The dynamic relationship between economic crisis, macroeconomic variables and stock prices in Sri Lanka

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Abstract

Purpose – This study aims to examine the short- and long-term equilibrium relationship between All share price index (ASPI), macroeconomic variables and the economic crisis in Sri Lanka.

Design/methodology/approach – Monthly time series data for inflation (CPI), industrial production (IP), an exchange rate (EX), an interest rate (TB), short-term interest rate (CD) and economic crisis were used from 2010 to 2021. The ADF test, the bound testing approach, the CUSUM test and the CUSUMQ test were used in this study.

Findings – The findings show a long-run stable relationship between stock price, macroeconomic variables and political crisis (i.e., CPI, IP, ER, TB, CD and economic crisis). The results of the Johansen cointegration test suggest that there is at least one cointegrating equation, indicating that there is a long-run equilibrium relationship between macroeconomic variables and stock prices in Sri Lanka.

Research limitations/implications – The vector error correction estimates show that the coefficient of the error correction term is significant with a negative sign, indicating that a long-run dynamic relationship exists between macroeconomic variables and stock prices. In the short term, economic crisis has had a big effect on stock prices suggesting that Sri Lanka's domestic financial markets are linked to the stability of the country.

Originality/value – This research establishes the links between stock returns, macroeconomic variables and economic crisis. So far, research has been unable to establish the empirical nature of such links. The authors believe that this paper fills that gap.

Keywords Impulse response, VAR, Stock prices, Macroeconomic indicators, Economic crisis

Paper type Research paper

Introduction

The business cycle is a prominent characteristic of the capitalist economy. Numerous studies have been conducted to comprehend the nature of this topic. Utilising leading economic indicators, it is possible to predict the business cycle. On the other hand, the stock market is assumed to be a forward-looking predictor of the business cycle and is a significant indicator for predicting the economy. The global economy has been affected by the COVID-19 pandemic and financial crisis and political crisis, but it is still not clear how these will affect stock markets. Even though the pandemic is still going on, most markets seem to have recovered. This suggests that there has been a structural break in the relationship between stock returns and COVID-19. The ongoing economic crisis in Sri Lanka began in the year 2019 and it is the worst economic crisis the nation has faced since it gained its independence in 1948. It has brought about unprecedented levels of inflation (CPI), a near-depletion of foreign

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exchange reserves, shortage of medical supplies and an increase in the price of essential commodities. It is believed that the crisis was caused by several interconnected factors, including tax cuts, the creation of money, a nationwide policy to shift to organic or biological farming, events like the Easter bombings in 2019, and the impact of the COVID-19 pandemic. Protests broke out in Sri Lanka in 2022 as a direct result of the subsequent economic difficulties.

Sri Lanka has had a trade deficit for decades. This has caused the foreign currency to run out, making it hard for traders to pay for imports. As of March 2022, Sri Lanka's remaining foreign exchange reserves of US$1.9 billion were insufficient to pay the country's foreign debt obligations for 2022, which was US$4 billion in total. Consequently, Sri Lanka was slated for sovereign default. Figure 1 demonstrates that the available official reserves are insufficient to cover import costs. As a result, Sri Lanka is experiencing a foreign exchange shortage, which has impeded its ability to import food and fuel and caused the country to default on its entire foreign debt.

In April 2019, the "local militant group National Thowheed Jamath (NTJ)" bombed three high-end hotels and three churches in the country, killing close to 270 people. The bombings incapacitated the tourism industry, and the COVID-19 pandemic made it harder to get back on its feet. Since tourism makes up more than 10% of Sri Lanka's GDP, these hits made it harder for the country to pay back its debt. In 2021, the government banned chemical fertilisers because it wanted to move towards 100% organic farming. This made farmers' crops grow much less, especially rice and sugar. Since then, the government has lifted some of the bans. To get the economy going again, the government cut taxes. But this turned out to be a bad idea because it hurt the government's income a lot. The action also caused "rating agencies to downgrade Sri Lanka to levels close to default," which meant the country "lost access to markets outside of the country." Instead of helping the local economy and boosting exports, the government of Sri Lanka has been borrowing huge amounts of money to pay for public services and imports. So, the country's public debt went up from "94% of GDP in 2019 to 119% of GDP in 2021." Also, the government used its foreign exchange reserves to pay off the debt. As a result, the government's foreign exchange reserves went from $6.9 billion in 2018 to $2.2 billion in 2022. So, the country does not have enough foreign currency to pay for goods that need to be brought in. Due to the on-going conflict between Russia and Ukraine, the prices of crude oil, sunflower oil and wheat have risen by a huge amount. "Crude oil prices

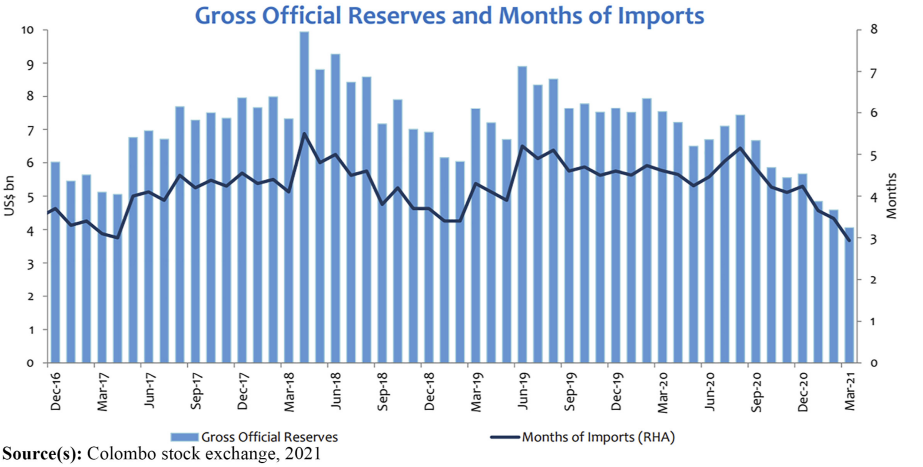


Figure 1.
Gross official reserves and months of Imports in Sri Lanka

Source(s): Colombo stock exchange, 2021

hit a record high" of more than $125 per barrel at the height of the crisis. Having fuel and goods prices go up so quickly hurts the lives of regular Sri Lankans.

Because of the current economic crisis in the country, the Colombo Stock Exchange (CSE) has been closed for five days starting in April 2022. The economic and political crisis is making the Sri Lanka CSE All Share Index fall as shown in Figure 2. A market that went up by 80% in 2021 has been sunk by a growing political crisis. After Mongolia, it is the best show in the world.

In this backdrop, this study examined the behaviour of stock markets in Sri Lanka amid the devastating economic and political crisis. The main research question that has been addressed in this study is "how does the current economic and political crisis affect the stock markets in Sri Lanka?"

Literature review

Macroeconomic variables and stock prices

Throughout the past few decades, academics, economists, policymakers and practitioners (Mukherjee and Naka, 1995; Maysami and Koh, 2000; Kwon and Shin, 1999, Gjerde and Sættem, 1999; Chinzara, 2011; Debata and Mahakud, 2018); have investigated the link between macroeconomic variables and stock return. According to the findings of a few studies (Czapkiewicz *et al.*, 2018; Tronzano, 2021; Park *et al.*, 2019), the return on stocks is largely dependent on macroeconomic factors such as GDP, interest rate (TB), CPI rate and industrial production (IP). Existing theories propose a variety of models that can be used to investigate the relationship between stock return and macroeconomic variables. Arbitrage pricing theory (APT) is the method that has gotten the most attention for its potential to link macroeconomic variables with stock return (1976). This model says that the return on stocks can be broken down into the risks of each of its parts. A few academics (Aquino, 2004; Barodawala and Ranawat, 2018) did research using macroeconomic variables that affect stock returns on the South Asian stock market. Also, they found that changes in the risk premium and IP were linked to the expected return on stock investments positively. But the expected return on the stock market was the opposite of the expected CPI rate and the unexpected CPI rate. On the other hand, the way the effect of macroeconomic variables on stock return is studied is not inconsistent from a methodological point of view.

