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DO STOCK MARKETS HAVE ANY IMPACT ON REAL ECONOMIC ACTIVITY?

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Abstract

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There is no doubt about the existence of connection between the stock markets and the real economic activity. Many researchers indicated that the stock markets causally affect the economic activity with the lag of three months. Contrary, the other group of researchers suggested, that these relationships are reversal, moreover some of them concluded that these relationships are reciprocal. The paper analyses the relationship between the stock markets and the economic activity in seven countries with the research objective to identify these relationships in relation of cause and effect. As the proxy of the stock markets are stock indices considered, while the economic activity is expressed by the Gross Domestic Product at constant prices. The correlation analysis and the Granger causality test applied on suggested vector autoregressive models are employed for the research in the paper. The paper concludes that stock markets may be considered as the significant predictor of the real economic activity with the lag of one quarter, however, there is no reciprocal links between them.

Keywords: economic activity, correlations analysis, the Granger causality, gross domestic product, mutual and unilateral relations, stock indices, stock markets, vector autoregressive models

INTRODUCTION

It is unquestionable that the stock markets are closely linked with the real economic activity throughout a variety of channels. However, the direction of these links is not clearly identified by the theory. For example, Morck *et al*. (1990) identified five main channels of the relation between stock prices and the real economic activity. Their results are supported by the fact that the investment decisions of managers of big corporations are influenced by the information provided by the stock markets. Moreover, they also indicated that stock prices reflect the present value of paid dividends in the future.

A number of different claims about the relationship between stock markets and the economic activity were provided empirically. Some researchers (Fama, 1981; Schwert, 1990; Mauro, 1995) confirmed the existence of this relationship, contrary the other group of researchers (Binswanger, 2000 and 2004; Mao and Wu, 2007) argued that any possible relationships between stock markets and the economic activity were breached at the beginning of the eighties of 20 century and therefore any change in stock prices cannot be explained on the basis of changes in the economy. In a number of studies are also analysed the causal relationships between the stock markets and the economy. Demetriades and Adriánová (2003) evaluated the direction of these causal links. One possibility is that the financial market reacts to the economic development of a respective country. If the real economy grows, the volume of savings in the financial system grows as well. Thus, the financial system is able to provide more financial sources to those who need them. The other possibility is that the well-functioning financial market stimulates the economic growth. In accordance to these two different possible links reciprocal causal relationships may be expected. However, any causal effect of financial markets on the economic activity were not unambiguously proved. This is probably caused by many factors which may be as follows: investments into unproductive activities as the result of microeconomic inefficiency of the banking system whereas the banks are unable

to solve the problems with the transmission of information quickly and effectively. An alternative explanation for inefficiency of banking activities may be the inappropriate political interference in the banking system. The causal effect of the financial market on the economic development may also indicate some macroeconomic problems, such as a high degree of political or economic uncertainty appearing for example in the form of unpredictable inflation.

Many authors focused on the analysis of the causal relationships between financial markets and the economy within one country rather than within multiple set of countries. Mao and Wu (2007) identified a long-term mutual causal relationship between the Australian stock market and the economic activity, while Fama (1990), Schwert (1990) and Mauro (1995) argued that increasing performance of the stock markets may have beneficial effects for the enhancing of economic efficiency. However, studies employing the Norwegian (Gjerde and Saettem, 1999) or the Korean data (Know and Shin, 1999) rejected that the economic output is determined by the efficiency on the stock market.

In general, the results of researchers employing the data of one country differ according to the economic development of a respective country. For example, Kaplan (2008) employing the Turkish data identified a long-term relationship between the stock market and the economy and proved that the stock market has the causal effect on the economic output. Based on his results the stock market may be considered as the main determinant of the future economic activity. Adamopoulos (2010) analysing the relationship between the German economy and the stock market concluded similarly. However, the results of Kaplan study (2008) were refused by more recent study of Goktas and Hepsag (2011). They confirmed the existence of a causal relationship between stock market's outputs and the economic activity with the lag of six months, however the identified direction is from the economy to the stock market output These controversial results may be caused by different methodology; since Goktas and Hepsag (2011) took into consideration the seasonal behaviour of the time series and therefore utilized the HEGY seasonal unit root test, while Kaplan (2008) did not.

