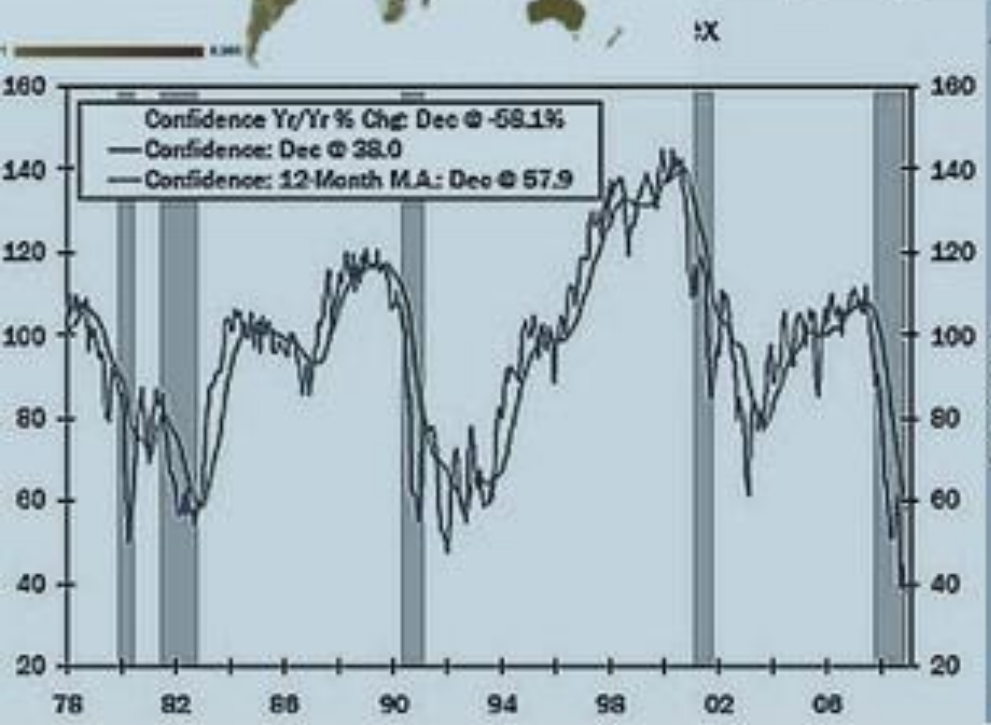
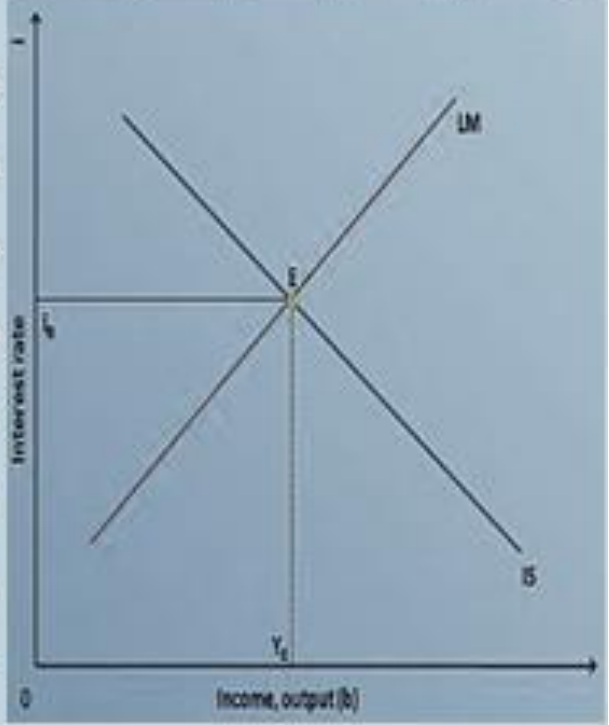
Vol. 5, Issue 4, 2017
ISSN 2343-7995 (online)

Hyperion Economic Journal





HYPERION ECONOMIC JOURNAL

Quarterly journal published by the Faculty of Economic Sciences from the Hyperion University of Bucharest, Romania

YEAR V, ISSUE 4, December 2017
ISSN 2343-7995 (online)

Editorial Office: Hyperion University, Faculty of Economic Sciences,
Calea Calarașilor no. 169, district 3, Bucharest, 030615
http://www.hej.hyperion.ro hej@hyperion.ro

CONTENTS

ANALYSIS OF THE LEVEL ACHIEVED BY VARIOUS SPECIFIC RAIL TRANSPORTATION INDICATORS BY IMPLEMENTING ITT

Gheorghe-Stelian BĂLAN, PhD
S.C. Alstom S.A. - Bucharest
sbalan_ro @yahoo.com

Mariana BĂLAN, PhD
Institute for Economic Forecasting-NIER, Romanian Academy
dr.mariana.balan@gmail.com

Abstract: *Rail transportation is one of the transportation ways that continues to remain of high interest due to some certain advantages: it is the least polluting and most environmentally friendly ways of transport. These are but two of the reasons why for the last years based on the strategies adopted by various international bodies the attempt is made to develop and implement some programmes for reinvigorating rail transportation and attracting increased traffic for this type of transportation.*

An important role in developing transports by and large and rail transportation in particular is played by technological innovation. This constitutes and will continue to be an important source of contributions for solving transportation issues. The rail traffic management systems might optimise the use of the network and improve transportation safety.

"Intelligent transportation systems" presuppose the use of Information and Telecommunications Technology (ITT) in the field of transports. Such applications are developed for various means of transport, but also for favouring their interaction (including intermodal platforms).

Aligning the Romanian rail transportation to the European one meant also the implementation of the ERTMS/ETCS system in Romania. Implementing ITT in rail transports might improve significantly both the activity and services provided by this activity sector. Next to interoperability, ERTMS means also increasing the capacity of the infrastructure, increasing speed and diminishing production and maintenance costs, improving safety but also reconfiguring skills and expertise of the service personnel.

The present paper intends to analyse the impact of implementing the new technologies from ITT in rail transportation on some specific indicators for this sector of activity in view of identifying some viable solutions for increasing its efficiency in relation to other transportation systems, but also for counteracting the social effects generated by these technologies.

Key words: rail transport, ITT, productivity performance, socio-economic implications; ERTMS/ETCS;

JEL Classification: J62, L63, L91, L96, R40

Introduction

In a broad (economic and social) understanding, the information and telecommunications technology (ITT) entered societies and economies in a way no one could have anticipated only a short time ago. In particular, transportation systems underwent and will undergo substantial changes due to market openness and innovation in the ITT field. The competitiveness of economies in general and, implicitly, of the rail transportation depends on the capacity of the respective entities (economies and companies) to adjust to innovation and new market requirements.

