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Interrelationship dynamics between stock markets of nation under debt crisis and its major trading partners: evidence from Sri Lankan crisis

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Abstract

A series of crises triggered over a decade may bring global recession, which may impact millions of investors, including countries teetering on the brink due to forex reserve shortages; this study addresses the significant financial event of a small nation declaring bankruptcy. Such events can have adverse consequences on the global economy, particularly affecting the stock market indices of the country's trading partners. Our research investigates the impact of small nation bankruptcies on the stock market indices of connected importing and exporting partners. Focusing on the recent political and economic crisis in Sri Lanka, we analyze interactions between the Sri Lankan stock exchange and its key trading partners. Employing pairwise cointegration and the vector auto-regressive model-based Granger causal approach, our findings reveal cointegration among the stock markets in Germany, Italy, and Sri Lanka. Notably, the pre-crisis causal links between the Colombo Stock Exchange and other stock markets have dissolved. These insights hold valuable implications for understanding and preparing for similar circumstances in other South Asian economies grappling with forex shortages and rising inflation.

Keywords Co-integration approach, Emerging markets, Economic contagion, Sri Lanka crises, Vector auto-regressive

JEL Classification G1, G11, G14, G15

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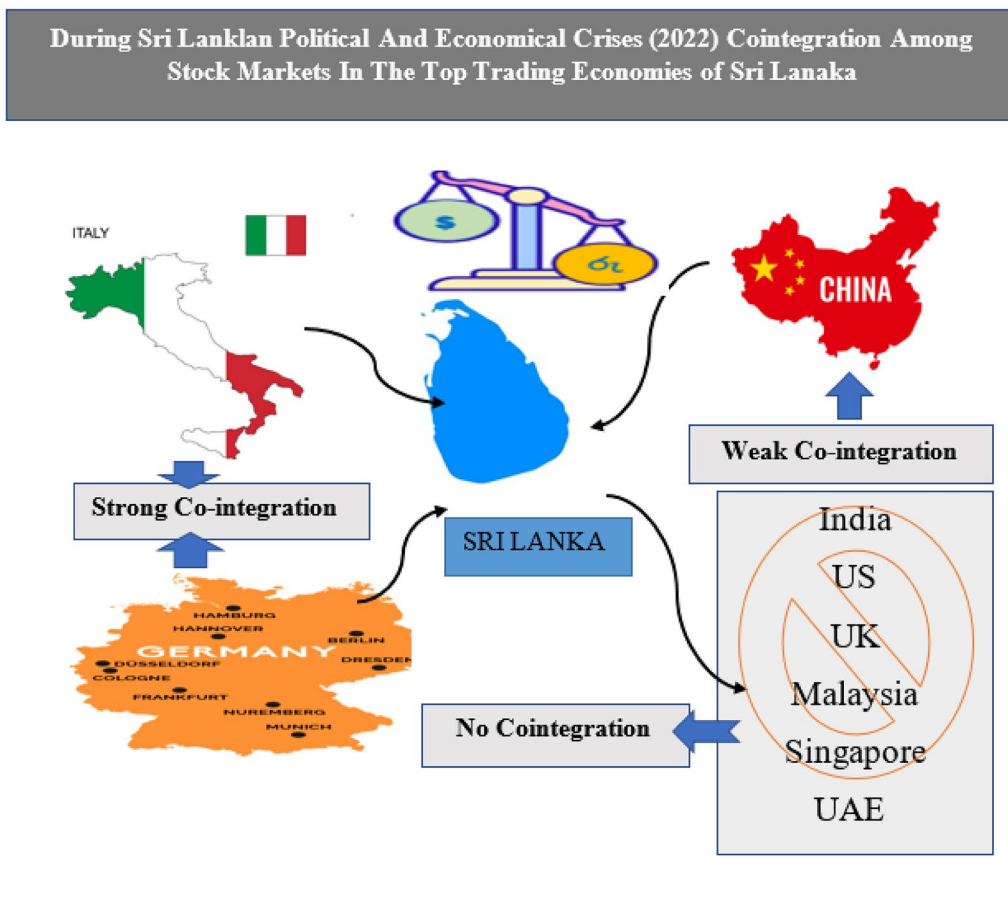
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Graphical abstract



Introduction

Sri Lanka experienced its worst-ever economic and political crisis in 2022. Beginning in March, the nation's slide toward chaos accelerated, displacing high-ranking officials and political figures accused of carrying out the disastrous economic policies that are the core of the country's issue [1]. The political casualties' extended power outages, long lines, and shortages of necessities failed to console people [2].

Can this happen to other South Asian Economies? Probably yes, as per the [3], South Asia is expected to slow down in 2023 [4]. Therefore, this study becomes essential not only for Sri Lanka but to all the economies that are facing forex shortages and poorly beaten by high inflation. From the theoretical perspective, we look at how the stock market of a country under crisis and the stock markets of its major trading partners interact.

The interaction between economies has increased post-globalization and is still increasing in many small economies. In recent decades, globalization has resulted

in the eternal links between the domestic stock market and cross-country trade and financial flows [5, 6]. The extensive economic liberalization process strengthened the linkage between the real economy and the fluctuating dynamics of international financial markets [7, 8]. However, economic globalization opens two fronts in global financial markets: possibilities (economic growth) and problems (transmission of crises). Although the interconnection of the world has provided some opportunities for investigators of global portfolio management, it is impossible to completely rule out the immediate effect of cross-country risks [9].

Globalization investment management in stock markets has benefited from the growing economic linkages between economies, yet financial crises may move from one economy to another in days or even hours [9]. While this capital flows through globalization have been linked with solid growth rates in certain emerging nations, several countries have seen periodic collapses in growth rates and significant financial crises throughout the same

time. These concerns have exacted a heavy macroeconomic and social cost burden [10].

