HOW DO THE MACROECONOMIC DETERMINANTS UNDERPIN THE CAPITAL MARKET DEVELOPMENT IN NORTH MACEDONIA?

Tatjana SPASESKA
Faculty of Economics – Prilep, "St. Kliment Ohridski" University – Bitola, Prilepski Braniteli St. 143, Prilep, North Macedonia
ORCID: https://orcid.org/0000-0002-9460-7799
Email: tatjana.spaseska@uklo.edu.mk
Ilija HRISTOSKI
Faculty of Economics – Prilep, "St. Kliment Ohridski" University – Bitola, Prilepski Braniteli St. 143, Prilep, North Macedonia
ORCID: https://orcid.org/0000-0002-9291-7873
Email: ilija.hristoski@uklo.edu.mk

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Abstract:
The capital market plays a vital role in economic growth since it is an important source of financing the business sector's investments. Hence, a developed capital market enables efficient financial resource allocation by channeling domestic savings to those that need capital, which in turn leads to increased investment directed towards innovation and supports sustainable growth. The main objective of this research is to examine the impact of macroeconomic determinants on the capital market development in the Republic of North Macedonia. The focus has been put on the investigation of two dependent variables, stock market turnover to GDP ratio and stock market turnover to market capitalization ratio (Turnover Ratio) as parameters resembling the liquidity (depth) of the capital market, and how they depend on the economic growth, macroeconomic stability, trade openness and gross investments to GDP ratio. The empirical study is based on a time-series data analysis based on relevant secondary data sources, based on the utilization of the Johansen Test of Cointegration and the development of a corresponding Vector Error Correction Model (VECM) to estimate the relationship, the impact, the magnitude, and the significance of the determinants that support, and influence the liquidity of the stock market in North Macedonia during the period from 2008:Q1 to 2021:Q4. The analysis shows the existence of a significant long-run relationship between the observed macroeconomic factors and the stock market liquidity. The findings indicate that imports and real interest rates have a negative, yet statistically significant impact on the stock market turnover to GDP ratio. The gross domestic product rate, exports, and inflation rate have all a positive and statistically significant impact on the stock market turnover to GDP ratio. Gross investments also positively affect the stock market turnover to GDP ratio, but not significantly. On the other hand, the analysis shows that gross investments and exports have a positive, yet statistically significant impact on the stock market turnover to market capitalization ratio. The gross domestic product, imports, and inflation rate

have all a negative and statistically significant impact, whilst the impact of the interest rates is negative but insignificant.

Keywords: capital market development, macroeconomic determinants, time series analysis, Johansen cointegration.

Introduction

The capital market is the driving force of the market economies and it plays an important role in the development process of any country. Such a role is related to its main function in the mobilization of financial resources and channeling savings and investment between suppliers and users of capital through financial intermediaries. Thus, a well-developed domestic capital market allows governments and companies to access long-term finance in local currency, increases investments, and promotes sustainable growth with greater employment opportunities for a growing middle-class (WBG, 2020).

For a developing economy such as North Macedonia, the process of accelerating economic growth is dependent on the availability of long-term capital which could be found in the capital market since it is designed to enable companies to raise funds at lower costs and achieve financial flexibility. Thus, the capital market provides a link between saving and investment and helps to direct the flow of savings into productive investments. Consequently, the development of the capital markets is particularly important for transition countries, taking into account that it puts a nation on the sustainable path of growth and development through savings accumulation, the optimal use of investment resources, and attracting portfolio investments.

According to the World Development Indicators of the World Bank database, the indicators such as market capitalization to GDP ratio and Stock Market Turnover to GPD ratio (as measures of capital market development), were, on average, 87.0% to 133.6% on a global level from 2010 to 2020. In high-income countries, it is evident higher values of these indicators, e.g. 96.3% up to 169.8% for the same period. Such values of these indicators indicate the importance of the capital market in developed economies.

Regarding all these above, this study is aimed at investigating the impact of the macroeconomic determinants on the capital market development in North Macedonia. The development of the capital market is usually considered through its size and depth. The indicator for the size of the capital market is the market capitalization to GDP ratio, while the depth of the market that refers to its liquidity is measured by stock market turnover to GDP ratio and stock market turnover to market capitalization ratio (Turnover Ratio). Therefore, the liquidity of the Macedonian capital market has been focused on in this study, where stock market turnover to

GDP ratio and stock market turnover to market capitalization ratio (Turnover Ratio) are used as dependent variables and the macroeconomic determinants are independent variables. Investigation of the determinants of the stock market liquidity has crucial importance because many experts in North Macedonia identify the illiquidity of the market as the main problem of the capital market functioning.

The rest of the paper is organized as follows. Section 2 broadly reviews some related research about the impact of the macroeconomic determinants on capital market development in different countries worldwide. Section 3 briefly introduces the reader to the evolution of the capital market in North Macedonia. Section 4 provides insights into the data, methodology, and results of the analysis, and explains the economic significance and messages of the obtained results. The last section concludes and recommends.

Related Research

The relationship between stock market development and economic growth has been of considerable attention in terms of identifying the causal direction. A growing number of studies have been conducted on the effect of the stock market on the level of economic growth and have reached a consensus that stock market development has a significant positive influence on long-run economic growth. Consequently, many researchers attempt to identify and discuss the impact of major macroeconomic determinants of capital market development. The common macroeconomic factors are economic growth, macroeconomic stability, saving rate, investment rate, banking sector development, trade openness, etc. Analysis of the causal relations between these factors and the development of the stock market is highly debatable in the literature. The only consensus that has been reached is the positive impact of economic development on the stock market development. Regarding the relationship between the other macroeconomic determinants and the stock market development, the results of studies are inconclusive.

One of the leading studies about the determinants of capital market development was the study of Calderón-Rossell (1991). The study developed a partial behavioral structural model of stock market development. In this model, economic growth and stock market liquidity are considered major determinants of stock market development and the study confirms that both determinants have a positive influence on stock market growth. Regarding the impact of the economic growth on the stock market capitalization as a measure of the level of development of the stock market (its size), two channels that influence it are identified. The first channel works on the supply side of shares through the value of companies, and the second one is on the demand side of shares. Economic growth leads to increased revenues and profits in the corporate sector which, in turn, results in higher stock prices and encourages companies to issue additional shares. On the other side, a higher level of economic growth rate provides investors with more resources, which results in increased demand for shares. Consequently, economic growth has a positive impact on both the supply and the demand for shares.

Regarding, the effect of the stock market liquidity on the stock market development, the study argued that it has two opposite effects on the stock market. The results of the study confirmed that a more liquid market brings additional listings, which means increased stock market capitalization, but the new listing shares could reduce the value of the companies.

A general criticism of Calderón-Rossell's model is the fact that capital market liquidity is used as an independent variable. Such a procedure is inappropriate since the liquidity of the capital market is representative of its depth and it is more suitable to use it as a dependent variable. This especially refers to the transition and developing economies that have problems with an illiquid capital market and it is crucial to identify the determinants which impact it and in this way to help the

policy makers to create strategies for its improvement. Although the Calderón-Rossell study was one of the leading studies which attempt to investigate the relationship between stock market development and economic activity, the main limitation is related with that only two variables are taken as independent (economic growth and stock market liquidity). Later, extensive studies have been conducted on the determinants of stock market development by adding further institutional, financial, and macroeconomic variables to the model of Calderón-Rossell (1991). Notable among them is the study conducted by Garcia and Liu (1999) who investigated the macroeconomic determinants of stock market development, using pooled data from 15 industrial and developing countries for the period between 1980 and 1995. They have shown that GDP growth, domestic investment, and financial intermediary sector development are the main factors that determine the stock market development in a sample of Latin America and Asian countries. Also, their study confirms that financial intermediaries and markets are complements instead of substitutes. Building upon Garcia and Liu's (1999) work, Naceur *et al*. (2007) examined the macroeconomic determinants of stock market development in the MENA region. Using unbalanced panel data they found that saving rate, financial intermediary, stock market liquidity, and the stabilization variable are the important determinants of stock market development. In addition, it is found that financial intermediaries and stock markets are complements rather than substitutes in the growth process. Similar results are gained from the study conducted by Cherif & Gazdar (2010). They investigated the institutional and macroeconomic determinants of stock market development in 14 Middle Eastern and North African countries during the period 1990-2007 using panel regression and found that while savings rate, financial intermediary, stock market liquidity, interest rate, and income are important determinants of stock market development, investment and in action do not prove to be significant. According to this research, the banking sector is a complement to the stock market in financing investment and the growth processes in the MENA region. Dev & Shakeel (2013) examine the important determinants for the growth of the stock market and revealed that foreign investors' portfolio investment and liquidity of the market are significant variables and are contributing positively to the growth of the stock market, whereas the discount rate is an insignificant variable.

In another study, Kurach (2010) examined the factors affecting stock market development in 13 Central and Eastern European countries during the period 1996-2007 using panel regression and found that stock market liquidity and EU membership had a positive impact on stock market development, but government budget deficits had a negative impact on stock market development. Similar results are confirmed in the study conducted by Yemelyanova (2013). The research explored the impact of major macroeconomic and institutional factors on stock market development in eight Central and Eastern European countries and found that domestic investment, stock market liquidity, and institutional quality had a positive impact on stock market development, but inflation had a negative impact on stock market development. On the other hand, B. Olgić Draženović & T. Kusanović (2016) provides evidence on the specific determinants of emerging European capital markets. They found a positive connection between financial development and economic growth and the model confirmed a causal relationship between the development of the capital market and non-bank financial intermediaries, based on proof of the importance of investment funds and

insurance companies' development for explaining equity market capitalization. Furthermore, evidence is provided for the thesis regarding the importance of complementary development of intermediation in the banking sector and capital market. The conclusion is derived that transition countries should strive to improve the development of the long-term financial market. Yartey (2010) also investigated the institutional and macroeconomic determinants of stock market development in 42 emerging market economies. The study revealed that GDP per capita, gross domestic investment, banking sector development, private capital inflows, and stock market liquidity had a positive impact on stock market development.

Brasoveanu *et al*. (2008) implemented Vector Error Correction Model (VECM) to examine the correlation involving capital market growth as well as economic development from 2000 to 2006 in Romania. The outcome exposes that capital market expansion is favorably associated with financial development by way of the feedback effect. Kralik (2012) in his study on the Romanian economy finds that stock market development is influenced by gold price, global interest rates, crude oil price, global interest rates, global stock market indices, and exchange rates. Abdelbaki (2013) investigates the relationship between macroeconomic variables and Bahraini stock market development by using the Auto-Regressive Distributed Lag (ARDL) model and confirmed that income level, domestic investment, banking system development, private capital flows, and stock market liquidity are important determinants of Bahraini stock market development. On the other hand, Aduda *et al*. (2012) investigated the determinants of Nairobi stock market development during the period 2005-2009 using regression analysis and found that GDP per capita, domestic savings, banking sector development, stock market liquidity, and institutional quality had a positive impact on stock market development. The regression analysis reported no relationship between stock market development and macroeconomic stability - inflation and private capital flows. The results also show that institutional quality represented by law and order and bureaucratic quality, democratic accountability, and corruption index are important determinants of stock market development because they enhance the viability of external finance. In the case of Turkey, Bayar (2016), using ARDL cointegration, Toda and Yamamoto's (1995) causality test, and regression analysis, found that both economic growth and stock market liquidity had a positive impact on stock market development in the long run, while inflation had a negative impact on stock market development. Ho (2019) analyzed the macroeconomic determinants of stock market development in South Africa from 1975 to 2015; the results confirm the findings by other studies that banking sector development and economic growth promote stock market development, while inflation rate and real interest rate inhibit stock market development. In addition, this paper finds an interesting result in the fact that trade openness has a negative impact on stock market development, which is different from the findings of many other studies. In a similar study, Ho & Odhiambo (2020) used the ARDL model to test the impact of some macroeconomic determinants on stock market development in Hong Kong and confirmed the results of the previous study conducted by Ho in 2019 for South Africa (Ho, 2019). They found that banking sector development and economic growth have positive impacts on stock market development, whereas the inflation rate and the exchange rate have negative impacts on stock market development both in the long and short run. In addition, the results show that trade openness

has a positive long-run impact but a negative short-run impact on stock market development.

As per the Republic of North Macedonia, there are limited studies focused on the impact of macroeconomic determinants on capital market development. Notable among them is the study conducted by Eliskovski (2012). He examined the macroeconomic determinants of stock market development and the results of his study have shown that gross investment and macroeconomic stability of the economy are the most important determinants of the size of the Macedonian capital market, while the liquidity of the capital market is poor determined by the analyzed determinants, with exception of gross investment. It is interesting to emphasize that the development of the banking sector has a complementary and not substitutable effect. Djambaska *et al*. (2016) analyzed the impact of GDP growth of the country, deposits interest rate, inflation, and gross savings as a percentage of the GDP on capital market development in Macedonia by using regression analysis for the period 1997 to 2012. The empirical findings of this study confirmed the different effects of the analyzed variables on the Macedonian capital market development from some previous findings in this area. Namely, the analysis has shown that economic growth, deposit interest rate, and gross savings have an inverse relation with the dependent variable, while inflation rate did not evident statistical significance for the market capitalization. The authors explain such a result with the fact that North Macedonia is a small country with unsustainable economic development and an undeveloped capital market. Therefore, Lazarov & Slaveski (2016) investigated the impact of macroeconomic, financial, and institutional specific determinants on capital markets development in the CEE countries (including North Macedonia) and found that macroeconomic determinants (economic growth, macroeconomic stability, and trade openness) and financial determinants (bank sector development and stock market liquidity) are the main drivers of capital markets development, while the institutional quality has had negative not significant influence on capital markets development. Spaseska *et al*. (2018) examined the important macroeconomic determinants that underpin Macedonian stock market growth and their findings indicate that economic growth has a negative, whereas trade openness has a significant and positive impact on the Macedonian Stock Market development expressed through its size (market capitalization to GDP ratio). Although the Gross Investments to GDP ratio showed a positive impact on stock market development, the coefficient was not significant.

