The analysis of correlation between the GDP and the Gross Income

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Abstract

În aceasta lucrare, autorii analizează interconectarea dintre produsul intern brut și venitul brut in Romania. Cercetarea presupune PIB ca variabilă dependentă, iar influența venitului brut este conturata prin aplicarea unui model de regresie liniară simplă. Modelul este analizat din punct de vedere al semnificației și al testelor statistice, dar mai important, parametrii sunt interpretati de către autori. Lucrarea cuprinde datele sursă, descrierea modelului econometric, în timp ce informațiile relevante sunt prezentate sub formă de grafice și imagini.

Cuvinte-cheie: influența, Produsul Intern Brut, venitul brut, regresie, populația

Abstract

In this paper, the authors analyze the interconnection between Romania's Gross Domestic Product and Gross income. The research assumes the GDP as dependent variable, and the influence of the GI is outlined through the application of a simple linear regression model. The model is analyzed from the viewpoint of statistical significance and tests, but more important, the parameters are interpreted by the authors. The paper includes the source data, the description of the econometric model, while relevant information is presented under the shape of charts and print screen images.

Keywords: *influence, Gross Domestic Product, Gross Income, regression, population*

Introduction. Literature review

Total revenue represents all cash income, regardless of the source (excluding loans and credits taken, withdrawals of deposits from banks and similar institutions) and equivalent income in nature (animal and human consumption of food and nonfood for own household resources, respectively goods and services obtained free or reduced price from public and private economic agents) which are not in the nature of salary. Data are from the Household Budget Survey (ABF), held since 2001. The Household Budget Survey has been designed in accordance with European standards and recommendations. The methodology differs from that used in the Integrated Household Survey conducted in 1997-2000 (data for this period are found in the matrix BUF104G). In year 2006, respectively, since 2008, did not provided information on the category of households for PATRONI (Employers) due to fewer observations collected in the survey. Due to rounding the last digit of the expansion coefficients for the data used in selective researches, sometimes there may be small differences between totals and what results from the process of summing. Since 2014 data have been estimated based on resident population and are not comparable with data series for previous periods.

Anghelache and Anghel (2015) focus on Gross Domestic Product analysis, based on statistical-econometric models. Anghelache, Manole and Anghel (2015) apply regression instruments to outline the influence of final consumption and gross investments on the GDP. Anghelache, Soare and Popovici (2015) develop on the final consumption – as factor for the GDP evolution. Capelli and Vaggi (2013) present an alternative, better, in their opinion, indicator of the standard of living. Macdonald (2010) analyzes a set of macroeconomic indicators on the OECD states. Vintrová (2005) presents the problems in GDP-based economic analyses.

Methodology and data

In the analysis of the correlation between the GDP and the Gross Income, we considered the GDP as dependent variable, and the yearly Gross income influence on it (as independent variable), using a data series between years 1997 and 2015, as there were published by the National Institute of Statistics of Romania.

Years	GDP in comparable prices (mil lei)	Average gross income (VB)(lei)
1997	10911,4	603,9984
1998	25152,9	922,2228
1999	37108,3	1235,033
2000	56808,2	1746,31
2001	85820,2	2170,175
2002	124461,5	2745,295
2003	161061,7	3406,871
2004	215374,8	4416,364
2005	259125,1	4950,6
2006	313889,3	5679,48
2007	370821,8	6932,52
2008	453638,3	8778,36
2009	487331	9567,12
2010	506446,5	9543,72
2011	539520,4	10074,36
2012	568719,4	10333,8
2013	616393,3	10750,2
2014	<u>656318,6</u>	11251,8
2015	<u>692617,4</u>	12128,04

The GDP and Average gross income in period 1997-2015

Source: National Institute of Statistics of Romania.

The simple linear regression function Y=f(X), where Y=PIB is the dependent, endogenous variable, and X= yearly Average gross income, as independent exogenous variable.

The regression function resulting from the model can be represented as: PIB= a+b VB + E

We used the software Eviews 7.2 for the study of the GDP evolution and the yearly average gross income in period 1997-2015, by analysing graphs and descriptive indicators

The mean value of the yearly average gross incomes in the period 1997 - 2015 was 6170.33 lei, having a distribution between 603.99 lei (the minimum in the year 1997) and 12128.04 lei (the maximum reached in 2015), and a standard deviation of 3998.59 lei. The value of the Skewness coefficient of asymmetry 0.008, which means an almost symmetric series.



The results of statistical tests related to VB in the period 1997 - 2015

Based on the graphical representation of the two indicators, and also from the value of the coefficient C(2)=58.71, which shows the link between the two variables, we can conclude that it is a direct relation / link between the GDP and the yearly average gross income, meaning that increase of the yearly average gross income will determine the increase of the GDP, and inverse, for lowering value of yearly average gross income (VB) determine the decrease of GDP.



The analysis was performed by using the Eviews 7.2 software, and the results are presented in the table below.

