Abstract

This paper attempts to analyze the relationship between exports, investments and economic development in two pre-accession countries of the European Union such as Bulgaria and Romania. For the search of this relationship we use a multivariate autoregressive VAR model. The results of cointegration analysis showed that there is one cointegrated vector among exports, investments and economic growth for the two countries. Granger causality tests based on error correction models (ECM) have indicated that there is a “strong Granger causal” relation between economic growth and exports as well as between investments and exports for the two countries. In addition, economic development and capital accumulation in an economy seem to have just as much of an influence on exports as exports have on capital accumulation and economic development.

keywords: exports, economic development, investments, multivariate autoregressive VAR model, Granger causality

JEL Classification: A10, C22
1. Introduction

The conditions for membership, set out by the Copenhagen European Council in 1993 and further detailed by subsequent European Councils, provide the benchmarks for assessing each candidate’s progress. These candidates are expected to join the European Union on the basis of the same economic and political criteria that had been set by the Copenhagen and Madrid European Councils. These conditions remain valid today and there is no question of modifying them. The Seville European Council in 1996 encouraged Bulgaria and Romania to pursue their efforts and reiterated its commitment to give them full support in their preparation for accession in European Union. As confirmed by the Laeken European Council in 2001 the accession process is now irreversible. ¹

The European Commission recommended, on the basis of Copenhagen criteria, that Bulgaria and Romania shouldn’t be included in the first group of countries with whom negotiations should be opened. Finally, Bulgaria and Romania were invited at the Helsinki summit meeting in December 1999 to start negotiations for membership. The substantive negotiations started in March 2000. ²

Romania and Bulgaria in accordance with Commission’s Regular Reports are obliged to strengthen their convergence efforts to European Union by meeting the Copenhagen economic criteria and continuing the reform of the public administration and the judiciary, since they have fulfilled the political criteria. The European Councils held at Santa Maria de Feira in 2000 and at Gothenburg in 2001 confirmed

the vital importance of the pre-accessions’ countries capacity to implement the requisite criteria. The economic criteria are the following:

- macroeconomic stability, in particular through the implementation of structural reforms
- market competitiveness through enterprises structuring
- taking measures to stimulate domestic and foreign investment
- simplification of legal and administrative procedures
- stabilization of government policy and transparency

Following the economic crisis in 1996 with negative real GDP growth, the currency board arrangement, introduced in July 1997, helped to stabilize the economy and to achieve real GDP growth close to 4% on average since 1998. Inflation came down to 7.4% on average in 2001 and fiscal discipline kept the deficit below 1% of GDP. An increase on foreign direct investment inflows that have also been the main source of an orderly financing of public deficits conducd to the improvement of business climate. However, as a consequence of structural reforms, unemployment has kept on rising until 19.9% in 2001 and slowly declined to 17% in 2002. The employment rate of the working-age population fell from 54.5% in 1997 to 50.7% in 2001. The investment growth which was 20% in 2001 and was supported by relatively low interest rates, has increased the ratio of gross fixed capital formation to GDP from 10.6% top 17.8% in 2001. Last year, real GDP growth was 4%, and in the first quarter of 2002 was estimated at 3.2%.

The high current account deficit continues to reflect the gap between the domestic savings and the investment, but is exceeded by net inflows of foreign direct investment in most years. The public debt declined below 80% of GDP in 2002. The

broad monetary aggregate M3 grew by 18% in nominal terms and by 9% in real terms between March 2001 and March 2002. Bulgaria continues to adhere to the currency board arrangement, which was introduced in July 1997 and fixes the Bulgarian lev (BGN) against the euro. Due to higher inflation that was anticipated, real short-term interest rates turned negative at the end of 2001. The general openness of the economy, measured by trade in goods and services as a percentage of GDP, decreased slightly from 58% (1997) to 56% (2001) for exports and increased from 54% (1997) to 63% (2001) for imports.4

