

A THREE-DIMENSIONAL APPROACH ON THE RICARDIAN EQUIVALENCE IN ROMANIA

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Abstract

This paper follows the validity of the Ricardian Equivalence Hypothesis in Romania for the period 2004 – 2013. In order to test this hypothesis, there has been used a Vector Error Correction Model, with three variables: households' consumption, real GDP and budgetary revenues. The frequency of the data used is quarterly. The role of this model is to test the reaction of the households in case of occurrence of a shock in the budgetary revenues (the shock represents an increase in taxation). The results show the fact that the Ricardian Equivalence is not confirmed as being a valid theory for the Romanian economy.

Keywords: consumption, ricardian equivalence, budgetary revenues.

Rezumat

Această lucrare testează validitatea ipotezei de echivalență ricardiană pentru economia României, în intervalul cuprins între 2004 și 2013. Pentru testarea acestei ipoteze, am recurs la folosirea unui model de tipul vector de corecție a erorilor, în care am au fost incluse trei variabile: consumul gospodăriilor, PIB-ul real și veniturile bugetare. Frecvența datelor folosite este trimestrială. Rolul modelului este acesta de a testa reacția consumului gospodăriilor în momentul apariției unui șoc pozitiv la nivelul veniturile bugetare (acest șoc reprezintă o simulare a creșterii taxelor). Rezultatele indică faptul că echivalența ricardiană nu poate fi confirmată drept o teorie validă pentru economia românească.

Cuvinte-cheie: consum, echivalența ricardiană, veniturile bugetare.

Cod JEL: E21, E62, C53.

Cod REL : 8I, 8K, 10H.

1. Introduction

During the last years, on the background of the economic crisis, there were questions, both among the practitioners and among the researchers in economy. These questions were related to the modality in which the monetary and the fiscal policies should be decided and implemented by the decision makers in the field of macro policies. Questions were also related to the way in which the real economy could answer to these stimuli. The ideas contained in this paper have – as a starting point – the neoclassical economic theory, whose main exponent was Robert Barro, given his

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writings on the Ricardian Equivalence. In the economic literature, especially in the one related to the fiscal policies, we can still find a wide controversy and debate on deficits and Ricardian equivalence topic.

The origins of the Ricardian Equivalence Hypothesis are set back in the 19th century, in David Ricardo's *Principles of Political Economy of Taxation* (1817). Ricardo asked himself which way is better to finance a war: through a new government debt or through a new temporary tax. His answer was that the debt is nothing else than postponed taxes, so the both ways are producing the same result. At the end of the 20th century, the Nobel Laureate Robert Barro (1974), asked himself a similar question, but in a manner more adapted to the modern economy: "the government bonds might be considered net wealth or not?" Two years after, Buchanan (1976) involves in his paper the same dilemma: "is the public debt equivalent with taxation?" He observes the similarities between Ricardo's writings and Barro's paper and proposes that this model should be entitled "Ricardian Equivalence".

The main objective of this paper is to test the existence of the Barro-Ricardo Equivalence for the Romanian economy, through a VEC model, which includes three variables. The next section will present a brief insight in the literature review, by focusing the main papers in the field, which targeted the Ricardian Equivalence Hypothesis for the Romanian Economy. The third section of this paper consists in a short description of the data and methodology. Section 4 contains the model's estimates and in the fifth section, one can find the conclusions and further developments of the model.

2. Literature review

There are several authors who made tests in order to confirm or not the Ricardian equivalence at the level of the Romanian economy. Most of these authors tested the equivalence as connected to another research. Therefore, Dumitru (2008) made an analysis on current account deficits in the states new members of European Union. For his analysis, he made the estimations based on a group of panel data, through two methods found in the specialty literature, the connections between the current account and its determinants.

The fact that the fiscal deficit has the power to influence the current account deficit by up to 30% (and on long term the percentage could be even higher), indicates the absence of the Ricardian Equivalence. In the same time, for Romania, the results obtained by Dumitru (2009) showed that for the period between 1998 and 2008 the current account deficit was excessive. The elements identified as main determinants for the structural current account deficit are the reduced income per capita and the high rate of investments (existent before the start of the crisis). In addition, Dumitru (2009) considers the current account deficit as being perfectly justified, taking into consideration that the discussion is about a country in transition – Romania. In the same time, excessive deficits of current accounts were found as well in other states invited to join EU.

