Ante Dodig
Union University Belgrade
School of Computing
11000 Belgrade, Serbia
adodig@raf.rs

Milica Bugarčić
Union University Belgrade
Belgrade Banking Academy
11000 Belgrade, Serbia
mbugarcic@bba.edu.rs

JEL: G14, G15, C33
Original scientific article
https://doi.org/10.51680/ev.36.1.5

Received: August 4, 2022
Revision received: August 21, 2022
Accepted for publishing: August 23, 2022

CAPITAL MARKET EFFICIENCY IN TRANSITIONING SOUTHEASTERN EUROPEAN COUNTRIES

Abstract

Purpose: This paper is a continuation of research in the series that examines the weak form of the efficient capital markets theorem in Southeast European transitioning economies. Model modifications are based on learnings through the previously established inapplicability of foreign exchange metrics. At the same time, the model is being expanded by incorporating new research markets, extending the time coverage to the longest duration to date, between 2005 and 2021, to cover economic bust and recovery periods and research inherent improvements in the capital market context, and adding new variables to provide more sturdiness and conclusiveness.

Methodology: The paper applies the panel pooled mean group estimator by aggregating cross-country data. By using level series prime data instead of differentials, this method enables efficient use of information and resolves at best the identified market shallowness.

Results: The statistical results of empirical research infer the inefficiency of the investigated markets with greater robustness and supplementary new information revealing more powerful corrective investor and policy behavior in collectively more mature markets.

Conclusions: The findings firmly reiterate subpar capital markets performance in a prolonged and more comprehensive environment. The recommendations conclusively emphasize the importance of structural reforms to support sustainability through elementary setup drivers, such as transparency, governance, judiciary productivity, and policy support, *inter alia*.

Keywords: Economy, capital markets, frontier and emerging markets, Southeast Europe, market efficiency

1. Introduction

The capital markets in Southeast Europe emerged in the early 1990s. As with other nascent markets, they showed frequent failures in the initial period. In the transitioning process from planned to free-market economies, the establishment of public stocks exchanges was set as a priority to serve as a means for privatizing assets previously owned by the state. Therefore, the development of the market in favor of the improvement of wider access, increased transparency and corporate governance, and the wider context through improving the complementary institutional, legislative, and tribunal environment was curtailed. With the passage of time, despite maturing, there is still data scarcity, and ceteris paribus, it deters irrefutable empirical confirmation of the relationship between macroeconomic indicators and the performance of stock exchanges. Such a condition has led to methodological inconsistencies and dissuaded vast empirical research. In the contemporary and more standardized performance and through proven and yet strengthened statistical methodologies, this research attempts to clarify frequently identified obscurity coming from fads in the relationship between indicators. It demonstrates with empirical evidence the existence and direction of meaningful relationships.

The underlying assumption for the efficient capital market theorem is that of prices always reflecting public information in an environment of full transparency and rational behavior. In this study, the weak form of the capital market efficiency theorem is examined by monitoring the impact of macroeconomic indicators on stock exchanges indexes over time and across countries. In a perfectly efficient market, no relevance of the relationship should be identified due to the market's a-priori absorption of public macroeconomic information, in action and expectation. Alternative theoretical forms of market efficiency are the semi-strong/event form, where prices are imminently adjusted to contemporary public information, and the strong/private form, where insider information is also contained in prices. Southeast European capital markets are universally shallow in daily secondary trading and provide for only sporadic corporate capital market actions. Therefore, the efficiency of the event form is not studied due to the lack of market-relevant data, and the efficiency of the private form is not considered either due to the well-known existence of transaction costs that would otherwise not be present in a perfectly efficient market. In Southeast Europe, the listed stock prices are generally not representative of the actual prices of market transactions. Market uncertainty is widespread amongst investors, and the representation of retail, portfolio, and foreign investors is often marginal. Most large local issuers often deliberately seek alternatives, and frequently so by using Western European capital markets in search of greater liquidity and business security.

This paper is organized in four sections as follows: The first section introduces the background environment and the economic thought behind the research question. The second section presents a review of the literature behind the study. The third section reveals the empirical assessment methodological approach and the results of empirical statistical testing with implicit interpretations. The final section concludes with findings and recommendations.

2. Literature review

Despite vast research to date, for emerging markets, let alone frontier markets, there is little consensus on uniform results for capital markets efficiency as measured by the impact of macroeconomic indicators on stock indexes. Consideration of research in the direction of the reverse relationship is hindered by commonalities in known scarce capital markets that form a constituent value, e.g. by capitalization or turnover, to national economic outputs, and which further calls into question the statistical relevance due to the greater possibility of endogeneity.

Table 1 Some empirical studies of capital market efficiency

Authors	Markets	Period	Method/Model	Main results
Azar, 2010	USA	January 1947 - March 2009	ARMA and GARCH models	An established negative impact of the key borrowing interest rate and of inflation on stock exchange market indexes.
Barakat et al., 2016	Egypt and Tunisia	January 1998 - January 2014	Granger causality	Statistically significant bivariate causality between macroeconomic indicators and listed stock markets.
Barbić & Čondić-Jurkić, 2011	Croatia, Czech Republic, Hungary, Poland, and Slovenia	January 1998 - January 2010	Johansen cointegration method and Granger causality test	Statistically significant bivariate association between macroeconomic indicators and listed stock prices.
Campbell & Vuolteenaho, 2004	USA	June 1927 - December 2002	VAR model	A negative impact of the key borrowing interest rate and inflation on stock exchange market indexes.
Dodig, 2020	Slovenia, Croatia, Serbia, B&H, and North Macedonia	September 2005 - December 2016	Panel PMG model	Market inefficiency testing through the existence of an established short- and long-term relationship and the impact of macroeconomic indicators on a set of indexes of transitioning countries, jointly and independently.
Dumas et al., 2003	Austria, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, the UK, and the USA	January 1970 - June 1996	Single-index statistical model	A positive impact of macroeconomic performance on financial market performance.
Fink et al., 2006	Bulgaria, Czech Republic, Slovakia, Hungary, Slovenia, Poland, Romania, Malta, and Turkey	1996 - 2000	Panel regression model and cross-section regression model	Growth in listed stock prices positively impacts the aggregate economic output measured by GDP.
Jamaludin et al., 2017	Singapore, Malaysia, and Indonesia	January 2005 - December 2015	Panel least square regression	Statistically significant co-integration between macroeconomic indicators and stock markets.
Pilinkus, 2010	Lithuania, Latvia, and Estonia	January 2000 - December 2008	Granger causality tests, Johansen cointegration method and VAR model	A positive association between an increase in money supply and listed stock prices.
Plíhal, 2016	Germany	January 1999 - September 2015	Johansen cointegration method, Granger causality test VAR model	A statistically significant relationship between the stock market index and industrial production, and between the stock market index and key interest rates.