Song *et al.* (2018) showed that macroeconomic factors do not affect share prices in Korea, but they do in the US (Abbas and Wang, 2020) also say that share returns in the USA might be affected by different macroeconomic factors or that (Javaira and Hassan, 2015) might not work. Masrizal *et al.* (2021) say that it is important for the model to include unexpected parts of share returns and macroeconomic variables. They say that (Kulhanek, 2012) may be an example of spurious regression. One of the most common ways to look at the relationship between macroeconomic variables and stock return is with the vector autocorrelation (VAR) model. Lin *et al.* (2018) look at how macroeconomic factors affect stock returns using the VAR model or some researchers (Khan *et al.*, n.d.; Chang *et al.*, 2019) employed the auto regression distribution lag (ARDL) model.

Aquino (2004) looked at monthly data from 1997–2001 to see if economic activity affected how well the Philippine stock market worked. The most important thing that the study showed was that domestic economic activity affects how well the domestic stock market does and that all the macroeconomic activities that were looked at in the study are important for understanding how stock prices move. Sheikh *et al.* (2020)) looked at the same relationship between five macroeconomic variables and stock returns. After looking at the short-term and long-term relationships between individual stock indices and macroeconomic variables like the gross national product, the consumer price index, the money supply, the TB and the exchange rate (EX), they found that all five stock price indices were related positively to

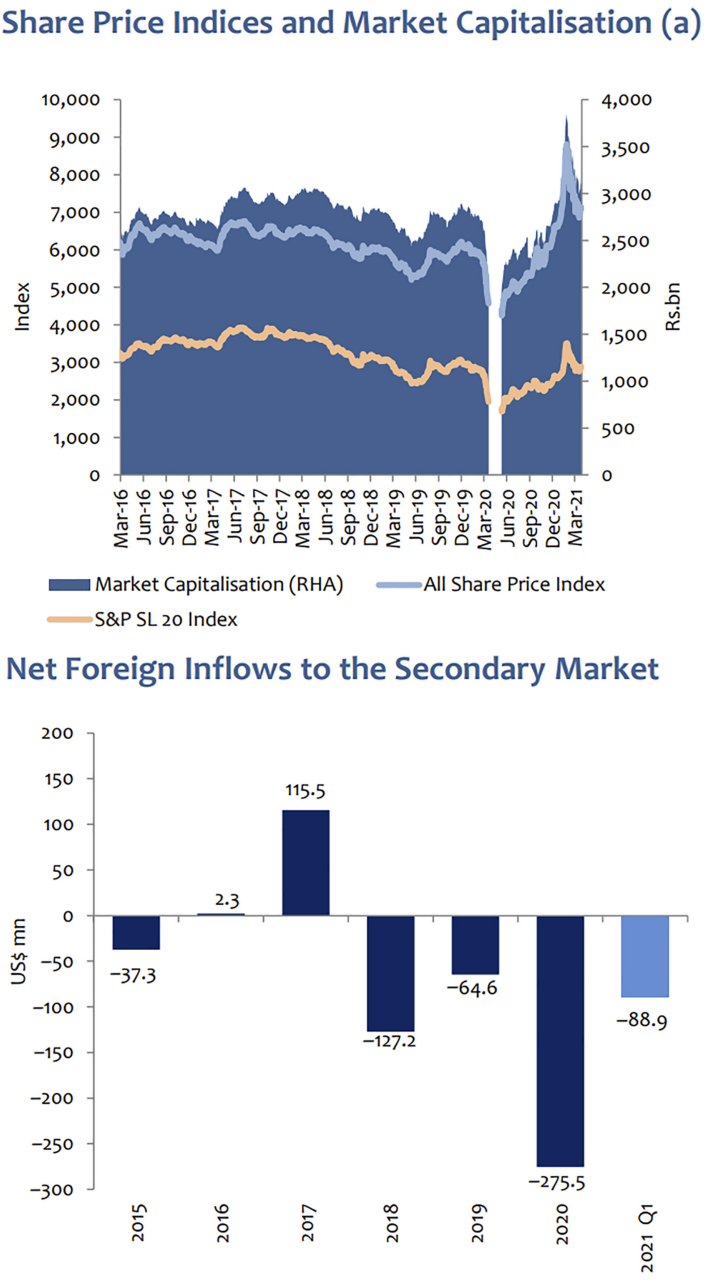


Figure 2.
All-share index and net foreign inflows

Source(s): Colombo stock exchange, 2021

growth in output and negatively to the aggregate price level. But stock prices and TBs have a long-term negative relationship in the Philippine (Aquino, 2004), while they have a positive relationship in Europe (Ersan *et al.*, 2019). Some researchers used the Johansen cointegration test (Chancharoenchai *et al.*, 2005) Hashmi and Chang (n.d.) found six macroeconomic variables co-integrated with the Japanese stock market, namely, EX, money supply, CPI, IP, long-term government bond rate and short-term call money rate. Moradi *et al.* (2021) found that the Singapore stock market is cointegrated with five macroeconomic variables. Nasir *et al.* (2021) showed that macroeconomic factors do not affect share prices in Vietnam (Kulhanek, 2012). VAR is a common way to look at macroeconomic variables and stock return (Liang and Willett, 2015; Patro *et al.*, 2014).

Hondroyiannis and Papapetrou (2001) used monthly data from 1984 to 1999 to examine the Greek stock market. The study showed that domestic economic activity affects the domestic stock market and that all of the macroeconomic activities examined are important for understanding stock price movements. Liang and Willett (2015) looked at the same relationship between macroeconomic variables and stock returns in China. After examining the short- and long-term relationships between stock indices and macroeconomic variables like the gross national product, the consumer price index, the money supply, the TB and the EX, they found that all five stock price indices were positively related to output growth and negatively related to the aggregate price level. Stock prices and TBs have a long-term negative relationship in Philippines, but a positive relationship in Indonesia.

Vasileiou (2021) shows a negative link between TBs and share returns. Bulmash and Trivoli (1991) found a negative correlation between stock prices and Treasury bill rate. Changes in TBs hurt stock returns, according to Gjerde and Saettem (1999) and Achsani and Strohe (2004). Most empirical studies have found that TBs affect stock returns, while IP does not. ARIMA model. Liu *et al.* (2019) compared stock market indexes, the EX and oil prices in China. The EX and oil price have significant effect on stocks (Tronzano, 2021).

Fama and Eugene (1990) and Schwert (1990) said the stock market reflected real-economy changes. Abbas *et al.* (2018) studied cause-and-effect relationships and dynamic interactions between macroeconomic variables and stock returns. CPI was not Granger caused by stock prices. CPI does not explain much of IP growth when stock returns and TBs are considered. Jung and Kim (2011) examined the relationship between stock prices and five macroeconomic variables: the TB, the level of prices, the national income and the amount of money in circulation. According to Balli *et al.* (2019), long-run Granger causality exists between stock prices and national income, price level and EX. So, the stock market was a leading indicator for many macroeconomic variables.

