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Stock market and economic growth in Eastern Europe

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Stock Market and Economic Growth in Eastern Europe

Maria A. Prats and Beatriz Sandoval

Abstract
A developed financial system is essential in a market economy. This paper studies the importance of the development of financial markets in general, and the stock market in particular, from the review of existing literature in the area of the relationship between financial development and economic growth, and especially, the link between the stock market and economic growth. Through an empirical analysis for six countries in Eastern Europe (Bulgaria, Slovakia, Hungary, Poland, Czech Republic and Romania) it is tried to show the link between the stock market development and economic growth in these countries from 1995 to 2012 in order to explain the transition processes, from communist to market economies, which began with the fall of the Berlin Wall in 1989. The results show evidence of Granger causality between economic growth variables and financial market variables.

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JEL F43 O16 G2
Keywords Economic growth; stock market; financial markets; financial development

Authors
Maria A. Prats, University of Murcia, Murcia, Spain, mprats@um.es
Beatriz Sandoval, ✉ University of Murcia, Murcia, Spain, beatriz.sandoval@um.es

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1. Introduction

Since the 20th century, especially the last decades, there has been a great interest in studying the relation between the financial system and the economic growth. There are numerous debates about the reasons of this relation and the role that the financial development has in the different financial institutions in the economic growth of a country. In particular, there has been a special interest in determining the role that the stock market has in this context, giving way to the implementation of an important theoretical and empirical framework in which the link between the stock market and the economic growth of a country or group of countries is analyzed.

In the same way, the economic growth has a lot of consideration for the institutions and the economic politics, since the concept of economic growth and the prosperity and wellbeing of a country are associated. In general, the growth rate of gross domestic product (GDP) is used as an economic growth indicator, while there is a broad debate on consideration of whether this is the best indicator of a country's well-being could be consideration of other non-material aspects, as indicated by Stiglitz, Sen and Fitoussi (2009). Despite this enriching and unfinished debate, economic growth continues to have a great importance for the prosperity of economy. For example, Sala-i-Martin (2006), states that there has been a greater poverty reduction precisely in those regions with a higher growth.

The relevant empirical studies on the subject show a positive relationship between financial development and economic growth. Thus, in the work of King and Levine (1993), Levine and Zervos (1998) and Rajan and Zingales (1998) among others, it is obtained evidence of this relationship.

Therefore, the objective of this paper is to review theoretical relationship between financial development and economic growth, and particularly, of the link between the stock market and economic growth, as well as an empirical study for six countries of Eastern Europe from 1995 until 2012, to try to get the link between the development of the stock market and economic growth in these countries.

This work will be structured as follows. Section 2 reviews the literature on the link between financial system and development, and more specifically, between economic growth and stock market. Section 3, discusses the characteristics and results of an empirical model, which attempts to demonstrate causality between variables of development of stock market and economic growth in six countries of Eastern Europe. Finally, set out the conclusions.

2. Theoretical framework

2.1 Literature review: financial system and economic growth

Gehringer (2013) defines the financial development such as improving the quality of financial transactions.

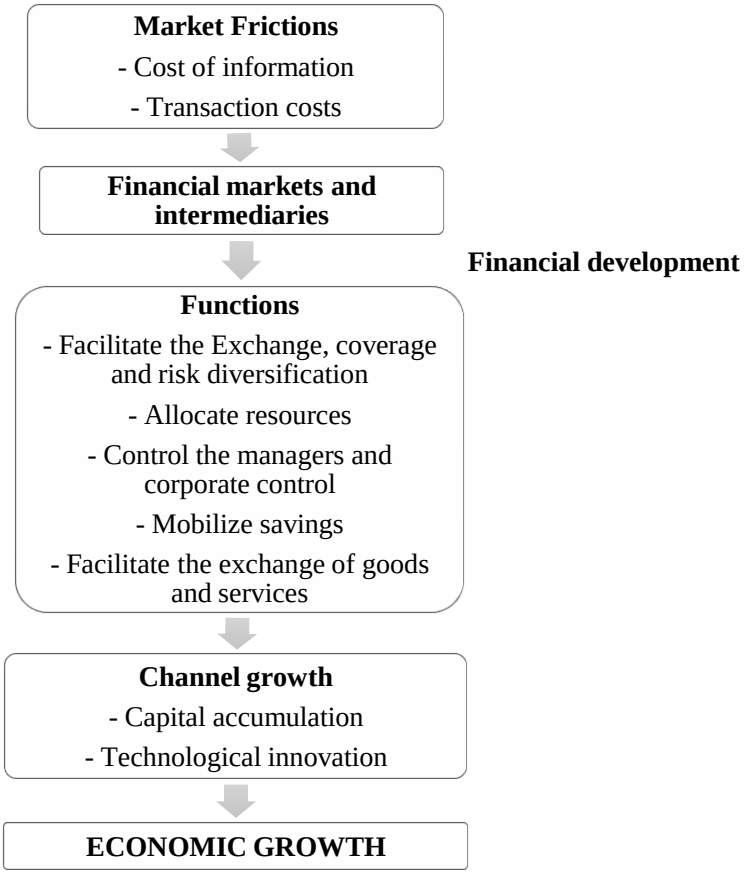
Levine (2004) extends this definition and points out that there is development finance when the intermediaries, markets and financial instruments improve (although

not necessarily deleted) information and transaction costs and, therefore, do better their corresponding work in terms of the performance of the functions of the financial markets.

However, indicators are needed to measure the financial development. The choice is a complex task, because there is not a single indicator. Some authors, such as Law and Singh (2013), only use indicators relating to banking activity, such as the volume of credit to the private sector or size of the liabilities. Other authors, like GoldSmith (1969), emphasize the role of financial intermediaries, using the value of the intermediated assets. King and Levine (1993), for example, use both types of indicators.

Levine (1997) carried out a theoretical approach since the emergence of the financial markets to economic growth. Firstly, he says that the costs of acquiring information and transactions created incentives for the emergence of financial markets and institutions. The degree of financial development affects the markets and institutions so that they can fulfil their functions correctly. Levine also indicates that the functions of the financial markets may affect economic growth through two channels: capital accumulation and technological innovation. It can be seen the process in the form of schema in Figure 1.

Figure 1. Theoretical approach financial markets and economic growth



Adapted from Levine (1997)

Joseph Schumpeter was the first author to highlight the role of financial intermediation[1]. Schumpeter (1911) notes that the services provided by financial intermediaries are essential for economic innovation, productive investment and economic growth.

The link between financial system and economic growth has been studied and analyzed empirically from the 20th century. Goldsmith (1969) was one of the first authors to demonstrate empirically the involvement between financial development and economic growth[2]. Goldsmith (1969) in a study for 35 countries between 1860 and 1963, uses the value of the assets intermediated as a percentage of GDP, as a proxy of financial development, under the assumption that the size of the financial sector is positively correlated with the provision and quality of its services. Goldsmith concludes that there is a parallel between economic growth and financial periods of several decades in development.

King and Levine (1993) examined data from 80 countries to study the relationship between financial development and long-term economic growth. These authors studied, for the period 1960-1989, the relationship between financial development and the growth rate of GDP per capita, the rate of capital accumulation and the rate of improvement of economic efficiency. Used to measure the level of financial development: the size of the financial intermediaries, i.e. the financial depth (the ratio of liquid liabilities of financial intermediaries and GDP); the importance of banks in relation to the Central Bank (i.e., the allocation of total domestic credit by the Central Bank and banks); the distribution of assets in the financial system, measured as the credit granted to private non-financial companies divided between the total credit (excluding the credit banks); and the credit granted to private non-financial companies divided between GDP. King and Levine found that higher levels of financial development are positively associated with higher rates of economic growth, of accumulation of physical capital and efficiency improvements. In addition, they also conclude that financial development is a good predictor of long-term growth in the next 10-30 years.