One example is macroeconomic forces influencing financial markets and their growth [11]. For instance, regional organizations like the Association of Southeast Asian Nations (ASEAN) and the Asian Development Bank (ADB) have to keep an eye on how closely the stock markets in Asia move in tandem so that macroprudential measures may be developed to protect financial stability in the face of potential shocks (in transferring these shocks co-movement, causal relationship). In Asia, emerging and frontier countries (Pakistan, Bangladesh, etc.) are standing just at the doorstep as facing recession problems due to over debt. As per the recent IMF report, one-third of the global economy will face recession or contraction with shrinking real income and rising prices [12]. So, exploring the contemporary crises in frontier countries, especially in Sri Lanka, is vital so that some relative startles could be framed for alarming recession.

For better understanding, the rest of the study is divided into five subsections: In “Literature review” section covers the literature review, Sect. 3 covers research objectives and questions, and the comprehensive methodology is covered in “Data and methodology” section. In “Results and discussion” section, empirical results are covered. Finally, the conclusion of the study is enclosed in “Conclusion” section.

Literature review

Bulgaria was plagued by a severe financial crisis in 1996–1997 that started with a banking crisis and transacted into a currency crisis [13]. Nagayasu [14] evidenced a significant impact on the stock markets as a transmission channel during the currency turmoil. The terrible economic and financial crisis in Thailand and its neighboring East Asian nations began on July 2, 1997, when a de facto \$ peg of the Thai baht collapsed [15]. The depreciation rate for most of the currencies in the region from the end of June 1997 exceeded 50 percent in January 1998, when the crisis was at its peak. In several crisis-stricken emerging nations, a dramatic stock market loss enhanced the risk of an extreme currency devaluation on the same day. For currency markets, there is evidence of excessive spillover within areas but limited impact outside the region. Severe occurrences in stock markets are far more interconnected globally, especially in the USA [16]. Such rigorous transmission of crises over the global stock markets takes the form of contagion.

Economic contagion is the spread of financial or economic shocks from shocked countries (economies or regions) to stable countries (economies or regions) through international business (trade) and finance (financial networks) [17–19]. When many financial

indexes move together because of some external effect, this sharp movement across borders has been named a contagion. This concept of contagion states that a crisis in one nation amplifies the probability of a problem in another country beyond the interdependence between these countries in non-crisis periods [20]. The subprime crisis (2007) and other financial shocks significantly influenced fundamental and financial factors [21]. Between “contagion” and “common shocks,” the literature makes a distinction [22–25]. When a crisis is dubbed contagion, there should be a robust transmission of shocks. However, cross-market interdependence may be called ‘shocks,’ which may be temporary. Several patterns of worldwide spillover of economic shocks are discussed in the literature. Masson [22] stated three stages of contagion: (1) financial contagion through “monsoonal effects” becomes contagious on the correlated underlying macroeconomic variables, (2) transmission of contagion through “spillovers” (via external links as trade), (3) “pure contagion” which causes a bull (favorable) market to bear (adverse) market. The first two situations (monsoonal impacts and spillovers) demonstrate interdependence. Crises caused by interdependence may be predicted using macroeconomic factors. Suppose the interdependence between countries is observed during non-crisis times. In that case, the impact of a financial crisis in one nation on the risk of a crisis in another country may be assessed. The third situation, equilibrium jumps, is what we refer to in this study as contagion: a more unexpected, stronger correlation during crisis periods than regular times.

The relationship between contagion and interdependence is significant. When markets have a more considerable correlation during crises, investors should modify their portfolios appropriately since diversification across markets may be less effective than expected if based on correlations in quiet times. Similarly, governmental responses to a crisis will be determined by the perceived pattern of shock transmission throughout financial markets. Policy intervention may be helpful if the source of a crisis is a random leap between equilibria, i.e., contagion. In contrast, if a crisis extends to other markets due to associated fundamentals, policymakers are less inclined to be able to avert the crisis from spreading. In a continual effort to boost economies, central banks, governmental organizations, and international organizations have intervened in the financial market [26, 27]. In a persistent effort to boost economies, central banks, governmental organizations, and international organizations have intervened in the financial market. Policymakers tasked with preserving financial stability are worried about whether shocks are communicated differentially across equities markets in unfavorable versus normal conditions.

Most influencing studies on Sri Lanka's prior crises with other recent crises and variables

In the late 1960s, Sri Lanka's purchasing power parity (PPP) per capita income was much higher than in Thailand and South Korea. In contrast, it was slightly lower than Malaysia's [28]. Wijeweera et al. [29] stated that from 1952 to 2002, despite the free trade policy launched in 1977. Moreover, from 1983 to 2009, the Sri Lankan economy was affected a lot; almost 100,000 people were killed in the civil war [30].

Sri Lanka does not have a debt overhang policy as total foreign indebtedness was not too high. Sri Lanka—the Tamil separatist war results indicated that fundamental conflicts in Sri Lanka's national development strategy and restricted trade system were at the core of the country's dual political strife [31]. Kelegama [32] stated that during 2007–2009, different terrorist attacks shook the industries of Sri Lanka. Nevertheless, the Sri Lankan economy grew by an astonishing 7.2 percent in 2012. It exhibited booming growth after the conclusion of a 30-year civil war in May 2009 and advanced to a higher sustainable development path. All-important sectors of the economy performed admirably in 2012, supported by a stable domestic environment, greater investor confidence, improving macroeconomic circumstances, and the global economy's slow recovery from one of the darkest periods of historical recession (Central Bank of Sri Lanka, 2012). According to research by AkXram [33], foreign public debt has aided the process of economic development in Sri Lanka; nevertheless, debt payment has a negative link with per capita GDP and investment. External debt played a critical part in developing the country's civil war; debt payment remains a severe worry in Sri Lanka. Domestic debt has a significant and positive link with per capita GDP [34–36]. Furthermore, COVID-19 had a substantial impact on the global stock market [37–40] and the behavior of sustainable business [41, 42, 42–44] and Colombo stock exchange, which reported a record low in mid-march 2020 [45, 46].

Sri Lanka's external sector performance has decreased because of lower export revenues, tourist receipts, and remittances, and the Sri Lanka rupee has drastically fallen versus major foreign currencies. Li et al. [42] also indicated that the economic center is critical to the region's economic and social growth.

