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A NOTE ON RELATIONSHIP BETWEEN ECONOMIC ACTIVITY AND STOCK MARKET DEVELOPMENT: A CASE OF EURO AREA COUNTRIES

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Abstract

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The aim of the paper is to empirically examine if the causal relationship between economic activity and stock market development exists in the selected 11 EA countries. The existence of relationship is investigated with the use of cointegration, vector error correction model and Granger causality during three sub-periods between January 1993 and January 2017. The results show that the general conclusion on the relation between activity and stock market development cannot be stated and that country-specific development should be taken into account when making decisions either from the investors' or policy makers' perspective. It also seems that the level of integration plays important role when studying the nature of relationship between variables during different time periods.

Keywords: economic activity, causality, cointegration, stock market development

INTRODUCTION

One can find many empirical studies that assess the finance-growth nexus. The main focus of these studies is to reveal the relationship between financial development and economic growth which allows the authors to formulate development policy recommendations and also their results can have important implications for the investors' strategies. Since financial system is very complex, the authors focus attention to the specific segment in most of works, e. g. banking system, individual segment of financial market. Also this study is focused on particular segment of financial system – stock market.

The direction of relationship between finance and economic activity is in the spotlight of attention in a majority of studies. The authors usually try to find the answer to the question if it is the growth that leads to financial development or vice versa. It is not an easy task to find universal answer since the financial systems of countries are not similar. So far published works can be divided into three different groups. The first group of authors holds the view that financial development is followed by economic growth, e. g. see Schumpeter (1911), King and Levine (1993), Arestis *et al.* (2001), Christopoulos and Tsionas (2004), Levine (2005). The second group advocates that economic growth leads to financial development, e. g. see Robinson (1952), Kindleberger (1978) or Demetriades and Hussein (1996). Patrick (1966) believes that the direction of causality changes depending on the economic growth level. He introduced concept of demand-following and supply-leading hypotheses. The third group of authors, for example Luintel and Khan (1999) or Calderón and Liu (2003) supports the view that the relationship between growth and financial development is mutually causal.

The aim of this paper is to find out if the causal relation between stock market development and economic activity exists in selected 11 Euro Area (EA) countries (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxemburg, Netherlands, Portugal and Spain). These countries are chosen because their financial systems are well-developed and their stock markets are not fragile and illiquid as many stock markets of some developing countries. Even though the financial systems of selected countries are more developed compared to developing countries, there still exist differences in the level of development of individual countries' stock markets. Following the demand-leading hypothesis proposed by Patrick (1966), it is expected that economic growth contributes to financial development in developed countries with sound financial markets that are supposed to be in the selected EA countries because of the high level of integration.

In relation to the recent papers, the study primarily continues in the research that has been started in the paper by Kajurova and Rozmahel (2016) which is focused on panel evidence for the EA and non-EA countries. Also Deltuvaite and Sineviciene (2014), Georgantopoulos *et al.* (2015) or Prahdan *et al.* (2015) provided the results for EA countries in panels or clusters. However, such results cannot be generalized since they are not valid for every country included in the panel or cluster and one still has to be aware of the fact stated by Levine (1997) that any statements about the direction of causality cannot be generalized since they are specific to particular countries and periods. Therefore, the analysis is employed at individual level to provide more sound results and recommendations for investors or policy makers.

The following questions are intended to be answered in the study. Does economic activity in the selected EA countries lead to stock market development or stock market development contributes to economic activity? Is the relation mutual? If the relation exists between variables, is it in the long-run or in the short-run?

In order to find answers for these questions, cointegration and vector error correction models are conducted. Also the author would like to find out if the relation and the nature of the link between growth and stock market development have changed during individual sub-periods which will be introduced in a section Data more in detail.

The paper is structured as follows. The next section briefly introduces main studies that deal with the relation between stock markets development and economic activity. Then the dataset, its characteristics and sub-periods are presented. In the next section, the methodology is explained. The results are presented in the following section and consequently, the section with discussion and conclusions follows.

Literature review

This part primarily surveys literature focused on the relationship between stock market development and economic activity. In case you are also interested in literature on economic activity and overall financial development, a well-arranged summary can be found e.g. in Demirgüc-Kunt and Levine (1996), Levine (1997), Cavenaile *et al.* (2014) or Havranek *et al.* (2014).

The papers that focus on the relation between stock market development and economic activity can be divided into several groups depending on selected criteria, e. g. based on the main findings, variables or methods the author used in research. We provide a brief summary of literature according to main obtained findings.

There is a prevailing amount of papers concluding that stock markets have impact on economic activity, e. g. Atje and Jovanovic (1993), Mauro (2003), Beck and Levine (2004), Nieuwerburgh et al (2006), Nowbutsing and Odit (2009), Panopoulou (2009), Nayaran and Nayaran (2013), Tang (2013), Cavenaile *et al.* (2014), Prahdan *et al.* (2014), Gazdar and Cherif (2015), Georgantopoulos *et al.* (2015) or Prahdan *et al.* (2015). Levine and Zevros (1998) find some variables not significant, but stock market liquidity is positively associated with contemporaneous and future growth rates. Boubakari and Jin (2010) conclude that growth is affected by stock markets that are more developed, but not in case of less developed stock markets.