In addition to the relationship between financial development and economic growth, also has been investigated on what features of the financial system are more conducive to induce economic growth. There is much debate over whether the banking financial systems (bank-based) stimulate more economic growth than the market-based financial systems (market-based) and vice versa. Traditionally, Continental Europe is bank-based, United Kingdom and United States are market-based.

Authors who are inclined to a financial system bank-based, highlight the deficiencies that have capital markets to fulfil functions that have in the financial system, and as indicated in Levine (2004). For example, Stiglitz (1985) points out the inadequacies of the capital markets and indicates that banks can take large positions in a company with a controlled risk.

For authors who are in favour of a financial system market-based, Levine (2004), argue that in banks-based systems, these can have a great influence on the companies

[1] See Ferreira (2013)
[2] See Maudos and Fernández (2006)

and the influence can manifest itself to them in a negative way. Rajan (1992) indicates that the banks can monitor companies and control their investment decisions, and this can distort incentives from the company.

On the other hand, there are authors who argue that the two aspects of the financial system, bank-based and market-based, are complementary, and both contribute to economic growth. For example, Levine and Zervos (1998) conclude that development of banks and the liquidity of the stock market (both) are good predictors of economic growth, capital accumulation and productivity growth.

It should be noted that the regulation and the legal system, are essential for the proper functioning of the financial system. La Porta, Lopez de Silanes, Shleifer and Vishny (1997) analyze the legal system from 49 countries and found that there is great evidence that the legal system has effects on the size and breadth of the capital markets. These authors emphasize that countries with a protection of investors poorer (as measured by the legal nature of the standards and the quality of the law enforcement), have small capital markets.

The influence of the industrial sector in the financial system has also been studied. Carlin and Meyer (2003) using a sample of 27 industries in 14 countries of the OECD in the period 1970-1995, found a strong relationship between the structure of financial systems, the characteristics of the industries and the growth and investment industries. Rajan and Zingales (1998) conclude that the development *ex ante* of financial markets, facilitates growth *ex post* sectors dependent on external funding, so that financial markets and institutions reduce the external cost of financing companies.

Some authors also show that financial development without limit is not positive. For example, Law and Singh (2013) show that there is a threshold in the relationship finance-growth, which, up to a limit, the financial development is positive for economic growth, but once this limit is exceeded, the financial development is not translated into economic growth. But it should be noted that only authors use banking development indicators as measures of financial development and no indicator of the development of the stock market, for example.

2.2 Literature review: stock market and economic growth

As it says Wachtel (2003), the stock market always arouses great interest, since the evolution of the share prices of the companies listed, is available for all economic players. Wachtel maintains that while banks dominate finance in many places, and even in advanced industrialized countries, the stock market has much relevance for major inputs of capital through it, the liquidity that provides as well as source of information that improves the efficiency of financial intermediation, reference value, useful for investors and the company improving efficiency.

Caporale, Howells and Soliman (2004) indicate that the more efficient allocation of capital is achieved through the liberalization of financial markets, i.e., leaving the market to allocate capital. If the financial market is only composed of banks, an efficient allocation of capital due to the shortcomings in the financing of the debt, in the presence of asymmetric information could not be attained. Therefore, the development of stock

markets is necessary to achieve the overall efficiency in the allocation of capital. They also explain that while banks finance only "safe projects", stock markets can finance projects with risk and innovative. The authors point out that the main advantage of a stock market is that it is a liquid mechanism negotiation and pricing for a wide range of financial instruments. This allows diversification of risk and the adequacy of the preferences of maturity between savers and investors. They conclude that these characteristics conducive to investment and reduce capital costs, thus contributing to economic growth.

There are varied literature showing and empirically demonstrates the link between the stock market and economic growth. Some authors explain the link between the stock market and economic growth, using indicators of the development of the stock market and others (especially banking) as indicators of financial development. Others, use aspects only of the development of the stock market or other more specific aspects.

Garcia and Liu (1999) found that the level of real income, the saving rate, the development of financial intermediaries and the liquidity of the stock market are important predictors of market capitalization, while macroeconomic stability is not significant. The authors measure the liquidity of the stock market with the ratio of total negotiated value with respect to GDP and the turnover ratio (ratio between the total value of shares traded on the stock market and the market capitalization). They measure the development of financial intermediaries with the ratio of liabilities to GDP and domestic credit to the private sector divided by GDP. Inflation indicators are used to measure macroeconomic stability. For the study, the authors used a sample of 15 industrial and developed countries from 1980 to 1995. Its main findings are running a stock market more developed in East Asia than in Latin America due to sustained economic growth, a higher saving rate, a more liquid stock market and a more developed banking sector.

Mauro (2000), shows that there is a positive and significant correlation between GDP growth and lagged stock returns in several countries, including advanced countries with a developed stock market, and less advanced countries with a stock market still in development. The presence of this correlation in a variety of countries and at different stages of growth and financial development, suggests that the relationship is fairly robust, and that the stock prices should be considered in predictions of GDP in developing countries and developed. The characteristics that make the correlation between the product and the income from the shares stronger are: a high ratio of capitalization to GDP, a greater number of domestic companies that are listed and a system of regulation of the stock market of English origin.

Caporale et al. (2004), found a strong relationship between the development of the stock market and economic growth. They use data from 7 countries (Argentina, Chile, Greece, Korea, Malaysia, the Philippines and Portugal) from 1977 to 1998 and estimate a vector Autoregressive model (VAR). As indicator of development of the stock market use two indicators: the capitalization to GDP and the value of shares traded to GDP. They use GDP levels as a measure for economic growth.

Cavenaile, Gengenbach and Palm (2011) used a sample of 5 countries (Malaysia, Mexico, Nigeria, Philippines and Thailand) from 1997 to 2007 to demonstrate the link between economic growth and financial development. They use as indicators of the

development of the financial intermediaries, passive liquids to GDP, and the private credit on deposits of the banks in relation to GDP. As indicators of the financial markets use the capitalization of the stock market to GDP, the turnover (defined as the value of the traded shares national between the value of the shares publicly traded) and the value negotiated in the stock market to GDP. Economic growth is measured as the logarithm of GDP per capita in local currency. The authors conclude that there is a relationship between all the indicators of financial development and economic growth; and that if they focus on the vector of cointegration with economic growth as the explained variable, they are that in most cases, at least one indicator of financial development has a positive impact on economic growth in the long term.

Among the most relevant authors whose studies are the most significant to explain the relationship between the stock market and economic growth are Levine and Zervos.

Levine and Zervos (1996) show that there is a significant and positive correlation between the development of the stock market and the real per capita growth, being this significant relationship at the 5% level, by the estimate of a sample of 41 countries in the period 1976-1993 using instrumental variables. To measure the development of the stock market used indicators of size, liquidity and risk diversification. Specifically, ratio divided by GDP market capitalization they use to measure the size of the stock market. To measure the liquidity of the stock using the ratio of the total value negotiated in relation to GDP and the turnover ratio, defined as the total value of negotiations divided by market capitalization. As a diversification of risk use the multifactorial model *International Arbitrage Price Model*, -IAPM.