Bulgaria’s most important export product is tourism whose revenues accounted for almost 9% of GDP in 2001. In the course of the abolition of tariffs in the context of the Europe Agreements, the European Union has become Bulgaria’s most important trading partner. Exports on goods consist mainly of petroleum products, agricultural and pharmaceutical products. Among the EU Member States, Italy, Germany, Greece have become the most important destinations for Bulgarian exports, while the most important destinations outside the EU are Turkey and Russia. The Communities programs (PHARE, SHAPARD, ISPA) provided an important financial assistance for economic development, R&D, environment, telecommunications and agricultural sector of Bulgaria.5

Romania on the basis of last Regular Report of European Union fulfills the political criteria as defined by Copenhagen European Council in 1993. However, Romania still needs to improve legislative and decision making processes, while judiciary reforms should be made political priority. The government’s policy supports the institutions of human rights and protection of local minorities. Important steps were taken to implement the National Strategy for improving the Condition of Roma.

5 In terms of one-month credit and deposit rates, corrected by CPI inflation.
Romania has continued to make progress towards being a functioning economy with competitive market. Sustained and full implementation of planned measures together with the completion of the reform agenda should allow Romania to be able to cope with competitive pressure and market forces within the Union in the medium term.\(^6\)

The ongoing extensions of the banking sector and the advance in privatization have progressively tightened enterprises financial discipline. Price and trade liberalization coupled with a significant adjustment of important reforms of the tax system, have set the stage for a more efficient allocation of resources.

The historic decision adopted by EU at Helsinki meeting in December 1999 to include Romania in the group of candidate countries signifies that Romania has moved to a new stage of its European integration process.\(^7\) The accession process provides an important impetus for the acceleration of much-needed reforms in Romania. It brings further opportunities as well as greater challenges to Romania and other candidate countries, since it improves the long-run development prospects by providing access to a large single market, and allowing free movement of goods, services, capital and people within the market.

Economic integration is to be facilitated by bringing new opportunities for trade, and as the economic environment becomes more attractive, by increasing foreign direct investment inflows. To this end, “Europe Agreement” provides the chance to Romania to have easier access in the economies of the European Union’s member–states.

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\(^7\) In Eastern and Central Europe, Slovenia, the Czech Republic, Hungary, Poland and Estonia were chosen as the first group of candidate countries, the so called “front runners” in 1998. Latvia, Lithuania, Slovakia, Bulgaria and Romania were invited to start EU accession negotiations in Helsinki.
European Commission has specified the following prerequisites before Romania can pave a solid way to EU accession. Firstly, macroeconomic stability, without which there cannot be sustainable growth, is essential and secondly, inflation reduction in the level of 2% on the basis of the ‘‘Europe Agreement’’. With an economic growth rate among the lowest in the group of candidates countries since 1990, and an inflation rate among the highest, Romania lagged the chances of acceding to the Union as more advanced candidates aiming at a functioning economy with competitive market accessible to all EU member-states

Trade is among the areas where Romania is most integrated with the EU. Trade liberalization and exports growth in agricultural and industrial products consist the main target for economy restructuring. The abolition of tariff barriers allows the foreign direct investments growth to the domestic market. Therefore, Romania is driven by the implementation of the “Europe Agreement”, a free-trade agreement that requires the elimination of remaining tariffs on non-agricultural imports from the EU by 2002 and gradual reciprocal tariff reductions for agricultural products.

Romania has concluded free-trade agreements with the European Union, EFTA, CEFTA, Moldova, and Turkey. The basic principles of the agreement between Romania and European Union are:

- trade liberalization
- elimination of quantitative restrictions on imports
- elimination of quantitative restrictions on exports

Romania’s commercial relations with the EU became predominant in 1995. The share of exports to EU countries in the total Romanian exports increased from 33.9% in 1990 to 65.5% in 1999. The same trend was registered for Romanian imports from EU countries, whose share in total was 55.1% in 1999 compared with
21.8% in 1990. Among the candidate countries in 1999 (including Turkey, Cyprus and Malta), Romania was both the sixth largest destination for exports and the sixth largest source of imports in Europe. Nevertheless, there has been a substantial decline in exports activities of mineral and chemical products and an increasing reliance on imports of industrial raw materials from the EU. In Central and Eastern Europe Romania is the largest exporter of clothing products to the EU.