Moreover, in further testing, it is of utmost importance to consider the distinct attributes associated with each location, including factors such as a country's level of accessibility to the capital market, the extent to which research and development expenditures are tax-deductible, and pertinent regulatory considerations [47].

In the Russia–Ukraine war, Ukrainian firm has shown negative return as the Ukrainian boundary touch with

European markets; these markets (European) intend to react negatively as significant abnormal negative returns as increased political uncertainty and geographic proximity [48, 49] as stock market impacted by the Russia–Ukraine [50–52], Which make changes in the behavior of the stock market [31] due to changes in the investor's sentiments [39]. Such crises further impact the corporations for disinvestments [53]. However, the impact of this war created a significant adverse effect on the Asian and European regions [54]. Ganegodage and Rambaldi [55] stated that the Sri Lankan war significantly affected GDP. In Sri Lanka, there is no evidence to suggest that political ties boost a company's value. The Sri Lankan government does not favor politically affiliated companies when awarding large contracts [56].

Politics may negatively influence economic ties, which can hurt fiscal linkage. The degree of risk aversion of investors may be increased by political crises as well. Foreign investments (particularly in developing nations, where political risk is higher) might be seen as riskier, and investors' funds could be pulled out of these areas due to investors' attention [39]. Since less money flows into such markets, this may induce a crisis and reduce their degree of global integration [57]. Arguably, a decline in share demand and market fragmentation would result from increased risk premia. A positive influence on stock market integration from political crises is feasible if contagion drives the impact of crises on financial integration. When the reasons for both positive and negative links appear credible, it is impossible to foresee which one will prevail; the subject must instead be decided experimentally [58]. A political crisis may cause awful news to spread swiftly to other markets, creating contagion effects that may exacerbate the co-movement of stock markets [39, 59, 60].

Current status of Sri Lankan political and economic crisis.

On April 3, 2022, a political crisis started in Sri Lanka for power between the Gotabaya Rajapaksha (Sri Lankan president) and the parliament of Sri Lanka [61]. It is made worse by the economic crisis in the country, which has caused people to protest against the government. Different parts of Sri Lanka are against the government, which has led to political instability that the nation has not seen since the civil war. The Chamber of Young Lankan Entrepreneurs (COYLE) also issued a call to action. It warned that if the ministry did not handle the present economic and political crises, it might lead to the liquidation of firms. A former World Bank official, Shanta Devarajan, cautioned that Sri Lanka's main threat is societal upheaval and volatility. He said a money transfer program might be implemented to prevent the economy from collapsing and assist people in need. To avoid economic

collapse, it also suggested reducing subsidies on food and gasoline [62]. On May 9, 2022, amid widespread anti-government movements, Prime Minister Mahinda Rajapaksa handed in his resignation letter. Ranil Wickremesinghe was sworn in on May 12, 2022, as prime minister. Still, on July 9, crowds put homes stormed and burned, which resulted in the reign of Wickremesinghe (prime minister) and Gotabaya (president). On July 15, Wickremesinghe retook an oath as acting president as Wickremesinghe flew to the Maldives and said not to discharge duty as out of Sri Lanka. Dinesh Gunawardena took oath on July 22 after the secret ballot of July 20, 2022 [61].

Sri Lankan government (on April 12) declared a unilateral debt standstill by suspending its foreign debt servicing with the limitation of payments to Multilateral Development Banks (MDBs) [63]. As a burst in inflation, rates paralyzed the Sri Lankan economy (Fig. 1), increasing daily, which severely impacted the economy of Sri Lanka. However, in August 2022, the IMF came up with some bailout packages to restructure Sri Lankan foreign debt (i.e., \$51 billion).

Sri Lanka’s Colombo stock market (consisting of 295 companies representing 20 Global Industry Classification System (GICS) with a \$5489 billion market cap in 2021) has also been influenced by different domestic and international crises [34–36]. So, it is essential to review the impact of crises on risk movements transfer in the trading stock market; no theoretical or empirical literature on Sri Lankan political turmoil (2022). A former World Bank official’ and United Nations (UN) experts’ deleterious statements related to economic collapse (as foreign reserves dried up with a \$51 billion loan, financial experts stated the country didn’t have enough currency to import), historically breaking inflation (high inflation rate with consistent growth (Fig. 1) with record high inflation (54.6%)), power outages, and debilitating fuel shortages have all contributed to Sri Lanka’s economic downfall. At

the ground level, the UN reported that people face challenges with medicines, food, and fuel [64]. Since January 2020, their foreign currency reserve has decreased by 70 percent (\$779 in December 2021). The asymmetric effect has been found in Sri Lankan stock returns [65–67].

In general, the prior studies have not investigated the emergence of economic contagion from the spark of Sri Lanka’s political turbulence (2022) and worsening financial crisis impacts and interdependency among most trading economies (focusing on top export and import in volume).

Theoretical description

Stock market reaction theory

The stock market reaction theory indicates an unbiased reaction of stock prices to public information. The property of “unbiased reaction” to public information, which formed the basis of efficiency, was seen to be an implication of rational, maximizing investor behavior in competitive securities markets [68]. Reduced to a basic level, the reasoning was that any systematically biased reaction to public information is costless and publicly observable and thus provides pure profit opportunities to compete away. Characterizing the market in terms of its response to information is only one of many feasible ways of modeling stock price behavior. Still, it introduced economic theory to the empirical study of stock prices, which had received little serious attention from economists prior to that point. Despite the subsequent spate of anomalies, the early efficiency literature not only adapted the standard economic theory to provide the first formal economic insights into how stock prices behave, but it helped pave the way for an outpour of theoretical and empirical work on stock markets and capital markets in general.