Implementing in rail transportation "intelligent transport systems" has as effects: the changes of marketing policy by promoting the social effects/benefits for customers (positive externalities); improving the transparency of processes and information management by which are facilitated the processes of planning and decision-making; creating opportunities for externalising specific economic processes; diminishing exploitation and maintenance costs for the rail infrastructure and the used superior rolling material; increasing the transportation capacity by increasing the tonnage of the freight trains as result of using locomotives with superior traction and intelligent waggons, and by increasing the number of trains for the same towing section by making use of traffic management systems for the entire territory of the member countries; diminishing the time of trans-border operations by using modern multi-power locomotives that might operate on various systems of electric traction and by using the single signalling system ERTMS/ETCS which eliminates the need of changing locomotives on crossing from one country to another; increasing the number of transported passengers on the railway by implementing audio-visual and internet apps.

The transportation system is very important for achieving the objectives of sustainable development in the context of the Information Society.

The ITT solutions applied by the Romanian rail transportation are still fragile but aligned to the EU standards of interoperability (TAF-TSI).

In Romania the ERTMS/ETCS system is implemented on less than 500 km of rail and follows to be implemented first on the Pan-European corridors crossing the country and thereafter for the rails making the connection between the corridors IV and IX, as well as on the TEN network on the national territory. Because of lacking funds from the state budget and poor absorption of European funds for the Romanian rail system, new locomotives cannot be purchased from the traditional manufacturers of rolling material, the only option being to modernise the locomotives with control and command systems that allow for diminishing electric power consumption, facilitate train driving and lower maintenance operations and costs. The cost of the modernization is by about 50% less than the price of a new locomotive.

In Romania, the implementation of the ERTMS system is at the beginning; implementing in pilot regime the ETCS Level 2 system on the 5100kW electric locomotive with the number 0538 allows, in correlation with the modernisation of the infrastructure, to achieve speeds of 160km/h. After 9 years as of making this locomotive operational, it continues to be the only one in Romania equipped with the ERTMS system and is used for testing infrastructure equipment and mechanics' training.

The lack of strategy for reinvigorating rail transportation in Romania represents one of the main reasons for the high delays recorded in implementing the ERTMS/ETCS system, as to this is added also the poor capacity of the management and implementation bodies.

Applying the ERTMS/ETCS system is made non-rationally regarding the infrastructure, on the same line being allotted successive rail sections of maximum 60 km to several foreign companies (which hinders uniformity of the rail equipment), and regarding rolling material no concrete actions were initiated. In this way, Romania will benefit of an infrastructure endowed according to European Union requirements but on which – for the near future – will not operate Romanian trains equipped with ERTMS.

The data regarding the level of implementation for ERTMS in EU were available for the year 2015. The gaps between the data sets are determined by the interval between the time of ETCS implementation and the one of visible effects emergence with regard to productivity; as result, the data used for evaluating the impact of implementing ERTMS on rail transportation productivity complies with the definition of cross-section series, and the differing reference timeframes of the data have rational support.

The estimates realised by the cross-section method have led to positive correlations between the variables of the automation degree of some subsectors of the rail transport (interoperability, speed and high transportation capacity, safety, modernising signalling and rolling material) and the level of increasing productivity.

1. Estimates of ITT implementation impact on the productivity of rail transportation

In the specialised economic literature, ITT implementation is regarded as key-factor in increasing productivity. Up to date, despite all visible progresses recorded by the rail industry and in the activity of rail operators, fewer efforts were made for quantifying the ITT contribution to the productivity of rail transports.

Methodology and used data

In 2000, the Inland Transport Committee of the United Nations Economic Commission for Europe (UNECE) defined a common framework for measuring the productivity of the rail transportation. This definition resulted from a double necessity: on one hand a system for evaluating national rail systems was necessary and, on the other hand, due to the strong interlinking of European countries this evaluation system needed to be unitary for allowing the comparison of national performances. Thus, a series of indicators were defined that would reflect best the productivity level of the rail system and that are presented in the table hereunder:

Table 1 *Indicators for expressing the productivity of the rail system*

Indicators	**Expression forms**
Labour productivity	a. employees/km of network b. Net tons-km/employee c. Passengers-km/employee
Freight transportation productivity	a. Gross (or net) tons-km/km of network b. Gross (or net) tons-km /employee
Passengers transportation productivity	a. Passengers-km/ km of network b. Passengers-km/ km employee
Traffic productivity	a. Tons net-km/km of network b. Passengers-km/km of network
Locomotives productivity	a. Tons gross-km/locomotive
Waggons productivity	a. Tons net-km/waggon
Rail productivity	a. Passenger trains-km/km of network b. Freight trains-km/km of network

Source: *The Committee for Internal Transports of the United Nations Economic Commission for Europe* (UNECE), http://www.unece.org

The data contained in the report of the United Nations Economic Commission for Europe (UNECE or ECE)[1] regarding rail transportation productivity, and statistics of the International Union of Railways (UIC)[2] were used for the proposed analysis.

The data regarding the level of implementing ERTMS in Europe are taken over from the European Commission[3] and from Eurostat statistics. For a better comparison between countries, the data were normalised with the length of the railway network corresponding to each country.

In the framework of the analysis were used also data regarding the ETCS-Net network defined according to the Decision of the Commission (2006/679/EC) from 28 March 2006 regarding the interoperability technical specification within the control-command and signalling subsystem for the conventional Trans-European Railway System[4]. The length of the rails endowed with operational ETCS, either contracted or planned, is as well a good indicator of the level of implementing ITT in rail transports. The source of these data is the ERTMS Atlas[5]. In this case as well, for better comparison, the length of the ETCS routes was normalised with the dimension of the national railway networks.

The poor availability of data determined the cross-sectional type data input of the analysis. These are sets of one-dimensional data corresponding to some subjects (which can be indicators, economic entities, sectors of activity, regions, countries, etc.) at a given time[6]. In the case taken into account, the data refer to the productivity of the rail transportation in member-countries of the European Union. The data used comply with the following: definition of cross-sectional series, and the various moments of collecting the data have a theoretic background.

The analysis of the cross-sectional data differs from the one of chronological data which approaches the evolution of an economic process or phenomenon in time, and the one of panel data studying the evolution in time of several indicators. The object of the cross-sectional analysis is, actually, highlighting the difference between the subjects, in our case the comparison regarding the productivity differences of the rail transportation in the member-countries in correlation with the level of implementing ERTMS/ETCS. By this approach is attempted to identify the influences of implementing the new control system of the railway traffic on the efficiency of the rail transportation.

By means of unifactorial regression is analysed the simplest relationship between the two variables, respectively the linear relation. According to it, the values of the elements of one variable may be estimated by multiplying them with a fixed coefficient of the elements of the other variable and by adding a constant: $y_i = a \cdot x_i + b$. If a linear relationship exists between the level of ERTMS implementation and the productivity of the rail system, this would prove that a higher level of implementing ERTMS coincides with a higher efficiency of railway transportation.