Macedonian Capital Market Development

The modern history of the Macedonian capital market is associated with the process of country transition in the 1990s of the 20th century. The Macedonian Stock Exchange is the first organized securities stock exchange in the history of the country which was successfully established in 1995 as a shareholding company on a non-profit base. Although it was established in September 1995, the birthday of the Macedonian stock exchange is associated with 28 March 1996, when the stock bell rang for the first time, which announced the official trading start.

The creation and development of the Macedonian Stock Exchange happened as a need to provide a successful transition process in the Macedonian economy as well as the need for the national economy to have an efficient and stable financial market. Namely, the process of privatization resulted in the establishment of many shareholding companies, which posed a need of creating a suitable

market infrastructure for the transfer of newly-created securities. So, the basic aim of the Macedonian stock exchange was to help the privatization process i.e. transformation of the capital from state ownership into a private one, and to provide the newly created shareholding companies source of financing for their investment projects. The development of the capital market in transition economies has crucial importance for their economic growth since it could be the main source of funding for the corporate sector. But, the Macedonian financial system is characterized by the dominant role of the banking institutions. This means that about 80% of the whole assets of the financial system in North Macedonia are owned by banks. Accordingly, the commercial banks provide the businesses with the necessary financial resources for their investment projects and it can be concluded that bank loans still have dominant participation in financing Macedonian businesses and are the most frequently used funding source. Opposite to funding through bank loans, providing the necessary financial resources through the capital market i.e. issue of securities has marginal importance, so the advantages of this form of funding are not very well known to the business entities. So, the capital market importance for the Macedonian financial system is low, mainly due to the modest securities offering and the low volume of stock market trading by these instruments, where the state is still the most active securities issuer.

During the first few years of the Macedonian stock exchange functioning, the market was rather unregulated and served privatization purposes. During this period, the listing of the companies was voluntary as in many transition economies that went through the ownership transformation phase. From the establishment of the Macedonian stock exchange up to 2001, only two shareholding companies were listed on the official market. To encourage the companies to be listed on the stock market and to accelerate the development of the Macedonian Stock Exchange, two projects of mandatory listing were implemented. The first one was implemented in 2002 when a considerable development of the Macedonian stock market started. After introducing the mandatory listing in 2002 the number of listed companies increased to 78 companies with a market capitalization of 219 million EUR, i.e. 5.5% of GDP, which means a five-fold increase compared to the previous year when it was only 1%. For more dynamic movement of the stock market during 2013 the mandatory listing was introduced for the second time and as a consequence of this measure, the number of listed shareholding companies from 32 increased to 116. Consequently, the market capitalization of the listed companies on the Macedonian Stock Exchange in 2013 reached 1.6 billion EUR (saw a rise of 277.18%) and as a consequence, the market capitalization to GDP ratio, as one of the main indicators of the capital market development, increased up to 20.35%. The Market Capitalization to GDP ratio[1] in the period from 2003 up to 2021 is shown in Fig. 1.

[1] it is calculated as a ratio of the market value of listed stocks on the market and GDP

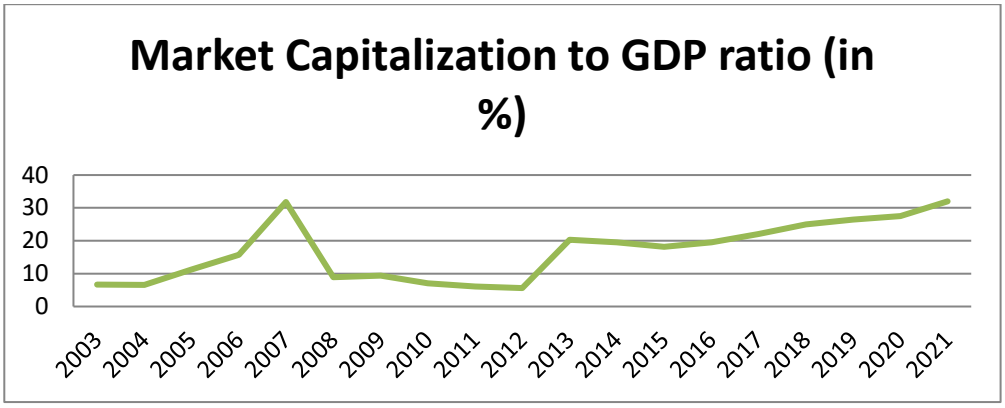


Figure 1. Market capitalization to GDP ratio for the period 2003-2021

Source: Authors' compilation from the annual reports issued by the Macedonian Stock Exchange and the State Statistical Office of the Republic of North Macedonia, 2003–2021

As is shown in Fig. 1, the period from 2003 up to 2007 is characterized by the rapid growth of the stock market. The stock market capitalization as a percent of GDP, resembling the size of the capital market increased significantly from 6.62% in 2003 and achieved its peak in 2007, e.g. 31.84%. But, the following 2008 this indicator dramatically decreased under the influence of the global financial crisis, which had a negative impact on the Macedonian capital market. Additional determinant that worst the situation was the fact that our country did not get the desired status as a member country of the NATO Alliance which in turn had negative implications on the Stock Market Activities. Such a negative trend in the level of the market capitalization to GDP ratio continued to 2012 when achieved the record lowest value of this indicator, 5.61%. Starting from 2013 the market capitalization of the listed companies has been on a continuous rise with small fluctuations and reached its highest value in 2021 of 32% concerning GDP.

The second very important indicator of the capital market development is the depth of the stock market which refers to its liquidity or the speed at which investors can convert securities into cash and vice versa. Brennan *et al*. (2012) refer to stock market liquidity as the ability of the market to absorb a huge volume of securities at a lower execution cost within a short period without having a significant effect on security prices. The liquidity of the market is very important for both investors and issuers of securities. It allows investors to hold the invested funds all the time and withdraw them as soon as they need them and also enables the issuers to get fresh capital at lower prices. The liquidity of the stock market is measured through stock market turnover to GDP ratio and stock market turnover to market capitalization ratio (Turnover Ratio)[2].

The graph in Fig. 2 shows the values of the indicators of the stock market liquidity for the period from 2003 up to 2021.

[2] In the calculations of the indicators of the Macedonian stock market liquidity, Stock Market Turnover is expressed by the trading in BEST, excluding block transaction, public auction and public offerings of securities.

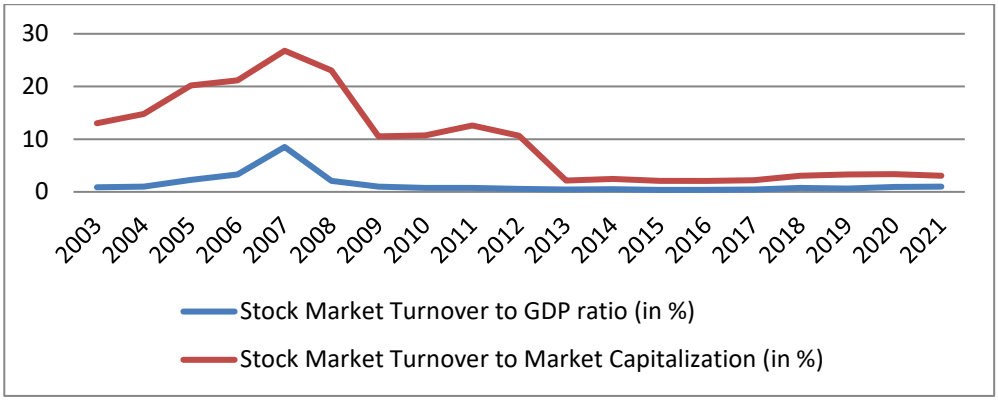


Figure 2. Stock market turnover to GDP ratio and stock market turnover to market capitalization ratio (turnover ratio), for the period 2003-2021

Source: Authors' compilation from the annual reports issued by the Macedonian Stock Exchange and the State Statistical Office of the Republic of North Macedonia, 2003–2021)

Similar to the first indicator (market capitalization to GDP ratio), both indicators of the stock market liquidity evidence growing trend in the period up to 2007 when they achieved their maximum values, and after that, they recorded a huge decline. Fig.2 shows that the stock value traded increased from about 0.87% of GDP in 2003 to 8.53% of GDP in 2007 when reached its peak. On the other side, the turnover ratio increased from 13% in 2003 to 26.79% in 2007. So, there is no doubt that 2007 was the year of the highest liquidity of the capital market in the Republic of North Macedonia. Such state of the Macedonian capital market is related to the high market capitalization and increased turnover of shares on the official and the regular market in 2007. The development of the Macedonian stock market in 2007 is a direct consequence of several activities undertaken in that period, such as the implemented reforms aimed at improving the stock market operations, the exemption from the capital gains tax to encourage greater dynamics in trading in shares, the entry foreign investors, the participation of the two domestic pension funds in the trading of the stock exchange, the privatization of state capital, and the stable macroeconomic environment. The following years up to today are evidence of a sharp failure of both indicators under the influence of the global financial crisis. An additional reason for such a situation is the fact that during 2008 the NBRM implemented a restrictive monetary policy, e.g. decided to increase the referent interest rate on 9% which in turn resulted in higher interest rates on savings deposits and absorbed a significant amount of financial resources in the banking sector.

To get a clear picture of the development of the capital market in North Macedonia, it is necessary to compare the values of the analyzed indicators in this research with those of the countries in the nearest neighborhood. The following figures are depicting the level of these indicators in several countries[3].

[3] The selection of the countries and the period is primarily based on data availability

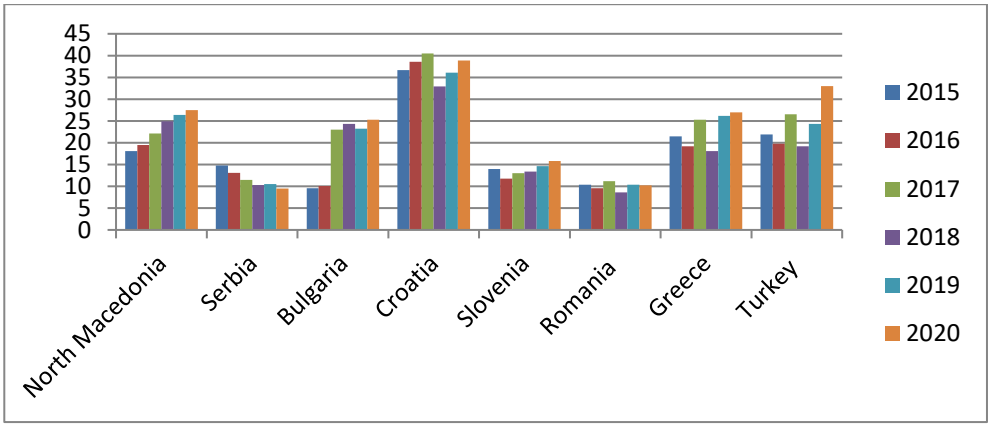


Figure 3. Comparative analysis of market capitalization to GDP ratio in percentages for some Balkan countries for the period 2015–2020

Source: World Development Indicators, The World Bank (WB, 2020)

Fig. 3 provides an overview of capital market development and shows the annual stock market capitalization concerning GDP across several countries. From the figure we can conclude that Croatia, Greece, Turkey, and Bulgaria have the most developed capital market in the region, North Macedonia is in the middle, while Serbia, Slovenia, and Romania have less developed capital markets expressed by Market Capitalization to GDP ratio.

Besides the size of the capital market, the second very important indicator of capital market development is the capital market liquidity, especially in developing countries that are faced with an illiquid market. So, to get a complete picture of the capital market development in the analyzed countries, the following figures (Fig. 4 and Fig. 5) illustrate the stock market depth (liquidity) in selected countries in the region. As it is shown in Fig. 4 and Fig. 5, Greece, Romania, and Croatia are characterized as countries with high stock market liquidity. Also, it is evident that North Macedonia has higher turnover ratios than Croatia in the analyzed period, such as higher values of the stock market turnover to GDP ratio compared to Bulgaria (for 2019 and 2020).

