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A Discussion Regarding the Armey Model Validity for Romania

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Abstract: In this paper we analyze whether the Romanian economic context confirms the Armey model, and present the relationship between public spending and economic growth that may offer a suitable basis for decision makers. The analysis is based on quarterly data regarding public spending and economic growth in Romania. The analytic results did not confirm the premises related to the Armey Curve for the Romanian context during 1990-2011. The time interval is marked by unpredictable phenomena such as the transition from the state economy to the market economy and the world financial crisis, both of which alter the results. The fact determines us to develop a new model that describes better the connections and the period characteristics.

Keywords: Armey curve; laffer curve; fiscal policy; Romania

1. Introduction

Many researches on determinants of economic growth presents results demonstrating that a high level of public expenditure affects economic growth showing that between the level of public expenditure and growth develops a relationship of non-linear regression. This relationship is possible due to the fact that a high level of public expenditure over the considered optimal (and economic literature distinguishes several levels as being optimal, according to the countries that has done the analysis, depending on the period analyzed (giving even different levels for the same country, for analysis that took into account different periods of time), or depending on which indicators were calculated to determine the optimum point). For example, Barro (Barro, 1990) identified an optimum level of the public sector, when its marginal product equals 1 (the so-called rule of Barro) and, based on empirical data represented a U shape curve returned, which shows the relationship between growth rate and the level of public expenditure as a percentage in GDP.

Our work, building on previous research empirical studies published by other authors, has a new scientific path, analyzing the Armey model compatibility with Romanian economy, the economy of a country that over the period considered followed the course of the transition from an centralized economy to one of the market, and, after he has earned the status of market economy has had as its objective the integration in the European Union.

The specific conditions of the economic crisis that the country just went through it are not forgotten, because they can influence the results of the study. During this stage particular structural and level changes were imposed in terms of fiscal-budgetary indicators used in this study, changes that can inflict interpretations and uncertainty upon our analysis results. Another new element, in addition to

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the fact that no one ever assessed Romanian economy using the connection between these two models, is represented by dual analysis (quarterly and annual) of the Romanian economy, including the use of econometric techniques, according to the objectives of our research.

2. Literature Review

The idea of a nonlinear relationship between public expenditure and economic growth was recast and popularized in several studies. For example Heitger (2001) was examined and demonstrated that if the level of public expenditure increases due to consumer spending, the effect on GDP is negative, while an increase in government spending on public investment growth has positive effects on economic growth. Heitger has shown that for the zero level in the public sector, the level of GDP is very low, since public goods are not supplied to the appropriate level.

The notion of "optimal level of public expenditure" was popularized by Armey (1995), who plotted the Armey curve. The author argued that the absence of Government generates anarchy and reduced level of GDP per capita, as there is no rule and ownership is not protected. Consequently, there is no motivation to save and invest because there is the threat of expropriation. Similarly, where all decisions are taken by the Government, the GDP per capita is also reduced. When there is a mix between public and private decisions on the allocation of capital, GDP should be higher. Thus, the expansion of public expenditure (from reduced levels) should be associated with the expansion of the outcomes. However, as public expenditure increase, additional projects financed by the Government are becoming less and less productive and the taxes and loans settled to finance government operations are becoming increasingly large. At a certain point, marginal benefit of increasing public expenditure becomes zero.

Generally, according to Chen and Lee (2005, p. 1053), there are two groups of economists who have shown the two types of relationships between public expenditure and economic growth. Thus, the first category has found a negative relationship between the level of public expenditure and economic growth. They believe that increasing the level of public expenditure will reach the useful results of the decline in public spending and the growth of public expenditure will cause a crowding out effect on private investments, in the context in which when a Government increase public expenditure needs an extra taxes to pay for additional growth of public expenditure, which has negative effects on the economy. The second group of economists has established a positive relationship between the size of public expenditure and economic growth, claiming that the increase of public expenditure will encourage private investment by improving the investment climate.