As was mentioned above, the results of studies analysing the direction of the relationship between stock markets and the economy may differ depending on the economic development of a respective country. In accordance to that the authors recently switched their interest from developed countries to emerging ones. Among them, Chakraborty (2008) examined the relationship between the Indian financial market and economy. He concluded that the development of the Indian financial market affects the economic activity, but this relationship is relatively weak. Further, Ibrahim (2010) stated for the Malaysian sample that the stocks returns may be considered as the main indicator of the future economic activity, but only for the period shorter of one year.

The influence of stock markets of five European countries (Germany, France, Netherlands, Italy and the Great Britain) on their economic efficiency was analysed by Siliverstovs and Duong (2006). Although the identified links were not statistically significant, they noted that the economic development positively responds to positive shocks taking place on the stock market and also that the stock markets of analysed countries imply certain information for the forecast of the economic activity. Similarly, Domain and Louton (1997) analysing the causal relationship between stock market returns and the economic efficiency taking into account the asymmetry of the business cycle noted that the sharp declines in the economic performance are caused by the decline on stock market returns, whereas the positive performance of the stocks market is followed by the increase of economic output.

Fama (1990) and Binswanger (2000) in their studies also suggested that monthly data have a little explanatory power for the analysis of the relationship between stock markets and the economic activity and quarterly or annual data seem to be more appropriate. Ibrahim (2010) also noted that irrespective to the fact that many studies contest the predictive ability of stock prices, their easy availability and exact measurements favouring them as the predictive indicator in comparison with other macroeconomic variables which are usually available with a long-term delay and whose values have to be often modified.

MATERIAL AND METHODOLOGY

The paper analyses the relationship between the stock markets and the real economic activity with focusing on the examination of the direction of identified links. As the proxy of the economic activity the Gross Domestic Product (GDP) at constant prices of the year 2005 are employed. By this premise the methodological approach of corresponding researchers (Adamapoulos, 2010; Goktas and Hepsag, 2011) is followed. Moreover, this assumption is in the line with the hypothesis indicating the relationship between the stock markets and the real economic activity. The stock markets are represented by the values of stock indices at the daily closing values. For the stock indices the effect of nonsynchronous trading is not taken under the consideration. The paper employs the data of seven countries, where the European Union (EU27) is considered as one country, further some of the European Union Member States (the Czech Republic, Germany, Poland, Hungary) are individually analyses; lastly the data of the United States of America (USA) and Japan are included. The selection of the countries was performed with the aim to analyse the relationship between

the stock markets and the economy of the Czech Republic and its neighbouring countries and to confront the situation of the Czech Republic with the large worldwide stock markets of the United States and Japan as well as in the context of the European Union Stock Market.

As was already mentioned the stock markets are represented by the values of stock indices of the most important stocks of these countries, namely by: Nikkey 225 Stock Average for Japan, Dow Jones Industrial Average for USA, Euro Stoxx 50 for EU27, Warsaw Stock Exchange Top 20 Index for Poland, Budapest Stock Exchange index for Hungary, PX for Czech Republic and Deutsche Borse AG German Stock Index for Germany. The values of GDP at constant prices are available from the database of the Organization for Economic Co-operation and Development (OECD), while the values of stock indices were obtained from Bloomberg database.

The period under consideration covers the data of the first quarter of the year 2000 to the second quarter of 2012. The datasets of both variables are expressed on the quarterly basis, were the quarterly values of stock indices were calculated as the average of daily values of a respective quarter. As was already mentioned, quarterly data have according to Fama (1990) or Binswanger (2000) better explanation power for the detection of examined relations in comparison with monthly, weekly or daily data. Moreover, the values of GDP are available only on quarterly basis.

The analysis is based on the correlation analysis, which identifies and measures a relationship between two sets of variables. Although the correlation analysis researches the intensity of a respective relationship, does not examine its direction in relation of cause and effect[1]. For this purpose the arranged vector autoregressive models (VAR models) were examined by the Granger causality test[2]. The proposed VAR models were as follows:

$$GDP_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i GDP_{t-i} + \sum_{j=1}^{m} \beta_i I_{t-j} + u_{1t}, \quad (1)$$

$$I_t = \gamma_0 + \sum_{i=1}^{m} \gamma_i I_{t-i} + \sum_{j=1}^{m} \delta_i GDP_{t-j} + u_{2t}, \quad (2)$$

where in the first equation (1) the assumption that the current values of GDP (GDP_t) are explained be its values of previous period (GDP_{t-i})and previous values of stock indices (I_{t-j}) was analysed. And it the second equation (2) is assumed that current values of stock indices (I_t) are explained by its values of previous period (I_{t-i}) and previous values of GDP (GDP_{t-i}).

