Is There a Relationship between Macroeconomic Variables and Stock Market Indices in Bosnia and Herzegovina?

Adem Abdić[*a], Ademir Abdić[b], Lejla Lazović-Pita[a], Fahir Kanlić[c]
[a] *Department of Finance, School of Economics and Business, University of Sarajevo, Sarajevo, Bosnia and Herzegovina*
[b] *Department of Quantitative Economics, School of Economics and Business, University of Sarajevo, Sarajevo, Bosnia and Herzegovina*
[c] *Agency for Statistics of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina*
adem.abdic@efsa.unsa.ba, ademir.abdic@efsa.unsa.ba, lejla.lazovic@efsa.unsa.ba, fahir.kanlic@bhas.gov.ba

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Abstract

The economic growth and development of a country are reflected in many aspects, one of them being the stock market indices. The purpose of the article is to examine and determine the relationship between selected macroeconomic variables and stock market indices in Bosnia and Herzegovina (BiH). Using quarterly data over the 2010q1-2019q4 period, a cointegration analysis was applied to model this relationship. The Vector Error Correction Model (VECM) was used to explore the short-run relationship as well as the long-run relationship. The article examined the predictive ability among variables of interest by applying the Granger causality test. The results indicate a stable long-run relationship between the analysed macroeconomic variables and stock market indices in BiH, while no short-run relationship was found. The results contribute to the scientific discussions about the relationship between selected macroeconomic variables and representative stock market indices in BiH which considers their direction and strength.

Introduction

Stock markets have long played an important role in economic life but the deepness/liquidity and level of sophistication of modern financial markets are arguably a contemporary phenomenon (Van Nieuwerburgh, Buelens & Cuyvers, 2006). Intuitively, the relationship between stock markets and the economic indicators are considered in two ways: *a) Leading or Lagging Indicator:* This perspective views the stock market as either a leading or lagging indicator of a country's economic activities. In this context, the stock market can provide early signals or delayed responses to changes in the broader economy; *b) Impact of Market-Oriented Parameters:* The second perspective considers how stock markets can be influenced by the gradual development or growth of market-oriented factors. This viewpoint focuses on how changes in factors such as market regulations, investor sentiment, and economic policies could impact the stock market.

[*] *Corresponding author*

From the first perspective, authors such as Adjasi & Biekpe (2006), Enisan & Olufisayo (2009), Khan & Khan (2018) consider that a robust and developed stock market plays a vital role in stimulating economic activity which then contributes to the economic growth and economic development. The financial development of the stock market can underpin economic growth through several mechanisms, as identified by Levine (2005): a) Reduce information costs and improve resource allocation; b) Monitor investments and implement corporate governance measures following financing; c) Support trading, diversification, and risk management activities; d) Aggregate and mobilize savings; e) Facilitate the exchange of goods and services. With the rapid transformation of economic structures, policies, and institutions on a global scale most recently, the role of capital markets as intermediary between investors an entrepreneurs is becoming more prominent in developing economies (Bayezid Ali, 2011).

Proponents of the second perspective such as Davidson & Froyen (1982), Dhakal, Kandil & Sharma (1993), La Porta et al. (1997), Bekaert & Harvey (2000), Svaleryd & Vlachos (2002), Masulis & Lakshmanan (2002), El-Wassal (2005), Carvajal & Elliott (2007), Yartey (2010), Pilinkus (2010), Finter, Niessen-Ruenzi & Ruenzi (2011), Şükrüoğlu & Nalin (2014), Arouri et al. (2016), Bayar (2016), Ho (2019), Asravor & Fonu (2021) evaluate how a stock market can be significantly influenced by various market-oriented factors, exploring the following evolving nature of the factors over time: a) *Changes in market regulations and economic policies* implemented by regulatory authorities can have a profound impact on stock markets; b) *Investor sentiment* plays a crucial role in stock market movements; c) *Government economic policies*, such as fiscal and monetary policies, taxation, and trade policies, can directly affect the stock market; d) *Changes in the structure of the market itself*, including the introduction of new trading platforms, the emergence of high-frequency trading, or advancements in technology, can impact stock market behaviour; e) *Global economic conditions*, such as recessions, economic growth, or geopolitical tensions, can reverberate through stock markets worldwide. Cross-border trade, international investment, and global economic interdependencies mean that events in one country can have spillover effects on stock markets in others.

At this juncture, it is important to emphasize that, according to Stulz (2001), there is no direct relation between a country's economic development and its financial structure. The author argues that, for example, Japan and the United States or Germany and England exhibit significantly different financial structures despite being at similar levels of economic development. Hence, Stulz (2001) concludes that it is not possible to state that the financial structure is entirely determined endogenously.

Thus, there is a general agreement that economic growth and financial markets are connected, but the disagreement lies in whether the financial market drives economic growth (supply-side argument) or whether economic growth leads to the development of the financial market (demand-side argument). It's an ongoing debate about the cause and the effect in the context of economic development and financial markets.

According to Pilinkus (2010), the stock market performance is supposed to illustrate the state of the country's economy: if stock prices start to fall economic depression is likely to take place and, conversely, rising stock prices show possible economic growth.

BiH is a small (post)transition country with underdeveloped financial markets. The two stock exchanges in BiH were established in Sarajevo and Banja Luka in the early 21st century (in 2001). Since the establishment, both stock markets have actively participated in the privatization process in BiH with several varieties of traded securities (stocks, government bonds, treasury bills, etc). These two exchanges operate on the same regulatory principles. *The Sarajevo Stock Exchange* (SASE) calculates and publishes the following stock indices[1]: a) SASX-10: Sarajevo Stock Exchange Index 10 – which tracks the performance of the 10 largest companies in the domestic market, measured by market capitalization and trading frequency; b) SASX-30: Sarajevo Stock Exchange Index 30 – which monitors the price movements of the 30 most liquid stocks from the Free Market of SASE; c) SASX Islamic: SASX-Islamic is an index created in collaboration with the local Bosnia Bank International. *The Banja Luka Stock Exchange* (BLSE) calculates and publishes the BIRS index[2]: The Stock Exchange Index of the Republic of Srpska – which tracks the movement of 5 to 30 issuers whose stocks are included in the composition of BIRS, depending on the number of issuers on the official stock market and the number of issuers meeting the criteria for inclusion in BIRS.

[1] See more at Sarajevo Stock Exchange website: http://www.sase.ba/v1/Tr%C5%BEi%C5%A1te/Op%C4%87e-Informacije/Indexi-SASE (accessed: 03/04/2024)

[2] See more at Banka Luka Stock Exchange website: https://www.blberza.com/Pages/indexlist.aspx (accessed: 03/04/2024)

According to Kumalić (2013), the financial market in BiH is bank-centric and structurally underdeveloped. The banking sector falls into the category of moderately developed with a high concentration of key aggregates, which makes it more sensitive and risk-prone. The capital market is underdeveloped both in terms of volume and the number of instruments, and it is characterized by a multi-layered organization, lack of functionality, and poor coordination.

Bearing in mind the current academic dilemma together with the underdeveloped financial markets in BiH and, the complex constitutional organization of the country reflected in the slow transition process with weak macroeconomic indicators, in this article, we wish to examine if there is a relationship between macroeconomic variables and stock market indices. Hence, we define two research questions:

1. *Is there a relationship between the macroeconomic variables and stock market indices in the BiH in the long and/or in the short run?*
2. *What is the direction of the relationship between macroeconomic variables and stock indices?*

After the introduction and literature review, the article is divided into the following sections: research design and methodology, results and discussion, and conclusion. Before concluding, we emphasize the significance of the obtained results.

Literature Review

Academic literature recognizes supply and demand side arguments in the examination and evaluation of the relationship between economic growth and financial markets. Theoretical causality between financial markets and economic growth are explained by the two main hypotheses defined by Patrick (1966): the supply-leading hypothesis and a demand-following hypothesis. *The supply-leading hypothesis* suggests that the development of financial markets and institutions drives economic growth. In this scenario, deliberately creating financial institutions and markets increases the availability/supply of financial services, consequently stimulating real economic growth. Some theoretical and empirical studies (Neusser & Kugler, 1998; Calderón & Liu, 2003) have provided evidence supporting the supply-leading phenomenon. *The demand-following hypothesis* suggests that economic growth leads to the development of financial markets and institutions. As the real economy expands, there is an increasing demand for financial services, which, in turn, drives the growth of the financial sector. Essentially, the financial sector reacts passively to economic growth. Some theoretical and empirical studies (Gurley & Shaw, 1955; Goldsmith, 1969; Stern, 1989; Romer, 1990) have provided evidence supporting the demand-following hypothesis.

Researchers have employed various theoretical frameworks to establish relationships and dynamic interactions between fluctuations in macroeconomic variables and fluctuations in stock market returns. On one hand, in line with the supply-leading hypothesis, these frameworks incorporate concepts such as the frictionless Arrow-Debreu economic world (1954), where there is no incentive for financial intermediation, alongside different types of financial contracts, markets, and institutions. On the other, following the demand-following hypothesis, these frameworks encompass concepts such as the EMH, as formulated by Fama (1970), and/or the Arbitrage Pricing Theory (APT), which was developed by Ross (1976). According to Fama (1970, p. 383), "*Semi-strong form of EMH, in which the concern is whether prices efficiently adjust to other information that is publicly available are considered*". Thus, as for the effect of macroeconomic variables such as GDP growth rate, money supply, interest rate, industrial production, FDI and exchange rate on stock prices, the EMH proposes that in a well-functioning market with profit-maximizing investors, all the pertinent information known about changes in the macroeconomic variables are fully reflected in market stock prices, so that investors will not be able to earn extra profit through prediction of future stock market movement (Chong & Goh, 2003). Contrary to the conclusions drawn by the EMH, substantial evidence spanning nearly a half-century has built up, indicating that essential macroeconomic variables play a role in predicting the time series of stock returns. The challenge to the conclusions derived from the EMH can be traced back to early studies by Nelson (1976), and Jaffe & Mandelker (1976), all of which affirm that macroeconomic variables indeed exert influence on stock returns. Similarly, according to Bhuiyan & Chowdhury (2020), a host of works that used the APT framework includes Chen, Roll & Ross (1986), Poon & Taylor (1991), Hamao (1988), Martinez & Rubio (1989), Ferson & Harvey (1991) and find a significant relationship between stock market returns and money supply, interest rate, and real economic activity questioning the validity of the EMH.

However, the introduction of cointegration by Engle & Granger (1987) provided an alternative approach to studying long-run equilibrium relationships between variables without concerns about spurious correlations. Regressions within the APT framework involving non-stationary variables were susceptible to such correlations. Since the development of cointegration analysis, a host of literature, including studies by Mukherjee & Naka (1995), Nasseh & Strauss (2000), Ratanapakorn & Sharma (2007), Humpe & Macmillan (2009), Kumar & Sahu (2017), Al-Kandari & Abul (2019), Tulcanaza-Prieto & Lee (2019), Bhuiyan & Chowdhury (2020) have examined and found significance in macroeconomic variables when explaining stock market returns, further challenging the validity of the EMH.

