12. CAUSALITY RELATIONSHIP BETWEEN REAL GDP AND ELECTRICITY CONSUMPTION IN ROMANIA (2001-2010)

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Abstract

After Industrial Revolution, importance of energy in production has increased. As a result of two petroleum crisis, energy was included directly into the production function. While development level of countries has increased, energy consumption has also raised. Substantial increase in energy consumption with economic growth provide a motivation to investigate questions "Is there is a relationship between energy consumption and economic growth?" and if there is "What kind of relationship exists between them?".

The aim of this study is to analyse dynamic causal relationship between electricity consumption and economic growth in the Romanian economy for the period of 2001 – 2010 to answer this question. To this end, we utilize the Dolado – Lütkepohl, Tado - Yamamoto and traditional Granger causality tests. In this regard, we use Phillips – Perron and Dickey Fuller – GLS unit root tests and Bai – Perron multiple structural breaks test. Results support that causality runs from electricity consumption to economic growth in the case of Romania economy.

Keyword: Electricity Consumption, Economic Growth, Causality Test, Romania

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I. Introduction

In the last century, development level of economies has increased very fast. The main reason behind this; is the Industrial Revolution that has reached its starting point towards the end of 18th century. Industrial Revolution has brought about the use of new energy resources. Production that depended on human and animal power began to be based on coal with invention of steam engines, on petroleum and its derivatives with the invention of multi-time engines and then on alternative energy resources such as electiricity and natural gas. Today, nuclear energy has come to fore as a new alternative. The importance of energy in production was neglected until 70's and although energy is seen as an outside variable, two petroleum crises that took place in 1973 and 1979 caused energy to be included in production function as inside variable (Karagol et. al., 2007). These incidents showed that economical growth is closely related with the use of energy and caused economy to be defined within the context of energy (Jobert and Karanfil, 2007).

Substantial increase in energy consumption with economic growth provide a motivation to investigate whether there is a casual relationship between energy consumption and economic growth. If there is a relationship between them, direction of casual relationship is important. Because it will give important insights to policy-makers in terms of design of policies implemented. On the one hand, if the direction of causality is from GDP to energy consumption or if there is no causal relationship between energy consumption and economic growth, energy saving policies will not effect economic growth. On the other hand, if the direction of causality is from energy consumption to GDP, decrease in energy consumption will have a negative impact on economic development (Narayan and Prasad, 2008).

There is a vast literature about investigating causal relationship between economic growth and energy consumption. These literature found different results for the same countries because of different methodologies and data. For example for Asian countries: Yu and Choi (1985) investigated causality for Philippines and found causal relationship running from energy consumption to economic growth. Also Masih and Masih (1996) for India, Masih and Masih (1997) for Korea, Chang et. Al. (2001) for Taiwan, Shiu and Lam (2004) for China, Yemane (2004) for Shangai, Narayan and Singh (2007) for Fiji Islands found the same direction of relationship. In contrast, Masih and Masih (1996) found causal relationship running from economic growth to energy consumption for Indonesia. Also Yu and Choi (1985) for Korea, Cheng and Lai (1997) for Taiwan, Soytas and Sari (2003) for Korea found the same results. Beside these results Asafu-Adjaye (2000) for Thailand, Glasure (2002) for Korea, Oh and Lee (2004) for Korea, Hwang and Gum (1992) for Taiwan, Paul and Bhattacharya (2004) for India, Squalli (2007) for Iran and Qatar, finally Chen et. Al. (2007) for China found two-way causality between variables.

Studies about African countries have mixed results too. Belloumi's (2009) and Odhiambo's (2009) papers about Tunisia and Tanzania support evidence of causality running from energy consumption to economic growth. In contrast to this line of studies, Wolde-Rafuel (2006) found adverse relationship for Cameroon, Ghana, Nigeria, Senegal, Zambia and Zimbabwe, two-way causality for Egypt, Gabon and

Morocco, finally no causal relationship for Algeria, Congo Republic, Kenya, South Africa and Sudan.

