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Article _____

The Relationship between Education, Economic Growth and Unemployment: Evidence in Eastern Europe

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Abstract

The article attempts to examine the causal relationship between government expenditure on education, tertiary enrolment, economic growth and unemployment of six emerging countries in Eastern Europe between 1998 and 2017 using a vector autoregressive model. We found that government expenditure on education has positive relationships with tertiary enrolment and GDP per capita. The increase of tertiary enrolment contributes to reducing unemployment rate. However, the proportion of tertiary enrolment should be effectively controlled and managed because this generates reduction of government expenditure on education and GDP in Eastern Europe. Economic growth negatively affects government expenditure on education. However, there is no co-integration among variables in the long run. Lastly, policies are recommended to achieve a sustainable development in Eastern Europe.

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INTRODUCTION

Education is an important contributor to economic and social development, which is defined as the most beneficial investment of the government. By 2013, government expenditure on education of 28 countries of the European Union (EU-28) accounted for 5 percent of total gross domestic product (GDP). Expenditure on education of Eastern European countries is lower than that of EU-28, except Poland (Csintalan and Badulescu, 2017). In recent years, the EU has to face issues in socio-economics. For instance, between 2008 and 2013, more than six million jobs were lost in this region and as a consequence, the number of unemployed people increased by more than 26 million and an unemployment rate reached nearly 11 percent in 2013 - the highest level for more than two decades. Further, the proportion of severely materially deprived people grew 9.9 percent by 2012 (Darvas and Wolff, 2014). Currently, Eastern European countries must deal with three obstacles in economic growth related to encouraging and retaining people into the labour force, catching up on innovation and developing financial platforms, and shifting to a green economy which can enhance competitiveness and improve investment opportunities (Djankov, 2016).

There are some existing studies assessing the influence of education on economic growth and unemployment in Eastern Europe in recent years (Shukarov and Maric, 2016; Maitah et al., 2015; Lavrinovicha et al., 2015; and Burja and Burja, 2013). However, none of these uses the vector autoregressive (VAR) model to estimate the causality between education, economic growth and unemployment in Eastern Europe. What is the relationship between education, economic growth and unemployment in Eastern Europe? How do these variables correlate in the short-run and long-run? This research, therefore, is carried out to narrow down the gap of existing studies. Specifically, a VAR model is employed to investigate the relationship between education, economic growth and unemployment in six emerging countries in Eastern Europe for the period 1998–2017. More importantly, policies are recommended to facilitate contributions of education to economic growth and employment in Eastern Europe.

The rest of this paper is organized as follows. Section 2 presents the empirical review. Methods are presented in section 3. Section 4 presents results and discussion. Finally, conclusion and policy implications are summarized in section 5.

EMPIRICAL REVIEW

Some studies assess the relationship between education and economic growth in recent years. Hanif and Arshed (2016) investigated the relationship between school education and economic growth of SAARC countries (Pakistan, India, Bangladesh, Bhutan, Nepal, Sri Lanka, Maldives and Afghanistan) from 1960 to 2013. They found that tertiary education enrolment has the highest effect on growth compared to primary and secondary education enrolment. Likewise, a research by Kotaskova et al. (2018) estimated the influence of education on economic growth of India between 1975 and 2016. Results showed that there is a positive correlation between education levels and economic growth in this country.

Further, some research examine the relationship between education and economic growth in Europe. Shukarov and Maric (2016) evaluated impacts of institution and education on economic growth in Macedonia, Serbia, Bulgaria and Slovenia over the period 2000–2013. They found that the society with higher degree of institutional development is more likely to foster economic growth. In addition, societies in Slovenia and Bulgaria, where have a higher degree of institutional development is higher, can produce well qualified and skilled labour force which are important contributors to economic growth. Similarly, Simionescu et al. (2017) examined determinants of economic growth in Czech Republic, Slovak Republic, Hungary, Poland, and Romania between 2003 and 2016. Results indicated that the expenditure on education generated economic growth only in Czech Republic, while the expenditure on research and development had positive effects in Romania, Hungary and the Czech Republic. A study by Soylu et al. (2018) assessed the relationship between economic growth and unemployment in Eastern European countries from 1992 to 2014. They found that economic growth and unemployment series are stationary at first level and economic growth negatively affects unemployment.