Many studies have examined the links between macroeconomic indicators and stock market performance. These studies mostly focussed on developed markets, especially the US, UK and China (Fama and Eugene 1990; Comincioli, 1996; Han *et al.*, 2015) amongst others, confirmed the stock market's role as a leading indicator of economic activity (Javaira and Hassan, 2015; Sreenu and Pradhan, 2022) said that stock prices are no longer a leading indicator of economic activity in the developing countries.

Structural break and stock prices

There have been several studies that have investigated the impact that structural breaks have on the stock market; however, new research on the financial crisis and how the markets reacted to the country provides us with new information. Liu *et al.* (2019) found evidence in the published research that the COVID-19 outbreak had a negative impact on the performance of stock markets in a variety of countries, including Korea, Japan, the United States, Germany, the United Kingdom and others. Sreenu and Pradhan (2022) and, Humpe and McMillan (2020); discovered that verified cases of COVID-19 had an immediate and detrimental impact on the

stock markets. According to the findings of (Humpe and McMillan, 2020), the daily increase in the number of confirmed cases and deaths had a significant and detrimental impact on the stock returns of all companies trading on the US stock market. Vasileiou (2021) that the number of confirmed COVID-19 cases and deaths had a positive effect on the market volatility index in developed countries. He stated that this was the case regardless of whether or not the cases were in Australia, France, UK, Singapore and Japan (Han *et al.*, 2015). Vasileiou (2021) demonstrated that the primary reasons why the stock market in the United States reacted more strongly to the COVID-19 pandemic than it did to other pandemics were because people chose to avoid each other and the government restricted business activity. These findings confirm that stock market recovery is directly linked to the business environment. It will depend on a variety of factors, such as the duration of lockdowns, the success of stimulus measures, and investor, business and consumer sentiment. This is like how the recovery of global financial markets is linked to the business environment.

Many researchers (Tronzano, 2021; Masrizal *et al.*, 2021; Huang *et al.*, 2022; Hartmann *et al.*, 2008) show that structural breaks such as Asian financial crisis, COVID-19 pandemic, Arab Spring significantly impact the stock market performance. Some researchers (Yang *et al.*, 2018; Asad *et al.*, 2020) stated that global market fluctuations during the global financial crisis had relatively little effect on stock market performance. So, it is impossible to ignore the possibility that Sri Lanka's stock market drops are caused by the country's economic crisis. No empirical studies have been done yet, of course, that look at how the economic crisis affects the stock market. But the argument is that the economic crisis has messed up stock price indices in a big way. Second, it is not likely that the fiscal measures will cause CPI. Third, the recent monetary policy of quantitative easing is likely to increase the amount of money in circulation. This will spread the risks of CPI, TBs and EXs, which could cause panic. Even though the effects of CPI, EX and TB risks on stock market movements are not clear during the current economic crisis, we can use macroeconomic variables as likely causes of nosedives in stock markets to estimate their effects and importance. The economic crisis has a bad effect on the production index, and it has made Sri Lanka's unemployment rate go up. The sudden drop in the production index may have made investors doubtful about how much money they could make from their investments. From this point of view, there are also not enough empirical studies. So, we looked at the production index as part of our analysis to figure out how it affects things and how important it is. Based on what was found in the review of relevant studies, the study came up with the following hypotheses.

H1. There is a long-run equilibrium relationship between stock prices and macroeconomic variables in Sri Lanka

H2. CPI is related to stock prices in the short-run.

H3. The ER is related to stock prices in the short run.

H4. IP index is related to stock prices in the short run.

H5. Treasury bill rate (TB) is related to stock prices in the short run.

H6. Short-term interest rate (CD) is related to stock prices in the short run.

H7. Economic crisis is related to stock price dynamics in the short run.

Data and methods

The purpose of this research is to investigate the relationship between stock returns and selected macroeconomic variable for the period spanning 2010 to 2021, monthly data.

Variables and indicators

CSE market price: The CSE market price is used to proxy the stock market prices. This major stock market index tracks the general performance of all common shares listed on the stock exchange. We use the end-of-quarter values of CSE's All share price index (ASPI) to measure the overall level of stock prices because these values are available to us.

Industrial production index (PI): PI is an economic indicator that measures real output for all facilities located in an economy manufacturing, mining, electric and gas utilities. The index is compiled monthly to bring attention to short-term changes in IP. It measures movements in production output and highlights structural developments in the economy. Growth in the production index from month to month is an indicator of growth in the industry.

Consumer price index (CPI): CPI is a measure that examines the weighted average of prices of a basket of consumer goods and services, such as transportation, food and medical care. It is calculated by taking price changes for each item in the predetermined basket of goods and averaging them. Changes in the CPI are used to assess price changes associated with the cost of living. CPI is one of the most frequently used statistics for identifying periods of CPI or deflation.

Foreign ER: The Sri Lankan rupee per the US dollar (USD) is selected based on the volume of international trade with Sri Lanka. The time-series data is a monthly-adjusted average. In effect, ER is the logarithm of the nominal exchange rate of Sri Lankan rupee per US dollar.

Certificate of deposit (CD): A certificate of deposit is a savings certificate with a fixed maturity date and specified fixed TB, and can be issued in any denomination aside from the minimum investment requirements, which differ amongst instruments. A CD restricts access to the funds until the investment's maturity date. Commercial banks generally issue DI. When the CD matures, the entire amount of principal and interest earned is available for withdrawal.

Treasury bill rate (TB):This study uses the TB to measure TB. This is because Treasury bill investments are considered an opportunity cost for holding shares. Treasury bills are the most actively traded monetary policy instruments. Every Friday, the Central Bank of Sri Lanka holds Treasury bill auctions. High Treasury bill TBs encourage investors to purchase more government securities. Therefore, the anticipated relationship between stock prices and Treasury bill yields is inversed.

Exogenous variable – economic crisis: The Sri Lankan government attributes the current economic crisis to shocks caused by the coronavirus pandemic. Still, the root causes date back more than three years and include a slew of poor economic decisions, such as taking on too many loans and cutting taxes. Sri Lanka's economy was particularly vulnerable to the pandemic and recent oil price spikes because of bad economic policy decisions.

Descriptive statistics of data

The Central Bank Annual Reports in Sri Lanka served as the source for all these time-series data, subsequently collected and retrieved. The time-series data for all these variables are collected monthly and used for the period beginning in January 2010 to 2021 (132 observations). The descriptive statistics and several other types of summary statistics for the time series are presented in Table 1. Observing the standard deviations reveal that the data are unstable, except for the IP index variable. The Jarque–Bera normality test rejects the assumption of normality for all variables except the production index.

The findings of the Pearson correlation analysis between the different time series are presented in Table 2. To examine multicollinearity between independent variables, a correlation analysis was conducted. Multicollinearity refers to the relationship between two or more explanatory variables in a multivariate regression model. If the pair-wise correlation between two regressors is greater than 0.80, the regression is deemed to have a significant multicollinearity problem.