Foreign direct investments played only a minor role in Romania’s transition between 1989 and 1996 (a total of US$1.7 billion), with levels becoming more significant only in 1997 (US$1.3 billion) and in 1999 (US$1 billion). The low level of foreign direct investment has been an obstacle to the modernization of the capital base and to the employment growth in the private sector. The status of Romania as an EU candidate should enhance its attractiveness to foreign investors. Gross Domestic Product was 7.3% in 1997 and next year declined to 6.6%.8

Bulgaria and Romania have set the year 2007 as their indicative date of accession to the EU as full members.

2. Theoretical and empirical approaches

In the last decades economic development literature has mainly focused on the relationship between exports expansion and economic development. Numerous studies have been conducted dealing with different aspects of this effect. Many of these studies have focused on testing whether exports expansion leads to improved growth performance, while others have attempted to find how exports affect economic development, by identifying the paths through which the effects of exports are

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transmitted to economic development. Economic theory suggests that exports expansion is believed to promote economic development via two paths: by improving efficiency in the allocation of productive resources and by increasing the volume of productive resources through capital accumulation, Romer (1989), Basu and McLeod (1991), Edwards (1992).

Edwards (1993) in order to test empirically if exports promote economic development used the regression analysis and showed that there is a positive relationship between exports expansion and economic development. In the light of these developments, the evidence in support of positive effect of exports on economic development was considered to be spurious. Consequently, interest shifted to the use of causality analysis to determine the relationship between exports growth and economic development.

In other empirical studies efforts have been made in order to relate the exports and economic development analysis with cointegration technique and error correction models, [see Bahmani et al (1991), Dodaro (1993), Sharma and Dhakal (1994), Ghatak, Milner and Utkulu (1997), Liu, Song and Romilly, (1997) and Islam (1998)]. The evidence from these studies showed that there is a causal effect running from exports expansion to economic development. However, no causal analysis has been attempted to identify how exports affect economic development.

To detect the causal relationship between exports and economic development, Pereira and Xu (2000), Ghirmay, Grabowski and Sharma (2001), adopted the concept of causality tests proposed by Granger (1969) and Sims (1972). In such causality tests, the export variable is said to cause the economic development variable in Granger’s sense if the forecast for the economic development variable improves when the lagged export variable is included. Similarly, the economic development variable
is said to cause the exports variable in Granger’s sense if the forecast for the export variable carries a smaller mean square error when the lagged economic development variable is included.

In this paper we extend the empirical investigation of the relationship between exports and economic development a step further by addressing the issue in a dynamic multivariate framework and especially in two pre-accession countries of the European Union such as Bulgaria and Romania. These less developing countries in relation to the remainder of 10 countries of Central and Northern Europe, achieved to increase their economic development largely. In exports and economic development, variables that have been used broadly in many empirical studies, we include the variable investment. The causal hypotheses to be tested are the following:

- Does exports expansion cause economic development by enhancing the efficiency in the allocation of productive resources?
- Does exports expansion cause increases in capital accumulation by increasing the level of investment?
- Does economic development cause exports expansion?
- Does economic development cause investment growth?
- Does investment growth cause economic development?
- Does investment growth cause exports expansion?

Both neoclassical growth theory and the ‘new’ growth theory attach considerably the importance of exports expansion on economic development. According to these theories, exports promote economic development by improving the efficiency in the allocation of productive resources and by increasing the volume of productive resources which cause capital accumulation growth see McKinnon.
In our empirical analysis of the two pre-accession countries we used quarterly data for the period 1991:I - 2001:IV for all variables. The remainder of the paper proceeds as follows: Section 2 presents the theoretical and empirical approaches, while Section 3 analyses the data and the three-variable model that is used. Section 4 applies the Dickey-Fuller tests and investigates the stationarity of the used data. The cointegration analysis between the used variables is implied in Section 5. Section 6 deploys the analysis of multivariate causality based on error correction model. Finally, section 7 provides the conclusions of this paper.