Papers include North and South American countries have results as follows: Cheng (1997) studied about Brazil and found causality running from energy consumption to economic growth. Soytas and Sari (2003), however, found two-way causality between energy consumption and economic growth for Argentina. In contrast, Akarca and Long (1980) and Yu and Hwang (1984) found no causality for USA. Cheng (1997) for Mexico and Venezuela and Narayan and Prasad (2008) for Mexico and USA found no causality also.

Narayan and Prasad (2008) examined European countries included Czech Republic, Iceland, Italy, Portugal and Slovak Republic and found causality running from energy consumption to economic growth. Hatemi-J and Irandoust (2005) examined Sweden, Narayan and Prasad (2008) examined Finland, Hungary and Netherlands and they found same results. Hondroyiannis (2002) in his paper found two-way relationship for Greece. Erol and Yu (1987) for West Germany and Aktas and Yilmaz (2008) for Turkey found the same results. Yu and Choi (1985) for Poland and United Kingdom and Narayan and Prasad (2008) for Belgium, Denmark, France, Germany, Ireland, Luxembourg, New Zeland, Norway, Poland, Spain, Sweden, Switzerland and Turkey investigated causal relationship and found no evidence of causal relationship between these variables. Although there are so much study examining countries all over the world, especially European countries, there is not enough study examining Romania.

Romania is the newest member of European Union with Bulgaria. Romania has renewable energy sources like hydro power and wind power energy in the different part of the country. This country has also big capacity about petroleum and metan gas. These energy sources are important advantages for Romania among European Union countries. Because of these reasons to investigate the direction of causality for Romanian economy is important.

The aim of the study is to analyse the causal relationship between electricity consumption and economic development in Romania. To achieve this purpose, Dolado-Lütkepohl (1996) and Toda – Yamamoto (1995) causality test is conducted and results are compared with traditional Granger causality test. In this context, paper is organized as follows. In the next section an overview is provided for the Romania economy, energy sector and energy policy of government. In the third section data is given and then methodolgy is explained. In section five, empirical results are discussed and finally a brief summary and policy implication are provided in the conclusion section.

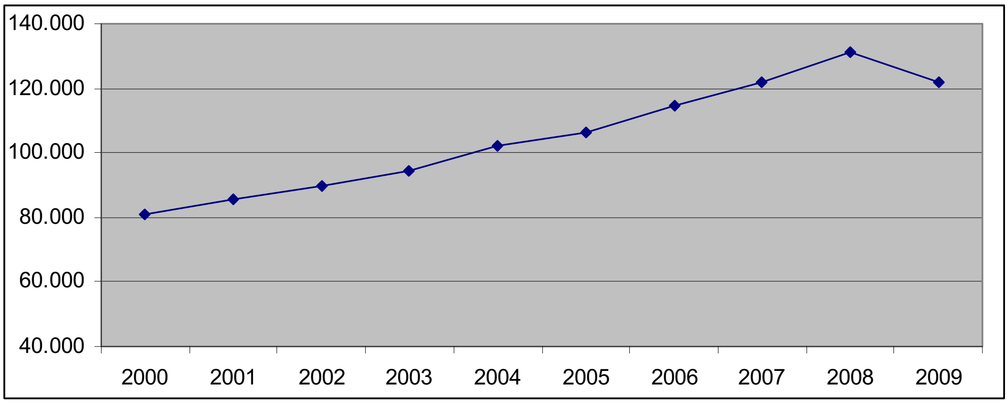
II. An Overview of Romanian Economy and Energy Sector

Romania joined European Union in 2007 and is the newest member of this union with Bulgaria. After Romanian Revolution in December 1989, the Romanian economy lived problems; low economic growth level, insufficient capital stock and unemployment, until 2000's. But after ten years, economy has started to grow up rapidly until today. Increase in GDP can be seen in the following graphic 1.

According to the Romanian National Institute of Statistics, the Romania economy grew up 6% in average between 2000 and 2008. The growth rate of the economy was negative in 2009 because of global crisis affected all over the world. GDP was nearly 81 miilion Lei in 2000 and then it increased to more than 131 million Lei in 2008. It was 121 million Lei in 2009 (constant year is 2000) (INSSE, 2009a).