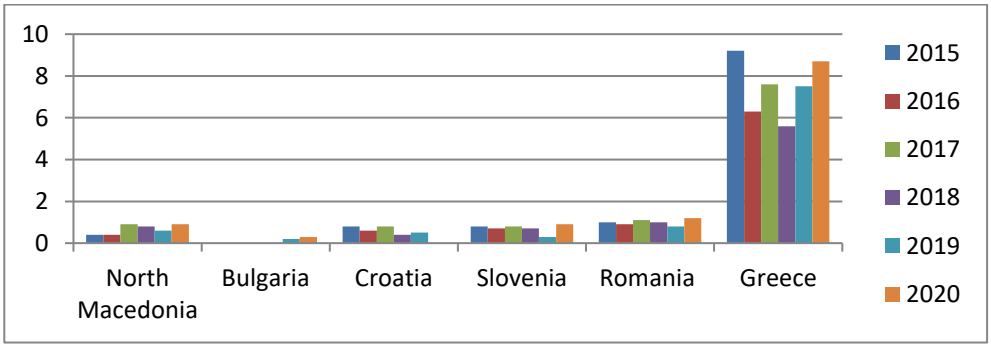


Figure 4. Comparative analysis of stocks traded as a percentage of GDP for several countries for the period 2015–2020

Source: World Development Indicators, The World Bank (WB, 2020)

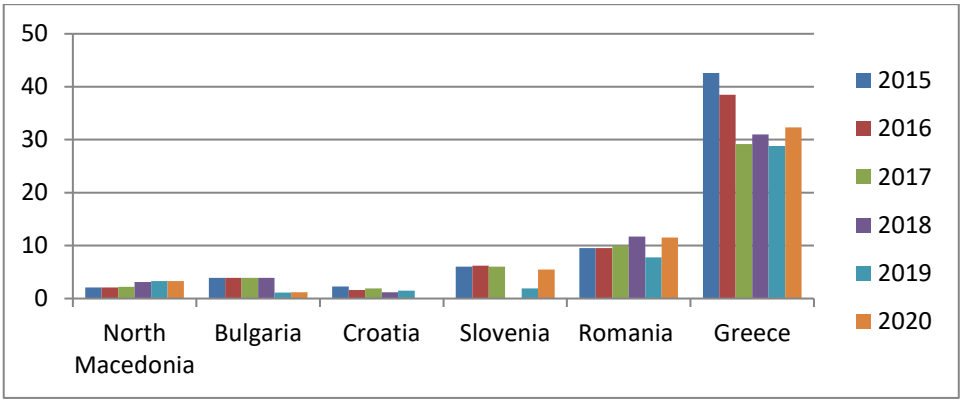


Figure 5. Comparative analysis of the turnover ratio for several countries for the period 2015–2020

Source: World Development Indicators, The World Bank (WB, 2020))

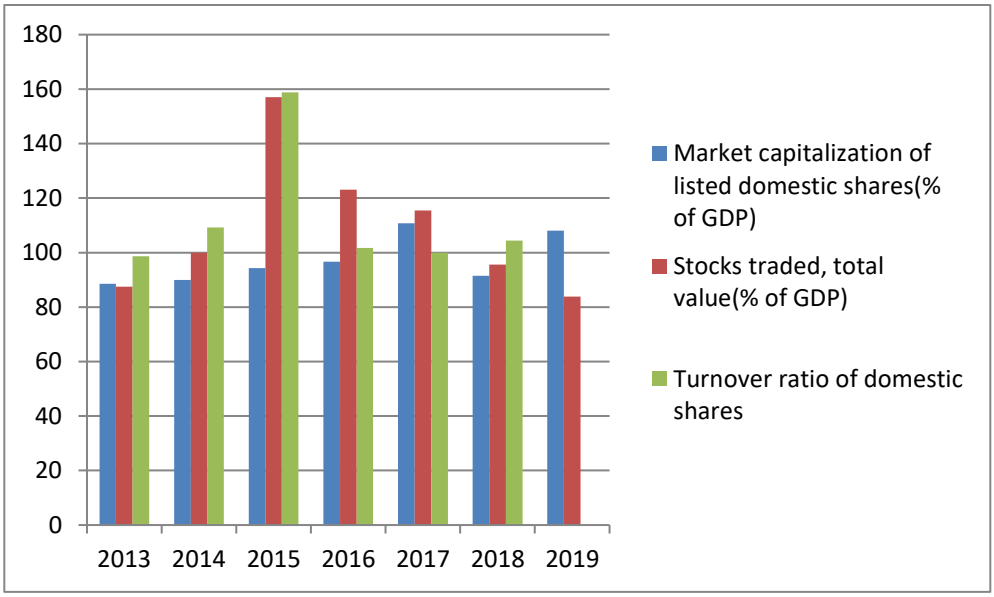


Figure 6. Capital market development indicators in the world, for the period 2013–2019

Source: World Development Indicators, The World Bank (WB, 2020)

Fig. 3, Fig. 4, and Fig. 5 provide a glimpse of the development of the capital market in North Macedonia and confirmed that its size and liquidity are at a low level that is much behind the countries with developed financial markets where the figure goes even above 100% (Fig.6). Although, many measures have been undertaken to support the development of the Macedonian capital market, it can be concluded that the market capitalization of the shares listed on the stock market and its turnover is at an unsatisfactory level. Consequently, analysis of the macroeconomic determinants of the capital market development in our country has

crucial importance and could be a basis to give measures and recommendations to the policymakers in direction of creating better strategies and accelerating its development.

Data, Methodology, and Results

Data

Taking into account the previously elaborated papers in the literature review section, in this paper, the starting point for determining the macroeconomic determinants that influence stock market turnover will be the updated and expanded Calderón-Rossell model (Calderón-Rossell, 1991). This study takes into account two dependent variables and six independent variables, as follows:

- *Dependent variables*
  - Stock Market Turnover to GDP ratio (*SMT2GDP*), as a measure of the depth (liquidity) of the stock market.
  - Stock Market Turnover to Market Capitalization ratio (*SMT2MC*), as a measure of the depth (liquidity) of the stock market.
- *Independent variables*
  - Real Gross Domestic Product Rate (*GDPR*), in percentages, is a measure of the economic activity in the country. *GDPR* is being calculated by the expenditure approach and is expressed in volume indices, compared to the corresponding period of the previous year;
  - Gross Investments to GDP ratio (*GI2GDP*), in percentages, as a measure of the investment rates in the country. *GI2GDP* is being calculated as a share of the gross capital formation in GDP calculated by the expenditure approach;
  - The level of openness of the national economy is presented by the:
    - Exports to GDP ratio (*EX2GDP*), in percentages;
    - Imports to GDP ratio (*IM2GDP*), in percentages;
  - Inflation Rate (*INFLR*), in percentages, as a measure of macroeconomic stability;
  - Reference Interest Rate (*INTER*), in percentages, as a measure of macroeconomic stability.

All the data used in this research have been exploited from relevant secondary sources. The dependent variable *SMT2GDP* is obtained as a ratio between the Stock Market Turnover and the GDP, whilst the dependent variable *SMT2MC* represents a ratio between the Stock Market Turnover and the Market Capitalization. The data for GDP is being calculated by the expenditure approach and is expressed in current prices [MKD]. These data can be obtained from the State Statistical Office's official website (MAKStat Database, –a). The data for the Stock Market Turnover and the Market Capitalization are both expressed in Macedonian denars [MKD] and can be found on the Macedonian Stock Exchange's official website (MSE, –). The data for independent variables *GDPR* and *GI2GDP* are taken from the State Statistical Office official website (MAKStat Database, –a). Dependent variables *EX2GDP* and *IM2GDP* are obtained as ratios between the Exports and Imports, and the GDP, respectively. The data for both the Exports and Imports are monthly and expressed in thousands of [EUR]; they can be obtained from the State Statistical Office's official website (MAKStat Database, –b). Since the data for GDP is expressed in current prices [MKD] on a quarterly level, the data for both the Exports and Imports had to be first pre-processed to be

transformed into quarterly data and then these data had to be converted into Macedonian denars [MKD] to become comparable to GDP data. The data for the last two independent variables, *INFLR* and *INTER*, are obtained from the National Bank of the Republic of North Macedonia's official website (NBRNM, –).

All the data used are given in a form of quarterly time series, covering the period from 2008:Q1 to 2021:Q4, and each consisting of 56 observations (14 years × 4 quarters/year = 56 quarters).

Methodology

To determine the impact and the magnitude of the chosen independent macroeconomic determinants on the Macedonian stock market turnover, the regression equations to be estimated in their initial form can be specified as follows (Eq. 1 and Eq. 2):

$$SMT2GDP_t = \beta_0 + \beta_1 \cdot GDPR_t + \beta_2 \cdot GI2GDP_t + \beta_3 \cdot EX2GDP_t + \beta_4 \cdot IM2GDP_t + \\ + \beta_5 \cdot INFLR_t + \beta_6 \cdot INTER_t + \varepsilon_t \quad (1)$$

$$SMT2MC_t = \beta_0 + \beta_1 \cdot GDPR_t + \beta_2 \cdot GI2GDP_t + \beta_3 \cdot EX2GDP_t + \beta_4 \cdot IM2GDP_t + \\ + \beta_5 \cdot INFLR_t + \beta_6 \cdot INTER_t + \varepsilon_t \quad (2)$$

where:

β_0 is the intercept in the linear regression model;

β_i (i = 1,…, 6) are coefficients of the six independent variables;

ε_t is the error term.

To determine the order of integration of each of the individual variables found in Eq. 1 and 2, two tests were used: the Augmented Dickey-Fuller Test (ADF Test) (Dickey & Fuller, 1979) and the Phillips-Perron Test (PP Test) (Phillips & Perron, 1988). This step is necessary to check out the stationarity of time series data, i.e. to confirm if the observed time series resemble stochastic processes whose unconditional joint probability distributions, as well as their statistical properties (e.g. parameters such as mean and variance), do not change when shifted in time (Gujarati, 2003). Both ADF and PP test the null hypothesis that a particular time series has a unit root, i.e. it is non-stationary. To overcome the non-stationarity, it is necessary to differentiate the time series d times until a stationary series is obtained with an order of integration I(d).

Based on the outcomes of both the ADF and PP test, the Johansen cointegration technique was chosen as the most appropriate econometric methodology to estimate the coefficients of the independent variables in the two regression models of interest, even though not all variables of interest are of I(1) order of integration. The Johansen technique of cointegration allows for taking into account variables that are integrated of the same order, I(1), determines if they are cointegrated in the long run, and addresses the problem of endogeneity among the variables using their time lags (Johansen, 1991). It assesses the validity of a cointegrating relationship, using a maximum likelihood estimates (MLE) approach.

It is also used to find the number of relationships and as a tool for estimating those relationships (Wee & Tan, 1997). In addition, many authors agree that the Johansen Cointegration Test is an improvement over Engle-Granger's test and Stock & Watson's test. It avoids the issue of choosing a dependent variable as well as issues created when errors are carried from one step to the next. As such, the test can detect multiple cointegrating vectors, i.e. more than one cointegrating relationship, and is, therefore, more appropriate than Engle-Granger's approach for multivariate analysis. Another desirable property is that Johansen's cointegration test treats every variable as an endogenous one (Saunders, 2005).

The optimal lag order selection for the needs of the Johansen cointegration test has been conducted using five criteria after estimating the corresponding unrestricted VAR model, i.e. the sequential modified LR test statistic (LR criterion), the Final Prediction Error (FPE criterion), the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC), and the Hannan-Quinn Information Criterion (HQ). This step was carried out carefully by avoiding exaggerated parametrization of the regression equations, which can cause unnecessary spending of the degrees of freedom and can lead to the estimation of non-relevant and rather non-objective coefficients.

The Johansen Cointegration Test was based on two tests to estimate the number of cointegration vectors (relationships) among the variables, r, including the Trace of the Stochastic Matrix test (λ_{trace}) and the Maximal Eigenvalue of the Stochastic Matrix (λ_{tmax_eigen}). In general, both tests are based on a null hypothesis that there are no cointegration vectors among the variables, i.e. $r = 0$. However, there are subtle differences in the specification of the null hypothesis with both tests. The null hypothesis for the Trace test is that the number of cointegration vectors is $r = r^* < k$, vs. the alternative one stating that $r = k$. Testing proceeds sequentially for $r^* = 1, 2$, etc., and the first non-rejection of the null hypothesis is taken as an estimate of r. The null hypothesis for the Maximal Eigenvalue test is the same as for the Trace test, but the alternative is $r = r^* + 1$, and, again, testing proceeds sequentially for $r^* = 1, 2$, etc., with the first non-rejection used as an estimator for r.

The number of cointegration vectors has been determined using the Pantula principle (Johansen, 1992), which helps in determining the presence/absence of deterministic elements in the regression equation taking into account the following five options:

Option 1. No intercept or trend in cointegrating equation (CE) or test VAR
Option 2. Intercept (no trend) in CE – no intercept in VAR
Option 3. Intercept (no trend) in CE and test VAR
Option 4. Intercept and trend in CE – no intercept in VAR
Option 5. Intercept and trend in CE – intercept in VAR

The most restricted model is gained using Option 1, whilst the least restrictive one can be obtained using Option 5. In practice, however, the most frequently used options are Option2, Option 3, and Option 4 (Option 1 and Option 5 are quite rare in applications), as suggested by Johansen (1992) and Harris & Sollis (2003).

According to the Pantula principle, the first model that is tested should be the most restricted one with no deterministic components. If the model is rejected, the next step is to test a model with a restricted constant. The process continues by moving from the most restrictive model to the least restrictive model, i.e. from Option 1 to Option 5.

Based on the findings of the Johansen Test of Cointegration, a Vector Error Correction Model (VECM) for both regression equations (1) and (2) has been used for estimating the coefficients of the long-run equilibrium among the variables of interest, by transforming their VAR models into corresponding VECM models with 3 lags (VAR 3), using Option 4. The focus is put on the first cointegration equation (equation #1) since what is investigated is the joint effect of all independent variables on the two dependent variables, *SMT2GDP* and *SMT2MC*.