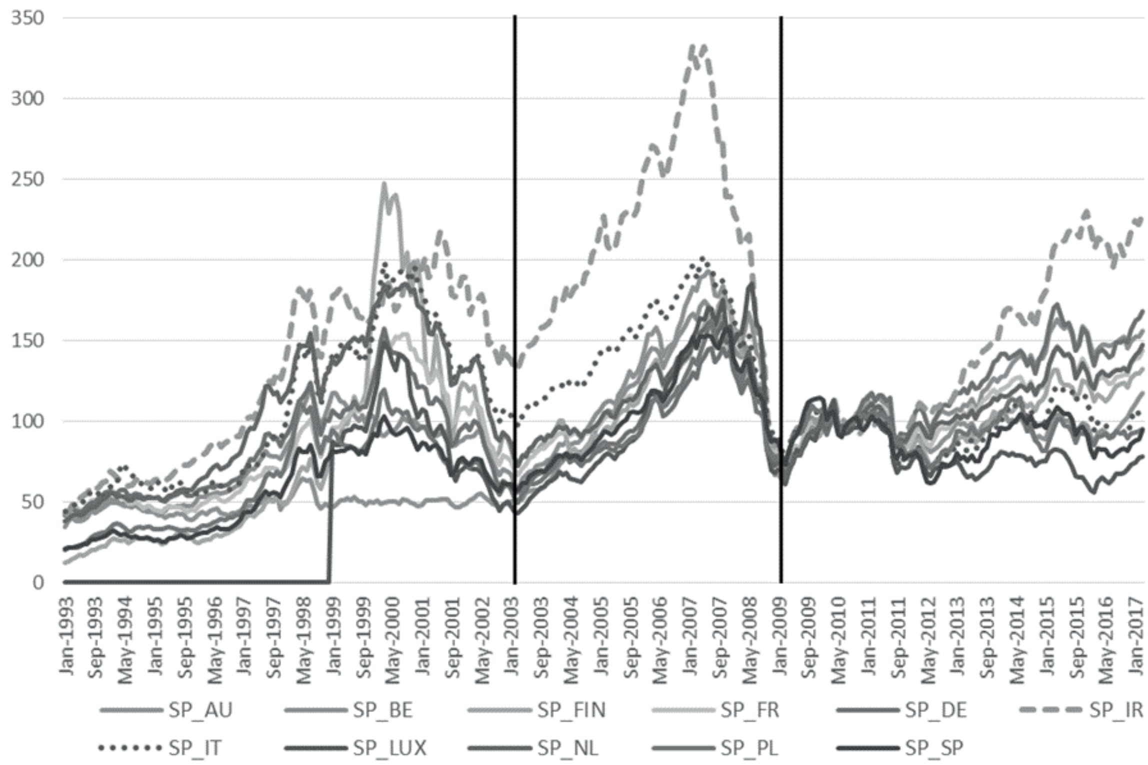
One can also find the contributions that found that economic growth leads to stock market development, e. g. see Dritsaki and Dritsaki-Bargiota (2005) or Liu and Sinclair (2008). Some studies find no significant influence of stock markets on growth, e. g. see Harris (1997), Fink *et al.* (2004), Fink *et al.* (2005), Hagmayr *et al.* (2007), Fink *et al.* (2009) or Caporale *et al.* (2015). And some contributions find bidirectional, mutual causal relationship, e. g. Marques *et al.* (2013) or Kajurova (2016). A detailed survey of literature on relationship between stock market development and growth can be found in Appendix A.

Data

The dataset is sourced from the OECD and Eurostat databases. As the measure of economic activity, the industrial production index is used. It is used instead of GDP since it is of low frequency of data, therefore the results can be distorted because of limited number of observations.

As Harvey (1989), Liu and Sinclair (2008), Humpe and Macmillan (2009), the main composite stock indices of each national stock exchange markets are applied as proxies of stock market development in the study. Stock market development is approximated with composite stock market indices for each national stock market. The list of used indices is provided in Appendix B.

Monthly data are used and the observed period starts in January 1993 and ends in January 2017. The whole period is divided to three sub-periods to examine how the relationship between variables was changing during different times. The sub-periods are determined according to trends of stock prices development, see Fig. 1. The following periods are set: a) period I (01/1993-12/2002), b) period II (01/2003-12/2008) and c) period III (01/2009-01/2017).