In addition, Burja and Burja (2013) investigated the relationship between education and GDP in Romania between 1980 and 2008. They recommended that human capital value, macroeconomic development and stability should be facilitated in order to foster sustainable development in this country. Likewise, Pegkas (2014) evaluated the correlation between education and economic growth in Greece from 1960 to 2009. Results demonstrated that there is a unidirectional long-run causality running from primary education to growth, bidirectional long-run causality between secondary and growth, long-run and short-run causality running from higher education to economic growth. Lastly, Lavrinovicha et al. (2015) estimated effects of education on unemployment and income of Latvia between 2002 and 2013. They found that differences in the amount of income and in the existence of job are determined by the level of education.

METHODS

Data and sources

A panel dataset for the causality between education, economic growth and unemployment is gathered from the database in World Development Indicators released by the World Bank. Specifically, six emerging countries in Eastern Europe, including Bulgaria, Czech Republic, Hungary, Poland, Romania, and Slovak Republic, are chosen for the study. A panel dataset is collected for the last two decades (1998–2017). Thus, a total of 120 observations are entered for data analysis. The panel data is used for this research because of the following advantages: (1) it benefits in terms of obtaining a large sample, giving more degree of freedom, more information, and less multicollinearity among variables; and (2) it may overcome constraints related to control individual or time heterogeneity faced by the cross-sectional data (Hsiao, 2014).

The vector autoregressive (VAR) model

The VAR model is used to examine the relationship between education, economic growth and unemployment of six emerging countries in Eastern Europe between 1998 and 2017. The VAR model is chosen for this study because it explains the endogenous variables solely by their own history, apart from deterministic regressors and therefore this method incorporates non-statistical a priori information (Pfaff, 2008). Further, the VAR model is a popular method in economics and other sciences since it is a simple and flexible model for multivariate time series data (Suharsono et al., 2017).

The specification of a VAR model can be defined as follows (Pfaff, 2008):

$$Y_t = A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + \varepsilon_t \quad (1)$$

Where: Y_t denotes a set of K endogenous variables (government expenditure on education, tertiary enrolment, GDP per capita, and unemployment rate); A_i represents (K x K) coefficient matrices for i = 1,…, p; and ε_t is a K-dimensional process with $E(\varepsilon_t) = 0$.

An important characteristic of the VAR model is stability and therefore it generates stationary time series with time invariant means, variances and covariance structure, given sufficient starting values. The stability of an empirical VAR model can be analyzed by considering the companion form and computing the eigenvalues of the coefficient matrix. A VAR model may be specified as follows (Pfaff, 2008):

$$\varepsilon_t = A\varepsilon_{t-1} + V_t \quad (2)$$

Where: ε_t denotes the dimension of the stacked vector; A is the dimension of the matrix (K_p x K_p); and V_t represents (KP x 1).

Table 1. Description of covariates in the VAR model

Variable	**Unit**
Government expenditure on education	% of GDP
Tertiary enrolment	%
GDP per capita	US$
Unemployment rate	%

Note: US$ means United States Dollar

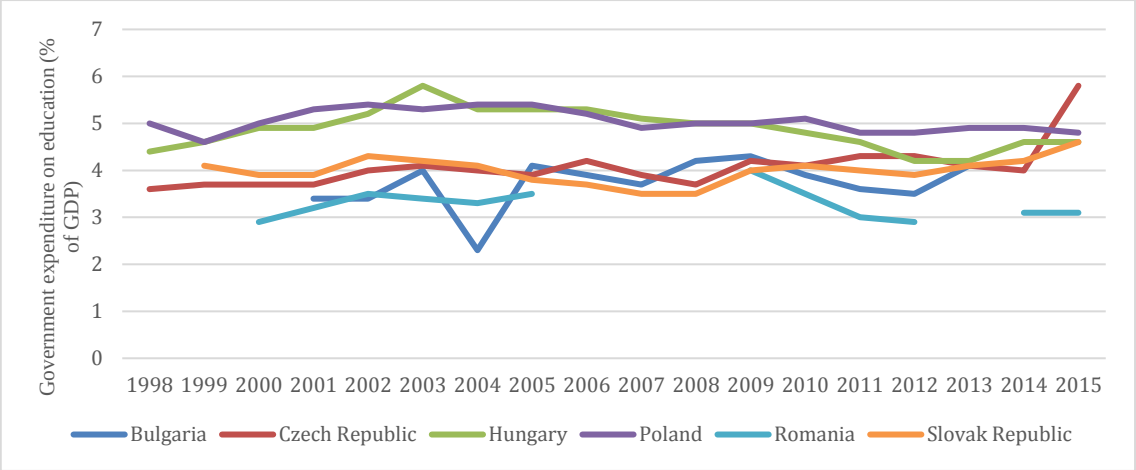
In this study, the procedure of a VAR model includes six steps, consisting of (1) performing the unit root test; (2) determining lag length; (3) estimating the VAR model; (4) testing the Granger

