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Exploring Structural Breaks in the Economic-Financial Nexus: Evidence from Panel Data Analysis

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Abstract

This study investigates the response of panel data consisting of the ASEAN-5 stock market to selected macroeconomic variables from January 2012 to December 2022. Specifically, it analyzes industrial production, the consumer price index, money supply (M1), Treasury Bills, long-term interest rates, and exchange rates. Utilizing the panel data approach, this research identifies two recent crises: U.S. Stock Market Crashes and the COVID-19 pandemic. The panel regression analysis reveals that the ASEAN-5 stock market index is consistently influenced by two different sets of selected macroeconomic variables. The results from Panel I indicate that industrial production and Treasury Bills have a negative influence, the consumer price index has a positive influence, and there is a mixed effect for money supply across the two breaks. When considering the long-term interest rate in Panel II, the results suggest the same selected variables and directional influence as seen on Panel I affecting the ASEAN-5 stock market. These findings remain consistent even after detecting structural breaks and conducting diagnostic checks. They also align with the observation that markets in developed economies tend to be heightened responsiveness to crises and global conflicts.

Keywords: Panel Data, Structural Break, ASEAN-5, COVID-19, U.S. Stock Market Crashes

Introduction

Financial markets are complex systems influenced by various factors, such as economic indicators, geopolitical events, and investor sentiment. However, the most significant impact on financial markets often arises from extreme events, which are rare and unexpected occurrences that can disrupt economies and financial systems (Lettau & Ludvigson, 2001). These extreme events lead to structural changes in financial markets, altering the investment landscape and risk management strategies. In the current global economic environment, extreme events have become more frequent and defining, characterized by their suddenness, severity, and disruptive potential. These events, ranging from financial crises to natural disasters, have the power to reshape economic paths, challenge existing paradigms, and necessitate immediate policy responses.

The twenty-first century has been marked by a series of extreme events that have significantly impacted economies worldwide. Instances such as the worldwide economic downturn in 2008 and the COVID-19 outbreak in 2020, technological advancements, and concerns regarding climate change have highlighted the volatile nature of economic systems (Singh *et al.,* 2020; Zoungrana *et al.,* 2021). In response to these events, it is crucial to understand and effectively address their implications, especially in an era where economic stability and growth are of utmost. This study embarks on a comprehensive exploration of the responses of stock markets within the Association of Southeast Asian Nations (ASEAN-5) countries such as Indonesia, Malaysia, Philippines, Singapore, and Thailand to a range of extreme events in panel data. Extreme events in this context encompass financial crises, natural disasters, pandemics, and other pivotal occurrences that have marked turning points in the region's economic and financial history. The central objective is to discern the structural breaks in panel data that emerge within these stock markets during and after these events, shedding light on the mechanisms underlying their responses.

Structural breaks are fundamental in various fields such as econometrics, economics, and time series, panel data analysis due to their significant impact on modeling and forecasting. These breaks represent shifts in the underlying data-generating process, leading to changes in parameters, trends, or relationships within the data (Rapach & Strauss, 2008). Detecting structural breaks is essential for understanding the dynamics of the data and ensuring the accuracy of models used for analysis. In economics, structural breaks can indicate changes in economic policies, market conditions, or other external factors that influence economic variables (Hansen, 2001). For instance, the introduction of new monetary policies or changes in regulations can lead to structural breaks in economic time series data, affecting variables like inflation rates, unemployment levels, or productivity (Perez *et al*., 2016). Understanding and accounting for these breaks are crucial for policymakers and analysts to make informed decisions and predictions. In panel data analysis, structural breaks play a crucial role in understanding the dynamics of the data and ensuring the validity of the models used. Panel data often involve multiple cross-sectional units observed over time, making it essential to account for structural breaks that may affect different units differently or simultaneously (Pesaran, 2006). Structural breaks can impact panel unit-root tests, cointegration analysis, and parameter estimation in panel data models, leading to biased results if not appropriately addressed (Chen *et al.,* 2022). Detecting and incorporating structural breaks in panel data models are vital for various reasons. Firstly, structural breaks can introduce non-stationarity in the data, affecting the assumptions of many econometric models commonly used in panel

data analysis (Zhang *et al.,* 2021). Ignoring these breaks can lead to incorrect inferences and unreliable results. Secondly, structural breaks can reveal important changes in the underlying data-generating process, such as shifts in trends, relationships, or parameters across different units in the panel (Horváth *et al*., 2016). By identifying and accounting for these breaks, researchers can improve the accuracy and robustness of their analyses and can more accurately capture the evolving dynamics between stock market performance and macroeconomic factors.

