



**THE EFFECT OF US YIELD SPREADS ON BANK  
INDEX PERFORMANCE IN ASEAN**

**BY**

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**AN INDEPENDENT STUDY SUBMITTED IN PARTIAL  
FULFILLMENT OF THE REQUIREMENTS FOR  
THE DEGREE OF MASTER OF SCIENCE  
PROGRAM IN FINANCE (INTERNATIONAL PROGRAM)  
FACULTY OF COMMERCE AND ACCOUNTANCY  
THAMMASAT UNIVERSITY  
ACADEMIC YEAR 2022  
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ENTITLED

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PERFORMANCE IN ASEAN

was approved as partial fulfillment of the requirements for  
the degree of Master of Science (Finance)


on ..... June 2, 2023

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Independent study title	THE EFFECT OF US YIELD SPREADS ON BANK INDEX PERFORMANCE IN ASEAN
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Academic year	2022

## **ABSTRACT**

The U.S. treasury yield has a causality impact on ASEAN differently. About two-thirds of U.S. yield spread change statistics significantly affect Singapore yield spread instantaneously. The bank index performance of Singapore and Vietnam is unrelated to the U.S. yield spread during historical data covering January 2012 to January 2023. The inverse U.S. yield spread due to inflation controlling after covid-19 expansion policy does not reveal any significant impact on the ASEAN market deviate from the past in the short run.

**Keywords:** US yield spread, Bank index performance, Causality to ASEAN, Inverse yield curve

## ACKNOWLEDGEMENTS

I am grateful for the recommendation of my advisor, Associate Professor Pantisa Pavabutr, Ph. D., who gives professional guidance regarding this study. I am also thankful to Assistant Professor Wasin Siwasarit, Ph.D. who gives comments to make the study completed. Lastly, I could not have undertaken this journey without the support of family and friends. Thank you for whole supporting.

Anong Pongpisarnsakul



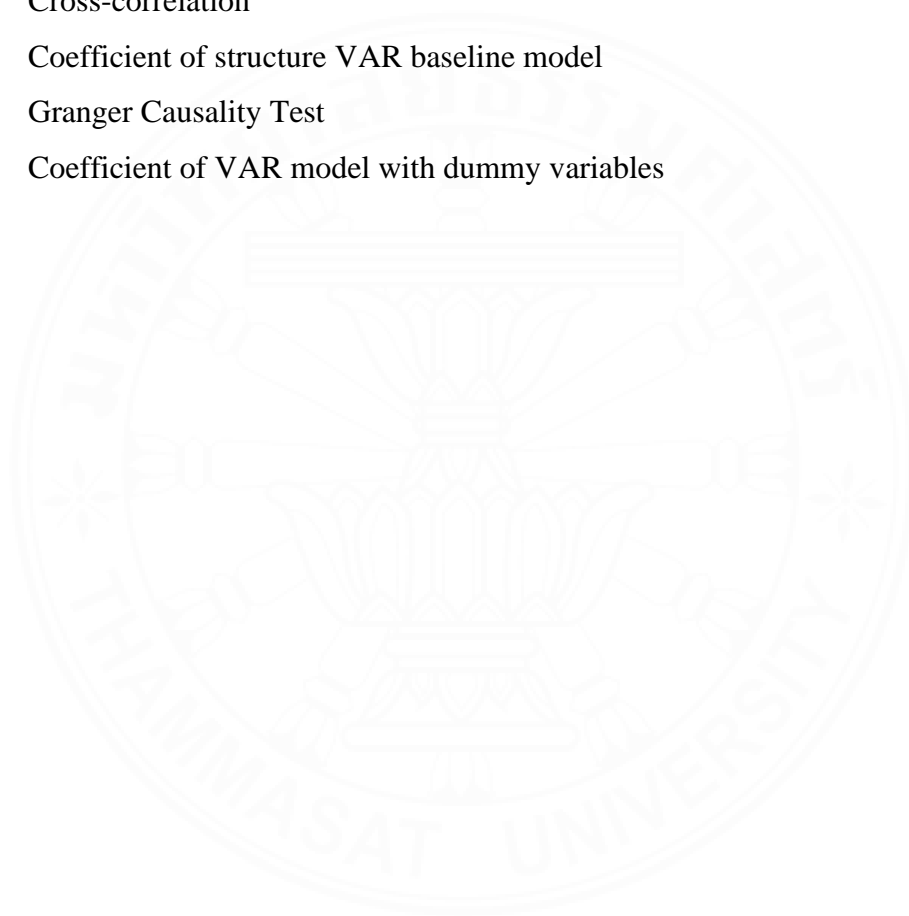
## TABLE OF CONTENTS

	Page
ABSTRACT	(1)
ACKNOWLEDGEMENTS	(2)
LIST OF TABLES	(5)
LIST OF FIGURES	(6)
LIST OF ABBREVIATIONS	(7)
CHAPTER 1 INTRODUCTION	1
CHAPTER 2 REVIEW OF LITERATURE AND MARKET BACKGROUND	4
2.1 Prior US monetary policy and effectiveness	4
2.2 Yield spread	5
2.3 Money market connectedness	6
2.4 ASEAN economy	10
2.4.1 Singapore market	11
2.4.2 Vietnam market	13
CHAPTER 3 DATA DESCRIPTION AND RESEARCH METHODOLOGY	17
3.1 Data description	17
3.1.1 Yield spread	17
3.1.2 Banking sector price index return	19
3.1.3 Data statistics	19
3.1.3.1 Contemporaneous correlation	21

	Page
3.1.3.2 Autocorrelation	21
3.1.3.3 Cross-correlation	21
3.2 Methodology	23
3.2.1 Structure vector autoregressive model	24
3.2.2 Dummy variable of inverse yield spread period	25
CHAPTER 4 RESULTS AND DISCUSSION	26
4.1 Evidence from structure VAR model	26
4.1.1 Structure matrix	26
4.1.2 Coefficient of VAR model	26
4.1.3 Accumulate impulse response function	29
4.1.4 Variance decomposition	31
4.1.5 Granger causality test/ Robustness check	33
4.2 Evidence from dummy variable of inverse yield spread period	34
CHAPTER 5 CONCLUSION	38
REFERENCES	39
BIOGRAPHY	41

**LIST OF TABLES**

Tables	Page
3.1 Data statistics in monthly frequency	21
3.2 Contemporaneous correlation	22
3.3 Autocorrelation	23
3.4 Cross-correlation	23
4.1 Coefficient of structure VAR baseline model	27
4.2 Granger Causality Test	33
4.3 Coefficient of VAR model with dummy variables	35

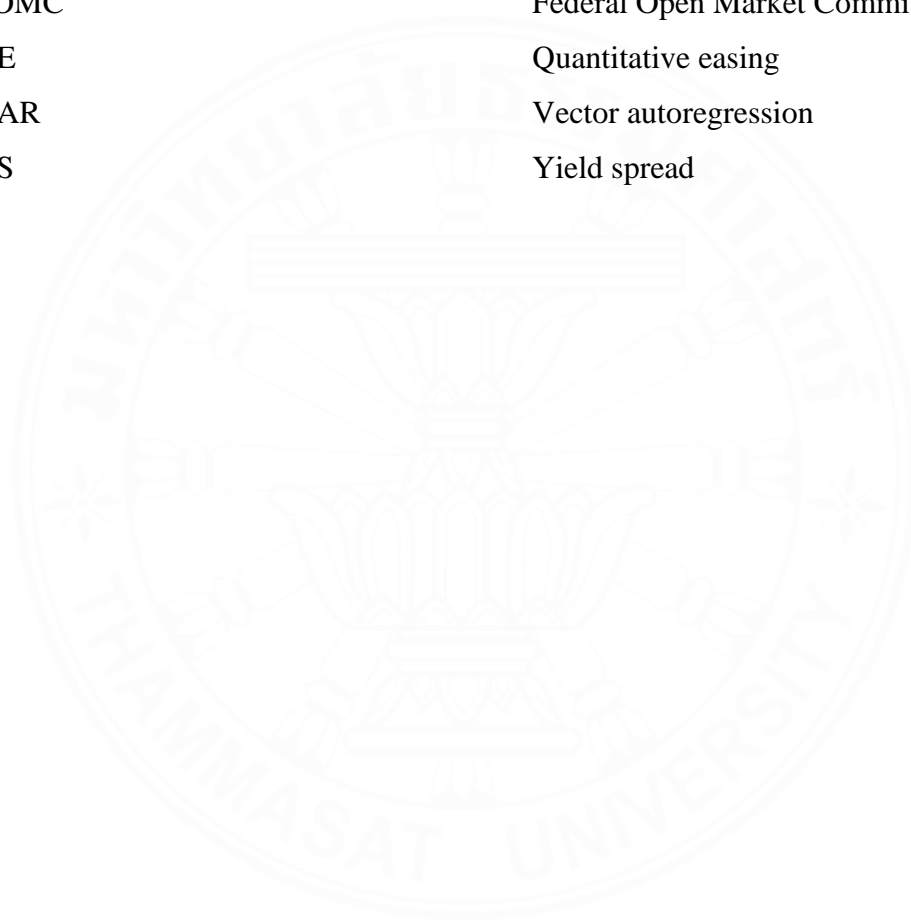


## LIST OF FIGURES

Figures	Page
2.1 The Yield Spread of 10-Year and 2-Year Treasury Yield - The U.S.	6
2.2 U.S. Bank Loan and Corporate Bond Outstanding	8
2.3 Interest Rate Spread (%)	9
2.4 U.S. Bank Loan and Bank Earning Index	9
2.5 Bank Loan Outstanding (\$ Billions) – ASEAN	10
2.6 Corporate Bond Outstanding (\$ Billions) – ASEAN	11
2.7 Singapore Bank Loan and Corporate Bond Outstanding	12
2.8 Singapore Bank Loan and Bank Earning Index	12
2.9 Vietnam Bank Loan and Corporate Bond Outstanding	14
2.10 Vietnam Bank Loan and Bank Earning Index	14
3.1 The Yield Spread of 10-Year and 2-Year Treasury Yield - The U.S.	18
3.2 The Yield Spread of 10-Year and 2-Year Treasury Yield - Singapore	18
3.3 The Yield Spread of 10-Year and 2-Year Treasury Yield - Vietnam	19
3.4 The variable trend during January 2012 – January 2023	20
4.1 Accumulated impulse response function of $\Delta YS_t^i$ and $\Delta BI_t^i$ to shock 1 ( $\Delta YS_t^{US}$ )	29
4.2 Accumulated impulse response function of $\Delta YS_t^i$ and $\Delta BI_t^i$ to shock 2 ( $\Delta YS_t^i$ )	30
4.3 Accumulated impulse response function of all variables.	31
4.4 Variance decomposition	32

## LIST OF ABBREVIATIONS

<b>Symbols/Abbreviations</b>	<b>Terms</b>
BI	Bank index
Fed	Central bank of U.S.
FOMC	Federal Open Market Committee
QE	Quantitative easing
VAR	Vector autoregression
YS	Yield spread



## **CHAPTER 1**

### **INTRODUCTION**

Monetary policy is a tool of a central bank to control the economy to achieve targeted economic growth, inflation level, or price stability. One common tool is the policy rate. In 2008, the U.S. market faced the subprime crisis. The central bank of the U.S. implemented the unconventional monetary policy which is a large-scale asset purchases program called quantitative easing (QE). Fed increased their assets by buying mortgage-backed securities to support the U.S. economy. The long-term interest rate was dropped from the Fed's action. The policy surprises announcements during 2008-2011 by Fed had a significant impact on treasury bond yield and corporate bond yield (Wright, 2012). Most existing studies use treasury yield or policy rate represent the monetary policy. Weale and Wieladek (2022) found that QE policy has a statistically significant to corporate yield and stock volatility. They use the 2-year treasury yield representing conventional monetary policy and the shadow rate representing QE policy.

Chen et al. (2016) also studied the QE impact but used a reduction of the U.S. yield spread and corporate bond spread measuring QE policy. Besides domestic impact, the QE policy had a spillover of global equity prices as well as emerging markets in Asia. This is consistent with Anaya et al. (2017), who found that the U.S. unconventional monetary policy influences capital flows to the emerging market. Thus, it is essential to understand the impact of U.S. policy implementation. In this study, I will use the U.S. yield spread as an explanatory variable to examine its impact across the ASEAN market by focusing on Singapore and Vietnam markets. Singapore is one of the banking hub countries with the largest US\$ loan outstanding among ASEAN. Whereas Vietnam is a key trading partner of the U.S. and has the biggest exporting trade values to U.S. among ASEAN. These two countries highly have relation to the U.S. market but in a different way, so I would like to begin the study from Singapore and Vietnam markets. The U.S. yield spread in this study is the difference between a 10-year government bond yield and a 2-year government bond yield representing the characteristic of the government bond market from January 2012 to January 2023, which covers the QE period of the Covid-19 pandemic.

During the period study, we found a contemporaneous effect between the U.S. interest rate and the Singapore interest rate. The government yields spread changes in Singapore are influenced by the U.S. interest rate changes. Consistent with Chen et al. (2016) who found that the U.S. corporate spread had positive impulse on Singapore's monetary policy indicator. The contemporaneous effect does not exist in Vietnam's interest rate. Also, the pattern of Vietnam yield spread depends on Vietnamese economy and their government policy which does not relate to the U.S. spread even the lagged 4 months coefficient seems significant, but it is likely to be a spurious relationship. However, Anwar and Nguyen (2018) implied that the fluctuation of the Federal fund rate has a significant impact on the short-term interest rate of Vietnam in the long-term horizon.

Period Covid-19 spread worldwide in 2020, the world economies and financial markets fell due to uncertainty and unpredictable situations. Besides the policy rate being decreased to near zero bound, the central bank of the U.S. had implemented a large QE. To release stress from the huge economic activity contraction, the Fed doubled its balance sheet and expanded its purchased scope covering exchange-traded funds, that has a stronger impact on the stock market than the previous QE of the 2008 financial crisis. Putnins (2022) revealed the strong relationship between Fed's balance sheet and the stock market. The consequence of this QE action is a sharp rise in the inflation level.