Moreover, this theory indicated that (a) the efficient market hypothesis was audacious and included a departure from the previous comparative ignorance of stock

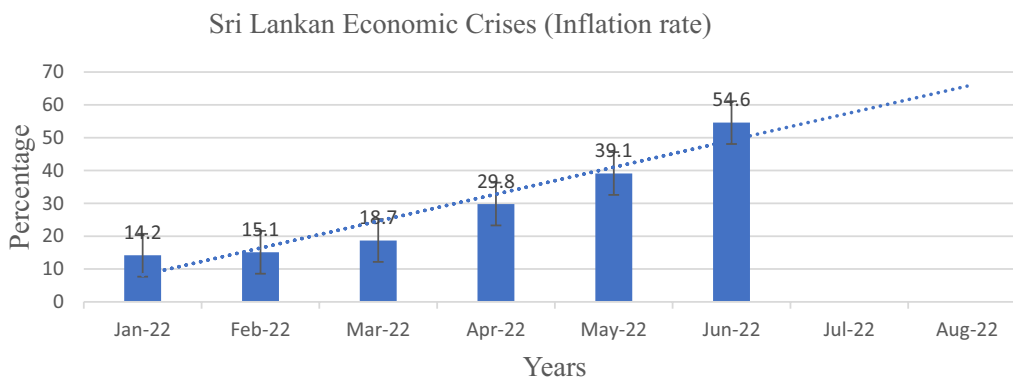


Fig. 1 Sri Lankan monthly inflation rate for 2022 (till June). *Source:* Created by Authors using Data from the Central Bank of Sri Lanka

market behavior; (b) “efficiency” is an implication of rational information use in a competitive market; (c) a priori, stock markets are paradigm examples of competition; (d) “efficiency” is one way of modeling competitive behavior in stock markets and, like all models, it has strengths, and (e) there are binding limitations in our model. (f) Similarly, the wide range of strange evidence discovered highlights the limitations of “efficiency” as a construct and our knowledge of asset pricing; (g) much of the strange evidence occurs where research designs are most sensitive to limitations in our understanding of asset pricing; and (h) the anomalous evidence provides an intriguing set of puzzles for researchers to solve (i) because of the priors stated in (c) above, anticipate that many of the anomalies will be resolved in favor of efficiency; however, (j) because of the low cost of accessing and processing large data files. The limitations in the theory of efficient markets indicate an inherently imperfect understanding of asset pricing and the likelihood that genuine exploit pricing errors occur in any market.

The findings of this study are aligned with the above theory as the Sri Lankan crises acted as unbiased stock market reactions that reacted with the Colombo stock market. The results are designed to aid investors by providing a foundation for analyzing the company’s future with consideration in the investment decision-making process.

Objective of the study

Restrictions on domestic migration and fiscal policy may have a positive impact on the economy. There could be several factors that can also have a strong positive association between political risk (Internal or external instability), health (COVID-19), war (Russia–Ukraine war), investors’ attention, and financial market uncertainty significantly may demonstrate a strong correlation with a notable decrease (increase) in an (other) stock market performance may act as the spillover transmitter or receivers [6, 39, 69–72]. Thus, it becomes essential to unveil the relationship as the interconnectedness among the economy of the Sri Lankan economy due to financial and political instability with its trading partner stock markets as variables.

As, the study seeks to address the following research objective, which is operationalized by the research questions in the form of RQ1 and RQ2.

RO: To analyze the causal relationship between the Colombo Stock Exchange (CSE) and the stock markets of the top five -export and -import partner countries during the Sri Lankan political crisis.

RQ1: Is there any significant co-movement existing between CSE and the stock markets of the top five -export and -import partner countries of Sri Lanka? If

yes, then how would convergence take place after the Sri Lankan political crisis?

RQ2: Is there any significant causal relationship exist between the CSE and the stock markets of the top five -export and -import partner countries? If yes, then did it change during the crisis period as compared to the pre-crisis period?

Data and methodology

The secondary data has been extracted from Bloomberg (source of data) in the form of daily closing price from 01/01/2017 to 20/07/2022 for trading partners of Sri Lanka (Table 1). To understand the cointegration dynamics between the markets, the study uses Johansen–Juselius’s [73] cointegration test along with the Vector Error Correction Model (VECM). The notion of cointegration was first presented in the field of econometrics by Granger [74] and subsequently expanded upon and formalized by Engle and Granger [75]. The underlying principle of this approach is rooted in the notion that economic time series have nonstationary characteristics. However, by using a suitable linear combination of trending variables, it is possible to eliminate the shared trend component. The linear combination of the time series variables will provide a stationary result, indicating that the relevant time series variables are cointegrated. Cointegration is a topic of interest for economists due to its potential implications for the presence of a long-term or stable equilibrium connection.

The study of cointegration tests has progressed in two primary avenues: (a) the utilization of residuals from a cointegration regression proposed by Engle and Granger [75] for testing and (b) the application of vector autoregressive models in a system of equations, as suggested by Johansen [76], Johansen and Juselius [77]. Cointegration is a statistical methodology used to ascertain the enduring association between time series data. -Within the framework of this research, the use of cointegration serves to facilitate comprehension of the extent to which the stock markets of several nations exhibit long-term synchronicity. This study has used a “pairwise” approach in their investigation of cointegration, whereby they have systematically examined pairs of nations to determine the presence of cointegration in their respective stock markets.

This approach is comprehensive, hence minimizing the possibility of disregarding any prospective long-term connections. The VAR-based Granger Causal Approach is a methodology used to analyze causal relationships between variables. The idea of Granger causality is a statistical tool used to ascertain the predictive relationship between two-time series. The use of a vector autoregression (VAR) framework enables researchers to

comprehensively analyze the Granger causality, hence facilitating an understanding of the dynamic interconnections between stock markets and the identification of the market that serves as the Granger causal factor for the other. The significance of this analysis is in its ability to ascertain the presence of a causal link between the stock markets of the respective nations, particularly in the aftermath of a notable event such as the declaration of bankruptcy. As per the objective of the study, the existence of cointegration among the stock markets in Germany, Italy, and Sri Lanka indicates a long-term equilibrium link among these markets.