Graphic 1

Annual GDP in Constant Prices (Million Lei) (Constant Year 2000)



(Source: National Institute of Statistics, Date: 20.07.2010)

Romania has 23,1 million citizen and this makes Romania one of the big labour force in EU. Romania had unemployment problem after Romanian revolution. Unemployment rate was only 3% in 1991 and after only two years it was 10,4% (INSSE, 2009c). In the beginning of 2000's, unemployment rate started to reduce. It was near 11% in 2000 and only about 3,7% in April 2008 (INSSE, 2009a).

According to National Institute of Statistics of Romania, labour force participation rate is 63,7% in 2006. Labour force participation rate was 89,5% for high educated labour, 70,5% for medium educated labour and 43,6% for low educated labour. Total employment rate was 58,8% in 2006. Employment rate for high educated labour was 86,1%, it was 64,9% for medium educated labour and 39,6% for low educated labour. Finally, according to International Labour Office, while total unemployment rate of Romania was 7,3% and but unemployment rate of high educated labour was only 3,8% in 2006 (INSSE, 2009c).

To improve education level, the Romanian government started to reform in education system in 2003. They increased compulsory schooling from eight years to ten years, decreased schooling age to six years old, structured into high schools that is composed of two stage from the beginning of 2003 education term (Eurydice, 2005).

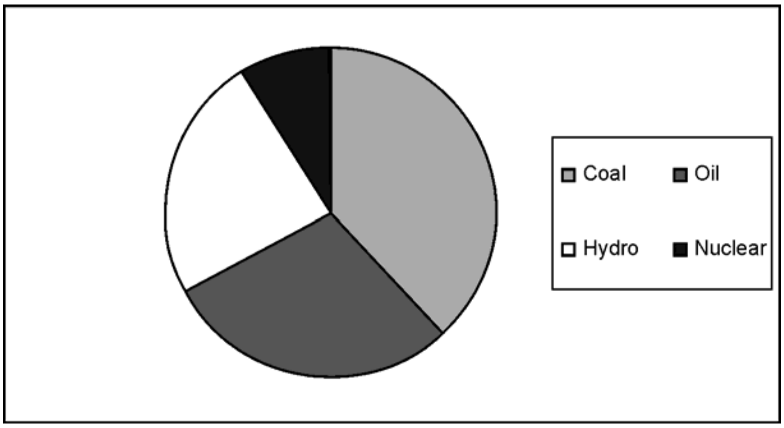
Romania has rapid growth level about foreign trade. FOB exports value of Romania reached to 123.450,4 million Lei in the of 2008. Compared with the end of 2007, export values increased with 25,2%. Increase in exports was supported by machinery, metal, vehicles and transport equipments, textile and minerale products sectors. 70% of total FOB exports was made to the European Union Countries (EU 26). By the end of 2008 CIF imports value of Romania amounted 206.807,7 million Lei. Also import values increased 20,7% compared with the end of 2007. The leading sectors in import value are machinery, mineral products and vehicles and transportation equipments sectors. 69,2% of total CIF imports was made from the other European Union Countries (EU 26) (INSSE, 2009b).

According to Preda (2008) Romania is very rich about underground sources. Preda reported that this country has two thousand different type of minerals. As mentioned above, mineral products force exports of Romania. Transilvania mountains are rich about iron and salt. So metal and machinery industries are developed. Today Romania has 14th biggest heavy machinery industry in the world. In the north of the country gold mines are also very rich. The other underground minerals are coal, lignite, manganese, chrome, copper, lead, uranium, antimony, silver and bauxite. Romania is the biggest petroleum producer in Europea after Russia. Metan gas is the other important energy source in the country.

Hydrolic energy, because of rivers flow inside of the country like Olt, Siret, Iolomita etc and wind energy on Black sea coast and mountains in the north of the country, illustrate that Romania is also very rich about renewable energy sources.

Graphic 2

Usage of Energy Resources (Source: Preda, 2008)



In 2008, 38% of total energy consumption is from coal energy, 29% oil energy, 24% hydro energy and 9% nuclear energy in Romania. Seperation of energy types' usage is as follows in Graphic 2.