Armey has implemented Laffer curve to assess the relationship between the size of the public sector and economic growth, after which Vedder and Gallaway have demonstrated in 1998 based on an empirical analyses that the level of the public sector and economic growth are asymmetrical, indicating that this relationship is an asymmetrical Armey curve, showing that a reduced public sector aims to protect private property and to provide public goods. Increase over the extent of the public sector will result in excessive public investment that will create an effect of crowding out private investment, with higher taxes and succession duties and payments of interest, which will affect the economy. A reduced level of the public sector will have a positive impact for the promotion of economic growth. Vedder and Gallaway have plotted the relation between the level of the public sector and growth in the form of an inverted U, according to the figure below:

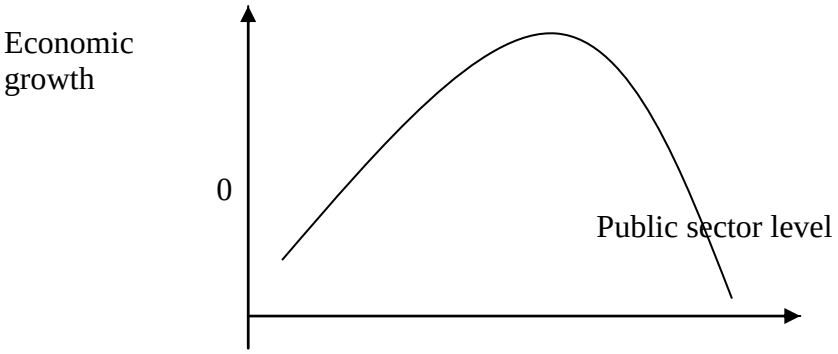

Figure 1. Armey Curve

Due to the shape of inverted U can find the optimal level of public sector, which promotes the highest rates of economic growth. The above mentioned authors have found this maximum point at 17.45% for the US economy in the period 1947-1997. In addition, optimum level (Vedder & Gallaway, 1998) of the public sector, calculated as the ratio between the total public expenditure and growth was calculated also for Canada, during the period 1854-1988 (21.37%), Denmark between 1854-1988 (26.14), Italy between 1873-1988 (22.23% United Kingdom, between the years 1830-1988 (20.97%).

Another analysis (Pevcin, 2005) carried out to test the validity of the Armey curve in 12 of the 27 countries of the European Union, for the period 1950-1996 has prove that it can be described only for the individual Armey curves in Italy, France, Finland, Sweden, Germany, Ireland, Netherlands and Belgium, while for countries such as United Kingdom, Austria, Denmark, Norway has not been able to obtain it, the coefficients of regression not being relevant from a statistical viewpoint. For countries for which it could not achieve optimal level of the curve, public expenditure as a percentage in GDP can be viewed in the following table:

Table 1. The optimal size of the public spending

Country	***Size of government, % of GDP in 1996***	***Armey Curve peak (% of GDP)***	***Percentage change (current to peak)***
Italy	44.90	37.09	-17.39
France	54.73	42.90	-21.62
Finland	58.74	38.98	-33.64
Sweden	65.02	45.96	-29.31
Germany	48.72	38.45	-21.08
Ireland	39.60	42.28	+6.77
Netherlands	51.97	44.86	-13.68
Belgium	52.97	41.91	-20.88

Source: (Pevcin, 2005, p. 1297)

In the meanwhile Davies (Davies, 2009) have analyzed the Armey by expanding the economic growth variable to the human development index, trying by it to highlight the relationship in the form of inverted U between the level of public expenditure as a % of GDP and the human development index, because, while the GDP measure productivity in its aggregate, HDI ("index, generally accepted, the measurement of international comparative welfare" (Wallace, l., 2004) reflects the types of goods and services which make up the GDP.