1: *Stock prices development in EA countries (01/1993-01/2017)*
Source: OECD database

I: *Descriptive statistics of used variables in natural logs (01/1993-01/2017)*

Country	Mean	Median	Max	Min	Std.dev.	Skewness	Kurtosis	Prob.
IP_AU	4.5529	4.6041	4.7255	4.2245	0.1354	–0.6254	2.0269	0.0000
IP_BE	4.4988	4.5350	4.7324	4.1848	0.1500	–0.4325	1.7360	0.0000
IP_DE	4.5970	4.6085	4.7376	4.4076	0.0992	–0.1644	1.4467	0.0000
IP_FIN	4.5854	4.5659	4.7916	4.4018	0.0819	0.5452	3.3848	0.0024
IP_FR	4.6712	4.6987	4.7625	4.5437	0.0624	–0.2089	1.4581	0.0000
IP_IR	4.5724	4.5724	5.2148	4.0258	0.2323	0.5053	3.9243	0.0002
IP_IT	4.6614	4.7197	4.8080	4.5057	0.1025	–0.2668	1.3754	0.0000
IP_LUX	4.6135	4.5957	4.8017	4.3767	0.0894	0.0924	2.4767	0.2501
IP_NL	4.5487	4.5507	4.6802	4.4222	0.0511	–0.2661	2.5307	0.1037
IP_PT	4.6526	4.6755	4.7740	4.5028	0.0797	–0.1923	1.5253	0.0000
IP_SP	4.6755	4.7252	4.8602	4.4892	0.1136	–0.1347	1.5109	0.0000
SP_AU	4.4597	4.5281	5.2640	3.8323	0.3956	0.0380	2.1425	0.0356
SP_BE	4.6865	4.6504	5.1628	4.0539	0.2534	–0.0321	2.2046	0.0569
SP_DE	4.6689	4.6989	5.1507	3.9087	0.2626	–0.5150	2.7086	0.0057
SP_FIN	4.6906	4.6674	5.5130	4.1814	0.2694	0.8643	3.5601	0.0000
SP_FR	4.6988	4.6945	5.0680	4.1985	0.2004	–0.2007	2.2476	0.0379
SP_IR	5.0985	5.1544	5.8061	4.2568	0.3491	–0.2615	2.3468	0.0427
SP_IT	4.7911	4.7593	5.3077	4.2301	0.2763	0.1282	2.0424	0.0120
SP_LUX	4.4496	4.3768	5.2223	3.7714	0.3212	0.5025	2.7015	0.0071
SP_NL	4.7558	4.7604	5.2201	4.1562	0.2317	–0.0242	2.3276	0.1294
SP_SP	4.5190	4.5235	5.0902	4.0014	0.2130	0.1562	3.3448	0.3773
SP_PT	4.5105	4.5075	5.0594	4.0368	0.2249	0.4365	3.0153	0.0323

II: *ADF Unit Root Test Statistics (01/1993-01/2017)*

Variable	Level			First differences		
	t-Stat.	Critical value	Prob.	t-Stat.	Critical value	Prob.
IP_AU	–0.8454	–3.4256	0.9592	–15.6805	–3.4256	0.0000
IP_BE	–2.5772	–3.4256	0.2912	–16.7124	–3.4256	0.0000
IP_DE	–3.5139	–3.4256	0.0398	–7.4452	–3.4256	0.0000
IP_FIN	–1.7308	–3.4256	0.7352	–19.7344	–3.4256	0.0000
IP_FR	–2.3413	–3.4256	0.4098	–9.2181	–3.4256	0.0000
IP_IR	–1.9298	–3.4256	0.6362	–17.5741	–3.4256	0.0000
IP_IT	–2.8644	–3.4256	0.1759	–7.3497	–3.4256	0.0000
IP_LUX	–1.6431	–3.4256	0.7735	–24.4450	–3.4256	0.0000
IP_NL	–2.6799	–3.4256	0.2458	–16.9321	–3.4256	0.0000
IP_PT	–1.7401	–3.4256	0.7309	–18.6481	–3.4256	0.0000
IP_SP	–2.2337	–3.4256	0.4686	–8.6408	–3.4256	0.0000
SP_AU	–2.0626	–3.4256	0.5640	–11.9914	–3.4256	0.0000
SP_BE	–2.2072	–3.4256	0.4833	–12.3561	–3.4256	0.0000
SP_DE	–2.4992	–3.4256	0.3284	–12.4178	–3.4256	0.0000
SP_FIN	–2.5751	–3.4256	0.2924	–11.8094	–3.4256	0.0000
SP_FR	–2.1532	–3.4256	0.5134	–12.7586	–3.4256	0.0000
SP_IR	–2.1067	–3.4256	0.5394	–12.0133	–3.4256	0.0000
SP_IT	–2.0931	–3.4256	0.5470	–13.5892	–3.4256	0.0000
SP_LUX	–2.3565	–3.4256	0.4014	–9.7438	–3.4256	0.0000
SP_NL	–2.4041	–3.4256	0.3766	–12.6690	–3.4256	0.0000
SP_PT	–2.4656	–3.4256	0.3451	–11.8726	–3.4256	0.0000
SP_SP	–1.9735	–3.4256	0.6126	–12.8923	–3.4256	0.0000

All data are converted into natural logarithmic form to gain more constant variance. The descriptive statistics of used variables for whole sample is reported in Tab. I. The statistics for sub-periods are reported in Appendix C.

Consequently data should be checked for stochastic non-stationarity, the unit root is required, data should be integrated of order one *I(1)*. The Augment Dickey-Fuller (1981) unit root tests (ADF) are performed to investigate the order of integration. The results of employed ADF unit root tests for overall period are reported in Tab. II. See the Appendix D for the results for individual sub-periods. The results suggest that data are stationary at first differences and therefore of order one *I(1)*. Therefore the existence of cointegration relationship can be tested subsequently.

