MEASURING THE ECONOMIC GROWTH USING EMPLOYMENT QUALITY PARAMETERS – AN ECONOMETRIC APPROACH

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Abstract: *The classic model of economic growth is described by GDP, employment rate for working-age individuals, unemployment rate and the labour cost index. This paper aims to present a changing of the paradigm to measure the effect on the economic growth of only the classical factors (indicators) with elements of employment quality. For this purpose will be used an econometric analysis – Vector Autoregressive model. The quarterly data used for Romania is provided by official statistics. The software used for the analysis is R Project, with the package vars. The classic model could be replaced by a new model which includes GDP, employment rate for people aged 15 and more, social productivity, NEETs rate, and rate of early leavers from education and training for individuals aged 15-24. Hence, the proposed model encloses new components, mainly the youth's performance in employment and their interest in education and employment and the active ageing. The need for such a model is based on some statistical insights of Active Ageing Index, NEETs rates and early leavers from education and training rates. The proposed model is multivariate; therefore, all the variables are addressed simultaneously, and is meant to explain the behaviour of a variable based on its past and other variables. Based on the results, the study will underline some important policy that could be implemented.*

Keywords: *Economic growth; Employment; GDP; Vector Autoregressive model; NEETs; Active ageing.*

JEL Classification: *C51; E24; J21; O47.*

1. Background

This study follows the idea that the economic growth paradigm is changing. Therefore, the classic model described by GDP, employment rate for working-age individuals, labour cost index and unemployment rate could be replaced by the new model which includes GDP, employment rate for people aged 15 and more, social productivity, NEETs rate, and rate of early leavers from education and training for individuals aged 15-24.
In the new approach, the labour cost index is replaced by the social productivity and the unemployment rate is substituted by the NEET and early school leavers rates.
The proposed model encloses two new components. Firstly, the employment rate extends its coverage in the new model, from 15-64 years to 15 years or more, in order to include also the active ageing. Secondly, the new paradigm provides the idea that the performance in employment (Social productivity) and the interest of

youth in education and employment (NEETs rate and rate of early school leavers) have strong impact on GDP, therefore on economic growth.

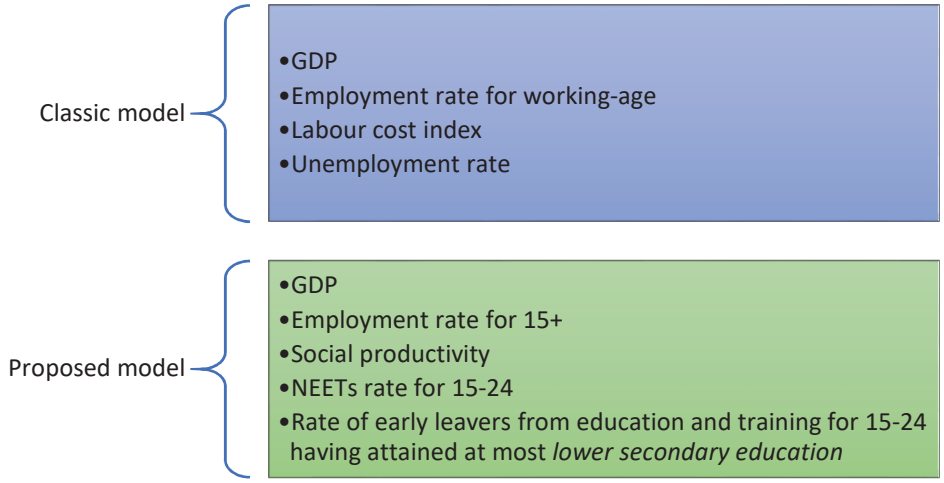

Figure 1: Classic model and proposed model for economic growth
Source: Authors' concept