Although Romania is very rich about renewable energy sources, it is hard to say that Romania uses these sources efficiently. Potential capacity of hydroelectricity production in the country is nearly 40 TWh/year and but Romania uses only 12 TWh/year part of potential capasity. Another important renewable energy source is wind energy. Useful capasity of wind energy is estimated more than 2.000 MW in the country. Despite all these sources, place of renewable sources usage in total energy source usage is only 5%.

Another important issue about Romanian energy sector is that equipments used for production of energy are very old. In the electricity generation based on fossil fuel more than 32% of the equipments are of more than 30 years of age, and 50% are between 20-30 years old. In this filed only 0,7% are less than 10 years old. In the hydro generation 24% of the equipments are more than 30 years old, 51% of more than 20 years old and only 13% are of more than 10 years old. (Road Map for Energy Sector of Romania, 2003)

In the begining of 2000's Romanian government started to privatization program and latest advances in privatization program are as follows:

- Two distribution companies were in the privatization process since 2004 for electricity distribution.
- Two gas distribution companies has been signed contract for the privatization process in 2007.
- Privatization of the thermal power generation started in 2007.

Romanian government also prepared a strategic plan named Romanian Energy Strategy 2007-2020 to establish sustainable growth in energy production and increase renewable energy sources. According to plan major projects for Romanian energy sector are indicated by Preda (2008) as follows:

1. Geological research to identify new reserves of energy primary resources.

2. Energy infrastructure strategic projects for trans-border interconnection:

2.1. For diversification of oil & gas supply sources for Europe:

- Nabucco Project
- PEOP-Pan European Pipeline Project

2.2. For interconnection of Romanian natural gas network with the neighbouring countries gas networks:

- with Hungary: Arad-Szeged (medium term 2007-2013);
- with Bulgaria: Giurgiu – Russe (medium term 2007-2013)
- with Ukraine: Siret – Cernauti (long term 2020);
- with Moldova: Drochia-Ungheni-Iasi.

3. Projects to improve the interconnection degree with the EU and the Black Sea area states from 10% which is now, to 15 – 20 % until 2020:

- Submerged electricity cable HVDC between Turkey and Romania;
- Overhead lines of 400 kV with Hungary, Serbia and Moldova.

4. Develop the natural gas storage capacity to sustain the picks of consumption during winter and to increase the security of natural gas supply.

5. Increase the oil storage capacity in order to attain 2.8 million tons of oil in 2011, to ensure the minimum stock for 67.5 days, calculated on the basis of the expected increase of internal consumption.

6. Rehabilitation of the national transportation network for electricity, natural gas and oil products.

7. Rehabilitation of hydro power plants and the commissioning of the pumping station of Tarnita Lapustesti and of the hydo power plant on Tisa (in partnership with Ukraine).
8. Further development of the nuclear programme with other two new units in Cernavoda nuclear power plant (PHWR – CANDU).
9. Setting up the integrated energy company by which state will maintain the control over important generation capacities summing up a total generation capacity enough high to ensure and maintain the energy security of Romania.
10. Active cooperation to integrate the Romanian energy market into the South-Eastern energy market, with the aim to be integated in the EU energy internal market.

III. Data

In this study we use quarterly data for electricity cunsumption and GDP belonging the Romanian economy. Data consists of the period of 2001Q1 – 2010Q1. Electricity consumption is measured Gigawatt/hour and obtained from The European Commision database named Eurostat. Because of the direct relationship between electricity consumption and domestic goods and services, real GDP is used in this study. Real GDP data is obtained from The National Institute of Statistics of Romania (INSSE) database. Real GDP data is obtained as deseasonalized from INSSE and we deseasonalized electricity consumption data by the Tramo/Seats program. Both of variables are transformed into natural logharitms, electricity consumption is denoted as lelc, real gross domestic product is denoted as lgdp.

Table 1

The Data Set

Variables	Explanations	Source
GDP	Real Gross Domestic Product (Base Year=2000)	INSSE
ELC	Electricity Consumption (Gigawatt/hour)	EUROSTAT

IV. Methodology

To test causal relationships among the variables, we use two different causality tests: Dolado – Lütkhepol (1996) causality test and Toda and Yamamoto (1995) causality test. We also control the results of traditional Granger causality test to compare the results of other causality tests.