As a constituent part of the analysis of the VECM, we have checked two types of causality relationships: the long-run and the short-run causality:

- In economics, a long-run is a theoretical concept based on equilibrium and refers to a period in which all economic variables of interest are flexible and have time to adjust. The long-run causality relationship focuses on the significance of the Error Correction Term (ECT) of the VECM equation;
- The short-run expresses the idea that an economy behaves differently depending on the length of time it has to react to certain stimuli. The short-run does not refer to any specific duration of time, but rather is unique to the economic variable being studied. In the short-run, economic variables under study do not have full freedom to reach a new equilibrium, i.e. a point in which opposing forces are balanced. The short-run causality relationship examines the joint significance of all the lags of a particular first differenced variable in the VECM equation, which is carried out using the Wald test.

Finally, the resulting VECM has been subject to a diagnostic checking of the residuals. More specifically, we have tested the model's residuals against the existence of a serial correlation (autocorrelation), heteroscedasticity, and normality of their distribution. The resulting VECM was also subject to stability diagnostics tests.

All the analyses have been carried out using the econometric package EViews v10.

Results and Interpretation

The result of the ADF and PP tests, according to the Akaike Information Criterion (AIC), are given in Table 1 (ADF Test) and Table 2 (PP Test). Both tests agree upon the order of integration of all the variables of interest, except for the variable *SMT2MC*. According to both tests, variables *SMT2GDP* and *GDPR* are of the order of integration I(0), i.e. they are stationary at level, whilst the order of integration of the variables *GI2GDP*, *EX2GDP*, *IM2GDP*, *INFLR*, and *INTER* is I(1) because they become stationary after being first-differenced. However, according to the ADF test, the order of integration of the variable SMT2MC is I(1), whilst according to the PP test, it is I(0).

Table 1. Results of the ADF Test (AIC criterion)

		At level			At first difference			
Variable		With Constant	With Constant & Trend	Without Constant & Trend	With Constant	With Constant & Trend	Without Constant & Trend	Order of integration
SMT2GDP	t-Statistic	–6.8125	–6.8459	–1.8731				I(0)
	Prob.	***0.0000***	***0.0000***	***0.0587***				
	Significant?	***	***	*				
SMT2MC	t-Statistic	–2.2653	–5.8988	–1.5952	–7.5040	–7.4288	–7.5587	I(1)
	Prob.	***0.1867***	***0.0000***	***0.1035***	***0.0000***	***0.0000***	***0.0000***	
	Significant?	**no**	***	**no**	***	***	***	
GDPR	t-Statistic	–3.7709	–3.8029	–2.6131				I(0)
	Prob.	***0.0057***	***0.0244***	***0.0099***				
	Significant?	***	**	***				
GI2GDP	t-Statistic	–1.1646	–1.9148	0.7849	–3.6038	–3.9096	–3.1943	I(1)
	Prob.	***0.6822***	***0.6314***	***0.8794***	***0.0096***	***0.0199***	***0.0020***	
	Significant?	**no**	**no**	**no**	***	**	***	
EX2GDP	t-Statistic	–1.3118	–3.7860	0.0792	–7.6245	–7.5857	–7.6882	I(1)
	Prob.	***0.6178***	***0.0248***	***0.7037***	***0.0000***	***0.0000***	***0.0000***	
	Significant?	**no**	**	**no**	***	***	***	
IM2GDP	t-Statistic	–2.5294	–4.0827	–0.0966	–5.9762	–6.0941	–6.0271	I(1)
	Prob.	***0.1142***	***0.0115***	***0.6459***	***0.0000***	***0.0000***	***0.0000***	
	Significant?	**no**	**	**no**	***	***	***	
INFLR	t-Statistic	–1.5439	–1.3625	–0.4277	–4.4028	–4.7689	–4.4261	I(1)
	Prob.	***0.5036***	***0.8601***	***0.5239***	***0.0008***	***0.0016***	***0.0000***	
	Significant?	**n0**	**n0**	**n0**	***	***	***	
INTER	t-Statistic	–1.5539	–2.7960	–1.6373	–4.1098	–4.0739	–3.9686	I(1)
	Prob.	***0.4988***	***0.2052***	***0.0953***	***0.0021***	***0.0120***	***0.0002***	
	Significant?	**n0**	**n0**	*	***	**	***	

** = The Null hypothesis that the time series has a unit root has been rejected at α = 1% level of significance*
*** = The Null hypothesis that the time series has a unit root has been rejected at α = 5% level of significance*
**** = The Null hypothesis that the time series has a unit root has been rejected at α = 10% level of significance*

Table 2. Results of the PP Test (AIC criterion)

		At level			At first difference			
Variable		With Constant	With Constant & Trend	Without Constant & Trend	With Constant	With Constant & Trend	Without Constant & Trend	Order of integration
SMT2GDP	t-Statistic	–6.8485	–6.8638	–3.5756				I(0)
	Prob.	***0.0000***	***0.0000***	***0.0006***				
	Significant?	***	***	***				
SMT2MC	t-Statistic	–3.8170	–5.9471	–2.1516				I(0)
	Prob.	***0.0048***	***0.0000***	***0.0314***				
	Significant?	***	***	**				
GDPR	t-Statistic	–5.4333	–5.3945	–4.7540				I(0)
	Prob.	***0.0000***	***0.0002***	***0.0000***				
	Significant?	***	***	***				
GI2GDP	t-Statistic	–6.0318	–7.2971	0.5087	–18.0369	–17.5397	–17.5663	I(1)
	Prob.	***0.0000***	***0.0000***	***0.8224***	***0.0000***	***0.0000***	***0.0000***	
	Significant?	***	***	**no**	***	***	***	
EX2GDP	t-Statistic	–1.4315	–3.5996	0.2603	–7.6319	–7.5935	–7.6881	I(1)
	Prob.	***0.5603***	***0.0390***	***0.7580***	***0.0000***	***0.0000***	***0.0000***	
	Significant?	**no**	**	**no**	***	***	***	
IM2GDP	t-Statistic	–2.4084	–3.9879	0.0244	–9.4856	–9.7631	–9.5751	I(1)
	Prob.	***0.1442***	***0.0148***	***0.6863***	***0.0000***	***0.0000***	***0.0000***	
	Significant?	**no**	**	**no**	***	***	***	
INFLR	t-Statistic	–3.3078	–2.8310	–2.9291	–4.5148	–4.9254	–4.5249	I(1)
	Prob.	***0.0192***	***0.1929***	***0.0041***	***0.0006***	***0.0010***	***0.0000***	
	Significant?	**	**no**	***	***	***	***	
INTER	t-Statistic	–1.2834	–2.4324	–1.6930	–7.4238	–7.3601	–7.2945	I(1)
	Prob.	***0.6311***	***0.3595***	***0.0854***	***0.0000***	***0.0000***	***0.0000***	
	Significant?	**no**	**no**	*	***	***	***	

** = The Null hypothesis that the time series has a unit root has been rejected at α = 1% level of significance*
*** = The Null hypothesis that the time series has a unit root has been rejected at α = 5% level of significance*
**** = The Null hypothesis that the time series has a unit root has been rejected at α = 10% level of significance*

It's worthy to point out that none of the observed variables have an order of integration I(2). Identical results of both tests are obtained according to the Schwarz Information Criterion (SIC).

Even though all of the observed variables for estimating both equations represent a mixture of variables with different order of integration, I(0) and I(1), the Johansen cointegration technique was chosen for time series analysis, after the application of Auto-Regressive Distributed Lag (ARDL) approach and the evaluation of a myriad of ARDL models neither showed the existence of a long run relationship between the regressors and each of the dependent variables, nor the obtained results were in unison with the economic theory. According to Cushman (2019), the Johansen procedure can be applied to a mixture of I(1) and I(0) variables, however "each I(0) variable will generate its vector, and therefore identifying any long-run relationships among the I(1) variables will be more difficult." According to Ahlgren (2019), cointegration analysis using the Johansen cointegration approach can be carried out as long as the variables are at most I(1). Therefore, the usage of the Johansen cointegration approach is justified as long as it can prove that there is a linear combination among the variables, which implies an existence of a cointegration/long-run relationship.

a) Analysis for the *SMT2GDP*

The optimal lag length assessment, according to five lag order selection criteria (LR, FPE, AIC, SC, and HQ), was based on the estimation of a standard VAR model where all the variables (SMT2GDP, GDPR, GI2GDP, EX2GDP, IM2GDP, INFLR, and INTER) are considered endogenous. The outcome suggests the usage of 4 lags, as most of the criteria point out (Table 3).

Table 3. Results of the optimal lag length assessment for regression equation #1

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-827.1670	NA	202448.3	32.08335	32.34601	32.18405
1	-681.4503	246.5974	4991.907	28.36347	**30.46481***	29.16908
2	-620.6156	86.57250	3502.087	27.90829	31.84830	29.41880
3	-548.7292	82.94590	1919.657	27.02804	32.80673	29.24346
4	-472.8336	**67.13836***	**1253.197***	**25.99360***	33.61096	**28.91391***

** Indicates the lag order selected by the criterion*
Source: Authors' calculations, EViews output

Based on this finding, the number of cointegration vectors for 4 lag intervals has been estimated by using the Pantula principle. The sublimed results of the appliance of the Pantula principle are given in Table 4.

Table 4. Results of the appliance of the Pantula principle for testing the number of cointegrating vectors for regression equation #1: *SMT2GDP = f* (*GDPR*, *GI2GDP*, *EX2GDP*, *IM2GDP*, *INFLR*, *INTER*), 4 lags

Number of cointegrating vectors	Option 1		Option 2		Option 3		Option 4		Option 5	
	λ_{trace}	λ_{max_eigen}	λ_{trace}	λ_{max_eigen}	λ_{trace}	λ_{max_eigen}	λ_{trace}	λ_{max_eigen}	λ_{trace}	λ_{max_eigen}
No vectors (r = 0)	×	×	×	×	×	×	×	×	×	×
At most 1 (r = 1)	×	×	×	×	×	×	×	×	×	×
At most 2 (r = 2)	×	×	×	×	×	×	×	×	×	√
At most 3 (r = 3)	×	×	×	×	×	×	×	√	×	
At most 4 (r = 4)	√	√	×	×	×	×	×		√	
At most 5 (r = 5)			√	×	×	×	√			
At most 6 (r = 6)				√	√	√				

Note: × = The null hypothesis is being rejected at a 5% level of significance; √ = The null hypothesis is being accepted at a 5% level of significance

Source: Authors' calculations,

According to Johansen (1992) and Harris & Sollis (2003), the most exploited options in the economic reality are Options 2, 3, and 4. The rest of the analysis has been carried out using "Option 3. Intercept (no trend) in CE and test VAR". This allows for the existence of an intercept, but no trend in Cointegration Equation (CE) and test VAR model.

According to the test results presented in Table 4 for Option 3, both the Trace statistics and the Max Eigen statistics indicate the existence of at most 6 cointegrating equations (vectors) at a 5% level of significance. The null hypothesis of no cointegration is rejected against the alternative one, claiming the existence of a cointegrating relationship in the model: all the model variables are cointegrated, meaning that they share a common stochastic trend and grow proportionally; they move together in a long-run, i.e. there is a long-run relationship among them in terms that corresponding time series are related and can be combined linearly. This way, even if there are any shocks in the short-run, which may affect movements in the individual series, they would converge with time.

The cointegration equation #1 with the normalized cointegrating coefficients, which is of particular interest for this study, is given in Fig. 7, in a tabular form.

1 CointegratingLog
Equation(s): likelihood −453.0335

Normalized cointegrating coefficients (standard error in parentheses)

SMT2GDP	GDPR	GI2GDP	EX2GDP	IM2GDP	INFLR	INTER
1.000000	−0.072514	0.030944	0.148153	−0.227529	0.231968	0.030737
	(0.02371)	(0.02159)	(0.03282)	(0.04428)	(0.05715)	(0.03016)

Figure 7. The cointegration equation #1 (Johansen Test of Cointegration) for the regression equation #1

Source: Authors' calculations, EViews output

Vector Error Correction estimates were obtained by specifying and running a corresponding VECM for Option 3, with $p = 4 - 1 = 3$ lags, because a lag is lost when specifying VECM. The estimated coefficients for the VECM specification of *SMT2GDP*, which are coefficients of the 1-lagged regressors, are presented in Table 5.