In another study, Levine and Zervos (1998) investigated empirically if indicators of the development of banks and stock market are jointly correlated with rates of growth present and future. They used data from 47 countries from 1976 until 1993 in an econometric study cross country. The authors found that the liquidity of the market, defined as the value of the traded shares national between the value of the shares publicly traded, is positively and significantly correlated with present and future rates of economic growth, capital accumulation and productivity growth. Furthermore, the level of development of the banks, measured as loans from the banks to the private sector between GDP, also is significant. The authors conclude that the development of banks and the liquidity of the stock market are (both) good predictors of economic growth, capital accumulation and productivity growth, on the other hand, other indicators of the stock market as volatility or the size of the market are less relevant.

There is a consensus on the indicators that measure the development of the stock market and, therefore, similar indicators are used in most of the literature.

To measure the size of the market of the stock market, commonly it is used market capitalization (Giannetti, Guiso, Japelli, Padula and Pagano, 2002). For these authors, a high market capitalization may be accompanied by low levels of activity, which can increase the risk premium that companies have to pay, because investors want to be compensated for the lack of liquidity of these assets.

For this reason, and complementing the indicator of size, are very important indicators of liquidity. The authors highlight that it is typically used as indicators of liquidity of the stock market, the total value of shares traded on the stock market, and

turnover ratio. The latter is defined as the ratio between the total value of shares traded on the stock market and market capitalization. This ratio measures the value of transactions in relation to the size of the market. Instead, Levine and Zervos (1998), use another definition of turnover to set it as the value of the domestic traded shares divided by the value of the shares publicly traded.

3. Empirical frame

3.1 The model and the countries

Bulgaria, Hungary, Poland, Czech Republic, Romania and Slovakia are the countries under study. All these countries have a common characteristic, they were socialist economies for several decades of the 20th century and formed the so-called Eastern bloc. According to Firtescu (2012), post-communist economies have had to confront a transition to become market economies. Therefore, it is interesting to consider whether the development of their financial systems, and especially their stock markets, has had impact on the economic growth of these countries[3].

For this purpose, it will analyze an econometric model with economic and financial variables, which intends to examine the relationship between all the variables, and if there is Granger causality especially, financial variables to economic variables, and also economic variables to financial variables and between financial variables. The economic variables used are gross domestic product (GDP) and foreign direct investment. The financial variables used are market capitalization, stock total traded value, and the turnover ratio. These last three, measure the development of the stock market.

Specifically, a vector Autoregressive model (VAR) with the aim of studying of Granger causality between the variables is estimated. The specification and monitoring of the model is based on Ake and Dehuan (2010), and Ake and Ognaligui (2010).

3.2 The data

The data sets of variables have been obtained from the World Bank database. The data are annual, and range from 1995 to 2012, in order to collect these Communist

[3] The activity of these stock markets was suspended after World War II and revived in the early 90s. Bulgarian Stock Exchange - Sofia was founded in 1914 and reopened its operations in 1991. Bratislava Stock Exchange (Slovakia) was created in 1991. Budapest Stock Exchange (Hungary) was founded in 1864 and re-established its activity in 1990. In Poland, the Warsaw Stock Exchange began its operations in 1817 and re-established its activity in 1990. Prague Stock Exchange (Czech Republic) began in 1871 and was restored in 1992. The beginnings of Bucharest Stock Exchange back to 1839 and reopened its activity in 1995.

countries transition to economies of market, initiated with the fall of the Berlin wall in 1989[4].

According to the World Bank, stock total traded value (current US $) is the value of shares traded. Turnover ratio is the value of domestic shares traded divided by their market capitalization. The value is annualized by multiplying the monthly average by 12[5]. This ratio shows if the market size corresponds to the value of the negotiations.

The data series for all countries are in Appendix 1.

3.3 Methodology

It will specify and estimate a vector Autoregressive model (VAR). On the application to financial and economic variables, the VAR model would follows, where the variables are endogenous and explained by the lags:

$$EG_t = \sum_{i=1}^{n} \alpha_i EG_{t-i} + \sum_{j=1}^{n} \beta_j SM_{t-j} + u_{1t} \quad (1)$$

$$SM_t = \sum_{i=1}^{n} \lambda_i SM_{t-i} + \sum_{j=1}^{n} \delta_j EG_{t-j} + u_{2t} \quad (2)$$

Where EG is economic growth and consists of variables that indicate economic growth: Gross domestic product (GDP) and Foreign direct investment (FDI). SM is stock market and consists of variables that denote development of the stock market: Market capitalization (MC), Stock total traded value (TTV) and Turnover ratio (TR).

There is a frequent change to transform the data into quartile data, by quadratic interpolation, so that the added data is the same as the sum of the un-added data.

Firstly, the existence of unit roots and the stationarity of the series of the different countries are studied. After a first graph analysis, we can sense that the series have a unit root (as they are highly persistent), as well as that some variables have an exponential attitude and abrupt changes. There are logarithmic corrections in GDP in all countries, foreign direct investment in Hungary and Romania, market capitalization in Slovakia and Romania, stock total traded value in Slovakia, Hungary, Poland and Czech Republic, and turnover ratio in Hungary and Czech Republic.

[4] Bulgaria becomes a democratic country in 1990 and adheres to the EU in 2007. Slovakia separated from the Czech Republic in 1993, is integrated into the EU in 2004 and is a member of EMU, with the euro as currency, since 2009. Hungary becomes a democratic country in 1989 and integrated into the EU in 2004. Poland begins the process of democratic transition in 1989 and joined the EU in 2004. Czech Republic separated from Slovakia in 1993, begins a democratic system 1989 and is integrated into the EU in 2004. Romania held the first free elections after communism in 1990 and adheres to the EU in 2007.

[5] Market capitalization is the share price times the number of shares outstanding (including their several classes) for listed domestic companies. Investment funds, unit trusts, and companies whose only business goal is to hold shares of other listed companies are excluded.

The existence of the unit roots and the order of integration of all of the variables are checked via the Ng-Perron test (2001), where the authors suggest using the MZα and Mzt statistics. Also, to evaluate the robustness of the results, the KPSS test is implemented: Kwiatkowski, Phillips, Schmidt and Schin (2001), in which the stationarity of the series is studied. The results point out that the series have unit roots and it is assumed that they are I(1), despite the ambiguity of some of the results in the test (see appendix 2).

The next step is to analyze the existence of cointegration, using the Johansen test (1991). According to the results of the trace statistic and the maximum eigenvalue statistic, the cointegration existence cannot be rejected, as it can be analyzed in appendix 3.

Next, after observing the presence of cointegration between the variables, the Granger causality is studied, by the VAR with the vector error correction, with the variables in differences. The estimated coefficients of VAR are not relevant for the object of this study, the remarkable is to analyze the link between the variables. Granger (1968) indicates that if a variable Y contains information in past terms that helps in the prediction X, and that information isn´t contained in any other series used, then Y Granger-causes X. This is a concept that is based on the predictability, on the capacity of a variable to help to predict another.