RESULTS AND DISCUSSION

The paper analyses the relationships between the stock markets and the real economic activity of seven chosen countries with the research objective to identify these relationships in relation of cause and effect.

In the first step, the values of stock indices were tested by X-12-ARIMA analysis for the identification of the significance of the seasonal component. With regard to the fact that the values of seasonally adjusted values significantly differ in comparison with unadjusted values in the further steps of analysis the seasonally adjusted values were employed. The values of GDP were not tested for the identification of the seasonal component, since their values were directly obtained in seasonally adjusted from OECD database.

Further, with objective to avoid of the problem of the apparent correlation, which may be caused by the developing trend or by the influence of the other variable, the trend component of both sets of data were eliminated by their transition on logarithmic returns according to following relations:

$$GDP_t(l) = 100 \times (\ln GDP_t - \ln GDP_{t-1}), \quad (3)$$

$$I_t(l) = 100 \times (\ln I_t - \ln I_{t-1}). \quad (4)$$

By this adjustment also the assumption of the Granger causality test requiring the stationarity of time series were met. The fulfilling of this assumption were tested by the ACF graph and by ADF unit root test[3], while KPSS[4] unit root test was used of the verification of stationarity only in ambiguous cases. The results of the ADF and KPSS test are available in Appendix 1. The second assumption of the Granger causality test, i.e. non-series correlation of the error term, was tested by the Lung-Box portmanteaus statistic at the 5% significance level of the proposed VAR models (1) and (2) as well as of the adjusted VAR models as follows:

$$GDP_t(l) = \alpha_0 + \sum_{i=1}^{m} \alpha_i GDP_{t-i}(l) + \sum_{j=1}^{m} \beta_i I_{t-j}(l) + u_{1t}, \quad (5)$$

$$I_t(l) = \gamma_0 + \sum_{i=1}^{m} \gamma_i I_{t-i}(l) + \sum_{j=1}^{m} \delta_i GDP_{t-j}(l) + u_{2t}, \quad (6)$$

where the values of GDP and stock indices (I) were transformed into the logarithmic returns (according

1 For more see Hindls (2007).
2 For more see Gujarati (2003).
3 The Augmented Dickey-Fuller test.
4 The Kwiatkowski-Phillips-Schmidt-Shin tests.

to above indicated formulas (3) and (4)), which were taken into consideration in the further research steps.

With regard to the results of studies of Estrella and Mishkin (1996), indicating that the development of the stock markets affect the development of the economic with the advance of one up to three months, and Goktas and Hepsag (2011) arguing that the economic development lead the stock market prices with advance of six months, the lag of one quarter or two were considered for the analysis. The verified research hypotheses were as follows: the development on stock markets is reflected by the development of the economy, indicated by GDP, with the lag of one or two quarter, i.e. with the lag of three or six months. Also the reversal relationship indicating the impact of the economic activity on the development of the stock markets were analysed.