Table 1.
Descriptive statistics of ASPI and macroeconomic variables (monthly, 2010–2021)

	LOG(ASPI)	LOG(CPI)	LOG(CD)	LOG(ER)	LOG(PI)	LOG(TB)
Mean	8.377187	4.984055	2.744131	4.789530	4.659062	2.341396
Median	8.639499	5.019925	2.740840	4.741883	4.677490	2.339399
Maximum	8.961623	5.262172	3.091042	5.003275	4.898586	2.993730
Minimum	7.315232	4.605170	2.302585	4.625953	4.280824	1.773256
Std. Dev	0.486115	0.216983	0.185604	0.106093	0.138394	0.345874
Skewness	−0.537424	−0.620950	−0.383214	0.354117	−0.372731	0.268553
Kurtosis	1.700120	2.138428	2.530257	1.845678	2.325386	2.092645
Jarque–Bera	15.64742	12.56542	4.444391	10.08730	5.559496	6.114762
Probability	0.000400	0.001868	0.108371	0.006450	0.062054	0.047011
Sum	1105.789	657.8952	362.2252	632.2180	614.9962	309.0643
Sum Sq. Dev	30.95628	6.167702	4.512805	1.474510	2.509043	15.67134
Observations	*132*	*132*	*132*	*132*	*132*	*132*

Source(s): Author calculation (2021)

Table 2.
Pearson correlations ($N = 132$)

	LOG(ASPI)	LOG(CPI)	LOG(ER)	LOG(PI)	LOG(TB)	LOG(DI)
LOG(ASPI)	1.000000	0.823934	0.673789	0.598319	−0.784198	0.531515
LOG(CPI)	0.823934***	1.000000	0.855108	0.485959	−0.586982	0.621621
LOG(ER)	0.673789***	0.855108	1.000000	0.518158	−0.401364	0.749726
LOG(PI)	0.598319***	0.485959	0.518158	1.000000	−0.621843	0.593894
LOG(TB)	−0.784198***	−0.586982	−0.401364	−0.621843	1.000000	−0.534494
LOG(DI)	0.531515***	0.621621	0.749726	0.593894	−0.534494	1.000000

Note(s): Correlation is significant at the 0.01 level (***, p-value < 0.01, 2-tailed)
Source(s): Author calculation (2021)

Unit root test

In the literature, it is well known that the process of getting data for many economic variables is marked by random trends that could lead to false conclusions if the time series properties are not carefully investigated. A time series is stationary if neither its mean nor its autocovariance changes over time. Any set that does not stay in one place is called non-stationary (i.e. it has a unit root). The unit root test is the formal way to see if a series is stationary. There are several well-known tests for this purpose that use individual time series.

These include the ADF unit root test (Dickey and Fuller, 1979, 1981) and the Phillips–Perron (PP) unit root test (Phillips and Perron, 1988). Tests of the unit roots are shown in Table 3.

The least squares method was used to test all the test equations. The model has an intercept but no time trend. All tests' probabilities are based on the idea of asymptotic normality. In the ADF and PP tests, the optimal lag is chosen automatically based on the Schwarz Info Criterion, and the lag length (bandwidth) is chosen automatically based on the Newey–West estimator (Newey and West, 1994) using the Bartlett kernel function. Based on (MacKinnon, 1996) one-sided p-values, probability values for rejecting the null hypothesis of a unit root are used at the 0.05 level in ADF and PP tests. The alternative hypothesis says that the series does have a unit root (non-stationary).

Results

A stationary result may be achieved by taking a linear combination of two or more non-stationary series (Engle and Granger, 1987). Two non-stationary time series are cointegrated

if there is a stationary linear combination that they can be combined. If these variables are cointegrated, then it can be deduced that there is a long-run equilibrium between them. In other words, if the variables are cointegrated, then there is a relationship that exists over the long run, and there is a force that exists to converge into equilibrium over the long run.

Cointegration test

The Engle–Granger single equation test method (Engle and Granger, 1987) and the Johansen cointegration test are two ways to find out if there is a long-term relationship between variables (Johansen, 1988). Cheung and Lai (1993) say that the Johansen method is better than the Engle–Granger single equation test method because the maximum likelihood method works well with both large and small samples. The Johansen cointegration test looks at each variable as a function of all the other variables in the system that has changed over time. The procedure also uses two ratio tests to test the number of cointegration relationships: a trace test and a maximum eigenvalue test. Both tests can figure out how many cointegrating vectors are present, but they do not always come up with the same number.

In Table 4, you can see how the Johansen cointegration test went. The method of least squares was used to test the test equation. There can be a linear, predictable trend in the data in regression models, and the model includes an intercept. In VAR models, however, there is no trend. The time between lags in the first differences is from 1 to 4. The probability value for rejecting the null hypothesis that there is no cointegration is based on the *p*-values from MacKinnon *et al.* (1999). This is for the two likelihood ratio test statistics. At the 5% significance level, the idea that there is no cointegration is not true. Both the trace test and the test for the largest eigenvalue show that at the 0.01 level, there is at least one cointegrating equation. So, at the 0.01 level, the null hypothesis that there is no cointegration can be thrown out. Table 4 shows the results of the Johansen cointegration test, which supports hypothesis 1

Variables	ADF(0)	ADF(1)	PP(0)	PP(1)
ASPI	−1.2758	−9.4917***	−1.170	−9.5917***
CPI	−1.2448	−9.4663***	−1.234	−9.985***
DI	−2.2728	−12.437***	−2.375	−12.498***
ER	−0.4032	−7.4108***	−0.3592	−7.247***
PI	−1.083	−3.563***	−1.702	−3.053***
TB	−1.3857	−7.3907***	−1.320	−7.887***

Note(s): The numeric values in cells are *t*-statistic. Probability values for rejection of the null hypothesis are employed at the 5% significant level (**, *p*-value < 0.05 and***, *p*-value < 0.01)
Source(s): Author calculation (2021)

Table 3.
Results of unit root tests

Number of cointegration (*r*)	Trace statistic	Maximum eigenvalue statistic
$r = 0$	104.3129 (95.756) ***	64.549 (40.077) ***
$r \leq 1$	65.4292 (69.818)	32.071 (33.876)
$r \leq 2$	39.277 (47.85613)	21.193 (27.584)
$r \leq 3$	30.793 (29.797)	18.590 (21.131)
$r \leq 4$	12.202 (15.494)	8.672 (14.264)
$r \leq 5$	1.072 (2.652)	1.072 (2.652)

Note(s): Series: LOG(ASPI) LOG(CPI) LOG(ER) LOG(PI) LOG(TB), LOG(DI), Economic Crisis Cointegrating equations are significant at the 0.05 level (**, *p*-value < 0.05 and ***, *p*-value < 0.01)
Source(s): Author calculation (2021)

Table 4.
Results of Johansen cointegration test

that there is a long-term equilibrium relationship between macroeconomic variables and stock prices in Sri Lanka.

Vector error correction estimates

Based on the Johansen cointegration test results in Table 4, it is clear that stock prices and macroeconomic variables in Sri Lanka are in a long-run equilibrium relationship. In this case, a VAR with no restrictions would not be a good way to test short-run dynamics. Engle and Granger (1987) said that if two or more variables are cointegrated, there is always an error correction representation. The deviation from equilibrium affects the short-run behaviour of the variables in the system. The cointegrated variables must have an error-correcting representation in which an error-correcting term is built into the model (Toda and Phillips, 1993). In this case, a vector error correction (VECM) model is made to bring back the information lost during the differencing process. This makes it possible to have both long-term equilibrium and short-term dynamics. The VECM says that changes in one variable are a function of the level of disequilibrium in the cointegrating relationship (captured by the error correction term) and changes in other explanatory variables. So, when the variables are cointegrated, the VECM is a good way to find out the long-run and short-run elasticity.