In this context, was realised as first state a descriptive analysis of the Romanian railway transportation within the Union from the perspective of the productivity indicators. The second part is

---

[1] The United Nations Economic Commission for Europe, Inland Transport Committee, Working Party on Rail Transport, *Productivity in Rail Transport* (ECE/TRANS/SC.2/2012/5 and (ECE/TRANS/SC.2/2014/6): www.unece.org

[2] *Railway Statistics,*2014-2016 Synopsis, International Union of Railways, www.uic.org

[3] European Commission, Staff Working Document of the Commission of the state of play of the implementation of the ERTMS Deployment Plan, SWD(2014) 48 final, Brussels, 14.2.2014, and Commission Implementation Regulation (EU) 2017/6 of 5 January 2017, on the *European Rail Traffic Management System European deployment plan* http://ec.europa.eu/ transport

[4] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:284:0001:0176:EN:PDF

[5] *ATLAS of ERTMS Worldwide Implementation*, International Union of Railways (UIC), http://www.uic.org/html/ertms-conference2007/conferences/2007/docs/Atlas-ERTMS.pdf

[6] Data might be collected for several moments in time however without giving importance to the time characteristic.

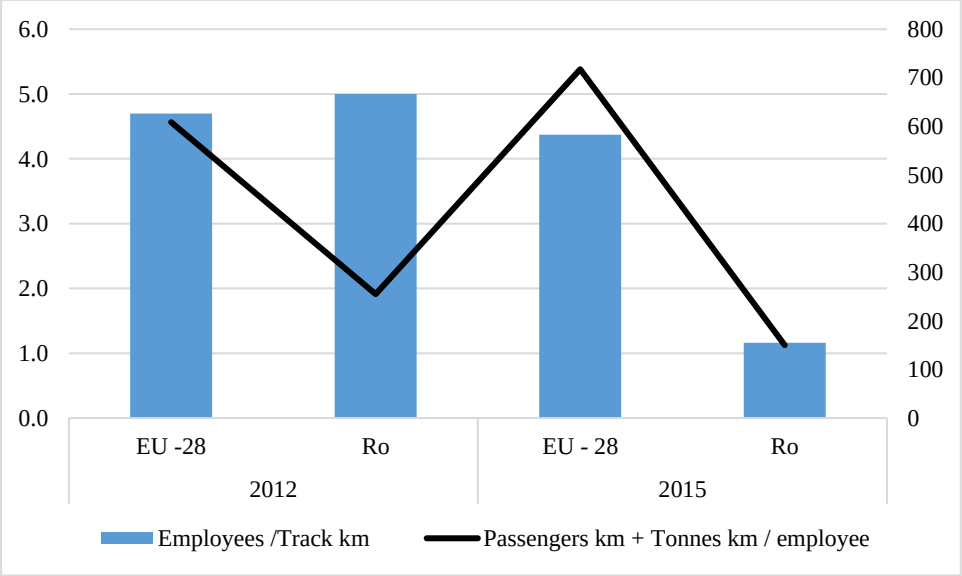
focused on studying the relationship between the level of ERTMS/ETCS implementation and the productivity of the railway systems by means of unifactorial linear regressions.

The descriptive analysis of the Romanian railway system was made by means of the data supplied by the productivity report drafted by UNECE and by the UIC statistics. Because the comparison with each of the other countries mentioned in the report might prove as inopportune, an option was made for comparing the situation of Romania with various aggregates of the European countries.

In the Romanian railway system, the number of employees in relation to the length of the railway is higher than the European average EU-28 for 2012, but much lower in 2015 (Figure 1).

The Romanian railway system had a high number of employees but that decreased significantly on a yearly basis, these being a factor that led to considerably less activity of the system than the European Union average. By relating the dimension of the passengers' transport (measured in persons/km.), and freight transport (measured in tons/km) to the number of employees results a performance of 255 units in the case of Romania, as compared with the EU-28 average of 609 in the year 2012, and 150 units for Romania and 717 units for the EU-28 in 2015.

Figure 1 *Labour productivity in railway transportation in Romania and EU-28*



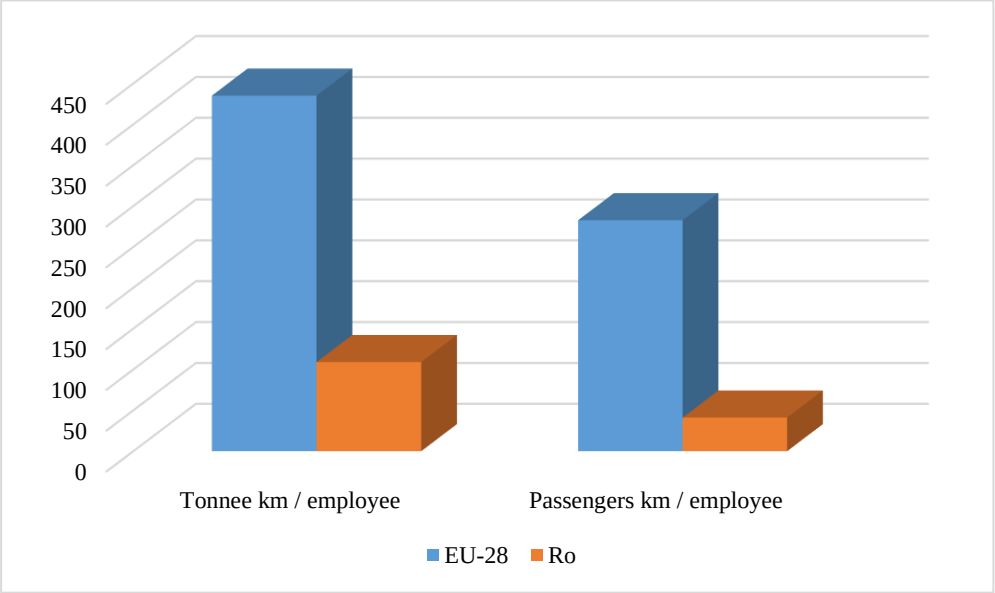
Data source: *Study on the Cost and Contribution of the Rail Sector*, Final Report September 2015, European Commission, www.eu.europe.eu/transport and *Railway Statistics*, 2014-2016 Synopsis, International Union of Railways, www.uic.org, Authors' own processing.

The analysis of this indicator on the two branches highlights the fact that the low productivity of Romanian employees is triggered, first, by the low activity of passengers' transportation (Figure 2). For a Romanian employee there are 41 passengers/km. while the European average is by over six times higher (282 persons/km./employee).

The results show that a Romanian's employee productivity is at half against the European average and against the EU-11 average regarding freight transportation. It is interesting that in the countries of the former communist bloc, freight transports on the railway is still at a very high level, comparable with the European average.

The degree of using railways in Romania is much lower as compared with the other European countries. Weighted with the dimension of the railway networks, the activity of freight and passengers' transport in Romania is of 1309 units, while the European average is of 2886.