MATERIALS AND METHODS

The existence of cointegration between variables is investigated firstly. If the variables have a common stochastic trend, they are co-integrated, see Granger (1988) and Engle and Granger (1987). Unit root should be tested and if the series are integrated of order one, a Johansen (1988) and Johansen and Juselius (1990) procedure can be conducted to find the common trend in the multivariate time series, which is based on the vector autoregressive (VAR) model:

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + Bx_t + \varepsilon_t \qquad (1)$$

where y_t is a k-vector of non-stationary $I(1)$ variables, x_t is a d-vector of deterministic variables, and ε_t is a vector of innovations. If the variables of $I(1)$ are cointegrated, it means that a linear function of these variables is $I(0)$.

The appropriate lag length for the co-integration test (order of VAR) is determined by Schwarz Bayesian criterion (BIC). In first difference error correction the model is specified as follows:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-p} + Bx_t + \varepsilon_t \ , \qquad (2)$$

where: $\Pi = \sum_{i=1}^{p} A_i - I$ and $\Gamma_i = -\sum_{j=i+1}^{p} A_j$

The null hypothesis of no co-integration is rejected, if the rank of the coefficient matrix is at least 1. Johansen and Juselius (1990) developed trace statistics and maximum eigenvalue statistics to determine the number of co-integrating vectors (the rank of the matrix). These statistics are computed for the null hypothesis as:

$$LR_{tr}\left(r|k\right)=-T\sum_{i=r+1}^{k}\log\left(1-\lambda_i\right) \quad (3)$$

$$LR_{\max}\left(r|r+1\right)=-T\log\left(1-\lambda_i\right)=LR_{tr}\left(r|k\right)-LR_{tr}\left(r+1|k\right) \quad (4)$$

Trace statistic tests the null hypothesis of r co-integrating relations against the alternative of n co-integrating relations, where n is the number of variables in the system for $r = 0, 1, 2…n – 1$. The maximum eigenvalue statistics tests the null hypothesis of r co-integrating relations against the alternative of $r + 1$ co-integrating relations for $r = 0, 1, 2… n – 1$. The results of these statistics should not differ substantially, however in some cases trace and maximum eigenvalue statistics may yield different results.

If cointegration exists between variables, a causal relation in at least one direction must exist (see Granger, 1988), hence vector error correction model can be employed for identification of the direction of the relationship. Therefore, the next step is to identify the causality between the variables and the vector error correction model can have the following form:

$$\Delta x_t=\sum_{i=1}^{p-1}\beta_i\Delta x_{t-i}+\sum_{i=1}^{p-1}\alpha_i\Delta y_{t-i}+\lambda_1 EC1_{t-1}\varepsilon_{1t} \quad (5)$$

$$\Delta y_t=\sum_{i=1}^{p-1}M_i\Delta x_{t-i}+\sum_{i=1}^{p-1}N_i\Delta y_{t-i}+\lambda_2 EC2_{t-1}\varepsilon_{2t} \quad (6)$$

where β_i, α_i, M_i and N_i are the short-run coefficients, *EC1* and *EC2* are error correction terms and ε_{1t} and ε_{2t} are residuals in the formulas. The first error correction term $EC1_{t-1}$ and $EC2_{t-1}$ represent the lagged value of residuals that is derived from the cointegrating regression of x on y or y on x.

The significance of the coefficient λ indicates long-run relationship from the explanatory variable to the dependent variable and shows how quickly variable(s) re-converge to the long-run relationship after a deviation. Therefore $H_0: \lambda_1 = 0$ and $\lambda_{1i} = 0\ \lambda_2 = 0$ are tested. Also short run causal effects are studied by using a Wald test (Chi-square test statistic: χ^2) for the significance of the lagged explanatory variables.

If cointegrating relation between variables does not exist, Granger causality tests are employed. Granger causality means only correlation between present value of one variable and past values of other variables (Brooks, 2008). The standard Granger causality model for two variables can be represented as:

$$Y_t=\sum_{i=1}^{\rho}\alpha y_i Y_{t-1}+\sum_{i=1}^{\rho}\alpha x_i X_{t-1}+\varepsilon_t \quad (7)$$

$$X_t=\sum_{i=1}^{\rho}\beta x_i X_{t-1}+\sum_{i=1}^{\rho}\beta y_i Y_{t-1}+\varepsilon_t \quad (8)$$

Where Y_t and X_t are stationary time series, ε_t is uncorrelated white noise, αx_i and βx_i are coefficients chosen to minimize σ^2, ρ is finite and shorter than the given time series (it can equal infinity but in practice, it is finite due to the length of the available data).

The null hypothesis *"X does not Granger cause Y"* (equation 1) or *"Y does not Granger cause X"* (equation 2) is rejected if the coefficients αx_i and βy_i are jointly significant.In our research, Granger causality test tries to find if share prices "Granger-cause" economic activity (past values of share prices improve the prediction of economic activity), and vice versa if economic activity do "Granger-cause" share prices (past values of economic activity improve the prediction of share prices).