The VECM is a method that makes it easier to capture how the variables change over time and how they depend on each other. A special type of restricted VAR can fix an imbalance that could shock the whole system. Because it can measure both short-run and long-run dynamics, the VECM can tell the difference between short-run and long-run elasticity. The error correction term shows how things will change in the long run. The significance of the *t*-test of the lagged error correction terms shows that the long-run elasticity is important. The multivariate VECM gives-statistics, which are used to figure out how statistically important the regressor coefficients are.

Statistical inference is affected by the instability of parameters, the correlation between residuals over time and the skewness of residuals. The results of VECM estimates, model diagnostic tests and residual diagnostic tests show that there are fewer outliers and that the fluctuation bands are smaller. The series is not very different from a normal distribution regarding how skewed it is. Using the Jarque–Bera test to check for histogram normality, the null hypothesis that residuals are multivariate normal is rejected. Breusch-Godfrey test for serial correlation. The null hypothesis that there is no serial correlation at lag order 2 is rejected by the Lagrange multiplier or LM test. Heteroskedasticity test (null hypothesis: no autoregressive conditional heteroskedasticity or ARCH effect at lag order 1) is also not true. So, this model gives satisfactory results.

Table 5 reports the results of VECM estimates. The coefficient of $ECT_{(t-1)}$ is significant with a negative sign at the 0.01 level, which indicates that the lagged structure of $ECT_{(t-1)}$ is unstable (see Figure 3). The result confirms that a negative dynamic relationship between macroeconomic variables to the stock market returns is observed in the long run.

Finally, hypothesis 7 postulates that economic crisis is related to stock price dynamics in the long- and the short-run. The coefficient of the political crises is significant, that is, the changes in stock prices in the long-run and the short-run in Sri Lanka are determined largely by external shocks in the model. The result suggests only that the economic crisis affect significant changes in the endogenous variables in the model.

Impulse responses

In addition to the findings correlating with the hypotheses, the impact of the impulse responses and variance decomposition may be noteworthy. Through the dynamic (lag) structure of the VAR, a shock to the jth variable affects that variable directly and all other endogenous variables. Estimating impulse responses and variance decomposition functions

	Endogenous variables: Lag order in () Dependent variable: ASPI(t)	VEC model 1 including exogenous crisis Coefficient t-statistics in [ ]	VEC model 2 excluding exogenous crisis Coefficient t-statistics in [ ]
Long-run dynamics[1]	ECT_{t-1}: error correction term	−0.08005[−3.54463]***	−0.0011[−1,1875]**
Short run dynamics[2]	D(LOG(ASPI(−1))	0.9292[0.9929]	0.1407 [1.434]
	D(LOG(CPI(−1)))	0.2474 [0.7835]	−0.0025 [−0.0063]
	D(LOG(ER(−1)))	0.4091 [0.8065]	−0.1584 [−0.2995]
	D(LOG(PI(−1)))	0.0656 [1.1228]	0.4247 [0.6351]
	D(LOG(TB(−1)))	0.0776 [0.6558]	−0.1080 [−0.95166]
	D(LOG(CD) (−1))	0.0474 [0.7835]	−0.0125 [−0.0263]
	Constant	0.0197 [2.718]	0.0072 [1.2164]
Exogenous variable	Economic Crisis	−0.0483 [2,8433] **	
Model diagnostic tests	R-squared	= 0.1358	= 0.0465
	Adjusted R-squared	= 0.086	= 0.0082
	F-statistic	= 2,739***	= 0.8499**

Note(s): The probability value for rejection of the null hypothesis is employed at the 0.05 level (**$p < 0.05$ and ***, $p < 0.01$)

[1]Long-run dynamics equation

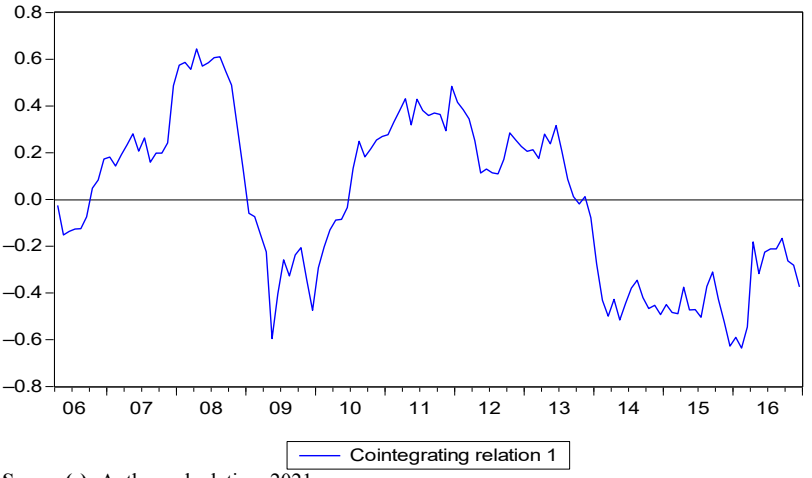
D(LOG(ASPI)) = C(1)*(LOG(ASPI(−1)) − 0.145278175484*LOG(CPI(−1)) − 3.35242379283*LOG(ER(−1)) + 0.88673050031*LOG(PI(−1)) + 1.34041461815*LOG(TB(−1)) + 0.134388603061*LOG(CD(−1)) + 0.762327818832)

[2]Short-run dynamics equation:

D(LOG(ASPI)) = C(2)*D(LOG(ASPI(−1))) + C(3)*D(LOG(CPI(−1))) + C(4)*D(LOG(ER(−1))) + C(5)*D(LOG(PI(−1))) + C(6)*D(LOG(TB(−1))) + C(7)*D(LOG(CD(−1))) + C(8) + C(9)*Crisis

Source(s): Author calculation (2021)

Table 5.
Results of vector error correction (VEC) estimates



Source(s): Author calculation, 2021

Figure 3.
Cointegration graph of the cointegrating equation

permit the evaluation of the effects of shocks on endogenous variables. Impulse response functions determine the impact of a one-time shock to one of the innovations on endogenous variables' present and future values. Since innovations are typically correlated, they may share a component that cannot be attributed to a particular variable. To interpret the impulses, it is common practice to apply a transformation to the innovations that render them uncorrelated. The Cholesky transforming method orthogonalises impulses using the inverse

of the Cholesky factor of the residual covariance matrix. This method imposes an order on the variables in the vector autoregressive system and attributes the entire effect of any common component to the first variable in the system. The impulse responses of stationary VAR models should decay to zero and the accumulated responses should asymptote to some constant.

Figure 4 displays the impulse responses of stock prices to one standard deviation change in endogenous variables introduced by Cholesky. The impulse response of stock prices to a shock in short-term interest rates (DI) is consistently negative, with a rise in the first four months followed by stabilisation. The response of stock prices to innovations in DI diminishes in subsequent periods and continues to negatively affect despite gradually diminishing. The response of stock prices to a shock in ERs is initially negative for four months, and then gradually turns positive in subsequent periods. The impulse response of stock prices to the TB shock and the TB shock continues to have a negative impact while accelerating this decline gradually.