3.4 Results

The results of the countries that we object to the study are detailed in appendix 4. The main results are shown as follows:

	FINANCIAL VARIABLES GRANGER-CAUSE ECONOMIC VARIABLES					
	Market capitalization - GDP	**Market capitalization - FDI**	**Stock total traded value- GDP**	**Stock total traded value- FDI**	**Turnover ratio - GDP**	**Turnover ratio - FDI**
Bulgaria		X		X		
Slovakia			X			
Hungary	X	X		X		X**
Poland	X					
Czech Republic						
Romania			X		X	X**

	ECONOMIC VARIABLES GRANGER-CAUSE FINANCIAL VARIABLES					
	GDP - Market capitalization	**FDI - Market capitalization**	**GDP - Stock total traded value**	**FDI - Stock total traded value**	**GDP - Turnover ratio**	**FDI - Turnover ratio**
Bulgaria	X	X	X	X		
Slovakia	X	X				
Hungary		X			X**	
Poland	X**					
Czech Republic		X		X		X
Romania			X	X	X	X

	FINANCIAL VARIABLES GRANGER-CAUSE FINANCIAL VARIABLES	
	Stock total traded value- Market capitalization	**Market capitalizacion- Stock total traded value**
Bulgaria	X	X
Slovakia	X	
Hungary	X	
Poland		
Czech Republic		
Romania	X	

X denote significance at the 5% level, X** denote significance at the 10% level

It is able to see that in all countries, except for Czech Republic, at least one financial variable Granger-causes an economic variable, whether it is GDP or a direct foreign inversion. In Bulgaria, the market capitalization and the stock traded value Granger-cause the direct foreign inversion. In Slovakia, the stock traded value Granger-causes the GDP. In Hungary, the market capitalization helps to predict the GDP and the direct foreign inversion; the stock traded value and the turnover ratio (with a significant level of 10%) Granger-cause the direct foreign inversion. In Poland, the market capitalization Granger-causes the GDP. In Romania, the stock traded value helps to predict the GDP, as well as the turnover ratio Granger-causes the GDP and the direct foreign inversion (with a significant level of 10%).

Granger causality also exists in the inverse, economic variables Granger-cause financial variables. In Bulgaria, the GDP and the direct foreign inversion help to predict the market capitalization and the total stock traded value. In Slovakia, the GDP and the direct foreign inversion help to predict the market capitalization. In Hungary, the direct foreign inversion Granger-causes the market capitalization, and the GDP Granger-causes the turnover ratio (with a significant level of 10%). In Poland, the GDP helps to predict the market capitalization (with a significant level of 10%). In Czech Republic, the direct foreign inversion Granger-causes the market capitalization, the total stock traded value and the turnover ratio. And finally, in Romania, the GDP and the direct foreign inversion Granger-cause the total stock traded value and the turnover ratio.

Therefore, it is interesting to state the influence that the variables that indicate stock market growth between them, Granger causality between liquidity and size. The turnover ratio isn't taken into account because it is made up approximately by the other two indicators. In Bulgaria the total stock traded value Granger-causes the market

capitalization and vice versa. In Slovakia, Hungary and Romania, the total stock traded value Granger- causes the market capitalization only in this way.

Consequently, for this selection of countries from Eastern Europe, there is evidence that the Granger causality between the variable that indicate economic growth and those that note stock market growth and so then, the existence of a link between the stock market and the economic growth, like the connection between stock market growth variables have, in size as well as liquidity.

4. Conclusions

With this paper it was intended the theoretical and empirical analysis of the relation between the stock market and the financial system. Firstly, in the theoretical term, it can be stated the importance of the financial system in a developed economy. The literature was reviewed about how the financial system and the financial development affect the economic growth. There are a considerable number of authors that maintain that a very important relation between financial variables and economic growth exists.

Moreover, stock market is a fundamental variable in a financial system, so that literature was revised about the importance of the stock market in the economic growth, and the role of the stock market in the financial system, being the opinion positive about the union between stock market and financial growth.

Secondly, in the empirical term, it was tried to demonstrate the connection between the stock market growth variables and the economic growth in various countries. A selection of 6 countries from Eastern Europe were used: Bulgaria, Slovakia, Hungary, Poland, Czech Republic and Romania, from 1995 until 2012. As variables that explain the development of the stock market the market capitalization, the total stock traded and the turnover ratio were used. As variable characteristics of the economic growth, the GDP in current prices and the direct foreign inversion were used. The Granger causality was used to study these variables and has proven evidence of existing links between the stock market growth variables and the economic growth variables. In particular, the relation of the cause between the financial variables and the economic variables is higher in Bulgaria, Hungary and Romania.

The relation between financial variables and the economic growth of a country or group of countries has been analyzed more profoundly in the last decades of the 20th Century. There is still a long way to go in the investigation of financial variables that can influence in the economic growth of a country, such as financial and bank crisis or idiosyncratic aspects of the regulation and legal system.

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Appendix

Appendix 1. Data

Table 1.1: GDP (current US$)

	Bulgaria	Slovakia	Hungary	Poland	Czech Republic	Romania
1995	13 069 094 969.29	25 733 043 137.25	46 166 297 229.22	139 412 439 030.43	59 537 113 790.50	35 477 055 618.92
1996	10 110 256 626.47	27 821 913 814.96	46 448 783 683.45	157 079 211 268.13	66 775 128 782.90	35 333 677 695.26
1997	11 195 830 236.58	27 658 295 003.97	47 070 176 268.25	157 550 131 674.84	61 621 397 381.06	35 285 888 482.05
1998	14 631 307 232.61	29 821 795 502.85	48 548 470 549.82	173 337 544 225.13	66 372 663 111.10	42 115 494 069.27
1999	13 659 823 835.21	30 409 021 947.58	48 965 869 805.85	168 224 897 393.82	64 719 367 646.10	35 592 337 082.86
2000	13 353 530 517.12	29 110 067 256.31	47 110 416 254.45	171 708 027 298.23	61 474 265 134.54	37 305 099 928.16
2001	14 303 810 794.54	30 699 979 418.34	53 533 393 254.51	190 901 056 474.27	67 375 682 473.47	40 585 886 768.97
2002	16 343 311 506.98	35 144 769 433.47	67 366 285 758.61	198 679 176 378.61	81 696 693 249.30	45 988 510 813.50
2003	21 101 364 344.66	46 810 992 099.32	84 738 408 726.15	217 514 167 875.18	99 300 329 682.02	59 466 017 705.53
2004	25 919 754 936.19	57 329 422 647.13	103 156 817 854.87	253 525 770 715.54	118 976 254 632.83	75 794 733 525.14
2005	29 300 588 272.66	62 676 556 398.46	111 890 070 522.22	304 412 019 236.71	135 990 121 361.17	99 172 613 715.92
2006	33 649 638 299.24	70 450 243 382.26	114 238 447 644.85	343 338 920 225.63	155 213 120 558.22	122 695 850 811.98
2007	43 634 648 380.10	86 030 964 960.31	138 580 119 899.62	428 948 928 326.17	188 818 465 531.12	170 616 958 884.45
2008	53 316 401 914.59	99 832 535 520.73	156 578 897 625.60	530 185 123 692.51	235 205 271 893.00	204 338 605 783.71
2009	50 161 405 416.93	88 634 272 020.01	129 359 841 851.65	436 476 394 987.34	205 729 790 694.02	164 344 371 295.29
2010	48 669 060 511.71	89 011 919 205.30	129 585 601 615.85	476 687 891 752.07	207 016 402 026.36	164 792 252 745.52
2011	55 765 057 234.27	97 525 386 433.14	139 439 620 999.23	524 362 764 952.07	227 307 241 312.73	182 610 666 615.64
2012	52 588 115 104.13	92 746 685 082.87	126 824 840 351.69	496 205 742 361.43	206 751 372 749.33	169 396 055 590.80