Active ageing is among the interests in the new economic and social policies among Europe. One initiative of the European Commission and UNECE is Active Ageing Index, established in 2012. This index measures the potential of older people for active and healthy ageing and is constructed from 22 individual indicators that are grouped into four domains: a) employment; b) participation in the society; c) independent, healthy and secure living and d) capacity and enabling environment for active ageing. The domain Employment is related to only one type of indicator, i.e. the employment rate for various age groups: 55-59, 60-64, 65-69 and 70-74.
The preliminary data for 2018 show that Romania ranks 15th position among EU member states, with an index valuing 28.9, compared with European level of 31.1, for the employment component. For the overall Active Ageing Index, Romania ranks the 26th position (the value of the index is 30.4), compared with the EU's average of 35.7. For the overall period 2010-2018, we can conclude that Romania faces a divergence of this index, as exposed in the Table 1.
For young people the situation has widely complex. Employment and unemployment rates do not capture the situation of all young people. Many of the remaining youth may still be enrolled in formal or non-formal education. It is beneficial for young people to remain in education, continuing to invest in their own human capital, which can lead to better jobs, higher salaries and productivity. The ones who find themselves out of education and training at an early age are becoming vulnerable, since they face disadvantages in labour market (European Training Foundation, 2015). The concept of NEET refers to the youth currently not employed and not enrolled in any form of education. The emergence of the NEET concept is linked to the growing complexity of youth transitions and changes in labour markets and the availability of jobs.

Table 1: Active Ageing Index in Romania and EU-28, 2010-2018

Year	Country	Value	Rank	Ratio RO/EU-28 (times)
2010	Romania	29.4	21	0.92
	EU-28	32.0		
2012	Romania	29.4	23	0.88
	EU-28	33.4		
2014	Romania	29.6	24	0.87
	EU-28	33.9		
2016	Romania	30.4	24	0.87
	EU-28	34.8		
2018 (preliminary data)	Romania	30.4	26	0.85
	EU-28	35.7		

Source: European Commission and UNECE, Active Ageing Index

Romania has higher NEET rates than the EU's average between 2004 and 2017. Data proves that in 2008 the rates were the lowest in all the period, even with the males' rate being under the EU's average.

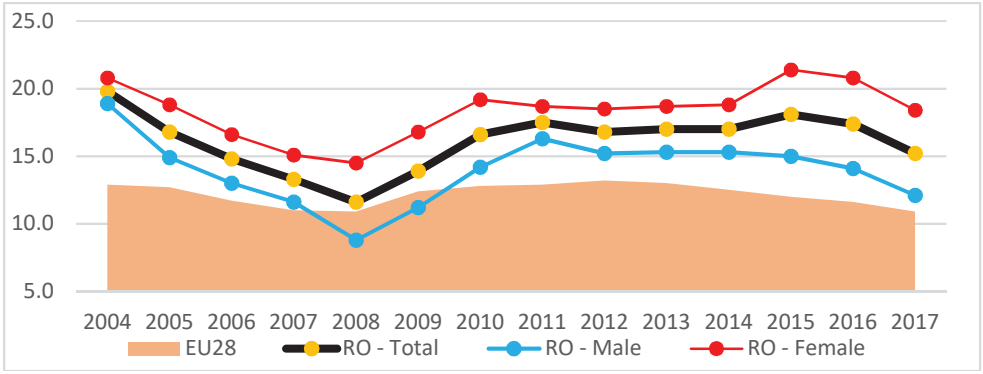

Figure 2: NEET rates for 15-24 years old, in Romania and EU-28, 2004-2017
Source: Eurostat database, edat_lfse_18

The interest of youth in education and employment is measured by the early leavers from education and training. Moreover, reducing school drop-out rates to less than 10% is one of the targets of Europe 2020 Strategy. The data provided by Eurostat show that, for Romania, the rate of early leavers from initial education who were unemployed was higher than the rate for employed ones in 2011, 2015 and 2016. In addition, the rate of early leavers that would like to work has outbalanced the rate of early leavers that are not interested in employment in all period, except the period after 2015.

At EU level, the situation is different. The rate of early leavers from initial education who were unemployed was lower than the rate for employed ones until 2008. The school drop-out rates for the individuals that would like to work is higher than the rates for individuals that do not want to work in all the period.

Figure 3: Early leavers from education and training rates for 18-24 years old, in Romania and EU-28, 2005-2017
Source: Eurostat database, edat_lfse_14

Therefore, we can conclude that in Romania there is a tendency of youth which are leaving the education in getting away also from employment, therefore in becoming NEETs.
These aspects are important in order to understand the impact that these indicators could possibly have on the economic growth, i.e. GDP.