Source: Authors

Most stock exchange index movements remain mysterious as only a minority is tied to fundamental economic information and more cohesive clustering is evident with findings that regional contagions are more abundant than global ones (Cornell, 2013; Gkillas et al., 2019; Patatoukas, 2021). Diverse empirical research results differ with regard to the existence and direction of the relationship between macroeconomic performance and the performance of financial markets. In the existent relationships, the positive impact mostly prevails for developed markets (Fama, 1981; Chen et al., 1986; Dumas et al., 2003), but there are bubbles and trends in the relationship (Binswanger, 1999; Domian & Louton, 1997; Issahaku et al., 2013; Ehrmann & Fratzscher, 2004). The findings show that stock indexes are more closely correlated with macroeconomic indicators in poorer economies. Typically, such an association is a result of a relatively larger public sector and the value of system- versus firm-specific components in performance (Morck et al., 2000). Likewise, frontier and emerging markets more often have co-integration between macroeconomic indicators and stock markets, yet without a clear indication of associating the direction of the relationship or causality (Barakat et al., 2016; Jamaludin et al., 2017). Context inadequacies in transition economies are often highlighted as a soft constraint that hinders capital market efficiency (Naceur et al., 2007; Koivu, 2002; Fink et al., 2006; Cojocaru et al., 2016). Forms of such deficiencies may appear, e.g., in public uncertainty about the quality of the institutional, regulatory or tribunal environment.

Apart from the previous own empirical research with the already identified limitations of still shallow markets and the necessity of expanding the temporal and geographic area, and identifying the factors of the set of variables, to date there has been no coherent and extensive research on the efficiency of capital markets in Southeast Europe (Dodig, 2020). Identified peripheral comparators include proven existence in the nexus of capital market development, using capitalization and turnover to aggregate economic output growth (Fink et al., 2006; Lazarov et al., 2016; Olgić Draženović & Kusanović, 2016). Further, through Granger causality, Barbić & Čondić-Jurkić (2011) identified a bivariate relationship of the impact of macroeconomic indicators on prices in capital markets in single-country studies in Croatia and Slovenia (Barbić & Čondić-Jurkić, 2011). Nicolescu's research from 2003 to 2019 using annual data points and single-country analysis shows a significant association of inflation and GDP per capita with inherent stock indexes in Romania and Hungary (Nicolescu, 2020). Multivariate research presented here covers approximated two full economic cycle periods, a panel review of more mature transitioning markets, and the improvements sought through a strengthened model with additional determining aspects. It seeks further to factually attest to a more trusting relationship between macroeconomic and capital market indicators in a longer time review, as is often recommended (Fama, 1990; Binswanger, 1999; Onofrei et al., 2019).

From a global overview, the impact of macroeconomic indicators on the listed stock prices points to sporadic capital market inefficiencies in the short run, and less so in the long run (Megaravalli & Sampagnaro, 2018; Lee & Wang, 2015; Pilinkus, 2010; Plíhal, 2016). Likewise, Onofrei et al. (2019) showed that the intensity of co-movement of frontier and emerging market stock indexes with developed market stock indexes is co-integrated with inflation, the foreign exchange rate, and the production rate. In particular, capital markets seem to be more reactive to a wider set of factors in periods of crisis and interestingly, there are implications that in post-crisis periods, macro-driven markets prevail in recovery (Celebi & Hönig, 2019). Other results suggest that good public governance is an important determinant of portfolio investments flows (Chipalkatti et al., 2007). The researchers identified a relationship with the foreign exchange factor and acknowledged a negative coefficient of contribution by increasing the key borrowing interest rate and by inflation on stock exchange market indexes (Azar, 2010; Balduzzi, 1995; Campbell & Vuolteenaho, 2004). In our previous research, the exchange rate indicator denominated in US dollars (USD) was found to be insignificant, as expected, due to the dependence of the underlying economic markets on the euro, a peg to or direct use of the euro, and the non-prevalence of USD investors. It is also noticeable that there have been no significant movements in the selected local currencies in relation to the euro exchange rate, there are frequent managed floats, and in addition, Croatia is expected to introduce the euro on 1 January 2023. For that reason, the FX factor was dropped in this research. By contrast, our previous research confirmed a long-run negative impact of the key rate and inflation and ul-

timately confirmed a statistically relevant relationship with the indicator of the net financial account of the balance of payments. This research progresses to decompose that indicator to sub-component relationships in search of association drivers and explanations of the direction of relationships.