From QE policy, the long-term securities yields were pressed downward due to demand increasing, and money in the system increased consequently. This relates to the banking industry as banks will have more liquidity and a low cost of money to lend to the business sector and household sector. However, the U.S. yield spread changes do not relate to the bank index return in both Singapore and Vietnam markets. During the low-interest rate period, the bank sector could not have superior profit but had more risk-taking, Whited et al. (2021). The earnings of a bank tend to depend on the net interest margin and loan amount. Nevertheless, the inverse yield spread may be significant to the equity market because of the recession prediction indicator.

The abundant money in the system leads to an increase in inflation-level concerns. The Fed decided to increase the Federal fund rate at the beginning of the year 2022 and continuously increase it to control the inflation level. The policy rate

increment affects the yield spread between long-term and short-term government bonds to be smaller and may turn inverse if the short-term yield is raised to reach a higher level than the long-term yield. The inverse yield spread contains the information to predict economic recession (Bauer and Mertens, 2018). The too-fast action of the contraction policy may lead to recession economic occurrence because of declining consumption. In April 2022, the inverse yield curve was observed. The 2-year U.S. government bond yield was higher than the 10-year government bond yield. I added the dummy variables in the structure vector autoregressive model during the inversion spread month but those are insignificant statistically for both Singapore and Vietnam. The impact of inverse spread may take time to reveal its effect on the bank sector. We have just seen the case of some U.S. banks failing from huge losses due to debt securities sold in March 2023. That is almost one year after the first time of inversion.

This study aimed to examine the impact of the U.S. yield spread across the yield spread and bank sector index of ASEAN using a structure vector autoregressive model with monthly data from January 2012 to January 2023. The model is chosen to evaluate how U.S. spreads affect local spreads and then on the equity banking sector index. The limitation is that the study cover only Singapore and Vietnam. The choice of these two countries is to highlight two very different banking exposures. As an Asian international financial hub, Singapore banks are bound to be more exposed to US interest rate changes whereas Vietnamese banks would have more local exposure. In comparison, each country has different economic relations with the U.S. and has its own policy, the response to the U.S. yield spread changes should differ. The study finds firstly, the government yield pattern of Singapore is dominated by the U.S. market whereas Vietnam has a weaker correlation. Secondly, the bank performance of both Singapore and Vietnam do not causality by the U.S. spread but bank earnings would depend on its net interest margin and bank loan amount. Thirdly, U.S. spread inversion has no immediate impact on both Singapore and Vietnam markets.

The study contains details as follows. Chapter 2 contains a review of literature and market background. The data description and research methodology are explained in chapter 3. The results of structure vector autoregressive model regression are shown in chapter 4. Chapter 5 is the conclusion.

## **CHAPTER 2**

### **REVIEW OF LITERATURE AND MARKET BACKGROUND**

#### **2.1 Prior US monetary policy and effectiveness**

Generally, the Federal Open Market Committee (FOMC) set targeted Federal fund rates as monetary policy tools for maximum employment and price stability goals. The Federal funds rate is an overnight rate that a bank receives from lending excess reserves to another bank. Once the FOMC targets to stimulate the economy by setting the Federal funds rate lower, they will decrease the interest rate on reserve balances, overnight reverse repurchases rate, and the discount rate, which are conventional monetary tools. Then, the bank can borrow the reserves from another bank at a low-interest rate which means that gets a lower cost of money, consequently influencing corporate loan rate, personal loan rate, bond yield, stock market, and other economic activities. The quantitative easing policy of the Fed in 2008 had an impact on the long-term interest rate of both treasury yield and corporate yield (Wright, 2012). However, there is no statistic significant that the impact of QE is different on the bond spread and stock market volatility compared to the conventional policy (Weale and Wieladek, 2022).

At the beginning of the Covid-19 pandemic period, FOMC suddenly decreased the Federal fund rate and strongly intervened in the market by purchasing huge amounts of securities including corporate ETFs for supporting credit to households and businesses. Putnins (2022) showed that these actions have an impact on bond yields and future economic expectations which consequently impact the stock market. As the inflation level elevates but is targeted at 2%, FOMC announced increases in the Fed fund rate and reduced holding the Treasury securities, agency securities, and agency mortgage-backed securities in March 2022. The money security market is affected. The yield of a 10-year treasury bond and a 2-year treasury bond was closer.

## 2.2 Yield spread

During the financial crisis period of the U.S. when the short-term interest rate is close to zero, Fed cannot use only conventional policy to boost the economy. They launched the quantitative easing program to increase liquidity in their economy. Once QE is implemented, the demand for long-maturity securities rises, the yield spread between the short-term securities and the long-term securities will be narrowed. The increased money supply drops the cost of money. The bank had liquidity with a lower cost of money to lend to the market. This is like an increase in the bond demand, the bond price rises but the bond yield goes down, that is interest rate decreases resulting in growth in economic activities and stock price. Monetary policy has an impact on the yield curve.

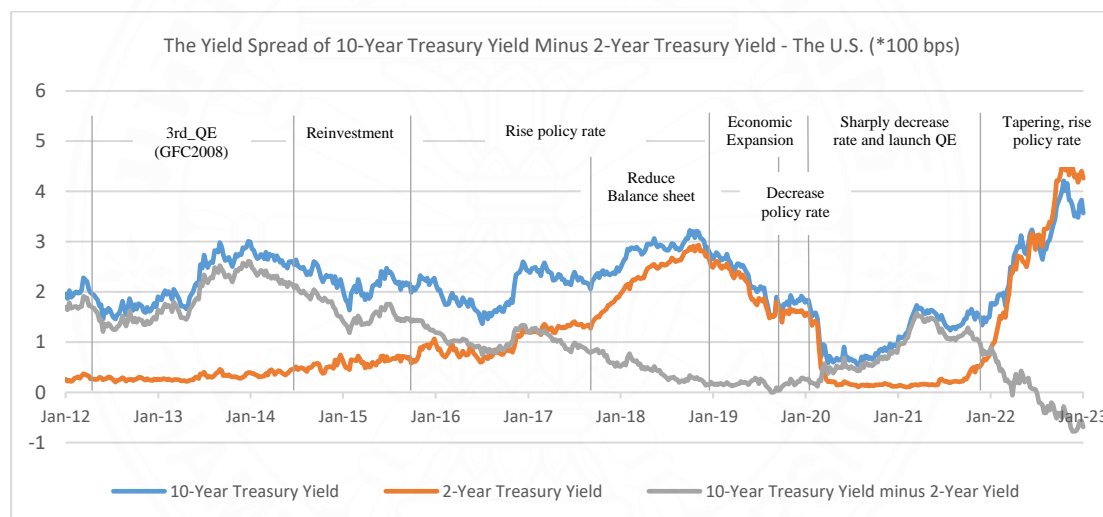
Generally, the longer-maturity bond yield should have a higher yield than the shorter-maturity bond yield because the bondholder compensates for the uncertainty risk of longer period holding. Another reason is the bondholder traded off with the chance to get a higher yield in the future. So, the yield curve which is a function of bond yield and maturity time is an upward slope curve. However, in history, there are some periods that the shorter-maturity bond has a higher yield than the longer-maturity bond when the central bank dramatically raises the short-term interest rate to slow down economic growth. At that time, the yield curve inverts. The inverse yield of 10-year and 2-year treasury yields is useful information for economic recession prediction, Bauer and Mertens (2018). Once the market realizes that the shorter-term securities give a higher yield than the longer-term securities, the market may foresee that a recession may occur, reallocating their investment portfolio and tightening their spending. The changes in yield spread reflect the economic environment in that period and the effort that the central bank tries to manage the economic situation.

From September 2012 to the end of 2014, the U.S. policy rate remained at zero bound level when Fed implemented the third QE buying mortgage-backed securities to support economic recovery since the great financial crisis in 2008. From Figure 2.1, the yield spread in this period was close to the yield of a 10-year treasury bond. In December 2015 – January 2019, the Fed raised the policy rate reflecting their improved economic situation, the spread was narrowed. In August 2019, the Fed

decreased the policy rate step by step to support economic expansion. Until February 2020, the Fed sharply decreased the Fed fund rate to zero bounds because of the sudden economic contraction from covid pandemic together with implementing a huge QE program. The spread was a bit larger and bank sector earnings were low at that time. After that, the Fed started decreasing the long-term securities holding in November 2021 and increasing the Fed fund rate in March 2022 to control the inflation level. As Figure 2.1, we can observe the inverse yield curve in April 2022 and August 2022.

Figure 2.1

*The Yield Spread of 10-Year and 2-Year Treasury Yield - The U.S.*



Source: Refinitiv United States Government Benchmark Bid Yield downloaded from Datastream.

### 2.3 Money market connectedness

In the 3-paned investment-saving/liquidity preference-money supply (IS/LM) model for an open economy, Mankiw (2016), explains the linkage of a local loanable funds market and foreign investment. In a market, the equilibrium in demand and supply is determined by price (real interest rate) and quantity. For an open economy equilibrium, the higher local real interest rate leads to higher local saving (higher loanable funds supply), lower domestic investment, and lower net foreign investment (lower loanable funds demand). The lower net foreign investment means that local

investor buys fewer foreign assets and foreigner buys more local assets. In other words, the investor would like to get a higher real interest rate, so there are fewer capital outflows from a local market and more capital inflows to the local market. In an open economy regime, the monetary policy announced by one country relating to interest rates can influence another country through interrelated activities.

The U.S. capital market size is the largest in the world. Investment from the U.S. is the biggest oversea portion of the ASEAN market (Lim Jock Hoi, 2022), and the two main investment industries are the financial and banking sector and the manufacturing sector. The U.S. economy and its monetary policy tend to impact the fund outflow from/inflow to the U.S. and consequently impact investment fund flow to ASEAN. In addition, US\$ is the currency for commodity traded goods quoted such as crude oil and gold. The appreciation or depreciation of US\$ against local ASEAN currency can impact the price in local countries. In sum, the monetary policy of the U.S. can impact to ASEAN economy.

The fixed-income security market of the U.S. is the largest size, counted as 38.7% of the total 126.9 trillion US\$, while Singapore's market size is 0.5% of the total (Kolchin et al., 2022). The changes in the U.S. fixed-income security yields tend to lead to changes in securities yields of small-open economy countries. As the U.S. market size is the largest, once the U.S. increase the interest rate or implements a tightening monetary policy, the capital will move from a lower-return market to a higher-return market because an investor seeks a higher return. The liquidity in the capital-outflow country will decrease and if the local-security issuer needs to raise the capital, the issuer must give an investor an increased return level.

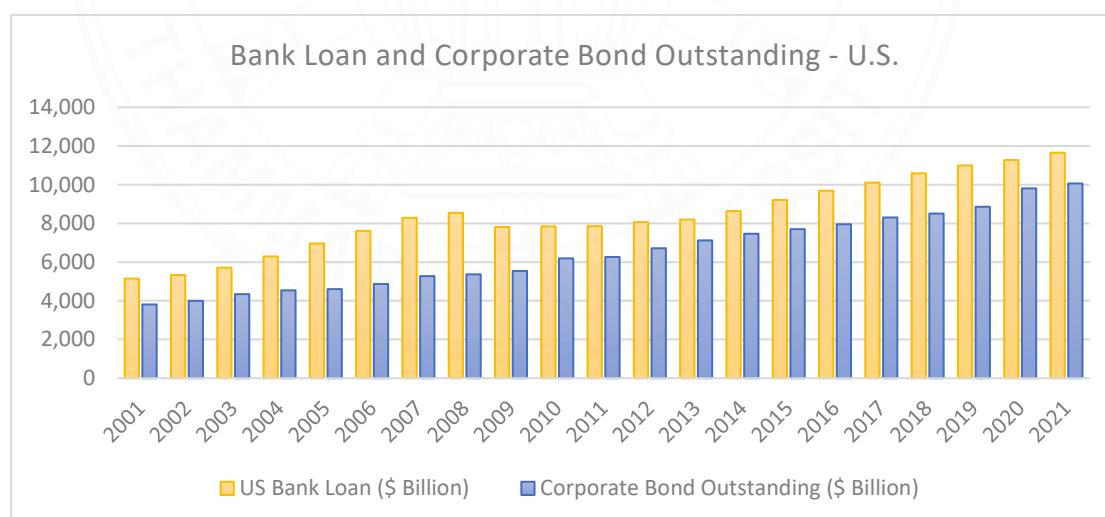
To raise funds from debt security, the corporate has a choice to borrow money from a bank or issue a corporate bond. In 2021, the corporate bond outstanding amount in the U.S. market is 10.06 trillion US\$ from the total 41 trillion US\$ of bond market worldwide, while the bank loan outstanding 11.65 trillion US\$ is an important source of loan for the household sector. The bank's interest rate is directly impacted by monetary policies as being an intermediary channel of policy transmission to the corporate and household sector. Whited et al. (2021) revealed that during the low-interest rate period, bank difficulty contributes profit because of a highly competitive market. Nevertheless, both lending rate and bond yield are influenced by monetary

policies. Figure 2.3 shows the risk premium of the lending rate of U.S. bank and interest rate spread of Singapore and Vietnam bank. The risk premium of U.S. bank has likely been stable since 2012 onward same as Singapore's interest rate spread, while the interest rate spread of Vietnam is more fluctuating. Observing from figure 2.2 that during 2006-2008, U.S. bank loans had accelerated growth, and the risk premium charged by banks was also higher than usual.

The growth of the bank loan amount and mostly stable bank interest spread should result in bank earnings increasing as shown in figure 2.4. However, the outside factor as the pandemic could impact earning bank projections that increased provision on credit losses and decreased bank earnings. Recently, since the Fed keep increasing interest rates since April 2022, the yield spread between the 10-year treasury yield and the 2-year treasury yield is inversed. The market foresees recession will occur and bank earnings may be impacted.