Table 5. Estimated coefficients for the regression equation #1: *SMT2GDP = f* (*GDPR*, *GI2GDP*, *EX2GDP*, *IM2GDP*, *INFLR*, *INTER*)

Regressor	Coefficient	t-Statistics	Critical values at a 1% level of significance, df = 51, two-tailed test	Critical values at a 5% level of significance, df = 51, two-tailed test	Critical values at a 10% level of significance, df = 51, two-tailed	Significant?
GDPR	0.080760	3.21543	±2.6757	±2.0076	±1.6753	yes *
GI2GDP	0.027484	0.87991	±2.6757	±2.0076	±1.6753	no
EX2GDP	0.254167	6.58891	±2.6757	±2.0076	±1.6753	yes *
IM2GDP	−0.398901	−8.18753	±2.6757	±2.0076	±1.6753	yes *
INFLR	0.583660	9.08943	±2.6757	±2.0076	±1.6753	yes *
INTER	−0.126721	−2.86891	±2.6757	±2.0076	±1.6753	yes *
C	12.88578					

*Note: *, **, and *** mean rejection of the null hypothesis claiming that the coefficient is not statistically significant at 1%, 5%, and 10% levels of significance, respectively*

Source: Authors' calculations, EViews output

Based on the findings in Table 5, it can be concluded that in the long run:

- Two of the regressors (*IM2GDP* and *INTER*) have a negative, yet statistically significant impact on the target variable *SMT2GDP*;
- The rest of the regressors (*GDPR*, *GI2GDP*, *EX2GDP*, and *INFLR*) have a positive impact on the target variable *SMT2GDP*; the impact of *GI2GDP* is statistically insignificant; however, the impacts of *GDPR*, *EX2GDP*, and *INFLR* are statistically significant;
- The increase of *GDPR* by 1 percentage point (pp) yields an increase of *SMT2GDP* ratio by 0.080760 pp, having minded the *ceteris paribus* principle;
- The increase of GI2GDP ratio by 1 pp will yield an increase of *SMT2GDP* ratio by 0.027484 pp, having minded the *ceteris paribus* principle;

- The increase of the *EX2GDP* ratio by 1 pp is expected to increase the *SMT2GDP* ratio by 0.254167 pp, having minded the *ceteris paribus* principle;
- The increase of the *IM2GDP* ratio by 1 pp is expected to decrease the *SMT2GDP* ratio by 0.398901 pp, having minded the *ceteris paribus* principle;
- Unexpectedly, the increase of *INFLR* by 1 pp is expected to increase the *SMT2GDP* ratio by 0.583660 pp, having minded the *ceteris paribus* principle;
- The increase of *INTER* by 1 pp is expected to decrease the *SMT2GDP* ratio by 0.126721 pp, having minded the *ceteris paribus* principle.

The resulting cointegrating equation is a basis for inferring the Error Correction Term (ECT), given by Eq. (3).

$$ECT_{t-1} = \begin{bmatrix} 1.000000 \cdot SMT2GDP_{t-1} + 0.080760 \cdot GDPR_{t-1} + 0.027484 \cdot GI2GDP_{t-1} + \\ +0.254167 \cdot EX2GDP_{t-1} - 0.398901 \cdot IM2GDP_{t-1} + \\ +0.583660 \cdot INFLR_{t-1} - 0.126721 \cdot INTER_{t-1} + 12.88578 \end{bmatrix} \quad (3)$$

The expression for *SMT2GDP* as a target (dependent) variable is given by Eq. (4).

$$\begin{aligned} &\Delta SMT2GDP_t = -0.411606 \cdot ECT_{t-1} - \\ &-0.398787 \cdot \Delta SMT2GDP_{t-1} - 0.027484 \cdot \Delta SMT2GDP_{t-2} - 0.211200 \cdot \Delta SMT2GDP_{t-3} - \\ &-0.002241 \cdot \Delta GDPR_{t-1} + 0.009139 \cdot \Delta GDPR_{t-2} + 0.015462 \cdot \Delta GDPR_{t-3} - \\ &-0.002381 \cdot \Delta GI2GDP_{t-1} + 0.022397 \cdot \Delta GI2GDP_{t-2} - 0.032585 \cdot \Delta GI2GDP_{t-3} + \\ &+0.081733 \cdot \Delta EX2GDP_{t-1} + 0.125572 \cdot \Delta EX2GDP_{t-2} + 0.012053 \cdot \Delta EX2GDP_{t-3} - \\ &-0.083693 \cdot \Delta IM2GDP_{t-1} - 0.083891 \cdot \Delta IM2GDP_{t-2} + 0.003896 \cdot \Delta IM2GDP_{t-3} + \\ &+0.065645 \cdot \Delta INFLR_{t-1} - 0.160455 \cdot \Delta INFLR_{t-2} + 0.133498 \cdot \Delta INFLR_{t-3} - \\ &-0.099176 \cdot \Delta INTER_{t-1} - 0.315908 \cdot \Delta INTER_{t-2} + 0.056197 \cdot \Delta INTER_{t-3} - \\ &-0.101410 \end{aligned} \quad (4)$$

The value of the coefficient of the ECT is negative (–0.411606), but not statistically significant (Table 6). This value suggests that the speed of the adjustment from a short-run to a long-run equilibrium is 41.16%, i.e. the system corrects its previous period of disequilibrium at a speed of 41.16% within one period of time (a quarter). However, since this coefficient explains the joint long-run causality running from all of the regressors to the target variable, *SMT2GDP*, it can be concluded that the joint long-run causality running from all the regressors to the current value of *SMT2GDP* is not statistically significant.

Table 6. The value and significance of the coefficient C(1) multiplying the ECT for the regression equation #1: *SMT2GDP = f* (*GDPR*, *GI2GDP*, *EX2GDP*, *IM2GDP*, *INFLR*, *INTER*)

Coefficient	Value	t-Statistics	Critical values at a 1% level of significance, df = 51, two-tailed test	Critical values at a 5% level of significance, df = 51, two-tailed test	Critical values at a 10% level of significance, df = 51, two-tailed	Significant?
C(1)	−0.411606	−1.53898	±2.6757	±2.0076	±1.6753	no

The significance of the coefficients in Eq. (4) has been obtained by estimating Eq. (4) by the method of the Least Squares, or, more specifically, by estimating the following equation, Eq. (5).

D(SMT2GDP) = C(1)*(SMT2GDP(−1) + 0.0807598392075*GDPR(−1) + 0.0274838485021*GI2GDP(−1)
+ 0.254166635901*EX2GDP(−1) − 0.398901279818*IM2GDP(−1) + 0.583659778766*INFLR(−1)
- 0.126720779742*INTER(−1) + 12.8857767595)
+ C(2)*D(SMT2GDP(−1)) + C(3)*D(SMT2GDP(−2)) + C(4)*D(SMT2GDP(−3))
+ C(5)*D(GDPR(−1)) + C(6)*D(GDPR(−2)) + C(7)*D(GDPR(−3))
+ C(8)*D(GI2GDP(−1)) + C(9)*D(GI2GDP(−2)) + C(10)*D(GI2GDP(−3))
+ C(11)*D(EX2GDP(−1)) + C(12)*D(EX2GDP(−2)) + C(13)*D(EX2GDP(−3))
+ C(14)*D(IM2GDP(−1)) + C(15)*D(IM2GDP(−2)) + C(16)*D(IM2GDP(−3))
+ C(17)*D(INFLR(−1)) + C(18)*D(INFLR(−2)) + C(19)*D(INFLR(−3))
+ C(20)*D(INTER(−1)) + C(21)*D(INTER(−2)) + C(22)*D(INTER(−3))
+ C(23) (5)

Table 7 shows the values of the coefficients C(1) through C(23) found in Eq. (5) and their corresponding significance at the 5% level.

Table 7. Estimated values and significance of the coefficients C(1) through C(23), for the regression equation #1

Coefficient	Value	Std. Error	t-Statistic	Prob.
C(1)	−0.411606	0.267454	−1.538979	0.1347
C(2)	−0.398787	0.266917	−1.494048	0.1460
C(3)	−0.244592	0.214728	−1.139076	0.2640
C(4)	−0.211200	0.177227	−1.191691	0.2430
C(5)	−0.002241	0.039681	−0.056469	0.9554
C(6)	0.009139	0.035967	0.254102	0.8012
C(7)	0.015462	0.026523	0.582952	0.5644
C(8)	−0.002381	0.028225	−0.084349	0.9334
C(9)	0.022397	0.031237	0.717014	0.4791

C(10)	–0.032585	0.029101	–1.119726	0.2720
C(11)	0.081733	0.082041	0.996253	0.3274
C(12)	0.125572	0.073937	1.698372	0.1001
C(13)	0.012053	0.058461	0.206177	0.8381
C(14)	–0.083693	0.115001	–0.727756	0.4726
C(15)	–0.083891	0.091772	–0.914125	0.3682
C(16)	0.003896	0.059501	0.065472	0.9482
C(17)	0.065645	0.146183	0.449059	0.6567
C(18)	–0.160455	0.117347	–1.367357	0.1820
C(19)	0.133498	0.130423	1.023578	0.3145
C(20)	–0.099176	0.193505	–0.512523	0.6122
C(21)	–0.315908	0.220076	–1.435449	0.1619
C(22)	0.056197	0.211469	0.265746	0.7923
C(23)	–0.101410	0.103613	–0.978747	0.3358

Source: Authors' calculations, EViews output

The short-run causality running from a particular regressor's lags towards the target variable D(*SMT2GDP*) has been carried out using the Wald test, which tests the null hypothesis claiming that there is no short-run causality running from the specific variable to the target variable (Table 8).

Table 8. Results of the Wald test for the regression equation #1

Regressor	Coefficient restriction	Chi-square value	df	Probability	Significant?
SMT2GDP's lags	C(2) = C(3) = C(4) = 0	2.666670	3	0.4459	no
GDPR's lags	C(5) = C(6) = C(7) = 0	0.409779	3	0.9382	no
GI2GDP's lags	C(8) = C(9) = C(10) = 0	3.557041	3	0.3134	no
EX2GDP's lags	C(11) = C(12) = C(13) = 0	3.989346	3	0.2626	no
IM2GDP's lags	C(14) = C(15) = C(16) = 0	1.757961	3	0.6241	no
INFLR's lags	C(17) = C(18) = C(19) = 0	2.742576	3	0.4330	no
INTER's lags	C(20) = C(21) = C(22) = 0	2.601819	3	0.4572	no

*Note: *, **, and *** mean rejection of the null hypothesis claiming that there is no short-run causality at 1%, 5%, and 10% levels of significance, respectively*

Source: Authors' calculations, EViews output

The results of the Wald test suggest that there is no short-run causality running from any of the independent variables to the current value of the target variable *SMT2GDP*. The statistical parameters of the model given by Eq. (4) and Eq. (5) are sublimed in Table 9.

Table 9. Statistical parameters of the model (regression equation #1)

Parameter	Value	Parameter	Value
R-squared	0.599907	Mean dependent var	−0.017651
Adjusted R-squared	0.296388	S.D. dependent var	0.736902
S.E. of regression	0.618125	Akaike info criterion	2.176415
Sum squared resid	11.08028	Schwarz criterion	3.039466
Log likelihood	−33.58680	Hannan-Quinn criter.	2.507288
F-statistic	1.976508	Durbin-Watson stat	2.039062
Prob(F-statistic)	0.043095		

The relatively high value of the coefficient of determination, $R^2 = 0.599907$, means that this model is acceptable since the independent variables explain the variability of the dependent variable, *SMT2GDP*, quite well (up to 60.00%).

However, the value of Adjusted R^2 equals 29.64%; As a measure of goodness of fit of the model *vis-à-vis* the observed time series, the relatively low value of this statistic points out the fact that the model includes regressors that do not sufficiently contribute to the explanatory power of the model, which suggests that the model is a below-the-average good-fitting model;

Since the value of F-statistics (1.976508) is significant at a 5% level of significance, i.e. Prob(F-statistic) = 0.043095 < 5%, it can be concluded that data are fitted quite well within the model, i.e. the independent variables jointly influence the dependent variable and that that influence is statistically significant.

The value of Durbin-Watson statistics is 2.039062 ≈ 2.00, meaning that the model is free from autocorrelation issues, i.e. it is free from first-order serial correlation.

The residual diagnostic tests have led to the following findings:

Fig. 8 shows the correlogram – Q-statistics of the residuals.

Since all the probabilities up to the specified lag order (24) are higher than 5%, the null hypothesis stating that there is neither autocorrelation nor partial correlation in the residuals is accepted at a 5% level of significance. The histogram of the Jarque-Bera normality test of the residuals is given in Fig. 9.

Date: 07/13/22 Time: 11:49
Sample: 2008Q1 2021Q4
Included observations: 52
Q-statistic probabilities adjusted for 22 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.021	-0.021	0.0237	0.878
		2	-0.055	-0.056	0.1962	0.907
		3	0.020	0.017	0.2185	0.975
		4	-0.000	-0.002	0.2185	0.994
		5	-0.103	-0.101	0.8480	0.974
		6	0.035	0.030	0.9212	0.988
		7	0.038	0.028	1.0105	0.995
		8	-0.156	-0.150	2.5575	0.959
		9	-0.040	-0.045	2.6622	0.976
		10	0.089	0.064	3.1888	0.977
		11	-0.197	-0.198	5.8365	0.884
		12	-0.112	-0.115	6.7188	0.876
		13	0.138	0.095	8.0889	0.838
		14	0.121	0.124	9.1758	0.820
		15	-0.063	-0.040	9.4816	0.851
		16	0.022	-0.036	9.5190	0.891
		17	-0.005	-0.028	9.5208	0.922
		18	-0.189	-0.152	12.478	0.822
		19	0.069	0.029	12.884	0.844
		20	-0.029	-0.116	12.957	0.879
		21	0.017	0.067	12.983	0.909
		22	0.104	0.145	13.994	0.902
		23	0.040	-0.047	14.147	0.923
		24	0.067	0.109	14.591	0.932

*Probabilities may not be valid for this equation specification.