This implies that over an extended period, these markets tend to exhibit parallel movements, indicating a state of dependency. The rationale for using the numerous studies [78, 79] as the VECM lies in its ability to use a complete information maximum likelihood estimation model. This model allows the testing of cointegration within a comprehensive system of equations, all in a single step, without necessitating the normalization of any individual variable. This approach enables us to prevent the propagation of mistakes from the first step to the subsequent one, which would occur if Engle–Granger’s technique were used. Additionally, it has the benefit of not necessitating any a priori assumptions on the endogeneity or exogeneity of the variables.

Vector auto-regression-based Granger causality test [80] implemented to compare the causal relationship between the pre-crisis (01/01/2017 to 02/04/2022) and during crisis (03/04/2022 to 20/07/2022) periods (Fig. 2). In this study, stock market indices selected as variables as the viability of stock market has the potential to affect a diverse array of stakeholders, including ordinary retail

investors, big institutional investors, businesses, and governments alike. Gaining comprehension of the stock market’s response to a crisis helps facilitate the preparedness and effective response of these relevant parties. Stock markets serve as a reflection of not just concrete economic indicators but also the subjective emotions of investors. Fluctuations in stock prices and trading volumes have the potential to serve as indicators of alterations in investor confidence, assuming a critical role in both the immediate aftermath and subsequent stages of a crisis. The interconnectedness of international commerce and finance implies that a crisis occurring in one nation might result in consequential repercussions for other countries. The examination of stock markets, particularly in nations that have substantial trade connections with the crisis-affected country (as in the Sri Lankan crises), is of paramount importance due to the potential manifestation of these ripple effects. However, in different periods, other sector studies used other relevant methods, such as [81, 82] used quantile regression to study FDI, renewable energy, [83] used cross-sectional auto-regression distributive lag model, and other variables. In taxation (Table 1).

Results and discussion

Table 2 shows the results of Augmented Dickey–Fuller (ADF) [84] and Philips–Perron (PP) [85] unit root tests at levels and first difference. Both tests confirm the non-stationarity issue in sample data sets.

Evidence does not accept the hypothesis that the selected ten stock index closing prices of different currencies have a unit root. The results convey that the data have mean and variance reverting behavior and changes with time. All variables were identified as stationary

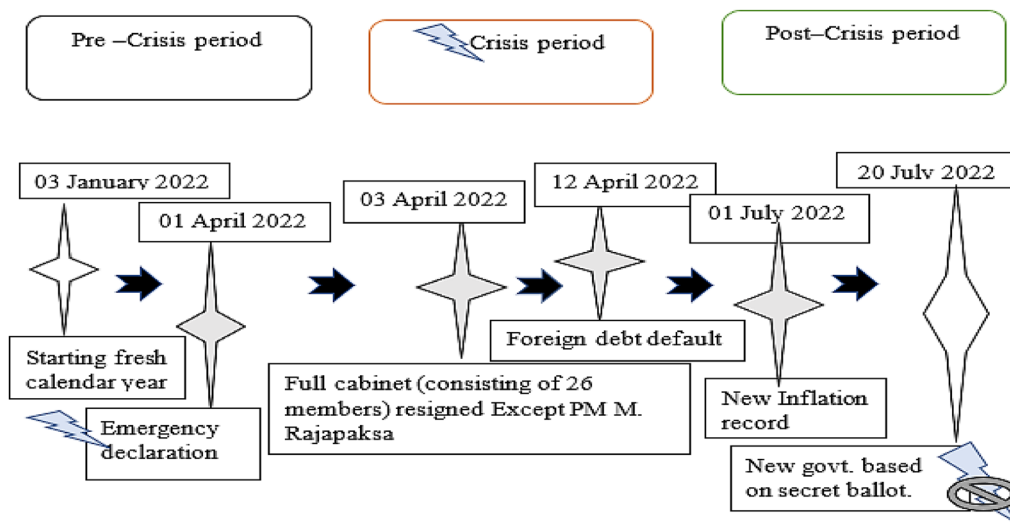


Fig. 2 Chronological event timeline of the Sri Lankan political crisis. Source: Created by authors

at the first order of integration I (1). Alternatively, we may say they were I(0) in the first difference. The mean remains constant across all variables. The first difference helps in stabilizing the mean once the seasonality and trend in the data series are taken care of. The stabilized mean helps avoid spurious analysis and draws realistic observations.

After determining that the variables under analysis were stationary at the first difference, we proceeded to test the cointegration between the variables. First, the CSE_P (Colombo Stock Exchange closing price) was analyzed with the other nine index prices of different countries. Then, we followed three steps to understand

Table 1 Trading Matrix of most significant trading partners of Sri Lanka (in \$) for 2021. Source: www.tradingeconomics.com

Import partners				Export partners			
Country	Index	Variable	Value	Country	Index	Variable	Value
China	Shanghai stock exchange	SSE_P	\$5.10B	US	S&P 500	SPX_P	\$3.30B
India	BSE sensex	SEN_P	\$4.74B	UK	FTSE 100	UKX_P	\$1.00B
UAE	Dubai financial market	DFM_P	\$1.41B	India	BSE sensex	SEN_P	\$891.46 M
Malaysia	Malaysia stock exchange	MLY_P	\$825.24 M	Germany	Deutscher Aktien Index	DAX_P	\$811.27 M
Singapore	Straits Times Index	STI_P	\$775.94 M	Italy	FTSEMIB	FTSEMIB_P	\$622.82 M

Export Partners—<https://tradingeconomics.com/sri-lanka/exports-by-country> and Import Partners—<https://tradingeconomics.com/sri-lanka/imports-by-country>