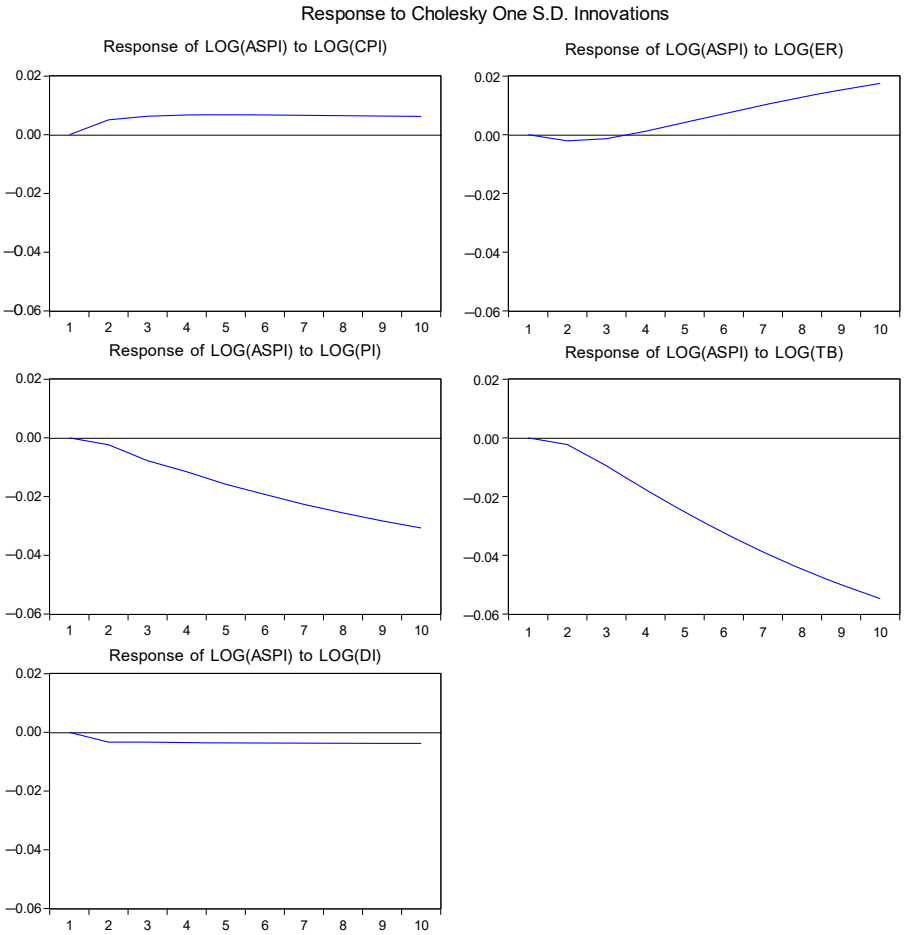


Figure 4.
Impulse response of ASPI to macroeconomic variables

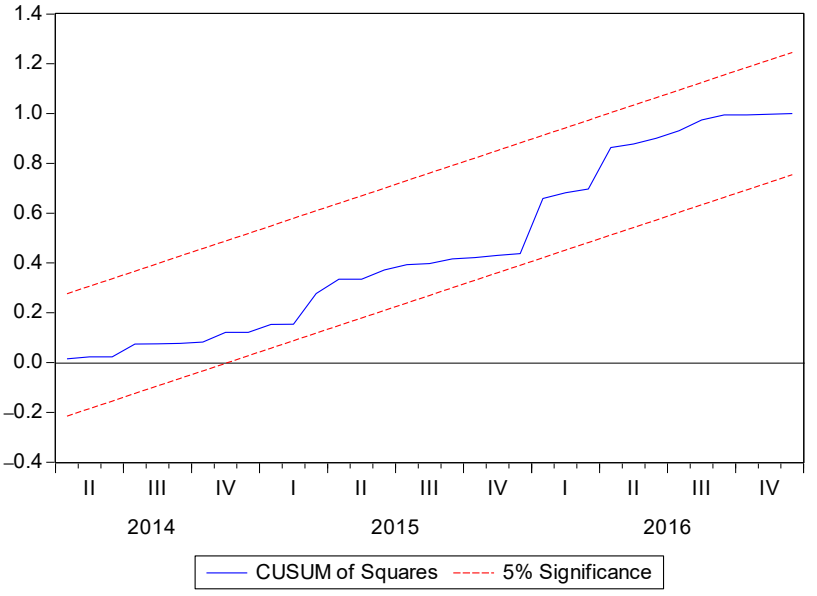
Source(s): Author calculation, 2021

Discussion and policy implication

The relationship between the ASPI and selected macroeconomic variables was investigated in this study. To investigate whether the variables are cointegrated, this study applied the time series methodology to ASPI monthly data spanning from 2010 to 2021. The empirical research findings offered compelling arguments against the null hypotheses regarding the existence of unit roots in most of the series that were the focus of the investigation. The application of the Johansen cointegration methodology yielded findings that demonstrated the existence of a relationship of long-term equilibrium between the ASPI and macroeconomic variables. In addition, the result of the EC_{t-1} co-efficient has the expected and highly significant negative sign (0.493, 0.010), which indicates the speed adjustment back from the short-term disequilibrium to the long-term equilibrium. This can be seen as an indication of the speed adjustment back from the short-term disequilibrium. In addition, the coefficients of the error-correction model were shown to be stable through the utilisation of the CUSUM stability tests (see Figure 5).

Estimating the long-term coefficients of macroeconomic variables sheds light on the fact that the macroeconomic variables contribute a great deal to the ASPI fluctuations and are therefore significant. As a result, the findings are in line with the findings from earlier studies (for example Chang and Rajput, 2018; Chang *et al.*, 2021; Aguiar and Broner, 2006; Yang *et al.*, 2018). For stock prices (ASPI) itself, the lagged period of stock prices has a positive influence on the current period while the one-legged period of CPI (CPI), the ER, IP index, TB and short-term interest rate (CD) shows no significant influence on the current period. This may prompt investors not to base their expectations of future results on past performance. The likelihood of various stock price outcomes is hypothetical, and everybody should realise the ups and downs of the stock market.

In the short run, political/economic crises in Sri Lanka are negatively related to stock prices with a significant coefficient of −0.0483. This means that the system corrects its



Source(s): Author calculation, 2021

Figure 5.
Model stability test

previous period disequilibrium 0.048 times reflecting a sizable speed of adjustment to reach an equilibrium steady-state position. Findings show compelling evidence that the political-economic crisis impacted the stock price dynamics in Sri Lanka. These findings are in line with the findings from earlier studies for example Masrizal *et al.* (2021), Abbas and Wang (2020) and Naifar and Al Dohaiman (2013). Considering these findings, financial managers can enhance their understanding of the political and economic stability and stock price dynamics. A better understanding of short- and long-run movements enables financial managers to better-informed investment and financial decisions.

This research contributes to the existing literature in three aspects. First, this research uncovers the fact that there exists a long-run equilibrium relationship between macroeconomic variables and stock prices in Sri Lanka. Second, the paper empirically explores the short-term dynamic relationships between selected macroeconomic variables and stock prices in Sri Lanka. Thirdly this study examines the impact of the effect of structural break, a political-economic crisis in 2020–2022.

Conclusions

The evidence in this study is important for policymakers, researchers and investors in many ways. The results shown in this paper can be used to make suggestions. From a long-term point of view, policymakers should look at some macroeconomic variables, like CPI, the EX, the IP index and TBs, as policy tools for the Sri Lankan stock market.