Understanding the dynamics of structural breaks during extreme events is imperative for a multitude of reasons. It allows for a deeper comprehension of the impact of such events on financial markets, enabling investors, policymakers, and institutions to navigate challenges more effectively. By identifying the structural shifts in stock market panel data, the objective of this study is to offer important findings that can contribute to the development of investment strategies, risk management techniques, and policy regulations. The scope of this research centers on ASEAN-5, a region characterized by its economic diversity and interconnectedness. The stock markets in these countries have played pivotal roles in driving economic growth and attracting foreign investments. They have also been susceptible to external shocks, often exhibiting distinct responses to regional and global extreme events. The analytical framework employed in this study involves panel data analysis, a method well-suited to examine the collective behavior of stock markets across multiple countries and time periods. We will consider a wide range of stock market variables, including stock price indices and their interrelationships. Through this lens, we aim to uncover the structural breaks that correspond to extreme events, discern patterns in their timing and magnitude, and draw comparisons before and after break across the ASEAN-5 countries.

The findings of this research hold significant implications for investors seeking to adapt their strategies in the face of uncertainty, policymakers with the objective of enhancing financial stability, and financial institutions striving to enhance risk management practices. Moreover, this study contributes to the broader body of knowledge on financial market responses to extreme events, offering insights that can inform future research and foster a deeper understanding of the ever-evolving dynamics of global financial markets. This study also gives a methodological framework to detect structural breaks or changes in the analysis of panel data. As we embark on this exploration, we recognize that the economic landscapes of the ASEAN-5 countries are dynamic, influenced not only by domestic factors but also by a rapidly changing global environment. This study endeavors to unravel the intricate interactions between extreme events and structural breaks in economic model for panel data in stock market, ultimately contributing to a more resilient and adaptable financial ecosystem in the ASEAN-5 region and beyond.

Literature Review

Macroeconomic variables play a crucial role in understanding financial market behavior. Research has shown that traditional macroeconomic variables have limitations in predicting stock returns, prompting exploration into how expected returns vary with cyclical frequencies and macroeconomic variables (Fry-McKibbin & Zhu, 2021). Moreover, scholars and policymakers have shown interest in examining the interrelationship between macroeconomic indicators and stock market volatility (Pierdzioch *et al*., 2008). The investigation of the influence of macroeconomic uncertainty on the behaviour of stock

markets has been a central area of interest, as evidenced by research findings that suggest the persistence of volatility in both stock markets and macroeconomic factors (Abbas & Wang, 2020). Chia and Lim (2015), argue that investigating the correlation between stock prices and macroeconomic variables presents a feasible area of research. The Arbitrage Pricing Theory (APT) is commonly utilised in research examining the correlation between stock market performance and macroeconomic factors. According to Ross (1976), based on APT, the returns of financial assets can be completely explained by the interaction of multiple risk factors. Ali et al (2015), classified the research on stock market returns and macroeconomic variables into three categories: studies focused on industrialised nations, studies focused on developing countries, and studies focused on group countries. The researchers determined that the combination of results and conclusions arises from variations in research methods, variables employed, and the time frame of the investigation. Furthermore, the discrepancy in the study region has a profound impact on the behaviour of the macroeconomic variables.

Based on economic theories, it is posited that an expansion in the money supply leads to a corresponding augmentation in the aggregate buying power of the economy. The prices of securities are subject to the effect of market forces, whereby an increase in investor liquidity results in a heightened demand for securities, hence causing a subsequent rise in prices. In essence, a direct relationship exists between the money supply and stock values. The research conducted by Ibrahim and Aziz (2003), Sahu and Pandey (2018), Menike (2010), Godfrey (2021), Bhattacharjee and Das (2021), and Ramadan (2016), provides evidence for the existence of a positive association between the two variables.