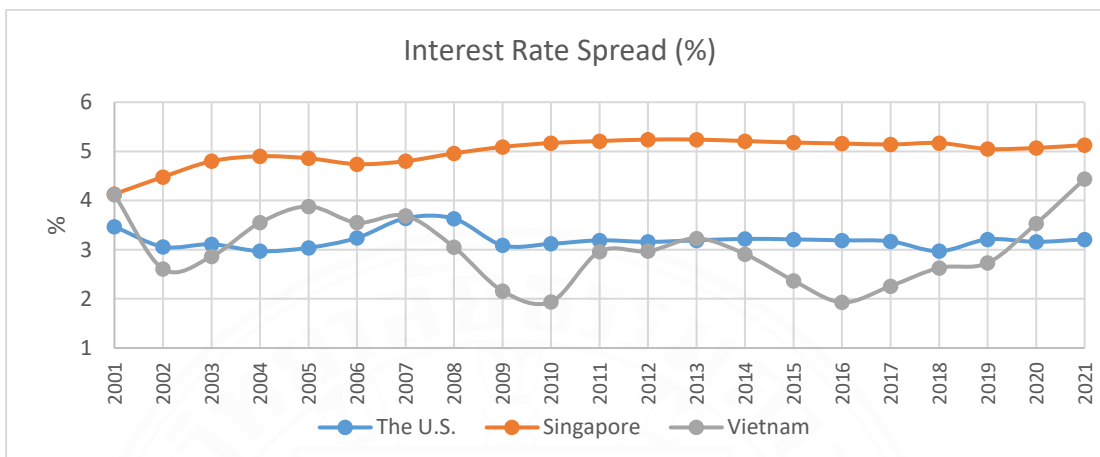
Figure 2.2

*U.S. Bank Loan and Corporate Bond Outstanding*



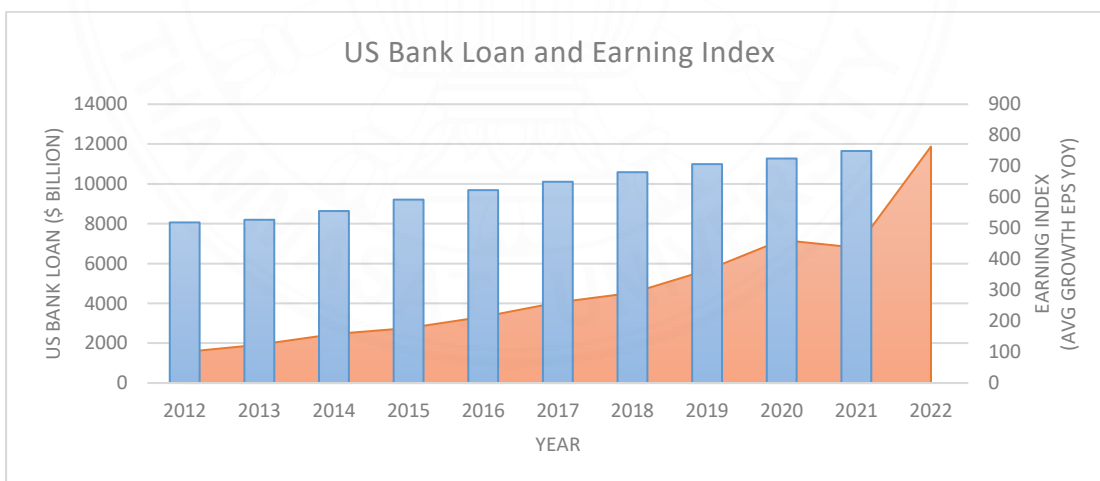
Source: Bank loan to private non-financial sector downloaded from BIS statistics. Corporate bond outstanding downloaded from SIFMA.

Figure 2.3

*Interest Rate Spread (%)*

Source: World Bank WDI, Singapore and Vietnam interest rate spread are lending rate minus deposit rate. U.S. interest rate spread is prime rate minus treasury bill rate.

Figure 2.4

*U.S. Bank Loan and Bank Earning Index*

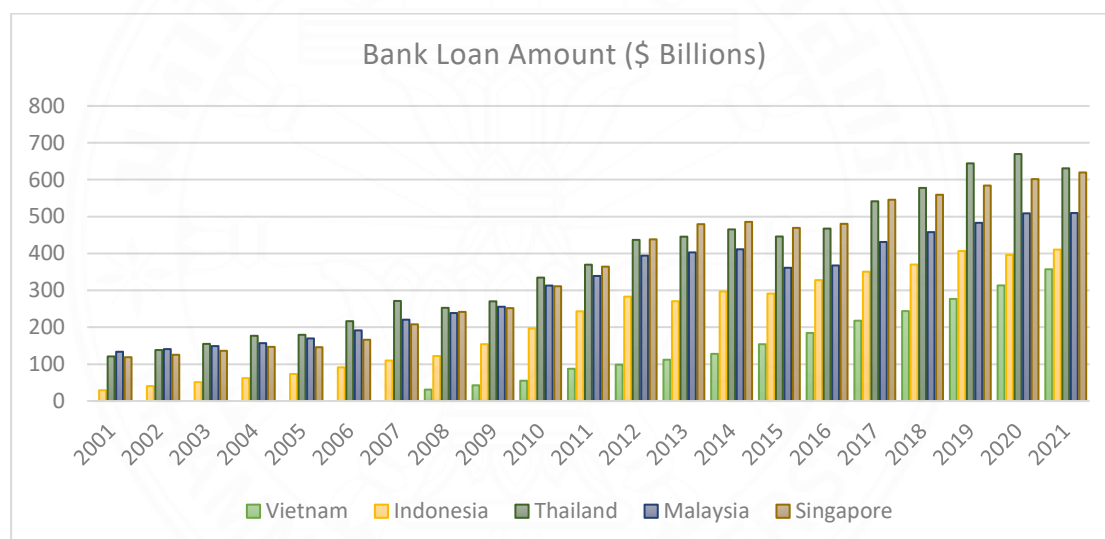
Source: Bank loan to private non-financial sector downloaded from BIS statistics. Earning index is calculated from average earning per share growth y-o-y by index equal to 100 in 2012.

## 2.4 ASEAN economy

The U.S. economy and the policy implemented do not affect only the U.S. market. Anwar and Nguyen (2018) found that the contraction of U.S Federal fund rate has a negative impact on the price level and short-term interest rate of Vietnam in the short run by employing the structure vector autoregressive model in studying the transmission into Vietnam.

Figure 2.5

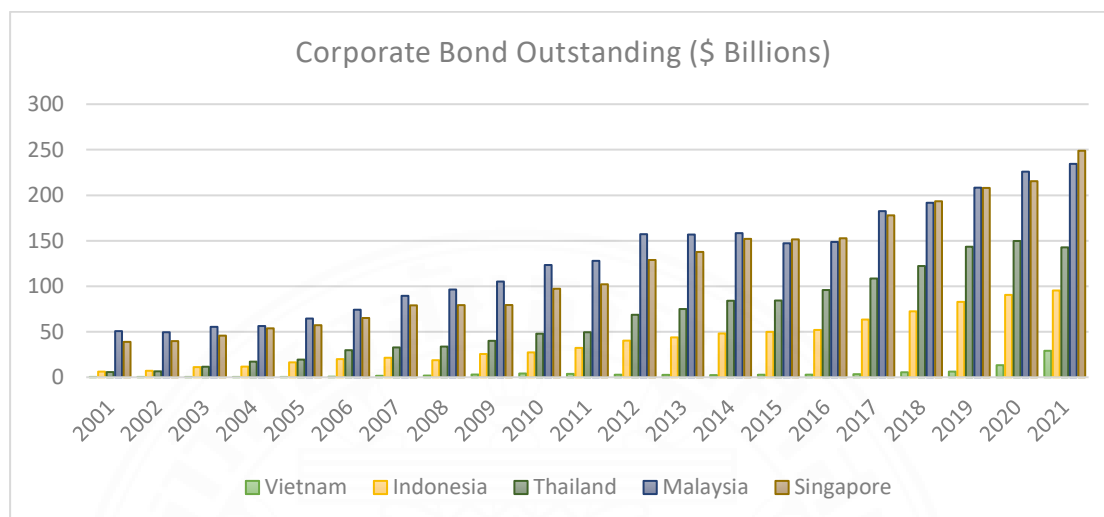
*Bank Loan Outstanding (\$ Billions) – ASEAN*



*Source: Bank loan to private non-financial sector downloaded from BIS statistics, except Vietnam. Vietnam bank loan is collected from financial statement each listed bank, 19 banks.*

Figure 2.5 shows an increasing trend of bank loans outstanding in key ASEAN countries. Singapore and Thailand have higher loan amounts than other countries. The significant loan growth is Vietnam market. Vietnam's economy is growing, and they have the highest exporting value to the U.S. among ASEAN countries nowadays.

Figure 2.6

*Corporate Bond Outstanding (\$ Billions) – ASEAN*

Source: Total corporate bond outstanding denominated in both local currency and foreign currency obtained from Asia Bond Online.

The ASEAN corporate bond market is smaller compared to the bank loan amount. Singapore and Malaysia have the highest corporate bond amount among the group, while Vietnam's corporate bond market is just developing, Figure 2.6.

#### 2.4.1 Singapore market

Singapore's banking industry consists of 6 local banks which the key local bank players are DBS, OCBC, and UOB, and 199 foreign banks which are separated by license types such as Wholesale Bank, Merchant Bank, Full Bank, and others. In addition, there are many financial institutions operating in Singapore such as Capital markets intermediaries, Financial advisory, Insurance, and Payments services. Singapore is the third largest financial center with very competitive market.

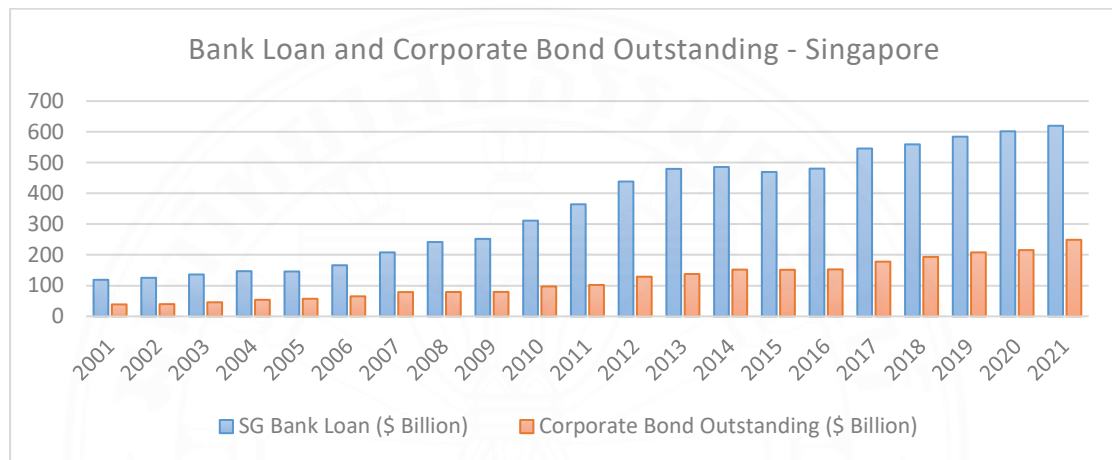
Singapore uses the exchange rate management policy to handle price stability. They apply the free funds flowing policy and fix the net effective exchange rate. Following the impossible trinity, Singapore cannot set the interest rate itself. Their interest rate should rely on the largest foreign interest rate to liquidity control in their system, so the interest rate movement of Singapore likely follows the interest rate of the U.S.

From Figure 2.7, the bond and loan amounts of Singapore have a growing trend. The corporate bond outstanding is lower than the bank loan amount

which is different from the U.S. market. While the interest rate spread stays at about 5%. Singapore bank earnings tend to increase over time. In Figure 2.8, we can observe that during the Covid pandemic, the banking sector earnings dropped.

Figure 2.7

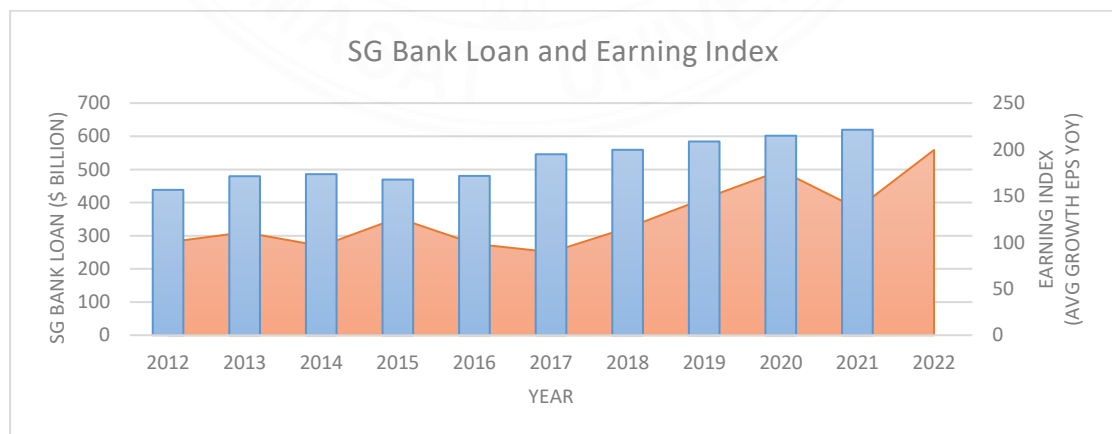
*Singapore Bank Loan and Corporate Bond Outstanding*



Source: Bank loan to private non-financial sector downloaded from BIS statistics. Corporate bond outstanding obtained from Asia Bond Online.

Figure 2.8

*Singapore Bank Loan and Bank Earning Index*



Source: Bank loan to private non-financial sector downloaded from BIS statistics. Earning index is calculated from average earning per share growth y-o-y by index equal to 100 in 2012.

