

MACROECONOMIC DETERMINANTS OF STOCK MARKET VOLATILITY: EVIDENCE FROM POST SOCIALIST COUNTRIES

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ABSTRACT

This paper aims to estimate macroeconomic determinants of stock market volatility (SMV) for post-socialist countries using unbalanced panel data from 1995 to 2020. We evaluated the impacts of the stock market and macroeconomic determinants on SMV using the Feasible Generalized Least Squares (FGLS) model based on the data of selected eleven post-socialist countries in terms of two consecutive years. The findings reveal that economic freedom has a strong and good impact at any time; however, although the previous year's turnover ratio (TOR) had a positive impact, it has an unfavorable impact on SMV in the current year. Furthermore, the year's inflation rate, level of corruption, economic growth rate, and stock market value have all shown a negative impact. The study's findings serve as a useful reference for stock market practitioners and policymakers in these nations in making decisions.

Keywords: Stock Market Volatility (SMV), Turnover Ratio (TOR), Stock Market Capitalization (SMC), Economic freedom (EF), Macroeconomic indicators

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INTRODUCTION

Numerous studies conducted in the past fifty years in this area which brought a significant contribution to understanding the phenomena of stock market volatility and the main

determinants of volatility and have been a valuable reference for the policymakers and market practitioners.

Volatility in the financial markets, especially in the stock market, is a problem for government

officials, market analysts, corporate executives, and economists. During the 1980s, new financial markets evolved globally, and financial institutions provided futures and option contracts on interest rates, stock indexes and currency exchange rates. These markets expanded at an incredible rate until the October 1987 global stock market collapse. Following this stock market collapse, serious concerns were raised about financial market volatility and the role of new financial futures and options (Scott, 1991). It has become extensive research to find its effects and factors that effect on SMV (Stock Market Volatility) since the end of the 20th century.

Numerous studies on the macroeconomic factors of stock market volatility have been conducted (Morelli, 2002; Engle, Ghysels, and Sohn, 2006; Beltratti and Morana, 2006; Engle and Rangel, 2008; Batten, 2008; Ciner, and Lucey, 2011; Wang, 2010; Walid, Chaker, Masood, and Fry, 2011; Beetsma and Giuliodori, 2012; Kearney, and Daly, 1998). A review of the above studies in this area confirmed that industrial production, real retail sales, money supply, interest rate, inflation, GDP and exchange rate were statistically significant determinants of SMV of the UK, USA, Australia and other developed countries. On the other hand, in other nations, such as Malaysia, there is no correlation between SMV and macroeconomic variable changes (Zakaria & Shamsuddin, 2012). Nonetheless, most economists agree that macroeconomic variables such as GDP, inflation, interest rates, industrial production and money supply have a significant impact on SMV.

Scholars and economists have become more interested in the volatility of emerging and developing country stock markets in recent decades. Such as, Diebold and Yilmaz (2008), Davis and Kutan (2003), Luo (2014), Mahmoud, Mostafa, and Hussein (2021) studied how the macroeconomic variables; including real economic growth rate, money supply, interest rate, inflation, and economic freedom and other macro variables; such as corruption effect on SMV of emerging countries (Brazil, Chile, China, Colombia, the Czech Republic, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Peru, the Philippines, Poland, Russia, South

Africa, Taiwan, Thailand and Turkey). In addition, financial sector development is crucial in economic growth and financial stability (Svirydzienka, 2016).

It has been 30 years since Central and Eastern European countries and Mongolia transferred to a market economy from a centrally planned economy. There is a growing tendency toward the bank sector being a dominant force in post-socialist countries' financial markets, especially in Mongolia. In recent decades, the average share of the money market or banking sector in Mongolia's overall active financial market has been 88.8 percent. While the stock market accounts for an average of 10.7 percent of the financial market total assets, insurance market contributes for an average of 0.51 percent (National Statistics Office of Mongolia, 2020). Thus, the purpose of this research is to examine stock market volatility and the macroeconomic variables associated with nations in which the initial stages of the stock market were similar.

In this study, we use FGLS model to examine the eight macroeconomic determinants including economic growth, inflation, turnover ratio (TOR), corruption, stock market capitalization (SMC), stock market returns (SMR), and economic freedom of stock market volatility in major Central and Eastern European countries. The result of this study provides a comprehensive overview for the professionals, scholars, and policymakers of these countries to strengthen the market. Additionally, the outcome may be utilized to assist policymakers and stock market practitioners in precisely forecasting SMV.