Table 2 Results of unit root test

S. No.	Variable	ADF test				PP test			
		Level		First difference		Level		First difference	
		t-statistic	Prob	t-statistic	Prob	t-statistic	Prob	t-statistic	Prob
1	CSE_P	-1.4618	0.8421	-25.9926	0.000	-1.5628	0.8071	-30.1095	0.000
2	SSE_P	-2.3131	0.4260	-37.9973	0.000	-2.3396	0.4115	-37.9983	0.000
3	SEN_P	-1.9717	0.6157	-15.5523	0.000	-1.9108	0.6483	-38.0988	0.000
4	DFM_P	-1.1624	0.9165	-33.8433	0.000	-1.2246	0.9043	-34.1136	0.000
5	MLY_P	-3.0231	0.1261	-37.2971	0.000	-3.3301	0.0618	-37.5167	0.000
6	STI_P	-2.1305	0.5277	-25.0237	0.000	-2.4576	0.3495	-39.1213	0.000
7	SPX_P	-2.5556	0.3011	-11.5988	0.000	-2.4075	0.3754	-43.8438	0.000
8	UKX_P	-2.5209	0.3178	-39.0233	0.000	-2.5407	0.3082	-39.0312	0.000
9	DAX_P	-2.5032	0.3265	-38.8588	0.000	-2.6196	0.2715	-38.8585	0.000
10	FTSEMIB_P	-2.4744	0.3409	-39.2525	0.000	-2.7823	0.2041	-39.3894	0.000

Source: The Author's Calculation

Table 3 Results of pairwise cointegration test

S. No.	V1	V2	Graphical cointegration	Direct cointegration	Lag length as per VAR	VAR based on cointegration (JJ test)
1	CSE	SSE_P	No	No	3	Yes (Trace)
2		SEN_P	No	No	8	No
3		DFM_P	No	No	3	No
4		MLY_P	No	No	3, 5	No
5		STI_P	No	No	8	No
6		SPX_P	No	No	8	No
7		UKX_P	No	No	8	No
8		DAX_P	Yes	Yes	3	Yes (trace & max-eigen)
9		FTSEMIB_P	Yes	Yes	7	Yes (trace & max-eigen)

Source: The Author's Calculation

the cointegration between the nine pairs of variables, as depicted in Table 3.

In the first step, the selected pair was graphically checked for the presence of any sign of co-movement. The results of which are depicted in column 4 of Table 3. In the second step, the selected variables were directly checked for cointegration by selecting variables and checking for the cointegration test in Eviews 12. The conclusion (step 3) regarding the cointegration between the variables was determined by the procedure suggested by the Johansen-Juselius test. Then, the appropriate vector auto-regression (VAR) model is reached using the proposed five lag length criteria, including Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike information criterion (AIC), Schwarz Criterion (SC), and Hannan–Quinn information criterion (HQC). Finally, the cointegration test is performed after reaching the final VAR model using lag length criteria to assess better the possibility of cointegration between the variables under consideration.

The results (Fig. 3) show that CSE_P is individually (Pairwise) and collectively (Sri Lanka–Germany–Italy–China) correlated with DAX_P, FTSEMIB_P, and SSE_P, respectively. Table 4 shows the results of the cointegration test performed on the VAR model with the above four variables after being log transformed collectively.

The cointegration test can be represented in the VAR framework as follows:

$$X_t = A_0 + \sum_{j=1}^p B_j X_{t-j} + e_t$$

where all variables are $n \times 1$ vectors except B ($n \times n$ matrix), X_t comprises variables at the first difference, A_0 includes constants, p indicates the maximum lag length, B represents the coefficient, and e_t is the error term.

The cointegration test aims for any long-term relationships between China, Germany, Italy, and Sri Lankan stock markets indices. However, the results of the stationarity test must show stationarity, and all variables must be integrated in the same order for the analysis to

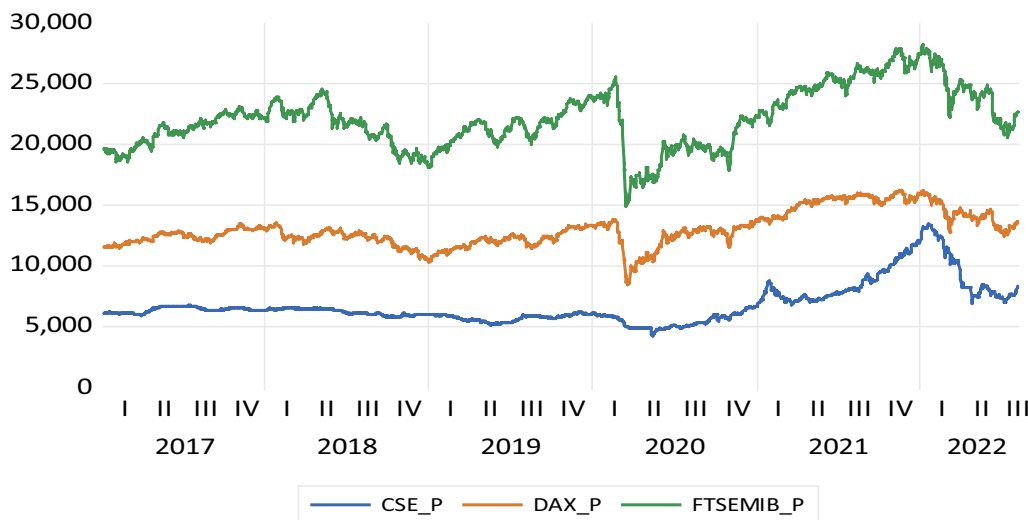


Fig. 3 Correlation among the CSE, DAX, and FTSE. Source: Created by Authors

Table 4 Results of the cointegration test based on the VAR framework

Hypothesized		Max-eigen			Trace		
No. of CE(s)	Eigenvalue	Statistic	Critical value	Prob	Statistic	Critical value	Prob
<i>Johansen cointegration test (trace and maximum eigenvalue) with lags 1 to 3</i>							
None*	0.0149	21.8732	27.5843	0.227	52.0064	47.8561	0.0194**
At most 1*	0.0102	14.9664	21.1316	0.2913	30.1331	29.7971	0.0457**
At most 2	0.0076	11.1867	14.2646	0.1451	15.1667	15.4947	0.056
At most 3*	0.0027	3.9799	3.8414	0.046	3.9799	3.8414	0.046

***, **, and * represent significant at 1%, 5%, and 10% significance levels respectively

Source: Calculation by Author's

be valid. Since cointegrated variables do not eventually drift apart, a long-run relation can be established. Table 4 clearly shows the presence of cointegration with the rejection of the Null hypothesis.