Although there is a solid theoretical foundation linking financial markets and key macroeconomic factors, empirical assessments show significant variation in their findings. According to Levine (2005) and Beck (2012) the sign of this relationship and the question of lead-lag effect have been subject to debate.

It can be concluded that economists hold different opinions on the nature of the relationship between macroeconomic variables and stock market development. However, most studies examining the relationship between stock markets and macroeconomic variables are primarily grounded in the APT which connects the returns of individual assets and portfolios to a range of independent macroeconomic variables. Authors such as Fama (1981), Gjerde & Sættem (1999), Merikas & Merika (2006), and Bekhet & Matar (2013) have found that key factors that influence stock prices include inflation, interest rates, industrial production, and exchange rates. Conversely, there are also studies, such as those conducted by Flannery & Protopapadakis (2002) and Maio & Philip (2015) that have been unable to establish a significant relationship between macroeconomic indicators and stock returns. Due to a vast academic interest in the topic, most recently, several authors such as Ruhani et al. (2018), Verma & Bansal (2021) or Chaurasia & Debnath (2023) have provided a systematic literature review on the effects and the impact between macroeconomic variables and stock markets/prices. Several macroeconomic variables have been repeatedly deployed such as GDP, FDI (foreign direct investments), foreign institutional investment, interest rates, exchange rates, money supply, etc. In terms of systematic research methods used in analyzing and predicting stock markets, authors such as Nti, Adekoya, & Weyori (2020) and Bustos & Pomares-Quimbaya (2020) have used machine and deep learning methods in the systematic literature reviews.

While the relationship between macroeconomic variables and stock market indices has been well documented and investigated in developed countries, there are a few similar empirical studies in developing and (post)transition countries.

Using the Panel Vector Error Correction Model (PVECM) Mojanoski (2022) explored the long-run and short-run relationship between the values of the stock market indices (MBI10, CROBEX, SASX-10 and BELEX 15) and the selected macroeconomic variables in BiH, Croatia, North Macedonia and Serbia. The results of PVECM between the values of the selected stock indices and independent variables (industrial production index, average monthly gross wages) show the existence of conditionality in the long run, while the independent variable Harmonized Index of Consumer Prices is excluded from the model. Similarly, Ligocká (2023) has investigated the relationship between selected macroeconomic variables (CPI, GDP, and M3) and the values of representative stock market indices for Central and Eastern European countries in the period 2004q1-2021q4. The application of VECM estimations and the Granger causality test indicate that the selected macroeconomic variables affect the values of European stock market indices in the long term rather than in the short term.

The relationship between the CROBEX index and relevant macroeconomic variables in Croatia has been examined by Hsing (2011). Applying the GARCH model, this paper finds that the CROBEX index is positively associated with real GDP, the M1/GDP ratio, the German stock market index and the euro area government bond yield and is negatively influenced by the ratio of the government deficit to GDP, the domestic real interest rate, the HRK/USD exchange rate, and the expected inflation rate. Similarly, Backović et al. (2023) have analysed the constitution of the emerging Montenegrin stock exchange. The results of four tests (ADF test, run test, ACF test, and Hurst test) conducted in this study do not provide empirical evidence supporting the random walk theory and its returns on aggregated shocks in the Montenegrin stock exchange market.

Djedović and Djedović (2018) conducted an ARDL model to investigate the long-run relationship between the macroeconomic variables in BiH and the stock market index (SASX-30). The results show that volatility of the exchange rate has a significant impact on stock index return. Furthermore, the results show that the deposit (interest) rate and IPI have a slightly negative significant long-term impact on stock index return. The other macroeconomic variables did not show any significant impact on the SASX-30 return.

The aforementioned studies did not include indices from BiH, except the work by Djedović and Djedović (2022), which assessed the long-term impact of the exchange rate, deposit interest rate, and industrial production index (IPI) exclusively on the SASX-30 index. Therefore, this study aims to fill the literature gap by investigating the stock market indices in both entities of BiH (SASX-10 and BIRS), which is relatively poorly researched with macroeconomic variables. Furthermore, the study will address the use of deseasonalized time series and the inclusion of new macroeconomic variables in the model, such as GDP, money supply, trade balance and interest rates on short-term liabilities. In terms of regional implications of the research, the inclusion of macroeconomic variables has been previously recognized as a research limitation in the works of Backović et al. (2023) in the case of the Montenegrin stock exchange and we try to fill in this literature gap too. As we use VECM, the article investigates the short-term and long-term relationship between selected macroeconomic variables and the values of both stock market indices in BiH.

Furthermore, a more comprehensive examination of the literature, including authors, variables, methods and obtained results is presented in Table 1.

Table 1
The comprehensive literature review

Study Authors	*Data-Country*	*Dependent variable*	*Independent variables*	*Estimation method*	*Results*
Mukherjee and Naka (1995)	(1971:M1-1990:M12) Japan	TSE index	exchange rate, money supply, inflation, industrial production, long-term government bond rate, call money rate	VECM model	A cointegrating relation indeed exists and stock prices contribute to this relation.
Wongbangpo and Sharma (2002)	(1985-1996) (monthly) Indonesia, Malaysia, Philippines, Singapore, and Thailand	JCSPI index, KLSE index, PSE index, SES index, SET index	GNP, the consumer price index, the money supply, the interest rate, and the exchange rate	Johansen cointegration, VECM model	The Granger causality tests detect the causal relationships from the macroeconomic variables to stock prices in all five ASEAN stock markets. The findings indicate that the past values of macroeconomic variables in these ASEAN countries can predict future changes in their stock price indices.
Maysami, Howe and Hamzah (2004)	(1989:M1-2001:M12) Singapore	STI index	The short and long-term interest rates, industrial production, price levels, exchange rate and money supply	Granger causality test, Johansen cointegration, VECM model	The study concludes that Singapore's stock market and the property index form an integrating relationship with changes in the short and long-term interest rates, industrial production, price levels, exchange rate and money supply.

Table 1
The comprehensive literature review (continued)

Study Authors	*Data-Country*	*Dependent variable*	*Independent variables*	*Estimation method*	*Results*
Nishat, Shaheen and Hijazi (2004)	(1973:Q1-2002:Q4) Pakistan	KSE index	industrial production index, the consumer price index, money supply (M1), and interest rate	Granger causality test, Johansen cointegration, VECM model	They find that these five variables are cointegrated and two long-term equilibrium relationships exist among these variables. Analysis of their results indicates that industrial production is the largest positive determinant of Pakistani stock prices, while inflation is the largest negative determinant.
Mehrara (2006)	(1994:Q1-2005:Q4) Iran	TEPIX index	money supply, value of trade balance, and industrial production	Granger causality test	The results show unidirectional long-run causality from macroeconomic variables to the stock market.
Ratanapakorn and Sharma (2007)	(1975:M1-2005:M4) USA	S&P500 index	long-term interest rates, the money supply, IP, inflation, the exchange rate and the short-term interest rate	VECM model	They observe a negative relationship between stock prices and long-term interest rates, and a positive relation between stock prices and the money supply, IP, inflation, the exchange rate and the short-term interest rate.
Abugri (2008)	(1986:M1-2001:M8) Argentina, Brazil, Chile, and Mexico	Stock returns	exchange rates, interest rates, industrial production and money supply, MSCI world index and the U.S. 3-month T-bill yield	VAR model	Using a six-variable vector autoregressive (VAR) model, the study finds that the global factors are consistently significant in explaining returns in all the markets. The country variables are found to impact the markets at varying significance and magnitudes.
Humpe and Macmillan (2009)	(1965:M1-2005:M6) USA and Japan	S&P500 index / NKY225 index	IP, CPI, M1, the real 10-year US T-Bond yield, the real official discount rate (lending rate) in Japan	VECM model	Using US data, they found evidence of a single cointegration vector between stock prices, IP, inflation and the long-term interest rate. In Japan, they found two cointegrating vectors. One normalized on the stock price provided evidence that stock prices are positively related to IP but negatively related to the money supply. They also found that for our second vector, normalized on IP, that IP was negatively related to the interest rate and the rate of inflation.

Table 1
The comprehensive literature review (continued)

Study Authors	*Data-Country*	*Dependent variable*	*Independent variables*	*Estimation method*	*Results*
Karagöz, Ergün and Karagöz (2009)	(1998:M1-2008:M12) Turkey	ISE index	interest rate, inflation (consumer price index), industrial production index, money supply (M1), growth (GDP) and real exchange rate	Johansen cointegration, VECM model	The results reveal that all variables have a statistically meaningful impact on the stock index except the real economic activity (IPI). It seems that consumer prices (INF) have a positive effect on stock prices. The results show that interest rates (INT) have a negative relationship with stock prices. Money supply (MS) has also the same effect on stock prices. Real exchange rates also affect the ISE index positively which means that a depreciation of the currency leads to higher real stock market returns.
Trivedi and Behera (2012)	(1997:M1-2011:M12) India	BSE Sensex index	IIP, WPI, interest rates, money supply, FIIs, MSCI world index	VECM, VAR, impulse response, variance decomposition	There is a positive reaction of the stock market due to IIP, money supply, FIIs and MSCI world index while negative reaction due to WPI and interest rate.
Osamwonyi and Evbayiro-Osagie (2012)	(1975-2005) Nigeria	Stock market index	interest rates, inflation rates, exchange rates, fiscal deficit, GDP and money supply	VECM	The major finding is that macroeconomic variables influence the stock market index in Nigeria.
Basci and Karaca (2013)	(1996:M1-2011:M10) Turkey	ISE 100 index	Exchange, Gold, Import, Export and ISE 100 Index	VAR model	At the end of the established VAR equation, it was specified that series' impact lags were successful in explaining the share price index.
Singh (2016)	(2007-2014) (monthly) India	BSE Sensex index	IIP, money supply, exchange rate, WPI, T-bill rate	Johansen cointegration, VECM	Money supply, WPI and interest rate exert a positive relation while the rest shows a negative relation.
Kumar and Sahu (2017)	2006-2015 (monthly) India	DJIIM index	WPI, interest rate (365-day T-bill rate), money supply (M3), exchange rate	Johansen cointegration, VECM, VAR, Granger causality test	WPI and money supply show a positive relation while interest indicated a negative relation
Al-Kandari and Abul (2019)	(2005-2018) Kuwait	Kuwaiti Stock Exchange index	M2, the three-month deposit interest rate, oil prices, the US Dollar vs Kuwaiti Dinar exchange rate and the inflation rate	Granger causality test, Johansen cointegration, VECM model	The study found that a long-run unidirectional relationship exists between the Kuwaiti Stock Exchange Index and the aforementioned macroeconomic variables. This study also confirmed the existence of a short-run relationship between oil prices and stock prices in Kuwait.