Figure 2 *Productivity of railway transportation related to the number of employees within the sector in Romania and EU-28 in 2015*



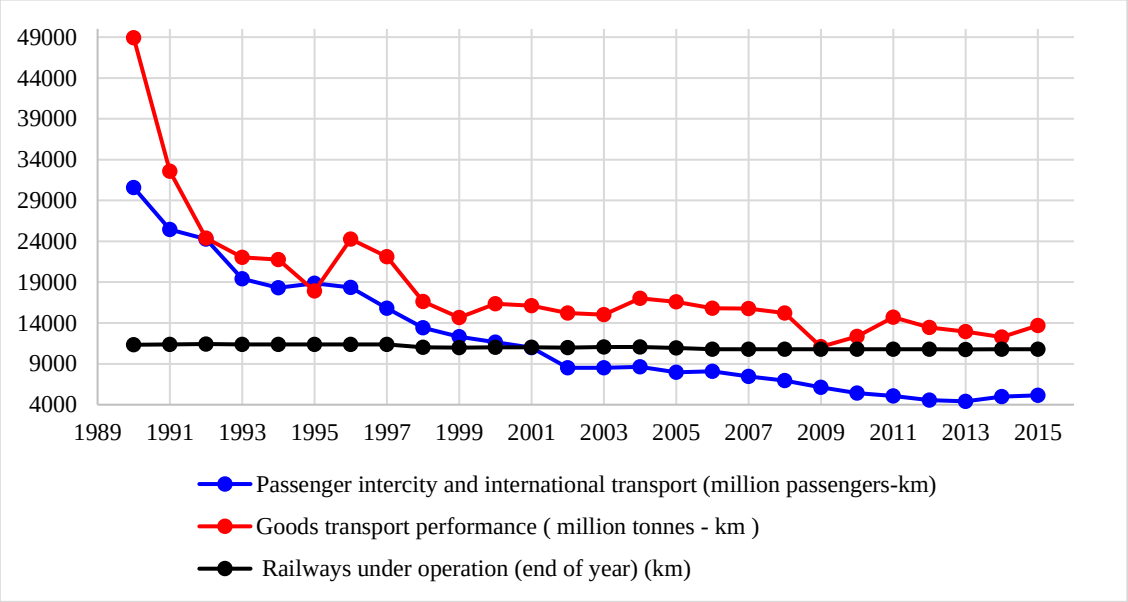
Data source: *Railway Statistics*, 2014-2016 Synopsis, International Union of Railways, www.uic.org, Authors' own calculations

The passengers' transportation in Romania's productivity is similar to the one of the former communist countries; however this is six times less productive than the average of the EU-28 countries. These outcomes denote a weak use of passengers' transportation in the entire former communist area, including here Romania. Nevertheless, the other former communist countries have developed freight transportation more than Romania.

Romania measured about 11348 kilometres. Comparatively, freight was transported by 9.4 times more (48912 mill. tons/km) on the railway in the year 1990 than in 2015 (13673 mill. tons/km.). The analysis of the diagrams in Figure 3 highlights the collapse of the CFR (Romanian Railways Company) together with the economic downfall of the period. In three years, 1990-1992 the volume of transported freight decreased from 48912 mill. tons/km to 24387 mill. tons/km. The activity of CFR-Freight decreased even more in the following years, reaching its minimum in 2009: 11088 mill. tons/km.

The situation is similar with respect to passengers' transport. In 1989, CFR transported 3545 mill. passengers/km. which is the maximum for the period under consideration. After 1990, the number of passengers decreased constantly, reaching only 5149 mill. passengers/km., respectively 7 times less than in the year 1989. Thus, the low productivity of the railway transportation system in Romania can be explained: an extended infrastructure requires numerous human resources for a poor, much under its actual potential, activity.

Figure 3. *Evolution of railway transportation from Romania, in the period 1990-2015*



Source: Romania's Statistical Yearbook 2016, National Institute of Statistics

Regarding the activity of trains considerable gaps exist between Romania and the EU-28: the EU-28 performance is almost double. As expected, the productivity of locomotives and waggons is also much under the European average.

2. Analysis of the ERTMS/ETCS impact on the performance of the public railway transportation system

The econometric analysis attempts to answer the question whether the implementation of the ERTMS/ETCS system in Europe led to increased productivity of the railway transportation. In economic terms, increasing efficiency means better use of infrastructure, rolling material and of the personnel employed in railway transportation.

An in-depth analysis of this phenomenon would require European level series of data that would contain several years, respectively panel-type data. These would show the evolution over time for each country. However, the poor availability of data restricts the econometric analysis to one of the cross-sectional type.

The statistical instruments employed most often to analyse the links existing between two variables are correlation and regression. The correlation model shows how strong is the link, how much the two variables tend to change together, and the regression model is used in explaining and forecasting the values of one variable based on the values of another variable.

The Pearson correlation coefficient not only shows the direction of the link but also its intensity. The value of the correlation index is situated between -1 and 1, where 1 indicates a perfect direct linear correlation, while -1 denotes a perfect reverse link. The zero value shows the missing link between the two studied variables.

The impact of implementing ERTMS/ETCS on railway transportation productivity

In order to study the impact of implementing ERTMS on some component elements of railway transportation productivity in EU was used the cross-section method. The obtained results are synthetically presented in Table 1 from the Annex.

The analysis of these results highlight that implementing ERTMS leads to railway transportation increased efficiency by a 1 pp increase of ERTMS implementation, the number of employees will diminish by about 5%, the volume of freight/km per kilometres of network grows, and the productivity of passengers' transportation is higher by increases in the numbers of passengers. The estimates were realised based on the hypothesis of a confidence threshold α, of 10%, which means that the coefficients of the exogenous variable might be considered as significantly different from zero under the conditions where $\alpha \leq 0{,}1$.

From the viewpoint of the confidence threshold, in analysing the results from Table 1 of the Annex as significant might be regarded the coefficients of the regressions corresponding to freight and passengers' transportation (the probability of these estimators being around the value 1).

In this context, it might be noticed that the level of implementing ERTMS has a favourable influence on the productivity of passengers' transportation. The regression equation used has the form:

$$w_L = a \cdot ERTMS + b + u \quad (1).$$

Where: w_L represents the productivity of passengers' transportation;

ERTMS represents the level of implementing ERTMS;

a is the regression coefficient designating the extent in which passengers' transportation productivity develops depending on *ERTMS*;

b represents the free term, and u is the error term.

The estimated regression coefficients both in case of the relation to the number of employees within the railway system, and to the dimensions of the railway network are significant, the confidence thresholds being of 5% in the first case, and 10% for the second one. The estimated values of the parameters are:

$$w_{L1} = 3979{,}67 \cdot ERTMS + 255{,}22 \quad (2)$$

$$w_{L2} = 18848{,}3 \cdot ERTMS + 1012{,}0 \quad (3)$$

where $w_{L1} = (passengers - km)/employees$, and $w_{L2} = (passengers - km)/(km - network)$

The correlation coefficient is by 0.36 in the case of the relation to employees and by 0.41 in the case of the relation to the dimension of the railway network.