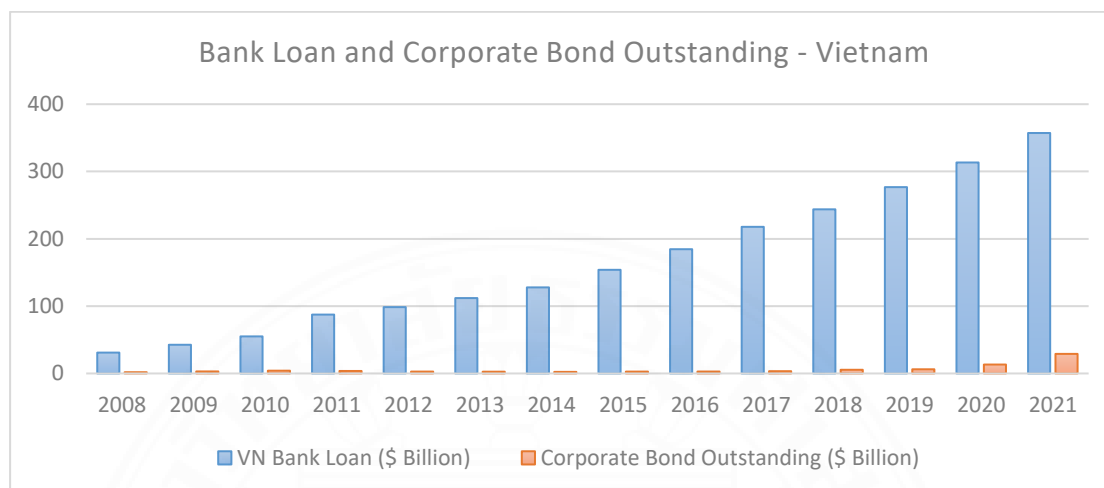
### 2.4.2 Vietnam market

Commercial bank in Vietnam has diverse type consisting of four State-Owned Commercial Banks, thirty-one Joint-Stock Commercial Banks, and nine Wholly Foreign Owned Banks. The three key players in terms of loan outstanding amounts in 2021 are the Joint Stock Commercial Bank for Investment and Development of Vietnam - BIDV, Vietnam Bank for Agriculture and Rural Development - Agribank, and Vietnam Joint Stock Commercial Bank of Industry and Trade – VietinBank. Vietnam’s government has an important role in the banking industry as Agribank is a state-owned bank and the State Bank of Vietnam also be the major shareholder of both BIDV and VietinBank.

Vietnam is one of the fastest-growing economies. Their economic expansion comes from the service sector, industry sector, and agriculture sector. Nowadays, Vietnam is a popular country for manufacturing base because of competitive labor costs with a growing young working population and developing new infrastructure to support foreign investment. Moreover, many firms would like to mitigate the risk of an unstable trade war between the U.S. and China. The banking industry of Vietnam is continuing growth. The bank loan amount has been rising as shown in Figure 2.9. However, the corporate bond market of Vietnam is relatively small compared to the bank loan size. The important credit provider to private firms is the banking channel.

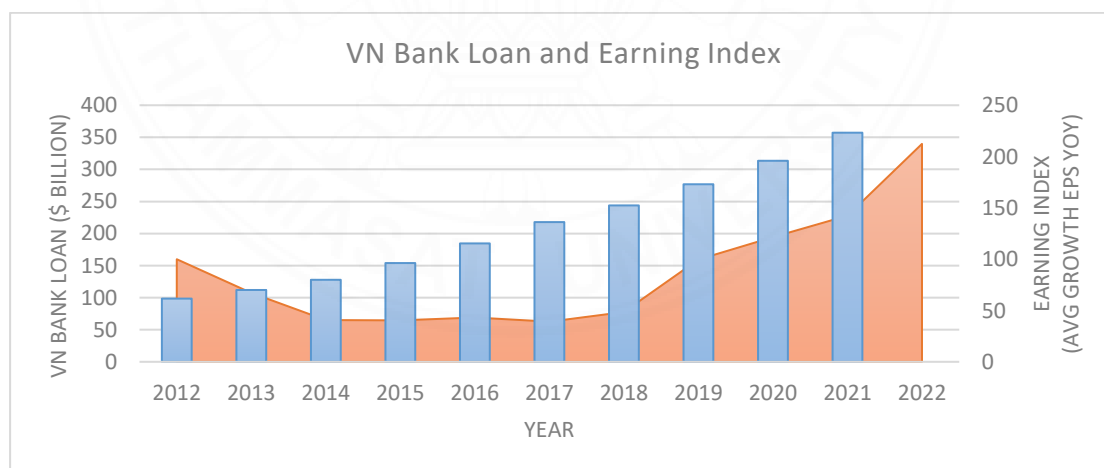
The interest rate spread of Vietnam’s bank is unstable unlike the U.S. bank and Singapore’s bank as Figure 2.3. However, the bank earning index shows accelerate growth since 2018, Figure 2.10.

Figure 2.9

*Vietnam Bank Loan and Corporate Bond Outstanding*

Source: Bank loan collected from financial statement of 19 listed banks. Corporate bond outstanding obtained from Asia Bond Online.

Figure 2.10

*Vietnam Bank Loan and Bank Earning Index*

Source: Bank loan collected from financial statement of 19 listed banks. Earning index is calculated from average earning per share growth y-o-y by index equal to 100 in 2012.

Besides impacting policy rates, the economic situation also impacts U.S. bank earnings as we observed during covid-19 pandemic. The bank price index is expected to sensitively reflect investor panic or expectations. I would like to study the

cross-country relationship between treasury bond yield spread changes and bank price index return focusing on the impact of U.S. treasury yield spread on ASEAN countries. My study will begin in Singapore and Vietnam. Singapore represents an advanced economy while Vietnam represents a developing economy. My study is finding the market connection using U.S. treasury yield spread and determining contemporaneous effect on ASEAN treasury yield spread and bank index return by employing the structure vector autoregressive model.

Hypothesis 1: The interest rate in a small-open economy country tends to be influenced by U.S. monetary policies. Singapore's monetary policy focuses on exchange rate management (Ong Chong Tee, 2013), their interest rate should be dominated by external interest rates. In addition, Singapore's economy has many foreign multinational companies with free capital flow policy. So, the Singapore treasury bond yield spread is expected to move following the U.S. bond spread. In terms of the bank sector index, the price index movement should depend on the economic situation and investor expectations. So, when the spread is narrower, the bank index return should increase as an investor may expect the economy is growing up, and vice versa.

In Vietnam's case, their economy is developing and is the fastest growth in ASEAN. Vietnam's economic structure is different from Singapore's. Their banking industry has fast expansion and is dominated by the state of Vietnam. Vietnam's monetary policy is interest rate setting, so the treasury yield spread of Vietnam should depend on their economic environment and the government policy. In addition, the bond market size of Vietnam is very small, so the relationship between Vietnam treasury bond yield spread and Vietnam bank index return may lack.

Hypothesis 2: As covid-19 pandemic impacted the world, Fed decreased its policy rate led to a broader treasury bond yield spread. At that time, the bank index return of all economies should align declining due to uncertainty situation. Then Fed increase the policy rate sharply to cool down the inflation level, U.S. spread is narrower and turns inverse. As the inverse yield spread has predictive power on economic recession, the U.S. bank index return is expected to decrease in this case. We can observe the inverse yield curve of the Singapore market in the later few months, the bank index returns of Singapore maybe decline as well if an investor expects a recession economy. Vietnam's economy also faces inflation issues, the government may

increase the interest rate, and their treasury bond yield spread has a narrower trend like U.S. or Singapore pattern but some delay. The U.S. is a key trading partner of Vietnam with the highest exporting value to the U.S. in 2021 (World Bank). The recession foresaw in the U.S. may have a negative impact on the bank index return of Vietnam.



## CHAPTER 3

### DATA DESCRIPTION AND RESEARCH METHODOLOGY

#### 3.1 Data description

The study observes the effect of U.S. monetary policy by using the U.S. treasury yield spread of the 10-year treasury benchmark yield minus the 2-year treasury benchmark yield, whether has an impact on the yield spread and the banking sector index of Singapore and Vietnam. The observed period is from January 2012 to January 2023, a total of 133 observations, covering an easing period and tightening period of the U.S. economy and the covid-19 pandemic period in the world. All variables are time-series data in monthly frequency obtained from DataStream.

##### 3.1.1 Yield spread

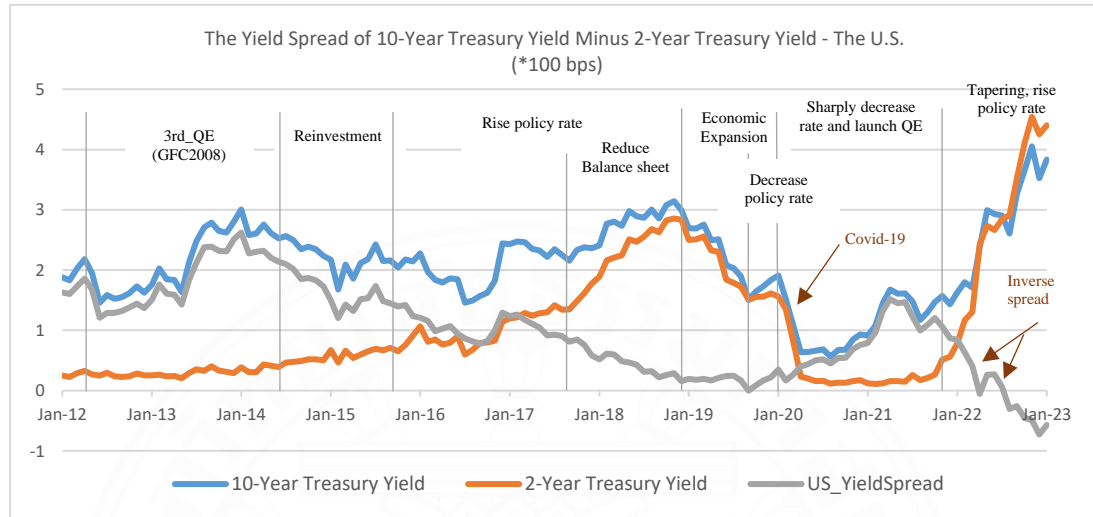
The yield spread of each country is calculated by the 10-year treasury benchmark yield minus the 2-year treasury benchmark yield. The yield spread of the U.S., Singapore, and Vietnam are shown in Figure 3.1, Figure 3.2, and Figure 3.3, respectively. The treasury yield spread pattern of the U.S. and Singapore are quite similar during the study period. While the pattern of Vietnam bond spread is different.

- **Period of inverse yield spread**

After covid-19 pandemic the Fed implemented huge QE resulting in the inflation level increasing. We can observe the narrowing treasury bond yield spread of the U.S. since the third quarter of 2021 that turns negative in April 2022 and again in August 2022. The treasury yield spread pattern of Singapore is quite similar to the U.S. The spread was narrower since the third quarter of 2021 as well but turns negative in December 2022. The spread of Vietnam treasury yields also had declined trend but the first quarter of 2022 and was very close to zero level in the first quarter of 2023. Even though the previous pattern seems unrelated to the U.S. spread, Vietnam is also facing a high inflation level, so they may increase the interest rate and result in an inverse bond yield spread in the near future.

Figure 3.1

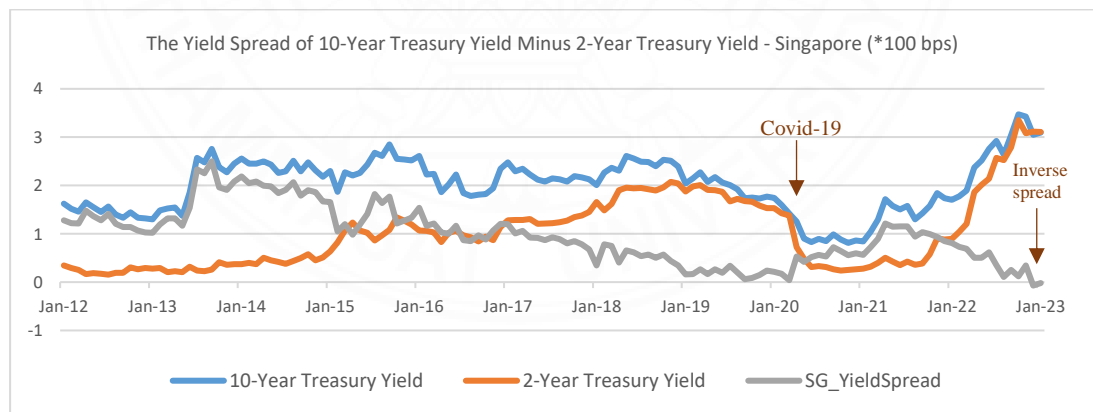
*The Yield Spread of 10-Year and 2-Year Treasury Yield - The U.S.*



Source: The U.S. government benchmark bid yield 10 years and 2 years are obtained from Refinitiv source.

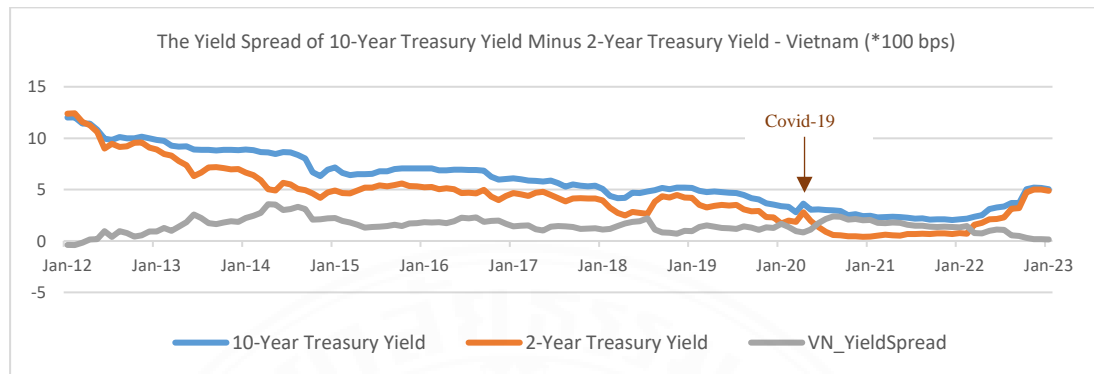
Figure 3.2

*The Yield Spread of 10-Year and 2-Year Treasury Yield - Singapore*



Source: Singapore government benchmark bid yield 10 years and 2 years obtains from Refinitiv source.