3. Empirical approach and results

The research sample consists of 378 data records from six Southeast European countries (Croatia, Slovenia, Bosnia and Herzegovina, Serbia, North Macedonia, and Montenegro) in the period from 2005 to 2021. Descriptive statistics are shown in the appendix. This research discusses markets that have similarly transitioned from central planning to a free market economy; however, individual markets today differ in the level of economic development, capital market development, and the surrounding institutional, regulatory, legislative, and tribunal environment, *inter alia multa*. The selected panel PMG method best addresses the characteristics of research data by using the primary data format and fixing long-run coefficients for more reliable results, but allowing for intercept variance and error variance on an individual country basis, which then provides an insight into short-run and individual country results sensitivity. The dynamic technique resolves the inconsistencies of static models, better addresses unobserved error bias, and tolerates data heterogeneity more effectively. It is a suitably poised method for the selected dataset by capturing in fixed coefficients the common cross-countries traits and at the same time in the variability of the error variance according to the specificities of individual countries. Finally, panel PMG effectively treats both stationary and non-stationary data and allows the use of nominal data values relative to the requirement for data differentiation and information loss.

Exploratory empirical analysis starts by using the Augmented Dickey Fuller (ADF) test to confirm the presence of unit roots in the data standard level and differences level series (Dickey & Fuller, 1979). In that way, non-stationarity is diagnosed as a precondition for integration. ADF results determine the stationary form only in other differentially smoothed data. Data information is lost in transformations through differentiation. Therefore, we believe that the ability of the panel PMG statistical method to simultaneously treat stationary and non-stationary parameters is an advantage compared to the bivariate Granger and Johansen methods, which can only treat stationary and non-stationary parameters. The cointegration analysis is set up in an environment where the time series variables exhibit drift but still do not diverge to a large extent to disturb the long-run equilibrium. In other words, although a short-run deviation in the cointegrating movement of two variables may be observed, the two variables exhibit a cointegrating equilibrium in the long run (Engle & Granger, 1987). In this research, we use the Johansen cointegration method to analyze such behavior (Johansen, 1991). The main reason why we used the Johansen cointegration method instead of the Engel and Granger two-step method is that the Johansen test has the ability to identify more than one cointegrating factor in a bivariate relationship, as shown in Table 4 in the appendix. Therefore, the Johansen methodology dominates the Engle and Granger methodology in cointegration analyses (Bilgili, 1998). In order to test the causality of the short-term transmission shock in the bivariate relationship, this research employs the Granger method. However, Granger testing may actually be spurious in the significance of results for series that contain a trend and are otherwise random. Thus, the Granger test implies that one occurs before the other without explicit theoretical support for the relationship. For this reason, panel PMG is further utilized to determine a meaningful impact and association in variable relationships.

This research focuses on learnings from utilization of the following panel PMG model:

$$\begin{aligned} SMI_{i,t} = \mu + \lambda_i SMI_{i,t-n} + \beta_1 GDPPC_{i,t} + \beta_2 MMIR_{i,t} \\ + \beta_3 HICP_{i,t} + \beta_4 IPI_{i,t} + \beta_5 FDI_{i,t} + \\ + \beta_6 PI_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

In (1) above, β is a long-run parameter coefficient, λ is a scalar value vector, i represents countries, t refers to time, μ refers to the constant value, n represents time periods, and ε refers to error disturbances. The selected macroeconomic indicators include gross domestic product per capita (GDPPC) in the nominal value in euros, inflation (HICP) in the index value, the levels of the industrial production index (IPI) in the index value, the money market interest rate (MMIR) in the absolute value, foreign direct investments (FDI) in the nominal value in euros, and portfolio investments (PI) in the

nominal value in euros. The proxy for the regulated exchange traded markets in Bosnia and Herzegovina (B&H), Serbia, North Macedonia, Montenegro, Croatia, and Slovenia are the equity indexes BATX, BELEX15, MBI10, MONEX, CROBEX10, and SBITOP, respectively.

The statistical testing results for the panel PMG method reveal that the error correction term (ECT) coefficient is negative and statistically significant at the 99% confidence level interval. That result suggests the existence of a stable relationship between macroeconomic indicators and stock indexes in Southeast Europe and therefore provides factual empirical confirmation of market weak form inefficiency. Compared to previous research, the results confirm the existence of the relationship and further reveal a better market correction of 19.7% (versus 8.8%) per annual quarter adjustment to the long-run equilibrium of the relationship. The error correction mechanism may be exhibited in the form of investor sentiment, policy, regulatory, or other response. Examples of stronger ECT in the short and the long run manifest anomalies and likely structural deficiencies underlying irrational behavior. Considering the implications of specific temporal results and the significance of independent variables, it can be noticed that the only long-term statistically significant factor is the MMIR, which is in line with our own previous findings (with proven significant HICP, MMIR, and BOPNFA associations) and reaffirms again the likelihood of improving market efficiency due to a smaller number of identified long-run associations between macroeconomic indicators and stock indexes. Portfolio market theory asserts that a contractionary monetary policy triggers a shift in portfolio preferences from equity to fixed income assets. The implications of the direction of the relationship with the MMIR are consistent with common findings that broadly higher returns are linked with an expansionary monetary policy (Conover et al., 1999; Ehrmann & Fratzscher, 2004). That is primarily the case in more developed markets as fads are more frequent in frontier and emerging markets. For example, Pilinkus (2010) showed in his study a positive money supply association with stock indexes in the case of Estonia in the period from 2000 to 2008.