Regarding the determination relationship, its values show that the percentage resulting from the variation of the endogenous variable due to the implementation of ERTMS is very low (e.g. 13.3%, from the productivity growth of passengers' transportation is due to implementing this system).

The analysis of the impact of implementing ERTMS on the level reached by various indicators specific to railway transportation (interoperability, high speed and high transportation capacity, safety, the replacement degree of signalling and of the rolling material) by the cross-section method based on the same hypotheses about the significance threshold of the estimators highlighted positive correlations but weak as intensity, varying between 0.2 and 0.31 (Table 2 of the Annex).

The determination relationship has low values confirming that on optimizing these indicators contribute, next to ERTMS, other factors as well.

The relationship between the ERTMS implementation level and trains' speed and transportation capacity increase is the most significant from those determined. The regression equation used is:

$$vicap = a \cdot ERTMS + b + u \quad (4)$$

Where: $vicap$ represents the speed and capacity increase of railway transportation,

a is the regression coefficient which designates the extent to which speed and transportation capacity vary depending on the level of ERTMS implementation,

b represents the free term,

u is the error term.

The estimated value of the parameters is: $vicap = 33.26 \cdot ERTMA + 5.844$

Implementing ITT in certain subsectors of railway transportation leads to its increased productivity. The study of the impact of implementing ITT for interoperability in each of the compartments for the productivity of the railway transportation was realised by the cross-section method. The equations have the form:

$$y_i = a_i \cdot x_i + b_i + u_i \quad (5)$$

where: y_i is the endogenous variable corresponding to a country i;

x_i is the exogenous variable corresponding to the country i;

a represents the regression coefficient designating the extent to which y developes depending on x in the country i;

b_i is the free term;

u_i is the error term.

The results of the regression equations are presented in Tables 3 and 4 of the Annex.

The link between speed and the transportation capacity and the level of labour productivity in railway transportation was realised with the help of a regression equation of the form:

$$w_a = a \cdot vicap + b + u \quad (6)$$

where: w_a represents the passengers' and freight transportation productivity;

$vicap$ - the speed and capacity increase of railway transportation as result of implementing ERTMS.

The significance threshold by 10% and a value of R^2 by 32% confirm the existence of a close link between the two variables (Table 3 from the Annex). The estimated value of the parameters is: $w_a = 62{,}33 \cdot vicap + 158{,}55$

The correlation coefficient between labour productivity in the railway transportation system and the speed and capacity of the railway transportation network is 0.6. In accordance with the results of the regression, the correlation shows a direct link between the two variables.

Implementing ITT for rolling material has implications on rendering efficient railway transportation. By regressing the productivity of locomotives depending on the replacement level of the rolling material a positive link is noticed, which is statistically significant for a threshold of 5% (Table 4 from the Annex). This result confirms that the new locomotives and waggons have better performance than the old ones, as they have the capacity to transport higher quantities in shorter time.

The regressionequation has the form:

$$w_i = a \cdot mat.rul_i + b_i + u_i \quad (7)$$

where: w_{loc} designates the productivity of locomotives expressed in tons/km per locomotive

$roll.mat.$ represents the replacement of rolling material.

The estimated value of the parameters is: $w = 13941 \cdot roll.mat - 24356$

The Pearson correlation coefficient is 0.52 confirming the existence of a positive direct link between the replacement of the rolling material (new or modernised) and the productivity of locomotives.

Even if in Romania modernisations were made for the rolling material, still the productivity of the locomotives is between the lowest ones. This situation might be explained by the presence of many locomotives in the rolling material park of CFR. However, a good part of these locomotives are depreciated from the technological point of view and are no longer in use or are inoperable due to the lack of spare parts.

Conclusions

As result of implementing ITT in railway transportation all activities are influenced within the sector. The increase in the productivity of the railway transportation and implementing ITT in the sector are two strongly correlated variables.

At the level of the European Union or of the empowered bodies in the field of railway transportations are made available databases referring to the implementation level of these systems for the whole sector and on sub-fields. The poor information which are retrievable in the UN, European Union, or the European Commission and UIC databanks or by inquiry to other bodies in the field are incomplete and most often than not contain data older than 5 to 6 years. At the same time, most of the supplied data are the result of surveys realised at the level of railway companies in Europe. This makes the existing data to be available only at the level of a single year.

In this context, the analysis regarding the ITT impact on railway transportation productivity was made based on cross-sectional-type data for a series of European countries. The data regarding the level of implementing ERTMS dates from 2008 and the variable on which it impacts, respectively the productivity of railway transportation is at the level of the year 2015. This time gap is natural due to the fact that the effects of implementing ETCS on productivity may be quantified after a couple of years after implementing the system.

By detailed analysis was highlighted:

- the implementation of ERTMS is one of the factors leading to increases of productivity for railway transportation; as result of this fact, the determination coefficient has low values, varying between 1-29%;

- the coefficients of the regression equations reflect the logical link between the considered variables. Thus, by implementing ERTMS the numbers of employed personnel is diminished by about 5%; the freight and passengers' transportation productivity is improved (by 28835.1 tons/railway network, respectively by 18848.3 passengers/km/ network);

- the study of the impact of implementing ERTMS on some specific indicators of railway transportation highlighted the existence of positive results. A significance threshold of 10% and a R^2 value by 0.32 confirm the existence of a close link between the ERTMS variables and the high speed and capacity of transportation;

- the analysis of the impact of implementing ETCS on productivity led to obtaining the right links between the two variables;

- the econometric estimates led to obtaining some coefficients that are not significant statistically which means that the number of observations was very low.

The automation degree of some subsectors from railway transportation (interoperability, speed and transportation capacity, safety, signalling and rolling material modernisation) influence the level of productivity increase for this sector. The estimates realised by the cross-section method led to positive correlations between the considered variables. The low number of observations determined the loss of statistical significance for some regression coefficients and thus to the low values of the determination relationship.

Because the econometric estimates were based on few observations, relevant conclusions cannot be drawn regarding the impact of ITT on productivity increase.

Moreover, the evaluation of the socio-economic impact of implementing ITT in railway transportation should be realised in a first stage at firm and subsector level and only thereafter at aggregate level.