The rest of this paper is organized as follows: Section 2 provides a literature review. Section 3 discusses our research methods. Section 4 presents the empirical results and discussion. Finally, Section 5 is our conclusion and recommendation.

LITERATURE REVIEW

In earlier studies, the researchers have taken only inflation, M2, CPI and GDP as macroeconomic determinants of SMV, even so the in recent researches started considering stock market indicators along with other determinants. In our study, we used both to

better understand the impact of those determinants on SMV in these countries.

There are several representative works on the subject for emerging and post-socialist countries. These studies examined a variety of macroeconomic drivers, including inflation, economic growth, interest rates, currency exchange rates, and trade openness; certain financial indicators, including financial freedom and SMRs; and other macroeconomic variables, such as corruption.

Numerous studies have examined changes in the collective volatility of the stock market. For example, Robert (1973) ties these shifts to macroeconomic indicators' volatility. According to Black (1976) and Christie (1982), financial leverage contributes to the explanation of this occurrence. Furthermore, several attempts have been made to link changes in stock market volatility to changes in projected stock returns, including those by Merton (1980), Pindyck (1984), Poterba and Summers (1986), French, Schwert, and Stambaugh (1987), Bollerslev, Engle, and Wooldridge (1988), and Abel (1988).

And Mascaro and Meltzer (1983) and Lauterbach (1989) establish a relationship between macroeconomic volatility and interest rates. Since then, academics and economists have been examining macroeconomic factors of stock market volatility.

Bekaert and Harvey (1997) investigated the market forces that cause capital market fluctuations in different countries with varying economies. They discovered that markets that are fully integrated are affected by international macroeconomic fundamentals at various times and periods, whereas markets that are segmented and operate at the local level is only affected by local market forces. These market forces cause stock returns to fluctuate, resulting in a volatile situation. Their study highlights how each capital market operated at the local level is affected by global capital markets and how this influence changes over time by analyzing the sources of variability in volatility separately.

Murinde and Poshakwale (2001) used daily indexes to investigate the main characteristics of stock market volatility in the emerging markets of European transition economies, such as Croatia, the Czech Republic, Hungary, Poland,

Russia, and Slovakia. They discovered nonlinearity and conditional heteroscedasticity in the stock markets of Poland and Hungary, reject the weekday effect, and demonstrate that the conditional volatility of the stock market index decreases more consistently in Poland than in Hungary.

Bekaert and Harvey (2003) examined the movement of capital uncertainty and investment performance in emerging markets, as well as the impact of exchange rate liberalization. They offered the compelling conclusion that capital markets in developed nations are less volatile than those in emerging economies. Additionally, they said that the capital market is impacted by price volatility, which results in a variation in the rate of return on securities. It is key research that establishes a relationship between macroeconomic fundamentals and stock market fluctuations and clarifies their impact on foreign portfolio volatility.

Diebold and Yilmaz (2008) pool data on GDP, consumption and inflation from 40 emerging and developed economies by combining the Schwert and Engle methodologies. By varying the frequency of observations (monthly, quarterly, and annual) and controlling one variable at a time, they discovered a positive relationship between the variables and also discovered that the relationship is unilateral: GDP volatility affects market volatility, but market volatility has no effect on GDP volatility.

Yu and Wen-jen (2012) investigated the impacts of macroeconomic variables on the stock market index in Poland in 2012 by using the GARCH or ARCH model. This article discovers that Poland's stock market index is positively correlated with industrial production or real GDP and the German stock market index, negatively correlated with the government borrowing/GDP ratio, the real interest rate, the nominal effective exchange rate, the expected inflation rate, and the euro area government bond yield, and exhibits a quadratic relationship with the M2/GDP ratio.

Several recent studies examined the impact of banking sector and stock market on financial market development, sustainability and economic growth. In particular, impact of banking sector of euro zone on the stock return

volatility (Niewinska, 2020), stock-bond market co-movement (Skintzi, 2018), bank concentration and stability (Yudaruddin, 2022). The studies revealed that bank concentration contributes negatively to the financial freedom and sustainability.

The most recent study by Yudaruddin (2022) reveal that an economic growth picked at highest rate in Central Asian countries like Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan and demonstrated 7 percent per year growth in 2000-2016, low stock market development and high bank concentration impacted in the financial stability as well as financial openness. The study concluded that higher concentration and well-capitalized banks increased financial stability however, it hindered as mentioned earlier financial freedom and stability.