Table 2 Panel PMG test results – Score of the group of SEE countries

Variable	Coefficient	
	Long run	**Short run**
GDPPC	0.0084 (0.0544)	0.0655 (0.1788)
MMIR	-4157.6770* (1998.4470)	4448.1040 (7271.9760)
HICP	-4.7404 (5.8261)	-40.4004 (48.3224)
IPI	-9.3940 (4.9933)	3.9179* (1.7804)
FDI	-0.0017 (0.0758)	0.1484 (0.2651)
PI	0.0003 (0.0384)	-0.1287* (0.0651)
ECT***	-0.1970** (0.0477)	
Constant		901.3524*
Log likelihood	-2181.048	
Hausman test	3.81[0.2826]	

Note: [] is the p-value. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.
*** Error correction term, coefficient, and standard error.
Source: Authors

What is specific to the results of this study is the existence of short-run relationships (compared to none in previous research) through the association relationship in that the growth in the IPI value has a positive association with the value of stock indexes and that the growth in the PI value has a negative association with the value of stock indexes. It is apparent that in the markets where the IPI is more represented in stock indexes, there have been greater volatilities in the performance of the IPI together with the bankruptcies of the key players. In addition, the results of the Johansen test (as shown in the appendix) confirm the significance of the IPI cointegrating relationship in the case of Croatia, B&H, and of Montenegro. Importantly, there are more short-term associating relationships, but none in the long run, which again indicates a possible improvement in market efficiency by means of corrective measures. The short-term existence of the relationship with PI is in line with the previously confirmed relationship with the broader net financial account of the balance of payments. Similarly, the direction of the relationship cannot be analyzed in detail without prior awareness of the constituents of tradable PI securities, either in product form (e.g. equities, fixed-income securities, derivatives) or duration (short- versus long-form). Similarly again, the absence of a long-term relationship for the same indicators may allude to market correction activity.

Table 3 PMG test results – Score of individual SEE countries

Country	Croatia	Slovenia	B&H	Serbia	North Macedonia	Montenegro
Long run						
GDPPC	0.0084 (0.0544)	0.0084 (0.0544)	0.0084 (0.0544)	0.0084 (0.0544)	0.0084 (0.0544)	0.0084 (0.0544)
MMIR	-4157.677* (1998.447)	-4157.677* (1998.447)	-4157.677* (1998.447)	-4157.677* (1998.447)	-4157.677* (1998.447)	-4157.677* (1998.447)
HICP	-4.7404 (5.8261)	-4.7404 (5.8261)	-4.7404 (5.8261)	-4.7404 (5.8261)	-4.7404 (5.8261)	-4.7404 (5.8261)
IPI	-9.3940 (4.9933)	-9.3940 (4.9933)	-9.3940 (4.9933)	-9.3940 (4.9933)	-9.3940 (4.9933)	-9.3940 (4.9933)
FDI	-0.0017 (0.0758)	-0.0017 (0.0758)	-0.0017 (0.0758)	-0.0017 (0.0758)	-0.0017 (0.0758)	-0.0017 (0.0758)
PI	0.0003 (0.0384)	0.0003 (0.0384)	0.0003 (0.0384)	0.0003 (0.0384)	0.0003 (0.0384)	0.0003 (0.0384)
ECT***	-0.1246* (0.0512)	-0.1122* (0.0494)	-0.2757* (0.1045)	-0.3643** (0.0698)	-0.0583 (0.0546)	-0.2468** (0.0688)
Short run						
GDPPC	- 0.0812 (0.2190)	0.0629 (0.1036)	0.0137 (0.1204)	0.0122 (0.1343)	-0.4779 (2.0480)	0.8632 (0.6509)
MMIR	8,448.0210 (5,042.800)	5,753.148 (6,659.123)	1160.0920 (4,778.463)	2099.9370 (1,718.697)	-23246.3600 (13,947.010)	32473.7800 (71,799.700)
HICP	45.9918 (54.1574)	34.7039 (24.5699)	9.7383 (8.5602)	14.1739 (15.6382)	-84.0029 (94.6866)	-263.0075* (112.5595)
IPI	4.1090 (7.0877)	-0.9916 (4.5900)	-0.2043 (1.4788)	2.6402 (1.8070)	8.2210 (8.0558)	9.7330 (6.4738)
FDI	-0.2858 (0.1065)*	0.0323 (0.0699)	0.0093 (0.0970)	-0.0686 (0.0457)	-0.2437 (1.2349)	1.4469 (1.1158)
PI	-0.0396 (0.0443)	0.0120 (0.0145)	-0.2001 (0.1390)	-0.0033 (0.0257)	-0.1323 (0.4513)	-0.4091 (0.7295)
Constant	438.8869* (218.7026)	225.6820 (149.8622)	578.0567 (310.1763)	834.2894* (346.5510)	310.8344 (269.8491)	3020.3650** (881.7832)
Log likelihood	-2181.048					
Hausman test	3.81[0.2826]					

Note: [] is the p-value. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$.
*** Error correction term, coefficient, and standard error
Source: Authors

The individual countries results imply a significant ECT coefficient for all of the markets except for North Macedonia, which is contradicts previous findings. In addition, there are new significant coefficients for B&H and Serbia. A greater number of significant ECTs may allude to more advanced market correction capacity. Of the significant short-term relationships between individual countries, the only relevant one is the negative connection of HICP in the case of Montenegro (compared to seven significant relationships identified in our own previous research). The identified negative impact of inflation is consistent with the dominant previous thematic findings (Azar, 2010; Balduzzi, 1995; Campbell & Vuolteenaho, 2004; Conover et al., 1999; Ehrmann & Fratzscher, 2004).