Table 1
The comprehensive literature review (continued)

Study Authors	*Data-Country*	*Dependent variable*	*Independent variables*	*Estimation method*	*Results*
Tulcanaza-Prieto and Lee (2019)	(1993-2017) Korea and Japan	Kospi index and Nikkei index	GDP growth, inflation rate, interest rate, exchange rate, crude oil WTI price, and gold price	Johansen cointegration, (VAR) model, VECM model	The results reveal that each stock market index, GDP growth, inflation rate, interest rate, exchange rate, crude oil WTI price, and gold price form a cointegration in the long term. In addition, GDP growth, interest rate, exchange rate, oil price, and gold price affect the Kospi short-run performance, while GDP growth, interest rate, and gold price affect Nikkei 225 in the short term.
Bhuiyan and Chowdhury (2020)	(2000-2018) US and Canada	S&P500 index	industrial production, money supply, long-term interest rate, and different sector indices	Granger causality test, Johansen cointegration, VECM model	Results suggest that there is a stable long-term relationship between the macroeconomic variables used in the study and different sector indices for the US but not for Canada. However, the US money supply and interest rate can explain the Canadian stock market.

Source: Authors

Research Design and Methodology

Research Design and Data

This study employs quarterly observations from 2010q1 to 2019q4 for stock indices (SASX-10 and BIRS) and macroeconomic variables for BiH. We selected the observed period between the two structural breaks in the economy namely the global financial crisis of 2008 and COVID-19. The data for the macroeconomic indicators such as GDP, IPI, STIR, TBC, and M1 are taken from the International Monetary Fund database and the Agency for Statistics of BiH. According to Liu & Chen (2017), Vychytilová et al. (2019) and Gokmenoglu, Azin & Taspinar (2015), both GDP and IPI are included in the study to improve the accuracy of the model because these variables contribute to different aspects of economic activity. Specifically, GDP reflects the overall economic situation, while the industrial production index provides additional insights into the manufacturing sector. This is particularly important for predicting stock market movements in BiH, given the structure of the SASX10 and BIRS indices, where over 90% of companies are involved in manufacturing activities. Consistent with the approach outlined by Humpe & Macmillan (2009), seasonally adjusted data[3] are utilized for all variables to account for their significant seasonality. Data on stock market composite indices for SASX-10 and BIRS are acquired from SASE and BLSE respectively with values based on the closing prices recorded on the final business day of each quarter. All index values and macroeconomic series are transformed into natural logarithmic form for analysis. The empirical section of the research was carried out using Stata 17.

Methodology and Model Specification

The selection of our methodology is guided by both data characteristics and existing literature. To identify the macroeconomic variables that impact the values of the selected stock indices, the APT framework is utilized, complemented by the application of analytical-synthetic and statistical methods for a comprehensive analysis. These combined approaches allow for a thorough identification of key variables and their influence on

[3] STL method is used. STL is a versatile and robust method for decomposing time series. STL is an acronym for “Seasonal and Trend decomposition using LOESS”, while LOESS is a method for estimating nonlinear relationships. The STL decomposition assumes an additive relationship between the seasonal, trend, and residual components of the series, using a filtering algorithm based on LOESS regressions to accurately estimate these three components (Cleveland et al., 1990).

stock market indices. In line with the methodology applied in previous research (Mukherjee & Naka, 1995; Nasseh & Strauss, 2000; Tulcanaza-Prieto & Lee, 2019; Bhuiyan & Chowdhury, 2020), the structure of our study is as follows: firstly, the stationarity of all series was tested using the ADF test. Next, the order of integration for each series was determined to assess if they contained a unit root. The series is integrated of order one suggests the suitability of employing cointegration tests. Moving on, an unrestricted Vector Auto Regression (VAR) model was utilized to establish the lag length necessary for the cointegration tests. Subsequently, the Johansen cointegration tests were employed to ascertain whether the variables were cointegrated. According to the existing literature, if cointegration is detected, a stable long-run relationship is estimated. Following this, a VECM was employed to gauge the speed of adjustment for variables deviating from their long-run trajectory.

Given our interest in analyzing the long-run relationship between stock market indices and macroeconomic variables, the cointegration technique proposed by Johansen (1991) is opted for. This method is favoured due to its ability to address issues stemming from non-stationarity, such as spurious relationships. Concerns regarding reverse causality between variables are also mitigated by cointegration. The flexible functional form of the Johansen cointegration method treats all variables as endogenous, eliminating the need for an arbitrary choice of the dependent variable in the cointegrating equation. Thus, cointegration emerges as the more suitable approach for our analysis.

According to the results of the ADF test and Johansen cointegration test VECM model was estimated to evaluate the effects of macroeconomic variables on the stock indices:

$Index_t = f\,(GDP_t, IPI_t, M1_t, STIR_t, TBC_t)$
where is:

- $Index_t$ - stock market composite indices for SASX-10 index or BIRS index;
- GDP_t - Nominal quarterly Gross Domestic Product (in millions of BAM), expenditure approach, current prices;
- IPI_t - Industrial Production Index (QoQ);
- $M1_t$ - money supply M1 (in millions of BAM);
- $STIR_t$ - short-term interest rate (in percentage, annually);
- TBC_t - trade balance coverage (in thousands of BAM);
- Note: All the level series are in natural logarithmic form.

The descriptive statistics of the variables are presented in Table 2, while the correlation matrix of all included variables are displayed in Table 3.

Table 2
Descriptive statistics of variables of interest

Variables	*SASX-10 index*	*BIRS index*	*GDP*	*IPI*	*M1*	*STIR*	*TBC*
Mean	769.48	699.11	7298350.00	102.47	9385.07	6.11	0.58
Median	751.78	675.75	7243922.00	101.48	8191.14	6.26	0.57
Maximum	1104.41	1124.14	8271177.00	114.05	17813.87	8.47	0.68
Minimum	563.07	514.35	6615434.00	93.04	5612.65	3.65	0.49
Std. Dev.	128.27	144.33	518321.50	6.23	3526.34	1.71	0.05
Skewness	0.932	0.953	0.325	0.187	0.764	-0.185	0.285
Kurtosis	3.256	3.401	1.761	1.765	2.402	1.466	2.148
Observations	48	48	48	48	48	48	48

Source: Authors

When a set of time series variables are each integrated of the same order, and if a linear combination of these variables produces a series integrated of order zero, then the set of variables are considered to be cointegrated. Cointegration is a technique commonly used to investigate whether a stable long-run relationship among two or more variables exists. In the context of this study, if stock indices, short-term interest rate, money supply, and real economic activity are integrated of order one, and their combination yields a series integrated of order zero, it suggests the presence of a long-run relationship among these variables. If the variables are indeed cointegrated, a VECM model can be applied to analyze the dynamics among them. A VECM model is a specialized form of VAR model tailored for use with series that are both cointegrated and non-stationary in their level form. Essentially, VECM is a VAR model adapted for variables that exhibit stationarity in their differences. Within the VECM framework, although short-term adjustments are permitted, the long-term behaviour of the endogenous variables is constrained to converge towards their cointegrating relationships.

Table 3
Correlation matrix of variables of interest

Correlation	*BIRS_SA*	*SASX-10_SA*	*GDP_SA*	*IPI_SA*	*M1_SA*	*STIR_SA*	*TBC_SA*
BIRS_SA	1.000000						

SASX-10_SA	0.628650	1.000000					
	0.0000	-----					
GDP_SA	-0.776043	-0.304433	1.000000				
	0.0000	0.0354	-----				
IPI_SA	-0.666027	-0.289744	0.695339	1.000000			
	0.0000	0.0458	0.0000	-----			
M1_SA	-0.678000	0.012431	0.838752	0.603708	1.000000		
	0.0000	0.9332	0.0000	0.0000	-----		
STIR_SA	0.715011	0.095919	-0.921024	-0.658843	-0.948250	1.000000	
	0.0000	0.5166	0.0000	0.0000	0.0000	-----	
TBC_SA	-0.734106	-0.121485	0.800423	0.708336	0.897064	-0.875879	1.000000
	0.0000	0.4108	0.0000	0.0000	0.0000	0.0000	-----

Source: Authors

The term representing cointegration in the VECM equation is explained by the error correction term. This term embodies the notion that deviations from long-run equilibrium are gradually rectified through a series of partial short-term adjustments. The multivariate VECM specified for this study is as follows:

$$\Delta Index_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i}\Delta ndex_{t-i} + \sum_{i=1}^{p} \beta_{2i}\Delta IPI_{t-i} + \sum_{i=1}^{p} \beta_{3i}\Delta GDP_{t-i} + \sum_{i=1}^{p} \beta_{4i}\Delta M1_{t-i} + \sum_{i=1}^{p} \beta_{5i}\Delta STIR_{t-i} + \sum_{i=1}^{p} \beta_{6i}\Delta TBC_{t-i} + \lambda_1 ECT_{t-1} + \varepsilon_t \qquad (1)$$

$$\Delta GDP_t = \eta_0 + \sum_{i=1}^{p} \eta_{1i}\Delta Index_{t-i} + \sum_{i=1}^{p} \eta_{2i}\Delta IPI_{t-i} + \sum_{i=1}^{p} \eta_{3i}\Delta GDP_{t-i} + \sum_{i=1}^{p} \eta_{4i}\Delta M1_{t-i} + \sum_{i=1}^{p} \eta_{5i}\Delta STIR_{t-i} + \sum_{i=1}^{p} \eta_{6i}\Delta TBC_{t-i} + \lambda_2 ECT_{t-1} + e_t \qquad (2)$$

$$\Delta IPI_t = \gamma_0 + \sum_{i=1}^{p} \gamma_{1i}\Delta Index_{t-i} + \sum_{i=1}^{p} \gamma_{2i}\Delta IPI_{t-i} + \sum_{i=1}^{p} \gamma_{3i}\Delta GDP_{t-i} + \sum_{i=1}^{p} \gamma_{4i}\Delta M1_{t-i} + \sum_{i=1}^{p} \gamma_{5i}\Delta STIR_{t-i} + \sum_{i=1}^{p} \gamma_{6i}\Delta TBC_{t-i} + \lambda_3 ECT_{t-1} + \mu_t \qquad (3)$$

$$\Delta M1_t = \theta_0 + \sum_{i=1}^{p} \theta_{1i}\Delta Index_{t-i} + \sum_{i=1}^{p} \theta_{2i}\Delta IPI_{t-i} + \sum_{i=1}^{p} \theta_{3i}\Delta GDP_{t-i} + \sum_{i=1}^{p} \theta_{4i}\Delta M1_{t-i} + \sum_{i=1}^{p} \theta_{5i}\Delta STIR_{t-i} + \sum_{i=1}^{p} \theta_{6i}\Delta TBC_{t-i} + \lambda_4 ECT_{t-1} + \omega_t \qquad (4)$$

$$\Delta STIR_t = \varphi_0 + \sum_{i=1}^{p} \varphi_{1i}\Delta Index_{t-i} + \sum_{i=1}^{p} \varphi_{2i}\Delta IPI_{t-i} + \sum_{i=1}^{p} \varphi_{3i}\Delta GDP_{t-i} + \sum_{i=1}^{p} \varphi_{4i}\Delta M1_{t-i} + \sum_{i=1}^{p} \varphi_{5i}\Delta STIR_{t-i} + \sum_{i=1}^{p} \varphi_{6i}\Delta TBC_{t-i} + \lambda_5 ECT_{t-1} + \upsilon_t \qquad (5)$$

$$\Delta TBC_t = \rho_0 + \sum_{i=1}^{p} \rho_{1i}\Delta Index_{t-i} + \sum_{i=1}^{p} \rho_{2i}\Delta IPI_{t-i} + \sum_{i=1}^{p} \rho_{3i}\Delta GDP_{t-i} + \sum_{i=1}^{p} \rho_{4i}\Delta M1_{t-i} + \sum_{i=1}^{p} \rho_{5i}\Delta STIR_{t-i} + \sum_{i=1}^{p} \rho_{6i}\Delta TBC_{t-i} + \lambda_6 ECT_{t-1} + \tau_t \qquad (6)$$

where:

- $\Delta Index_t$ - changes in composite indices from one time period to the next;
- ΔGDP_t - changes in gross domestic product from one time period to the next;
- ΔIPI_t - changes in industrial production from one time period to the next;
- $\Delta M1_t$ - changes in money supply from one time period to the next;
- $\Delta STIR_t$ - changes in the short-term interest rate from one time period to the next;
- ΔTBC_t - changes in the trade balance coverage from one time period to the next;
- p - the number of lagged differences;

- ECT_{t-1} - the error correction term;
- ε_t, e_t, μ_t, ω_t, υ_t, and τ_t - represent error terms;
- The coefficient λ of the error correction term quantifies the speed of adjustment when a deviation from equilibrium occurs;
- The coefficient vectors β, η, γ, θ, φ and ρ capture the short-run dynamics among the variables.

Results and Discussion

Our analysis begins by presenting the results of both descriptive statistics and a correlation matrix, as illustrated in Tables 2 and 3 (Appendix 1), respectively.

From Table 1, we can determine that the mean value of SASX-10 index over 2010q1-2019q4 period was 769.48 index points, with a standard deviation of 128.27 index points. The lowest value of SASX-10 index amounted to 563.07 index points on 2017q4, while the highest value was 1104.41 index points on 2011q1. Over 2010q1-2019q4, the mean value of BIRS index was 699.11 index points with standard deviation of 144.33 index points. The lowest value of 514.35 index points BIRS index was on 2018q4 and the highest value of 1124.14 index points was on 2011q1.

The correlation matrix results reveal a positive correlation coefficient between BIRS index and STIR, and a negative correlation coefficient were between BIRS index and GDP, IPI, M1 and TBC. Similarly, there is a positive correlation coefficient between SASX-10 index and STIR and M1, and a negative correlation coefficient between SASX-10 index and GDP, IPI, and TBC.

Table 4
Unit root tests for all variables for 2010-2019

Variables	*ADF test*		*PP test*	
	Level	*First Difference*	*Level*	*First Difference*
Indices				
SASX-10 index	-1.299	-6.311***	-1.005	-7.314***
BIRS index	-1.777	-6.178***	-1.789	-6.147***
Macroeconomic Variables				
GDP	-2.586	-6.989***	-2.775	-9.604***
IPI	-2.667	-7.915***	-2.663	-7.915***
M1	-1.274	-6.428***	-1.272	-6.421***
STIR	-1.299	-7.619***	-1.384	-7.610***
TBC	-2.025	-10.063***	-1.715677	-11.300***

Notes: The numerical values represent ADF test statistic. ***p ⩽ 0.001, **p ⩽ 0.005, *p ⩽ 0.01. All the level series are in natural logarithmic form.
Source: Authors

In this study, ensuring that all time series variables are integrated of order one is mandatory. Before proceeding with VAR/VECM estimation, it is important to assess the stationarity of the time series. Both the Augmented Dickey Fuller (ADF) test and the Philips-Perron (PP) test were utilized to detect the presence of a unit root. Results of both tests for stock indices and macroeconomic variables are presented in Table 4. The ADF tests and PP test were conducted under the null hypothesis of a unit root with a constant and a time trend, selected based on the trending behavior of all the series. The *p-values* of both tests exceed the 5% significance level, indicating that the time series have a unit root, and thus, they are non-stationary.

Table 4 reveals that all macroeconomic series together with both BiH's stock market indices exhibit unit root behaviour in level, indicating non-stationary processes. However, the first difference of all series appears to be stationary.

The second crucial aspect of VAR/VECM estimation is the determination of the optimal number of lags. Selecting the appropriate lag length involves subjective judgment and consideration of factors such as the study's context and both theoretical and empirical evidence. Following the approach presented by Ivanov and Kilian (2001), lag lengths from 1 to 4 were tested, and the SIC was used to identify the optimal lag length, as the mentioned authors suggest it is the most accurate criterion for quarterly series with fewer than 120 observations. The results, as shown in Table 5, reveal the optimal number of lags. According to the SIC, our models should incorporate only one lag for both indices (Table 5).

Table 5

Information criteria results for number of lags

VAR Model: *SASX-10 GDP IPI M1 STIR TBC*						
Lag	*LogL*	*LR*	*FPE*	*AIC*	*SIC*	*HQC*
1	508.7718	NA	1.61e-19	-26.26510	-24.68158*	-25.71241
2	543.0428	45.69464	2.04e-19	-26.16904	-23.00201	-25.06366
3	587.0187	43.97595	2.02e-19	-26.61215	-21.86159	-24.95408
4	661.1356	49.41127	7.04e-20*	-28.72976*	-22.39568	-26.51899*
VAR Model: *BIRS GDP IPI M1 STIR TBC*						
Lag	*LogL*	*LR*	*FPE*	*AIC*	*SIC*	*HQC*
1	513.4096	NA	1.24e-19	-26.52276	-24.93924*	-25.97007
2	547.2435	45.11189	1.61e-19	-26.40242	-23.23538	-25.29704
3	598.5271	51.28352	1.06e-19	-27.25150	-22.50095	-25.59343
4	679.4482	53.94743*	2.54e-20*	-29.74712*	-23.41305	-27.53636*

Notes: * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: final prediction error.

Source: Authors.

Table 6

Short-Run Wald Tests for variables of interest

Dependent variable: D(SASX-10)				*Dependent variable: D(BIRS)*			
Excluded	*Chi-sq*	*df*	*Prob.*	*Excluded*	*Chi-sq*	*df*	*Prob.*
D(GDP)	1.051362	1	0.3052	D(GDP)	4.144521	1	0.0418
D(IPI)	0.032263	1	0.8575	D(IPI)	0.996946	1	0.3181
D(M1)	0.493458	1	0.4824	D(M1)	0.074561	1	0.7848
D(STIR)	1.663245	1	0.1972	D(STIR)	0.634440	1	0.4257
D(TBC)	1.457600	1	0.2273	D(TBC)	6.079672	1	0.0137
All	4.257740	5	0.5129	All	7.181068	5	0.2075

Notes: D() indicates that these variables have been differenced; Null hypothesis: X does not Granger cause Y.

Source: Authors

Further, in Table 6 we present the results of Granger Causality/Block Exogeneity Wald Tests. Based on Table 6 and the results presented in the left panel, we cannot to reject the null hypothesis indicating no Granger causality from any observed variables to SASX-10, even at a significance level of 10%.

Similarly, in the right panel, we cannot reject the null hypothesis suggesting no Granger causality from IPI, M1 and STIR to BIRS at the 10% significance level. However, we can reject the null hypothesis suggesting no causality from GDP and TBC to BIRS at the 5% significance level. The *p-values* associated with the joint tests are 0.5129 for the SASX-10 index and 0.2075 for the BIRS index. These values suggest that, in the short-run, jointly, the independent variables do not exhibit statistically significant Granger causality with the dependent variable at the predetermined level of significance.

This finding suggests that past values of observed variables offer little predictive value for future movements in both indices in the short-run. The results imply that changes in observed variables do not Granger-cause changes in either index. The absence of Granger causality suggests that historical observed variables may not reliably signal forthcoming changes in either index. For financial and macroeconomic stakeholders, this underscores the importance of exercising caution when relying on historical data of observed variables to forecast movements in SASX-10 and BIRS indices. Such reliance may necessitate adjustments in trading and risk management strategies.

The Johansen cointegration test is employed to explore the existence of a long-run relationship between the stock indices and GDP, IPI, M1, STIR and TBC. The *Trace statistic* and the *Maximum eigenvalue statistic* are compared with the critical value at a 5% level of significance, and the cointegration relation results are presented in Table 7 (SASX-10) and Table 8 (BIRS).

Table 7
Cointegration Test for SASX-10 and Macroeconomic Variables for 2010-2019

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.770147	146.1653	95.75366	0.0000
At most 1 *	0.623697	90.29326	69.81889	0.0005
At most 2 *	0.566134	53.15360	47.85613	0.0146
At most 3	0.295827	21.42288	29.79707	0.3318
At most 4	0.160219	8.095112	15.49471	0.4553
At most 5	0.037686	1.459756	3.841466	0.2270
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	*Eigenvalue*	*Max-Eigen Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.770147	55.87206	40.07757	0.0004
At most 1 *	0.623697	37.13966	33.87687	0.0197
At most 2 *	0.566134	31.73073	27.58434	0.0138
At most 3	0.295827	13.32776	21.13162	0.4225
At most 4	0.160219	6.635356	14.26460	0.5331
At most 5	0.037686	1.459756	3.841466	0.2270

Notes: Trace test indicates 3 cointegrating equations at the 0.05 level. Max-eigenvalue test indicates 3 cointegrating equations at the 0.05 level. * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values.
Source: Authors

Table 8
Cointegration Test for BIRS and Macroeconomic Variables for 2010-2019

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.795854	155.0284	95.75366	0.0000
At most 1 *	0.607175	94.64951	69.81889	0.0002
At most 2 *	0.516890	59.14264	47.85613	0.0031
At most 3 *	0.463904	31.49720	29.79707	0.0315
At most 4	0.148525	7.806371	15.49471	0.4863
At most 5	0.043664	1.696556	3.841466	0.1927
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	*Eigenvalue*	*Max-Eigen Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.795854	60.37887	40.07757	0.0001
At most 1 *	0.607175	35.50686	33.87687	0.0317
At most 2 *	0.516890	27.64545	27.58434	0.0491
At most 3 *	0.463904	23.69083	21.13162	0.0213
At most 4	0.148525	6.109815	14.26460	0.5992
At most 5	0.043664	1.696556	3.841466	0.1927

Notes: Trace test indicates 4 cointegrating equations at the 0.05 level. Max-eigenvalue test indicates 4 cointegrating equations at the 0.05 level. * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values.
Source: Authors

Both the *Trace test* and *Maximum Eigenvalue test* reject the null hypothesis of a rank of two for SASX-10 index and all observed variables, supporting the existence of a three cointegrating vector between the indices and the macroeconomic variables. This implies a long-run relationship among SASX-10, GDP, IPI, M1, LTIR, and TBC.