Figure 8. Correlogram – Q-statistics of the residuals for the regression equation #1

Source: Authors' calculations, EViews output

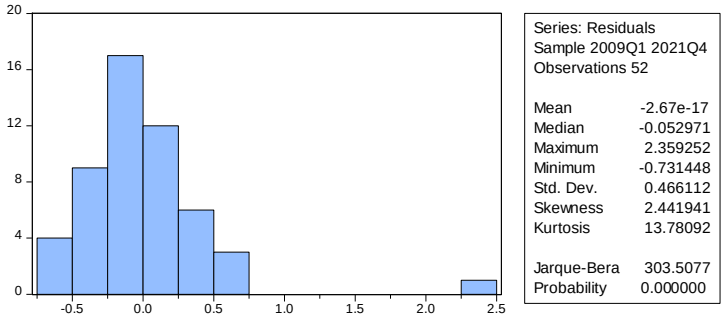


Figure 9. Histogram of the normality test of the residuals for the regression equation #1

Source: Authors' calculations, EViews output

Since Prob. = 0.000000 < 5%, the null hypothesis, stating that residuals are normally distributed, has to be rejected in favor of the alternative one. The residuals are not normally distributed. The output of the Serial Correlation LM Test is presented in Fig. 10.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.340500	Prob. F(2,27)	0.7144
Obs*R-squared	1.279287	Prob. Chi-Square(2)	0.5275

Figure 10. The output of the Serial Correlation LM Test for the regression equation #1

Source: Authors' calculations, EViews output

Since Prob. Chi-Square(2) = 0.5275 > 5%, the null hypothesis stating that there is no serial correlation in the residuals is accepted at a 5% level of significance.

The output of the Breusch-Pagan-Godfrey heteroskedasticity test is given in Fig. 11.

Heteroskedasticity Test: Breusch-Pagan-Godfrey

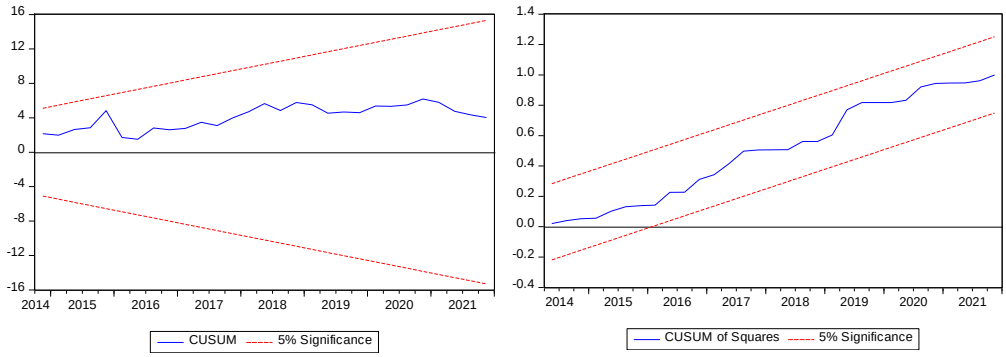
F-statistic	0.325261	Prob. F(28,23)	0.9973
Obs*R-squared	14.74992	Prob. Chi-Square(28)	0.9810
Scaled explained SS	29.31642	Prob. Chi-Square(28)	0.3966

Figure 11. The output of the Breusch-Pagan-Godfrey heteroskedasticity test for the regression equation #1

Source: Authors' calculations, EViews output

Since Prob. Chi-Square(28) = 0.9810 > 5%, the null hypothesis stating that there is no heteroskedasticity in the residuals is accepted at a 5% level of significance.

Finally, the plot of the CUSUM test remains strictly between the 5% critical bounds, which proves the stability of the parameters, i.e. coefficients of the model (Fig. 12a), confirming that the regression model for equation (1) is structurally stable. As a test for instability in the variance of the regression error, the plot of the CUSUM of Squares test shows that the test statistics lie between the ±5% level of significance, meaning that the variance of the regression error in the regression model for equation (1) is also stable (Fig. 12b).



(a) CUSUM (b) CUSUM of Squares

Figure 12. The CUSUM and CUSUM of Squares plots

Source: Authors' calculations, EViews output

b) Analysis for the *SMT2MC*

The optimal lag length assessment, according to five lag order selection criteria (LR, FPE, AIC, SC, and HQ), was based on the estimation of a standard VAR model where all the variables (*SMT2MC*, *GDPR*, *GI2GDP*, *EX2GDP*, *IM2GDP*, *INFLR*, and *INTER*) are considered endogenous. The outcome suggests the usage of 4 lags, as most of the criteria point out (Table 10).

Table 10. Results of the optimal lag length assessment for regression equation #2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-856.2426	NA	619416.6	33.20164	33.46431	33.30234
1	-708.9965	249.1857	14400.85	29.42294	**31.52428***	30.22855
2	-641.1740	96.51664	7721.954	28.69900	32.63901	30.20951
3	-564.9766	**87.92006***	3586.044	27.65295	33.43163	29.86836
4	-494.1650	62.64105	**2846.631***	**26.81404***	34.43139	**29.73435***

* Indicates the lag order selected by the criterion

Source: Authors' calculations, EViews output

Based on this finding, the number of cointegration vectors for 4 lag intervals has been estimated by using the Pantula principle. The sublimed results of the appliance of the Pantula principle are given in Table 11.

Table 11. Results of the appliance of the Pantula principle for testing the number of cointegrating vectors for the regression equation (2): *SMT2MC* = *f* (*GDPR*, *GI2GDP*, *EX2GDP*, *IM2GDP*, *INFLR*, *INTER*), 4 lags

Number of cointegrating vectors	Option 1		Option 2		Option 3		Option 4		Option 5	
	λ_{trace}	λ_{max_eigen}	λ_{trace}	λ_{max_eigen}	λ_{trace}	λ_{max_eigen}	λ_{trace}	λ_{max_eigen}	λ_{trace}	λ_{max_eigen}
No vectors (r = 0)	×	×	×	×	×	×	×	×	×	×
At most 1 (r = 1)	×	×	×	×	×	×	×	×	×	×
At most 2 (r = 2)	×	×	×	×	×	×	×	×	×	×
At most 3 (r = 3)	×	×	×	×	√	√	×	×	×	√
At most 4 (r = 4)	×	√	√	√			×	×	√	
At most 5 (r = 5)	√						√	√		
At most 6 (r = 6)										

Note: × = The null hypothesis is being rejected at a 5% level of significance; √ = The null hypothesis is being accepted at a 5% level of significance

Source: Authors' calculations, EViews output

The rest of the analysis has been carried out using "Option 3. Intercept (no trend) in CE and test VAR". This allows for the existence of an intercept, but no trend in Cointegration Equation (CE) and test VAR model.

According to the test results presented in Table 11 for Option 3, both the Trace statistics and the Max Eigen statistics indicate the existence of at most 3 cointegrating equations (vectors) at a 5% level of significance. The null hypothesis of no cointegration is rejected against the alternative one, claiming the existence of a cointegrating relationship in the model: all the model variables are cointegrated, meaning that they share a common stochastic trend and grow proportionally; they move together in a long-run, i.e. there is a long-run relationship among them in terms that corresponding time series are related and can be combined linearly. This way, even if there are any shocks in the short-run, which may affect movements in the individual series, they would converge with time.

The cointegration equation #1 with the normalized cointegrating coefficients, which is of particular interest for this study, is given in Fig. 13, in a tabular form.

Vector Error Correction estimates were obtained by specifying and running a corresponding VECM for Option 3, with $p = 4 - 1 = 3$ lags, because a lag is lost when specifying VECM. The estimated coefficients for the VECM specification of *SMT2MC*, which are coefficients of the 1-lagged regressors, are presented in Table 12.

1 Cointegrating Equation(s):		Log likelihood	–446.1662			
Normalized cointegrating coefficients (standard error in parentheses)						
SMT2MC	GDPR	GI2GDP	EX2GDP	IM2GDP	INFLR	INTER
1.000000	–0.428837	0.342723	0.032371	–0.078909	–0.446047	–0.019939
	(0.03898)	(0.03643)	(0.06055)	(0.08273)	(0.10423)	(0.05099)

Figure 13. The cointegration equation #1 (Johansen Test of Cointegration) for the regression equation #2

Source: Authors' calculations, EViews output

Table 12. Estimated coefficients for the regression equation #2: *SMT2MC = f* (*GDPR*, *GI2GDP*, *EX2GDP*, *IM2GDP*, *INFLR*, *INTER*)

Regressor	Coefficient	t-Statistics	Critical values at a 1% level of significance, df = 51, two-tailed test	Critical values at a 5% level of significance, df = 51, two-tailed test	Critical values at a 10% level of significance, df = 51, two-tailed	Significant?
GDPR	–0.491577	–8.40972	±2.6757	±2.0076	±1.6753	yes *
GI2GDP	0.294073	4.01569	±2.6757	±2.0076	±1.6753	yes *
EX2GDP	0.184974	2.03579	±2.6757	±2.0076	±1.6753	yes **
IM2GDP	–0.312714	–2.69045	±2.6757	±2.0076	±1.6753	yes *
INFLR	–0.277797	–1.81855	±2.6757	±2.0076	±1.6753	yes **
INTER	–0.016851	–0.15760	±2.6757	±2.0076	±1.6753	no
C						

*Note: *, **, and *** mean rejection of the null hypothesis claiming that the coefficient is not statistically significant at 1%, 5%, and 10% levels of significance, respectively*

Source: Authors' calculations, EViews output

Based on the findings in Table 12, it can be concluded that in the long run:

- Two of the regressors (*GI2GDP* and *EX2GDP*) have a positive, yet statistically significant impact on the target variable *SMT2MC*;
- The rest of the regressors (*GDPR*, *IM2GDP*, *INFLR*, and *INTER*) have a negative impact on the target variable *SMT2MC*; the impact of *INTER* is statistically insignificant; however, the impacts of *GDPR*, *IM2GDP*, and *INFLR* are statistically significant;
- Unexpectedly, the increase of *GDPR* by 1 percentage point (pp) yields a decrease in *SMT2MC* ratio by 0.491577 pp, having minded the *ceteris paribus* principle;
- The increase of GI2GDP ratio by 1 pp will yield an increase of *SMT2MC* ratio by 0.294073 pp, having minded the *ceteris paribus* principle;
- The increase of the *EX2GDP* ratio by 1 pp is expected to increase the *SMT2MC* ratio by 0.184974 pp, having minded the *ceteris paribus* principle;

- The increase of the *IM2GDP* ratio by 1 pp is expected to decrease the *SMT2MC* ratio by 0.312714 pp, having minded the *ceteris paribus* principle;
- The increase of *INFLR* by 1 pp is expected to decrease the *SMT2MC* ratio by 0.277797 pp, having minded the *ceteris paribus* principle;
- The increase of *INTER* by 1 pp is expected to decrease the *SMT2MC* ratio by 0.016851 pp, having minded the *ceteris paribus* principle.

The resulting cointegrating equation is a basis for inferring the Error Correction Term (ECT), given by Eq. (6).

$$ECT_{t-1} = \begin{bmatrix} 1.000000 \cdot SMT2MC_{t-1} - 0.491577 \cdot GDPR_{t-1} + 0.294073 \cdot GI2GDP_{t-1} + \\ +0.184974 \cdot EX2GDP_{t-1} - 0.312714 \cdot IM2GDP_{t-1} - \\ -0.277797 \cdot INFLR_{t-1} - 0.016851 \cdot INTER_{t-1} + 3.483337 \end{bmatrix} \quad (6)$$

The expression for *SMT2MC* as a target (dependent) variable is given by Eq. (7).

$$\begin{aligned} &\Delta SMT2MC_t = -0.212612 \cdot ECT_{t-1} - \\ &-0.568995 \cdot \Delta SMT2MC_{t-1} - 0.270181 \cdot \Delta SMT2MC_{t-2} - 0.225857 \cdot \Delta SMT2MC_{t-3} - \\ &-0.183794 \cdot \Delta GDPR_{t-1} - 0.117055 \cdot \Delta GDPR_{t-2} - 0.069265 \cdot \Delta GDPR_{t-3} + \\ &+0.012621 \cdot \Delta GI2GDP_{t-1} + 0.026341 \cdot \Delta GI2GDP_{t-2} - 0.067824 \cdot \Delta GI2GDP_{t-3} + \\ &+0.027357 \cdot \Delta EX2GDP_{t-1} + 0.139832 \cdot \Delta EX2GDP_{t-2} + 0.018400 \cdot \Delta EX2GDP_{t-3} + \\ &+0.106082 \cdot \Delta IM2GDP_{t-1} + 0.015419 \cdot \Delta IM2GDP_{t-2} + 0.069177 \cdot \Delta IM2GDP_{t-3} - \\ &-0.096620 \cdot \Delta INFLR_{t-1} - 0.363209 \cdot \Delta INFLR_{t-2} - 0.117274 \cdot \Delta INFLR_{t-3} - \\ &-0.410318 \cdot \Delta INTER_{t-1} - 0.289421 \cdot \Delta INTER_{t-2} + 0.551678 \cdot \Delta INTER_{t-3} - \\ &-0.322279 \end{aligned} \quad (7)$$

The value of the coefficient of the ECT is negative (–0.212612), but not statistically significant (Table 13). This value suggests that the speed of the adjustment from a short-run to a long-run equilibrium is 21.26%, i.e. the system corrects its previous period of disequilibrium at a speed of 21.26% within one period of time (a quarter). However, since this coefficient explains the joint long-run causality running from all of the regressors to the target variable, *SMT2MC*, it can be concluded that the joint long-run causality running from all the regressors to the current value of *SMT2MC* is not statistically significant.