causality; (5) checking the stability of eigenvalues; and (6) implementing the Johansen test for co-integration. The VAR model is estimated by the Stata MP 14.2 software.

RESULTS AND DISCUSSION

Education, economic growth and unemployment in Eastern Europe: An overview

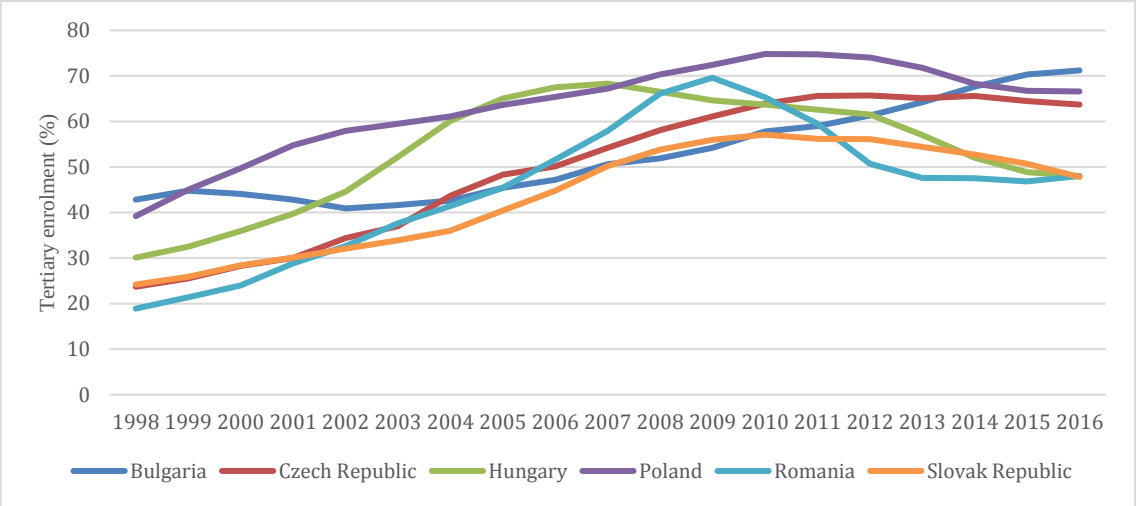
Figure 1. Government expenditure on education of selected countries in Eastern Europe



Source: World Bank, 2019

Poland had the largest government expenditure on education from 1998 to 2015, followed by Hungary, while the government of Romania spent the lowest expenditure on education. However, by 2015, government expenditure on education of Czech Republic had the highest level by 5.8 percent of GDP which was higher than that of Poland by 1 percent, while investment in education of Romania only accounted for more than 3 percent (Figure 1).