4. Conclusions and recommendations

The results of empirical research factually support evidence of market inefficiency with regard to Eugene Fama's weak form theorem. A comparison with earlier findings shows that the two are much in line, but it is also clear that with extended time and better adjusted model variables, the results show faster market adjustment and lesser sensitivity to macro factors. New findings reveal the existence of the impact of portfolio investments. Furthermore, the inclusion of Montenegro gives findings relatively comparable to other regional markets. Finally, the extended time coverage confirms the reliability of the data through another period of boom and bust in relation to the spillover of Covid-19 and the onset of the economic crisis from 2020 onwards. From a policy perspective, in addition to the empirically established weak form of capital inefficiency, it is important to remain aware of the assumption of a general market equilibrium in which the expected prices follow a "random walk" under the restrictive precondition of fair market competition and homogeneity in behavior. Therefore, the results of this study do not rely on the realism of the theoretical assumptions, but on the acceptability of the implications. In this regard, with the obtained results, policy makers have clear evidence of the expected direct impact of the monetary policy adjustment on long-term expected results of the capital market. Similarly, it is evident that an improvement in industrial production has an imminent positive association with the performance of capital markets. On the contrary, rising inflation harms the performance of capital markets in the imminent term. Therefore, according to the obtained results, the impact of fiscal policies can be anticipated not only according to the direction of the association, but also through the lag from implementation to reaching the results of the impact. Nevertheless, this research does not study or adjust for frequently preconceived subpar judicial effectiveness, the presence of systemic corruption, and irrational behavioral traits that may act as important determining components in the operating environment. It is recommended that future research attempts to address these important open questions. Future research may also benefit from further expanding temporal coverage adding standardization and stability to performance. Similarly, it would be insightful to contrast market development and efficiency in comparable global regions with their transitioning process from planned to free markets (e.g. in the Baltics or Southeast Asia), but in their specific environments. Overall, this and future follow-up research may uncover new value by integrating additional qualitative influences into the endogeneity of research models. Important qualitative factors to consider may be the widely used indexes for the caliber of governance at state institutions, regulatory quality, judicial efficiency, corruption control, competition liberalization, etc. The prospects of these findings create new valuable information to a wider audience including researchers, policy makers, investors, etc.

References

1. Azar, S. A. (2010). Inflation and stock returns. *International Journal of Accounting and Finance*, *2*(3-4), 254-274. https://doi.org/10.1504/IJAF.2010.034399
2. Balduzzi, P. (1995). Stock returns, inflation, and the 'proxy hypothesis': A new look at the data. *Economics Letters*, *48*(1), 47-53. https://doi.org/10.1016/0165-1765(94)00568-M
3. Barakat, M., Elgazzar, S. & Hanafy, K. (2016). Impact of macroeconomic variables on stock markets: Evidence from emerging markets. *International Journal of Economics and Finance*, *8*(1), 195-207. https://doi.org/10.5539/ijef.v8n1p195
4. Barbić, T. & Čondić-Jurkić, I. (2011). Relationship between macroeconomic fundamentals and stock market indices in selected CEE countries. *Ekonomski pregled*, *62*(3-4), 113-133.
5. Bilgili, F. (1998). Stationarity and cointegration tests: Comparison of Engle-Granger and Johansen methodologies. *MPRA Paper No. 75967*. Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi.
6. Binswanger, M. (2000). Stock market booms and real economic activity: Is this time different?. *International Review of Economics & Finance*, *9*(4), 387-415. https://doi.org/10.1016/S1059-0560(99)00056-8
7. Campbell, J. Y. & Vuolteenaho, T. (2004). Inflation illusion and stock prices. *American Economic Review*, *94*(2), 19-23. https://doi.org/10.1257/0002828041301533
8. Celebi, K. & Hönig, M. (2019). The impact of macroeconomic factors on the German stock market: Evidence for the crisis, pre-and post-crisis periods. *International Journal of Financial Studies*, *7*(2), 1-13. https://doi.org/10.3390/ijfs7020018
9. Chen, N. F., Roll, R. & Ross, S. A. (1986). Economic forces and the stock market. *Journal of Business*, *59*(3), 383-403. https://doi.org/10.1086/296344
10. Chipalkatti, N., Le, Q. V. & Rishi, M. (2007). Portfolio flows to emerging capital markets: Do corporate transparency and public governance matter?. *Business and Society Review*, *112*(2), 227-249. https://doi.org/10.1111/j.1467-8594.2007.00295.x
11. Cojocaru, L., Falaris, E. M., Hoffman, S. D. & Miller, J. B. (2016). Financial system development and economic growth in transition economies: New empirical evidence from the CEE and CIS countries. *Emerging Markets Finance and Trade*, *52*(1), 223-236. https://doi.org/10.1080/1540496X.2015.1013828
12. Conover, C. M., Jensen, G. R. & Johnson, R. R. (1999). Monetary environments and international stock returns. *Journal of Banking & Finance*, *23*(9), 1357-1381. https://doi.org/10.1016/S0378-4266(99)00007-2
13. Cornell, B. (2013). What moves stock prices: Another look. *The Journal of Portfolio Management*, *39*(3), 32-38. https://doi.org/10.3905/jpm.2013.39.3.032
14. 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/10.1080/01621459.1979.10482531
15. Dodig, A. (2020). Relationship between Macroeconomic Indicators and Capital Markets Performance in Selected Southeastern European Countries. *Zagreb International Review of Economics & Business*, *23*(2), 55-88. https://doi.org/10.2478/zireb-2020-0014
16. Domian, D. L. & Louton, D. A. (1997). A threshold autoregressive analysis of stock returns and real economic activity. *International Review of Economics & Finance*, *6*(2), 167-179. https://doi.org/10.1016/S1059-0560(97)90022-8
17. Dumas, B., Harvey, C. R. & Ruiz, P. (2003). Are correlations of stock returns justified by subsequent changes in national outputs?. *Journal of International Money and Finance*, *22*(6), 777-811. https://doi.org/10.1016/j.jimonfin.2003.08.005
18. Ehrmann, M. & Fratzscher, M. (2004). Taking stock: Monetary policy transmission to equity markets. *Journal of Money, Credit and Banking*, *36*(4), 719-737. https://doi.org/10.1353/mcb.2004.0063

19. Engle, R. F. & Granger, C. (1987). Cointegration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, *55*(2), 251-276. https://doi.org/10.2307/1913236

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

21. Fama, E. F. (1990). Stock returns, expected returns, and real activity. *The Journal of Finance*, *45*(4), 1089-1108. https://doi.org/10.1111/j.1540-6261.1990.tb02428.x

22. Fink, G., Haiss, P. & Vuksic, G. (2006). Importance of Financial Sectors for Growth in Accession Countries. In Liebscher K. et al. (Eds.), *Financial Development, Integration and Stability* (pp. 154-185). Edward Elgar Publishing. https://doi.org/10.4337/9781847203038

23. Gkillas. K., Tsagkanos, A. & Vortelinos, D. I. (2019). Integration and risk contagion in financial crises: Evidence from international stock markets. *Journal of Business Research*, *104*, 350-365. https://doi.org/10.1016/j.jbusres.2019.07.031

24. Issahaku, H., Ustarz, Y. & Domanban, P. B. (2013). Macroeconomic variables and stock market returns in Ghana: Any causal link?. *Asian Economic and Financial Review*, *3*(8), 1044-1062.