First test of causality is modified Wald (MWALD) test developed by Dolado-Lütkepohl (1996). The most important advantage of this type causality test is that the unit root analysis is not important since the estimated model is robust to the type of integration and cointegration properties exhibited by data (Booth and Ciner, 2005). The Granger causality test requires carrying out zero restrictions on VAR coefficients using familiar χ^2 or F-tests based on the Wald principle. The presence of I(1) variables in the VAR model may cause nonstandard asymptotic distribution of these statistics. Particularly, Wald tests for Granger causality may result in nonstandard limiting distributions based on the cointegration properties of the system and possibly on nuisance parameters. These nonstandard asymptotic properties of the test of the zero restriction on cointegrated VAR processes are due to the singularity of the asymptotic distributions of the estimators (Lütkepohl and Kratzig, 2004). The Dolado-Lütkepohl causality test overcomes this singularity problem by adding an additional lag to the true order of the VAR model. The testing procedure involves two steps. Firstly, a VAR (p) is determined by a model selection criterion such as Akaike Information Criterion (AIC). Secondly, a VAR(p +1) is estimated and then the standard Wald test is applied on the first p lags.

First and probably the most important step of the Dolado-Lütkepohl testing appraoch is to select the optimal lag length since results of causality test are sensitive to the lag imposed. We employee Akaike Information Criterion to find optimum lag and estimate VAR(k+1) model by OLS,

$$\begin{bmatrix} lelc_t \\ \lg dp_t \end{bmatrix} = \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} + \begin{bmatrix} a_{11,1} & a_{12,1} \\ a_{21,1} & a_{22,1} \end{bmatrix} \begin{bmatrix} lelc_{t-1} \\ \lg dp_{t-1} \end{bmatrix} + .. + \begin{bmatrix} a_{11,k+1} & a_{12,k+1} \\ a_{21,k+1} & a_{22,k+1} \end{bmatrix} \begin{bmatrix} lelc_{t-(k+1)} \\ \lg dp_{t-(k+1)} \end{bmatrix} + \begin{bmatrix} U_t \\ W_t \end{bmatrix} \quad (1)$$

The hypothesis that real GDP does not cause electricity consumption can be constructed as: $H_0 : a_{12,1} = a_{12,2} = ... = a_{12,(k)} = 0$; and the hypothesis that electricity consumption does not cause real GDP can be constructed as: $H_0 : a_{21,1} = a_{21,2} = a_{21,(k)} = 0$.

Second approach is Toda and Yamamoto (1995) causality test. The Toda and Yamamoto (1995) procedure represents an improvement over the standard Granger causality test by ensuring that the latter's test statistic follows a standard asympthotic distribution (Squalli, 2007). This technique has advantage that is applicable irrespective of the integration and cointegration properties of the system. In this approach, VAR $(k + d_{\max})$ has to be estimated to use the modified Wald test for linear restrictions on the parameters of a VAR (k) which has an asymptotic distribution. All we need is to determine the maximal order of integration $d_{\max}$ which we suspect might occur in the model and then to over-fit intentionally a level VAR with additional lags (Toda and Yamamoto, 1995). In the first step of Toda and Yamamoto causality test, the lag length of the variables (k) can be set according to Akaike Information criterion (AIC) and then to identify integration of variables ($d_{\max}$) stationary tests.

In the last step of test a modified Wald test is employed to estimate following VAR system where the null hypothesis of no causality is not rejected when $\beta_{1i} = 0$ and $\lambda_{1j} = 0$.

$$lelc_t = a_0 + \sum_{i=1}^{k} a_{1i} lelc_{t-i} + \sum_{j=k+1}^{d} a_{2j} lelc_{t-j} + \sum_{i=1}^{k} \beta_{1i} \lg dp_{t-i} + \sum_{j=k+1}^{d} \beta_{2j} \lg dp_{t-j} + \varepsilon_{1t} \quad (2)$$

$$\lg dp_t = \gamma_0 + \sum_{i=1}^{k} \gamma_{1i} \lg dp_{t-i} + \sum_{j=k+1}^{d} \gamma_{2j} \lg dp_{t-j} + \sum_{i=1}^{k} \lambda_{1i} lelc_{t-i} + \sum_{j=k+1}^{d} \lambda_{2j} lelc_{t-j} + \varepsilon_{2t} \quad (3)$$

V. Empirical Results

In the first step we employee stationary test to find maximum integration number ($d_{\max}$) of time series. To this end, we use Dickey Fuller – GLS stationary test developed by Eliot, Rothenberg and Stock (1996) and PP stationary test developed by Phillips and Perron (1988). According to both test results the number of maximum integration number is two.