Figure 3.3

*The Yield Spread of 10-Year and 2-Year Treasury Yield - Vietnam*

Source: Vietnam government benchmark bid yield 10 years and 2 years obtains from Refinitiv source.

### 3.1.2 Banking sector price index return

The banking sector price index return of each country is the return of bank index at time  $t$  over time  $t-1$ , the equation is shown below,

$$\Delta BI_t^i = \left( \left[ \text{Bank Index}_t^i / \text{Bank Index}_{t-1}^i \right] - 1 \right) * 100$$

where  $i$  is country, Singapore (SG), and Vietnam (VN). (1)

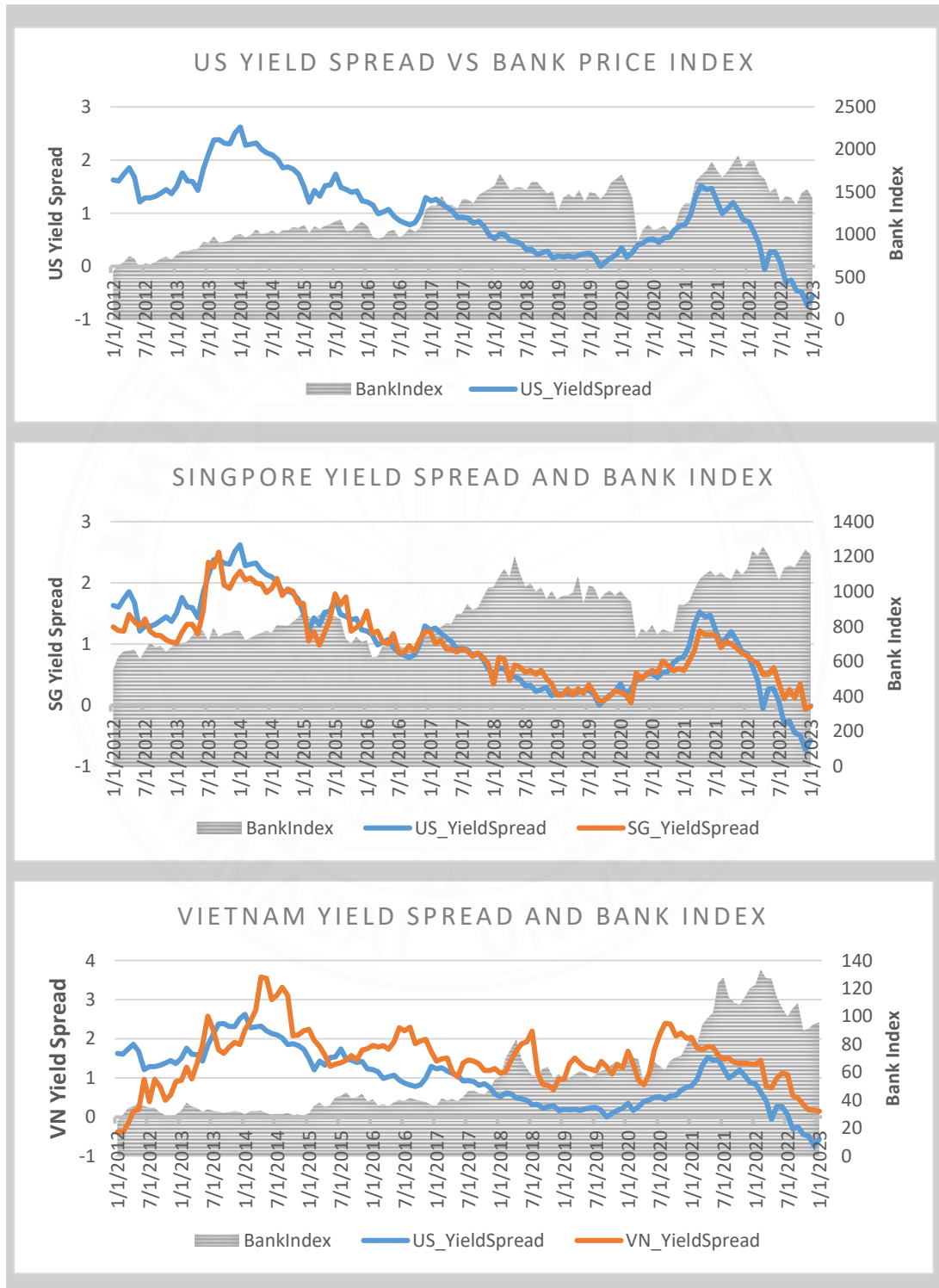
### 3.1.3 Data statistics

Table 3.1 shows the statistics of the data used. The average changes in the yield spread of the U.S. and Singapore have the same declining direction. Over the studied period the average yield spread between 10-year and 2-year yields is about declined monthly by 1.8 basis points for the U.S. spread and 1.1 basis points for Singapore spread. Whereas the average yield spread change of Vietnam is 0.4 basis points increased. Considering in terms of spread volatility, the U.S. and Singapore spread have less volatile than Vietnam spread. Comparing the bank index return which is calculated by equation (1), the monthly average bank index returns, and standard deviation of Vietnam variables are the highest while Singapore has the lowest.

The data trend of studied variables is shown in Figure 3.4.

Figure 3.4

The variable trend during January 2012 – January 2023



Source: The government benchmark bid yield 10 years and 2 years are obtained from Refinitiv source and bank indexes are obtained from Datastream.

Table 3.1 Data statistics in monthly frequency

	$\Delta YS_t^{US}$	$\Delta YS_t^{SG}$	$\Delta YS_t^{VN}$	$\Delta BI_t^{US}$	$\Delta BI_t^{SG}$	$\Delta BI_t^{VN}$
<b>COUNT</b>	133	133	133	133	133	133
<b>MEAN</b>	-0.0180	-0.0113	0.0041	1.0069	0.7021	1.3050
<b>STD</b>	0.1506	0.1926	0.2914	7.1993	5.6169	7.8719
<b>MIN</b>	-0.4660	-0.6100	-1.0750	-35.6793	-22.1391	-25.1520
<b>25%</b>	-0.0970	-0.1020	-0.1230	-3.6968	-2.3924	-3.3588
<b>50%</b>	-0.0140	-0.0300	0.0030	2.0285	1.0536	1.4200
<b>75%</b>	0.0580	0.1020	0.1390	5.1318	4.0273	5.5961
<b>MAX</b>	0.4060	0.7950	0.8440	19.8638	19.9951	22.3275

Note:  $\Delta YS_t^i$  is the monthly yield spread change of each country where yield spread is the difference between 10-year government yield and 2-year government yield of each country collect from Refinitiv.

$\Delta BI_t^i$  or Bank index return data are percentage monthly return of bank index each country.

The statistics cover Jan2012 – Jan2023.

### 3.1.3.1 Contemporaneous correlation

The contemporaneous correlation in Table 3.2 shows that the correlation between the yield spread change of the U.S. and Singapore has statistically significant. The bank index return of the U.S. has a significant correlation to the yield spread change of the U.S. and Singapore. The bank index returns of the U.S., Singapore, and Vietnam have significant contemporaneous correlation, that is probably because the local stock market is sensitive to the movement of the U.S. stock market.

### 3.1.3.2 Autocorrelation

Table 3.3 shows the autocorrelation of each variable and its lag period from lagged one month to lagged six months. The yield spread change and the bank index return of only Singapore country that have significant autocorrelation at lagged 1 month and lagged 3 months, respectively.

### 3.1.3.3 Cross-correlation

Cross-correlation is the relation between lag 0 to lag 6 months of the U.S. yield spread change to the yield spread change and the bank index return of Singapore and Vietnam. From Table 3.4, Singapore variables have strong cross-correlation with the U.S. yield spread change at lag 0. Vietnam yield spread change and Vietnam index return has the strongest cross-correlation, respectively, at lagged 4

months and lagged 3 months to the U.S. yield spread change. But cross-correlation at lagged 4 months is stronger than lagged 3 months.

Considering both autocorrelation and cross-correlation of variables, in the estimation structure vector autoregressive model, I will use lagged 4 months for the Vietnam equation and lagged 1 month for the Singapore equation.

Table 3.2 Contemporaneous correlation

<b>Correlation Probability</b>	$\Delta YS_t^{US}$	$\Delta YS_t^{SG}$	$\Delta YS_t^{VN}$	$\Delta BI_t^{US}$	$\Delta BI_t^{SG}$	$\Delta BI_t^{VN}$
$\Delta YS_t^{US}$	1.0000					
<i>p-value</i>	-----					
$\Delta YS_t^{SG}$	0.5506**	1.0000				
<i>p-value</i>	0.0000	-----				
$\Delta YS_t^{VN}$	0.0069	0.0129	1.0000			
<i>p-value</i>	0.9376	0.8827	-----			
$\Delta BI_t^{US}$	0.3474**	0.1835*	0.0107	1.0000		
<i>p-value</i>	0.0000	0.0345	0.9023	-----		
$\Delta BI_t^{SG}$	0.1002	-0.0038	-0.0056	0.6169**	1.0000	
<i>p-value</i>	0.2510	0.9657	0.9489	0.0000	-----	
$\Delta BI_t^{VN}$	0.0575	-0.0350	0.1538	0.4315**	0.3800**	1.0000
<i>p-value</i>	0.5109	0.6889	0.0771	0.0000	0.0000	-----

Note: \* is significant at 95% confidence level,

\*\* is significant at 99% confidence level

The correlation matrix between the yield spread changes each country and the bank index return each country. P-value is a statistical measure of the t-statistic for the null hypothesis that there is no statistically significant correlation.

Table 3.3 Autocorrelation

Autocorrelation	lag 1	lag 2	lag 3	lag 4	lag 5	lag 6
$\Delta YS_t^{US}$	0.120	-0.004	-0.074	0.193	0.037	0.088
<i>p-value</i>	0.161	0.374	0.437	0.095	0.151	0.163
$\Delta YS_t^{SG}$	-0.187*	0.060	-0.112	-0.040	0.043	0.063
<i>p-value</i>	0.029	0.073	0.073	0.126	0.190	0.237
$\Delta YS_t^{VN}$	0.072	-0.048	-0.098	-0.003	0.036	-0.105
<i>p-value</i>	0.403	0.604	0.507	0.676	0.776	0.669
$\Delta BI_t^{US}$	-0.068	-0.069	0.098	-0.057	-0.07	0.08
<i>p-value</i>	0.425	0.526	0.457	0.548	0.587	0.589
$\Delta BI_t^{SG}$	-0.234**	0.060*	0.064*	-0.024	0.105	-0.029
<i>p-value</i>	0.006	0.019	0.036	0.072	0.070	0.113
$\Delta BI_t^{VN}$	0.098	-0.087	-0.034	-0.024	-0.044	-0.029
<i>p-value</i>	0.254	0.312	0.477	0.632	0.724	0.813

Note: \* is significant at 95% confidence level,

\*\* is significant at 99% confidence level

The autocorrelation of each variable and its lag period from lag 1 to lag 6. P-value is a statistical measure of the Ljung-Box  $Q$ -statistic at lag for the null hypothesis that there is no autocorrelation up to order  $k$ , where  $k$  is number of lags.

Table 3.4 Cross-correlation

Cross-Correlation	lag 0	lag 1	lag 2	lag 3	lag 4	lag 5	lag 6
$\Delta YS_t^{SG}$	<b>0.5506</b>	0.1883	0.0062	-0.0766	0.0964	0.0514	0.0959
$\Delta YS_t^{VN}$	0.0069	0.0950	-0.0463	0.0240	<b>0.2198</b>	-0.0094	-0.0468
$\Delta BI_t^{SG}$	<b>0.1002</b>	-0.0280	0.0497	-0.0300	0.0219	-0.0250	0.0558
$\Delta BI_t^{VN}$	0.0575	0.0126	0.1315	<b>0.1330</b>	0.0526	-0.1247	0.0306

Note: Cross-correlation is the relation between lag 0 to lag 6 of the U.S. yield spread change and the yield spread change and the bank index return of Singapore and Vietnam.

### 3.2 Methodology

The data used in this study are monthly time-series data that caused variables to have stochastic properties. It is needed to check the stationery of all variables to prevent the spurious problem. By performing the unit root test, all yield spread, and bank index return variables are stationary at first different. The variables

are integrated of order 1 or I(1). In the estimated structure VAR model, all variables must be stationary, hence the variables in the equation are the yield spread changes and the bank index returns.

### 3.2.1 Structure vector autoregressive model

To study the impact of the U.S. treasury yield spread on Singapore and Vietnam spread and banking sector index, the assumption is that the U.S. spread which is reflected by monetary policies transmits the shock to small open economy countries. The small economy country that has inter-activities with the U.S. would be influenced by U.S. spread but have no reversion impact. The structural vector autoregressive model imposes the structure metric to determine the simultaneous effect of U.S. spread to local spread and local bank index return. The structural-form equation can be stated as  $AY_t = \Gamma_0 + \Gamma_1 Y_{t-1} + \varepsilon_t$ , where  $A$  is a 3x3 matrix of parameter structure,  $Y_t$  is a vector of endogenous variables and  $Y_{t-1}$  is a vector of lagged term,  $\Gamma_0$  and  $\Gamma_1$  are the matrices of coefficients,  $\varepsilon_t$  is a vector of innovations.