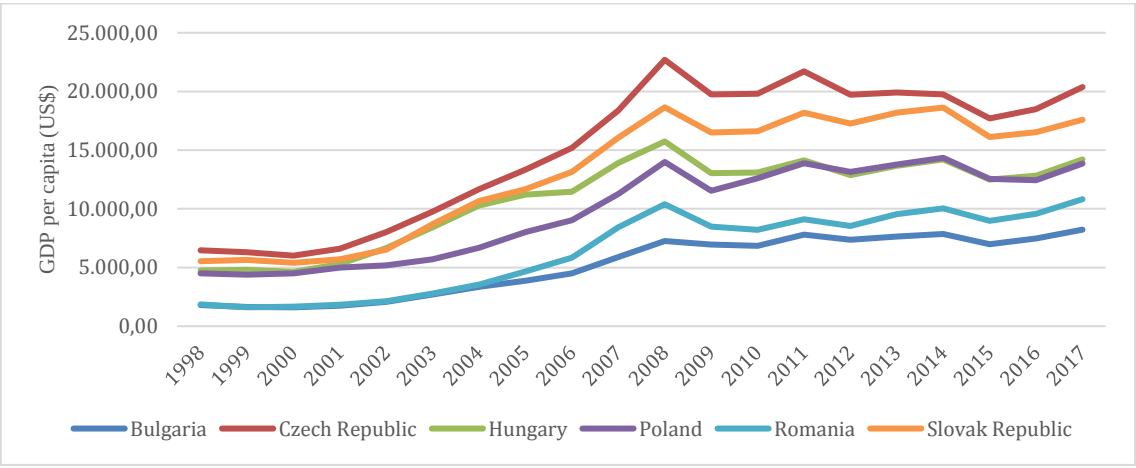
Figure 2. Tertiary enrolment of selected countries in Eastern Europe



Source: World Bank, 2019

From 1998 to 2007, the rate of tertiary enrolment is dominated by Poland and Hungary. The proportion of tertiary enrolment of Bulgaria and Czech Republic significantly increased for 19 years (1998–2016). By 2016, Bulgaria has overcome Poland to become the leading country in tertiary enrolment with more than 71 percent, followed by Poland (66.6 percent), Czech Republic (63.7 percent), while the rate of tertiary enrolment of Romania accounted for only more than 47 percent (Figure 2).

Figure 3. GDP per capita of selected countries in Eastern Europe

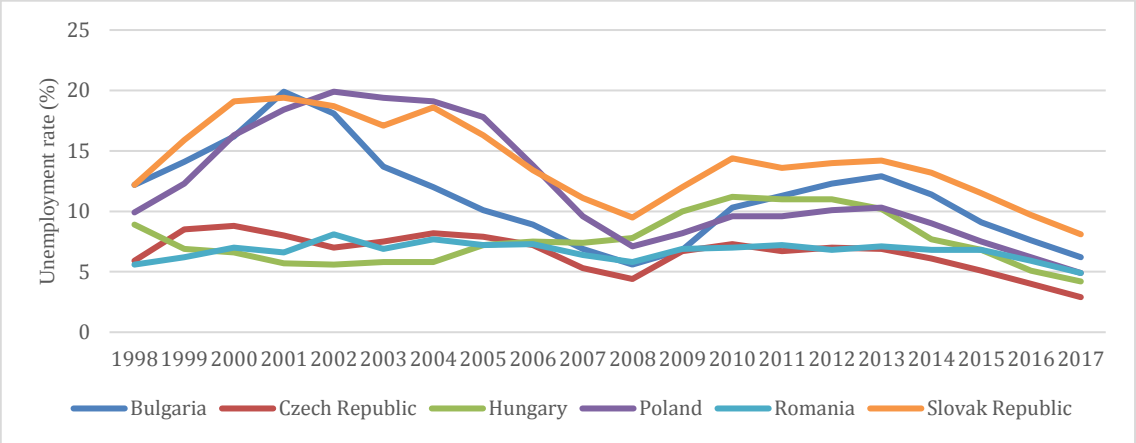


Source: World Bank, 2019

For two decades (1998–2017), Czech Republic had the highest GDP per capita, followed by Slovak Republic, while Bulgaria is ranked at the end of the list. For example, by 2017, the average GDP per capita of Czech Republic reached more than US$20,000, followed by Slovak

Republic (more than US$17,600), while GDP per capita of Bulgaria accounted for only more than US$8,200 (Figure 3).

Figure 4. Unemployment rate of selected countries in Eastern Europe



Source: World Bank, 2019

Unemployment rate of six countries tended to decrease over two decades (1998–2017). By 2017, unemployment rate of Bulgaria reduced by 6 percent compared to this in 1998, followed by Poland by 5 percent, Hungary by 4.7 percent, while Romania by only 0.7 percent (Figure 4).