3. Data and specification of the model

In order to test the causal relationship discussed above, we specify the following three–variable VAR model\(^9\)

\[
U = (Y, INV, EXP) \quad (1)
\]

where:
Y is the economic development
INV are the investments
EXP are the exports

\(^9\) The specification of a multivariate equation in a causality analysis is a major departure from the bivariate equations that have been widely used in the literature to examine the causal relationships. The bivariate studies have been considered to suffer from specification error.
Further, based on the results of the above sets of causal hypotheses, the corresponding bi-directional hypotheses can be examined.

To investigate the causal relationships a vector autoregressive VAR, model popularized by Sims (1980) is formulated of the vector $U$ defined in equation 1\(^{10}\). A unique advantage of the VAR model is that it treats each variable of the system as potentially endogenous and relates each variable to its own past values and to past values of all other variables included in the model.

Engle and Granger (1987) and Granger (1988) pointed out that a VAR model in levels with nonstationary variables may lead to spurious results and a VAR model in first differences with cointegrated variables is misspecified. In the latter case the error correction term, ECT, which represents the long run relationship between the variables is reintroduced back into the VAR and the resulting model is known as the vector error correction model VECM.

A three-variable unrestricted VAR model with the deterministic term can be written as:

$$U_t = A_0 + A(L)U_t + e_t$$

where $A(L) = [a_{ij}(L)]$ is a 3 X 3 matrix of the polynomial

$$a_{ij}(L) = \Sigma a_{ij}L^m$$

$m_{ij}$ is the degree of the polynomial

$$A_0 = (a_{10} a_{20} a_{30})'$$

is a constant

$e_t$ is a 3 X 1 vector of random errors.

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\(^{10}\) Cooley and LeRoy (1985) have criticized the VAR, being a system of unrestricted reduced form equations. See also Runkle (1987) for the controversy surrounding this methodology. However all agree that there are important uses of the VAR model.
Model (2) can be rewritten as a VECM assuming there exists at least one cointegrating vector

\[ \Delta U_t = \alpha_0 + A(L)\Delta U_{t-1} + \delta E_{Ct-1} + \mu_t \quad (3) \]

where \( E_C_t \) is the error correction term

\( \mu_t \) is a 3 X 1 vector of white noise errors, \( E(\mu_t) = 0 \) and \( (\mu_t \mu_{t-1}) = \Omega \), for \( t = s \) and zero otherwise.

After normalizing the cointegrating vector, the economic development equation can be written as:

\[ \ln Y_t = \beta_1 \ln INV_t + \beta_2 \ln EXP_t \quad (4) \]

The error correction term is obtained from equation (4) as:

\[ EC_t = \ln Y_t - \beta_1 \ln INV_t - \beta_2 \ln EXP_t \quad (5) \]

Finally, the economic growth equation in detailed form for model (3) is written as:

\[ \Delta LY_t = a_0 + \sum a_{1j} \Delta LY_{t-j} + \sum a_{2j} \Delta INV_{t-j} + \sum a_{3j} \Delta EXP_{t-j} + \delta E_{Ct-1} + \epsilon_t \quad (6) \]

where \( EC_{t-1} \) represents the deviation from equilibrium in period \( t \) and the coefficient \( \delta \) represents the response of the dependent variable in each period to departures from equilibrium.

As Granger (1988) pointed out there are two channels of causality. One channel is through the lagged values of \( \Delta INV \) and \( \Delta EXP \), i.e., \( a_{11}, a_{12}, \ldots, a_{im} \) are jointly significant, and the other is if \( \delta \) is significant. If \( \delta \) is significant in equation (6) then investments and exports also cause economic development so we apply the second channel.
The economic development variable \( (Y) \) is measured by the real GDP (nominal GDP adjusted by GDP deflator). The investment variable \( (INV) \) is measured by the gross fixed capital adjusted by the GDP deflator. The exports \( (EXP) \) variable is measured by the real export revenue and is obtained by adjusting the nominal export value by an export price index from the International Financial Statistics (IFS). The data that used in this analysis are quarterly, cover the period 1991:I -2001:IV regarding 1996 as a base year and came from the database of OECD (Business Sector Data Base).