The relationship between long-term inflation and stock prices remains ambiguous. As per the Fisher hypothesis, equity shares represent ownership in a company's tangible assets and therefore act as a safeguard against inflation. Fisher (1930), posited a theoretical framework positing a positive association between inflation and stock prices. Conversely, Fama (1981) proposed a negative correlation between inflation and stock prices. Fama (1981), posited that inflation has an adverse impact on actual economic activity, but real economic activity is positively correlated with stock prices. With an increase in inflation, there is a concomitant reduction in real economic activity, resulting in a loss in stock prices. Thus, it is logical to expect a clear and direct relationship between the money supply and the Indian stock market. In contrast, the Indian stock market can be influenced either positively or negatively by inflation.

Extensive study has been conducted on the correlation between exchange rates and stock prices. Based on the literature, export companies gain advantages from a decrease in the value of the currency in the country they are selling to, whereas importers are negatively affected by this devaluation (Pantzalis, 2004). Furthermore, the conventional methodology, suggested by Dornbusch and Fischer (1980), posits that the foreign exchange rate has an impact on stock prices, whereas the portfolio balance approach argues that the effect flows from stock prices to the foreign exchange rate. Therefore, based on the preceding explanation, we anticipate a correlation between the foreign exchange rate and the Indian stock market, which might be either positive or negative.
Classical economic theory posits an inverse relationship between the interest rate and stock values. When a country's central bank increases the bank rate, it results in higher borrowing

costs for financial institutions. As a result, financial institutions levy higher interest rates on the loans they extend to businesses. The enterprises are unable to borrow the desired amount, leading to a decline in overall capital investment in the economy. Decreased business expenditures result in decreased profits, which subsequently manifest in the firm's securities prices. Therefore, fluctuations in interest rates do not directly influence the decrease in stock prices. Instead, they diminish the earnings of companies and lower the anticipated dividends of investors. The inverse correlation between interest rates and stock prices has been established by several researchers. Maghayereh (2003), Menike (2006), Uddin and Alam (2010), Sirucek (2012), Aurangzeb (2012), and Bhattacharjee and Das (2021) have documented this link for Jordan, Sri Lanka, Bangladesh, the USA, Pakistan, and India, respectively. According to the theory and actual data, we anticipate a negative correlation between the interest rate and the Indian stock market.

Producers react to the decline in consumer spending by reducing their production. Consequently, a decrease in industrial production results in reduced profits and diminished expectations for dividends. Consequently, there is a decrease in demand for the securities, leading to a decline in pricing. On the other hand, a rise in consumer spending leads to a corresponding rise in production. Individuals increase their expenditure, leading to larger profits for businesses. Increased profitability will result in elevated dividend projections, hence enhancing the appeal of the securities. Hence, there exists a positive correlation between industrial production and the stock market. Based on the aforementioned idea, we anticipate a favourable correlation between domestic industrial production and the Indian stock market.

Methodology

Data and Variables

This research delves into examining how macroeconomic indicators influence the Stock Market Index (SMI) within the ASEAN-5 countries. The macroeconomic variables include industrial production (IP), consumer prices (CPI), money supply (M1), 3 months' treasury bills rates (TB), long-term interest rate (INT) and exchange rate (ER). The data on SMI are at a monthly frequency and cover the period from January 2012 to December 2022. Data on stock market index, industrial production, consumer prices, money supply long-term interest rate and exchange rates are sourced from the International Monetary Fund (IMF) Database (https://www.imf.org/en/Data), 3 months' treasury bills rates (TB) come from the official website of central bank for each ASEAN-5 country. All variables were converted to natural logarithms, except for the Treasury bill rates and long-term interest rate which are in percentages. Utilising the natural logarithm reduces the presence of interrelationship between the variables. Additionally, compressing the scale in which variables are measured aids in the reduction of heteroscedasticity.

Structural Breaks in Panel Data: The Model

This work adopts the methods proposed by Ditzen *et al.* (2021) to examine a linear panel data model with N units, T periods, and b structural break as follows:

$$y_{i,t} = x'_{i,t}\beta + Z'_{i,t}\delta_j + e_{i,t} \quad (1)$$

where, $t = T_{j-1}, \dots, T_j$ and $j = 1, \dots, b+1$ with $T_0 = 0$ and $T_{b+1} = T$. For panel data model, N > 1, $y_{i,t}$ is dependent variable, $x'_{i,t}$ and $Z'_{i,t}$ are p x1 and q x 1 vectors of regressors respectively and the regression error, $e_{i,t}$ are scalars. Hence, there are b breaks, or $b+1$ regimes with regimes j covering the observations $T_{j-1}, \dots, T_j$.
In order emphasize the break structure, can be written (Eq.2) regime-wise;