RESULTS

The results are presented chronologically. In each period, cointegration is tested at first for each country and then in case of its existence, the VECM is employed. The Granger causality tests are conducted in case the cointegration between stock market development and economic activity has not been confirmed.

Period I

Since stationarity with the use of ADF tests was confirmed for the variables, tests for the presence of cointegration can be employed. Both trace statistic and max-eigen statistic are provided to check if the results are same. The results of the Johansen cointegration rank test presented in Tab. III for the period I (01/1993-12/2002) show that there is no equilibrium relationship in the long-run between economic activity and stock market development in all countries because the values of both statistics are lower than critical value 3.8415 and the probability is higher than 5%. Therefore, the nature of relationship cannot be investigated consequently with the use of VECM because of no present cointegration.

Since cointegration was not found between stock market development and economic activity, Granger caucality tests are employed. These tests do not allow us to investigate causality, however they can help us to reveal the correlation between present value of one variable and past values of other variable. The results of Granger causality tests are presented in Tab. IV.

No causality in Granger sense was not found for Austria, Belgium, Italy, Luxemburg and Portugal because the probability is not lower than 5% and therefore the null hypothesis cannot be rejected. Only the first null hypothesis that stock market development does not Granger cause economic activity can be rejected for Finland, France and Spain meaning that past values of stock prices can help to

III: *Results of Johansen cointegration rank tests – period I*

Hypothesized number cointegrating equations: one				
Country	**Trace statistic**	**Prob.**	**Max-Eigen statistic**	**Prob.**
AU (1)	1.0462	0.9038	1.0462	0.3418
BE (2)	1.7993	0.1798	1.7993	0.1798
DE (2)	3.8373	0.0501	3.8373	0.0501
FIN (2)	2.8830	0.0895	2.8830	0.0895
FR (2)	1.6035	0.2054	1.6035	0.2054
IR (2)	3.7775	0.0579	3.7775	0.0579
IT (1)	2.6953	0.1006	2.6953	0.1006
LUX (1)	0.2521	0.6156	0.2521	0.6156
NL (2)	1.8711	0.1714	1.8711	0.1714
PT (3)	3.5245	0.0605	3.5245	0.0605
SP (2)	2.2168	0.1345	2.2168	0.1345

Note: The critical value for both statistics is 3.8415.

IV: *Granger causality tests results for period I*

Country	Null hypothesis	F-stat.	Prob.
AU	Stock market development does not Granger cause economic activity	1.1715	0.3136
	Economic activity does not Granger cause stock market development	1.0705	0.3463
BE	Stock market development does not Granger cause economic activity	1.1214	0.3294
	Economic activity does not Granger cause stock market development	0.3070	0.7363
DE	Stock market development does not Granger cause economic activity	4.5901	**0.0121**
	Economic activity does not Granger cause stock market development	3.2345	**0.0431**
FIN	Stock market development does not Granger cause economic activity	2.6807	**0.0729**
	Economic activity does not Granger cause stock market development	2.0006	0.1400
FR	Stock market development does not Granger cause economic activity	4.6391	**0.0116**
	Economic activity does not Granger cause stock market development	0.1968	0.8217
IR	Stock market development does not Granger cause economic activity	3.4537	**0.0350**
	Economic activity does not Granger cause stock market development	2.3902	**0.0962**
IT	Stock market development does not Granger cause economic activity	0.8523	0.4291
	Economic activity does not Granger cause stock market development	0.5205	0.5956
LUX	Stock market development does not Granger cause economic activity	2.0434	0.1426
	Economic activity does not Granger cause stock market development	1.2253	0.3042
NL	Stock market development does not Granger cause economic activity	1.3248	0.2699
	Economic activity does not Granger cause stock market development	3.8485	**0.0242**
PT	Stock market development does not Granger cause economic activity	2.1535	0.1208
	Economic activity does not Granger cause stock market development	0.0875	0.9163
SP	Stock market development does not Granger cause economic activity	3.4477	**0.0352**
	Economic activity does not Granger cause stock market development	0.8705	0.4216

Note: Statistically significant values are in bold.

explain the values of economic activity. The second null hypothesis was rejected for Netherlands where therefore past values of economic activity allowed us to explain the values of stock prices. The mutual relationship in Granger sense was found in Germany and in Ireland.

Period II

The situation has not changed when evaluating the results for the period II (01/2003-12/2008) in Tab. V. The null hypothesis that there is at most one cointegration vector is tested. Since the values for both statistics are lower than critical value 3.8415 and the values of probabilities are higher than 5%, the null cannot be rejected meaning that there is no cointegration in each case.

Similarly, as in the period I, the Granger causality tests are employed because no evidence of cointegration was confirmed. The results are presented in Tab. VI. The mutual relationship in Granger sense was found for Austria, Belgium, V: *Results of Johansen cointegration rank tests – period II*

Hypothesized number cointegrating equations: one				
Country	**Trace statistic**	**Prob.**	**Max-Eigen statistic**	**Prob.**
AU (1)	1.1902	0.2753	1.1902	0.2753
BE (2)	1.3457	0.2460	1.3457	0.2460
DE (1)	3.2601	0.0710	3.2601	0.0710
FIN (1)	1.9429	0.1634	1.9429	0.1634
FR (2)	0.1134	0.7363	0.1134	0.7363
IR (2)	0.1252	0.7235	0.1252	0.7235
IT (3)	2.2713	0.1318	2.2713	0.1318
LUX (2)	2.2741	0.1315	2.2741	0.1315
NL (1)	1.6754	0.1955	1.6754	0.1955
PT (2)	0.7730	0.3793	0.7730	0.3793
SP (1)	0.8606	0.3536	0.8606	0.3536

Note: The critical value for both statistics is 3.8415.