Table 13. The value and significance of the coefficient C(1) multiplying the ECT for the regression equation (2): *SMT2MC = f* (*GDPR*, *GI2GDP*, *EX2GDP*, *IM2GDP*, *INFLR*, *INTER*)

Coefficient	Value	t-Statistics	Critical values at a 1% level of significance, df = 51, two-tailed test	Critical values at a 5% level of significance, df = 51, two-tailed test	Critical values at a 10% level of significance, df = 51, two-tailed	Significant?
C(1)	−0.212612	−1.376656	±2.6757	±2.0076	±1.6753	no

The significance of the coefficients in Eq. (7) has been obtained by estimating Eq. (7) by the method of the Least Squares, or, more specifically, by estimating the following equation, Eq. (8).

D(SMT2MC) = C(1)*(SMT2MC(−1) − 0.491577087345*GDPR(−1) + 0.294072738687*GI2GDP(−1) + 0.184974409328*EX2GDP(−1) − 0.312714392216*IM2GDP(−1) − 0.277796730974*INFLR(−1) − 0.0168509955431*INTER(−1) + 3.48333650612) + C(2)*D(SMT2MC(−1)) + C(3)*D(SMT2MC(−2)) + C(4)*D(SMT2MC(−3)) + C(5)*D(GDPR(−1)) + C(6)*D(GDPR(−2)) + C(7)*D(GDPR(−3)) + C(8)*D(GI2GDP(−1)) + C(9)*D(GI2GDP(−2)) + C(10)*D(GI2GDP(−3)) + C(11)*D(EX2GDP(−1)) + C(12)*D(EX2GDP(−2)) + C(13)*D(EX2GDP(−3)) + C(14)*D(IM2GDP(−1)) + C(15)*D(IM2GDP(−2)) + C(16)*D(IM2GDP(−3)) + C(17)*D(INFLR(−1)) + C(18)*D(INFLR(−2)) + C(19)*D(INFLR(−3)) + C(20)*D(INTER(−1)) + C(21)*D(INTER(−2)) + C(22)*D(INTER(−3)) + C(23) (8)

Table 14 shows the values of the coefficients C(1) through C(23) found in Eq. (8) and their corresponding significance at the 5% level.

Table 14. Estimated values and significance of the coefficients C(1) through C(23), for regression equation #2

Coefficient	Value	Std. Error	t-Statistic	Prob.
C(1)	−0.212612	0.154441	−1.376656	0.1792
C(2)	−0.568995	0.189269	−3.006268	0.0054
C(3)	−0.270181	0.208659	−1.294844	0.2056
C(4)	−0.225857	0.153248	−1.473805	0.1513
C(5)	−0.183794	0.080509	−2.282907	0.0300
C(6)	−0.117055	0.069948	−1.673440	0.1050
C(7)	−0.069265	0.054057	−1.281344	0.2102
C(8)	0.012621	0.044152	0.285852	0.7770
C(9)	0.026341	0.037339	0.705454	0.4862
C(10)	−0.067824	0.040145	−1.689488	0.1019
C(11)	0.027357	0.081515	0.335603	0.7396
C(12)	0.139832	0.084597	1.652925	0.1091
C(13)	0.018400	0.081191	0.226631	0.8223

C(14)	0.106082	0.065120	1.629029	0.1141
C(15)	0.015419	0.091123	0.169211	0.8668
C(16)	0.069177	0.088393	0.782607	0.4402
C(17)	–0.096620	0.205748	–0.469606	0.6421
C(18)	–0.363209	0.153868	–2.360527	0.0252
C(19)	–0.117274	0.169279	–0.692784	0.4940
C(20)	–0.410318	0.271670	–1.510351	0.1418
C(21)	–0.289421	0.286033	–1.011844	0.3200
C(22)	0.551678	0.294340	1.874288	0.0710
C(23)	–0.322279	0.148273	–2.173559	0.0380

Source: Authors' calculations, EViews output

The short-run causality running from a particular regressor's lags towards the target variable D(*SMT2MC*) has been carried out using the Wald test, which tests the null hypothesis claiming that there is no short-run causality running from the specific variable to the target variable (Table 15).

Table 15. Results of the Wald test for regression equation #2

Regressor	Coefficient restriction	Chi-square value	df	Probability	Significant?
SMT2MC's lags	C(2) = C(3) = C(4) = 0	12.64395	3	0.0055	yes *
GDPR's lags	C(5) = C(6) = C(7) = 0	5.287831	3	0.1519	no
GI2GDP's lags	C(8) = C(9) = C(10) = 0	5.368089	3	0.1467	no
EX2GDP's lags	C(11) = C(12) = C(13) = 0	3.867613	3	0.2761	no
IM2GDP's lags	C(14) = C(15) = C(16) = 0	4.834793	3	0.1843	no
INFLR's lags	C(17) = C(18) = C(19) = 0	8.861815	3	0.0312	yes **
INTER's lags	C(20) = C(21) = C(22) = 0	7.367553	3	0.0611	yes ***

*Note: *, **, and *** mean rejection of the null hypothesis claiming that there is no short-run causality at 1%, 5%, and 10% levels of significance, respectively*

Source: Authors' calculations, EViews output

The results of the Wald test suggest that there is a statistically significant short-run causality running from the independent variables *INFLR* and *INTER* towards the current value of the target variable *SMT2MC*. Also, all the three lags of the target variable *SMT2MC* significantly affect its current value in the short run. However, there is no short-run causality running from the other four regressors, *GDPR*, *GI2GDP*, *EX2GDP*, and *IM2GDP*, towards the current value of the target variable, *SMT2MC*.

The statistical parameters of the model given by Eq. (7) and Eq. (8) are sublimed in Table 16.

Table 16. Statistical parameters of the model (regression equation #2)

Parameter	Value	Parameter	Value
R-squared	0.716822	Mean dependent var	−0.098202
Adjusted R-squared	0.501997	S.D. dependent var	1.237043
S.E. of regression	0.872973	Akaike info criterion	2.866844
Sum squared resid	22.10040	Schwarz criterion	3.729894
Log likelihood	−51.53795	Hannan-Quinn criter.	3.197717
F-statistic	3.336770	Durbin-Watson stat	2.328244
Prob(F-statistic)	0.001364		

The relatively high value of the coefficient of determination, R^2 = 0.716822, means that this model is highly acceptable since the independent variables explain quite well the variability of the dependent variable *SMT2MC* (up to 71.68%).

The value of Adjusted R^2 equals 50.20%; As a measure of goodness of fit of the model *vis-à-vis* the observed time series, this statistic's value points out the fact that the model includes regressors that moderately contribute to the explanatory power of the model, which suggests that the model is a moderately good-fitting model;

Since the value of F-statistics (3.336770) is significant at a 5% level of significance, i.e. Prob(F-statistic) = 0.001364 < 5%, it can be concluded that data are fitted quite well within the model, i.e. the independent variables jointly influence the dependent variable and that that influence is statistically significant.

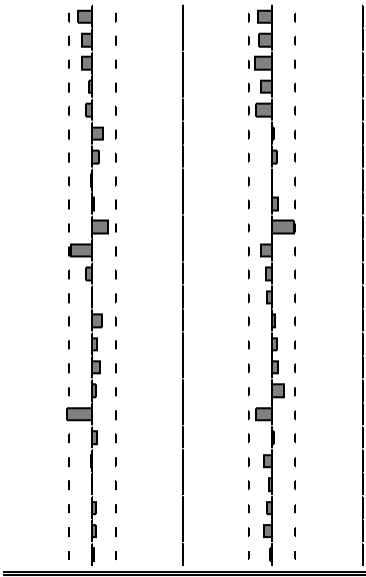
The value of Durbin-Watson statistics is 2.328244 $\in$ [−1.50, +2.50], meaning that the model is free from autocorrelation issues, i.e. it is free from first-order serial correlation.

The residual diagnostic tests have led to the following findings:

Fig. 14 shows the correlogram – Q-statistics of the residuals.

Since all the probabilities up to the specified lag order (24) are higher than 5%, the null hypothesis stating that there is neither autocorrelation nor partial correlation in the residuals is accepted at a 5% level of significance. The histogram of the Jarque-Bera normality test of the residuals is given in Fig. 15.

Date: 07/14/22 Time: 07:07
Sample: 2008Q1 2021Q4
Included observations: 52
Q-statistic probabilities adjusted for 22 dynamic regressors



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.166	-0.166	1.5210	0.217
		2	-0.119	-0.151	2.3141	0.314
		3	-0.136	-0.194	3.3802	0.337
		4	-0.032	-0.128	3.4416	0.487
		5	-0.071	-0.173	3.7462	0.587
		6	0.120	0.009	4.6201	0.593
		7	0.073	0.042	4.9482	0.666
		8	-0.017	-0.005	4.9669	0.761
		9	0.024	0.066	5.0061	0.834
		10	0.173	0.255	6.9979	0.726
		11	-0.258	-0.129	11.544	0.399
		12	-0.071	-0.081	11.898	0.454
		13	-0.002	-0.058	11.899	0.536
		14	0.112	0.025	12.832	0.540
		15	0.062	0.050	13.125	0.593
		16	0.097	0.068	13.857	0.609
		17	0.029	0.139	13.923	0.673
		18	-0.289	-0.184	20.829	0.288
		19	0.046	0.013	21.009	0.336
		20	-0.016	-0.085	21.032	0.395
		21	-0.001	-0.028	21.033	0.457
		22	0.036	-0.051	21.154	0.511
		23	0.029	-0.092	21.236	0.567
		24	0.015	-0.014	21.259	0.623

*Probabilities may not be valid for this equation specification.

Figure 14. Correlogram – Q-statistics of the residuals of a regression equation #2

Source: Authors' calculations, EViews output

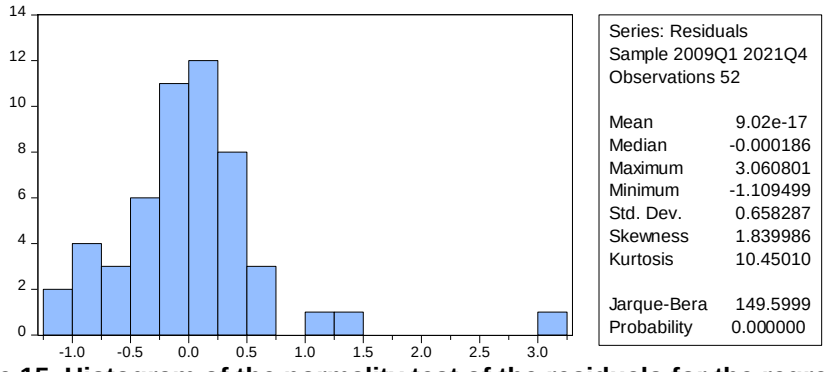


Figure 15. Histogram of the normality test of the residuals for the regression equation #2

Source: Authors' calculations, EViews output

Since Prob. = 0.000000 < 5%, the null hypothesis, stating that residuals are normally distributed, has to be rejected in favor of the alternative one. The residuals are not normally distributed. The output of the Serial Correlation LM Test is presented in Fig. 16.

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.944323	Prob. F(8,21)	0.5026
Obs*R-squared	13.75745	Prob. Chi-Square(8)	0.0883

Figure 16. The output of the Serial Correlation LM Test for the regression equation #2

Source: Authors' calculations, EViews output

Since Prob. Chi-Square(8) = 0.0883 > 5%, the null hypothesis stating that there is no serial correlation in the residuals is accepted at a 5% level of significance.

The output of the Breusch-Pagan-Godfrey heteroskedasticity test is given in Fig. 17.

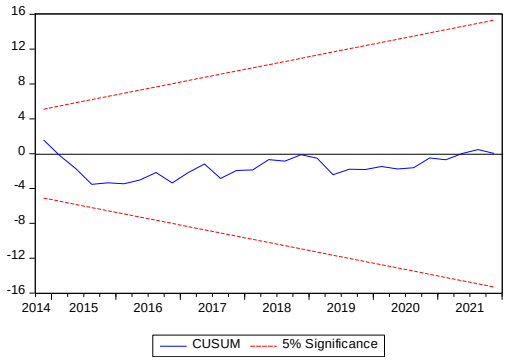
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.363795	Prob. F(28,23)	0.9941
Obs*R-squared	15.96100	Prob. Chi-Square(28)	0.9664
Scaled explained SS	23.45609	Prob. Chi-Square(28)	0.7099

Figure 17. The output of the Breusch-Pagan-Godfrey heteroskedasticity test for regression equation #2

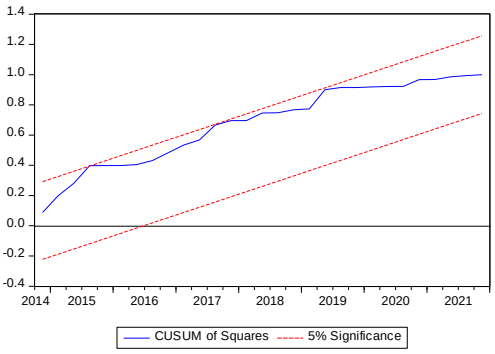
Source: Authors' calculations, EViews output

Since Prob. Chi-Square(28) = 0.9664 > 5%, the null hypothesis stating that there is no heteroskedasticity in the residuals is accepted at a 5% level of significance.