Table 2. Characteristics of education, economic growth and unemployment of selected countries in Eastern Europe

Variable	Mean	SD	Min	Max
Government expenditure on education	3.45	1.76	0	5.8
Tertiary enrolment	48.86	17.70	0	74.8
GDP per capita	10090.34	5443.47	1609.9	22698.9
Unemployment rate	9.70	4.18	2.9	19.9

Source: Author's calculation, 2019

Note: SD denotes standard deviation

The average proportion of government expenditure on education and tertiary enrolment of six Eastern European countries account for 3.45 percent and 48.86 percent, respectively. GDP per capita and unemployment rate of these countries reach more than US$10,000 and 9.7 percent, respectively, on average (Table 2).

The relationship between education, economic growth and unemployment in Eastern Europe

Implementation of the unit root test

The unit root test is carried out to check the stationarity or non-stationarity of the time series variables (Adeola and Ikpesu, 2016). In this study, the Augmented Dickey-Fuller (ADF) test is used to examine the stationarity of government expenditure on education, tertiary enrolment, GDP per capita and unemployment rate with the hypothesis as follows:

Null hypothesis (H_0): The variables contain a unit root

Alternative hypothesis (H_a): The variables do not contain a unit root

Table 3. The ADF test for the unit root

Variables	**Level**	**1st difference**	**2nd difference**
LnGovernment expenditure	T-statistic: -5.76	T-statistic: -5.13	T-statistic: -4.87
	P-value: 0.00	P-value: 0.00	P-value: 0.00
	Critical values:	Critical values:	Critical values:
	1% level: -3.50	1% level: -3.50	1% level: -3.50
	5% level: -2.88	5% level: -2.88	5% level: -2.88
	10% level: -2.57	10% level: -2.57	10% level: -2.57
LnTertiary enrolment	T-statistic: -8.39	T-statistic: -5.83	T-statistic: -4.87
	P-value: 0.00	P-value: 0.00	P-value: 0.00
	Critical values:	Critical values:	Critical values:
	1% level: -3.50	1% level: -3.50	1% level: -3.50
	5% level: -2.88	5% level: -2.88	5% level: -2.88
	10% level: -2.57	10% level: -2.57	10% level: -2.57
LnGDP per capita	T-statistic: -2.86	T-statistic: -3.23	T-statistic: -3.52
	P-value: 0.05	P-value: 0.01	P-value: 0.00
	Critical values:	Critical values:	Critical values:
	1% level: -3.50	1% level: -3.50	1% level: -3.50
	5% level: -2.88	5% level: -2.88	5% level: -2.88
	10% level: -2.57	10% level: -2.57	10% level: -2.57
LnUnemployment rate	T-statistic: -3.13	T-statistic: -3.80	T-statistic: -3.94
	P-value: 0.02	P-value: 0.00	P-value: 0.00

Critical values:	Critical values:	Critical values:
1% level: -3.50	1% level: -3.50	1% level: -3.50
5% level: -2.88	5% level: -2.88	5% level: -2.88
10% level: -2.57	10% level: -2.57	10% level: -2.57

Source: Author's calculation, 2019

Results show that we cannot reject the null hypothesis because P-values of all variables are greater than critical values at 1%, 5%, and 10%, respectively and these imply that variables exhibit a unit root (Table 3).

Determination of the lag length

The objective of this step is to specify the optimal lag for the VAR model. If the lag is used too little, then the residual of the regression will not show the white noise process and as the result, the actual error could not be accurately estimated by the model (Suharsono et al., 2017).

Table 4. Selection of the lag length

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-388.62				0.01	6.76	6.80	6.86
1	-105.78	565.68	16	0.000	0.00	2.16	2.36	2.64*
2	-78.39	54.77*	16	0.000	0.00*	1.97*	2.31*	2.82
3	-71.99	12.79	16	0.688	0.00	2.13	2.63	3.37
4	-61.40	21.19	16	0.171	0.00	2.23	2.88	3.84

Endogenous: LnGovernment expenditure LnTertiary enrolment LnGDP per capita LnUnemployment

Exogenous: Constant

Number of observations = 116

Source: Author's calculation, 2019

Notes: * denotes lag order selected by the criterion; LL means log likelihood values; LR represents sequential modified LR test statistics; FPE denotes final prediction error; AIC means Akaike information criterion; HQIC represents Hannan-Quinn information criterion; and SBIC means Schwarz's Bayesian information criterion.