Estimating the regression parameters

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Dependent Variable: PIB
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 09/08/16 Time: 19:57
Sample: 1997 2015
Included observations: 19
PIB=C(1)+C(2)*VB
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	Coefficient	Std. Error	t-Statistic	Prob.
C(1) C(2)	-36956.23 58.71637	7445.743 1.020634	-4.963405 57.52934	0.0001 0.0000
R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	0.994890 0.994589 17314.62 5.10E+09 -211.3300 3309.625 0.000000	Mean dependent var S.D. dependent var Akaike info criterion Schwarz criterion Hannan-Quinn criter. Durbin-Watson stat		325343.2 235385.0 22.45579 22.55521 22.47262 0.612412

The regression model follows the function: PIB = -36956.23 + 58.71 VB Due to the positive value of parameter b (C2), there is a direct relation/ link between the GDP and the gross income (VB), and more if we suppose the gross income increase by one unit, the GDP would increase by 58.71 mil lei.

The R-squared coefficient of determination, shows how the changes of the dependent variable is determined by the changes of the independent variable. Meaning that 99.48% of the GDP changes is determined by the change of the gross income, the rest is caused by other factors.

The calculated standard errors related to the estimated parameters (standard error C(1) = 7445.74 and standard error C(2)=1.02) were used for the significance test for the parameters of the regression functions. The two estimators can be considered as satisfactory, because their probability is very nearby to zero.

The value F=3309.62 validating the model, showing a probability which guaranty the results of 95%. The significance of F has a value very nearby to zero.

Conclusions

The regression analysis has outlined the influence of the Gross Income on the Gross Domestic Product of Romania. The model developed has substantial statistical significance and is sound, being possible to be used in future analyses and forecast studies. The direct correlation between the two variables is outlined by the parameters of the model, however the value of the free term invites to further researches mainly on the factors that influence the GDP, but also on the Gross Income.

Bibliography

- Ang, A., Piazzesi, M., Wei, M. (2006). What does the yield curve tell us about GDP growth?, Journal of Econometrics, Volume 131, Issues 1–2, March–April 2006, Pages 359–403
- Anghelache, C., Anghel, M.G. (2015). *GDP Analysis Methods through the Use of Statistical Econometric Models*, "ECONOMICA" Scientific and didactic journal, nr. 1 (91), Chişinău, Republica Moldova, pp. 124-130, ISSN: 1810-9136, (print) / ISSN 1844-0029 (online),
- Anghelache, C., Manole, A., Anghel, M.G. (2015). Analysis of final consumption and gross investment influence on GDP – multiple linear regression model, Theoretical and Applied Economics, No. 3/2015 (604), Autumn, pg 137-142, ISSN 1841-8678
- Anghelache, C., Soare, D.V., Popovici, M. (2015). Analysis of Gross Domestic Product Evolution under the Influence of the Final Consumption, Theoretical and Applied Economics, Volume XXII, No.4 (605), Winter, pp. 45-52, ISSN 1841-8678
- Anghelache, C., Manole, A., Anghel M.G. (2015). Analysis of final consumption and gross investment influence on GDP – multiple linear regression model, Theoretical and Applied Economics, No. 3/2015 (604), Autumn, Pages: 137-142

- Anghelache, C., Anghel, M.G. (2015). GDP Analysis Methods through the Use of Statistical – Econometric Models, "ECONOMICA" Scientific and didactic journal, nr. 1 (91), Chişinău, Republica Moldova, Pages: 124-130
- 7. Anghelache, C., Anghel, M.G. (2015). *Model of Analysis of the Dynamics of the DFI (DFI) Sold Correlated with the Evolution of the GDP at European Level*, Romanian Statistical Review Supplement, No. 10, Pages: 79-85
- 8. Benjamin, C., Herrard, N., Houée-Bigot, M., Tavéra, C. (2012). Forecasting with an Econometric Model, Springer, ISBN 978-3-642-11648-3
- Capelli, C., Vaggi, G. (2013). A better indicator of standards of living: The Gross National Disposable Income, University of Pavia, Department of Economics and Management in DEM Working Papers Series with number 062.
- Dumitrescu, D., Anghel, M.G, Anghelache, C. (2015). Analysis Model of GDP Dependence on the Structural Variables, Theoretical and Applied Economics, Volume XXII, No.4 (605), Winter, Pages: 151-158
- De Michelis, N., Monfort, P. (2008). Some reflections concerning GDP, regional convergence and European cohesion policy, Regional Science Policy & Practice, Volume (Year): 1 (2008), Issue (Month): 1 (November), Pages: 15-22
- Hulten, Ch., Schreyer, P. (2010). GDP, Technical Change, and the Measurement of Net Income: the Weitzman Model Revisited, NBER Working Paper No. 16010 Issued in May 2010
- Jones, Ch., Klenow, P. (2010). Beyond GDP? Welfare across Countries and Time, NBER Working Paper No. 16352
- Macdonald, R. (2010). Real Gross Domestic Income, Relative Prices and Economic Performance Across the OECD, Statistics Canada, Analytical Studies Branch in Economic Analysis (EA) Research Paper Series with number 2010059e.
- Ramcharan, R. (2007). Does the Exchange Rate Regime Matter for Real Shocks? Evidence from Windstorms and Earthquakes, Journal of International Economics, Volume 73, No. 1, Pages: 31–47
- Vintrová, R. (2005). What the GDP Indicator Does Not Reveal in Economic Analyses (in English), Charles University Prague, Faculty of Social Sciences in its journal Finance a uver - Czech Journal of Economics and Finance, Volume (Year): 55 (2005), Issue (Month): 11-12 (November), pp. 578-594