Matrix  $A$  imposed in the model to examine the impact from the U.S.

yield spread on local variables is  $\begin{bmatrix} 1 & 0 & 0 \\ \cdot & 1 & 0 \\ \cdot & \cdot & 1 \end{bmatrix}$ . For example, the equation for studying

Singapore market with lag 1 term can be stated as equation 2.

$$\begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix} \begin{bmatrix} \Delta YS_t^{US} \\ \Delta YS_t^i \\ \Delta BI_t^i \end{bmatrix} = \begin{bmatrix} \gamma_{10} \\ \gamma_{20} \\ \gamma_{30} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} \end{bmatrix} \begin{bmatrix} \Delta YS_{t-1}^{US} \\ \Delta YS_{t-1}^i \\ \Delta BI_{t-1}^i \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} \quad (2)$$

$$\Delta YS_t^{US} = \gamma_{10} + \gamma_{11} \Delta YS_{t-1}^{US} + \gamma_{12} \Delta YS_{t-1}^i + \gamma_{13} \Delta BI_{t-1}^i + \varepsilon_{1t} \quad (2.1)$$

$$\Delta YS_t^i + a_{21} \Delta YS_t^{US} = \gamma_{20} + \gamma_{21} \Delta YS_{t-1}^{US} + \gamma_{22} \Delta YS_{t-1}^i + \gamma_{23} \Delta BI_{t-1}^i + \varepsilon_{2t} \quad (2.2)$$

$$\Delta BI_t^i + a_{31} \Delta YS_t^{US} + a_{32} \Delta YS_t^i = \gamma_{30} + \gamma_{31} \Delta YS_{t-1}^{US} + \gamma_{32} \Delta YS_{t-1}^i + \gamma_{33} \Delta BI_{t-1}^i + \varepsilon_{3t} \quad (2.3)$$

where,  $\Delta YS_t^i$  is yield spread changes of local country  $i$

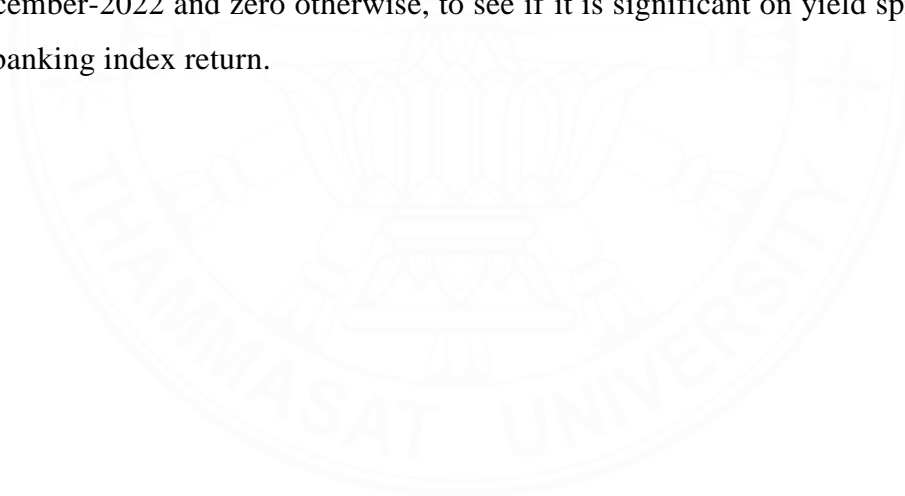
$\Delta BI_t^i$  is bank price index return of country  $i$

$i$  is SG for Singapore, VN for Vietnam

From equation (2), we can observe the contemporaneous impact of the U.S. spread on country  $i$  spread from coefficient  $a_{21}$ , and the impact on country  $i$  banking index return from coefficient  $a_{31}$ . The relation of variables in country  $i$  can be observed by coefficient  $a_{32}$ . In addition, the impact of each variable on other variables in the equation can be seen by accumulating impulse response function to compare the direction and magnitude of the shock in each country model.

### **3.2.2 Dummy variable of inverse yield spread period**

The inverse yield curve between 10-Year U.S. Treasury Yield and 2-Year Treasury Yield was observed in April 2022, and again in August 2022. I will add dummy variable to the base equation (2) to see the impact on the local yield spread and bank index return during the inverse yield curve month. Apr-dummy is equal to one in April-2022 and zero otherwise. Aug-dummy is equal to one in August-2022 and zero otherwise. Moreover, the yield spread of the Singapore market was also inverse in December 2022, so I will test the SG-dummy, which equals to one in December-2022 and zero otherwise, to see if it is significant on yield spread change or banking index return.



## CHAPTER 4

### RESULTS AND DISCUSSION

#### 4.1 Evidence from structure VAR model

##### 4.1.1 Structure matrix

From equation (2), the estimated matrix A of Singapore (Panel A) variables is as follows. The significant coefficient a<sub>21</sub> means that the yield spread changes of the U.S. have a contemporaneous impact on the yield spread change of Singapore. The 0.643 units of U.S. yield spread changes affect the Singapore yield spread changes at the same time.

Panel A: Singapore      Matrix A is 
$$\begin{bmatrix} 1.000 & 0 & 0 \\ -0.643^{**} & 1.000 & 0 \\ -5.253 & 2.527 & 1.000 \end{bmatrix}$$

Note: \*\* is significant at 99% confidence level

The structure matrix A of Vietnam (Panel B) variables is as follows. All coefficients are insignificant. There is no statistically significant contemporaneous effect from the U.S. spread changes to the yield spread change of Vietnam and bank index return over the period studied.

Panel B: Vietnam      Matrix A is 
$$\begin{bmatrix} 1.000 & 0 & 0 \\ 0.156 & 1.000 & 0 \\ -1.942 & -3.583 & 1.000 \end{bmatrix}$$

##### 4.1.2 Coefficient of VAR model

The coefficients of VAR model are shown in table 4.1, Panel A is the model of Singapore and Panel B is the model of Vietnam.

In Panel A, the yield spread changes of the U.S. and lag one month of both U.S. and Singapore spread changes have statistically significant explaining the current period changes of Singapore spread. However, the change in yield spread of the

U.S. and Singapore has no statistical impact on Singapore bank index return. Only autocorrelation is significant in the Singapore bank index return equation.

In Panel B, the lagged 4 months of U.S. yield spread change has positive causality to Vietnam yield spread change significantly. While the contemporaneous impact and lagged 1-3 months are insignificant. That could be a spurious relation as the link between them is weak and Vietnam's interest rate change is impacted by their economic factors. Vietnam yield spread change has an inverse significant impact on its bank index return at lag length 3.

For the U.S. yield spread change equations in both panels, there have no local variables statistically significant in the U.S. market which is in accordance with the theory.

Table 4.1 Coefficient of VAR baseline model

<b>Panel A: Singapore Equation</b>			
<b>Equation</b>	$\Delta YS_t^{SG}$	$\Delta BI_t^{SG}$	$\Delta YS_t^{US}$
$\Delta YS_{t-1}^{US}$	<b>0.547**</b>	-0.596	0.186
<i>t-stat</i>	4.365	-0.154	1.767
$\Delta YS_{t-1}^{SG}$	<b>-0.421**</b>	0.656	-0.090
<i>t-stat</i>	-4.344	0.219	-1.099
$\Delta BI_{t-1}^{SG}$	-0.001	<b>-0.233**</b>	-0.000
<i>t-stat</i>	-0.493	-2.703	-0.133
<b>Constant</b>	-0.003	0.916	-0.014
<i>t-stat</i>	-0.203	1.873	-1.043
<b>N</b>	132	132	132
<b>R_Square</b>	0.160	0.056	0.024
<b>F-Statistic</b>	8.136	2.529	1.050
<b>Log Likelihood</b>	42.120	-410.648	64.959
<b>Akaike AIC</b>	-0.578	6.283	-0.924
<b>Schwarz SC</b>	-0.490	6.370	-0.836

Note: \* is significant at 95% confidence level,  
\*\* is significant at 99% confidence level

Table 4.1 Coefficient of VAR baseline model (Cont.)

<b>Panel B: Vietnam Equation</b>			
<b>Equation</b>	$\Delta YS_t^{VN}$	$\Delta BI_t^{VN}$	$\Delta YS_t^{US}$
$\Delta YS_{t-1}^{US}$	0.244	0.962	0.133
<i>t-stat</i>	1.413	0.214	1.485
$\Delta YS_{t-2}^{US}$	-0.107	8.631	0.006
<i>t-stat</i>	-0.606	1.881	0.067
$\Delta YS_{t-3}^{US}$	0.021	4.410	-0.107
<i>t-stat</i>	0.117	0.951	-1.148
$\Delta YS_{t-4}^{US}$	<b>0.503**</b>	4.374	<b>0.253**</b>
<i>t-stat</i>	2.829	0.948	2.735
$\Delta YS_{t-1}^{VN}$	0.065	-4.004	-0.008
<i>t-stat</i>	0.722	-1.708	-0.176
$\Delta YS_{t-2}^{VN}$	-0.017	2.826	0.043
<i>t-stat</i>	-0.185	1.203	0.924
$\Delta YS_{t-3}^{VN}$	-0.155	<b>-5.363*</b>	-0.024
<i>t-stat</i>	-1.710	-2.278	-0.509
$\Delta YS_{t-4}^{VN}$	0.023	-3.388	0.057
<i>t-stat</i>	0.252	-1.420	1.197
$\Delta BI_{t-1}^{VN}$	-0.001	0.075	0.000
<i>t-stat</i>	-0.259	0.809	-0.043
$\Delta BI_{t-2}^{VN}$	-0.004	-0.142	-0.002
<i>t-stat</i>	-1.028	-1.580	-1.358
$\Delta BI_{t-3}^{VN}$	0.005	-0.006	0.000
<i>t-stat</i>	1.625	-0.066	0.206
$\Delta BI_{t-4}^{VN}$	0.001	0.018	-0.001
<i>t-stat</i>	0.382	0.198	-0.567
<b>Constant</b>	0.008	<b>1.485*</b>	-0.010
<i>t-stat</i>	0.292	2.068	-0.715
<b>N</b>	129	129	129
<b>R_Square</b>	0.116	0.139	0.095
<b>F-Statistic</b>	1.265	1.561	1.014
<b>Log Likelihood</b>	-16.659	-436.736	67.768
<b>Akaike AIC</b>	0.460	6.973	-0.849
<b>Schwarz SC</b>	0.748	7.261	-0.561

Note: \* is significant at 95% confidence level

\*\* is significant at 99% confidence level

The coefficient of VAR model in Panel A-Singapore and Panel B-Vietnam. The t-statistic is the test of statistically significant.

### 4.1.3 Accumulate impulse response function

Analysis of the impulse response function of Singapore yield spread changes and bank index return to the U.S. yield spread changes (Shock 1) is shown in Figure 4.1, Panel A. The accumulated impulse response shows that the positive shock of U.S. spread changes tends to follow by positive changes of Singapore spread changes. However, that shock has a very small impact and is insignificant to Singapore bank index return.

In Panel B, the accumulated impulse response shows that the shock of U.S. spread changes tends to follow by positive changes of both Vietnam spread changes and bank index return, even if those responses are insignificant.

Figure 4.1

*Accumulated impulse response function of  $\Delta YS_t^i$  and  $\Delta BI_t^i$  to shock 1 ( $\Delta YS_t^{US}$ )*