VI: *Granger causality tests results for period II*

Country	Null hypothesis	F-stat.	Prob.
AU	Stock market development does not Granger cause economic activity	4.4597	**0.0152**
	Economic activity does not Granger cause stock market development	2.9818	**0.0575**
BE	Stock market development does not Granger cause economic activity	4.5194	**0.0144**
	Economic activity does not Granger cause stock market development	7.1535	**0.0015**
DE	Stock market development does not Granger cause economic activity	16.368	**0.0000**
	Economic activity does not Granger cause stock market development	0.4648	0.6303
FIN	Stock market development does not Granger cause economic activity	14.425	**0.0000**
	Economic activity does not Granger cause stock market development	0.8948	0.4135
FR	Stock market development does not Granger cause economic activity	3.8117	**0.0271**
	Economic activity does not Granger cause stock market development	1.6122	0.2071
IR	Stock market development does not Granger cause economic activity	9.0985	**0.0003**
	Economic activity does not Granger cause stock market development	3.6901	**0.0302**
IT	Stock market development does not Granger cause economic activity	0.3125	0.7327
	Economic activity does not Granger cause stock market development	8.1232	**0.0007**
LUX	Stock market development does not Granger cause economic activity	6.8112	**0.0020**
	Economic activity does not Granger cause stock market development	0.7279	0.4867
NL	Stock market development does not Granger cause economic activity	2.2164	0.1169
	Economic activity does not Granger cause stock market development	9.8137	**0.0002**
PT	Stock market development does not Granger cause economic activity	0.7736	0.4654
	Economic activity does not Granger cause stock market development	2.3885	**0.0995**
SP	Stock market development does not Granger cause economic activity	7.1293	**0.0016**
	Economic activity does not Granger cause stock market development	3.6556	**0.0311**

Note: Statistically significant values are in bold.

Ireland and Spain. The past values of economic activity can help explain stock prices in Italy, Netherlands and in Portugal. The past values of stock prices contribute to economic activity in Germany, Finland, France and Luxemburg.

Period III

The results of Johansen cointegration rank test in Tab. VII indicate the existence of cointegration in six countries: Finland, France, Italy, Luxemburg, Portugal and Spain. It means that there is a long run relationship between the variables and therefore the direction and nature of the relationship can be investigated with the use VECM for each country. The Granger causality tests are employed for remaining five countries.

The results of Granger causality test in Tab. VII show that causality in Granger sense exists in the majority of observed countries: Austria, Belgium, Germany and Ireland except of Netherlands. Since the first null hypothesis is

VII: *Results of Johansen cointegration rank tests – period III*

Hypothesized number cointegrating equations: one				
Country	**Trace statistic**	**Prob.**	**Max-Eigen statistic**	**Prob.**
AU (2)	1.8178	0.1776	1.8178	0.1776
BE (1)	2.7550	0.0970	2.7550	0.0970
DE (1)	1.4665	0.2259	1.4665	0.2259
FIN (1)	3.5847	**0.0433**	3.5847	**0.0433**
FR (1)	3.5784	**0.0435**	3.5784	**0.0435**
IR (1)	0.2442	0.6212	0.2442	0.6212
IT (1)	5.5721	**0.0182**	5.5721	**0.0182**
LUX (1)	5.3846	**0.0203**	5.3846	**0.0203**
NL (1)	2.1768	0.1401	2.1768	0.1401
PT (1)	5.1496	**0.0232**	5.1496	**0.0232**
SP (2)	3.8722	**0.0491**	3.8722	**0.0491**

Notes: The critical value for both statistics is 3.8415. Statistically significant values are in bold.

VIII: *Granger causality tests results for period III*

Country	Null hypothesis	F-stat.	Prob.
AU	Stock market development does not Granger cause economic activity	4.7677	**0.0107**
	Economic activity does not Granger cause stock market development	1.3070	0.2756
BE	Stock market development does not Granger cause economic activity	2.6722	**0.0745**
	Economic activity does not Granger cause stock market development	0.7498	0.4753
DE	Stock market development does not Granger cause economic activity	5.6112	**0.0050**
	Economic activity does not Granger cause stock market development	0.4218	0.6571
IR	Stock market development does not Granger cause economic activity	5.1376	**0.0077**
	Economic activity does not Granger cause stock market development	0.3986	0.6724
NL	Stock market development does not Granger cause economic activity	1.4792	0.2332
	Economic activity does not Granger cause stock market development	0.6735	0.5124

Note: Statistically significant values are in bold.