2. Methodology of the VAR model

For analysing the new proposed model of economic growth based on youth and active ageing contribution in Romania, the present paper aims to test a multivariate Vector Autoregressive Model (VAR).
The model includes the following variables: GDP, employment rate for people aged 15 and more, social productivity, NEETs rate for individuals aged 15-24, and rate of early leavers from education and training for individuals aged 15-24.
The software used for the analysis is R Project, with the package vars (Pfaff, 2008), which is specific for the VAR, SVAR and SVEC analyses. The statistical software R shows the advantages of an open source system: costs related only with the training of users, easy customization of the applied methodology, technical support provided by a large community of users and experts, continuous upgrade and linkage with the way statisticians think and work (Dobre et. al, 2013).
The quarterly data used in the analysis is provided by official statistics (NIS of Romania and Eurostat) and comprise the period 2005 Q1 – 2017 Q2. The variables included in the model are explained below.

1. GDP – Gross domestic product, expressed in national currency (Romanian Lei).

2. EMP - Employment rate for people aged 15 and more - the share of employed people aged 15 or more in the total population of the same age group.
3. PROD - Social productivity – the ratio between GDP and civil economically active population.
4. NEET - NEETs rate for individuals aged 15-24 - percentage of the youth aged 15-24 who is not employed and not involved in education or training.
5. ESL - Rate of early leavers from education and training for individuals aged 15-24 - percentage of the people aged 15 to 24 who has completed at most lower secondary education and is not involved in further education or training, out of the total population aged 15 to 24.

The proposed model is multivariate; therefore, all the variables listed above are addressed simultaneously, and is meant to explain the behaviour of a variable based on its past and other variables.

The applied VAR model suppose that a vector of state variables follows a first-order VAR, i.e. every state variable in period t+1 can be explained by a linear combination of the state variables in the previous period (t) and a constant deterministic regressor. All variables were converted into natural logarithms, as the use of log-transformed data has become a good practice in macroeconomic forecasting with VAR models (Mayr, Ulbricht, 2007).

A preliminary step in the development process of VAR models is the application of unit root test ADF (Augmented Dickey-Fuller). This tests the unit root against a trend stationary alternative. In R software, the Augmented Dickey-Fuller test is implemented by the function ur.df(), included in the package urca. The stationarity of the series implied in the models was tested in two different ways.

Firstly, it was considered that the natural logarithms of the series follow a stochastic process autoregressive of order 1, type "trend". Secondly, it was tested if the series follow a stochastic process AR (1) autoregressive of order 1, type "drift".

Table 2. Critical values of 1%, 5% and 10%

Type	Critical values 99%	Critical values 95%	Critical values 90%
Trend	-4.15	-3.50	-3.18
	7.02	5.13	4.31
	9.31	6.73	5.61
Drift	-3.58	-2.93	-2.60
	7.06	4.86	3.94

The ADF test results were compared with the critical values for the various thresholds of significance. In both cases – trend and drift - the test results are higher than the critical values of 1%, 5% and 10% in the Table 2, therefore the null hypothesis of the presence of unit root in the series could not be rejected. This means that the series are not stationary.

Table 3: Augmented Dickey Fuller Test-statistic values for variables included in the model

Time series	Type	ADF Value
GDP	Trend	-2.5853
		4.9491
		4.6062
	Drift	-3.6214
		6.5627
EMP	Trend	-1.7433
		1.0439
		1.5451
	Drift	-15.6285
		122.3807
PROD	Trend	-1.8219
		9.0674
		6.1064
	Drift	-6.5492
		21.5
NEETS	Trend	-2.2177
		1.7484
		2.4596
	Drift	-5.8096
		17.0465
ESL	Trend	-2.3838
		3.3067
		4.3789
	Drift	-8.737
		38.1812

Source: R output on ADF Tests

3. Results of the VAR model and comments

In the next step, an optimal lag length was determined for an unrestricted VAR for a maximal lag length of four (general accepted lag for quarterly data). According to VARselect() procedure in R, the optimal lag for models is 4, considering Akaike (AIC), Schwarz (SC) and FPE (Final Prediction Error) Criterion.
Since the minimum values for AIC and SC criteria have the order 4, a VAR (4) model will be conducted. VAR()function performs the VAR model for each of the five equations by using least squares method. By default, it will consider the minimum value of Akaike criterion. Further, by applying the summary() function, more details on equation "GDP" will be presented. A summary on these details is exposed in the Table 4.