Similar conclusions are drawn for the BIRS index. There are at least four cointegrated equations between the five variables and the BIRS index, indicating a prolonged association with GDP, IPI, M1, STIR and TBC. Therefore, all six variables are cointegrated, indicating that there is a long-run equilibrium relationship between the both stock market index, GDP, IPI, M1, STIR and TBC in BiH.

Table 9

Normalized cointegrating coefficients for the SASX-10 index

SASX-10	*GDP*	*IPI*	*M1*	*STIR*	*TBC*	*Const.*
1.000	-18.409	-0.365	4.522	0.260	2.718	246.239
	(1.617)	(0.368)	(0.335)	(0.188)	(0.405)	

Note: Standard errors in ( )

Source: Authors

Table 9 presents normalized cointegrating coefficients for the SASX-10 index. These values represent long-run elasticity at the same time, due to logarithmic transformation of the series. So, the long-run equilibrium relationship (cointegration equation) can be expressed as:

$$SASX10_{t-1} = 18.409 \cdot GDP_{t-1} + 0.365 \cdot IPI_{t-1} - 4.522 \cdot M1_{t-1} - 0.260 \cdot STIR_{t-1} - 2.718 \cdot TBC_{t-1} - 246.239 \quad (7)$$

Furthermore, to examine the short-run causality between variables VECM with SASX-10 index as target variable (results are provided in Appendix 1) is estimated:

$$\Delta SASX10_t = -\underset{(0.020)}{0.012} + \underset{(0.174)}{0.194} \cdot \Delta SASX10_{t-1} + \underset{(0.441)}{0.079} \cdot \Delta IPI_{t-1} - \underset{(2.016)}{2.067} \cdot \Delta GDP_{t-1} + \underset{(0.888)}{0.624} \cdot \Delta M1_{t-1} + \underset{(0.406)}{0.490} \cdot \Delta TBC_{t-1} - \underset{(0.266)}{0.343} \cdot \Delta STIR_{t-1} - \underset{(0.142)}{2.63} \cdot ECT_t + \varepsilon_t \quad (8)$$

The estimated error correction term is ECT_{t-1} = -0.263. This coefficient represents the speed of adjustment towards equilibrium. The adjustment coefficients show that SASX-10 index are corrected in -26.3% in each period. Furthermore, we revealed that the sign of ECT_{t-1} is negative and significant at the 5% level (t = -1.85). We can conclude that there is a long-run causality running from GDP, IPI, M1, STIR and TBC to the SASX-10 index. The long-run equations for the SASX-10 index indicate a significant negative relationship, at least at the 5% level, between M1 and TBC in the t-1 period with the SASX-10 in the same period. On the contrary, the GDP from the previous period has a significant positive impact on the SASX-10. The variables IPI and STIR do not show significant effects. A short-run causality is not evident in any analyzed case, at standard significance levels.

Normalized cointegrating coefficients for the BIRS index displayed in Table 10 represent long-run elasticity at the same time, due to logarithmic transformation of the series. So, the long-run equilibrium relationship (cointegration equation) can be expressed as:

$$BIRS_{t-1} = 11.502 \cdot GDP_{t-1} - 0.615 \cdot IPI_{t-1} - 3.521 \cdot M1_{t-1} - 0.520 \cdot STIR_{t-1} - 0.800 \cdot TBC_{t-1} - 140.105 \quad (9)$$

Table 10

Normalized cointegrating coefficients for the BIRS index

BIRS	*GDP*	*IPI*	*M1*	*STIR*	*TBC*	*Const.*
1.000	-11.502	0.615	3.521	0.520	0.800	140.105
	(1.339)	(0.309)	(0.280)	(0.156)	(0.337)	

Note: Standard errors in ( )

To examine the short-run causality between variables VECM with BIRS index as target variable (results are provided in Appendix 2) is estimated:

$$\Delta BIRS_t = \underset{(0.019)}{0.011} + \underset{(0.173)}{0.373} \cdot \Delta BIRS_{t-1} + \underset{(0.396)}{0.396} \cdot \Delta IPI_{t-1} - \underset{(1.631)}{3.321} \cdot \Delta GDP_{t-1} + \underset{(0.721)}{0.197} \cdot \Delta M1_{t-1} + \underset{(0.318)}{0.784} \cdot \Delta TBC_{t-1} + \underset{(0.247)}{0.197} \cdot \Delta STIR_{t-1} - \underset{(0.139)}{0.503} \cdot ECT_t + \varepsilon_t \quad (10)$$

The estimated error correction term is ECT_{t-1} = -0.503. The adjustment coefficients show that BIRS are corrected in -50.3% in each period. Furthermore, we found that the sign of ECT_{t-1} is negative and significant at the 5% level (t = -3.62). We can conclude that there is a long-run causality running from GDP, IPI, M1, LTIR and TBC to the BIRS index. The long-run equations for BIRS reveal that IPI, M1, STIR and TBC in t-1 period have a significant negative (at least 5% level) relationship with the BIRS index in t-1 period, while the GDP has a significantly positive effect on the BIRS index. A short-run causality is evident in the case of BIRS, GDP, and TBC, at least at the 5% significance level. While the coefficient for IPI is positive in the BIRS equation and negative in the SASX-10 equation, this suggests that industrial production may have a different impact on these two stock indices. Theoretically, from an economic point of view, it is possible that the higher growth of industrial production in the FBiH has a negative impact on the movement of BIRS in the RS, but this depends on the wider context and economic relations between the two entities. However, in order to confirm the above hypothesis, it is necessary to additionally investigate the dynamics of trade relations between the two entities, industrial competitiveness, and capital and investment flows within BiH.

Our findings are consistent with previous studies. In BiH, we found a significantly negative a cointegration between the stock market indices and M1. This aligns with studies by Mukherjee & Naka (1995), Wongbangpo & Sharma (2002), Maysami, Howe & Hamzah (2004), Nishat, Shaheen & Hijazi (2004), Ratanapakorn & Sharma (2007), Karagöz, Ergün & Karagöz (2009), Singh (2016), and Bhuiyan & Chowdhury (2020), but contrasts with Abugri (2008), Humpe and Macmillan (2009), Kumar & Sahu (2017) and Kandari & Abul (2019).

The empirical results suggest that macroeconomic activity do rationally signal changes in the stock market indices in terms of GDP. This result is in line with the theoretical expectation and general finding of related literature. This result aligns with the findings of Karagöz, Ergün & Karagöz (2009) and Tulcanaza-Prieto & Lee (2019). However, Osamwonyi and Evbayiro-Osagie (2012) obtained different results.

The long-run relation between stock market indices and the IPI is positive, similar to results reported in Chen, Roll & Ross (1986), Mukherjee & Naka (1995), Maysami, Howe & Hamzah (2004), Nishat, Shaheen & Hijazi (2004), Abugri (2008), Humpe and Macmillan (2009), and Singh (2016). The next effect is from TBC. In our paper, we have found evidence of this positive long-run relationship between TBC and the stock market indices. Similar results were obtained by Basci & Karaca (2013).

The results are mixed for the cointegration between the stock market indices and STIR. While the long-run relation between the BLSE and STIR is negative, the long-run relation between the SASX-10 and STIR isn't exist. Maysami, Howe & Hamzah (2004), Ratanapakorn & Sharma (2007), Karagöz, Ergün & Karagöz (2009), and Al-Kandari & Abul (2019) achieve a significantly positive effect from the interest rate. Mukherjee & Naka (1995), Wongbangpo & Sharma (2002), Nishat, Shaheen & Hijazi (2004), Abugri (2008), Singh (2016), Kumar & Sahu (2017), and Tulcanaza-Prieto & Lee (2019) obtained opposite results.

Comparing findings of this study with similar studies from the region, such as research by Mojanoski (2022) and Ligocká (2023), it could be concluded that stock markets in BiH are influenced by similar macroeconomic factors as markets in neighboring countries. Both studies, using VECM and Granger causality tests, show that macroeconomic variables have a long-term effect on stock index values, while the short-term effects are weaker. Also, the results of Hsing (2011) regarding the Croatian CROBEX index emphasize the importance of real GDP and monetary aggregates in the formation of the index value, which is also confirmed in analysis for BiH. A similar pattern can be seen in the research of Backović et al. (2023) on the Montenegrin market, which suggests similarities between stock markets in the Balkans.

Conclusions

Based on the presented conceptual framework, in which the theoretical and empirical aspects of the role and importance of financial markets are elaborated, the relationship between stock markets and the economy in the real world can generally be understood in two ways: on one hand, the development of the stock market is seen as a means to mobilize savings towards potentially productive projects, evaluating the efficiency and productivity of investments, and facilitating the redistribution of financial resources among individuals, corporations, and governments. On the other hand, the stock market is not isolated but rather interconnected with a broader ecosystem of market-oriented factors. This perspective focuses on how these factors, whether through gradual development or sudden shifts, can influence stock market performance and behavior. Understanding these dynamics is crucial for investors, policymakers, and market participants to make informed decisions in a complex and dynamic financial environment.

It is important to note that the relationship between these macroeconomic variables and the stock market is complex and can vary based on the specific circumstances of each country and market. Traders and investors use these variables as indicators to make informed decisions, but many other factors can also influence stock prices, including market sentiment, geopolitical events, and technological advancements.

This study identifies key macroeconomic variables that are cointegrated with the SASX-10 and BIRS stock indices in Bosnia and Herzegovina using the Vector Error Correction Model (VECM). The analysis demonstrates the existence of long-run relationships between the stock indices and five main macroeconomic variables: GDP, IPI, M1, STIR, and TBC. For the SASX-10 index, the normalized cointegrating coefficients indicate a long-run equilibrium relationship. The error correction term (ECT) of -0.263 suggests a correction of 26.3% of deviations from the long-term equilibrium in each period. The results show a significant long-run negative relationship between the SASX-10 index and the variables M1 and TBC, while GDP has a significant positive impact. The IPI and STIR variables do not show significant effects on the

SASX-10 index in the long-run. No significant short-run causality among the analyzed variables was found. For the BIRS index, the normalized cointegrating coefficients indicate a long-term equilibrium relationship. The error correction term of -0.503 run analysis reveals significant negative relationships between the BIRS index and the variables IPI, M1, STIR, and TBC, while GDP has a significant positive impact. In the short-run, significant causality was observed among the BIRS index, GDP, and TBC, at least at the 5% significance level.