All data are expressed in logarithms in order to include the proliferative effect of time series and are symbolized with the letter \( L \) preceding each variable name. If these variables share a common stochastic trend and their first differences are stationary, then they can be cointegrated. Economic theory scarcely provides some guidance for which variables appear to have a stochastic trend and when these trends are common among the examined variables as well. For the analysis of the multivariate time series that include stochastic trends, the augmented Dickey-Fuller unit root test is used for the estimation of individual time series, with intention to provide evidence about when the variables are integrated. The unit root test is followed by the multivariate cointegration analysis.

4. Unit root test

The cointegration test among the variables that are used in the above model requires previously the test for the existence of unit root for each variable and especially for exports, investment and economic development, using the Augmented Dickey – Fuller (ADF) (1979) test on the following regression:
\[ \Delta X_t = \delta_0 + \delta_1 t + \delta_2 X_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta X_{t-i} + u_t \quad (7) \]

The ADF regression tests for the existence of unit root of \( X_t \), namely in the logarithm of all model variables at time \( t \). The variable \( \Delta X_{t-1} \) expresses the first differences with \( k \) lags and final \( u_t \) is the variable that adjusts the errors of autocorrelation. The coefficients \( \delta_0, \delta_1, \delta_2, \) and \( \alpha_i \) are being estimated. The null and the alternative hypothesis for the existence of unit root in variable \( X_t \) is

\[ H_0 : \delta_2 = 0 \quad H_1 : \delta_2 < 0 \]

The results of these tests appear in Table 1. The minimum values of the Akaike (AIC) (1973) and Schwarz (SC) (1978) statistics have provided the better structure of the ADF equations as well as the relative numbers of time lags, under the indication “Lag”. As far as the autocorrelation disturbance term test is concerned, the Lagrange Multiplier LM(4) test has been used. The MFIT 4.0 (1997) econometric package that was used for the estimation of ADF test, provides us with the simulated critical values.

Insert Table 1

The results of Table 1 suggest that the null hypothesis of a unit root in the time series cannot be rejected at a 5% level of significance in variable levels. Therefore, no time series appear to be stationary in variable levels. However, when the logarithms of the time series are transformed into their first differences, they become stationary and consequently the related variables can be characterized integrated order one, \( I(1) \). Moreover, for all variables the LM (4) test first differences shows that there is no correlation in the disturbance terms.
5. Cointegration and Johansen test

If the time series (variables) are non-stationary in their levels, they can be integrated with integration order 1, when their first differences are stationary. These variables can be cointegrated as well, if there are one or more linear combinations among the variables that are stationary. If these variables are being cointegrated, then there is a constant long-run linear relationship among them.

Since it has been determined that the variables under examination are integrated of order 1, then the cointegration test is performed. The testing hypothesis is the null of non-cointegration against the alternative that is the existence of cointegration using the Johansen (1988) maximum likelihood procedure, Johansen and Juselius (1990, 1992). An autoregressive coefficient is used for the modelling of each variable (that is regarded as endogenous) as a function of all lagged endogenous variables of the model.

Given the fact that in order to apply the Johansen technique a sufficient number of time lags is required, we have followed the relative procedure, which is based on the calculation LR (Likelihood Ratio) test statistic (Sims 1980). The results showed that the value $\rho=3$ is the appropriate specification for the above relationship. Further on we determine the cointegration vectors of the model, under the condition that Table 2 has an order $r<n$ (n=3). The procedure of calculating order $r$ is related to the estimation of the characteristic roots (eigenvalues), which are the following:

$\hat{\lambda}_1 = 0.39750 \quad \hat{\lambda}_2 = 0.15294 \quad \hat{\lambda}_3 = 0.065791$