In another paper, where there the savings and the main factors determining it, have been analysed in a panel of countries, with focus on Romania, Dumitru & al. (2011) denied the idea of the complete Ricardian Equivalence. Their conclusion occurs because of the econometric estimations they made: an increase by 1% (as percent of GDP) of the budget deficit generates an increase of 0.2% of the private savings. Since the elasticity is smaller

than 1, the rejection of the complete equivalence is validated. According to the same results, the fiscal consolidation leads to an increase of the total internal savings (public and private), because the increase of public savings resulted through reducing the budget deficit it is only to a small extend compensated by a decrease of the private savings.

In order to test the effect of the fiscal policy in Romania, Ianici (2009) used the model proposed by Barro and Sala-i-Martin (1995). In the introduction of his paper, he uses the logical cracks of the Barro-Ricardo equivalence in order to explain why the equivalence does not represent a viable effect of the daily economic reality.

Mesea (2012) chose to test the effect of the Governmental deficit on the economic growth. The author took into consideration three possible scenarios regarding the deficit, with the following estimations: if the deficit coefficient has the “+” sign, then the economy reacts positively when such a deficit appears, confirming thus Keynes’ theory. If the same coefficient is negative, then the economy behaves according to the neoclassic theory. Finally, if the coefficient is “0”, then the hypothesis of the neutral Ricardian Equivalence of deficits will be confirmed.

Belingher and Moroianu (2015) have suggested another regression model, which tests the existence of the Ricardian Equivalence. They used a function of the aggregate consumption, according to the ones described by the literature. The analysed period is between 2004 and 2012, while the data have a quarterly frequency. The estimations of the coefficients, mainly of that for Governmental spending, do not confirm the hypothesis of the equivalence for the Romanian economy.

3. Methodology

The following presented model has the role to test the answer of the household consumption to the potential budgetary shocks that could occur. The modality in which consumption answers to the budgetary challenges represents a current theme in the Romanian economy (e.g. the increase of general VAT in 2010 and decrease of VAT for food products in 2015). The starting point in building this model was the paper of Giorgioni and Holden (2003). In this paper, the two economists tested - through various Vector Error Correction Models (VECMs) - the way of functioning of the economies of many countries: either Ricardian or Keynesian or according to the EFC model (*Expansionary Fiscal Contraction*), with the support of impulse-response functions (*impulse*: budgetary incomes/budgetary expenditures – *response*: private consumption).

The used variables in specifying the basic model of the two authors are the following:

- The logarithm of the **real GDP**;
- The logarithm of the **real private consumption**;
- The logarithm of the **real budgetary expenditures**;
- The logarithm of the **real budgetary revenues**;
- The logarithm of the **actual stock market index**.

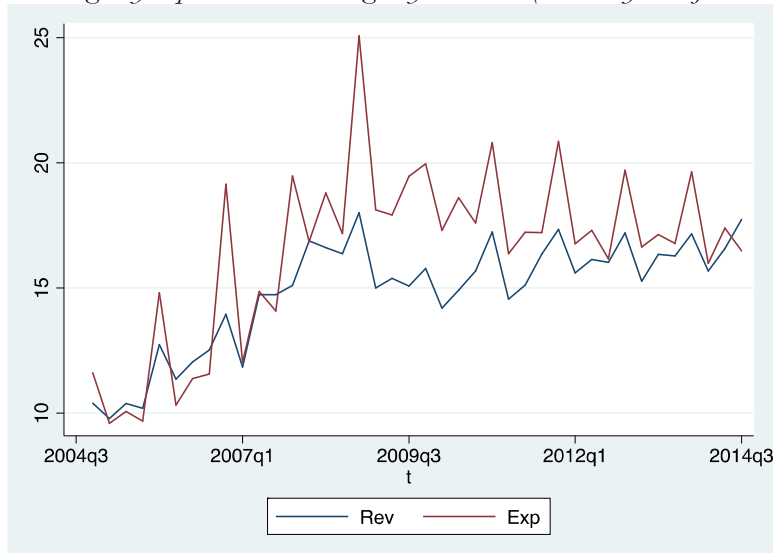
According to the related methodology, the data have been tested for stationarity, and cointegration, with the support of the adequate tests. The data included in the VECM, used for the analysis of the Romanian economy were the following:

- **Household consumption**, source the National Institute of statistics, according to ESSA 2010, denominated in million lei current prices, seasonally adjusted;

- **Gross Domestic Product**, source the National Institute of statistics, according to ESSA 2010, denominated in million lei current prices, seasonally adjusted;
- **Budgetary Revenue**, source Economist Intelligence Unit, denominated in billion lei current prices, seasonally unadjusted;
- **Budgetary expenditures**, source Economist Intelligence Unit, denominated in billion lei current prices, seasonally unadjusted;

Subsequently, all the series have been transformed in billion lei and in natural logarithms. Time series taken from EIU have been also seasonally adjusted. The analysed period is between 2004:4 and 2014:3 (40 observations), while the frequency of data is quarterly based. The seasonal component of the last two time series (those taken from EIU), can be noticed by in fig. no.1:

Fig. 1: *Budgetary expenditures vs. Budgetary Revenues (seasonally unadjusted series)*



Source of the processed data: EIU (2015)

Giorgioni and Holden (2003) used in building their model the stock exchange index, but this was not found relevant for the Romanian economy, after running the preliminary tests. Also, another reason for reducing the model is that the advent of new information directly affects asset prices (Călin, 2015). Further, in order to simplify the writing, the above-described acronyms will be used (**lnHHC**, **lnRGDP**, **lnRev**, **lnExp**).

According to the literature, starting from a VAR model's equation, then a VECM model can be re-write according to equation no. 1:

$$y_t = c + \Pi A_1 y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i y_{t-i} + e_t \quad (1)$$

, where $\Pi = \sum_{j=1}^p A_j - I_k$ and $\Gamma_i = -\sum_{j=i+1}^p A_j$.

If all variables in y_t are $I(1)$, then the matrix Π has rank $r \geq 0$ and $r < k$, where r is the number of linearly independent cointegrating vectors. If the variables are cointegrated, the vector autoregressive in first differences becomes misspecified as it excludes the error correction term (Baum, 2013). According to Simionescu (2013), if $r=0$, the Π matrix becomes null and there is no relationship on long-run (VAR in differences model) and if $r=p$, the variables are stationary.

4. The estimations of the model

In the first model, for analysis has been included all those four variables, previously mentioned, in the third section. According to the decision test of the optimum number of lags, it has been chosen a four lags model. Johansen test of cointegration run by Stata indicates the fact that there is only one cointegration relationship at the level of those four time series. In the following, this model will not be too detailed, as it did not offer conclusive results for the analysis made. For the first equation, the one regarding the household consumption, errors' correction coefficient turned to be positive, therefore the model was not sustainable. According to Burke and Hunter (2005), the models with only one cointegration equation have to have a negative coefficient of errors' correction. Below it can be seen the graphical representation of the results previously discussed:

Table no. 1: *The positive coefficient of errors' correction, related to the first model which has been run*

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
D_lnHHC						
_cel						
L1.	.1467629	.1225341	1.20	0.231	-.0933995	.3869253

Source: own estimations

Subsequently, based on a re-evaluation of the situation, we decided to exclude the budgetary expenditures from the model, even if these represented one of the variables of real interest for the current research. Further, simulations will be made concerning the answer of the consume when there are tax increases (increases of the Governmental revenues). According to the work methodology for estimating VEC model, after removing the problem-making variable, we did a new run of the test regarding the optimum number of lags that should be used. It came out that the optimum number of lags is also four, as in the previous model, as per the below table:

Table no. 2: *Selection criteria of the optimum number of lags*

Selection-order criteria

Sample: **2005q4 – 2014q3**Number of obs = **36**

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	201.538				3.3e-09	-11.0299	-10.9838	-10.8979
1	275.727	148.38	9	0.000	8.7e-11	-14.6515	-14.4673	-14.1237*
2	288.564	25.674	9	0.002	7.1e-11	-14.8647	-14.5423*	-13.941
3	299.164	21.2	9	0.012	6.7e-11*	-14.9536	-14.493	-13.634
4	309.004	19.679*	9	0.020	6.8e-11	-15.0002*	-14.4015	-13.2847

Endogenous: **lnHHC lnRGDP lnRev**Exogenous: **_cons***Source: own estimations*

The next step that was to check time series cointegration. The results revealed the fact that there was one cointegration equation (the option without trend and constant has been used), as the value of *trace statistic* is smaller than the critical value (the value marked by asterisk). The used series were not converted to a stationary form, due to the cointegration test, as well as the VECM need non-stationary series. Johansen test, according to the methodology described by the scientific literature, is presented in the table no. 3:

Table no. 3: *Johansen test for implementing VECM model*

Johansen tests for cointegration

Trend: none

Number of obs = **36**Sample: **2005q4 – 2014q3**Lags = **4**

maximum				5%	
rank	parms	LL	eigenvalue	trace statistic	critical value
0	27	292.38786	.	32.2937	24.31
1	32	303.61671	0.46411	9.8359*	12.53
2	35	307.86719	0.21033	1.3350	3.84
3	36	308.53468	0.03640		

Source: own estimations

The model has the role to test the effect of the increase of taxation on household consumption: *if there is a decrease of consumption when the taxes are raised, then the population reacts in a Keynesian mode, but if the taxes rise does not influence the household consumption, then the population reacts in a Ricardian manner.*

The estimations of VECM model revealed that there is one long-term equilibrium relationship between the three endogenous variables. Below is presented the first part of VECM model, i.e. the equation of the *lnHHC* variable:

Table no. 4: *Vector Error Correction Model for identification of the Barro Ricardo equivalence at the level of the Romanian economy (short term)*

Vector error-correction model

Sample: 2005q4 - 2014q3	No. of obs	=	36		
	AIC	=	-15.08982		
Log likelihood = 303.6167	HQIC	=	-14.59854		
Det(Sigma_ml) = 9.49e-12	SBIC	=	-13.68224		
Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_lnHHC	10	.01254	0.7933	99.79929	0.0000
D_lnRev	10	.046156	0.6545	49.24249	0.0000
D_lnRGDP	10	.011099	0.7094	63.47006	0.0000

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
D_lnHHC						
_ce1						
L1.	-.0679829	.0201486	-3.37	0.001	-.1074735	-.0284923
lnHHC						
LD.	.5555659	.162538	3.42	0.001	.2369972	.8741345
L2D.	.3924946	.2101517	1.87	0.062	-.0193953	.8043844
L3D.	.3788862	.220307	1.72	0.085	-.0529077	.8106801
lnRev						
LD.	-.0249777	.0513965	-0.49	0.627	-.125713	.0757577
L2D.	.0336562	.051562	0.65	0.514	-.0674036	.1347159
L3D.	-.0959761	.0513611	-1.87	0.062	-.1966419	.0046898
lnRGDP						
LD.	-.1914039	.2587307	-0.74	0.459	-.6985068	.3156991
L2D.	-.5754118	.2533229	-2.27	0.023	-1.071916	-.078908
L3D.	-.376078	.2155634	-1.74	0.081	-.7985745	.0464185

Source: own estimations

The first part of the equation *lnHHC* revealed that the value on short term of errors' correction coefficient is almost equal with -0,068 and is significant from the statistical point of view, according to *P-statistic* (0,001). This coefficient shows that about 7% of the imbalance is corrected from one quarter to another. Therefore, it was possible to move to the long term modelling. Taking into consideration the fact that a VECM model reveals analysis results on both short term (in this case – four quarters) and on long-term, below will be presented the long-term results and the equilibrium equation.