$$\begin{aligned} y_{i,t} &= x'_{i,t}\beta + Z'_{i,t}\delta_1 + e_{i,t} \text{ for } t = T_0, \dots, T_1 \\ y_{i,t} &= x'_{i,t}\beta + Z'_{i,t}\delta_2 + e_{i,t} \text{ for } t = T_1, \dots, T_2 \\ &\vdots \\ y_{i,t} &= x'_{i,t}\beta + Z'_{i,t}\delta_{b+1} + e_{i,t} \text{ for } t = T_b, \dots, T_{b+1} \end{aligned} \quad (2)$$

From equation (2), the regressor coefficients in $x_{i,t}$ are unchanged by the breaks, whereas the coefficients in $Z'_{i,t}$ are influenced by the breaks. There exists a potential scenario when all independent variables experience a break, resulting in the definition of $x'_{i,t}\beta$ as zero. The break dates are universally applicable to all units. This assumption is widely held and justifiable in contexts characterised by low data frequency. In their study, Ditzen *et al.* (2021) examined three distinct hypotheses associated with the examination of various structural breaks in panel data. This work employs a sequential test approach that compares H_0 : no breaks with H_1 : b breaks, the researcher specifying the number of breaks under H_1 : b.

As a number of breaks is detected, the next step is to estimate the break's date and construct a valid confidence interval. Bai and Perron (1998), and Ditzen *et al.* (2021) suggest the standard approach to estimate breaks by minimizing the sum of squared residuals. The break date estimator as follows:

$$\hat{T}_b = \arg \underbrace{min}_{T_b \in T_{b,\varepsilon}} SSR(T_b), \quad (3)$$

Where $SSR\ (T_b)$ is the sum of squared residuals based on b breaks. The residuals are taken from Eq. (1). Once $\hat{T}_b$ has been obtained, confidence intervals for each estimated break date can be constructed using the formulas given in Bai and Perron (1998), and Ditzen *et al.* (2021).

Panel Data Regression Analysis
The primary objective of this study is to examine the empirical statistical association between a stock market index and relevant macroeconomic variables through the analysis of two sets of panel data. The differences between two set of panel data is the first one using Treasury bills 3 months whereas the second set used long-term interest rate, others selected macroeconomic variable are same. The specification models for panels employed in this study be written as follows:

Panel I $$lnSMI_{i,t} = \beta_0 + \beta_1 lnIP_{i,t} + \beta_2\, lnCPI_{i,t} + \beta_3\, lnM1_{i,t} + \beta_4\, lnER_{i,t} + \beta_5\, TB_{i,t} + e \quad (4)$$

Panel II $$lnSMI_{i,t} = \beta_0 + \beta_1 lnIP_{i,t} + \beta_2\, lnCPI_{i,t} + \beta_3\, lnM1_{i,t} + \beta_4\, lnER_{i,t} + \beta_5\, INT_{i,t} + e \quad (5)$$

where i is the individual country and t is a time period. The general form panel data regression model was transformed into a log-log linear model by applying the natural

logarithm to both sides of the equation. This transformation allows for the estimation of coefficient values as elasticities. The model coefficients, as delineated in Equations (4 and 5), can thus be construed as a percentage alteration in the dependent variable due to a percentage modification in the independent variables.

Descriptive Analysis

Table 1 provides an overview of the descriptive statistics, as well as the outcomes of the cross-sectional dependence (CD) test conducted by Pesaran (2021). This test aims to assess the null hypothesis that there is no residual cross-sectional correlation in the general panel model. At all conventional levels of significance, the null hypothesis is rejected for all variables, suggesting that the models used are inadequate in explaining the cross-section correlation.