These findings highlight significant long-run relationships between stock indices in BiH and key macroeconomic variables, emphasizing the importance of GDP, money supply, and trade balance coverage. Policymakers should consider these findings to enhance stock market development, focusing on maintaining economic stability and promoting factors that positively influence stock indices. Further research should focus on the specific mechanisms of these interactions to better understand and support stock market growth in transitional economies.

The stock market is significantly influenced by various market-oriented factors that evolve over time. Changes in market regulations and policies implemented by regulatory authorities can profoundly impact stock markets, influencing market behavior through increased transparency and investor protection. Investor sentiment, driven by economic optimism or pessimism, plays a crucial role in stock price movements, either boosting or declining prices. Government economic policies, such as fiscal and monetary measures, taxation, and trade policies, directly affect stock markets by influencing investor behavior and market activity. Structural changes in the market, including new trading platforms and technological advancements, alter trading dynamics, affecting volumes, liquidity, and information processing speed. Moreover, global economic conditions, such as recessions or geopolitical tensions, create interconnectedness among stock markets globally, where events in one country can spill over to impact markets in others.

In this paper, the signs of the long-run elasticity coefficients of the macroeconomic variables on stock prices are generally consistent with the hypothesized equilibrium relations. This study has significant value from several aspects. First, for policy makers, because it provides an insight into how their decisions can affect stock market indices in Bosnia and Herzegovina. Second, for investors, who need to understand how the market will react to changes in the macroeconomic environment. Third, this study is unique in the aspect that it covers both indices in BiH and compares how important macroeconomic variables influence those indices. By paying attention to the asymmetry in the market across the FBiH and RS, long-term investors could make a better decision for their investments. Therefore, knowledge of this relationship and the ability to predict future trends can be a valuable tool for investors in their efforts to achieve greater profits, and for authorities in preserving the stability of financial markets. However, it is important to note that the number of observations may represent a potential limitation of the study when applying cointegration methods. For future research, analyzing sector-specific stock market indices will be useful, as the composite index can mask the sensitivity of individual sectors. A sector-wise analysis will provide clearer insights into the direction and strength of each sector's movements in response to changes in macroeconomic variables.

References

Abugri, B. A. (2008). Empirical relationship between macro-economic volatility and stock returns: Evidence from Latin American Markets. *International Review of Financial Analysis*, *17*(2), 396–410. DOI: https://doi.org/10.1016/j.irfa.2006.09.002

Adjasi, C. K. D., & Biekpe, N. B. (2006). Stock market development and economic growth: The case of selected African countries. *African Development Review*, *18*(1), 144–161. DOI: 10.1111/j.1467-8268.2006.00136.x

Al-Kandari, A. M., & Abul, S. J. (2019). The impact of macroeconomic variables on stock prices in Kuwait. *International Journal of Business and Management*, *14*(6), 99–112. DOI: 10.5539/ijbm.v14n6p99

Arouri, M., Estay, C., Rault, C., & Roubaud, D. (2016). Economic policy uncertainty and stock markets: Long-run evidence from the US. *Finance Research Letters*, *18*(C), 136–141. DOI: https://doi.org/10.1016/j.frl.2016.04.011

Arrow, K. J., & Debreu, G. (1954). Existence of an Equilibrium for a Competitive Economy. *Econometrica*, *22*(3), 265–290. DOI: https://doi.org/10.2307/1907353

Asravor, R. K., & Fonu, P. D.-D. (2021). Dynamic relation between macroeconomic variable, stock market returns and stock market development in Ghana. *International Journal of Finance & Economics*, 1–10. DOI: 10.1002/ijfe.1925

Backović, T., Karadžić, V., Gričar, S. & Bojnec, Š. (2023). Montenegrin Stock Exchange Market on a Short-Term Perspective. *Journal of Risk and Financial Management, 16*, 315. DOI: https://doi.org/10.3390/jrfm16070315

Basci, E. S., & Karaca, S. S. (2013). The Determinants of stock market index: VAR approach to Turkish stock market. *International Journal of Economics and Financial Issues*, *3*(1), 63–71.

Bayar, Y. (2016). Macroeconomic Determinants of Stock Market Development: Evidence From Borsa Istanbul. *Financial studies*, *20*(1), 69–89.

Bayezid Ali, M. (2011). Impact of Micro and Macroeconomic Variables on Emerging Stock Market Return: A Case on Dhaka Stock Exchange (DSE). *Interdisciplinary Journal of Research in Business*, *1*(5), 8–16.

Beck, T. (2012). The role of finance in economic development-benefits, risks, and politics. In D. C. Mueller (Ed.), *Oxford handbook of capitalism* (pp. 118–151). Oxford: University Press

Bekaert, G., & Harvey, C. (2000). Foreign speculators and emerging equity markets. *Journal of Finance*, *55*(2), 565–614. DOI: https://doi.org/10.1111/0022-1082.00220

Bekhet, H. A., & Matar, A. (2013). Co-integration and causality analysis between stock market prices and their determinates in Jordan. *Economic Modelling*, *35*, 508–514. DOI: http://dx.doi.org/10.1016/j.econmod.2013.07.012

Bhuiyan, E. M., & Chowdhury, M. (2020). Macroeconomic variables and stock Market indices: Asymmetric Dynamics in the US and Canada. *The Quarterly Review of Economics and Finance*, *77*, 62–74. DOI: https://doi.org/10.1016/j.qref.2019.10.005

Bustos, O., & Pomares-Quimbaya, A. (2020). Stock market movement forecast: A systematic review. *Expert Systems with Applications*, *156*. DOI: 10.1016/j.eswa.2020.113464

Calderón, C., & Liu, L. (2003). The direction of causality between financial development and economic growth. *Journal of Development Economics*, *72*, 321–334. DOI: 10.1016/S0304-3878(03)00079-8

Carvajal, A., & Elliott, J. E. (2007). Strengths and Weaknesses in Securities Market Regulation: A Global Analysis. *IMF Working Paper No. 07/259*, 1–49. DOI: 10.5089/9781451868227.001

Chaurasia, A., & Debnath, P. (2023). Macroeconomic Determinants of Stock Market Development: A Systematic Literature Review. *Jurnal Multidisiplin Madani*, *3*(8), 1800–1807. DOI: https://doi.org/10.55927/mudima.v3i8.3667

Chen, N. F., Roll, R., & Ross, S. (1986). Economic forces and the stock market. *Journal of Business*, *59*(3), 383–403. DOI: http://dx.doi.org/10.1086/296344

Chong, C., & Goh, K. (2003). *Linkages of economic activity, stock prices and monetary policy: the case of Malaysia*. Universiti Utara Malaysia Sintok.

Cleveland, R. B., Cleveland, W. S., McRae, J. E., & Terpenning, I. J. (1990). STL: A seasonal-trend decomposition procedure based on Loess. *Journal of Official Statistics*, *6*(1), 3–33.

Davidson, L. S., & Froyen, R. T. (1982). Monetary policy and stock returns: are stock markets efficient? *Federal Reserve Bank of St. Louis Review*, *64*(3), 3–12.

Dhakal, D., Kandil, M., & Sharma, S. C. (1993). Causality between the Money Supply and Share Prices: A VAR Investigation. *Quarterly Journal of Business and Economics*, *32*(3), 52–74.

Djedović, E. & Djedović, I. (2018). Impact of macroeconomic variables on stock market index in Bosnia and Herzegovina. *Zbornik radova Pravnog fakulteta u Tuzli*, *4*(2), 100–125.

El-Wassal, K. A. (2005). Understanding the Growth in Emerging Stock Markets. *Journal of Emerging Market Finance*, *4*(3), 227–261. DOI: https://doi.org/10.1177/097265270500400302

Engle, R. F., & Granger, C. W. J. (1987). Cointegration and error correction representation: estimation and testing. *Econometrica*, *55*(2), 251–276. DOI: https://doi.org/10.2307/1913236

Enisan, A. A., & Olufisayo, A. O. (2009). Stock market development and economic growth: Evidence from seven sub-Sahara African countries. *Journal of Economics and Business*, *61*, 162–171. DOI: https://doi.org/10.1016/j.jeconbus.2008.05.001

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, *25*(2), 383–417.

Fama, E. F. (1981). Stock returns, real activity, inflation and money. *The American Economic Review*, *71*(4), 545–565.

Ferson, W. E., & Harvey, C. R. (1991). The variation of economic risk premiums. *Journal of Political Economy, 99*(2), 385–415.

Finter, P., Niessen-Ruenzi, A., & Ruenzi, S. (2011). The Impact of Investor Sentiment on the German Stock Market. *CFR Working Paper, No. 10-03 [rev.]. University of Cologne, Centre for Financial Research (CFR)*, 1–43.

Flannery. M. J., & Protopapadakis, A. A. (2002). Macroeconomic Factors Do Influence Aggregate Stock Returns. *The Review of Financial Studies*, *15*(3), 751–782. DOI: https://doi.org/10.1093/rfs/15.3.751

Gjerde, O., & Sættem, F. (1999). Causal Relations among Stock Returns and Macroeconomic Variables in a Small, Open Economy. *Journal of International Financial Markets, Institutions and Money*, *9*, 61–74. DOI: https://doi.org/10.1016/S1042-4431(98)00036-5

Gokmenoglu, K., Azin, V., & Taspinar, N. (2015). The Relationship between Industrial Production, GDP, Inflation and Oil Price: The Case of Turkey. *Procedia Economics and Finance*, *25*, 497–503. DOI: https://doi.org/10.1016/S2212-5671(15)00762-5

Goldsmith, R. W. (1969). *Financial Structure and Development*. Yale University Press.

Gurley J., & Shaw, E. (1955) Financial Aspects of Economic Development. *American Economic Review, 45*(4), 515–538.

Hamao, Y. (1988). An empirical examination of the arbitrage pricing theory. *Japan and the World Economy*, *1*(1), 45–61. DOI: https://doi.org/10.1016/0922-1425(88)90005-9

Ho, S-Y. (2019). Macroeconomic determinants of stock market development in South Africa. *International Journal of Emerging Markets, 14*(2), 322–342. DOI: https://doi.org/10.1108/IJoEM-09-2017-0341

Hsing, Y. (2011). Macroeconomic variables and the stock market: The case of Croatia. *Economic research - Ekonomska istraživanja*, *24*(4), 41–50.