25. Jamaludin, N., Ismail, S. & Manaf, S. A. (2017). Macroeconomic variables and stock market returns: Panel analysis from selected ASEAN countries. *International Journal of Economics and Financial Issues*, *7*(1), 37-45.

26. Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica: Journal of the Econometric Society*, *59*(6), 1551-1580. https://doi.org/10.2307/2938278

27. Koivu, T. (2002). *Do efficient banking sectors accelerate economic growth in transition countries.* Bank of Finland - Institute for Economies in Transition. https://doi.org/10.2139/ssrn.1015710

28. Lazarov, D., Miteva-Kacarski, E. & Nikoloski, K. (2016). An empirical analysis of stock market development and economic growth: the case of Macedonia. *South East European Journal of Economics and Business*, *11*(2), 71-81. https://doi.org/10.1515/jeb-2016-0012

29. Lee, Y. M. & Wang, K. M. (2015). Dynamic heterogeneous panel analysis of the correlation between stock prices and exchange rates. *Economic Research-Ekonomska istraživanja*, *28*(1), 749-772. https://doi.org/10.1080/1331677X.2015.1084889

30. Megaravalli, A. V. & Sampagnaro, G. (2018). Macroeconomic indicators and their impact on stock markets in ASIAN 3: A pooled mean group approach. *Cogent Economics & Finance*, *6*(1), 1-14. https://doi.org/10.1080/23322039.2018.1432450

31. Morck, R., Yeung, B. & Yu, W. (2000). The information content of stock markets: why do emerging markets have synchronous stock price movements?. *Journal of Financial Economics*, *58*(1-2), 215-260. https://doi.org/10.1016/S0304-405X(00)00071-4

32. Naceur, S. B., Ghazouani, S. & Omran, M. (2007). The determinants of stock market development in the Middle-Eastern and North African region. *Managerial Finance*, *33*(7), 477-489. https://doi.org/10.1108/03074350710753753

33. Nicolescu, L. (2020). Macroeconomic factors and capital markets. Selected experiences in Central and Eastern Europe. *Management Dynamics in the Knowledge Economy*, *8*(2), 159-174.

34. 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

35. Onofrei, M., Cărăușu, D. N. & Lupu, D. (2019). The role of the macroeconomic environment in shaping capital market co-movement in CEE countries. *Economic Research-Ekonomska istraživanja*, *32*(1), 3813-3834. https://doi.org/10.1080/1331677X.2019.1675525

36. Patatoukas, P. N. (2021). Stock market returns and GDP news. *Journal of Accounting, Auditing & Finance*, *36*(4), 776-801. https://doi.org/10.1177/0148558X20913418

37. Plíhal, T. (2016). Stock market informational efficiency in Germany: Granger causality between DAX and selected macroeconomic indicators. *Procedia-Social and Behavioral Sciences*, *220* (2016), 321-329. https://doi.org/10.1016/j.sbspro.2016.05.505

38. Pilinkus, D. (2010). Macroeconomic indicators and their impact on stock market performance in the short and long run: the case of the Baltic States. *Technological and Economic Development of Economy*, *16*(2), 291-304. https://doi.org/10.3846/tede.2010.19

Appendix

Table 1 Descriptive statistics

Country	Indicator	SMI	GDPPC	MMIR	HICP	IPI	FDI	PI
Croatia	CAGR	-0.06%	2.46%	-2.58%	1.72%	0.01%	-0.99%	14.59%
	% of nominal change	-0.85%	45.78%	-33.33%	30.21%	0.12%	-13.59%	645.87%
	median	1855.19	10523.94	0.07	99.39	105.43	-1151.25	-141.89
	st. dev.	842.94	1159.55	0.02	6.79	6.86	822.83	978.41
	mean	2175.40	10873.69	0.06	96.14	105.42	-1323.52	-94.43
	min	1451.32	8765.44	0.03	80.72	92.07	-3661.94	-2139.18
	max	5239.03	13530.30	0.09	105.10	121.20	-111.62	1861.64
	skewness	2.41	0.76	0.13	-0.84	0.22	-1.09	0.00
	kurtosis	5.27	-0.22	-1.61	-0.44	-0.37	0.89	-0.49
Slovenia	CAGR	-0.28%	3.05%	-100%	1.71%	2.22%	10.91%	5.92%
	% of nominal change	-4.13%	59.41%	-100%	29.98%	40.48%	360.55%	133.45%
	median	832.37	18485.80	0.00	99.67	100.37	-330.39	759.96
	st. dev.	445.42	2173.19	0.01	6.75	12.60	560.27	3043.14
	mean	957.88	19121.91	0.01	97.14	103.74	-353.77	-137.64
	min	520.23	14881.06	0.00	81.85	84.57	-1619.57	-6878.51
	max	2623.68	23721.29	0.04	106.50	133.60	710.27	5023.88
	skewness	2.35	0.49	1.73	-0.77	0.66	-0.30	-0.45
	kurtosis	5.48	-0.34	1.84	-0.35	-0.69	-0.79	-0.85
B&H	CAGR	-1.29%	2.72%	-100%	1.25%	2.84%	-1.60%	32.67%
	% of nominal change	-13.88%	39.94%	-100%	21.20%	53.37%	-21.16%	6371.64%
	median	710.46	4163.56	0.01	99.70	97.55	-346.78	40.85
	st. dev.	89.18	537.53	0.01	4.89	8.90	278.16	64.52
	mean	728.67	4359.75	0.01	97.62	97.03	-418.20	56.26
	min	578.78	3724.26	0.00	83.44	69.63	-1434.44	-116.75
	max	944.18	5320.18	0.04	102.98	114.17	-98.81	222.77
	skewness	0.70	0.56	1.31	-1.38	-0.43	-2.19	0.81
	kurtosis	0.03	-1.17	0.42	0.90	0.42	5.06	1.12