Table 4: Estimation results for equation GDP

Variable	Estimate	Std. Error	t value	Pr(>|t|)
GDP.l1	-8.5170884	2.9666429	-2.871	0.00841 **
EMP.l1	10.2516934	2.9194474	3.512	0.00179 **
PROD.l1	8.7736664	2.9295739	2.995	0.00628 **
NEETS.l1	0.1653621	0.0988330	1.673	0.10729
ESL.l1	-0.2102843	0.1472272	-1.428	0.16609
GDP.l2	-7.2289153	3.7306835	-1.938	0.06451 .
EMP.l2	8.8198111	3.7430783	2.356	0.02696 *
PROD.l2	7.1810147	3.7531775	1.913	0.06771 .
NEETS.l2	0.4040847	0.1180939	3.422	0.00223 **
ESL.l2	-0.4625923	0.1574375	-2.938	0.00718 **
GDP.l3	0.1166351	2.9271657	0.040	0.96855
EMP.l3	0.3111179	2.8768631	0.108	0.91478
PROD.l3	0.2011913	2.9357864	0.069	0.94593
NEETS.l3	0.1689971	0.1028929	1.642	0.11354
ESL.l3	0.1652273	0.1617102	1.022	0.31709
GDP.l4	7.9324392	2.5689273	3.088	0.00503 **
EMP.l4	-7.1264436	2.5270860	-2.820	0.00948 *
PROD.l4	-8.1467966	2.5250055	-3.226	0.00360 **
NEETS.l4	-0.1459936	0.1251538	-1.167	0.25487
ESL.l4	-0.1042758	0.1461219	-0.714	0.48234
const	14.17701	5.2352748	2.708	0.01228 *
trend	0.00081	0.0008768	0.927	0.36333

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.009125 on 24 degrees of freedom
Multiple R-Squared: 0.9951, Adjusted R-squared: 0.9909
F-statistic: 233.3 on 21 and 24 DF, p-value: < 2.2e-16
Source: R output on VAR model

The output of the VAR model outlines some figures. GDP is explained only by its own past and by the past of employment rate and social productivity. Also, it is strongly influenced by employment rate in t, t+1 and t+3, by social productivity in t and t+3, by NEETS rate in t+1, and by rate of early school leavers in t+1. In period t, the influence is high among GDP, employment rate and social productivity. Therefore, we can conclude with some remarks:

a) The effects of employment rate (15+) on the economic growth is strong across all the lags, except the 3rd one;
b) The social productivity is influencing the GDP in the first and third lags;
c) The NEETs effects on the economic growth are visible upon two lags;
d) The drop-out rates influence on the GDP is observed after two lags.

For future research, another version of this model could be the one in which we substitute the social productivity with the wage-led productivity. This approach could be motivated by the specific levels of wages for active ageing and youth on the labour market. Considering the wage-led growth arises from the idea that real wage growth restraint reduces productivity growth more than output growth – thus creating higher employment. Moreover, as stated in the literature, a one-percentage point step-up

in real wage growth raises productivity growth by 0.38 percentage points (ILO, 2013, p. 109).

4. Conclusions

The study proposes a new approach of analysing economic growth by means of an econometric model – Vector Auto Regressive.
The results showed the influence of employment rate for people aged 15 and more, social productivity of labour, NEETs rate, and rate of early leavers from education and training for individuals aged 15-24 having attained at most lower secondary education, on GDP.
The effects of NEETs and dropout rates on the economic growth are not immediate observed on the economy. The situation is similar with the investments. Their effects do not appear instantly, they have to be validated by some economic cycles.
Moreover, the importance of the indicator dropout rate of individuals having attained at most lower secondary education is important, considering that the Romanian economy is mostly composed of workers with this level of education.
Strong policy measures concerning the active ageing and the employment and education of youth shall be considered in Romania. On one hand, the evidence generated is raising awareness of the challenges and opportunities for older people to seek ways to develop their full potential, thereby contributing to improving the future sustainability of welfare systems and their own well-being. On the other hand, the policy makers shall be able to forecast the needs in the labour market and shall coordinate the education system towards the accomplishment of the quality of employment, mainly for the youth. The youth is a vulnerable group on the labour market, so it has special needs. Improving the efficiency of education and training systems at national level is essential to avoid the waste of human capital and financial resources, increase employability and reduce inequalities. All these proposed policy measures would lead to economic growth:
- Focusing on reducing school drop-out in secondary education (specific for Romania);
- Increasing the rate of transition to higher education, with specialization in technical domains (according to the reindustrialization) and digital fields (the fourth industrial revolution);
- Assuring a sustainable employment by linking productivity and wages;
- Measures for the active ageing are beneficial. Regarding this, for future research, we could consider the analysis of active ageing rate versus NEETs rate.