Moreover, another research (Mahmoud , Mostafa , & Mahmoud, 2021) studied the effects of macro determinants like corruption, inflation, financial freedom, SMR, TOR to SMV in the case of the countries in Middle East region applied FGLS model . Also, we adopted the research model of this study and proposed to estimate the impact of macro determinants to SMV in the case of the post-socialist countries.

DATA AND METHODOLOGY

Initially, we decided to select 17 countries; however, due to the lack of data or missing data for the selected period of time we included only 11 countries in the study, including Bulgaria, Czechia, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Mongolia, Poland, Russia and Ukraine. We extracted out data for the target countries from the open sources like The Global Economy.com, The World Bank, Global Financial Development Database, Trading Economics Database, CEIC Database, Central Bank and Stock Exchange of the countries. Data used in the study and descriptions of each variable are briefly described below.

Table 1 shows the description of the variables used in this study. SMV is measured by stock price volatility and researchers tend to take it as dependent variable as measure only stock market trend of a country and estimate it in relation to the other factors present impacts.

Table 1. Description of the variables

Variables	Description
SMV	SMV is measured by stock price volatility; this is the standard deviation of the return on the national stock market index over a 360-day period.
EG	Economic growth is defined as the yearly percentage growth of GDP based on constant 2010 U.S. dollars.
INF	Inflation, as measured by the consumer price index, is the annual percentage change in the cost to the typical consumer of obtaining a basket of goods and services.
TOR	The turnover ratio is calculated as the value of traded domestic stocks divided by their market capitalization. The monthly average is multiplied by 12 to obtain the yearly figure.
COR	COR is the score for the freedom from corruption index. The estimate gives the country's score on the aggregate indicator, ranging from 0 to 100. Increased index values indicate less corruption.
SMC	SMC is calculated as the market capitalization to current GDP ratio.
SMR	Stock Market Return is the annualized growth rate of the stock market index. The yearly average stock market index was derived by averaging the daily stock market indices accessible through Bloomberg.
EF	Economic freedom is measured on a scale of 0 to 100, with 100 being the greatest degree of liberty.
Dummy variables	Economic downturn is defined by dummy variables. Estimation the year during economic downturn: 1 is taking for the years of economic down turn; others are indicated at 0 .

Therefore, we decided considering SMV along with other macroeconomic determinants in the case of the target countries. Moreover, we selected the following variables that repeatedly used by various researchers in the similar studies:

1. Economic growth
2. Inflation

Initially we considered including real interest rate as a variable, however due to lack of data for six countries we excluded it from further consideration. Additionally, the following stock market variables mainly used in the stock market trend estimation are included:

1. Stock market turnover ratio is the value of domestic shares traded divided by their market capitalization
2. Stock market return
3. SMC is defined as the market capitalization to current GDP ratio.

Other variables that are widely used in previous studies towards to SMV like COR index and Economic freedom is included in the study. Economic downturn worldwide greatly influenced the research outcomes, therefore we used dummy variables as they enable to represent multiple indicators by a single regression.

Methodology

This study covers that have stock markets and have relatively reasonable time series data related to the model variables. Our initial purpose was to cover all post-socialist countries but given that data from some countries is unavailable in time series, the sample includes only ten countries. The major reason underlying the choice of period was data availability and, more especially, on corruption and SMV indices. The key data on TOR, SMC, SMR and SMV were unavailable to obtain. Thus, the panel data, which ranges between 1995 to 2020, is unbalanced and, consequently, this study's data set consists of 147 yearly observations.

Therefore, our model is as shown in the following equation:

$$SMV_{i,t} = \alpha_1 EG_{i,t} + \alpha_2 INF_{i,t} + \alpha_3 TOR_{i,t} + \alpha_4 COR_{i,t} + \alpha_5 SMC_{i,t} + \alpha_6 SMR_{i,t} + \alpha_7 EF_{i,t} + \alpha_8 + \beta_1 EG_{i,t-1} + \beta_2 INF_{i,t-1} + \beta_3 TOR_{i,t-1} + \beta_4 COR_{i,t-1} + \beta_5 SMC_{i,t-1} + \beta_6 SMR_{i,t-1} + \beta_7 EF_{i,t-1} + \varepsilon_{it} \quad (1)$$

Where i denotes country, t denotes time and the ε_{it} is the error term of the estimated model. The parameters from α_1 to α_7 are the coefficients of the potential macro determinants of SMV at present time while the parameters β_1 to β_7 denote the coefficients of macro determinants of SMV with a first lag. Determinant α_8 is the dummy variable to calculate the economic downturn period.