Country	Indicator	SMI	GDPPC	MMIR	HICP	IPI	FDI	PI
Serbia	CAGR	-1.97%	6.27%	-12.90%	5.14%	0.23%	1.54%	2.23%
	% of nominal change	-26.48%	156.52%	-88.24%	117.46%	3.66%	22.97%	34.67%
	median	692.93	4577.98	0.09	96.67	104.43	-2041.41	-103.07
	st. dev.	558.83	1058.17	0.05	19.21	9.04	782.54	1040.62
	mean	867.57	4767.56	0.08	88.47	103.21	-2178.36	-365.15
	min	380.83	2790.46	0.01	52.50	86.57	-3750.10	-2935.54
	max	2849.35	7158.16	0.18	114.17	121.60	-752.84	1291.46
	skewness	2.58	0.60	0.25	-0.52	0.00	-0.29	-0.62
	kurtosis	6.19	-0.13	-0.75	-1.17	-0.83	-1.05	-0.18
North Macedonia	CAGR	5.53%	5.14%	-14.02%	2.01%	0.79%	-2.34%	2.87%
	% of nominal change	130.41%	117.37%	-90.38%	36.10%	13.00%	-29.50%	51.87%
	median	2538.86	3947.40	0.04	99.62	95.87	-247.05	-53.70
	st. dev.	1625.90	864.88	0.03	7.35	10.77	126.30	235.98
	mean	3087.91	4046.37	0.05	97.20	96.67	-278.18	-122.18
	min	1633.20	2488.35	0.01	80.70	73.80	-604.23	-967.11
	max	9283.00	5413.40	0.13	109.84	118.87	-12.79	161.55
	skewness	1.71	-0.02	0.77	-0.52	0.04	-0.53	-1.18
	kurtosis	3.20	-1.18	-0.33	-0.54	-0.46	-0.11	1.27
Montenegro	CAGR	0.79%	4.83%	-100%	2.26%	-3.59%	-2.30%	N/A
	% of nominal change	13.04%	98.24%	-100%	41.49%	-43.3%	-26.99%	-6716.8%
	median	11208.19	5409.13	0.01	99.20	104.00	-415.93	-29.62
	st. dev.	7639.89	1107.61	0.01	7.21	21.78	189.04	150.06
	mean	13910.21	5716.36	0.01	98.59	110.58	-485.69	-76.90
	min	8814.86	3511.64	0.00	76.09	68.30	-1114.46	-490.48
	max	40433.96	7924.18	0.04	107.67	167.60	-303.87	216.22
	skewness	2.59	0.34	1.31	-1.23	0.59	-2.14	-0.65
	kurtosis	5.97	-0.64	0.42	1.68	-0.36	4.56	0.16

Source: Authors

Table 2 Summary of the existent PMG pair relationship

Country	SMI	Panel PMG estimation on significant short-run relationship existence from macroeconomic indicators onto individual country's SMI	Aggregate regional data panel PMG estimation on significant long-run relationship existence from macroeconomic indicators onto SMIs	Aggregate regional data panel PMG estimation on significant long-run relationship existence from macroeconomic indicators onto SMIs
B&H	BATX		IPI+, PI-	MMIR-
Serbia	BELEX15			
North Macedonia	MBI10			
Croatia	CROBEX			
Slovenia	SBITOP			
Montenegro	MONEX	HICP-		

Note: A "+" sign marks positive relationship direction, and a "-" sign marks negative relationship direction.
Source: Authors

Table 3 Summary of the existent Johansen and Granger pair relationship

Country	SMI	Bivariate Johansen test on a long-run cointegrating relationship between SMI with the selected macroeconomic indicator	Bivariate Granger test on a causal relationship between SMI with the selected macroeconomic indicator: *-> indicates causality direction*
Croatia	*CROBEX*	MMIR, HICP, IPI, PI	
Slovenia	*SBITOP*	MMIR, HICP	SBITOP à IPI
B&H	*BATX*	HICP, IPI, FDI	
Serbia	*BELEX15*	HICP, FDI, PI	MMIR à BELEX15 FDI à BELEX15 BELEX15 à MMIR
North Macedonia	*MBI10*	PI	FDI à MBI10 MBI10 à IPI
Montenegro	*MONEX*	MMIR, IPI, FDI, PI	

Note: A "+" sign marks positive relationship direction, and a "-" sign marks negative relationship direction.
Source: Authors

Table 4 Results of ΔMAX and ΔTRACE statistics for pairs of SMI and selected macroeconomic variables with present cointegration. Johansen co-integration test results