Finally, the plot of the CUSUM test remains strictly between the 5% critical bounds, which proves the stability of the parameters, i.e. coefficients of the model (Fig. 18a), confirming that the regression model for equation (2) is structurally stable. As a test for instability in the variance of the regression error, the plot of the CUSUM of Squares test shows that the test statistics lie between the ±5% level of significance, meaning that the variance of the regression error in the regression model for equation (2) is also stable (Fig. 18b).



(a) CUSUM



(b) CUSUM of Squares

Source: Authors' calculations, EViews output

Conclusion

Macedonian Stock Exchange as a representative of the capital market in North Macedonia experienced continued growth over the years. Measured by the share price index, the MBI10 increased from 2,291 points in 2005 when it was established, to 6,153 points in 2021. The current value of the MBI10 is a result of consecutive growth in the last five years, with a cumulative growth of 269%. In addition, the growth of the stock market in the country was shown by the market capitalization ratio which increased from 6.62% in 2003 to 32.00% in 2021.

So, the main objective of this study was to identify the key macroeconomic drivers of the capital market in North Macedonia. Therefore, the research aims to investigate the impact of selected macroeconomic determinants on capital market development measured by stock market liquidity indicators (stock market turnover to GDP ratio and stock market turnover to market capitalization ratio-Turnover Ratio). The main reason for choosing these indicators as dependent variables was the fact that many experts in our country identify the illiquidity of the market as the main problem of the capital market's functioning. Consequently, identifying the determining factors of the stock market liquidity will help policymakers to create strategies that lead to its improvement.

To reach the main goal of the study, it has been carried out a time-series data analysis, originating from valid secondary data sources, based on the utilization of the Johansen Test of Cointegration and the development of a corresponding Vector Error Correction Model (VECM). The results of the empirical research have shown that most of the analyzed variables have statistically significant effects on stock market turnover to GDP ratio and stock market turnover to market capitalization ratio-(Turnover Ratio) as proxies of the liquidity of the stock market.

We find that gross domestic product rate, exports to GDP ratio, and inflation rate are important determinants of stock market development measured by stock market turnover to GDP ratio, while gross investments do not prove to be significant. So, the findings revealed a positive relationship between gross domestic product rate and stock market turnover to GDP ratio and confirmed the results of the related research that capital market development can accelerate economic growth. Also, the inflation rate has a positive and statistically significant impact on the stock market turnover to GDP ratio which indicates that macroeconomic stability does play a considerable role in determining stock market

liquidity. The export to GDP ratio is positively associated with the stock market development in North Macedonia which confirmed the theories which suggest that trade openness benefits financial market development, including the stock market, in two different ways, which can be described as 'supply-side' and 'demand-side' roles (Niroomand *et al*. 2014). Although gross investments showed a positive impact on stock market turnover to GDP ratio, the coefficient was insignificant. In addition, we find that imports and reference interest rates have a negative, yet statistically significant impact on the stock market turnover to GDP ratio.

Regarding the second indicator of the stock market liquidity, the turnover ratio, we found that gross investments and exports have a significant positive impact on the stock market turnover to market capitalization ratio. Therefore, the increase of gross investments to GDP ratio by 1 percentage point will yield an increase in the turnover ratio by 0.294073 percentage points. So, the results indicate that the liquidity of the Macedonian Stock Exchange is highly determined by the higher level of gross investments. Additionally, the impact of the reference interest rates is negative but insignificant. On the other hand, the gross domestic product, imports, and inflation rate have all a negative and statistically significant impact. Unexpectedly, the increase of *GDPR* by 1 percentage point yields a decrease in the *SMT2MC* ratio by 0.491577 percentage points which is not in line with the results of the related studies. Such a relationship between turnover ratio and gross domestic product rate could be explained by the behavior of the economic agents in our country who in terms of increased GDP probably prefer to use services from other financial institutions (banks), instead of the stock market.

Based on these findings, the policymakers in North Macedonia should create and implement strategies that facilitate improving macroeconomic determinants which have a significant impact on stock market development. First, it is important to initiate policies to foster economic development and investment since economic growth can significantly promote stock market development. Second, the policymakers should pursue policies that promote trade openness by encouraging the use of equity financing by the main exporting industries which in turn will increase the demand for equity financing on the stock market. In addition, the monetary authority should strive to maintain macroeconomic stability by keeping stable inflation and interest rates. Furthermore, for liquidity stock market development the banks must be proactive, especially in the domain of investment banking by offering attractive services which will stimulate the companies to use the capital market as a source for finding their investment projects.

REFERENCES

Abdelbaki, H. H.. 2013. Causality Relationship between Macroeconomic Variables and Stock Market Development: Evidence from Bahrain. *The International Journal of Business and Finance Research,* Vol. 7, No. 1, pp. 69–84.

Aduda, J., Masila, J. M., & Onsongo, E. N.. 2012. The Determinants of Stock Market Development: The Case for the Nairobi Stock Exchange. *International Journal of Humanities and Social Science*, 2(9): 214–230.

Ahlgren, N.. 2019. Answer to the question "Can JJ cointegration be applied if six variables are I(1), but one is I(0)?" posted by Kolachi, N. on

ResearchGate.net. Available from: https://www.researchgate.net/post/Can_JJ_cointegration_be_applied_if_six_variables_are_I1_but_on_is_I0 [Accessed July 19, 2022]

Bayar, Y.. 2016. Macroeconomic Determinants Of Stock Market Development: Evidence From Borsa Istanbul. *Studii Financiare (Financial Studies)*, Centre of Financial and Monetary Research "Victor Slavescu", 20(1), 69–89.

Brasoveanu, L. O., Dragota, V., Catarama, D., & Semenescu, A.. 2008. Correlations Between Capital Market Development and Economic Growth: The Case of Romania. *Journal of Applied Quantitative Methods,* Vol. 3, No. 1, pp. 64–75.

Brennan, M. J., Chordia, T., Subrahmanyam, A., & Tong, Q. 2012. Sell-order liquidity and the cross-section of expected stock returns. *Journal of Financial Economics*, 105(3), 523–541. https://doi.org/10.1016/j.jfineco.2012.04.006

Calderón-Rossell, R. J., 1991. The Determinants of Stock Market Growth. In Rhee, S. G. & Chang, R. P. (Eds.). *Pacific Basin Capital Markets Research Proceeding of the Second Annual Pacific Basin Finance Conference,* Vol. II, Bangkok, Thailand.

Chee Wee, P. & Tan, R. G. K., 1997. Performance of Johansen's Cointegration Test. In East Asian Economic Issues (Applied Economics Research Series) 3, 402–414.

Cherif, M. & Gazdar, K., 2010. Macroeconomic and Institutional Determinants of Stock Market Development in MENA Region: New Results from a Panel Data Analysis. *International Journal of Banking and Finance*, 7(1), 139–159.

Cushman, D. O., 2019. Answer to the question "Can I use Johansen Cointegration test if my variables are I(0) and I(1)?" posted by Abas, S. on ResearchGate.net. Available from: https://www.researchgate.net/post/Can-I-use-Johansen-Cointegration-test-if-my-variables-are-I0-and-I1 [Accessed July 19, 2022]

Dev, K. & Shakeel, S. F., 2013. Determinants for the Growth of Stock Market, *Journal of Independent Studies and Research-Management, Social Sciences and Economics* (JISR-MSSE), Vol. 11, No. 2, pp. 71–82.

Dickey, D. A. & Fuller, W. A., 1979. Distribution of the Estimators for Autoregressive Time Series with a Unit Root. Journal of the American Statistical Association, 74(366), 427–431. https://doi.org/10.1080/016-21459.1979.10482531

Djambaska, E., Petkovski, V., & Lozanoska, A., 2016. Capital Market and the Determinants of Development in the Republic of Macedonia. *Economic Development*, No. 3, pp. 152–165.

Eliskovski, M., 2012. Macroeconomic Determinants of the Capital Market Development in the Republic of Macedonia. XIII Annual Conference of the Macedonian Stock Exchange, Skopje, Republic of Macedonia

Garcia, V. F. & Liu, L., 1999. Macroeconomic Determinants of Stock Market Development, *Journal of Applied Economics,* Vol. II, No. 1, pp. 29–59.

Gujarati, D. N., 2003. *Basic Econometrics*, Fourth Edition. McGraw-Hill/Irwin, New York, NY, USA.

Harris, R. & Sollis, R., 2003. *Applied Time Series Modelling and Forecasting*. John Wiley & Sons Ltd., West Sussex, England.

Ho, S.-Y. & Odhiambo, N. M., 2020. The Macroeconomic Drivers of Stock Market Development: Evidence from Hong Kong. *Journal of Financial Economic Policy*, 12(2), 185–207. https://doi.org/10.1108/JFEP-11-2018-0163

Ho, S.-Y., 2019. Determinants of Stock Market Development in South Africa. *International Journal of Emerging Markets,* 14(2), 322–342. https://doi.org/10.1108/IJoEM-09-2017-0341

Johansen, S., 1991. Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. Econometrica, 59(6): 1551–1580. https://doi.org/10.2307/2938278

Johansen, S., 1992. Determination of Cointegration Rank in the Presence of a Linear Trend. Oxford Bulletin of Economics and Statistics, 54(3): 383–397. https://doi.org/10.1111/j.1468-0084.1992.tb00008.x

Kralik, L. I., 2012. Relationship between macroeconomic variables and stock market returns on Bucharest Stock Exchange. *Metalurgia International,* 17(8): 127–132.

Kurach, R., 2010. Stock Market Development in CEE Countries - the Panel Data Analysis, *Ekonomika,* 89(3): 20–29. https://doi.org/10.15388/Ekon.2010.0.978

Lazarov, D. & Slaveski, T., 2016. Empirical Estimation of Macroeconomic, Financial and Institutional Specific Determinants of Capital Markets Development in the CEE Countries. *Proceedings of the 14th EACES Conference "Comparative Economic Development in the Long Run,* Regensburg, Germany

MAKStat Database (–a). Gross Domestic Product by expenditure approach, by quarters. State Statistical Office of the Republic of North Macedonia, Skopje, North Macedonia. Available from: http://makstat.stat.gov.mk/ [Accessed: July 10, 2022]

MAKStat Database (–b). Exports, imports, trade balance, and coverage of imports by exports, monthly. State Statistical Office of the Republic of North Macedonia, Skopje, North Macedonia. Available from: http://makstat.stat.gov.mk/ [Accessed: July 10, 2022]

MSE (–). Reports. Macedonian Stock Exchange AD. Skopje, North Macedonia. Available from: https://www.mse.mk/en/reports [Accessed: July 10, 2022]

Naceur, S. B., Ghazouani, S., & Omran, M., 2007. The determinants of stock market development in the MENA region. *Managerial Finance*, 33(7), 477–489.

NBRNM (–). Financial stability reports. National Bank of the Republic of North Macedonia, Skopje, North Macedonia. Available from: https://www.nbrm.mk/izvieshtai_za_finansiskata_stabilnost-en.nspx [Accessed: July 10, 2022]

Niroomand, F., Hajilee, M., & Al Nasser, O. M., 2014. Financial market development and trade openness: Evidence from emerging economies. *Applied Economics*, 46(13):1490–1498.

Olgić Draženović, B. & Kusanović, T., 2016. Determinants of capital market in the new member EU countries. *Economic Research-Ekonomska Istraživanja*, 29(1): 758–769. https://doi.org/10.1080/1331677X.2016.1197551

Phillips, P. C. B. & Perron, P., 1988. Testing for a Unit Root in Time Series Regression. Biomètrika, 75(2): 335–346. https://doi.org/10.1093/biomet/75.2.335

Saunders, P. J., 2005. Time series evidence on social security and private saving: The issue revisited. Available from: http://www.cwu.edu/business/sites/cts.c-wu.edu.business/files/Soc%20Sec%20Final%20Draft.pdf [Accessed: June 27, 2022]

Spaseska, T., Hristoski, I., Odzaklieska, D., & Risteska-Jankuloska, A., 2019. Macroeconomic Determinants of Stock Market Development: Evidence from the Macedonian Stock Exchange. In Kozarević, E. and Okičić, J. (Eds.), *Proceedings of the 6th International Scientific Conference "Economy of Integration"* (ICEI 2019), "(E)migrations and Competitiveness of Southeastern European Countries", pp. 101-111.

WB (2020). World Development Indicators Database. The World Bank. Available from: http://data.worldbank.org/indicator [Accessed: July 20, 2022]

WBG (2020). *Capital Markets Development: A Primer for Policymakers*, The World Bank Group, Washington, D.C., USA. Available from: https://openknowledge.worldbank.org/bitstream/handle/10986/36058/Capital-Markets-Development-A-Primer-for-Policymakers.pdf [Accessed: July 15, 2022]

Yartey, C. A., 2010. The Institutional and Macroeconomic Determinants of Stock Market Development in Emerging Economies. *Applied Financial Economics*, 20(21): 1615–1625. https://doi.org/10.1080/09603107.2010.522519

Yemelyanova, L., 2013. The Determinants of Stock Market Development in the CEE Countries, *Business Enterprise & Finance*, Vol. –, No. 3, pp. 241–254.