Descriptive statistics of study variables are presented in Table 2 presents. According to the results in Table 2, standard deviation of inflation for Bulgaria is very high (202.85), while it is relatively high for Kazakhstan (32.71), Ukraine (71.32), Russia (38.79), which indicates the variability among countries. Corruption level is low and close to each other for most of the countries. But SMR value is high for Mongolia (45.93%), Kazakhstan (34.98%), while market return low for Ukraine (3.20%), Czechia (4.13%), Poland (6.96%). Market capitalization is resulted highest for Russia (41.53%), while markets of Czechia (21.38%), Hungary (20.23%), Kazakhstan (19.67%), Poland (25.44%) have relatively high market value. Market value is low for Latvia (5.33%), Mongolia (8.55%). The turnover rate is lower for all markets, as shown in Table 2.

Table 3. Descriptive statistics

Country	Variables															
	SMV		EG		INF		TOR		COR		SMC		SMR		EF	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All countries	26.46	19.11	3.33	4.87	14.71	68.36	0.23	0.28	0.24	0.79	18.02	12.53	19.07	52.14	0.01	0.03
Bulgaria	19.61	10.43	2.25	4.86	51.88	202.85	0.21	0.37	0.01	0.08	13.48	11.24	19.93	43.77	0.01	0.03
Czechia	19.84	7.48	2.48	3.08	3.35	2.88	0.47	0.20	0.01	0.07	21.38	7.22	4.13	22.66	0.00	0.02
Estonia	20.08	12.57	3.99	5.50	5.38	6.64	0.27	0.19	0.02	0.08	13.15	7.22	20.27	47.48	0.01	0.03
Hungary	24.79	8.69	2.30	2.91	7.07	6.86	0.62	0.30	-0.01	0.11	20.23	6.82	19.02	36.51	0.01	0.02
Kazakhstan	34.81	18.53	4.72	4.82	16.17	32.71	0.08	0.08	0.18	0.46	19.67	11.66	34.98	92.48	0.02	0.04
Latvia	19.34	9.30	3.74	5.57	5.05	5.95	0.04	0.07	0.37	1.05	5.33	2.80	15.37	24.69	0.01	0.03
Lithuania	14.33	6.46	4.11	4.88	4.95	8.55	0.05	0.09	0.41	1.02	13.20	8.30	16.15	32.71	0.02	0.03
Mongolia	47.39	40.43	5.79	4.59	10.75	10.51	0.02	0.03	0.36	1.04	8.55	3.79	45.93	97.09	0.00	0.04
Poland	25.86	8.45	3.95	2.10	5.24	6.57	0.40	0.13	0.42	1.01	25.44	11.89	6.96	24.12	0.01	0.03
Russia	37.07	21.33	2.56	4.56	22.50	38.79	0.39	0.16	0.44	1.01	41.53	12.23	23.33	40.24	0.01	0.04
Ukraine	29.53	12.01	0.80	6.81	29.48	71.32	0.02	0.02	0.44	1.02	17.67	13.66	3.20	43.16	0.01	0.05

Source: Calculated by the authors depending on the available data

Table 3 shows the pairwise correlation matrix for the model's explanatory variables. As shown by the results, there is a relatively low correlation between the explanatory variables or which suggests a low probability of multicollinearity. Moreover, it shows that SMC and INF have a weak correlation and other variables

demonstrate comparatively weak overly. *Correlation analysis and unit root test*

Table 4. Correlation matrix

	EG	INF	TOR	COR	SMC	SMR	EF
EG	1.00						
INF	-0.09	1.00					
TOR	0.30	-0.08	1.00				
COR	0.06	0.14	-0.05	1.00			
SMC	0.06	0.47	0.11	0.09	1.00		
SMR	-0.22	-0.01	0.14	-0.02	0.15	1.00	
EF	-0.13	-0.08	-0.12	0.01	-0.16	0.18	1.00

Source: Calculated by the authors depending on the available data

To detect a multicollinearity problem in regression analysis, the variance inflation factor (VIF) was employed. A VIF greater than 5 indicates a significant degree of correlation or the presence of the multicollinearity problem (Touny, 2014). In our study, all explanatory variables present less than 2 or it means no multicollinearity problem prevails in the model (Table 4).