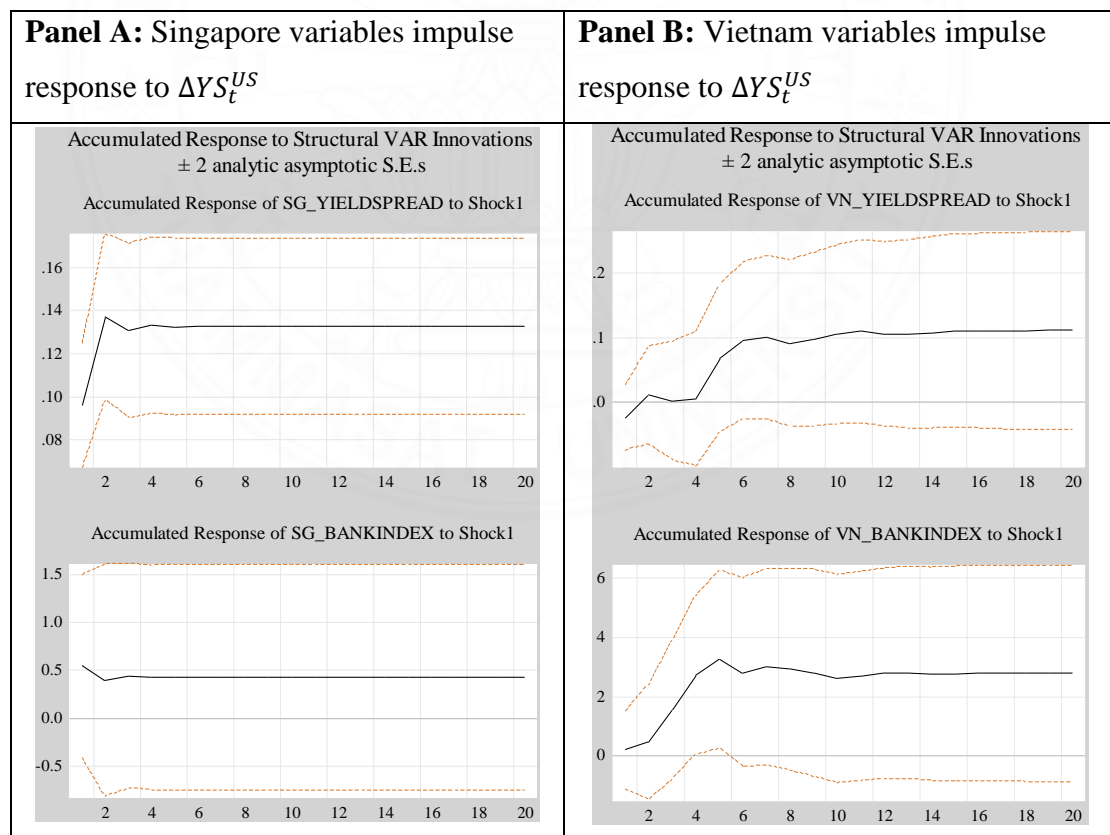
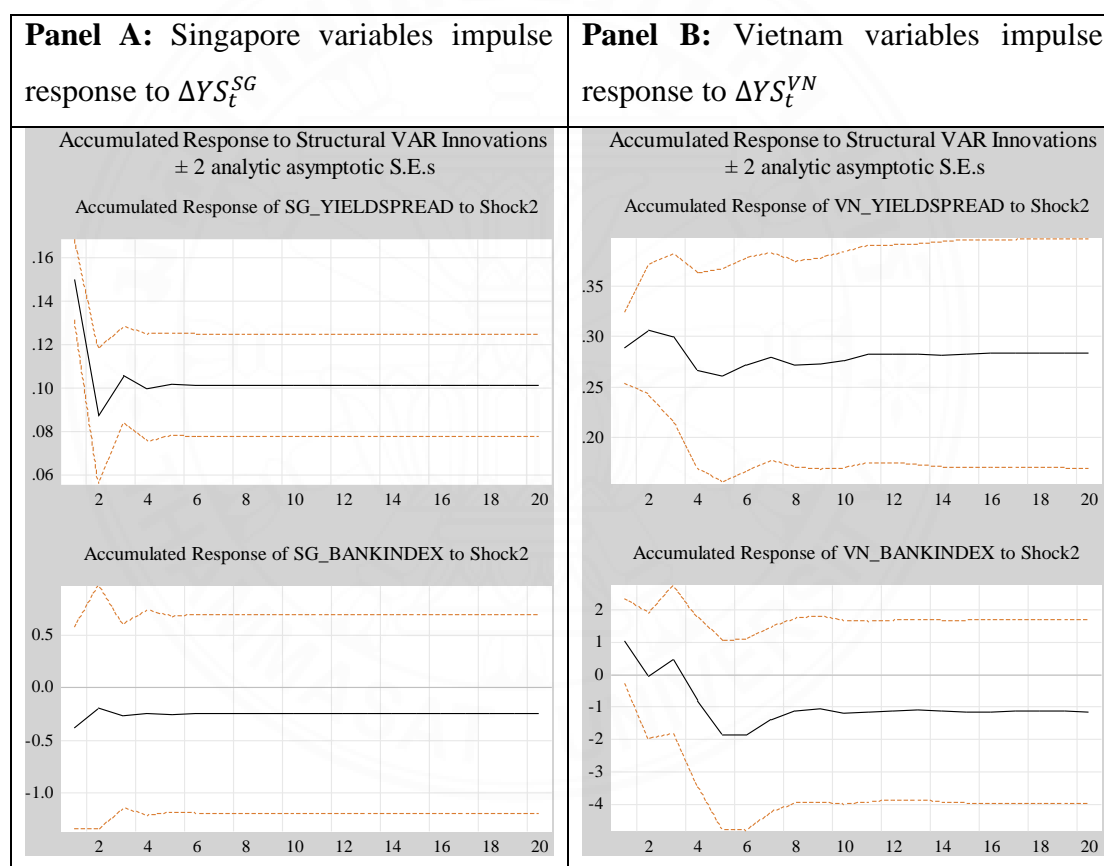


Figure 4.2 analyses the impulse response to the yield spread change of each local country. Panel A shows that Singapore bank index return tends to have a negative direction to Singapore yield spread changes, but insignificant.

The response of Vietnam bank index returns from the shock of Vietnam spread changes is negative direction but insignificant as well.

Figure 4.2

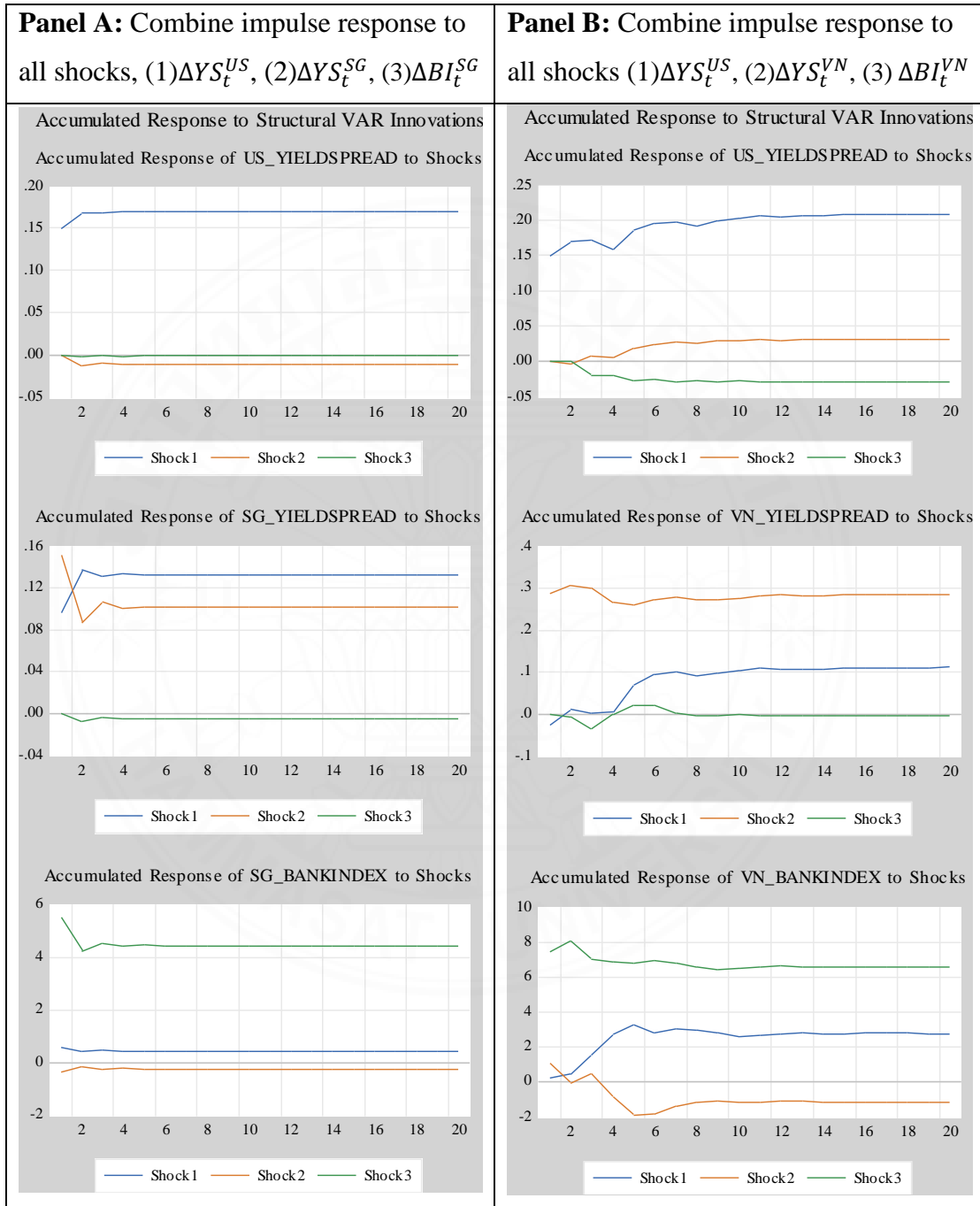
*Accumulated impulse response function of  $\Delta YS_t^i$  and  $\Delta BI_t^i$  to shock 2 ( $\Delta YS_t^i$ )*



Combining the accumulated impulse response function to all shocks in Figure 4.3, the shock of local variables is insignificant to the U.S. yield spread changes. The accumulated response to the U.S. yield spread changes in Singapore is stronger compared to Vietnamese case. While the bank index returns have the most response to itself in both panels.

Figure 4.3

Accumulated impulse response function of all variables

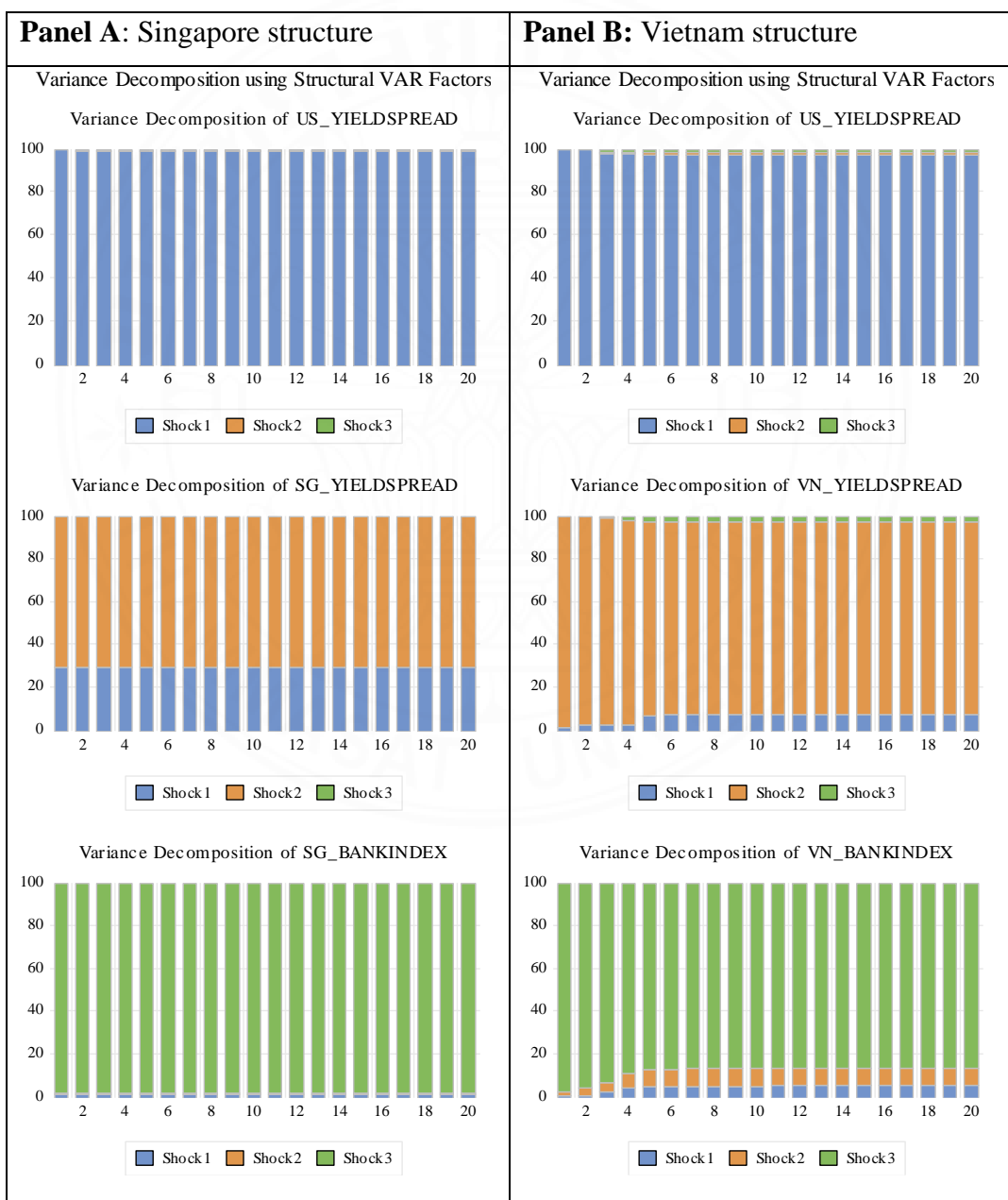


#### 4.1.4 Variance decomposition

The variance decomposition analyses in Figure 4.4 shows that the shock from the U.S. yield spread changes strongly impact Singapore yield spread

changes. The forecast error variance of Singapore spread changes by approximately one-third is influenced by the U.S. yield spread changes. Whereas only about 1% of U.S. yield spread changes influence the forecast error variance in Singapore bank index return, the U.S. yield spread has a weak impact on Singapore bank index.

Figure 4.4  
Variance decomposition



Note: Structure ordering is  $\Delta YS_t^{US}$ ,  $\Delta YS_t^i$  and  $\Delta BI_t^i$

In panel B, the forecast error variance decomposition of Vietnam spread changes is influenced by the U.S. yield spread changes of about 7%. While the Vietnam bank index return is likely dominated by the U.S. and local spread changes more than the Singapore case.

#### 4.1.5 Granger causality test/ Robustness check

Checking the robustness of employing structure vector autoregressive model about causation relationship between U.S. yield spread and local variables. Table 4.2, Panel A, shows that Singapore yield spread changes and bank index return are not causality to U.S. yield spread changes which aligns with the assumption that the yield spread, and bank index return of the small opened-economy market should not impact the U.S. yield spread. The test also shows that the U.S. yield spread changes highly influence Singapore spread change. This is reasonable as Singapore policy does not set the interest rate. Singapore uses the free flow of capital and exchange rate policy, so in order to liquidate the money in their economy, the interest rate cannot be set. However, there is no causality correlation between yield spreads to the bank index return of Singapore.

Table 4.2 Granger Causality Test

<b>Panel A: VAR Granger Causality of Singapore equation</b>				
<b>Dependent variable: <math>\Delta YS_t^{US}</math></b>				
Excluded	Chi-sq	df	Prob.	
$\Delta YS_t^{SG}$	1.2081	1	0.2717	
$\Delta BI_t^{SG}$	0.0178	1	0.8940	
All	1.2109	2	0.5458	
<b>Dependent variable: <math>\Delta YS_t^{SG}</math></b>				
Excluded	Chi-sq	df	Prob.	
$\Delta YS_t^{US}$	19.0492	1	0.0000	
$\Delta BI_t^{SG}$	0.2426	1	0.6224	
All	19.0537	2	0.0001	
<b>Dependent variable: <math>\Delta BI_t^{SG}</math></b>				
Excluded	Chi-sq	df	Prob.	
$\Delta YS_t^{US}$	0.0237	1	0.8777	
$\Delta YS_t^{SG}$	0.0479	1	0.8267	
All	0.0495	2	0.9756	

Table 4.2 Granger Causality Test (Cont.)