Table 1.2: Foreign direct investment

	Bulgaria	Slovakia	Hungary	Poland	Czech Republic	Romania
1995	90 400 000.00	236 132 979.23	4 804 151 332.43	3 659 000 000.00	2 567 564 641.63	419 000 000.00
1996	109 000 000.00	350 826 240.04	3 288 936 448.52	4 498 000 000.00	1 435 279 128.15	263 000 000.00
1997	504 800 000.00	173 745 483.80	4 154 801 370.83	4 908 000 000.00	1 286 492 873.14	1 215 000 000.00
1998	537 317 256.15	562 131 586.61	3 343 000 955.27	6 365 000 000.00	3 700 169 387.63	2 031 000 000.00
1999	818 788 154.86	354 306 697.53	3 307 673 094.37	7 270 000 000.00	6 312 596 675.96	1 041 000 000.00
2000	1 001 503 842.00	2 052 480 853.38	2 770 479 254.39	9 343 000 000.00	4 987 079 129.26	1 037 000 000.00
2001	812 942 201.97		3 943 892 054.89	5 714 000 000.00	5 640 707 235.87	1 157 000 000.00
2002	904 659 791.09	4 104 198 575.64	3 012 851 827.59	4 131 000 000.00	8 496 609 035.78	1 144 000 000.00
2003	2 096 788 700.06	559 265 399.64	2 177 247 085.31	4 589 000 000.00	2 021 275 745.96	1 844 000 000.00
2004	2 662 208 755.84	3 037 419 118.60	4 281 793 078.60	12 716 000 000.00	4 977 795 183.34	6 443 000 000.00
2005	4 098 122 930.78	2 998 306 984.61	8 505 362 816.56	11 051 000 000.00	11 601 977 305.79	6 866 410 000.00
2006	7 874 476 255.43	4 071 689 261.05	18 678 720 024.69	21 518 000 000.00	5 521 761 930.77	11 450 830 000.00
2007	13 875 270 456.91	3 890 418 042.86	70 631 297 038.93	25 573 000 000.00	10 606 063 122.28	10 290 000 000.00
2008	10 296 720 633.72	4 076 009 620.85	75 013 000 490.33	15 031 000 000.00	6 572 516 198.39	13 849 000 000.00
2009	3 896 664 559.17	1 605 221 843.95	-2 967 152 013.42	14 388 000 000.00	2 868 837 936.81	4 926 000 000.00
2010	1 866 586 151.21	2 117 516 330.84	-20 933 508 134.17	17 074 000 000.00	6 119 064 333.97	3 204 000 000.00
2011	2 124 233 096.40	3 658 300 078.58	10 506 179 880.44	17 357 000 000.00	2 248 932 509.69	2 557 000 000.00
2012	1 578 342 035.79	1 527 246 239.89	10 586 972 839.56	6 701 000 000.00	7 975 891 701.12	2 629 000 000.00

Table 1.3: Market capitalization (current US$)

	Bulgaria	Slovakia	Hungary	Poland	Czech Republic	Romania
1995	61 000 000.00	1 235 000 000.00	2 399 000 000.00	4 564 000 000.00	15 664 000 000.00	100 000 000.00
1996	7 000 000.00	2 182 000 000.00	5 273 000 000.00	8 390 000 000.00	18 077 000 000.00	57 000 000.00
1997	2 000 000.00	1 826 000 000.00	14 975 000 000.00	12 135 000 000.00	12 786 000 000.00	627 000 000.00
1998	992 000 000.00	965 000 000.00	14 028 000 000.00	20 461 000 000.00	12 045 000 000.00	1 016 000 000.00
1999	706 269 000.00	1 060 000 000.00	16 317 414 700.00	29 576 801 900.00	11 796 462 500.00	873 085 600.00
2000	617 260 000.00	1 217 000 000.00	12 020 680 000.00	31 279 430 000.00	11 002 220 000.00	1 069 290 000.00
2001	504 790 000.00	1 557 510 000.00	10 366 870 000.00	26 016 530 000.00	9 331 180 000.00	2 124 010 000.00
2002	733 310 000.00	1 903 760 000.00	13 109 600 000.00	28 749 780 000.00	15 892 710 000.00	4 561 470 000.00
2003	1 755 120 000.00	2 779 050 000.00	16 729 200 000.00	37 164 660 000.00	17 662 620 000.00	5 584 370 000.00
2004	2 803 960 000.00	4 410 160 000.00	28 711 380 000.00	71 101 970 000.00	30 863 060 000.00	11 786 040 000.00
2005	5 085 590 000.00	4 392 720 000.00	32 575 660 000.00	93 873 380 000.00	38 345 150 000.00	20 587 850 000.00
2006	10 324 980 000.00	5 573 990 000.00	41 934 530 000.00	149 054 160 000.00	48 604 250 000.00	32 784 330 000.00
2007	21 792 990 000.00	6 971 300 000.00	47 651 140 000.00	207 321 870 000.00	73 420 080 000.00	44 925 260 000.00
2008	8 857 549 047.48	5 078 963 899.12	18 579 373 336.45	90 232 639 217.01	48 850 496 446.56	19 922 571 864.34
2009	7 103 248 309.76	4 672 202 935.36	28 288 046 219.45	135 277 059 782.03	52 687 966 785.73	30 324 651 895.32
2010	7 275 908 437.73	4 149 644 388.00	27 708 444 461.58	190 234 893 127.32	43 055 621 649.80	32 384 851 262.92
2011	8 253 157 431.69	4 736 353 990.89	18 772 961 554.57	138 246 241 209.10	38 352 335 114.71	21 196 718 000.00
2012	6 666 184 920.57	4 610 591 442.26	21 080 368 083.91	177 729 977 664.84	37 163 260 276.85	15 925 220 857.25

Table 1.4: Stock total traded value (current US$)

	Bulgaria	Slovakia	Hungary	Poland	Czech Republic	Romania
1995	4 000 000.00	832 000 000.00	355 000 000.00	2 770 000 000.00	3 630 000 000.00	1 000 000.00
1996	30 000.00	2 321 000 000.00	1 641 000 000.00	5 538 000 000.00	8 431 000 000.00	6 000 000.00
1997	0	2 155 000 000.00	7 472 000 000.00	7 951 000 000.00	7 071 000 000.00	268 000 000.00
1998	12 000 000.00	1 032 000 000.00	16 042 000 000.00	8 918 000 000.00	4 807 000 000.00	596 000 000.00
1999	53 500 000.00	473 680 000.00	14 395 000 000.00	11 149 210 000.00	4 120 000 000.00	316 690 000.00
2000	57 690 000.00	895 510 000.00	12 150 160 000.00	14 631 470 000.00	6 581 890 000.00	235 730 000.00
2001	70 070 000.00	965 530 000.00	4 818 220 000.00	7 432 150 000.00	3 349 100 000.00	255 770 000.00
2002	172 420 000.00	789 050 000.00	5 941 300 000.00	5 841 920 000.00	6 082 650 000.00	403 170 000.00
2003	196 890 000.00	664 380 000.00	8 299 590 000.00	8 497 910 000.00	8 796 630 000.00	442 490 000.00
2004	510 890 000.00	655 240 000.00	13 010 770 000.00	16 568 790 000.00	17 663 350 000.00	943 470 000.00
2005	1 388 390 000.00	69 060 000.00	23 910 860 000.00	29 973 950 000.00	41 040 170 000.00	3 398 550 000.00
2006	1 509 010 000.00	89 630 000.00	31 183 290 000.00	55 040 770 000.00	32 875 340 000.00	4 259 860 000.00
2007	5 497 850 000.00	30 000 000.00	47 496 610 000.00	84 568 110 000.00	41 934 340 000.00	8 094 680 000.00
2008	1 650 692 438.59	22 472 863.10	30 801 723 198.65	67 954 587 588.92	43 033 502 111.33	3 674 512 495.93
2009	400 594 001.77	175 108 053.33	25 939 676 645.61	55 778 243 711.21	20 606 185 636.08	1 884 584 680.07
2010	369 019 666.51	173 665 277.26	26 466 122 250.85	77 463 888 144.07	14 082 539 229.82	1 701 870 798.00
2011	319 590 203.70	269 393 320.97	19 489 849 298.55	95 893 641 578.44	15 471 448 710.99	3 202 573 990.78
2012	361 968 926.13	166 634 566.78	10 877 600 000.00	67 246 040 259.78	10 211 119 138.56	2 126 101 011.30