The results of Fisher's test (Table 5), based on the p-values, granted that all series are fixed under the null hypothesis, as opposed to the alternative that at least one series in the panel is **fixed**. All four tests on panel unit root present rejection the null hypothesis for all series, which means at least one panel is **fixed** in the estimated model. This means all panels contain unit roots at 1% of significance or there are no unit roots in panels under the given test conditions.

Table 5. VIF test multicollinearity

<i>Variable</i>	<i>VIF</i>
EG	1.24
INF	1.06
TOR	1.21
COR	1.07
SMC	1.23
SMR	1.30
EF	1.02

Source: Calculated by the authors depending on the available data

Table 6. Fisher-type tests for panel unit root test

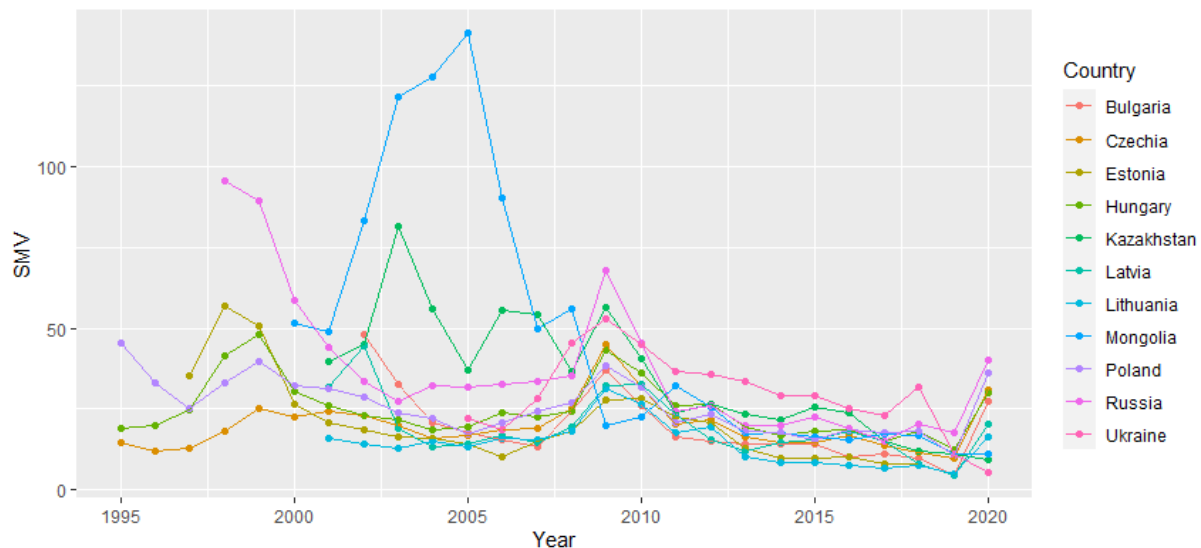
Ho: All panels contain unit roots	Number of panels=11							
Ha: At least one panel is stationary	Avg.number of periods= 22							
Panel means:	Drift term: Included							
Included								
Time trend: Not included								
<i>Fisher-type tests</i>								
Panel	P		Z		L*		Pm	
	<i>Statistic</i>	<i>P-value</i>	<i>Statistic</i>	<i>P-value</i>	<i>Statistic</i>	<i>P-value</i>	<i>Statistic</i>	<i>P-value</i>
EG	72.66	0.00	-5.59	0.00	-5.97	0.00	7.64	0.00
INF	173.82	0.00	-10.71	0.00	-14.67	0.00	22.89	0.00
TOR	74.37	0.00	-3.55	0.00	-5.42	0.00	7.89	0.00
COR	152.47	0.00	-10.15	0.00	-12.88	0.00	19.67	0.00
SMC	80.42	0.00	-5.28	0.00	-6.35	0.00	8.81	0.00
SMR	98.28	0.00	-7.02	0.00	-8.20	0.00	11.50	0.00
EF	129.01	0.00	-8.86	0.00	-10.88	0.00	16.13	0.00
SMV	77.64	0.00	0.00	0.00	-5.90	0.00	8.39	0.00

Source: Calculated by the authors depending on the available data

In our case, SMVs in a majority of target countries have common features, particularly in 1997, 2008 and 2020 when the financial markets were significantly influenced by the worldwide economic downturn (Figure 1). To estimate the

changes of the shock impact we used dummy variables. From our study, we observed that the shock impact started by changes in the stock market and the downturn itself continued locally for about 2-3 years.

Figure 1. Comparison of SMV by countries



Source: Author's finding

When we evaluated our model, we used FE and RE models. However, greater part of variables demonstrated insignificance. Therefore, we used FGLS developed by Hoechle (2007) and Reed and Ye (2011).