Table 1
Descriptive Statistics

Variable	Mean	Min.	Max.	Std. dev.	CD	UR	Obs.
ln*SMI*	5.01	4.43	5.53	0.27	17.3447***	-1.9588***	660
ln*IP*	4.79	3.27	5.29	0.22	16.0294***	-1.4342***	660
ln*CPI*	4.79	4.65	5.12	0.11	31.5743***	-1.4518***	660
ln*M1*	10.30	7.07	16.53	3.05	35.3079***	1.3755***	660
ln*ER*	3.69	0.20	9.67	3.18	25.7522***	-2.5876***	660
TB	2.46	0.00	8.70	2.17	11.7918***	-1.8779***	660
INT	3.62	0.19	9.64	2.06	13.4182***	-1.7720***	660

Note: the sign "UR" is used to represent a unit root test. Pesaran's (2007) CIPS test is employed when the variable exhibits cross-sectional variance, as it permits the examination of cross-sectional dependency in the form of a shared factor. The Levin-Lin-Chu (2002) unit-root test is employed when the variable exhibits temporal fluctuations. The acronym "CD" denotes the cross-sectional correlation test proposed by (Pesaran, 2021).

Correlation Analysis

Maintaining a low degree of correlation among the explanatory factors is considered beneficial. The reason for this is to mitigate the issue of multicollinearity among variables. Variance Inflation Factor (VIF) is a straightforward method for assessing the issue of highly correlated in panel data. According to Atahrim (2013), the presence of correlation among independent variables can distort the correct interpretation of regression coefficients. It is imperative to note that while correlation between independent variables is acceptable, perfect collinearity, which refers to a situation where there is a linear relationship among independent variables, is not permissible. However, the occurrence of near-perfect collinearity, where the relationship is either non-linear or exhibits an almost negligible correlation, remains within the realm of acceptable assumptions and does not violate the principles of regression analysis. Therefore, the present study additionally used VIF analysis to detect the severity of multicollinearity in the ordinary least square (OLS) regression analysis. Typically, VIFs that are greater than 10 indicate significant multicollinearity that needs to be addressed.

Results and Discussion

Identification of the Breakpoints

We employed Karavias' (2022) breakpoint tests to examine several structural breaks in panel data that exhibit cross-section dependence. The results are presented in Table 2. One notable observation is the high significance of the Shapiro-Wilk (SW) test, which indicates that the break dates are projected to occur in February 2018 and March 2020.

The first breakpoints data is found to be February 2018 and corresponds to the month marked by volatility in financial markets, ongoing trade tensions, and a backdrop of solid global economic growth tempered by inflationary concerns. One of the significant events was a spike in stock market volatility. In early February 2018, global stock markets experienced a sharp decline, with the Dow Jones Industrial Average (DJIA) in the United States dropping by over 1,000 points in a single day. This volatility was attributed to concerns over rising interest rates, inflationary pressures, and algorithmic trading. Trade tensions between the United States and other countries, particularly China, continued to escalate. The U.S. announced tariffs on imported solar panels and washing machines in January 2018, followed by further tariffs on steel and aluminum imports in February. These actions sparked fears of a trade war and roiled global markets.

In March 2020, in response to market panic, between March 4, 2020, and May 20, 2020, the Federal Reserve System of the United States substantially grew its balance sheet assets by 66%, soaring from $4,241,507 million to $7,037,258 million. This action led to a rapid recovery of global stock markets, which regained most of their losses from March to April 2020 by May to June 2020 (Kavanagh et al., 2021). The second boundary corresponds to the adoption of "quantitative easing" (QE) policies by prominent central banks within the COVID-19 crisis, leading to a significant upswing in stock markets. The projected threshold represents the influence of quantitative easing (QE) policies, which result in a decrease in interest rates and provide two primary outcomes that contribute to the appreciation of stock prices. To begin with, quantitative easing (QE) improves the current value of forthcoming cash flows by reducing the discount rate. Additionally, it reduces the appeal of safe assets, prompting investors to shift a greater proportion of their investments towards equities, hence resulting in an increase in stock prices (Karavias et al., 2022).

Consequently, the sample period can be partitioned into three distinct sub-periods, as depicted in Figure 1. The initial surge of market strain commenced with a stock market correction, specifically a subperiod of stock market volatility, which persisted until February 2018 (volatility_1). Following a period characterised by an unparalleled state of panic, the stock market exhibited a predominantly calm state until February 2020 (volatility_2). The onset of the COVID-19 pandemic occurred in March 2020, marking the onset of a new wave of health crises.