This study makes a contribution to the existing body of knowledge by offering empirical insights into the ways in which the economic crisis has caused investors in Sri Lanka to have a pessimistic outlook. The finding that the current economic crisis is having a significant negative effect on stock markets in Colombo indicates that economic crisis generates spirals of market uncertainty, which in turn weakens investors' sentiments and causes market volatility. This finding was made possible by the fact that the current economic crisis is having a significant negative effect. In addition to this, the study highlights the empirical evidence of the significance of economic crises, such as drops in the price of oil and fluctuations in EXs, in negatively affecting the sentiments of investors when they are deciding whether or not to make investments in the stock market in Sri Lanka. Therefore, government regulators and policymakers have a responsibility to protect the interests of investors, perhaps by ensuring that businesses have access to opportunities for increased liquidity and profitability. Taking into account the gravity of the crisis, the primary objective of the government policy should be to gradually stimulate the travel and tourism, manufacturing, construction and service sectors. The result of this would be that investors would have a more positive outlook on the company's future earnings, which, in turn, would reduce market volatility and pave the way for economies to grow in a more stable manner. Despite the key empirical insights that were drawn from this study, there is room for expansion in the work by including other socio-economic, demographic, political and policy parameters in the analysis. This would be a step in the right direction.

References

Abbas, G. and Wang, S. (2020), "Does macroeconomic uncertainty really matter in predicting stock market behavior? A comparative study on China and USA", *China Finance Review International*, Vol. 10, pp. 393-427, doi: 10.1108/CFRI-06-2019-0077.

Abbas, G., McMillan, D. and Wang, S. (2018), "Conditional volatility nexus between stock markets and macroeconomic variables Empirical evidence of G-7 countries", *Journal of Economic*, Vol. 45, pp. 77-99, doi: 10.1108/JES-03-2017-0062.

Achsani, N.A. and Strohe, H.G. (2004), "Dynamic causal links between Russian stock exchange and selected international stock markets", in Gavrilenkov, Y., Welfens, P.J.J. and Wiegert, R. (Eds), *Economic Opening up and Growth in Russia*, Springer-Verlag.

Aguiar, M. and Broner, F. (2006), "Determining underlying macroeconomic fundamentals during emerging market crises: are conditions as bad as they seem?", *Journal of Monetary Economics*, Vol. 53, pp. 699-724, doi: 10.1016/j.jmoneco.2005.02.005.

Aquino, R. (2004), "A multifactor model of Philippine stock returns using latent macro risk factors", *Applied Economics Letters*, Vol. 11, pp. 961-968, doi: 10.1080/1350485042000285832.

Asad, M., Tabash, M., Sheikh, U., Al-Muhanadi, M. and Ahmad, Z. (2020), "Gold-oil-exchange rate volatility, Bombay stock exchange and global financial contagion 2008: application of NARDL model with dynamic multipliers for evidences beyond symmetry", *Cogent Business and Management*, Vol. 7, doi: 10.1080/23311975.2020.1849889.

Balli, F., de Bruin, A. and Chowdhury, M. (2019), "Spillovers and the determinants in Islamic equity markets", *North-American Journal of Economics and Finance*, Vol. 50, doi: 10.1016/j.najef.2019.101040.

Barodawala, R. and Ranawat, D. (2018), "Fundamental drivers of Indian stock market", in Mishra, A., Arunachalam, V. and Patnaik, D. (Eds), *Presented at the Current Issues in The Economy and Finance Of India*, pp. 69-86, doi: 10.1007/978-3-319-99555-7_5.

Bulmash, S.B. and Trivoli, G.W. (1991), "Time-lagged interactions between stock prices and selected economic variables", *The Journal of Portfolio Management*, Vol. 17, pp. 66-67.

Chancharoenchai, K., Dibooglu, S. and Mathur, I. (2005), "Stock returns and the macroeconomic environment prior to the Asian crisis in selected southeast Asian countries", *Emerging Markets Finance and Trade*, Vol. 41, pp. 38-56, doi: 10.1080/1540496X.2005.11052616.

Chang, B. and Rajput, S. (2018), "Do the changes in macroeconomic variables have a symmetric or asymmetric effect on stock prices? Evidence from Pakistan", *South Asian Journal of Business Studies*, Vol. 7, pp. 312-331, doi: 10.1108/SAJBS-07-2018-0077.

Chang, B., Meo, M., Syed, Q. and Abro, Z. (2019), "Dynamic analysis of the relationship between stock prices and macroeconomic variables an empirical study of Pakistan stock exchange", *South Asian Journal of Business Studies*, Vol. 8, pp. 229-245, doi: 10.1108/SAJBS-06-2018-0062.

Chang, C.P., Feng, G.F. and Zheng, M. (2021), "Government fighting pandemic, stock market return, and COVID-19 virus outbreak Emerg", *Emerging Markets Finance and Trade*, pp. 1-18.

Cheung, Y.-W. and Lai, K.S. (1993), "A fractional cointegration analysis of purchasing power parity", *Journal of Business and Economic Statistics*, Vol. 11, pp. 103-112.

Chinzara, Z. (2011), "Macroeconomic uncertainty and conditional stock market volatility in South Africa", *South African Journal of Economics*, Vol. 79, pp. 27-49, doi: 10.1111/j.1813-6982.2011.01262.x.

Comincioli, B. (1996), "The stock market as a leading indicator: an application of granger causality, the park place economist", Illinois Wesleyan University, Vol. 4 No. 1, p. 155.

Czapkiewicz, A., Jamer, P. and Landmesser, J. (2018), "Effects of macroeconomic indicators on the financial markets interrelations", *Czech Journal of Economics and Finance*, Vol. 68, pp. 267-292.

Debata, B. and Mahakud, J. (2018), "Interdependence between monetary policy and stock liquidity: a panel VAR approach", *Margin- Journal of Applied Economic Research*, Vol. 12, pp. 387-413, doi: 10.1177/0973801018786270.

Dickey, D.A. and Fuller, W.A. (1979), "Distribution of the estimators for autoregressive time series with a unit root", *Journal of the American Statistical Association*, Vol. 74, pp. 427-431.

Dickey, D.A. and Fuller, W.A. (1981), "Likelihood ratio statistics for autoregressive time series with a unit root", *Econometrica*, Vol. 49, pp. 1057-1072.

Engle, R. and Granger, C. (1987), "Cointegration and error correction: representation, estimation and testing", *Econometrica*, Vol. 55, pp. 251-276.

Ersan, O., Akron, S. and Demir, E. (2019), "The effect of European and global uncertainty on stock returns of travel and leisure companies", *Tourism Economics*, Vol. 25, pp. 51-66, doi: 10.1177/1354816618792398.

Fama and Eugene, F. (1990), "Stock returns, expected returns, and real activity", *Journal of Finance, American Finance Association*, Vol. 45, pp. 1089-1108.

Gjerde, Ø. and Sættem, F. (1999), "Causal relations among stock returns and macroeconomic variables in a small, open economy", *Journal of International Financial Markets, Institutions and Money*, Vol. 9, pp. 61-74.

Han, H., Kutan, A. and Ryu, D. (2015), "Effects of the US stock market return and volatility on the VKOSPI", *Economics: The Open-Access, Open-Assessment E-Journal*, Vol. 9, doi: 10.5018/economics-ejournal.ja.2015-35.

Hartmann, D., Kempa, B. and Pierdzioch, C. (2008), "Economic and financial crises and the predictability of US stock returns", *Journal of Empirical Finance*, Vol. 15, pp. 468-480, doi: 10.1016/j.jempfin.2007.07.003.

Hashmi, S. and Chang, B. (n.d.), "Asymmetric effect of macroeconomic variables on the emerging stock indices: a quantile ARDL approach", *International Journal of Finance and Economics*. doi: 10.1002/ijfe.2461.