The impact of divergence and convergence mechanisms in the cointegrated variables is studied by applying the vector error correction model (VECM). The same set of variables, when estimated using the VECM, shed light on the error correction mechanism.

The cointegration equation was found to be:

$$E_t = -12.7707 + 1(\text{Ln}_{\text{cse}_p}) + 3.9178(\text{Ln}_{\text{dax}_p}) - 0.5643(\text{Ln} - \text{ftsemib}_p) - 1.2262(\text{Ln}_{\text{sse}_p})$$

The results are shown in Table 5. The CSE_P, DAX_P, FTSEMIB_P, and SSE_P are cointegrated with each other. As per the data from 1/01/2017 to 08/08/2022, the variables might diverge in the short run but eventually converge, given the ordinary course of operations in the stock market. The impact of the Sri Lankan political crisis on the Colombo stock exchange creates a short-term divergence among the cointegrated markets of Sri Lanka, Germany, Italy, and China. As per the results of VECM, Sri Lanka, Germany, and Italy would converge by 0.44 percent, 0.42 percent, and 0.39 percent, respectively. This convergence speed is relatively slow, but collectively, they would achieve it relatively fast.

Apart from checking the cointegration, we also compared the causality of stock indices of different key import and export countries for Sri Lanka. The causality was also performed pairwise using the VAR model for better interpretation of the causality, given that VAR follows the appropriate lag length criteria (LR, FPE, AIC, SC, and HQ) to reach a stable model. The causality results for the pre-crisis and post-crisis periods are compared in Table 6.

The Df column depicts the number of lags chosen for the 9 Pairwise VAR models as per the lag length suggested by different lag length criteria discussed above.

The results show that all the unidirectional and bidirectional causal relationships do not exist in the crisis period. Only FTSEMIB_P (Italy) granger causes CSE_P (Sri Lanka). There could be many reasons for such a market behavior of the Colombo stock exchange, which may include the following but may not be limited to a crash in the stock market (already 25 percent market got wiped out on the date of the political crisis in our study, i.e., 03/04/2022) high inflation in Sri Lanka, Drastic fall in Sri Lanka Rupee to US\$ (1 US\$=202.88 on March 3, 2022, and was 1US\$= 359.93 on August 12, 2022).

The findings reveal the presence of cointegration among the stock markets of Sri Lanka, Germany, Italy, and China. The results are consistent with the study of [86], which also indicated among emerging economies China (weak integration) and India (no integration) as this study has a similar pattern of the causal relationships in the pre-crisis period between CSE and other stock markets disappeared in the crisis period. Overall, this study suggests that small country bankruptcy can have a significant negative impact on the stock market indices of importing and exporting partners. These findings indicate the importance of monitoring small countries' economic conditions and taking appropriate measures to mitigate the spillover effects of their bankruptcy.

Conclusion

This study has examined the cointegration and causal relationship between Sri Lanka and its top five imports and five export countries with reference to the Sri Lankan crises. It was found that the Colombo Stock Exchange Index was cointegrated with the Financial Times Stock Exchange (FTSE)-Milano Indice di Borsa (MIB) or FTSEMIB (Italy) and Deutscher Aktien Index (DAX) (Germany) Index (Meeting RQ1). In the long term, the Sri Lankan stock market can converge (0.44 percent) as per the movement of the German and Italian stock markets, i.e., 0.42 percent and 0.39 percent per day. Given the situation, after the crisis reverts to normal, the Sri Lankan

Table 5 Results of VECM among Sri Lanka, Germany, Italy, and China

Countries	Sri Lanka	Germany	Italy	China
Status	–	Exporter	Exporter	Importer
Variables	D (LN_CSE_P)	D (LN_DAX_P)	D (LN_FTSEMIB_P)	D (LN_SSE_P)
Error correction term	–0.0044	0.0042	0.0039	–0.0019
Standard error	–0.0014	–0.0016	–0.0018	–0.0013
T-Statistics	[–3.1877]	[2.5903]	[2.1709]	[–1.3924]
Significant	Yes	Yes	Yes	No
Correction %	0.44%	0.42%	0.39%	–

Source: Authors calculation

Table 6 Causality results during the pre-crisis and post-crisis

Pair		Pre-crisis period (1/1/2017–1/04/2022)			Crisis period (03/04/2022 to 20/07/2022)		
		Chi-Sq	Df (Lag as per VAR)	Prob	Chi-Sq	Df (Lag as per VAR)	Prob
Sri Lanka–China	(C–S)	9.4879	2	0.0087*	3.6821	2	0.1586
	(S–C)	0.4086	2	0.8152	0.9919	2	0.6090
Sri Lanka–India	(I–S)	29.3225	8	0.0003*	6.4923	3	0.0900
	(S–I)	24.5386	8	0.0019*	6.2641	3	0.0994
Sri Lanka–UAE	(U–S)	2.4051	2	0.3004	6.5627	3	0.0872
	(S–U)	9.2411	2	0.0098*	2.7131	3	0.4380
Sri Lanka–Malaysia	(M–S)	4.9484	2	0.0842	0.8574	3	0.8357
	(S–M)	0.4944	2	0.7810	3.0789	3	0.3796
Sri Lanka–Singapore	(Sin–S)	8.1387	8	0.4200	6.0737	3	0.1081
	(S–Sin)	14.6985	8	0.0653	1.6681	3	0.6441
Sri Lanka–US	US–S	36.7063	8	0.0000*	0.8903	3	0.8277
	S–US	20.2382	8	0.0095*	5.4344	3	0.1426
Sri Lanka–UK	UK–S	12.7344	8	0.1213	3.7107	3	0.2944
	S–UK	14.0073	8	0.0816	4.283	3	0.2325
Sri Lanka–Germany	G–S	28.8642	7	0.0002*	4.3025	3	0.2306
	S–G	20.9013	7	0.0039*	4.0319	3	0.2580
Sri Lanka–Italy	I–S	23.4453	7	0.0014*	7.2229	2	0.0270
	S–I	34.0463	7	0.0000*	1.0052	2	0.6049

***, **, and * represent significant at 1%, 5%, and 10% significance levels respectively

Source: Calculation by authors

stock market would adjust to the pre-crisis period in 80 Days [$100/(0.44 + 0.42 + 0.39)$]. Even if we assume the adjustments to be twice as slow, the convergence could happen in 160 days (approximately five months).