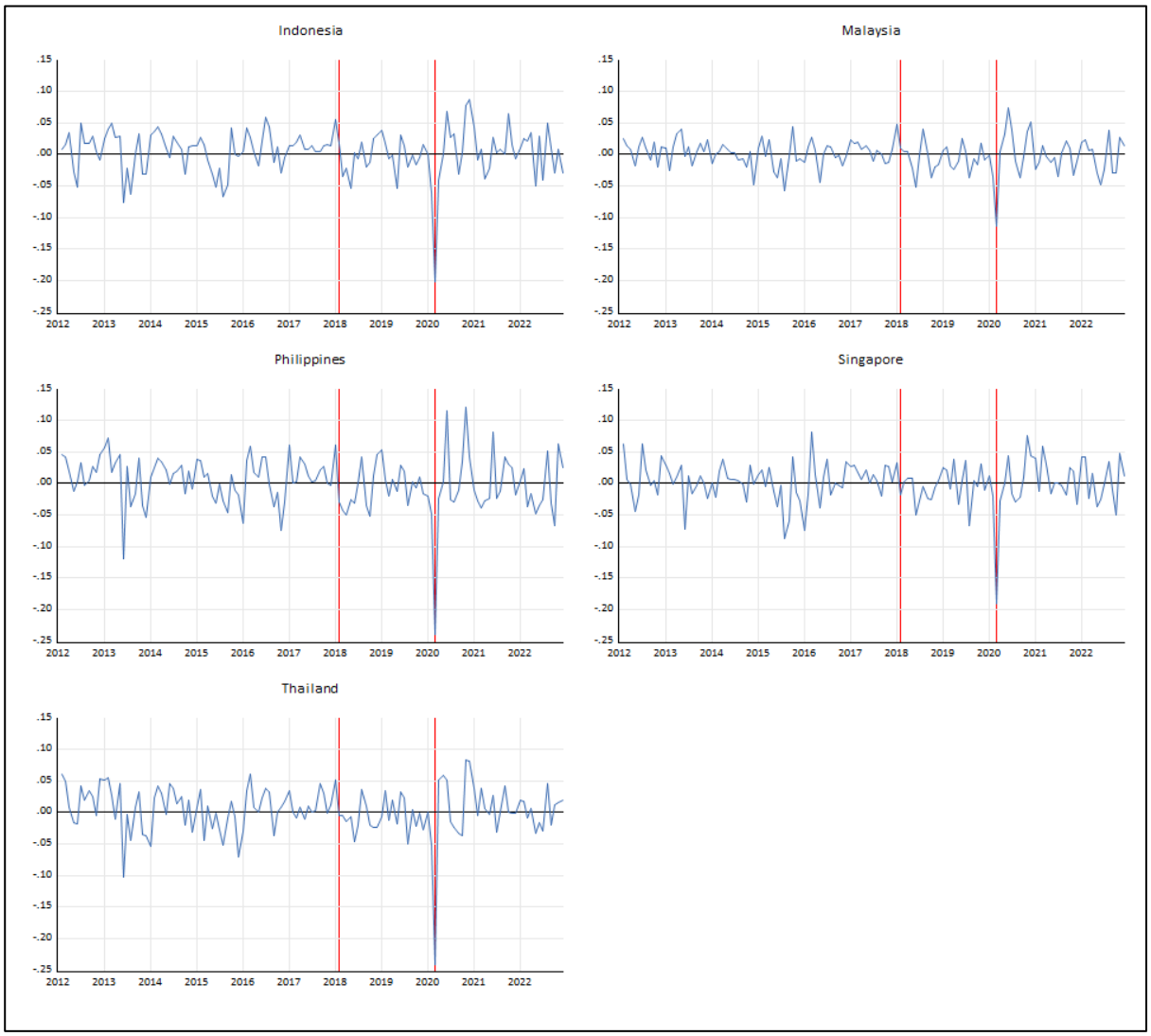

Fig.1. Cross-sectional returns of the analyzes stock market index ASE

Effects of Macroeconomic Factors

The key findings are summarised in Table 2. The provided information encompasses the computed coefficients and their corresponding significance levels, the projected breakpoint dates, and the associated 95% confidence intervals. In summary, our research suggests that macroeconomic issues had varying impacts on the stock market index over the time examined periods.