Table no. 1 *ERTMS impact on railway transportation productivity*

y	**Employees/ km of rail**	**Passengers km+T. net km/ employee**	**Tons km/ km of network**	**Tons km/ employee**	**Passengers km/ km of network**	**Passengers km/ employee**
x	*ERTMS Implementation*					
a	- 4,8947	2082,5	28835,1	6059,0	18848,3	3976,67
b	5,490	760,8	2308,6	505,6	1012,0	255,22
Prob. (a)	0,544	0,679	0,1139	0,23850	0,0413	0,077
R^2	0,02656	0,03559	0,06613	0,01899	*0,1326*	*0,09162*

continuation

y	**Tons net km + passengers km/ km of network**	**Tone brut km/ locomotive**	**Tons net km/ waggon**	**Passenger train km + freight train km/ km of network**	**Tons net km + passengers km/ km of network**
x	*ERTMS implementation*				
a	9992	386223	7570,5	66,278	9992
b	3321	55666	1066,7	13,744	3321
Prob. (a)	0,586	0,3672	0,5742	0,397	0,586
R^2	0,02979	0,00645	0,029	0,01075	0,02979

Source: Authors' own processing

Table no. 2 *ERTMS impact on some railway transportation indicators*

y	**Interoperability**	**High speed/ capacity**	**Safety**	**Signalling replacement**	**Rolling material replacement**
x	*Implementarea ERTMS*				
a	11,18143	33,26674	28,22674	14,92884	17,98836
b	7,594899	5,844793	6,538336	5,478053	4,428013
Prob. (a)	0,5523	0,1594	0,2548	0,4077	0,2701
R^2	0,038570	*0,064831*	0,022713	0,016566	0,017616
Pearson correlation coefficients	0,20	0,34	0,26	0,22	0,31

Source: Authors' processing

Table no 3 *Impact of speed and transportation capacity increase on railway transportation productivity*

y	**Employees/ km of rail**	**Passengers km+T. net km/ employee**	**Tons km/ km of network**	**Tons km/ employee**	**Passengers km/ km of network**
x	*High speed and transportation capacity*				
a	-0,3183	62,33	78,31	14,70	156,5
b	8,1398	158,55	764,09	100,94	642,7
Prob.(a)	0,2889	0,0108	0,504	0,318	0,189
R^2	0,01287	*0,3179*	0,034	0,0042	0,0527
Pearson correlation coefficients	0,26	0,60	0,17	0,26	0,33

continuation

y	**Passengers km/ employee**	**Tons net km + passengers km/ km of network**	**Tons gross km/ locomotive**	**Tons net km/ waggon**	**Passenger train km + freight train km/ km of network**
x	*High speed and transportation capacity*				
a	47,65	234,8	5721	-240,5	0,2111
b	57,44	1406,7	7362	2464,5	19,3413
Prob.(a)	0,0954	0,130	0,192	0,1887	0,825
R^2	*0,1192*	0,0888	0,051	0,053	0,0631
Pearson correlation coefficients	0,42	0,38	0,33	0,33	0,05

Source: Authors' processing

Table no.4 *Impact of rolling material replacement on railway transportation productivity*

y	**Employees/ km of rail**	**Passengers km+T. net km/ employee**	**Tons km/ km of network**	**Tons km/ employee**	**Passengers km/ km of network**
x	*Rolling material replacement*				
a	-0,1886	50,27	86,57	21,67	23,28
b	7,0386	309,11	838,93	88,51	1750
Prob.(a)	0,6942	0,229	0,640	0,350	0,9039
R^2	0,055	0,0345	0,05	0,0043	0,065
Pearson correlation coefficients	0,10	0,31	0,12	0,24	0,03

continuation

y	**Passengers km/ employee**	**Tons net km + passengers km/ km of network**	**Tons gross km/ locomotive**	**Tons net km/ waggon**	**Passenger train km + freight train km/ km of network**
x	*Rolling material replacement*				
a	28,58	63,31	13941	111,5	0,483
b	220,65	2589	-24356	1481,2	20,358
Prob.(a)	0,541	0,8027	0,0342	0,706	0,7486

R^2	0,0396	0,062	*0,2168*	0,056	0,059
Pearson correlation coefficients	0,16	0,07	*0,52*	0,10	0,08

Source: Authors' own processing

References

[1] *A Vision For Railways in 2050*, The International Transport Forum 2010, "TRANSPORT AND INNOVATION. Unleashing the Potential", ed. Thompson L., Forum Paper, no 4, OCDE, www.internationaltransportforum.org

[2] Alexa C., (2001), *Transporturi internaţionale*, Editura ASE;

[3] *Annual Report 2012*, Community of European Railway and Infrastructure Companies (CER). www.cer.be

[4] *ATLAS of ERTMS Worldwide Implementation*, International Union of Railways (UIC), http://www.uic.org

[5] Bahuguna, R., K., (2010), *ICT for Efficient Railway Infrastructure*, www.irse.org;

[6] *Banca Mondială,* World Development Indicators, *www.* data.worldbank.org/indicator

[7] Białas-Motyl A., (2010), *Railway passenger transport decreased slightly at the beginning of 2009*, Eurostat, Statistics in Focus 15/2010, http:// epp.eurostat.ec.europa.eu;

[8] Buciuman I., (2007), „*Sisteme de management al traficului feroviar*", Agenţia Feroviară Europeană, www. club-feroviar.ro

[9] Callaghan P., (2006), *A review of the use of information and communication technology to achieve transport policy goals*, Forum for the Future, www.forumforthefuture.org;

[10] Caraiani Gh., (2001), *Tratat de transporturi*, Vol.I şi Vol II, Editura Lex;

[11] Comisia Europeană, Document de lucru al Comisiei privind *stadiul punerii în aplicare al Planului de implementare al ERTMS*, SWD(2014) 48 final, Brussels, 14.2.2014, http://ec.europa.eu

[12] Comisia Europeană, Document de lucru al Comisiei privind *stadiul punerii în aplicare al Planului de implementare al ERTMS*, SWD(2014) 48 final, Brussels, 14.2.2014, and Commission Implementing Regulation (EU) 2017/6 of 5 January 2017, on the *European Rail Traffic Management System European deployment plan* http://ec.europa.eu/ transport

[13] *Comitetul pentru Transport Intern al Comisiei Economice a Organizaţiei Naţiunilor Unite pentru Europa* (UNECE), http://www.unece.org;

[14] *Digital Agenda for Europe Annual Progress Report 2011*, 22 December 2011, www.eu.europa.eu

[15] *Faza de modernizare a infrastructurii sistemului IRIS*, S&T România**,** www.snt.ro

[16] *Global Transport Scenarios 2050*, World Energy Council, 2011, www.worldenergy.org

[17] Nemţanu F. C., (2003), *Arhitectura Sistemelor Inteligente de Transport – ITS*, revista Transurb, nr.1/2003

[18] *Plan Strategic în Domeniul Transporturilor, www.mt.ro*

[19] Porter D., (2002), *Implementing ETMS in UK: Human Factors implications for Trein Drivers*, http://www.intlrailsafety.com

[20] *Railway Statistics*,2014-2016 Synopsis, International Union of Railways, www.uic.org

[21] *Raport de activitate CNCF"CFR"-SA, 2012-2016*, www. cfr.ro

[22] *Societatea Naţională de Transport Feroviar*, www.relaţii internaţionale CFR.htm;