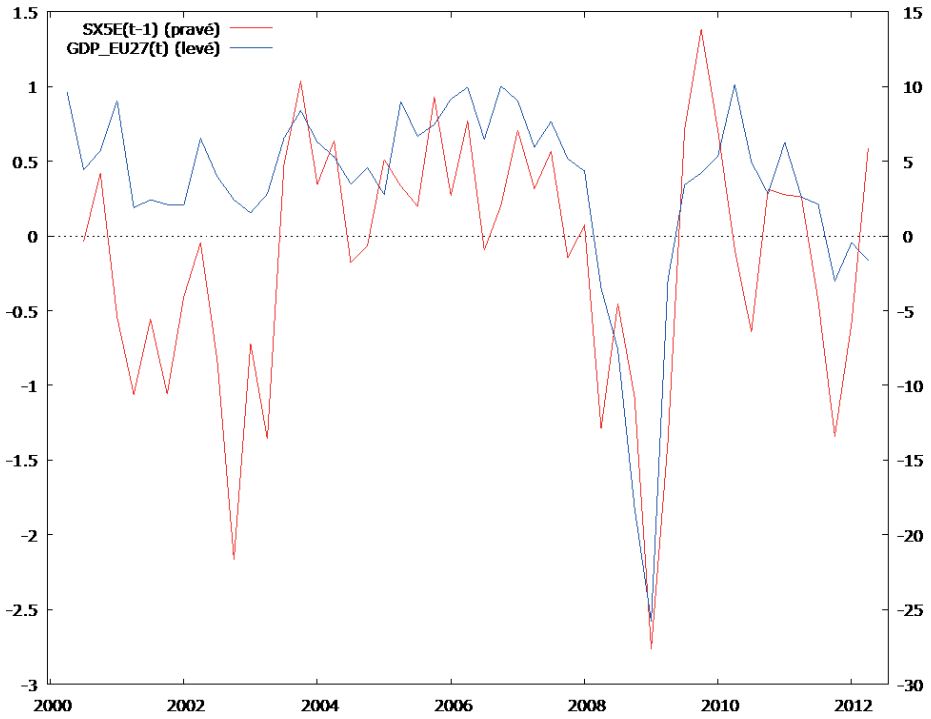
Firstly, any possible relationships between both sets of variables, i.e. stock indices and GDP, were identified by the correlation analysis. The pair correlation coefficients were calculated for each pair of stock index and a respective GDP indicator without any lag as well as for the situation where one of the variables were lagged by one or two quarter. To be clear, the correlation analysis was applied on the adjusted data for the further analysis, i.e. on the transformed data into logarithmic returns according to relation indicated by equations (3) and (4). The following table (Tab. I) shows the results of the correlation analysis. The list of abbreviation used for the presentation of the results in the paper is available in Appendix 2.

The above stated table shows strong relations between the stocks markets and the economic activity for the situation, where the stock markets are considered as the predictor of the economic activity

I: *The pair correlation coefficients of logarithmic returns of the quarterly values of GDP and the logarithmic returns of quarterly average values of stock indices for the period of Q1:2000–Q2:2012, n = 49*

	BUX	**DJIA**	**GDAX**	**NKY225**	**PX**	**SX5E**	**WIG20**
	GDP_HU	**GDP_US**	**GDP_GE**	**GDP_JAP**	**GDP_CR**	**GDP_EU27**	**GDP_PL**
$GDP_{(t-2)}; I_{(t)}$	–0.2557	0.0877	–0.0963	–0.0165	–0.1741	–0.0910	–0.0473
$GDP_{(t-1)}; I_{(t)}$	0.1069	0.1955	0.1077	0.1475	0.1450	0.1932	0.2437*
$GDP_{(t)}; I_{(t)}$	0.3417**	0.4189***	0.4155***	0.3838***	0.5087***	0.4995***	0.4207***
$GDP_{(t)}; I_{(t-1)}$	0.5380***	0.3728***	0.5921***	0.4072***	0.6593***	0.6513***	0.4501***
$GDP_{(t)}; I_{(t-2)}$	0.4830***	0.1039	0.3585**	0.1170	0.5203***	0.4667***	0.6127***

Source: author's own adaption in Gretl



1: *The development of logarithmic returns of SX5E Index with the lag of one quarter and EU27 GDP in the period Q1:2000–Q2:2012*
Source: author's own adaption

with advance of one or two quarters. The strongest relation is indicated for the Czech stock market and economy and the European Union. The below stated figure (Fig. 1) shows the progress of the relations between the European stock market and economy.

The correlation analysis shows strong links between the development performed by the stock markets and the economic activity. In addition to the identified relations also the direction of these relations in terms of causal effects were analysed. The Granger causality test were applied on parameters of proposed VAR models in equations (5) and (6). The tested null hypotheses were as follows:

- the development on the stock markets affects the economic development in terms of the Granger causality (5) and
- the development of the economy is not influenced by performance of the stock markets in terms of the Granger causality (6).

The Granger causality test was applied for proposed VAR models with the lag of one or two quarter and further evaluated by p-value of Wald's F-statistic. The obtained results are available in below stated table (Tab. II). The direction of relations are indicated by direction of arrows.

The above table shows, that there are statistically significant causal relation at 1% significance level in the direction from the stock markets to the economic activity with the lag of one quarter for Hungary, Germany, the Czech Republic and the European Union and at 5% significance level for Japan, the and Poland. In other words, the development on the stock markets of these countries determines the development in their economy with advance of one quarter. The results correspond with the hypothesis that the stock market leads the economic activity. The similar conclusion were also obtained by Kaplan (2008) and Adampolous (2010). The reversal relation were identified for the United States of America. For the analysis of the Granger causality of VAR models with the lag of two quarter the similar results were identified, i.e. the direction of causal effect leading from the market to the economy. In case of the Japanese data no relation between the stock market and the economy were detected at 10% significance level. The reversible relations were identified for Hungary, while no relations were identified for the United States of America.