Humpe, A., & Macmillan, P. (2009). Can macroeconomic variables explain long-term stock market movements? A comparison of the US and Japan. *Applied Financial Economics, 19*(2), 111–119. DOI: https://doi.org/10.1080/09603100701748956

Ivanov, V., & Kilian, L. (2001). A practitioner's guide to lag-order selection for vector autoregressions. *CEPR Discussion Papers, 2685.*

Jaffe, F., & Mandelker, G. (1976). The Fisher effect for risky assets: An empirical investigation. *The Journal of Finance, 31*(2), 447–458. DOI: https://doi.org/10.2307/2326616

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica*, *59*, 1551–1580. DOI: https://doi.org/10.2307/2938278

Karagöz, K., Ergün, S., & Karagöz, M. (2009). Impact of Macroeconomic Factors on Stock Market: Evidence from Istanbul Stock Exchange. *Proceedings of the 1. International Symposium on Sustainable Development*, June 9-10, Sarajevo, 122–130.

Khan, I., & Khan, J. (2018). The Impact of Macroeconomic Variables on Stock Prices: A Case Study of Karachi Stock Exchange. *Journal of Economics and Sustainable Development, 9*(13), 15–25.

Kumalić, I. (2013). Razvijenost finansijskog tržišta u Bosni i Hercegovini. *Časopis za ekonomiju i tržišne komunikacije / Economy and Market Communication Review*, *3*(1), 57–72. DOI: https://doi.org/10.7251/EMC1301057K

Kumar Verma, R., & Bansal, R. (2021). Impact of macroeconomic variables on the performance of stock exchange: a systematic review. *International Journal of Emerging Markets*, *16*(7), 1291–1329. DOI: https://doi.org/10.1108/IJOEM-11-2019-0993

Kumar, K. K., & Sahu, B. (2017). Dynamic linkages between macroeconomic factors and Islamic stock indices in a non-Islamic country India. *The Journal of Developing Areas*, *51*(1), 193–205. DOI: https://doi.org/10.1353/jda.2017.0011

Ligocká, M. (2023). The relationship between macroeconomic variables and stock market indices: evidence from Central and Eastern European countries. *Eastern Journal of European Studies*, *14*(2), 76–107. DOI: 10.47743/ejes-2023-0204

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. W. (1997). Legal determinants of external finance. *Journal of Finance*, *52*, 1131–1150. DOI: 10.1111/j.1540-6261.1997.tb02727.x

Levine, R. (2005). Finance and Growth: Theory, Evidence, and Mechanisms, In P. Aghion & S. Durlauf (Eds.), *Handbook of Economic Growth* (pp. 191–215). Amsterdam: North-Holland Elsevier Publishers. DOI: https://doi.org/10.1016/S1574-0684(05)01012-9

Liu, H. Y., & Chen, X. L. (2017). The imported price, inflation and exchange rate pass-through in China, *Cogent Economics & Finance*, *5*(1), 1–13. DOI: https://doi.org/10.1080/23322039.2017.1279814

Maio, P., & Philip, D. (2015). Macro variables and the components of stock returns. *Journal of Empirical Finance*, *33*(C), 287–308. DOI: http://dx.doi.org/10.2139/ssrn.2021885

Martinez, M. A., & Rubio, G. (1989). Arbitrage pricing with macroeconomic variables: an empirical investigation using Spanish data. *Working Paper, Universidad del Pais Vasco*.
Masulis, R. W., & Lakshmanan, S. (2002). Does Market Structure Affect the Immediacy of Stock Price Responses to News? *Journal of Financial and Quantitative Analysis*, *37*(4), 617–648. DOI: https://doi.org/10.2307/3595014
Maysami, R. C., Howe, L. C. & Hamzah, M. A. (2004). Relationship between Macroeconomic Variables and Stock Market Indices: Cointegration Evidence from Stock Exchange of Singapore's All-S Sector Indices. *Journal of Pengurusan*, *24*, 47–77.
Mehrara, M. (2006). The Relationship between Stock Market and Macroeconomic Variables: a Case Study for Iran. *Iranian Economic Review*, *10*(17), 138–148.
Merikas, A. G., & Merika, A. A. (2006). Stock prices response to real economic variables: The case of Germany. *Managerial Finance*, *32*(5), 446–450. DOI: 10.1108/03074350610657454
Mojanoski, G. (2022). Long-run and short-run causality between sock price indices and macroeconomic variables: Evidence of panel VECM analysis from Bosnia and Herzegovina, Croatia, North Macedonia and Serbia. *Economic Review: Journal of Economics and Business*, *20*(2), 3–14. DOI: 10.51558/2303-680X.2022.20.2.3
Mukherjee, T. K., & 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*, *18*(2), 223–237. DOI: https://doi.org/10.1111/j.1475-6803.1995.tb00563.x
Nasseh, A., & Strauss, J. (2000). Stock prices and domestic and international macroeconomic activity: a cointegration approach. *The Quarterly Review of Economics and Finance, 40*(2), 229–245. DOI: https://doi.org/10.1016/S1062-9769(99)00054-X
Nelson, C. (1976). Inflation and rates of return on common stocks. *The Journal of Finance*, *31*(2), 471–487. DOI: https://doi.org/10.1111/j.1540-6261.1976.tb01900.x
Neusser, K., & Kugler, M. (1998). Manufacturing Growth and Financial Development: Evidence from OECD Countries. *The Review of Economics and Statistics, 80*, 638–646. DOI: https://doi.org/10.1162/003465398557726
Nishat, M., Shaheen, R., & Hijazi, S. T. (2004). Macroeconomic factors and the Pakistani equity market. *The Pakistan Development Review, 43*(4), 619–637.
Nti, I. K., Adekoya, A. F., & Weyori, B. A. (2020). A systematic review of fundamental and technical analysis of stock market predictions. *Artificial Intelligence Review*, *53*(4), 3007–3057. DOI: https://doi.org/10.1007/s10462-019-09754-z
Osamwonyi, I. O., & Evbayiro-Osagie, E. I. (2012). The Relationship between Macroeconomic Variables and Stock Market Index in Nigeria. *Journal of Economics, 3*(1), 55–63.
Patrick H. T. (1966). Financial Development and Economic Growth in Underdeveloped countries. *Economic Development and Cultural Change,* 14(1), 174–189. DOI: http://dx.doi.org/10.1086/450153
Pilinkus, D. (2010). Macroeconomic indicators and their impact on stock market performance in the short and long run: The case of the Baltic States. *Technological and Economic Development of Economy, 16*(2), 291–304. DOI: https://doi.org/10.3846/tede.2010.19
Poon, S., & Taylor, J. (1991). Macroeconomic Factors and the UK Stock Market. *Journal of Business Finance & Accounting*, *18*(5), 619–636. DOI: https://doi.org/10.1111/j.1468-5957.1991.tb00229.x
Ratanapakorn, O., & Sharma, S. C. (2007). Dynamic analysis between the US stock returns and the macroeconomic variables. *Applied Financial Economics, 17*(5), 369–377.
Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy, 98*, 71–102.
Ross, S. A. (1976). The arbitrage theory of capital asset pricing. *Journal of Economic Theory*, *13*, 341–360. DOI: http://dx.doi.org/10.1016/0022-0531(76)90046-6
Ruhani, F., Islam, M. A., Ahmad, T. S. T., & Quddus, M. R. (2018). Effects of financial market variables on stock prices: a review of the literature. *Journal of Modern Accounting and Auditing*, *14*(11), 597–610. DOI: 10.17265/1548-6583/2018.11.002
Singh, G. (2016). The impact of macroeconomic fundamentals on stock prices revised: a study of Indian stock market. *Journal of International Economics, 7*(1), 76–91.
Stern, N. (1989). The economics of development: A survey. *The Economic Journal, 100*, 597-685. DOI: https://doi.org/10.2307/2233764
Stulz, R. (2001). Does Financial Structure Matter for Economic Growth? A Corporate Finance Perspective. *In* A. Demirgüç-Kunt, & R. Levine (Eds.), *Financial Structure and Economic Growth A Cross-Country Comparison of Banks,*

Markets, and Development (pp. 143–188). London: Massachusetts Institute of Technology. DOI: 10.7551/mitpress/3001.003.0008

Şükrüoğlu, D., & Nalin, H. T. (2014). The Macroeconomic Determinants of Stock Market Development in Selected European Countries: Dynamic Panel Data Analysis. *International Journal of Economics and Finance*, *6*(3), 64–71. DOI: 10.5539/ijef.v6n3p64

Svaleryd, H., & Vlachos, J. (2002). Markets for risk and openness to trade: how are they related? *Journal of International Economics, 57*, 369–395. DOI: 10.1016/S0022-1996(01)00153-2

Trivedi, P., & Behera, S. R. (2012). Macroeconomic Fundamentals as Determinants of Equity Prices: An Empirical Analysis for India. *The IUP Journal of Applied Finance*, *18*(3), 5–30.

Tulcanaza-Prieto, A. B., & Lee, Y. (2019). Determinants of Stock Market Performance: VAR and VECM Designs in Korea and Japan, *Global Business & Finance Review*, *24*(4), 24–44. DOI: https://doi.org/10.17549/gbfr.2019.24.4.24%0A

Van Nieuwerburgh, S., Buelens, F., & Cuyvers, L. (2006). Stock market development and economic growth in Belgium. *Explorations in Economic History*, *43*(1), 13–38. DOI: 10.1016/j.eeh.2005.06.002

Verma, R. K., & Bansal, R. (2021). Impact of macroeconomic variables on the performance of stock exchange: a systematic review. *International Journal of Emerging Markets*, *16*(7), 1291–1329. DOI: https://doi.org/10.1108/IJOEM-11-2019-0993

Vychytilová, J., Pavelková, D., Pham, H., & Urbánek, T. (2019). Macroeconomic factors explaining stock volatility: multi-country empirical evidence from the auto industry. Economic Research-Ekonomska Istraživanja, *32*(1), 3333–3347. DOI: https://doi.org/10.1080/1331677X.2019.1661003

Wongbangpo, P., & Sharma, S. C. (2002). Stock Market and Macroeconomic Fundamental Dynamic Interactions: ASEAN-5 Countries. *Journal of Asian Economics, 13*(1), 27–51. DOI: https://doi.org/10.1016/S1049-0078(01)00111-7

Yartey, C. A. (2010). The institutional and macroeconomic determinants of stock market development in emerging economies. *Applied Financial Economics*, *20*(21), 1615–1625. DOI: 10.1080/09603107.2010.522519

Appendix 1. Vector Error Correction Estimates (SASX-10)