Table 2

Phillips Perron Unit Root Test Results

	lgdp			lelc			Critical Values
	I(0)	*I*(1)	*I*(2)	*I*(0)	*I*(1)	*I*(2)	
1	-1.67	-2.59	-7.56	-1.63	-5.86	-21.17	0.01= -3.63 0.05= -2.95 0.10= -2.61
2	0.18	-3.10	-7.54	-1.97	-6.22	-20.87	0.01= -4.25 0.05= -3.54 0.10= -3.20

[1] Intercept (c) term; [2] Trend (t) and intercept (c) term.
Note: *MacKinnon (1996) critical values was used. All variables was made Phillips-Perron test according to Schwarz information criterion.*

Table 3

Dickey Fuller-GLS Unit Root Test Results

	lgdp			lelc			Critical Values
	I(0)	*I*(1)	*I*(2)	*I*(0)	*I*(1)	*I*(2)	
1	-0.74	-2.61	-5.24	-1.14	-5.90	-9.39	0.01= -2.63 0.05= -1.95 0.10= -1.61
2	-1.91	-2.99	-6.06	-2.08	-5.82	-10.02	0.01= -3.77 0.05= -3.19 0.10= -2.89

[1] Intercept (c) term; [2] Trend (t) and intercept (c) term.
Note: *MacKinnon (1996) critical values was used. All variables was made Dickey Fuller-GLS test according to Schwarz information criterion.*

As can be seen in Table 2, results of Dickey Fuller – GLS and Phillips – Perron unit root tests show that the null hypothesis of non-stationary was performed at the 1% significance level. According to test results logarithm of electricity consumption data has unit root at 1 % level of significancy. But this variable is found to be stationary when tested at first difference.

Real GDP variable has unit root at 1% level of significance also. For this reason we controlled stationarity of first difference of logarithm of real GDP. Results show that first difference of logarithm real GDP has unit root at 1% significance level for both stationary tests. Finally we found that second difference of variable is stationary at 1% significance level.

Another important point is to learn whether there is any structural breaks in economy during the period we analyse. Because economic and financial crisis affect economy policies and it makes structural breaks in data belonging variables. So econometric analysis gives incorrect results. To see structural breaks in data belonging the Romania economy between years 2001 – 2010, we apply Bai and Perron (1998, 2003) multiple structural breaks test. The main advantage of this procedure is that it is possible to test for multiple breaks at unknown dates in such a way that it is successively estimates each break point by using a spesific-to-general strategy in order to consistently determine the number of breaks (Esteve and Requena, 2006).

Table 4

Bai and Perron Structural Break Test Results

Spesification					
Yt={lgdp} Zt={1,lelc}	Q	P	H	M	ε_t
	2	0	5	5	0.15
Tests					
SupFt(1)	SupFt(2)	SupFt(3)	SupFt(4)	SupFt(5)	UDmax
6.6845	4.7924	4.7111	3.8786	2.9504	7.4600
[8.58]*	[7.22]*	[5.96]*	[4.99]*	[3.19]*	[8.88]*
SupFt(2\1)	SupFt(3\2)	SupFt(4\3)	SupFt(5\4)		WDmax
1.6424	0.4667	0.5989	0.1449		6.7824
[8.58]*	[10.13]*	[11.14]*	[12.25]*		[9.91]*
The Number of Chosen Breaks According to Information Criterion					
Sequential	0				
BIC	1				
LWZ	0				
Break Date (BIC)					
2004Q3					
Break Date (LWZ)					
-					
Break Date (Sequential)					
-					

*shows that null hypothesis is accepted %5 significance level. $\sup F_t(k)$, *UD*max , *WD*max and $\sup F_t(l+1/l)$ tests critical values obtained from Bai and Perron (2003b).