3. Quarterly Model

3.1. Data, Sources and Model Validation

Generally, most economists accept the validity of the curve in inversed U as a realistic description of the relationship between the evolution of public expenditure and economic growth. In essence, to validate this curve it takes an empirical analysis.

To test the existence of Armey curve (the relationship between the level of total public expenditure and economic growth, in the form of an inverted U curve) on the Romanian economy conditions we initially used quarterly data (1st quarter 2000-2011 1st quarter).

The analysis was conducted using the econometric program EWiews. The first stage of the analysis was to determine the actual values of the variables analyzed (growth rate of GDP growth calculating quarterly values as differences compared to the same quarter the previous year and the second variable, the total public expenditure in GDP, %, calculated as of the quarterly values all by comparison with the same quarter in previous year) by reference to the HICP available in Eurostat's database with fixed basis in 2006. Because the quarterly data are affected by seasonality, have been subject to seasonal adjustment procedures. For this we use the ARIMA X 12 method.

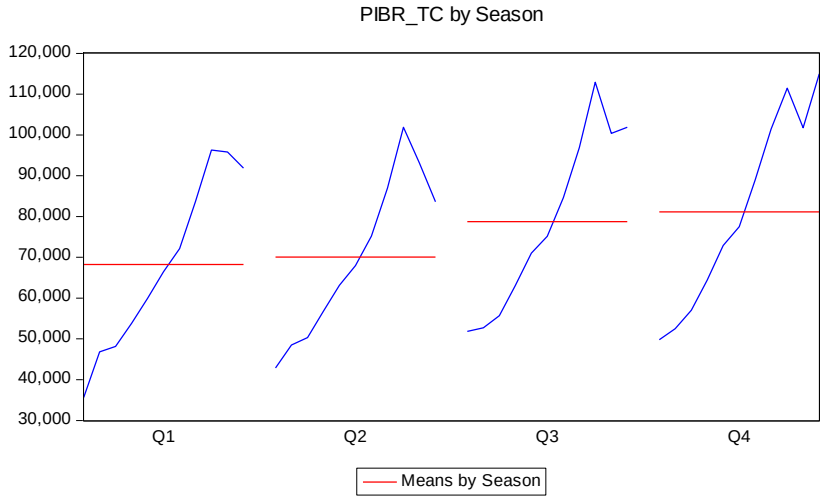

Figure 2. Economic growth evolution (seasonally)

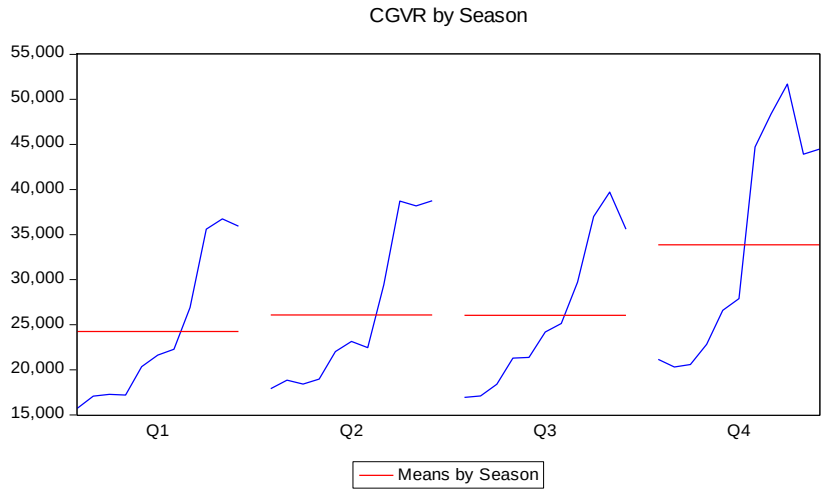

Figure 3. Public spending evolution (seasonally)

Since neither of the two time series was not stationary (procedure checked by the Augmented Dickey-Fuller test) we proceeded to their idle time. Thus, the seasonally adjusted series above were differentiated by the order of 1.

