors' awareness of the market, banks should also actively develop cross-market financial products and allow investors to trade in the money, interest rate, and securities markets. Banks should not restrict investment in the securities market to improve market liquidity and lower interest rates. By doing this, different markets can regulate one another, stabilizing bank performance and the banking industry's stock price

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