Insert Table 2
The results that appear in Table 2 suggest that the number of statistically significant cointegration vectors is equal to 1 and are the following:

Bulgaria \( LY = 0.81852 + 0.86149 \text{LEXP} + 0.21827 \text{LINV} \)

Romania \( LY = 0.70469 + 0.99149 \text{LEXP} + 0.05487 \text{LINV} \)

From these cointegrated vectors we can infer that in the long-run exports and investments have a positive relationship with economic development in both two examined countries. According to the signs of the vector cointegration components and based on the basis of economic theory the above relationships can be used as an error correction mechanism in a VAR model.

6. VAR model with an error correction mechanism

After determining that the logarithms of the model variables are cointegrated, we must estimate then a VAR model in which we shall include a mechanism of error correction model (MEC). The error correction model (equation 3) is used to investigate the causal relationships among the variables economic development, investments and exports (\( Y, \text{INV}, \text{EXP} \)). Such analysis provides the short – run dynamic adjustment towards the long – run equilibrium. The significance levels of the F – statistics for the lagged variables and the t – statistics for the coefficient \( \delta \) of \( EC_{t-1} \) are used to test for Granger causality. The numbers in parentheses are the lag lengths determined by using the Akaike criterion.

As discussed earlier in section 3, there are two channels of causality Granger (1988). These are called channel 1 and channel 2. If lagged values of a variable (except the lagged value of the dependent variable) on the right hand side in equation 3 are jointly
significant then this is channel 1. On the other hand, if the lagged value of the error correction term is significant, then this is channel 2. The results are summarized in table 3.

Insert Table 3

For convenience in discussing the results, let us call the relationships a “strong causal relation” if it is through both channel 1 and channel 2 and simply a “causal relation” if it is through either channel 1 or channel 2.

From the results of table 3 we can infer that coefficient $\delta$ is statistically significant in the case we use exports and investments as endogenous variables for Bulgaria and also for the economic development of Romania. So, then we have channel 2 which means that investments and economic development have an effect on exports, as well as exports and economic development have an effect on investments for the case of Bulgaria whereas for the case of Romania investments and exports have an effect on economic development.

Moreover, the coefficients of lagged variables are statistically significant in the case where exports and investments are used as endogenous variables for the case of Bulgaria and for the case of Romania exports and economic development are used (channel 1). That means exports have an effect on economic development for Bulgaria just like investments and economic development have an effect on exports for Romania.

The results of table 4 present causality test through these channels

Insert Table 4
From the results of Table 4 we can infer that the hypothesis that exports (EXP) cause economic development (Y) finds support in both countries and especially the causal relationship in Romania is “strong”.

The second hypothesis that exports (EXP) cause investments (INV), finds support only in Bulgaria and this causal relationship is “strong”.

The third hypothesis that economic development (Y) cause exports (EXP), finds support in both countries with “strong” causal relationship for the case of Bulgaria.

The hypothesis that economic development (Y) cause investments (INV), finds support only in Bulgaria and the causal relationship is “strong”.

The hypothesis that investments (INV) cause economic development (Y), finds support only in Romania and the causal relationship is “strong”.

Finally, the hypothesis that investments (INV) cause exports (EXP) finds support in both countries with “strong” causal relationship for Bulgaria and “simple” causal relationship for Romania.

7. Conclusions

In this paper an effort was made in order to examine the relationship between exports, economic development and investments in two pre-accession countries of European Union through the analysis of multivariate causality based on an error correction model leading to some important hypotheses. For testing empirically these hypotheses, we used the Johansen cointegration test and Granger causality test based on a vector error correction model.
The results of the cointegration analysis suggest the existence of cointegration relationship between the three variables for both examined countries. This indicates the presence of common trend or long-run relationships among these variables.

The results of the causality analysis denote that exports cause economic development in both countries, meaning that exports’ expansion for these countries may lead to economic development either increasing the investment amount or improving the efficiency or both. Particularly, for Bulgaria exports’ expansion leads to investments’ growth.