Table no. 5: *Vector Error Correction Model for identification of the Barro-Ricardo equivalence, at the level of the Romanian economy (long term)*

Cointegrating equations

Equation	Parms	chi2	P>chi2
_cel	2	18324.01	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
_cel					
lnHHC	1	.	.	.	.
lnRev	.9786386	.3402576	2.88	0.004	.3117461 1.645531
lnRGDP	-1.75666	.2699549	-6.51	0.000	-2.285761 -1.227558

Source: own estimations

It can be observed that also on long term the value of the errors' correction coefficient is significant, according to *P-statistic*. The equilibrium equation of the above presented model can be re-written as:

$$\ln HHC - 0,979 \ln REV - 1,757 \ln RGDP \quad (2)$$

Further, we have tested the model for serial autocorrelation (with the support of Lagrange multiplier, up to the eight lag) and for stability. These tests confirmed that the model has been correctly specified, it is stable and that there was no serial autocorrelation and the model could generate stationary series for forecast. In the same time, the test for errors' distribution and its result denied that the errors had a normal distribution. As a result, for this issue two possible causes have been identified: the analysed time sample was quite small; also, the Romanian economy was young, with not so many years in transition, which led to quite quickly changes of the structure of the economic variables and further – to changes of the properties of the data.

Normally, if the model is stable, the cointegration equation (*ce*) should be stationary. The results of the Dickey-Fuller and Phillips-Peron (MacKinnon approx. p-value = 0.0162) confirmed the fact that the new generated series *ce* is a stationary one.

The last stage in building the model is related to the implementation of the impulse response function (IRF). It has been used an orthogonalized IRF. The second graph is a larger-scale representation of the first graph, from the third line. Here the impulse was applied to the *lnRev* variable (Governmental revenues), while the response was offered by the variable *lnHHC* (household consumption). Therefore, in this study we are mainly and particularly interested by the second graph.

Fig. 3: *Impulse-response function of the VEC Model*

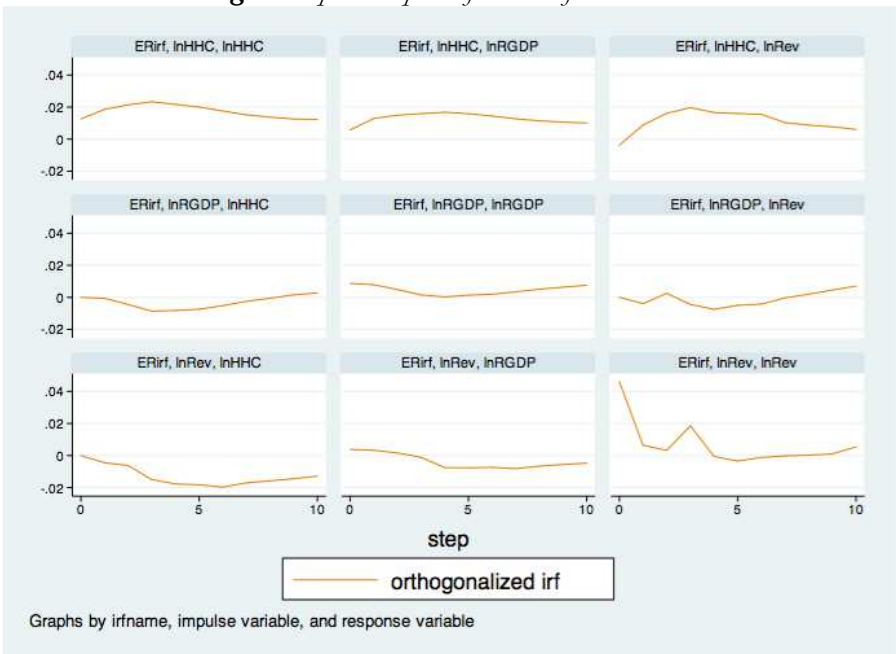
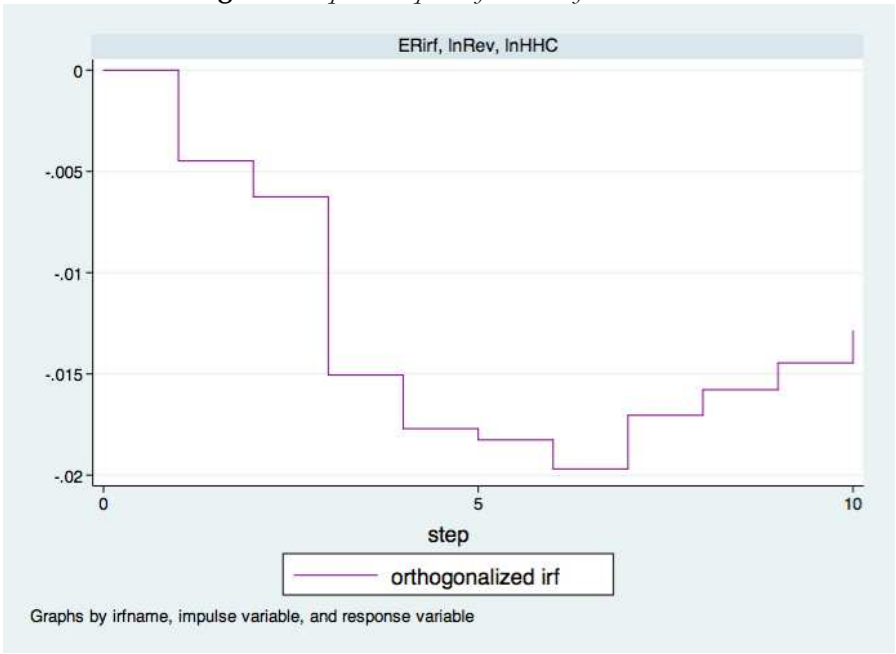