Based on the obtained results the following question may arise: Do the stock markets lead the economic activity with advance of one or two quarters? For identification, whether the lag of one or two quarter has more conclusive for the considered sample, the evaluation based on the information criteria BIC, AIC and HQC[5] of the arrange VAR models were used. The decision was derived from the lower value of respective information criteria for each individual pair of variables, where the BIC and AIC information criteria were considered as the main decisive, while the HQC information criterion as additional, i.e. decisive in the ambiguous cases. The results are presented in below stated table (Tab. III), where only these pairs of variables, where the relation in the direction from the stock markets to economic activity was identified, were taken into consideration.

From the table (Tab. III) is observable, that the German, the European, the Czech and the Hungarian stock markets indicate performance of the economy with advance of one quarter, while in case of Poland, the advance of two quarter is

II: *The results of Granger causality test for stock indices and GDP in the period Q1:2000–Q2:2012 with the lag of one and two quarter*

	p-value Lag 1	**p-value Lag 2**
GDP_HU=>BUX	0.5938	0.0314**
BUX=>GDP_HU	0.0014***	0.0046***
GDP_US=>DJIA	0.0122**	0.1838
DJIA=>GDP_US	0.1486	0.4807
GDP_GE=>GDAX	0.4161	0.7257
GDAX=>GDP_GE	0.0003***	0.0028***
GDP_JAP=>NKY225	0.7976	0.7870
NKY225=>GDP_JAP	0.0214**	0.0795*
GDP_CR=>PX	0.3594	0.2945
PX=>GDP_CR	0.0002***	0.0004***
GDP_EU27=>SX5E	0.7982	0.3556
SX5E=>GDP_EU27	0.0004***	0.0030***
GDP_PL=>WIG20	0.7000	0.3351
WIG20=>GDP_PL	0.0247**	0.0034***

Source: author's own adaption

5 Akeike information criterion, Bayesian information criterion and Hannan-Quinn information criterion.

III: *Analysis of the suitability of the length of lag*

	VAR model, Lag 1,		
	AIC	**BIC**	**HQC**
BUX=>GDP_HU	9.5865	**9.8204**	**9.6749**
GDAX=>GDP_GE	**9.4576**	**9.6915**	**9.5460**
PX=>GDP_CR	9.3027	**9.5366**	**9.3910**
SX5E=>GDP_EU27	**7.9394**	**8.1733**	**8.0278**
WIG20=>GDP_PL	8.9320	9.1659	9.0204
	VAR model, Lag 2,		
	AIC	**BIC**	**HQC**
BUX=>GDP_HU	**9.5656**	9.9592	9.7137
GDAX=>GDP_GE	9.6195	10.0132	9.7676
PX=>GDP_CR	**9.2795**	9.6731	9.4276
SX5E=>GDP_EU27	8.0359	8.4295	8.1840
WIG20=>GDP_PL	**8.6235**	**9.0172**	**8.7716**

Source: author's own adaption

more appropriate. Based on the analysis of more conclusive length of lag, it is possible stated, that for German, Hungary, the Czech Republic and the European Union are the results in the line with Estrella and Mishikn (1996). In case of the US stock market, the reciprocal relation were identified, which is consistent with the conclusion Goktas and Hepsag (2011). Generally, based on the analysis performed in the paper, may be concluded that in five of seven considered countries the causal relation of stock market and the economic activity were detected.

The results of the paper are in contrary with the conclusion of some studies (Gjerde and Saettem, 1999; Know and Shin, 1999) but on the other hand in accordance with many others (Schwert, 1990; Fama, 1990 or Adamopoulos 2010). This discrepancy may be caused by the maturity or the size of a respective country and its stock market. However, based on the results of the analysis carried out in the paper; in considered countries the stock indices may be used as the important leading indicator of the economic activity. This fact may be beneficial within the formulation of an investment strategy; if stock prices grow in the long-term, it is possible to assume that the investment will be profitable. The use of this theoretical approach may be a very powerful tool at the prevention of loss-making investment or the sudden failure of the businesses.