As seen in Table 4, results suggest that the optimal lag length in this case is the lag 2 (the number of lag is equal to 2) because this value is recommended by FPE, AIC, and HQIC indicators,

while lag 1 is recommended by only SBIC. Therefore, lag 2 is chosen to run the VAR model in the next step.

Estimation of the VAR model

We found that government expenditure on education has positive relationships with tertiary enrolment and GDP per capita. In contrast, tertiary enrolment has negative relationships with government expenditure on education, GDP per capita, and unemployment rate. Lastly, GDP per capita and unemployment rate have negative effects on government expenditure on education (see details in Table A1 of the appendix).

Testing the Granger causality

The goal of the Granger causality is to assess the predictive capacity of a single variable on other variables (Musunuru, 2017). In this study, hypotheses need to be tested as follows:

Testing the relationship between government expenditure and other variables:

Null hypothesis (H_0): Government expenditure does not cause tertiary enrolment, GDP and unemployment rate

Alternative hypothesis (H_a): Government expenditure causes tertiary enrolment, GDP and unemployment rate

Testing the relationship between tertiary enrolment and other variables:

Null hypothesis (H_0): Tertiary enrolment does not cause government expenditure, GDP and unemployment rate

Alternative hypothesis (H_a): Tertiary enrolment causes government expenditure, GDP and unemployment rate

Testing the relationship between GDP and other variables:

Null hypothesis (H_0): GDP does not cause government expenditure, tertiary enrolment and unemployment rate

Alternative hypothesis (H_a): GDP causes government expenditure, tertiary enrolment and unemployment rate

Testing the relationship between unemployment rate and other variables:

Null hypothesis (H_0): Unemployment rate does not cause government expenditure, tertiary enrolment and GDP

Alternative hypothesis (H_a): Unemployment rate causes government expenditure, tertiary enrolment and GDP

Table 5. Results of the Granger causality Wald test

Directional relationship	Probability	Conclusion
Expenditure ⟶ Enrolment	0.00 < 0.05	Reject H_0
Expenditure ⟶ GDP	0.00 < 0.05	Reject H_0
Expenditure ⟶ Unemployment	0.00 < 0.05	Reject H_0
Enrolment ⟶ Expenditure	0.00 < 0.05	Reject H_0
Enrolment ⟶ GDP	0.66 > 0.05	Accept H_0
Enrolment ⟶ Unemployment	0.34 > 0.05	Accept H_0
GDP ⟶ Expenditure	0.17 > 0.05	Accept H_0
GDP ⟶ Enrolment	0.00 < 0.05	Reject H_0
GDP ⟶ Unemployment	0.81 > 0.05	Accept H_0
Unemployment ⟶ Expenditure	0.77 > 0.05	Accept H_0
Unemployment ⟶ Enrolment	0.00 < 0.05	Reject H_0
Unemployment ⟶ GDP	0.26 > 0.05	Accept H_0

Source: Author's calculation, 2019

There is a directional relationship running from government expenditure to tertiary enrolment, GDP and unemployment; from tertiary enrolment to government expenditure; from GDP to tertiary enrolment; and from unemployment to tertiary enrolment (Table 5).

Examination of eigenvalue stability

The purpose of this assignment is to check stability of the eigenvalues in the VAR model. All the eigenvalues lie inside the unit circle and we can conclude that the VAR model satisfies stability condition (Figure 5).