Sample (adjusted): 2010Q3 2019Q4
Included observations: 38 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	*CointEq1*
LOG(SASX-10_SA(-1))	1.000000
LOG(GDP_SA(-1))	-18.40899
	(1.61699)
	[-11.3848]
LOG(IPI_SA(-1))	-0.364510
	(0.36771)
	[-0.99129]
LOG(M1_SA(-1))	4.522277
	(0.33495)
	[13.5015]
LOG(STIR_SA(-1))	0.260182
	(0.18849)
	[1.38037]
LOG(TBC_SA(-1))	2.718114
	(0.40500)
	[6.71142]
C	246.2390

Error Correction:	*D(LOG(SASX-10_SA))*	*D(LOG(GDP_SA))*	*D(LOG(IPI_SA))*	*D(LOG(M1_SA))*	*D(LOG(STIR_SA))*	*D(LOG(TBC_SA))*
CointEq1	-0.262554	0.043957	0.079129	-0.053175	0.083439	-0.063116
	(0.14195)	(0.01730)	(0.05651)	(0.02756)	(0.08449)	(0.06893)
	[-1.84961]	[2.54022]	[1.40018]	[-1.92937]	[0.98758]	[-0.91572]
D(LOG(SASX10_SA(-1)))	0.194003	0.015458	-0.109332	0.082969	-0.251199	0.182432
	(0.17430)	(0.02125)	(0.06939)	(0.03384)	(0.10374)	(0.08463)
	[1.11307]	[0.72753]	[-1.57560]	[2.45176]	[-2.42143]	[2.15562]
D(LOG(GDP_SA(-1)))	-2.067356	-0.058702	-0.140956	-1.085584	0.774972	-0.769717
	(2.01623)	(0.24579)	(0.80269)	(0.39146)	(1.20004)	(0.97899)
	[-1.02536]	[-0.23883]	[-0.17560]	[-2.77314]	[0.64579]	[-0.78623]
D(LOG(IPI_SA(-1)))	0.079283	0.051276	-0.240399	0.051356	-0.448649	0.300339
	(0.44140)	(0.05381)	(0.17573)	(0.08570)	(0.26272)	(0.21432)
	[0.17962]	[0.95294]	[-1.36802]	[0.59925]	[-1.70773]	[1.40133]
D(LOG(M1_SA(-1)))	0.623751	0.136848	0.059397	0.452958	-1.221403	0.930634
	(0.88795)	(0.10824)	(0.35351)	(0.17240)	(0.52850)	(0.43115)
	[0.70247]	[1.26426]	[0.16802]	[2.62736]	[-2.31108]	[2.15850]
D(LOG(STIR_SA(-1)))	-0.343354	0.027261	0.071612	-0.069919	-0.222210	0.271428
	(0.26623)	(0.03246)	(0.10599)	(0.05169)	(0.15846)	(0.12927)
	[-1.28967]	[0.83996]	[0.67563]	[-1.35263]	[-1.40230]	[2.09966]
D(LOG(TBC_SA(-1)))	0.489831	-0.023094	-0.006830	0.147695	-0.427493	-0.138256
	(0.40572)	(0.04946)	(0.16152)	(0.07877)	(0.24148)	(0.19700)
	[1.20731]	[-0.46693]	[-0.04229]	[1.87493]	[-1.77029]	[-0.70180]
C	-0.012194	0.003040	0.002948	0.017436	0.001197	-0.007733
	(0.02048)	(0.00250)	(0.00815)	(0.00398)	(0.01219)	(0.00995)
	[-0.59536]	[1.21758]	[0.36151]	[4.38451]	[0.09821]	[-0.77755]
R-squared	0.176010	0.378276	0.290041	0.342511	0.369108	0.421367
Adj. R-squared	-0.016254	0.233207	0.124384	0.189097	0.221900	0.286353
Sum sq. resids	0.167222	0.002485	0.026504	0.006304	0.059239	0.039425
S.E. equation	0.074660	0.009101	0.029723	0.014496	0.044437	0.036252
F-statistic	0.915460	2.607557	1.750855	2.232595	2.507389	3.120911
Log likelihood	49.17474	129.1465	84.17307	111.4602	68.89175	76.62809
Akaike AIC	-2.167091	-6.376134	-4.009109	-5.445273	-3.204829	-3.612005
Schwarz SC	-1.822336	-6.031379	-3.664354	-5.100518	-2.860074	-3.267250
Mean dependent	-0.004065	0.005207	0.002127	0.022364	-0.018621	0.002982
S.D. dependent	0.074060	0.010394	0.031764	0.016097	0.050376	0.042913
Determinant resid covariance (dof adj.)		4.85E-20				
Determinant resid covariance		1.17E-20				
Log likelihood		548.4036				
Akaike information criterion		-26.02124				
Schwarz criterion		-23.69415				
Number of coefficients		54				

Source: Authors.

Appendix 2. Vector Error Correction Estimates (BIRS)

Sample (adjusted): 2010Q3 2019Q4
Included observations: 38 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	*CointEq1*
LOG(BIRS_SA(-1))	1.000000
LOG(GDP_SA(-1))	-11.50183
	(1.33911)
	[-8.58913]
LOG(IPI_SA(-1))	0.614637
	(0.30892)
	[1.98963]
LOG(M1_SA(-1))	3.520821
	(0.28049)
	[12.5524]
LOG(STIR_SA(-1))	0.519638
	(0.15613)
	[3.32821]
LOG(TBC_SA(-1))	0.799709
	(0.33678)
	[2.37458]
C	140.1048

Error Correction:	*D(LOG(BIRS_SA))*	*D(LOG(GDP_SA))*	*D(LOG(IPI_SA))*	*D(LOG(M1_SA))*	*D(LOG(STIR_SA))*	*D(LOG(TBC_SA))*
CointEq1	-0.502784	0.031318	-0.057229	-0.088216	0.118560	0.088610
	(0.13870)	(0.02083)	(0.06512)	(0.03015)	(0.09903)	(0.07993)
	[-3.62490]	[1.50383]	[-0.87885]	[-2.92618]	[1.19717]	[1.10859]
D(LOG(BIRS_SA(-1)))	0.371558	-0.001871	0.002718	0.037051	-0.152141	0.012850
	(0.17249)	(0.02590)	(0.08098)	(0.03749)	(0.12316)	(0.09940)
	[2.15412]	[-0.07226]	[0.03356]	[0.98828]	[-1.23536]	[0.12927]
D(LOG(GDP_SA(-1)))	-3.321094	-0.218442	-1.357589	-1.119546	0.518053	0.605622
	(1.63134)	(0.24494)	(0.76588)	(0.35457)	(1.16477)	(0.94009)
	[-2.03581]	[-0.89183]	[-1.77258]	[-3.15746]	[0.44477]	[0.64421]
D(LOG(IPI_SA(-1)))	0.395773	0.039825	-0.208049	0.084095	-0.461272	0.250199
	(0.39638)	(0.05951)	(0.18609)	(0.08615)	(0.28301)	(0.22842)
	[0.99847]	[0.66916]	[-1.11799]	[0.97611]	[-1.62986]	[1.09534]
D(LOG(M1_SA(-1)))	0.196963	0.221709	0.329864	0.366298	-1.064645	0.663206
	(0.72132)	(0.10830)	(0.33865)	(0.15678)	(0.51502)	(0.41568)
	[0.27306]	[2.04712]	[0.97407]	[2.33639]	[-2.06719]	[1.59548]
D(LOG(STIR_SA(-1)))	0.196648	0.029872	0.094217	-0.031153	-0.323644	0.258402
	(0.24688)	(0.03707)	(0.11591)	(0.05366)	(0.17627)	(0.14227)
	[0.79652]	[0.80587]	[0.81287]	[-0.58056]	[-1.83602]	[1.81625]
D(LOG(TBC_SA(-1)))	0.784386	0.022967	0.165117	0.100718	-0.352336	-0.313527
	(0.31812)	(0.04776)	(0.14935)	(0.06914)	(0.22714)	(0.18332)
	[2.46570]	[0.48084]	[1.10557]	[1.45665]	[-1.55121]	[-1.71024]
C	0.011000	0.001933	0.004392	0.020235	-0.003136	-0.010134
	(0.01864)	(0.00280)	(0.00875)	(0.00405)	(0.01331)	(0.01074)
	[0.59027]	[0.69078]	[0.50198]	[4.99589]	[-0.23571]	[-0.94369]
R-squared	0.354320	0.264838	0.230436	0.357752	0.292331	0.364706
Adj. R-squared	0.203661	0.093301	0.050871	0.207894	0.127208	0.216471
Sum sq. resids	0.130344	0.002938	0.028729	0.006158	0.066448	0.043286
S.E. equation	0.065915	0.009897	0.030946	0.014327	0.047063	0.037985
F-statistic	2.351802	1.543907	1.283303	2.387275	1.770384	2.460321
Log likelihood	53.90844	125.9623	82.64135	111.9058	66.70975	74.85311
Akaike AIC	-2.416234	-6.208540	-3.928492	-5.468726	-3.089987	-3.518585
Schwarz SC	-2.071479	-5.863785	-3.583737	-5.123971	-2.745232	-3.173830
Mean dependent	-0.007796	0.005207	0.002127	0.022364	-0.018621	0.002982
S.D. dependent	0.073865	0.010394	0.031764	0.016097	0.050376	0.042913
Determinant resid covariance (dof adj.)		6.22E-20				
Determinant resid covariance		1.50E-20				
Log likelihood		543.6982				
Akaike information criterion		-25.77359				
Schwarz criterion		-23.44650				
Number of coefficients		54				

Source: Authors

Ali obstaja povezava med makroekonomskimi spremenljivkami in borznimi indeksi v Bosni in Hercegovini?

Izvleček

Gospodarska rast in razvoj države se odražata v številnih vidikih, med drugim tudi v borznih indeksih. Namen tega članka je preučiti in določiti povezavo med izbranimi makroekonomskimi spremenljivkami in borznimi indeksi v Bosni in Hercegovini (BiH). Za modeliranje te povezave je bila uporabljena analiza kointegracije s četrtletnimi podatki v obdobju od prvega četrtletja leta 2010 do zadnjega četrtletja leta 2019. Za raziskovanje kratkoročne in dolgoročne povezave je bil uporabljen vektorski model korekcije napak (VECM). Članek je preučil napovedno sposobnost med izbranimi spremenljivkami z uporabo Grangerjevega testa vzročnosti. Rezultati kažejo na stabilno dolgoročno povezavo med analiziranimi makroekonomskimi spremenljivkami in borznimi indeksi v BiH, medtem ko kratkoročne povezave ni bilo mogoče ugotoviti. Rezultati prispevajo k znanstvenim razpravam o povezavi med izbranimi makroekonomskimi spremenljivkami in reprezentativnimi borznimi indeksi v BiH, pri čemer upoštevajo njihovo smer in moč.

Ključne besede: indeksi borznega trga, makroekonomske spremenljivke, BiH, model VECM, Grangerjev test vzročnosti