Panel I of Table 2 indicates that industrial production exhibits a negative and statistically insignificant trend both before and after the break. The correlation between industrial production and the stock market index in the ASEAN-5 region is shown to be rather weak. Industrial production typically declines during a sharp stock market decline. This is because a falling stock market indicates a decrease in investor confidence, which can lead to businesses delaying or cancelling investments. Additionally, consumers may also cut back on spending if they are worried about the state of the economy, which can further reduce demand for industrial goods. These findings are corroborated by the analysis conducted by Filis (2010),

which reveals a lack of established correlation between industrial production and the stock market in the Greek market.

During the initial stage of the crisis, there is a notable positive impact of inflation on the stock market volatility in the United States. This outcome is contrary to expectations as there is a theoretical interrelationship between higher inflation and lower equity prices. The outcome is consistent with Sheikh et al (2020), who theorized the investors responded favourably to favourable variations in CPI before international economic recession. The global financial crisis has impacted on the relationship between the Consumer Price Index (CPI) and stock index. However, investors did not respond to the crisis, resulting in a lack of events interrelationship between the two variables following the initial break in February 2018. On the contrary, the Consumer Price Index (CPI) exhibits a notable positive correlation with the stock market index in the ASEAN-5 countries, coinciding with transmission of the COVID-19 virus worldwide. Several research has presented evidence that the inclusion of new data after March 2020 has had a significant and positive effect on consumer price index (Nurmasari & Nur'aidawati, 2021; Ball et al., 2021). Although the initial stages of the pandemic were marked by increasing concerns, certain financial markets initially responded positively to the spread of information about the outbreak (He et al., 2021; Yarovaya et al., 2022). Therefore, the observed concurrent rise in inflation and stock returns during this period appears to be consistent.

The relationship between money supply and stock market index is found to be significantly positive before the break of stock market volatility in the US but became statistically significant negative relationship after first break. A contraction in monetary policy, characterised by a reduction in the rate of expansion of the money supply, will lead to a drop in the availability of capital and a rise in interest rates. An upward adjustment in interest rates will result in a corresponding rise in savings and a decline in the demand for capital. In a sequential manner, the modifications will ultimately restore the market to a state of equilibrium (Reilly & Brown, 2003). The relationship is statistically significant positive relationship after the second break COVID-19. When the money supply or the value of the local currency rises relative to the US Dollar, individuals are more inclined to engage in the stock market due to their increased financial resources or the ability to purchase a greater quantity of goods and services.

Table 2
Estimation Results

		Coefficient	Std. Error
Panel I			
ln IP_1	$\beta_{volatility\_1}$	-0.0122	0.0962
ln IP_2	$\gamma_{volatility\_2}$	-0.0882	0.0612
ln IP_3	γ_{COVID_1}	-0.0239	0.0186
ln CPI_1	$\beta_{volatility\_1}$	0.6977***	0.1195
ln CPI_3	γ_{COVID_1}	1.0722***	0.1821
ln M1_1	$\beta_{volatility\_1}$	0.4010***	0.0529
ln M1_2	$\gamma_{volaitility\_2}$	-0.5070***	0.1410
ln M1_3	γ_{COVID_1}	0.7333***	0.0742
TB_1	$\beta_{volatility\_1}$	-0.0177***	0.0057
TB_2	$\gamma_{volatility\_2}$	-0.0079	0.0068
TB_3	γ_{COVID_1}	-0.0695***	0.0085
Panel II			
ln IP_1	$\beta_{volatility\_1}$	-0.0377	0.0940
ln IP_2	$\gamma_{volatility\_2}$	-0.0908	0.0611
ln IP_3	γ_{COVID_1}	-0.0245	0.0215
ln CPI_1	$\beta_{volatility\_1}$	0.7357***	0.1180
ln CPI_3	γ_{COVID_1}	1.4642***	0.3086
ln M1_1	$\beta_{volatility\_1}$	0.4201***	0.0512
ln M1_2	$\gamma_{volatility\_2}$	-0.5884***	0.1651
ln M1_3	γ_{COVID_1}	0.7067***	0.0900
INT_1	$\beta_{volatility\_1}$	-0.0253***	0.0058
INT_2	$\gamma_{volatility\_2}$	-0.0103	0.0075
INT_3	γ_{COVID_1}	-0.0445***	0.0107
$\hat{b}$	February 2018 [January, 2018; March 2018]		
	March 2020 [February, 2020; April, 2020]		