Appendix 1

IV: *Results of ADF tests, the seasonally adjusted time series of stock indices and GDP at constant prices*

Variable	Without constant	With constant	With constant and trend
BUX	0.5029	0.3407	0.6134
DJIA	0.7166	0.0647*	0.0320**
GDAX	0.4295	0.1977	0.2922
NKY225	0.3712	0.2263	0.4764
SXE5	0.1244	0.1698	0.3637
PX	0.5058	0.4558	0.8725
WIG20	0.4581	0.3020	0.4795
GDP_CR	0.9548	0.6356	0.9225
GDP_EU27	0.8951	0.5313	0.4909
GDP_GE	0.9294	0.8289	0.0628*
GDP_HU	0.8776	0.2242	0.8918
GDP_PL	0.9992	0.9768	0.2589
GDP_US	0.9841	0.8297	0.7837
GDP_JAP	0.8776	0.4109	0.3223

Source: author's own adaption

V: *Results of ADF and KPSS tests, the logarithmic returns adjusted time series of stock indices and GDP at constant prices*

	ADF test			KPSS test
	Without constant	**With constant**	**With constant and trend**	**t-stat**
BUX	0.0040***	0.0071***	0.0309**	
DJIA	0.0000***	0.0098***	0.0058***	
GDAX	0.0001***	0.0036***	0.0186**	
NKY225	0.0000***	0.0000***	0.0008***	
SXE5	0.0001***	0.0028***	0.0162**	
PX	0.0001***	0.0051***	0.0203**	
WIG20	0.0001***	0.0033***	0.0188**	
GDP_CR	0.0108**	0.0390**	0.0855*	
GDP_EU27	0.0088***	0.0674*	0.1733	0.2139***
GDP_GE	0.0001***	0.0012***	0.0069***	
GDP_HU	0.0799*	0.4036	0.0252**	0.5570**
GDP_PL	0.1793	0.0200**	0.1419	0.1797***
GDP_US	0.0001***	0.0008***	0.0059***	
GDP_JAP	0.0000***	0.0001***	0.0009***	

Source: author's own adaption

Appendix 2

VI: *List of abbreviations*

The abbreviations for Stock Indices	
BUX	Budapest Stock Exchange Index – for Hungarian Stock Market
DJIA	Dow Jones Industrial Average – for American Stock Market
GDAX	Deutsche Borse AG German Stock Index – for German Stock Market
NKY225	Nikkei 225 Stock Average – for Japanese Stock Market
PX	An official stock indices of Prague Stock Market
SXE5	Dow Jones EURO STOXX 50 – for the European Union Stock Market
WIG20	Warsaw Stock Exchange Top 20 Index – for Poland Stock Market
The abbreviations for GDP	
GDP_CR	Gross Domestic Product for the Czech Republic
GDP_EU27	Gross Domestic Product for the European Union
GDP_GE	Gross Domestic Product for Germany
GDP_HU	Gross Domestic Product for Hungary
GDP_JAP	Gross Domestic Product for Japan
GDP_PL	Gross Domestic Product for Poland
GDP_US	Gross Domestic Product for the United States

Source: author's own adaption

CONCLUSION

The paper analysed the relationship between the stock markets and the real economic activity. As a proxy of the economic activity the Gross Domestic Product indicator at constant prices was considered, while the stock markets were represented by the main stock indices of the chosen countries (the United States of America, Japan, Germany, Poland, Hungary, the Czech Republic and the European Union). The hypothesis of the predictive ability of the stock markets on the economic activity was verified in the paper. However, based on the theoretical background the direction of this relation may be reversal or even reciprocal. The analysis was based on the verification of the statistical significance of pair correlation coefficients. The direction of detected relation was tested by the Granger causality test of the proposed VAR models. Based on the correlation analysis strong relations between the stock markets and the economic activity were identified. With regard to results of the Granger causality analysis may be stock markets represented by stock indices considered as the important leading indicator of the economic development.

From the empirical results of correlation analysis is obvious that there are quite strong links between stock market development and economic activity. Based on the analysis of Granger causality it is possible to consider stock markets as an important leading indicator of economic activity. The findings of the paper are in contradiction with the conclusion of some studies but on the other hand in accordance with many others. The empirical findings of the research in the paper support the contention that the stock markets leads the real economic activity and there are no feedback relationships between these two indicators.

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