[23] Stancu M., (2005), *Integrarea europeana a transportului feroviar din România*, www.agir.ro

[24] *Statistici Eurostat*, www.eu.europa.eu

[25] *Statistici UIC*, www.uic.org

[26] *Strategic Rail Research Agenda 2020* (SRRA), www,ec.europa.eu/.../rail/research

[27] *Synopsis with 2014-2016 data*, International Union of Railways http://uic.org

[28] The United Nations Economic Commission for Europe, Inland Transport Committee, Working Party on Rail Transport, *Productivity in Rail Transport* (ECE/TRANS/SC.2/2012/5 and (ECE/TRANS/SC.2/2014/6): www.unece.org

[29] *White Paper*, "Foaie de parcurs pentru un spaţiu european unic al transporturilor – Către un sistem de transport competitiv şi eficient din punctul de vedere al resurselor, COM(2011) 144 final, http://eur-lex.europa.eu

[30] Whiteing T., Menaz B., (2009), *Rail Transport Thematic Research Summary*, European Commission DG Energy and Transport, Transport Research Knowledge Centre, www. transport-research.info;

[31] Zincă I., (2003), *Reţeaua de telecomunicaţii CFR*, www.cablu.org

THE CONTENT AND QUALITY OF THE INFORMATION CONTAINED IN THE FINANCIAL STATEMENTS

Andrei – Mihai Cristea, PhD Student
University „1 Decembrie 1918" Alba Iulia
cristeaandm@yahoo.com

Abstract: *The financial statements are the basis of the system of financial and economic indicators - through which they collect and consolidate information aimed at financing and distribution of resources available to an entity. In this context, the financial statements it is the responsibility of the primary role of financial information and communication. Also, they shall be responsible for monitoring the objectives set out in the employment and distribution of resources feature, the pursuit of the deviations from the indicators plan according to the system of budgets, but also identify measures should be implemented in order to improve the activity of the entity. Last but not least, on the basis of the financial information shall draw up estimates of future activities, meant to substantiate the decision-making process at management level in the direction of the adoption of measures to render the activity.*

Key words: *managerial accounting, cost, expense, accounting information*

JEL classification: M41, M48

1. Introduction

The basic component of accounting documents, financial statements presents a structure whose content is rolling character, in the sense that it has improved continuously, including for certain entities and an instrument of the cash flow, or a statement of changes in equity.

However, we believe that we characterize this component as optimal. Also, we believe that the information contained in the financial statements need to be addressed in terms of their usefulness qualitative rather than quantitative.

On the other hand, it should be noted that the financial statements appear as a result of the interaction between the following categories of users:

1. the economic entities in the quality of subjects, through the activities that the proceeds provide subject to inform them of the financial management;
2. users of accounting information;
3. accountants by profession exercised nature.

Analyzing all three categories it is clear that those who are responsible to continuously improve the content of financial statements and to ensure the credibility of accounting information are accountants..

2. The necessity of accounting information

Although entities are often tempted to publish only certain types of information needs of users of accounting information are conditioning the decision-making process in this matter. This is a necessary approach because only on the basis of full information may be determined indicators of profitability, liquidity and solvency, needed for the various assessments of the primary users.

The values given in the profit and loss account are those which serve as basis for determining the profitability of an entity, for example, but not all of the information contained herein shall meet the needs of the users. We must take account of the fact that they can work and the estimated values, even in the context of the events that took place. We refer mainly to depreciation and provisions, which may influence the accounting profit of the entity. As a result, a profit, as he entered appears in the profit and loss account, does not provide users a signal necessarily favorable. There may be circumstances in which an increase in the profit margin to be the result of an accounting options or the use of new accounting methods. In order to obtain additional information in connection with this aspect, users can analyze the notes on the accounts. In our opinion, however, they do not provide any useful information to users, not possible to analyze the different accounting of alternative processes and the results of their implementation.

We believe that to carry out an analysis of the relevant to the profitability of an entity is required information to enable the comparison with similar entities, not only time comparison for the same entity. Comparison of random elements can be but irrelevant as long as the entities may opt for the use of different accounting policies. In such a context, the accounting information from different entities does not offer the possibility of a comparison. As examples, we can analyze the Depreciation charges on recorded by different entities. Their size is dependent on a set of variables, remember: the life, the residual value, the method of depreciation, etc. A comparison of such expenditure should be irrelevant and would have no meaning.

Liquidity and solvency of an entity together with profitability are other indicators of particular interest to users concerned. Because the liquidity shall be calculated on the basis of current assets and liabilities, a superficial analysis of financial statements might seem sufficient to form an opinion as to the ratio of the assets and liabilities, liquidity, respectively. However, since the concepts of assets and liabilities are concerned, the current interpretative liquidity becomes in turn a concept which leaves room for interpretations. Say this is motivated by the fact that the attribute "current" are characterized those items sheet which will be carried out over a period of 12 months from the date of the balance sheet. In this context, only the use of the system of rates can provide accurate analysis of the degree of liquidity.

Another contentious issue is the fact that the balance sheet and the profit and loss account may not highlight the entity's capacity to generate profit, namely financial risk which might affect its activity. In order to clarify this occurs the cash flow statement, which shows a summary calculation that highlights both cash flows and their training method.

3. The limits of accounting information

The limits of accounting information contained in the financial statements can be summarised as follows::

„-synthetic documents contain information that concerns the past, and the decisions they take information users are considering future;

- assessment base quantities in the financial statements is mostly historical cost;

- some of the information contained in the financial statements are based on estimates of different sizes, which causes them to have a subjective character;

- important user information are not included in the financial statements, as they may not be expressed in money (such as, for example, the information which relate to human capital and its "value");

- Even if the defining feature to attract funds should be transparent, some of the information may not be published by the companies in their financial situations, so that they would generate competitive disadvantages;

- interaction between the tax and accounting generates deformations of the information in the financial statements;

- freedom in applying accounting principles and rules may cause results not intended by accountants and real information"[7].

Despite these limitations, the information presented in the financial statements are at the basis of economic decisions by users. Moreover, to ensure a high level of credibility, they can be improved.

4. Ways to improve the content and quality standards of accounting information

Consider the following effective ways to improve the content and quality standards of financial statement information:

- The inclusion of accounting information supply balances designed to assist users in the adoption of decisions which, as a rule, have in view of the future;

- Disclosure forecast as budgets (aimed at business planning entity) and / or projections (forecasts of future events);

- The normalisation of the provision of information supply balances, which would allow the comparative analysis of the entities;

- Reduce the risks related to the confidentiality of the information, which could generate competitive disadvantages, lack of accuracy and maximum signal lacking credibility;

- professionalization and accountability issuers accounting information in the financial statements;

- preparation absolutely mandatory to all entities of a statement of cash - flow - sized objective indicator, which is not influenced by bias provided accounting result of profit and loss[8];

- preparation of a "social balance", containing information of interest to employees (eg. training courses, experience and seniority labor collective relationships etc.);

- presenting risks to which the entity must meet the risk management strategy adopted situation included as an annex to the financial statements.