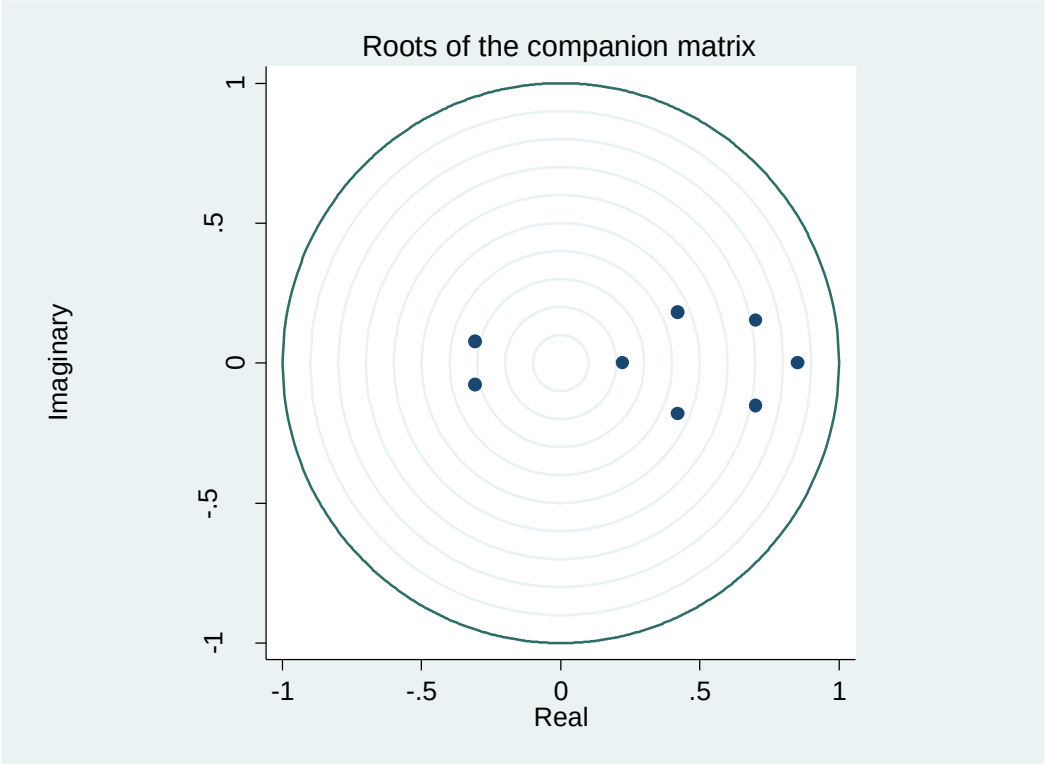


Figure 5. Checking the stability of eigenvalues in the VAR model

Source: Author's calculation, 2019

Performance of the Johansen co-integration test

The Johansen co-integration test is performed in order to examine the long-run relationship among variables. If variables are co-integrated, it suggests that there is a long term relationship among variables (Musunuru, 2017).

The hypothesis to be tested can be identified as follows:

Null hypothesis (H_0): There is no co-integration among variables

Alternative hypothesis (H_a): There is co-integration among variables

In this study, the Johansen co-integration test is carried out by trace statistic test. Trace test is a likelihood-ratio-type test, which operates under different assumptions in the deterministic part of the data generation process (Lutkepohl et al., 2001).

Table 6. Results of trace statistic in the Johansen co-integration test

Maximum rank	LL	Eigenvalue	Trace statistic	5% critical value	1% critical value
0	-139.10		110.43	47.21	54.46
1	-112.34	0.36	56.91	29.68	35.65
2	-95.86	0.24	23.95	15.41	20.04
3	-87.49	0.13	7.20	3.76	6.65
4	-83.88	0.05			

Source: Author's calculation, 2019

As seen in Table 6, value of trace statistic is greater than the 1% and 5% critical values in all ranks and this suggests that there is no co-integration among variables in the long run.

Discussion

We found that government expenditure on education has positive relationships with tertiary enrolment and GDP per capita. This implies that government expenditure on education has played an important contribution to fostering the rate of tertiary enrolment and boosting economic growth in Eastern European countries. The increase of tertiary enrolment contributes to reducing unemployment rate. However, the proportion of tertiary enrolment should be effectively controlled and managed because this generates reduction of government expenditure and GDP in Eastern Europe. GDP negatively affects government expenditure on education and this reflects that an increase of GDP has been preferred to use for other activities such as army and security, science and technology rather than tertiary education. Further, there is a directional relationship running from government expenditure to tertiary enrolment, GDP and unemployment; from tertiary enrolment to government expenditure; from GDP to tertiary enrolment; and from unemployment to tertiary enrolment. However, there is no co-integration among variable in the long run.