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Appendix. Data used for the model VAR, converted into natural logarithms

Year	Quarter	GDP	EMP	PROD	NEETS	ESL
2005	Q1	4.8287	1.7042	0.8779	1.2897	1.3363
2005	Q2	4.8474	1.7251	0.8758	1.2171	1.3357
2005	Q3	4.8703	1.7168	0.9068	1.2633	1.3348
2005	Q4	4.8842	1.711	0.9268	1.2554	1.3207
2006	Q1	4.9068	1.7067	0.9524	1.2426	1.2983
2006	Q2	4.9239	1.7316	0.9451	1.1578	1.308
2006	Q3	4.9415	1.7388	0.957	1.2038	1.3041
2006	Q4	4.9671	1.7135	1.0075	1.1936	1.2927
2007	Q1	4.9842	1.716	1.0235	1.1967	1.2807
2007	Q2	5.0048	1.7316	1.0286	1.1219	1.2904
2007	Q3	5.0201	1.7427	1.0365	1.157	1.2887
2007	Q4	5.0525	1.7218	1.0898	1.1591	1.2771
2008	Q1	5.0874	1.7168	1.1334	1.1334	1.271
2008	Q2	5.1098	1.7348	1.1382	1.0374	1.2661
2008	Q3	5.1275	1.7412	1.1497	1.0931	1.2554
2008	Q4	5.1339	1.7259	1.1713	1.1066	1.2528
2009	Q1	5.0889	1.7118	1.1413	1.154	1.2838
2009	Q2	5.1023	1.7275	1.1387	1.1005	1.2667
2009	Q3	5.1007	1.7275	1.1387	1.1791	1.2482
2009	Q4	5.1237	1.6998	1.1898	1.2163	1.2453
2010	Q1	5.1163	1.6928	1.1904	1.2327	1.2915
2010	Q2	5.1241	1.721	1.1705	1.1773	1.3126
2010	Q3	5.1215	1.7202	1.1696	1.2232	1.277
2010	Q4	5.136	1.6972	1.2076	1.245	1.2559
2011	Q1	5.1429	1.6955	1.2166	1.2572	1.2885
2011	Q2	5.1441	1.7042	1.2093	1.2201	1.2646
2011	Q3	5.1538	1.7067	1.2173	1.2451	1.2444
2011	Q4	5.1561	1.6964	1.2303	1.246	1.2345

Year	Quarter	GDP	EMP	PROD	NEETS	ESL
2012	Q1	5.1563	1.6946	1.2335	1.2497	1.2408
2012	Q2	5.1746	1.7118	1.2347	1.2038	1.263
2012	Q3	5.1759	1.716	1.2321	1.2217	1.2526
2012	Q4	5.1791	1.7042	1.2468	1.2254	1.2411
2013	Q1	5.1851	1.6937	1.264	1.2359	1.2357
2013	Q2	5.1973	1.7093	1.2605	1.2036	1.249
2013	Q3	5.2058	1.7135	1.2657	1.2385	1.2431
2013	Q4	5.2145	1.7024	1.2852	1.2389	1.2269
2014	Q1	5.2128	1.6981	1.2885	1.2278	1.2377
2014	Q2	5.2205	1.7118	1.2821	1.2005	1.2596
2014	Q3	5.224	1.7193	1.2784	1.2415	1.2674
2014	Q4	5.229	1.7059	1.2968	1.2521	1.2681
2015	Q1	5.248	1.6902	1.3322	1.3051	1.2551
2015	Q2	5.2381	1.7118	1.3004	1.2318	1.2896
2015	Q3	5.2552	1.7177	1.3128	1.2356	1.2962
2015	Q4	5.259	1.7042	1.3304	1.2519	1.2784
2016	Q1	5.216	1.692	1.2996	1.2639	1.2831
2016	Q2	5.2289	1.7067	1.2982	1.2018	1.2666
2016	Q3	5.2342	1.7135	1.2984	1.2185	1.2429
2016	Q4	5.249	1.7016	1.325	1.2724	1.2778
2017	Q1	5.2648	1.699	1.3445	1.2453	1.2811
2017	Q2	5.2788	1.7316	1.3262	1.0886	1.2612

Source: Eurostat and NIS of Romania databases