The result of FGLS model is described in Table 6. As proposed 1% significance level (when other independent variables remain constant) SMR, EF have a positive and significant effect on SMV. However, even INF, TOR and COR effects are negative, TOR with time lag has a strong and significant effect on SMV. According to the results, particularly dummy variables and 1 percent increase or 20.39 units of TOR with a time lag have strong and positive effect on SMV. Despite that 1% increase of SMR results in 0.50 point increase of SMV. Results of model estimation present that in any time EF has a strong effect on SMV.

Table 7. Result of the FGLS model

Number of obs=147		
Number of groups=11		
Dependent variables: SMV		
Variables	FGLS	
	Coeff.	P-value
INF_t	-0.19	0.00***
TOR_t	-4.07	0.00***
COR_t	-0.62	0.00***
SMR_t	0.03	0.00***
EF_t	22.44	0.00***
Dummy	8.63	0.00***
EG_{t-1}	-0.33	0.00***
TOR_{t-1}	20.39	0.00***
SMC_{t-1}	-0.20	0.00***
SMR_{t-1}	0.05	0.00***
EF_{t-1}	25.47	0.00***

*** Rejection of hypothesis is 0.1% of the significance level

In model evaluation, we used one data with the time lag and excluded all in significant variables to prevent heteroscedasticity and autocorrelation problems in the estimated models.

As it is shown in Table 7, the results presented efficient and reliable estimators that contain homoscedastic panels. No autocorrelation is

observed. The regression results confirm our hypotheses about the signs of the coefficient estimates. Studentized Breusch-Pagan test (1979) to reveal heteroscedasticity and proved to be homoscedastic. According to Breusch-Godfrey/Wooldridge test for serial correlation in panel models shows no autocorrelation is observed as we hypothesized. Our hypothesis supported.

Table 8. Goodness fit and diagnostic tests of the estimated models

Test	FGLS
<i>Multiple R-squared:</i>	0.50472
<i>Heteroscedasticity</i>	studentized Breusch-Pagan test BP = 8.6605, df = 10, p-value = 0.5646
<i>Autocorrelation</i>	Breusch-Godfrey/Wooldridge test for serial correlation in panel models F = 1.652, df1 = 8, df2 = 128, p-value = 0.1165

DISCUSSION

According to our study results, economic growth, stock market return has a positive effect, while stock market turnover ratio with a time lag and economic growth have a strong and positive effect on SMV all the time. On the other hand, in our case, inflation, corruption, and stock market turnover ratio is insignificant to SMV.

In one study, the estimation FGLS model results of indicated that inflation, corruption, stock MCR and TOR have positive and significant impacts on SMV, whereas economic growth, financial freedom and SMR have significant negative effects on SMV(Mahmoud , Mostafa , & Mahmoud, 2021).

The complete reverse results were found in the earlier study (Mahmoud , Mostafa , & Mahmoud, 2021), although similar methods were applied in the research. We assume that the cultural and socio-economical characteristics of the target countries may have had an impact on the results.

The characteristics such as low levels of market yields, liquidity, prevalence of corruption and low effect of macroeconomic determinants to SMV may prevail in these countries. Macro determinants of SMV in the case of Middle east, differs slightly, as it indicated in the above-mentioned research 1 % increase of Inflation resulted in 0.38-point increase in SMV and increasing transparency is suggested.

CONCLUSION AND RECOMMENDATION

The study aimed to research macroeconomic determinants to SMV in the case of 11 post-socialist countries covering time period from 1995 to 2020. Due to the lack of data not all 17 countries are included in the study as we proposed in the initial stage of the study.

We considered stock market volatility as the dependent variable and economic growth, inflation, stock market turnover ratio, stock market return, stock market capitalization, corruption, economic freedom, and real interest rate are considered as the independent variables, however, due to incompleteness of real interest rate data we considered other 8 variables for this study.

The estimation of FGLS model results show that economic growth, stock market return have a positive effect, while stock market turnover ratio with a time lag and economic growth have a strong and positive effect on SMV all the time. Moreover, dummy variables used for estimating economic downturn effects indicated a positive effect on SMV. On the other hand, in our case, inflation, corruption, and stock market turnover ratio have a negative effect or are insignificant to SMV. The remaining variables have no effect on SMV.

We concluded that there is a need to further this research by estimating the results for each country included in this research to better understand and reveal the stock market development in these countries.

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