Our results are consistent with Simionescu et al. (2017) and Burja and Burja (2013) who found that government expenditure on education has a positive influence on economic growth in Czech Republic and Romania. However, our study found that there is no relationship between economic growth and unemployment, while Soylu et al. (2018) argued that economic growth negatively affects unemployment in Eastern Europe.

CONCLUSION AND POLICY IMPLICATIONS

The article attempts to investigate the causal relationship between government expenditure on education, tertiary enrolment, economic growth and unemployment of six emerging countries in Eastern Europe between 1998 and 2017. We found that government expenditure on education has positive relationships with tertiary enrolment and GDP per capita. The increase of tertiary enrolment contributes to reducing unemployment rate. However, the proportion of tertiary enrolment should be effectively controlled and managed because this generates reduction of government expenditure and GDP in Eastern Europe. GDP negatively affects government expenditure on education. In addition, there is a directional relationship running from government expenditure to tertiary enrolment, GDP and unemployment; from tertiary enrolment to government expenditure; from GDP to tertiary enrolment; and from unemployment to tertiary enrolment. However, there is no co-integration among variables in the long run.

Clearly, government expenditure on education should be facilitated because it contributes to the rise of tertiary enrolment and economic growth in Eastern European countries. Although tertiary enrolment assists to reduce unemployment rate, this should be effectively controlled and managed because it has been defined as a source of reduction in government expenditure on education and GDP. Finally, economic development should be carried out along with improving the program and quality of education to achieve a sustainable development in Eastern Europe.

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APPENDICES

Table A1. Estimation of the VAR model

Variables	Coefficient	Standard Error	t	P-value
LnGovernment expenditure				
LnGovernment expenditure				
L1	0.463***	0.09	4.97	0.000
L2	0.181	0.11	1.60	0.113
LnTertiary enrolment				
L1	-0.166**	0.06	-2.56	0.012
L2	-0.147*	0.08	-1.74	0.085
LnGDP per capita				
L1	0.768***	0.26	2.95	0.004
L2	-0.726***	0.23	-3.14	0.002
LnUnemployment rate				
L1	0.918***	2.25	3.61	0.000
L2	-0.850***	2.25	-3.29	0.001
Constant	1.044	0.74	1.40	0.164
LnTertiary enrolment				
LnGovernment expenditure				
L1	1.117***	0.15	7.43	0.000
L2	-0.299	0.18	-1.64	0.105
LnTertiary enrolment				
L1	-0.136	0.10	-1.30	0.195
L2	0.319**	0.13	2.34	0.021
LnGDP per capita				
L1	-0.294	0.42	-0.70	0.484
L2	0.190	0.37	0.51	0.611
LnUnemployment rate				
L1	0.601	0.41	1.46	0.146
L2	-0.532	0.41	-1.28	0.204
Constant	2.854**	1.20	2.37	0.020
LnGDP per capita				
LnGovernment expenditure				
L1	0.006	0.03	0.18	0.859
L2	0.072*	0.04	1.72	0.088
LnTertiary enrolment				
L1	0.245***	0.02	10.30	0.000
L2	-0.112***	0.03	-3.61	0.000
LnGDP per capita				
L1	1.125***	0.09	11.73	0.000
L2	-0.257***	0.08	-3.01	0.003
LnUnemployment rate				
L1	-0.009	0.09	-0.11	0.916
L2	0.035	0.09	0.38	0.707
Constant	0.556**	0.27	2.02	0.045
LnUnemployment rate				
LnGovernment expenditure				
L1	0.023	0.03	0.62	0.534
L2	-0.024	0.04	-0.55	0.587
LnTertiary enrolment				
L1	-0.146***	0.02	-5.67	0.000
L2	0.002	0.03	0.09	0.930
LnGDP per capita				
L1	0.170	0.10	1.65	0.102
L2	-0.145	0.09	-1.58	0.118
LnUnemployment rate				
L1	1.243***	0.10	12.27	0.000
L2	-0.356***	0.10	-3.47	0.001

Constant	0.547*	0.29	1.84	0.068

Source: Author's calculation, 2019
Notes: L1 and L2 mean lag 1 and lag 2; ***, ** and * denote statistical significance at 1%, 5%, and 10%, respectively