On the other hand, the results suggest that economic development leads to exports’ expansion for both countries, especially for Bulgaria economic development leads to investments’ growth as well. Finally, from the results’ analysis we conclude that the investments’ growth leads to exports’ expansion for both countries, as well as the economic development of Romania.
Reference


### Table 1 – DF/ADF unit root tests

<table>
<thead>
<tr>
<th>Variables (Xₜ)</th>
<th>In levels</th>
<th>1st differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lag</td>
<td>Test statistic (DF/ADF)*</td>
</tr>
<tr>
<td><strong>BULGARIA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LY</td>
<td>1</td>
<td>-0.9741</td>
</tr>
<tr>
<td>LEXP</td>
<td>2</td>
<td>-1.2817</td>
</tr>
<tr>
<td>LINV</td>
<td>1</td>
<td>-1.0835</td>
</tr>
<tr>
<td><strong>ROMANIA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LY</td>
<td>1</td>
<td>-0.9193</td>
</tr>
<tr>
<td>LEXP</td>
<td>2</td>
<td>-1.2236</td>
</tr>
<tr>
<td>LINV</td>
<td>4</td>
<td>-1.5495</td>
</tr>
</tbody>
</table>

*Critical value: - 2.9400
**The numbers in brackets show the levels of significance

### Table 2 – Johansen and Juselius test for multiple cointegrating vectors in (Y, EXP, INV) Maximum lag in VAR = 3

<table>
<thead>
<tr>
<th>Country</th>
<th>Statistic</th>
<th>k = 0</th>
<th>k ≤ 1</th>
<th>k ≤ 2</th>
<th>No. of Cointegrating Vector</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BULGARIA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>λ -max</td>
<td>19.7066</td>
<td>5.1456</td>
<td>2.1097</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>λ -trace</td>
<td>26.9619</td>
<td>7.2553</td>
<td>2.1097</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>ROMANIA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>λ -max</td>
<td>18.2606</td>
<td>6.5985</td>
<td>3.8236</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>λ -trace</td>
<td>27.6827</td>
<td>9.4221</td>
<td>3.8236</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Notes: The critical values for the λ – max test for k = 0, k ≤ 1, k ≤ 2 at 5% level of significance are respectively 17.68, 11.03, 4.16. At 10% significance level they are 15.57, 9.28, 3.04. For the λ – trace statistics the critical values for k = 0, k ≤ 1, k ≤ 2 at 5% level of significance are respectively 24.05, 12.36, 4.16. At 10% significance level they are 21.46, 10.25, 3.04.

### Table 3 – Causality test results based on vector error – correction modeling

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>F – significance level</th>
<th>t – statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ALY</td>
<td>ALEXP</td>
</tr>
<tr>
<td><strong>BULGARIA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔLY</td>
<td>0.023** (2)</td>
<td>0.000*** (2)</td>
</tr>
<tr>
<td>ΔLEXP</td>
<td>0.028** (2)</td>
<td>0.026** (3)</td>
</tr>
<tr>
<td>ΔLINV</td>
<td>0.006*** (1)</td>
<td>0.014*** (2)</td>
</tr>
<tr>
<td><strong>ROMANIA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔLY</td>
<td>0.000*** (2)</td>
<td>0.000*** (2)</td>
</tr>
<tr>
<td>ΔLEXP</td>
<td>0.000*** (2)</td>
<td>0.000*** (2)</td>
</tr>
<tr>
<td>ΔLINV</td>
<td>0.250 (4)</td>
<td>0.277 (4)</td>
</tr>
</tbody>
</table>

Notes: **, and *** indicate 10%, 5%, and 1% levels of significance. Number in parentheses are lag lengths.

### Table 4 – Summary of causal relations

<table>
<thead>
<tr>
<th>Country</th>
<th>Y→EXP</th>
<th>Y→INV</th>
<th>EXP→Y</th>
<th>EXP→INV</th>
<th>INV→Y</th>
<th>INV→EXP</th>
</tr>
</thead>
<tbody>
<tr>
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