Note: y_t is dependent variable, z_t represents the regressors allowed to change, q is the number of regressors subject to change, p=0 means that the procedure considers only the pure structural change model where all coefficients are subject to change. *h* syands fort he minimum number of observations in each segment, whereas *M* is the maximum number of breaks.

Bai and Perron (2003) used three different information criterion to determine multiple structural breaks. First of them is Bayesian information criterion produced by Yao (1988) , another is LWZ criterion that produced by Liu, Wu and Zidek (1997) via modifying Schwarz information criterion. Last one is produced by Bai – Perron (BP) named sequential information criterion. The results of applying the Bai – Perron tests to the relationship between variables according to three information criterion are shown in Table 4. Test results show that there is only one structural break in 2004Q3, according to Bayesian information criterion.

To determine lag length of VAR (k), we employee Akaike information criterion and we find lag length as three. According to lag length of VAR process, we employee modified Wald test for VAR(4) to get results of Dolado – Lütkepohl causality test.

Table 5

Dolado – Lütkepohl Causality MWALD Test Results

Hypothesis	Wald Statistics	Probability Value	Decision
ELC is not Granger cause of GDP	7.15	0.0013	Causality from ELC to GDP
GDP is not Granger cause of EC	0.24	0.8606	No causality from GDP to EC

Table 5 illustrates the results for the Dolado-Lütkepohl causality test. It is clear that there is a causality between electricity consumption and real GDP, from electricity consumption to real GDP. As seen in the table, probability value of causality is 0.0013 and null hypothesis will be rejected, coefficients are not equal to zero. Also it is clear that there is no causality from real GDP to electricity consumption. For a probability value of 0.86, there is no causality from real GDP to electricity consumption and so null hypothesis will be accepted, coefficients are equal to zero.

Another causality test, Toda and Yamamoto (1995), employees modified Wald test for VAR $(k + d_{\max})$ to estimate casual relationship. k is 3 and $d_{\max}$ is 2, for this reason, we employee modified Wald test for VAR(5). Results are shown in table 6.

Table 6

Toda and Yamamoto Causality MWALD Test Results

Hypothesis	Wald Statistics	Probability Value	Decision
ELC is not Granger cause of GDP	5.01	0.0089	Causality from ELC to GDP
GDP is not Granger cause of EC	0.76	0.5246	No causality from GDP to EC

Toda and Yamamoto causality test results show that there is a causality between two variables and the direction is from electricity consumption to real GDP. The probability value is 0.0089 and in this situation null hypothesis will be rejected and coefficients do not equal to zero. When we test causality from real GDP to electricity consumption, results show that there is no evidence about such a causality. The null hypothesis will be accepted and coefficients equal to zero.

Finally, we employee traditional Granger causality test to compare results of other type causality tests. Results supports Dolado – Lütkepohl and Toda – Yamamoto causality results and can be seen in Table 7.

Table 7

Traditional Granger Causality Test Results

Hypothesis	Wald Statistics	Probability Value	Decision
ELC is not Granger cause of GDP	33.69	0.0000	Causality from ELC to GDP
GDP is not Granger cause of EC	5.97	0.11	No causality from GDP to EC

VI. Conclusion

In this study we aimed to test relationship between economic growth and electricity consumption. We examined whether there is casual relationship between electricity consumption and real GDP. In this context we employee Dickey Fuller – GLS and Phillips – Perron unit root tests to control stationary and we used Bai – Perron structural break test to control time series whether there is any structural break in economy during this time. We tested causality by using Dolado – Lütkepohl and Toda – Yamamoto causality method to test the Romanian economy from 2001Q1 to 2010Q1.

According to test results, real GDP is stationary in its second difference and electricity consumption is stationary in its first difference. Also there is only one structural break in economy and it means that the economy of Romania is stable during the first decade of 21th century. We obtained that direction of causality runs from electricity consumption to real GDP. We compared results of both tests with traditional Granger causality test and we got the same results.

In the light of this finding, it is rationale to say that neutrality hypothesis implies no relationship between the variables is not valid for Romania. The energy growth policies regarding electricity consumption should be adapted in such a way that the development of this sector stimulates economic growth (Narayan and Singh, 2007).

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