Conclusion

This study employed panel data models with structural breakdowns to analyse the correlation between stock market index and specific macroeconomic indicators in ASEAN-5 nations from January 2012 to December 2022. The study conducted by Ditzen et al (2021), utilised the structural breaks test in panel data to estimate regime shifts. Additionally, a panel data regression model was employed to estimate coefficients that vary over time. The subsequent examinations took into account the presence of cross-sectional dependency and a uniform structure among the slope coefficients, as evidenced by the data presented in Table 2. The stationarity of the series was assessed using Pesaran's (2007), CIPS method. When a series with a unit root at the level is first-differenced, it becomes stationary. Additionally, the Bai & Perron (1998, 2003), test for unknown sequential structural breaks was utilized to identify any significant shifts in the panel data. The examination unveiled a noteworthy disruption in the structure over the months of February 2018 and March 2020 (Table 2). The ratcheting up of bilateral tariffs between the US and China has had limited effect on their bilateral trade balance. In fact, in 2018, the trade deficit increased for the US as imports from China rose, which partly reflects the front-loading. At the global level, the additional impact of the

recently announced and envisaged new US-China tariffs, expected to extend to all trade between those countries, will subtract about 0.3 percent of global GDP in the short term, with half stemming from business and market confidence effects. Meanwhile, in March 2020, the world faced the rapid spread of the COVID-19 pandemic, leading to widespread lockdowns, disruptions in supply chains, reduced consumer spending, and a sharp decline in economic activity globally. Governments and central banks responded with unprecedented measures to mitigate the economic fallout. These responses included fiscal stimulus packages, monetary policy interventions such as interest rate cuts and quantitative easing, and various support programs for businesses, workers, and healthcare systems. The pandemic-induced economic crisis triggered significant structural changes, accelerating trends such as remote work, digitalization, and shifts in consumer behavior. The dates representing the structural breakpoints in both of these events are explained by their enduring impacts on economic models and policies, influencing strategies in domains like taxation, government spending, monetary policy, healthcare, and technology adoption. The relationship between industrial production, consumer price, money supply, Treasury bill 3 (panel I), interest rate (panel II) and stock market index were estimated using the FE model.

The findings of this study seem to suggest that both Treasury bills and long-term interest rest give impact to stock market index with similar pattern. The structural break test and diagnostic test before investigating whether selected macroeconomic variables have predicted explanatory power over ASEAN-5 stock market index using two different set of panels. The diagnostic test indicates that stock market prices are influenced with a consistent set of selected macroeconomic variables, namely, industrial production, consumer price index, money supply and Treasury Bills for panel I, meanwhile for panel II, industrial production, consumer price index, money supply and long-term interest rates. Moreover, panel regression analysis suggests that ASEAN-5 stock market index are influenced negatively by industrial production (both set of panels), Treasury Bill (panel I) and long-term interest rate (panel II) for time period before and after structural break. On the other hand, the consumer prices index influenced positively consistency before and after breaks for both panels. Besides, money supply influences positively before first break in both set of panel but negatively after first break and turns positively for second break.

Thus, the threat to inference posed by structural change has been acknowledged for quite some time. As the time span of the panel increases, the likelihood of a structural break occurring also rises. It is recommended that tests for structural breaks be consistently included alongside other descriptive statistics in papers utilizing panel data regression. From a policy perspective, the results suggest that, during significant events like the US-China trade war and the COVID-19 crisis, monetary policy responses in ASEAN-5 markets can be twofold: firstly, central banks may opt for interest rate adjustments, potentially lowering rates to stimulate investment and support stock prices; secondly, they could implement targeted support programs, providing liquidity and specific assistance to sectors most affected by the crises, ensuring stability and fostering economic recovery.

This research significantly contributes to the existing body of knowledge by providing a nuanced understanding of how macroeconomic variables influence stock markets in the ASEAN-5 region, particularly during periods of economic instability. The identification of structural breaks and the consistent influence of selected variables across different crises

offer valuable insights into the resilience and vulnerability of emerging markets. Theoretically, this study enhances the literature on the economic-financial nexus by integrating panel data analysis with structural break detection, thus offering a robust methodological framework for future research. Contextually, the findings underscore the importance of macroeconomic stability and policy interventions in mitigating the adverse effects of global financial disruptions on regional markets. By highlighting the differential impacts of industrial production, consumer prices, money supply, and interest rates, this research provides policymakers and investors with critical information to navigate economic uncertainties and foster sustainable market growth.

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