IX: *VECMs results – period III*

Model	Results	FIN	FR	IT	LUX	PT	SP
VECM 1	λ_1	–0.0492	–0.1672	0.0150	–0.2432	–0.1579	–0.0728
	t-stat.	–1.0748	–2.5626	1.1027	–3.5298	–2.8055	–2.9659
	Prob.	0.2853	**0.0120**	0.2730	**0.0014**	**0.0061**	**0.0039**
	χ^2_1	0.0102	3.6175	2.4852	0.1082	0.4081	0.6994
	Prob.	0.9197	**0.0572**	0.1149	0.7422	0.5230	0.4030
VECM 2	λ_2	–0.0417	0.0161	–0.1085	0.0230	–0.1045	–0.0570
	t-stat.	–2.0053	1.2688	–2.7206	1.2950	–2.6370	–1.3038
	Prob.	**0.0478**	0.2070	**0.0078**	0.1985	**0.0098**	0.1956
	χ^2_2	0.1589	0.1009	0.2043	0.4105	0.0468	0.9599
	Prob.	0.6902	0.7508	0.6512	0.5217	0.8288	0.3272

rejected, it can be assumed that past values of stock prices can help to explain the values of economic activity measured by industrial production index.

Since the cointegration was found between economic activity and stock market indices in Finland, France, Italy, Luxemburg, Portugal and Spain during the period III, the VECMs are employed for the further study of nature of this relationship. The results of employed tests are presented in Tab. IX.

The results for Finland and Italy indicate that there is a long-run causality between economic activity and stock prices coming from economic activity because the error correction term λ_2 is negative and statistically significant. No short-run causalities are observed since the values of Chi-square statistics are not statistically significant.

The results for France show that the error correction term λ_1 is negative and statistically significant meaning that there is a long-run causality between independent variable and dependent variable. In other words, it means that stock market development leads to growth measured by industrial production index. Also the results of Chi-square statistic confirm the existence of short-run causality in the same direction.

The outcomes for Luxemburg and Spain are similar to the results for France, a long-run causality is found to be in the same direction but without a short-run causality. When assessing the results for Portugal, a mutual relation is indicated with the use of VECMs.

CONCLUSION

The aim of the paper was to empirically examine the relationship between economic activity and stock market development on the sample of 11 European developed countries. The cointegration tests did not confirm the existence of long-run relation between stock market development and economic activity during first two sub-periods for all 11 observed countries. Also no cointegration was found for five countries (AU, BE, DE, IR, NL) during the period III. These findings are similar to Harris (1997), Fink *et al.* (2004), Fink *et al.* (2005), Fink *et al.* (2009) or Caporale *et al.* (2015) who evidenced no significant influence of stock markets on growth. The cointegration was confirmed only in the period III in six countries (FIN, FR, IT, LUX, PT, SP). As Fink *et al.* (2004), from the long-run perspective, the author came to the conclusion that financial sector including stock markets did not play any positive role for the growth during the periods I and II and for above mentioned countries in the period III.

When assessing the short-run causality, Granger causality tests were conducted to check if past values of one variable can help explain the values of other variable. The results of causality tests were mixed, however during the period II when markets became more volatile, the number of causal relations grew significantly compared to the period I. The outcomes of employed tests indicated all variations of results: one-way relationship coming from stock market development to economic development (e.g. as in Beck and Levine, 2004; Nieuwerburgh *et al.*, 2006; Nowbutsing and Odit, 2009; Tang, 2013; Gazdar and Cherif, 2015; Georgantopoulos *et al.*, 2015 among others), one-way relationship coming from economic growth to stock market development (e.g. see Dritsaki and Dritsaki-Bargiota, 2005; Liu and Sinclair, 2008), mutual relationship (similar as e.g. in Marques *et al.*, 2013; or Kajurova, 2016) and no relation between variables (e. g. Harris, 1997; Fink *et al.*, 2005; or Hagmayr *et al.*, 2007). Fink *et al.* (2009) or Caporale *et al.* (2015). The increasing number of relations when comparing individual periods can point to the fact that the level of integration plays important role when studying the nature of relationship between variables.

The study employed by Kajurova and Rozmahel (2016) including EA countries confirmed the long-term causality running from economic growth to stock market development for whole EA panel. But when focusing on the results that were obtained in this study for individual countries during different periods, it should be emphasized that the statements about the direction of causality cannot be generalized as proposed by Levine (1997). The recommendations provided at panel level are no valid for all countries included in the sample. The demand-following hypothesis proposed by Patrick (1966) was not confirmed for all observed EA countries, only for a few of them.

The knowledge about the nature of the relationship can have important implications for both the investors and policy makers. The investors can benefit from knowledge about the link between economic activity and stock market development, e.g. the information about stock market development can bring them important preliminary information about overall economic situation in the country and also about individual sectors when focusing on sectoral development of share prices. However, it does not automatically mean that they will benefit from all shares, the knowledge of firm's specific situation and is necessary to make appropriate decision. Also the information on the relationship between economic activity and stock market development can provide some implications for macroeconomic and development policy. As Pradhan *et al.* (2015) and Kajurova and Rozmahel (2016), a sound and continued economic growth of countries can be promoted by stabilization of macroeconomic environment and the stock market development should be supported even in short-run. Finally, the investors and policy makers should be aware of the fact that the nature of the relationship can change over time and that the results should be regularly re-estimated.