Null Hypothesis: DCHPR_SA has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.463847	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Source: own assessments

Null Hypothesis: DPIBR_SA has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.024291	0.0002
Test critical values:	1% level	-3.632900	
	5% level	-2.948404	
	10% level	-2.612874	

*MacKinnon (1996) one-sided p-values.

Source: own assessments

The evolution chart of both quarterly variables stationaries and without season affect is as follows:

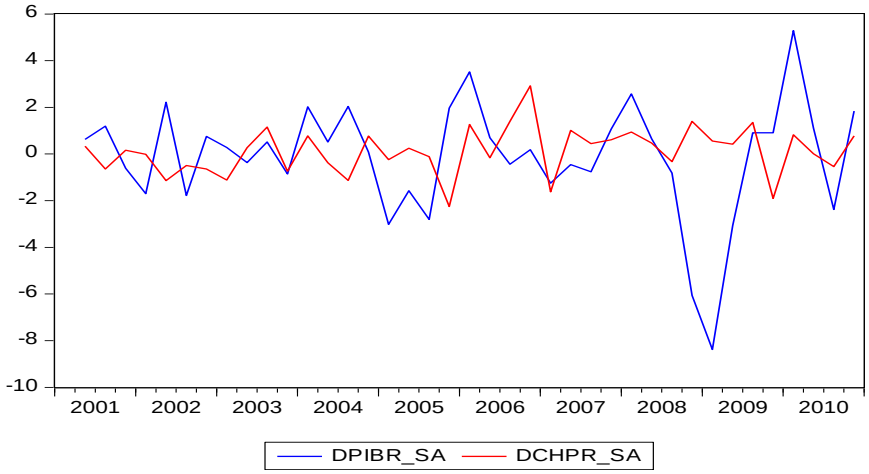

Figure 4. GDP and public spending evolution in România - 2001-2010 (quarterly)

3.2. Estimation of the Hyperbolic Regression Model

The next stage of analysis is the estimation of the hyperbolic regression model and possibly testing the estimated model.

Dependent Variable: DPIB
Method: Least Squares
Sample (adjusted): 2000Q2 2009Q4
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.500924	0.632001	-0.792600	**0.4332**
DChP	-0.095390	0.071722	-1.329997	**0.1919**
DChP^2	0.008123	0.010801	0.752118	**0.4569**

R-squared	0.046835	Mean dependent var	-0.121538
Adjusted R-squared	-0.006119	S.D. dependent var	2.469228
S.E. of regression	2.476771	Akaike info criterion	4.725592
Sum squared resid	220.8382	Schwarz criterion	4.853558
Log likelihood	-89.14904	Hannan-Quinn criter.	4.771505
F-statistic	0.884446	Durbin-Watson stat	1.210796
Prob(F-statistic)	0.421724		

Estimated regression model parameters are not significantly different from zero and errors do not comply with the hypothesis of lack of autocorrelation. An important conclusion being that we cannot design a relation of the U form (Armey curve) between economic growth and the share of public expenditure in GDP on quarterly data.

Therefore we try to design the residual variable of this model previously estimated by Box and Jenkins methodology so as to achieve a regression model which meets all the assumptions.

The pattern obtained is of the form:

Dependent Variable: DPIB
Method: Least Squares
Sample (adjusted): 2001Q2 2009Q4
Included observations: 35 after adjustments
Convergence achieved after 5 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DChP	-0.080767	0.034964	-2.309973	**0.0273**
AR(4)	-0.644531	0.154090	-4.182829	**0.0002**

R-squared	0.349658	Mean dependent var	-0.121429
Adjusted R-squared	0.329951	S.D. dependent var	2.549080
S.E. of regression	2.086588	Akaike info criterion	4.364382
Sum squared resid	143.6770	Schwarz criterion	4.453259
Log likelihood	-74.37669	Hannan-Quinn criter.	4.395063
Durbin-Watson stat	1.285379		

The general pattern is: $Y = \alpha + \beta X + \varepsilon$ (1) where: Y is the dependent variable, α = term; β = the independent variable; X = the independent variable, and ε-residual variable.