Hondroyiannis, G. and Papapetrou, E. (2001), "Macroeconomic influences on the stock market", *Journal of Financial Economics*, Vol. 25, pp. 33-49.

Huang, J., Dong, X., Chen, J. and Zhong, M. (2022), "Do oil prices and economic policy uncertainty matter for precious metal returns? New insights from a TVP-VAR framework", *International Review of Economics and Finance*, Vol. 78, pp. 433-445, doi: 10.1016/j.iref.2021.12.010.

Humpe, A. and McMillan, D. (2020), "The Covid-19 stock market puzzle and money supply in the US", *Economic Bulletin*, Vol. 40, pp. 3104-3110.

Javaira, Z. and Hassan, A. (2015), "An examination of herding behavior in Pakistani stock market", *International Journal of Emerging Market*, Vol. 10, p. 474, doi: 10.1108/IJoEM-07-2011-0064.

Johansen, S. (1988), "Statistical analysis of cointegrating vectors", *Journal of Economic Dynamics and Control*, Vol. 12, pp. 231-254.

Jung, H. and Kim, D. (2011), "Innovations in the future money growth and the cross-section of stock returns in Korea", *Asia-Pacific Journal of Financial Studies*, Vol. 40, pp. 683-709, doi: 10.1111/j.2041-6156.2011.01054.x.

Khan, M.K., Teng, J., Khan, M.I. and Khan, M.F. (n.d.), "Stock market reaction to macroeconomic variables: an assessment with dynamic autoregressive distributed lag simulations", *International Journal of Finance and Economics*. doi: 10.1002/ijfe.2543.

Kulhanek, L. (2012), "The relationship between stock markets and gross domestic product in the central and Eastern Europe", in Kotlebova, J. (Ed.), *Presented at the Proceedings Of The 7th International Conference On Currency, Banking And International Finance - How Does Central And Eastern Europe Cope Up With The Global Financial Crisis?*, pp. 135-145.

Kwon, C.S. and Shin, T.S. (1999), "Cointegration and causality between macroeconomic variables and stock market returns", *Global Finance Journal*, Vol. 10 No. 1, pp. 71-81.

Liang, P. and Willett, T. (2015), "Chinese stocks during 2000-2013: bubbles and busts or fundamentals?", *China Economic*, Vol. 48, pp. 199-214, doi: 10.1080/10971475.2015.1031600.

Lin, F., Yang, S., Marsh, T. and Chen, Y. (2018), "Stock and bond return relations and stock market uncertainty: evidence from wavelet analysis", *International Review of Economics and Finance*, Vol. 55, pp. 285-294, doi: 10.1016/j.iref.2017.07.013.

Liu, Z., Ding, Z., Lv, T., Wu, J. and Qiang, W. (2019), "Financial factors affecting oil price change and oil-stock interactions: a review and future perspectives", *Natural Hazards*, Vol. 95, pp. 207-225, doi: 10.1007/s11069-018-3473-y.

MacKinnon, J.G. (1996), "Numerical distribution functions for unit root and cointegration tests", *Journal of Applied Econometrics*, Vol. 11, pp. 601-618.

MacKinnon, J.G., Haug, A.A. and Michelis, L. (1999), "Numerical distribution functions of likelihood ratio tests for cointegration", *Journal of Applied Econometrics*, Vol. 14, pp. 563-577.

Masrizal, S.R., Al Mustofa, M. and Herianingrum, S. (2021), "Can country risks predict Islamic stock index? Evidence from Indonesia", *Journal of Islamic Accounting and Business Research*, Vol. 12, pp. 1000-1014, doi: 10.1108/JIABR-04-2020-0127.

Maysami, R.C. and Koh, T.S. (2000), "A vector error correction model of the Singapore stock market", *International Review of Economics and Finance*, pp. 79-96.

Moradi, M., Appolloni, A., Zimon, G., Tarighi, H. and Kamali, M. (2021), "Macroeconomic factors and stock price crash risk: do managers withhold bad news in the crisis-ridden Iran market?", *Sustainability*, Vol. 13, doi: 10.3390/su13073688.

Mukherjee, T.K. and Naka, A. (1995), "Dynamic relations between macroeconomic variables and the Japanese stock market: an application of a vector error correction model", *Journal of Financial Research*, Vol. 18, pp. 223-237.

Naifar, N. and Al Dohaiman, M. (2013), "Nonlinear analysis among crude oil prices, stock markets' return and macroeconomic variables", *International Review of Economics and Finance*, Vol. 27, pp. 416-431, doi: 10.1016/j.iref.2013.01.001.

Nasir, M., Shahbaz, M., Mai, T. and Shubita, M. (2021), "Development of Vietnamese stock market: influence of domestic macroeconomic environment and regional markets", *International Review of Economics and Finance*, Vol. 26, pp. 1435-1458, doi: 10.1002/ijfe.1857.

Newey, W.K. and West, K.D. (1994), "Automatic lag selection in covariance matrix estimation", *Review of Economic Studies*, Vol. 61, pp. 631-653.

Park, K., Fang, Z. and Ha, Y. (2019), "Stock and bond returns correlation in Korea: local versus global risk during crisis periods", *Journal of Asian Economics*, Vol. 65, doi: 10.1016/j.asieco.2019.101136.

Patro, D., Wald, J. and Wu, Y. (2014), "Currency devaluation and stock market response: an empirical analysis", *Journal of International Money and Finance*, Vol. 40, pp. 79-94, doi: 10.1016/j.jimonfin.2013.09.005.

Phillips, P.C.B. and Perron, P. (1988), "Testing for a unit root in time series regression", *Biometrika*, Vol. 75, pp. 335-346.

Schwert, W.G. (1990), "Stock market volatility", *Financial Analysts Journal*, Vol. 46, pp. 23-34.

Sheikh, U., Asad, M., Israr, A., Tabash, M. and Ahmed, Z. (2020), "Symmetrical cointegrating relationship between money supply, interest rates, consumer price index, terroristic disruptions, and Karachi stock exchange: does global financial crisis matter?", *Cogent Economics and Finance*, Vol. 8, doi: 10.1080/23322039.2020.1838689.

Song, W., Park, S. and Ryu, D. (2018), "Dynamic conditional relationships between developed and emerging markets", *Physica A: Statistical Mechanics and its Applications*, Vol. 507, pp. 534-543, doi: 10.1016/j.physa.2018.05.007.

Sreenu, N. and Pradhan, A. (2022), "The effect of COVID-19 on Indian stock market volatility: can economic package control the uncertainty?", *Journal of Facilities Management*. doi: 10.1108/JFM-12-2021-0162.

Toda, H.Y. and Phillips, P.C.B. (1993), "Vector autoregressions and causality", *Econometrica*, pp. 1361-1393.

Tronzano, M. (2021), "Financial crises, macroeconomic variables, and long-run risk: an econometric analysis of stock returns correlations (2000 to 2019)", *Journal of Risk and Financial Management*, Vol. 14, doi: 10.3390/jrfm14030127.

Vasileiou, E. (2021), "Explaining stock markets' performance during the COVID-19 crisis: could Google searches be a significant behavioral indicator?", *Intelligent Systems in Accounting, Finance and Management*, Vol. 28, pp. 173-181, doi: 10.1002/isaf.1499.

Yang, E., Kim, S., Kim, M. and Ryu, D. (2018), "Macroeconomic shocks and stock market returns: the case of Korea", *Applied Economics*, Vol. 50, pp. 757-773, doi: 10.1080/00036846.2017.1340574.

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