Country	Pair of indicators	Hypothesized no. of CE(s)	λ_{trace}	5% critical value	λ_{max}	5% critical value
Croatia	CROBEX to MMIR 2006Q2-2021Q2 (2)	None*	15.5944	15.41	13.1591	14.07
		At most 1	2.4353	3.76	2.4353	3.76
	CROBEX to HICP 2006Q3-2021Q2 (3)	None*	29.7508	15.41	21.6551	14.07
		At most 1	8.0957	3.76	8.0957	3.76
	CROBEX to IPI 2006Q3-2021Q2 (4)	None*	16.0486	15.41	14.4369	14.07
		At most 1	1.6117	3.76	1.6117	3.76
	CROBEX to PI 2006Q4-2021Q2 (1)	None*	16.8832	15.41	13.7514	14.07
		At most 1	3.1318	3.76	3.1318	3.76
Slovenia	SBITOP to MMIR 2008Q1-2021Q2 (4)	None*	76.5901	15.41	74.5257	14.07
		At most 1	2.0644	3.76	2.0644	3.76
	SBITOP to HICP 2006Q4-2021Q2 (2)	None*	19.7491	15.41	14.7349	14.07
		At most 1	5.0143	3.76	5.0143	3.76
B&H	BATX to HICP 2010Q1-2021Q4 (1)	None*	16.8104	15.41	12.5973	14.07
		At most 1	4.2132	3.76	4.2132	3.76
	BATX to IPI 2010Q1-2021Q4 (1)	None*	25.3417	15.41	18.3015	14.07
		At most 1	7.0402	3.76	7.0402	3.76
	BATX to FDI 2010Q2-2021Q4 (2)	None*	23.7261	15.41	17.2795	14.07
		At most 1	6.4466	3.76	6.4466	3.76
Serbia	BELEX15 to HICP 2006Q3-2021Q2 (3)	None*	16.6718	15.41	15.2434	14.07
		At most 1	1.4284	3.76	1.4284	3.76
	BELEX15 to FDI 2008Q2-2021Q2 (2)	None*	32.4617	15.41	28.5571	14.07
		At most 1	3.9046	3.76	3.9046	3.76
	BELEX15 to PI 2008Q2-2021Q2 (2)	None*	26.3660	15.41	22.3518	14.07
		At most 1	4.0142	3.76	4.0142	3.76
North Macedonia	MBI10 to PI 2006Q4-2021Q2 (1)	None*	17.1148	15.41	14.9582	14.07
		At most 1	2.1566	3.76	2.1566	3.76

Country	Pair of indicators	Hypothesized no. of CE(s)	λ_{trace}	5% critical value	λ_{max}	5% critical value
Montenegro	MONEX to MMIR 2006Q2-2021Q2 (2)	None*	19.8272	15.41	17.0838	14.07
		At most 1	2.7434	3.76	2.7434	3.76
	MONEX to IPI 2006Q1-2021Q2 (1)	None*	31.5948	15.41	26.4859	14.07
		At most 1	5.1089	3.76	5.1089	3.76
	MONEX to FDI 2008Q4-2021Q2 (4)	None*	34.8046	15.41	18.8159	14.07
		At most 1	15.9886	3.76	15.9886	3.76
	MONEX to PI 2008Q4-2021Q2 (4)	None*	25.2682	15.41	16.6475	14.07
		At most 1	8.6207	3.76	8.6207	3.76

Note: Optimal selection order criteria are shown per quarter and determined by SBIC. The selection of lags is presented in parentheses (). *The null hypothesis is rejected at the 5% level ($p<0.05$). For example, the first row in the case of Croatia shows a CROBEX to MMIR cointegrating relationship with one cointegrating vector. None of the significant results revealed two or more cointegrating vectors.

Source: Authors

Table 5 Granger causality test results

Country	SMI	GDPPC	MMIR	HICP	IPI	FDI	PI
Direction of selected macroeconomic indicator causality on the stock exchange index.							
Croatia	CROBEX	1.982 (0.371)	NA***	NA***	NA***	0.048 (0.827)	NA***
Slovenia	SBITOP	0.250 (0.882)	NA***	NA***	0.133 (0.936)	0.032 (0.984)	0.078 (0.962)
B&H	BATX	0.381 (0.537)	2.987 (0.084)	NA***	NA***	NA***	0.386 (0.534)
Serbia	BELEX15	1.130 (0.568)	14.106** (0.003)	NA***	2.524 (0.640)	NA***	NA***
North Macedonia	MBI10	1.791 (0.181)	2.404 (0.121)	0.007 (0.933)	9.130 (0.058)	3.835* (0.050)	NA***
Montenegro	MONEX	0.174 (0.917)	NA***	0.130 (0.718)	NA***	NA***	NA***
Direction of stock exchange index causality on the selected macroeconomic indicator.							
Croatia	CROBEX	5.911 (0.052)	NA***	NA***	NA***	*1.954 (0.162)*	NA***
Slovenia	SBITOP	3.432 (0.180)	NA***	NA***	7.310* (0.026)	0.488 (0.783)	2.020 (0.364)
B&H	BATX	0.640 (0.424)	1.062 (0.303)	NA***	NA***	NA***	0.038 (0.845)
Serbia	BELEX15	1.992 (0.369)	19.855** (0.000)	NA***	9.120 (0.058)	NA***	NA***
North Macedonia	MBI10	1.788 (0.181)	1.409 (0.235)	0.046 (0.830)	10.983* (0.027)	2.962 (0.085)	NA***
Montenegro	MONEX	2.294 (0.318)	NA***	1.147 (0.284)	NA***	NA***	NA***

Note: A chi^2-value shown on top, and a p-value shown in brackets (). Optimal selection order criteria are shown per quarter and determined by SBIC. * p<0.05, ** p<0.01. ***Due to the established existence of statistically significant cointegration relationships of a pair of indicators or due to the unavailability of Johansen test results for the given pair of indicators, the Granger test and the results as such are misspecified. In such cases, reparameterization into an error correction model is necessary and is completed in this research with panel PMG results.

Macroeconomic indicators that cause the impact of SMI prove to be MMIR in the case of Serbia and FDI in the case of North Macedonia. In contrast to a directional relationship impact, SMI significantly impacts MMIR in Serbia, and IPI in two cases, i.e., in Slovenia and in North Macedonia.

Source: Authors