The resulted model is: $GDP = - 0{,}080767 * P.exp + \varepsilon_t - 0{,}0644531 * \varepsilon_{t-1}$ (2) where: GDP = real growth, differentiation and without season affect of order 1, P.exp = actual total public expenditure level, without season affect and differentiated of order 1.

The regression model complies with all the normal assumptions for a regression model. Thus the link between economic growth and increased government expenditure (quarterly data) is linear and inverse. According to the interpretations of the econometric evidence which may be carried out for this case would be that when government expenditure increase, growth decreases. According to the pattern above (2), on average, real economic growth drops by 0.080767%, for an increase of one unit in the level of actual total public expenditure. From the economic point of view, however, that interpretation cannot be accepted as valid, because we cannot argue that any kind of public expenditure has negative impact on economic growth, even for the fact that this expenditure will be in demand for certain goods and services, besides the positive impact upon the public investments recognized by many authors (Stoian et. all, 2007).

According to the determination report, however, only 34,96% of the *public expenditures increase* variable variation may explain the reverse variation of economic growth the rest up to 100% being due to random or other factors that are not included in the model.

4. Concluding Remarks

As specified above, the link between economic growth and the level of public expenditure as percentage of GDP can positive (if we are talking in particular about public investments) or negative (if we consider especially public expenditure and consumption-but not all of them). Detailed rules for the financing of such types of expenditure requires but a different analysis, though, and in this case you should comply with the principles of funding available, and at micro, namely long-term needs to be covered at the expense of resources in the long term, while short-term needs to cover short-term

available resources). On the other hand, an increase in public expenditure increased the rate of the marginal productivity of capital, which leads to the increase in the rate of economic growth. However, in the current economic situation, taking account of this period of crisis, it's hard to admit that he may leave at this level in the form of public budgets.

Regarding the results obtained using the econometric analysis of the curve for the particular case of Romania it should also be specified that we would need to know to what it is available. It would be interesting to assess if the approximate value of 30% can be taken into account not only at the theoretical level for designing the public budgets and if indeed the positive impact upon economic growth is similar to that resulting from the mathematical calculus.

5. References

Armey, D. (1995). *The Freedom Revolution*. Washington: Regnery Publishing.

Barro, R.J. (1990). Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy*, pp. 103-125.

Chen, S.T. & Lee C.C. (2005). Government size an economic growth in Taiwan: A threshold regression approach. *Journal of Policy Modeling*, 27, p. 1054.

Davies, A. (2009). Human Development and the optimal size of government. *The Journal of Socio-Economics,* vol. 38, p. 326.

Heitger, B. (2001). *The Scope of Government and Its Impact on Economic Growth in OECD Countries*. Institute of World Economics, Kiel, Working Paper No. 1034.

Nuță, A.C. (2008). The incidence of public spending on economic growth. *EuroEconomica*, Galati, issue 1/20.

Nuță, F. M. & Nuță, A. C., (2009). *Implicatiile socio-economice ale politicilor fiscal-bugetare/The scoio-economic implications of fiscal budgetary policies.* Galati: Europlus.

Pevcin, P. (2005). Government and economic performance. *International Conference Enterprise in Transition*, ISI Proceedings, p. 1295.

Stoian, A.; Câmpeanu, E. & Roman, M. (2007). *Fiscal sustainability based on reaction function: Case study Romania*, 11th International Conference on Macroeconomic Analysis and International Finance, Rethymno, Greece.

Vedder, R.K. & Gallaway, L.E. (1998). Government size and economic Growth. *Eastern Economic Journal*, 19(3), p. 326.

Wallace, L. (2004). People in economics. *Finance & Development*, vol. 41 (3), pp. 4-5.