Fig. 3.1: *Impulse-response function of the VEC Model*



Source: own estimation

It can be observed that when a shock appears at the level of the governmental revenues (for instance, an increase of the level of taxation), as a response occurs a decrease

of the household consumption. The measurement unit used for the model estimations is represented by the natural logarithms in billion lei. The minimum point of this event is in the 6th quarter from the event, while 0.2 of the logarithm represents about 1.22 (in this case – billion lei). After the 6th quarter, the household consumption tends to return to the initial level, while at the end, after a longer period (which couldn't be exactly identified due to the small sample of observations), the shock is totally assimilated.

For the period between 1930 and 1976 and using a study realised for the US economy, based on a regression model, Kormendi (1983) discovered that an increase of the taxation does not affect the consume. The results are in accordance with the Ricardian equivalence. In the model described at the beginning of this section, Giorgioni and Holden (2003), started from the following working hypothesis: if in the moment of a shock at the level of budgetary revenues and taxation the consume decreases, then the consumers will behave in a Keynesian manner. According to the studied bibliography for this research paper, and mainly according to the papers of the two previously mentioned authors, it can be said that the VEC model, calibrated for the Romanian economy, denies the hypothesis of the Ricardian equivalence.

5. Concluding remarks

This paper consisted in a three-dimensional approach, through a VECM, of the Ricardian Equivalence Hypothesis for the Romanian Economy. It was calibrated Giorgioni and Holden's (2003) model, where our used variables were: the real GDP, budgetary revenues and households' consumption. The model discussed in this paper it revealed the fact the Ricardian Equivalence cannot be considered a valid economic theory related to the national economy. The Romanian economy reacts in a Keynesian manner, as the simulation of the impulse-response function shows: when a taxation positive shock occurs, the result is going to be a decrease in the households' consumption. The shock is absorbed after a period of more than 6 quarters.

The main factors identified as potential reasons for which the Ricardian Equivalence does not hold in Romania are: the logical cracks in this economic theory (an infinite time horizon, perfect capital markets and uncertainty regarding the future taxation and incomes), a poor economic education of the Romanian consumers and the way that the taxes are applied and perceived – Gustave le Bon, in 1895, explained the way in which taxes are decided by the policy-makers and accepted by the consumers – it can be chosen an unfair tax, if it is the best masked, by the deciders (Belingher, 2015).

As further developments of this model, there is going to be considered a larger data sample, when more observations are going to be available and also, other variables are going to be tested, in order to obtain a better accuracy of the simulations.

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