<b>Panel B: VAR Granger Causality of Vietnam equation</b>			
<b>Dependent variable: <math>\Delta YS_t^{US}</math></b>			
Excluded	Chi-sq	df	Prob.
$\Delta YS_t^{VN}$	2.2188	4	0.6956
$\Delta BI_t^{VN}$	2.0592	4	0.7249
All	3.7028	8	0.8829
<b>Dependent variable: <math>\Delta YS_t^{VN}</math></b>			
Excluded	Chi-sq	df	Prob.
$\Delta YS_t^{US}$	9.9197	4	0.0418
$\Delta BI_t^{VN}$	4.0532	4	0.3989
All	13.1123	8	0.1080
<b>Dependent variable: <math>\Delta BI_t^{VN}</math></b>			
Excluded	Chi-sq	df	Prob.
$\Delta YS_t^{US}$	6.3441	4	0.1749
$\Delta YS_t^{VN}$	10.9591	4	0.0270
All	16.6269	8	0.0342

Panel B shows the causation relationship of each equation between U.S. yield spread and Vietnam variables. Vietnam conditions are not causality to U.S. yield spread changes same as the Singapore case which is reasonable. The test also shows that Vietnam's spread change is impacted by the U.S.'s spread changes. And Vietnam bank index return is significantly causality by the changes of Vietnam yield spread.

#### 4.2 Evidence from dummy variable of inverse yield spread period

Dummy variables of inverse yield spread are added in model equation (2) to examine whether different impact exists on the month period that the inverse yield curve of 10-year and 2-year government yield occurs. Panel A of Table 4.3 is the coefficient of Singapore model. Both Panel A1 which is the coefficient of Singapore yield spread changes equation and Panel A2 which is the coefficient of Singapore bank index return equation show that it does not exist significance of any dummy variables. The variable used in this model is the yield spread changes which probably have no

meaning in the equation as the data covers the period of increasing and decreasing yield spread. Moreover, the effect from U.S. inverse yield curve may take some period to impact the bond market and bank stock index in other countries.

Singapore's yield curve was inverted in December 2022. The dummy added of inverse yield month in the Singapore equation does not have a significant impact on both Singapore stock index return, and Singapore yield spread changes.

Table 4.3 Coefficient of VAR model with dummy variables

<b>Panel A1: Singapore <math>\Delta YS_t^{SG}</math> Equation</b>			
<b>Equation</b>	<b>Apr-dummy</b>	<b>Aug-dummy</b>	<b>SG-dummy</b>
$\Delta YS_{t-1}^{US}$	<b>0.540**</b>	<b>0.539**</b>	<b>0.528**</b>
<i>t-stat</i>	4.256	4.316	4.222
$\Delta YS_{t-1}^{SG}$	<b>-0.419**</b>	<b>-0.431**</b>	<b>-0.398**</b>
<i>t-stat</i>	-4.296	-4.453	-4.094
$\Delta BI_{t-1}^{SG}$	-0.001	-0.002	-0.001
<i>t-stat</i>	-0.504	-0.647	-0.367
<b>Constant</b>	-0.003	-0.001	-0.001
<i>t-stat</i>	-0.171	-0.077	-0.082
<b>Apr-Dummy</b>	-0.077		
<i>t-stat</i>	-0.424		
<b>Aug-Dummy</b>		-0.258	
<i>t-stat</i>		-1.427	
<b>SG-Dummy</b>			-0.302
<i>t-stat</i>			-1.675
<b>R_Square</b>	0.161	0.173	0.178
<b>F-Statistic</b>	6.108	6.661	6.890
<b>Log Likelihood</b>	42.213	43.170	43.562
<b>Akaike AIC</b>	-0.564	-0.578	-0.584
<b>Schwarz SC</b>	-0.455	-0.469	-0.475

Note: \* is significant at 95% confidence level

\*\* is significant at 99% confidence level

Panel A1 is Singapore  $\Delta YS_t^{SG}$  equation, Panel A2 is Singapore  $\Delta BI_t^{SG}$  equation.

Panel B1 is Vietnam  $\Delta YS_t^{VN}$  equation, Panel B2 is Vietnam  $\Delta BI_t^{VN}$  equation.

Table 4.3 Coefficient of VAR model with dummy variables (Cont.)

<b>Panel A2: Singapore <math>\Delta BI_t^{SG}</math> Equation</b>			
<b>Equation</b>	<b>Apr-dummy</b>	<b>Aug-dummy</b>	<b>SG-dummy</b>
$\Delta YS_{t-1}^{US}$	-0.320	-0.477	-0.339
<i>t-stat</i>	-0.082	-0.123	-0.087
$\Delta YS_{t-1}^{SG}$	0.557	0.809	0.350
<i>t-stat</i>	0.185	0.269	0.115
$\Delta BI_{t-1}^{SG}$	<b>-0.232**</b>	<b>-0.226**</b>	<b>-0.238**</b>
<i>t-stat</i>	-2.677	-2.604	-2.744
<b>Constant</b>	0.896	0.885	0.890
<i>t-stat</i>	1.823	1.799	1.812
<b>Apr-Dummy</b>	2.981		
<i>t-stat</i>	0.532		
<b>Aug-Dummy</b>		3.989	
<i>t-stat</i>		0.709	
<b>SG-Dummy</b>			4.010
<i>t-stat</i>			0.714
<b>R_Square</b>	0.058	0.060	0.060
<b>F-Statistic</b>	1.956	2.015	2.017
<b>Log Likelihood</b>	-410.501	-410.387	-410.383
<b>Akaike AIC</b>	6.295	6.294	6.294
<b>Schwarz SC</b>	6.405	6.403	6.403

Note: \* is significant at 95% confidence level

\*\* is significant at 99% confidence level

Studying the impact of inverse U.S. yield spread month on the Vietnam market, the coefficient is shown in Panel B of Table 4.3. Those dummy variables are insignificant in both Apr-dummy and Aug-dummy and in both yields spread change equation and bank index return equation.

The inverse yield curve does not statistically impact the local variables in that period. However, the U.S. inverse yield curve has recession-predictive power. Therefore, there probably has a consequence impact in the future on other bond markets and the banking industry.

Table 4.3 Coefficient of VAR model with dummy variables (Cont.)

<b>Panel B</b>	<b>Panel B1: <math>\Delta YS_t^{VN}</math> Equation</b>		<b>Panel B2: <math>\Delta BI_t^{VN}</math> Equation</b>	
<b>Equation</b>	<b>Apr-dummy</b>	<b>Aug-dummy</b>	<b>Apr-dummy</b>	<b>Aug-dummy</b>
$\Delta YS_{t-1}^{US}$	0.255	0.224	0.946	1.516
<i>t-stat</i>	1.459	1.280	0.208	0.333
$\Delta YS_{t-2}^{US}$	-0.100	-0.108	8.620	8.646
<i>t-stat</i>	-0.562	-0.608	1.865	1.881
$\Delta YS_{t-3}^{US}$	0.020	0.060	4.411	3.339
<i>t-stat</i>	0.110	0.319	0.947	0.690
$\Delta YS_{t-4}^{US}$	<b>0.514**</b>	<b>0.460*</b>	4.357	5.574
<i>t-stat</i>	2.860	2.452	0.933	1.146
$\Delta YS_{t-1}^{VN}$	0.075	0.067	-4.018	-4.050
<i>t-stat</i>	0.806	0.738	-1.671	-1.724
$\Delta YS_{t-2}^{VN}$	-0.017	-0.019	2.827	2.877
<i>t-stat</i>	-0.192	-0.205	1.198	1.222
$\Delta YS_{t-3}^{VN}$	-0.156	-0.145	<b>-5.362*</b>	<b>-5.652*</b>
<i>t-stat</i>	-1.714	-1.573	-2.267	-2.368
$\Delta YS_{t-4}^{VN}$	0.026	0.019	-3.392	-3.286
<i>t-stat</i>	0.278	0.211	-1.414	-1.373
$\Delta BI_{t-1}^{VN}$	-0.001	-0.001	0.075	0.084
<i>t-stat</i>	-0.243	-0.343	0.804	0.895
$\Delta BI_{t-2}^{VN}$	-0.004	-0.004	-0.142	-0.142
<i>t-stat</i>	-1.079	-1.033	-1.558	-1.570
$\Delta BI_{t-3}^{VN}$	0.006	0.005	-0.006	0.008
<i>t-stat</i>	1.636	1.452	-0.067	0.085
$\Delta BI_{t-4}^{VN}$	0.001	0.001	0.018	0.017
<i>t-stat</i>	0.335	0.388	0.198	0.190
<b>Constant</b>	0.008	0.010	<b>1.485*</b>	<b>1.420*</b>
<i>t-stat</i>	0.276	0.373	2.059	1.962
<b>Apr-Dummy</b>	0.155		-0.225	
<i>t-stat</i>	0.503		-0.028	
<b>Aug-Dummy</b>		-0.240		6.674
<i>t-stat</i>		-0.738		0.790
<b>R_Square</b>	0.118	0.120	0.139	0.144
<b>F-Statistic</b>	1.179	1.205	1.429	1.485
<b>Log Likelihood</b>	-16.517	-16.354	-436.736	-436.387
<b>Akaike AIC</b>	0.473	0.471	6.988	6.983
<b>Schwarz SC</b>	0.783	0.781	7.299	7.293

Note: \* is significant at 95% confidence level,

\*\* is significant at 99% confidence level

## **CHAPTER 5**

### **CONCLUSION**

This study focuses on finding the contemporaneous effect or the lag impact of the U.S. yield spread changing on the ASEAN market. ASEAN countries selected for this study are Singapore which represents the developed market and Vietnam which represents the developing market. From the study, the yield spread changes in Singapore have positively highly correlated with the U.S. government bond yield spread. That is explained by the Singapore monetary policy which controls the exchange rate. Their bond yield pattern is quite similar to the U.S. pattern. In comparison, Vietnam has its own pattern and has no contemporaneous relationship with the U.S. yield spread changes. The lagged 4 months significance of the U.S. spread in Vietnam yield spread equation could be spurious due to lack of theory support.

The structure VAR model of bank index return in both Singapore and Vietnam has neither contemporaneous effect found nor significant lag relation to the U.S. yield spread changes. The study expects that the U.S. inverse yield curve could affect the bank index return but it does not. The dummy variables added during the inverse yield curve month show not statistically significant. However, the situation of some U.S. banks that failed (e.g., Silicon Valley Bank) just occurred in March 2023 due to huge losses from government bond selling. The U.S. inverse yield case takes many months to reveal its effect on the U.S. bank sector. Such that the impact on ASEAN probably delay, so it is meaningful to continue the study of the case of the U.S. bank failure and its effect on Singapore bank index which is one of the key financial hubs, and Vietnam bank index which is an emerging market and see how these markets react and how large the impacting scale. In addition, the ASEAN bank should analyze the reason for the U.S. bank's failed case to prevent the risk that might occur from the inverse yield curve.

## REFERENCES

- Anaya P., Hachula M., Offermanns C. J., (2017). Spillovers of U.S. unconventional monetary policy to emerging market: The role of capital flows. *Journal of International Money and Finance*, 73(2017), 275–295. <https://doi.org/10.1016/j.jimonfin.2017.02.008>
- Anwar, S. and L. P. Nguyen (2018). Channels of monetary policy transmission in Vietnam. *Journal of Policy Modeling*, 40(4), 709-729. <https://doi.org/10.1016/j.jpolmod.2018.02.004>
- Bauer M. D. and Mertens T. M., (2018). Information in the Yield Curve about Future Recessions. FRBSF Economic Letter 2018-20. <https://www.frbsf.org/wp-content/uploads/sites/4/el2018-20.pdf>
- Chen Q., Filardo A., He D., and Zhu F. (2016). Financial crisis, US unconventional monetary policy and international spillovers. *Journal of International Money and Finance*, 67(2016), 62–81. <https://doi.org/10.1016/j.jimonfin.2015.06.011>
- Kolchin K., Podziemska J., and Hadley D. (2022). *Capital Markets Fact Book*. Securities Industry and Financial Markets Association, Sifma. <https://www.sifma.org/resources/research/fact-book/>
- Lim Jock Hoi (2022). The ASEAN Secretariat. ASEAN Investment Report 2022, The Association of Southeast Asian Nations and United Nations Conference on Trade and Development. <https://asean.org/book/asean-investment-report-2022/>
- Mankiw, N. Gregory author. (2016). *Macroeconomics*. New York: Worth Publishers
- Ong Chong Tee (2013). An exchange-rate-centred monetary policy system: Singapore's experience. Bank for International Settlements, BIS Papers No. 73. <https://www.bis.org/publ/bppdf/bispap73.htm>
- Putniņš, T. J. (2022). Free markets to Fed markets: How modern monetary policy impacts equity markets. *Financial Analysts Journal*, 78(2), 35-36. <https://doi.org/10.1080/0015198X.2022.2029081>
- Weale M. and Wieladek T., (2022). Financial Effects of QE and Conventional Monetary Policy Compared. *Journal of International Money and Finance*, 127. <https://doi.org/10.1016/j.jimonfin.2022.102673>

- Whited T. M., Wu Y., and Xiao K., (2021). Low Interest Rates and Risk Incentives for Banks with Market Power. *Journal of Monetary Economics*, 121, 155–174. <https://doi.org/10.1016/j.jmoneco.2021.04.006>
- Wright J. H. (2012). What Does Monetary Policy Do to Long-Term Interest Rate at The Zero Lower Bound? *The Economic Journal*, 122, F447-F466. <https://doi.org/10.1111/j.1468-0297.2012.02556.x>



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