Table 1.5: Turnover ratio (%)

	Bulgaria	Slovakia	Hungary	Poland	Czech Republic	Romania
1995		71.5699	17.7544	72.6653	33.6049	1.3158
1996	0.0882	135.8502	42.7789	85.5025	49.9748	7.6433
1997	0.0000	107.5349	73.8048	77.4762	45.8219	78.3626
1998	2.4145	73.9520	110.6230	54.7184	38.7177	72.5502
1999	6.3005	46.7832	94.8743	44.5631	34.5616	33.5284
2000	8.7176	78.6570	85.7514	48.0854	57.7392	24.2723
2001	12.4896	69.6000	43.0437	25.9430	32.9419	16.0192
2002	27.8524	45.5931	50.6149	21.3340	48.2293	12.0611
2003	15.8244	28.3753	55.6295	25.7847	52.4306	8.7226
2004	22.4120	18.2284	57.2650	30.6074	72.8000	10.8630
2005	35.1957	1.5690	78.0291	36.3375	118.5991	20.9956
2006	19.5841	1.7986	83.7021	45.3146	75.6195	15.9628
2007	34.2354	0.4783	106.0362	47.4600	68.7311	20.8332
2008	10.7710	0.3730	93.0137	45.6754	70.3906	11.3327
2009	5.0197	3.5915	110.6939	49.4686	40.5879	7.5012
2010	5.1327	3.9372	94.5278	47.5951	29.4172	5.4278
2011	4.1160	6.0633	83.8608	58.3861	38.0097	11.9540
2012	4.8523	3.5655	54.5882	42.5640	27.0437	11.4547

Appendix 2. Ng-Perron test, KPSS test

Critical values Ng-Perron (modified Akaike)

Critical values constant, trend			Critical values constant		
	MZα	MZt		MZα	MZt
1%	-23.8	-3.42	1%	-13.8	-2.58
5%	-17.3	-2.91	5%	-8.1	-1.98
10%	-14.2	2.62	10%	-5.7	-1.62

Critical values KPSS

Critical values constant, trend		Critical values constant	
1%	0.216000	1%	0.739000
5%	0.146000	5%	0.463000
10%	0.119000	10%	0.347000

* denote significance at the 1% level, and ** denote significance at the 10% level

2.1: Bulgaria tables

Table 2.1.1: Ng-Perron I(0) vs. I(1)

	MZα	**MZt**	**H0: Unit root**	
LGDP	-5.61896	-1.65726	YES	Constant, trend
FDI	-10.7238	-2.31544	YES *	Constant
MC	-5.32397	-1.60924	YES	Constant
TTV	-4.12845	-1.43637	YES	Constant
TR	-9.12374	-2.13578	YES *	Constant

Table 2.1.2: KPSS I(0) vs. I(1)

	LM-Stat	**H0: Stationarity**	
LGDP	0.143220	NO**	Constant, trend
FDI	0.413101	NO**	Constant
MC	0.670893	NO	Constant
TTV	0.308811	YES	Constant
TR	0.268601	YES	Constant

Table 2.1.3: Ng-Perron I(1) vs. I(2)

	MZα	**MZt**	**H0: Unit root**	
ΔLGDP	-0.67486	-0.32898	YES	Constant, trend
ΔFDI	-11.9109	-2.43515	NO	Constant
ΔMC	-23.7041	-3.43213	NO	Constant
ΔTTV	-26.6841	-3.6526	NO	Constant
ΔTR	-1.39845	-0.83415	YES	Constant

Table 2.1.4: KPSS I(1) vs. I(2)

	LM-Stat	**H0: Stationarity**	
ΔLGDP	0.167205	YES	Constant, trend
ΔFDI	0.120835	YES	Constant
ΔMC	0.069407	YES	Constant
ΔTTV	0.053547	YES	Constant
ΔTR	0.124632	YES	Constant

2.2: Slovakia tables

Table 2.2.1: Ng-Perron I(0) vs. I(1)

	MZα	**MZt**	**H0: Unit root**	
LGDP	-3.48701	-1.18662	YES	Constant, trend
FDI	-5.46353	-1.63271	YES	Constant
LMC	-2.58535	-1.00223	YES	Constant
LTTV	-6.24993	-1.70943	YES	Constant
TR	-1.58984	-0.75006	YES	Constant

Table 2.2.2: KPSS I(0) vs. I(1)

	LM-Stat	**H0: Stationarity**	
LGDP	0.13562	NO**	Constant, trend
FDI	0.648483	NO	Constant
LMC	0.124946	YES	Constant
LTTV	0.683055	NO	Constant
TR	0.845068	NO	Constant

Table 2.2.3: Ng-Perron I(1) vs. I(2)

	MZα	MZt	H0: Unit root	
ΔLGDP	-10905.5	-73.8397	NO	Constant, trend
ΔFDI	-27.8015	-3.59967	NO	Constant
ΔLMC	-3.18526	-1.23233	YES	Constant
ΔLTTV	-14.0538	-2.6104	NO	Constant
ΔTR	-39.7555	-4.43752	NO	Constant

Table 2.2.4: KPSS I(1) vs. I(2)

	LM-Stat	H0: Stationarity	
ΔLGDP	0.162065	YES	Constant, trend
ΔFDI	0.140987	YES	Constant
ΔLMC	0.068165	YES	Constant
ΔLTTV	0.08305	YES	Constant
ΔTR	0.112441	YES	Constant

2.3: Hungary tables

Table 2.3.1: Ng-Perron I(0) vs. I(1)

	MZα	MZt	H0: Unit root	
LGDP	-1.46276	-0.61125	YES	Constant, trend
LFDI	-8.75441	-2.08409	YES *	Constant
MC	-3.38365	-1.23239	YES	Constant
LTTV	-0.65352	-0.51836	YES	Constant
LTR	-1.67812	-0.88904	YES	Constant

Table 2.3.2: KPSS I(0) vs. I(1)

	LM-Stat	H0: Stationarity	
LGDP	0.149117	NO	Constant, trend
LFDI	0.522696	NO	Constant
MC	0.610271	NO	Constant
LTTV	0.636516	NO	Constant
LTR	0.349994	NO**	Constant

Table 2.3.3: Ng-Perron I(1) vs. I(2)

	MZ*α*	MZt	H0: Unit root	
∆LGDP	-1418.43	-26.6193	NO	Constant, trend
∆LFDI	-26.8942	-3.62581	NO	Constant
∆MC	-7.18121	-1.85144	NO**	Constant
∆LTTV	-0.21431	-0.28896	YES	Constant
∆LTR	1.16663	0.91084	NO	Constant

Table 2.3.4: KPSS I(1) vs. I(2)

	LM-Stat	H0: Stationarity	
∆LGDP	0.183015	YES	Constant, trend
∆LFDI	0.102778	YES	Constant
∆MC	0.092118	YES	Constant
∆LTTV	0.216974	YES	Constant
∆LTR	0.503286	NO*	Constant

2.4: Poland tables

Table 2.4.1: Ng-Perron I(0) vs. I(1)

	MZ*α*	MZt	H0: Unit root	
LGDP	-2.43903	-0.99861	YES	Constant, trend
FDI	-13.3778	-2.5612	YES *	Constant
MC	1.03216	0.59439	YES	Constant
LTTV	-1.2248	-0.61153	YES	Constant
TR	-6.12775	-1.64087	YES	Constant