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Appendix A. A literature survey

Author(s)	Country/ Countries	Period	Methods	Findings
Atje and Jovanovic (1993)	40	1980–1988	Cross-sectional regressions with lagged investments	Stock markets have long-run impact on economic growth
Demirgüc-Kunt and Levine (1996)	44	1986–1993	Correlations	It shows some important correlations, but the paper stimulates future research
Levine and Zervos (1996)	47	1976–1993	Pooled cross-country, time series regressions	SMD is associated with long-run economic growth.
Harris (1997)	49	1980–1991	Regressions (OLS and 2SLS)	Stock market activity does not have much explanatory power
Levine and Zevros (1998)	47	1976–1993	Cross-country regressions	Stock market liquidity is positively correlated with contemporaneous and future rates of economic growth
Mauro (2003)	17 advanced and 8 emerging	1971–1998	Individual-country regressions Panel regressions	Lagged stock returns influence output growth
Beck and Levine (2004)	40	1976–1998	Dynamic panel model (GMM)	SMD has positive impact on economic growth
Fink *et al.* (2004)	9 transition economies and 18 developed	1996–2000	Cross-section analysis Panel analysis	Up to 2004 stock markets did not play important role.
Dritsaki and Dritsaki-Bargiota (2005)	Greece	1988–2002	Cointegration VECM framework Error correction models	Unidirectional causality coming from economic growth to SMD

Author(s)	Country/ Countries	Period	Methods	Findings
Fink *et al.* (2005)	22 market economies and 11 transition	1990–2001	Panel regressions	Financial sector induces weaker growth impulses in market economies.
Nieuwerburgh *et al.* (2006)	Belgium	1830–2000	Cointegration analysis Granger causality tests	SMD was important determinant of economic growth
Hagmayr *et al.* (2007)	4 SEE countries	1995–2005	Panel regressions	Stock markets were insignificant for output growth in the observed sample
Liu and Sinclair (2008)	Greater China	1973–2003	Causality tests within VECM framework	Economic growth affects stock indices in long-run, oppositely in short-run
Fink *et al.* (2009)	9 EU-accession countries	1996–2000	Panel data regressions	No significant influence of stock markets on growth
Nowbutsing and Odit (2009)	Mauritius	1989–2006	Error correction model	SMD positively affect growth in long run and short run
Panopoulou (2009)	12 EA countries	1988–2005	Bivariate and multivariate Granger causality tests	SMD leads economic growth in half of EA countries
Boubakari and Jin (2010)	5 Euronext countries	1995–2008	Granger causality tests	Developed stock markets affects growth, less developed do not.
Kolapo and Adaramola (2012)	Nigeria	1990–2010	Cointegration VECM framework Granger causality tests	Long run relationship between variables, but different results for different indicators when employing causality tests
Marques *et al.* (2013)	Portugal	1993–2011	VAR Granger causality tests	Positive bidirectional causal relationship
Nayaran and Nayaran (2013)	65 developing countries	1995–2011	Dynamic panel model (GMM)	SMD has a positive effect on economic growth for whole sample. Results differ for regional panels.
Tang (2013)	Australia	1960–2008	Cointegration Granger causality tests	Unidirectional causality running from stock price to economic growth
Cavenaile *et al.* (2014)	5 developing countries	1977–2007	Panel cointegration tests Individual VECM framework	Stock markets foster growth in long run
Prahdan *et al.* (2014)	ASEAN countries	1961–2012	Panel VAR model Granger causality tests	SMD matters in determination of long run economic growth
Caporale *et al.* (2015)	10 EU transition countries	1994–2007	Dynamic panel model (GMM)	Contribution of stock market to growth has been rather limited
Gazdar and Cherif (2015)	18 MENA countries	1984–2007	Dynamic panel regression	Stock markets can promote growth in countries with sound institutional environment
Georgantopoulos *et al.* (2015)	EA and non-EA (28 countries)	1996–2012	Dynamic panel model (GMM)	EA – stock market indicators are growth factors
Prahdan *et al.* (2015)	G20	1961–2012	Panel cointegration Panel VECM Panel causality tests	Promoting the development of stock market depth may support long-run growth
Kajurova (2016)	V4 countries	2004–2016	Cointegration VECM Granger causality	Different results for each country.
Kajurova and Rozmahel (2016)	EU countries	1999–2015	Panel VECM Panel causality tests	Long-run effects for EA panel coming from economic growth and short-run effect for non-EA panel coming from SMD
Prazak and Stavarek (2017)	V4 countries	2005–2014	VECM framework	No universal conclusion were found for V4 countries

Note: SMD means stock market development.

Appendix B. A list of used indices

Country	Stock index
Austria	Wiener Borse Index
Belgium	Belgian All Shares Index
Finland	HEX Index
France	SBF250 Index
Germany	DAX Index
Ireland	ISEQ Index
Italy	MIB Index
Luxembourg	LUX General Index
Netherlands	AEX All Shares Index
Portugal	BVL Share Price Index
Spain	IGBM Index

Source: OECD statistics (2017)

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