Also, the VAR-based Granger causality results infer that all the unidirectional and bidirectional causal relationships between Stock exchanges of dominant import and export partner countries and the Colombo Stock Exchange do not hold in case of such an enormous economic and financial turmoil (deficient levels of forex reserves) (Meeting RQ2). Therefore, all the economies on the verge of bankruptcy, struggling with low forex reserves, and dealing with extreme inflation (especially after COVID-19 and the Russia-Ukraine crisis) can use the above results by incorporating these findings while drafting their fiscal and monetary policy.

The literature's core argument for financial contagion considers changes in shareholder psychology, attitude, and behavior. Real linkages (such as trade) and financial linkages (including investor behavior) play critical roles in understanding financial contagion, and their importance varies from instance to case. Strong domestic economic foundations may determine an economy's ability to withstand global shocks. In this

regard, fiscal, monetary, and trade policies should reduce financial fragility, decreasing needless debt commitments. In addition, financial standards should be strengthened in a synchronized approach at the international level.

Policy recommendation and future agenda

Various issues were hampering effective mangrove management, such as inefficient communication, inconsistencies between policies, and insufficient financial capacity of government stakeholders responsible for policy implementation. Similarly, in the situation of the political and economic crises of Sri Lanka produce spirals of market uncertainty, which in turn undermines investor confidence and promotes market volatility. This discovery was made feasible since the present economic crisis is having a substantial detrimental impact. Furthermore, the study emphasizes empirical evidence of the importance of financial crises, as indicated by Italy and Germany as highly cointegrated economies, which can act as hedging of the risk with other economies like India, followed by China as least cointegrated due to the instability in the Sri Lankan economy. As a result, government regulators and politicians must defend investors' interests, maybe by ensuring that enterprises have access to prospects for

greater liquidity and profitability. Given the urgency of the situation, the fundamental goal of government policy should be to progressively revive the travel and tourism, manufacturing, construction, and service sectors.

As a consequence, investors will have a more optimistic perspective on the company's future profitability, which will lessen market volatility and pave the way for economies to expand more steadily. The current situation of Sri Lankan recession and inflation can act as a formulation of the framework across the globe; the study would help small economies or countries get insights to formulate their fiscal and monetary policy better. It is high time that all countries, especially ones that are facing shortages in forex reserves, analyze the Sri Lankan political crisis and its impact on its stock market. This proactive approach to analyzing a country with bankruptcy would help many countries, like Bangladesh, Pakistan, Bhutan, etc., to formulate better strategies to counter inflation, recession, and the problem of low forex reserves, which are generally coupled together.

The state of politics, additional socioeconomic, population demographic, political, and policy elements in the analysis and stability have a significant impact on the stock market. Effective policy choices, elections, and political unpredictability may cause market volatility. Since political changes may affect industries, policies, and investment sentiment, investors keep a careful eye on them. We address the limitation of the study to the stock market indices with the period of the Sri Lankan crises period only, as designed to check the impact of the crises on the top trading partners' stock markets of Sri Lanka. The primary constraint of this research is that it focused on trading partners of Sri Lanka only.

As in the future, recent crises, such as the silicon valley bank (SVB) crash and the Russia–Ukraine war crash, can be further tested by expanding to the South Asian stock markets. Moreover, a future study can be conducted to investigate the impact of the Sri Lankan crises on different macro-variables or exchange rates, which could help in framing the currency board or may have relevance to IMF or domestic government in the context of monetary (to reconstruct the debt of Sri Lanka) policy or fiscal policy.

Limitations of the study

In the context of the limitation, this study is limited to the benchmark indices of the stock market only. This study is limited to the recent (2022) political and economic crises in Sri Lanka. Policies and the economy might change over time as potential changes in Sri Lanka's economic circumstances or the state of the global economy that took place after the study period may not have been captured by this study. The study's emphasis

on Sri Lanka's current political and economic crises may restrict the findings' applicability to other small countries or other geopolitical circumstances. Not every small country approaching bankruptcy will have the same set of conditions as Sri Lanka. The results could be impacted by certain political or economic circumstances depending on the period selected, which could not apply in other contexts. Although analyzing the Sri Lankan crisis has yielded insightful information, care should be used when applying these conclusions to other economies in South Asia. Financial dynamics are influenced by a variety of distinct economic, political, and social factors; thus, what is valid for one country may not always be true for another. According to the Granger Causal Approach, there are a number of external factors that can make it challenging to demonstrate actual causation in financial markets, even while statistical techniques such as Granger causality can uncover correlations.

Abbreviations

CSE	Colombo Stock Exchange
COYLE	The Chamber of Young Lankan Entrepreneurs
GICS	Global Industry Classification System
MDB	Multilateral Development Banks
PPP	Purchasing Power Parity
UN	United Nations
VAR	Vector Auto-Regression
VECM	Vector Error Correction Mechanism
SVB	Silicon Valley Bank crash
FTSEMIB	Financial Times Stock Exchange-Milano Indice di Borsa
DAX	Deutscher Aktien Index
LR	Likelihood Ratio
FPE	Final Prediction Error
AIC	Akaike Information Criterion
SC	Schwarz Criterion
HQC	Hannan–Quinn information Criterion

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Author contributions

NS worked on conceptualization, methodology, supervision and writing original draft. SK managed the conceptualization, methodology, Project Administration, writing original draft. AS has played a crucial role in visualization, reviewing & editing, and AK has contributed by writing, conceptualization, reviewing & editing. All authors read and approved the final manuscript.

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Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

The authors guarantee that this manuscript has not been previously published in other journals and is not under consideration by other journals. The authors also guarantee that this manuscript is original and is their own work.

Competing interests

The authors affirm that they have no known financial or interpersonal conflicts that could have appeared to have impacted the research presented in this study.

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