Table 2.4.2: KPSS I(0) vs. I(1)

	LM-Stat	H0: Stationarity	
LGDP	0.146531	NO	Constant, trend
FDI	0.64507	NO	Constant
MC	1.005117	NO	Constant
LTTV	0.996964	NO	Constant
TR	1.005117	NO	Constant

Table 2.4.3: Ng-Perron I(1) vs. I(2)

	MZ*α*	MZt	H0: Unit root	
∆LGDP	-395.989	-14.0558	NO	Constant, trend
∆FDI	-15.3761	-2.49525	NO	Constant
∆MC	-24.9127	-3.44579	NO	Constant
∆LTTV	0.68537	0.30042	YES	Constant
∆TR	-24.9127	-3.44579	NO	Constant

Table 2.4.4: KPSS I(1) vs. I(2)

	LM-Stat	H0: Stationarity	
∆LGDP	0.121182	YES	Constant, trend
∆FDI	0.222215	YES	Constant
∆MC	0.055573	YES	Constant
∆LTTV	0.220098	YES	Constant
∆TR	0.100767	YES	Constant

2.5: Czech Republic tables

Table 2.5.1: Ng-Perron I(0) vs. I(1)

	MZ*α*	MZt	H0: Unit root	
LGDP	-14.4756	-2.61849	YES	Constant, trend
FDI	0.66219	0.36636	YES	Constant
MC	-11.5232	-2.36693	YES *	Constant
LTTV	-1.56009	-0.83183	YES	Constant
LTR	-3.52719	-1.26742	YES	Constant

Table 2.5.2: KPSS I(0) vs. I(1)

	LM-Stat	H0: Stationarity	
LGDP	0.145809	NO**	Constant, trend
FDI	0.383929	NO**	Constant
MC	0.783015	NO	Constant
LTTV	0.687203	NO	Constant
LTR	0.204074	YES	Constant

Table 2.5.3: Ng-Perron I(1) vs. I(2)

	MZα	MZt	H0: Unit root	
ΔLGDP	-123.562	-7.82907	NO	Constant, trend
ΔFDI	-974.821	-22.0415	NO	Constant
ΔMC	-1.81067	-0.94405	YES	Constant
ΔLTTV	0.72675	1.23296	NO	Constant
ΔLTR	1.56317	1.0955	NO	Constant

Table 2.5.4: KPSS I(1) vs. I(2)

	LM-Stat	H0: Stationarity	
ΔLGDP	0.166165	YES *	Constant, trend
ΔFDI	0.052881	YES	Constant
ΔMC	0.12042	YES	Constant
ΔLTTV	0.366279	YES	Constant
ΔLTR	0.32826	YES	Constant

2.6: Romania tables

Table 2.6.1: Ng-Perron I(0) vs. I(1)

	MZα	MZt	H0: Unit root	
LGDP	-3.75909	-1.21854	YES	Constant, trend
LFDI	-2.7025	-1.12195	YES	Constant
LMC	-0.18062	-0.14555	YES	Constant
TTV	-10.5067	-2.29077	YES *	Constant
TR	-5.3556	-1.61265	YES	Constant

Table 2.6.2: KPSS I(0) vs. I(1)

	LM-Stat	H0: Stationarity	
LGDP	0.146628	NO	Constant, trend
LFDI	0.709273	NO	Constant
LMC	1.037904	NO	Constant
TTV	0.565784	NO	Constant
TR	0.355655	NO**	Constant

Table 2.6.3: Ng-Perron I(1) vs. I(2)

	MZα	**MZt**	**H0: Raíz Unitaria**	
ΔLGDP	-793.651	-19.9154	NO	Constant, trend
ΔLFDI	-4.70201	-1.48115	YES	Constant
ΔLMC	0.13084	0.2072	NO	Constant
ΔTTV	-17.1987	-2.87462	NO	Constant
ΔTR	0.19739	0.33386	YES	Constant

Table 2.6.4: KPSS I(1) vs. I(2)

	LM-Stat	**H0: Stationarity**	
ΔLGDP	0.194187	YES *	Constant, trend
ΔLFDI	0.111422	YES	Constant
ΔLMC	0.212943	YES	Constant
ΔTTV	0.096074	YES	Constant
ΔTR	0.074641	YES	Constant

Appendix 3. Johansen cointegration test

Critical values from Osterwald-Lenum (1992)

Table 3.1: Bulgaria Johansen cointegration test

Hypothesized No. of CE(s)	**Trace statistic**	**5% critical value**	**1% critical value**	**Max-Eigen statistic**	**5% critical value**	**1% critical value**
None	207.9207	77.74	85.78	119.8636	36.41	41.58
At most 1	88.05710	54.64	61.24	47.18616	30.33	35.68
At most 2	40.87094	34.55	40.49	26.67536	23.78	28.83
At most 3	14.19558	18.17	23.46	8.239146	16.87	21.47
At most 4	5.956435	3.74	6.40	5.956435	3.74	6.40
Trace test indicates 3 cointegrating equation(s) at both 5% and 1% levels				Max-eigenvalue test indicates 3 cointegrating equation(s) at the 5% level. Max-eigenvalue test indicates 2 cointegrating equation(s) at the 1% level		

Table 3.2: Slovakia Johansen cointegration test

Hypothesized No. of CE(s)	Trace statistic	5% critical value	1% critical value	Max-Eigen statistic	5% critical value	1% critical value
None	177.1452	77.74	85.78	96.75905	36.41	41.58
At most 1	80.38614	54.64	61.24	53.22919	30.33	35.68
At most 2	27.15695	34.55	40.49	17.15448	23.78	28.83
At most 3	10.00247	18.17	23.46	6.371541	16.87	21.47
At most 4	3.630934	3.74	6.40	3.630934	3.74	6.40
Trace test indicates 2 cointegrating equation(s) at both 5% and 1% levels				Max-eigenvalue test indicates 2 cointegrating equation(s) at both 5% and 1% levels		

Table 3.3: Hungary Johansen cointegration test

Hypothesized No. of CE(s)	Trace statistic	5% critical value	1% critical value	Max-Eigen statistic	5% critical value	1% critical value
None	213.543	77.74	85.78	109.8649	36.41	41.58
At most 1	103.6781	54.64	61.24	58.02699	30.33	35.68
At most 2	45.65108	34.55	40.49	25.66966	23.78	28.83
At most 3	19.98143	18.17	23.46	10.89217	16.87	21.47
At most 4	9.089253	3.74	6.40	9.089253	3.74	6.40
Trace test indicates 5 cointegrating equation(s) at the 5% level. Trace test indicates 3 cointegrating equation(s) at the 1% level				Max-eigenvalue test indicates 3 cointegrating equation(s) at the 5% level. Max-eigenvalue test indicates 2 cointegrating equation(s) at the 1% level		

Table 3.4: Poland Johansen cointegration test

Hypothesized No. of CE(s)	Trace statistic	5% critical value	1% critical value	Max-Eigen statistic	5% critical value	1% critical value
None	135.5990	77.74	85.78	60.51536	36.41	41.58
At most 1	75.08367	54.64	61.24	38.34305	30.33	35.68
At most 2	36.74062	34.55	40.49	25.63948	23.78	28.83
At most 3	11.10114	18.17	23.46	9.957158	16.87	21.47
At most 4	1.143984	3.74	6.40	1.143984	3.74	6.40
Trace test indicates 3 cointegrating equation(s) at the 5% level. Trace test indicates 2 cointegrating equation(s) at the 1% level				Max-eigenvalue test indicates 3 cointegrating equation(s) at the 5% level. Max-eigenvalue test indicates 2 cointegrating equation(s) at the 1% level		

Table 3.5: Czech Republic Johansen cointegration test

Hypothesized No. of CE(s)	Trace statistic	5% critical value	1% critical value	Max-Eigen statistic	5% critical value	1% critical value
None	182.7942	77.74	85.78	87.45159	36.41	41.58
At most 1	95.34256	54.64	61.24	64.80216	30.33	35.68
At most 2	30.54040	34.55	40.49	18.58526	23.78	28.83
At most 3	11.95514	18.17	23.46	10.12627	16.87	21.47
At most 4	1.828865	3.74	6.40	1.828865	3.74	6.40
Trace test indicates 2 cointegrating equation(s) at both 5% and 1% levels				Max-eigenvalue test indicates 2 cointegrating equation(s) at both 5% and 1% levels		

Table 3.6: Romania Johansen cointegration test

Hypothesized No. of CE(s)	Trace statistic	5% critical value	1% critical value	Max-Eigen statistic	5% critical value	1% critical value
None	207.5912	68.52	76.07	128.8916	33.46	38.77
At most 1	78.69957	47.21	54.46	39.29610	27.07	32.24
At most 2	39.40346	29.68	35.65	28.54123	20.97	25.52
At most 3	10.86224	15.41	20.04	7.209000	14.07	18.63
At most 4	3.653238	3.76	6.65	3.653238	3.76	6.65
Trace test indicates 3 cointegrating equation(s) at both 5% and 1% levels				Max-eigenvalue test indicates 3 cointegrating equation(s) at both 5% and 1% levels		

Appendix 4. Granger causality test

Null hypothesis is no Granger causality

** denote significance at the 10% level

Table 4.1: Bulgaria Granger causality test

	p-value	Granger causality
ΔMC Granger-cause ΔGDP	0.9458	NO
ΔTTV Granger-cause ΔGDP	0.9747	NO
ΔTR Granger-cause ΔGDP	0.9878	NO
ΔMC Granger-cause ΔFDI	0.0000	YES
ΔTTV Granger-cause ΔFDI	0.0003	YES
ΔTR Granger-cause ΔFDI	0.3619	NO
ΔTTV Granger-cause ΔMC	0.0000	YES
ΔGDP Granger-cause ΔMC	0.022	YES
ΔFDI Granger-cause ΔMC	0.0000	YES
ΔMC Granger-cause ΔTTV	0.0000	YES
ΔGDP Granger-cause ΔTTV	0.0091	YES
ΔFDI Granger-cause ΔTTV	0.0000	YES
ΔGDP Granger-cause ΔTR	0.9981	NO
ΔFDI Granger-cause ΔTR	0.9387	NO

Table 4.2: Slovakia Granger causality test

	p-value	Granger causality
ΔMC Granger-cause ΔGDP	0.7952	NO
ΔTTV Granger-cause ΔGDP	0.0102	YES
ΔTR Granger-cause ΔGDP	0.9693	NO
ΔMC Granger-cause ΔFDI	0.8855	NO
ΔTTV Granger-cause ΔFDI	0.8567	NO
ΔTR Granger-cause ΔFDI	0.9455	NO
ΔTTV Granger-cause ΔMC	0.0444	YES
ΔGDP Granger-cause ΔMC	0.0105	YES
ΔFDI Granger-cause ΔMC	0.0384	YES
ΔMC Granger-cause ΔTTV	0.6992	NO
ΔGDP Granger-cause ΔTTV	0.8291	NO
ΔFDI Granger-cause ΔTTV	0.8067	NO
ΔGDP Granger-cause ΔTR	0.1172	NO
ΔFDI Granger-cause ΔTR	0.9785	NO

Table 4.3: Hungary Granger causality test

	p-value	Granger causality
ΔMC Granger-cause ΔGDP	0.0000	YES
ΔTTV Granger-cause ΔGDP	0.3916	NO
ΔTR Granger-cause ΔGDP	0.7048	NO
ΔMC Granger-cause ΔFDI	0.0039	YES
ΔTTV Granger-cause ΔFDI	0.0056	YES
ΔTR Granger-cause ΔFDI	0.0561	YES **
ΔTTV Granger-cause ΔMC	0.0003	YES
ΔGDP Granger-cause ΔMC	0.8297	NO
ΔFDI Granger-cause ΔMC	0.0055	YES
ΔMC Granger-cause ΔTTV	0.6010	NO
ΔGDP Granger-cause ΔTTV	0.3355	NO
ΔFDI Granger-cause ΔTTV	0.3828	NO
ΔGDP Granger-cause ΔTR	0.0055	YES **
ΔFDI Granger-cause ΔTR	0.8297	NO

Table 4.4: Poland Granger causality test

	p-value	Granger causality
ΔMC Granger-cause ΔGDP	0.0000	YES
ΔTTV Granger-cause ΔGDP	0.7778	NO
ΔTR Granger-cause ΔGDP	0.8048	NO
ΔMC Granger-cause ΔFDI	0.9669	NO
ΔTTV Granger-cause ΔFDI	0.8899	NO
ΔTR Granger-cause ΔFDI	0.9470	NO
ΔTTV Granger-cause ΔMC	0.8749	NO
ΔGDP Granger-cause ΔMC	0.0900	YES **
ΔFDI Granger-cause ΔMC	0.9373	NO
ΔMC Granger-cause ΔTTV	0.1131	NO
ΔGDP Granger-cause ΔTTV	0.16	NO
ΔFDI Granger-cause ΔTTV	0.1778	NO
ΔGDP Granger-cause ΔTR	0.7032	NO
ΔFDI Granger-cause ΔTR	0.5787	NO

Table 4.5: Czech Republic Granger causality test

	p-value	Granger causality
ΔMC Granger-cause ΔGDP	0.6515	NO
ΔTTV Granger-cause ΔGDP	0.7765	NO
ΔTR Granger-cause ΔGDP	0.6641	NO
ΔMC Granger-cause ΔFDI	0.1221	NO
ΔTTV Granger-cause ΔFDI	0.8033	NO
ΔTR Granger-cause ΔFDI	0.2628	NO
ΔTTV Granger-cause ΔMC	0.2788	NO
ΔGDP Granger-cause ΔMC	0.3504	NO
ΔFDI Granger-cause ΔMC	0.0006	YES
ΔMC Granger-cause ΔTTV	0.1885	NO
ΔGDP Granger-cause ΔTTV	0.7060	NO
ΔFDI Granger-cause ΔTTV	0.0281	YES
ΔGDP Granger-cause ΔTR	0.6278	NO
ΔFDI Granger-cause ΔTR	0.0416	YES

Table 4.6: Romania Granger causality test

	p-value	Granger causality
ΔMC Granger-cause ΔGDP	0.8149	NO
ΔTTV Granger-cause ΔGDP	0.0010	YES
ΔTR Granger-cause ΔGDP	0.0141	YES
ΔMC Granger-cause ΔFDI	0.6019	NO
ΔTTV Granger-cause ΔFDI	0.2688	NO
ΔTR Granger-cause ΔFDI	0.0553	YES **
ΔTTV Granger-cause ΔMC	0.0000	YES
ΔGDP Granger-cause ΔMC	0.8015	NO
ΔFDI Granger-cause ΔMC	0.2798	NO
ΔMC Granger-cause ΔTTV	0.7129	NO
ΔGDP Granger-cause ΔTTV	0.0126	YES
ΔFDI Granger-cause ΔTTV	0.0013	YES
ΔGDP Granger-cause ΔTR	0.0003	YES
ΔFDI Granger-cause ΔTR	0.0141	YES

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