Also additional ways to improve the quality of accounting information presented above, we believe that any entity should prepare an overview of its evolution or provide relevant information and detailed activity profile, market share, conducting business with the principles eco - economy, etc., information that may be required different categories of users of accounting information.

[7] Feleagă N. (1996), *Accounting controversy,* Editura Bucuresti, p. 128-133

[8] When preparing the cash flow statement is mandatory for companies applying accounting regulations harmonized with international standards for other types of enterprises was optional, and once the change and republish the Accounting Law (2005) stops this entry.

5. Conclusions

It is mandatory for annual financial statements to comply with legislation, both of the national and the international scrutiny, that international standards were adopted. If the application of such rules is not sufficient to provide a true, accounting treatments that have been applied will be accompanied by explanatory notes, in which will be presented information, relevant and credible, useful and necessary decision-making processes of the users.

It is important to note that the objective of financial statements is dependent and accounting systems adopted usually different from one country to another. The argumentation assertions bring to the fore the accounting system Anglo - Saxon, in which the investor holds the most important position in terms of formulating objectives of financial statements. Unlike this system, accounting continental central objective of financial statements is provide fair, objective that we consider to be very large.

Moreover, depending on the category of the reporting entity or SME, large taxpayers or groups of entities, significant differences in the formulation of the objectives of financial statements.

Collection and use of accounting information in real time is particularly important in the context of risk management. Such targets can be set realistic and consistent, appropriate level of resources available to the entity. We believe that application and enforcement of IFRS may facilitate achieving all entity.

6. Bibliography

[1] Borfoaia A.T., *Evaluation of uncertainty in accounting through provisions, public accounting*.Finance magazine, No.5 / 2009, online article, http://discutii.mfinante.ro/static/10/Mfp/revista_nou/2009/200905_art.pdf

[2] Briciu S. (2006), *Managerial accounting. Theoretical and practical aspects*, Ed. Economica, Bucharest

[3] Briciu S. (coord.) (2010), *Accounting and management control tools to assess the performance of the entity*, Ed. Aeternitas, Alba Iulia

[4] Căruntu C., Lepăduşi M.L. (2011), *International Financial Reporting Standards - overview of adoption and their application within the company*, Annals of "Constantin Brancusi 'of Targu Jiu, Economy Series, No.2 / 2011

[5] Deaconu A. (2009), *Adoption of IAS / IFRS in Europe*, Magazine Accounting, Expertise and Audit Affairs, Ed. CECCAR no. 8 August 2009

[6] Domnişoru S., Brabete V., Drăgan C. (2007), *Implications of the implementation of IFRS on financial communication process*, Magazine Accounting and Auditing Expertise Affairs, Nr. 10/2007

[7] Feleagă N. (1996), *Controversies accounting*, Economic Publishing House, Bucharest, p.128 - 133

MEASURES TO REDUCE TAX EVASION AT EUROPEAN LEVEL

Geraldina Terezia Vajda, PhD Student
"December 1st, 1918" University of Alba Iulia
av.vajda.geraldina@gmail.com

Abstract: *Fraud and tax evasion have a significant cross-border dimension. Member States cannot effectively solve the problem unless they cooperate. Improving administrative cooperation between tax administrations of the Member States is therefore a key objective of the European Commission's strategy in this field / domain.*

Detection of cross-border VAT fraud in the European Union depends to a large extent on information relating to intra-Community transactions. Economic agents are those that provide such information, and Member States will exchange them under agreements concluded since 1993. It is necessary to improve synchronization, the information available, the target, the quality and processing of information, in order to fight effectively against fraud from current business environment.

Keywords: *tax evasion, tax fraud, VAT*

JEL Classification: F38, H26

The main solutions for the reduction of tax evasion at European level

I. Eliminate gaps on taxation of savings income

Adoption of the amendments proposed by the Commission regarding the Savings Taxation Directive[9] will allow the elimination of shortcomings in the directives and therefore will improve the effectiveness of this tool. This will help Member States to better ensure effective taxation of cross-border savings income. It is now the responsibility of the EU Council to adopt this proposal and to give the Commission a mandate for negotiation with a view to the adoption of the corresponding amendments to existing agreements with third countries on taxation of savings income.

II. Draft agreement on cooperation and tax fraud

Similarly, the Commission invites the Council to sign and conclude the draft agreement on tax cooperation and against fraud between the EU and its Member States and Liechtenstein, which they presented to the Council in 2009[10] and to adopt the draft mandate for opening similar negotiations with four other neighboring third countries. This will enable the Commission to negotiate agreements guaranteeing that the same tools to fight fraud and the same high standards of transparency and exchange of information shall be made available to all Member States.

[9] COM(2008) 727 final, 13.11.2008
[10] COM(2009) 644 final from 23.11.2009 and COM(2009) 648 final from 23.11.2009

III. Rapid Reaction Mechanism against VAT fraud

On July 31st, 2012 the Commission presented a proposal for a Rapid Reaction Mechanism against VAT fraud[11]. If adopted, this proposal would allow the Commission to rapidly authorize a Member State to take temporarily derogating measures, to find solutions to cases of sudden and massive fraud with major financial impact.

IV. Optional application of the reverse charge mechanism for VAT

The Commission presented in 2009 a proposal for an optional application of a reverse charge mechanism for VAT for delivery of certain goods and services susceptible to fraud[12]. Only part of this proposal, concerning the certificates of greenhouse gas emissions, was adopted in March 2010[13]. The adoption of other part of the proposal would allow all Member States to apply the reverse charge mechanism under the same conditions in those sectors where it is the most effective tool against fraud "carousel", instead of adopting individual derogations from the VAT Directive, which could have a negative effect on the fight against fraud in other Member States.

V. EU VAT Forum

Both enterprises and tax authorities confirmed that the current VAT system is unmanageable and vulnerable to fraud. In order to improve VAT governance at EU level, the Commission decided to create an EU VAT Forum[14]. Within this platform for dialogue, representatives of large enterprises, small and medium-sized enterprises and tax authorities can exchange views on the subject of concrete cross-border aspects of VAT administration and also can identify and discuss best practices that could help rationalize management of the VAT system, aimed at reducing compliance costs while guaranteeing VAT revenue.

VI. Legislative proposal for combating tax evasion in the intra-Community transactions: reduction of time limits

In accordance with the ECOFIN Council's conclusions of June 5th, 2007, the Commission has already presented in March 2008 a legislative proposal designed to reduce both the reporting deadlines for intra-Community transactions by economic agents and those of the information exchange between tax administrations[15]. The purpose of this proposal is to ensure that the tax authorities of the destination Member States are informed much quicker than today about acquisitions taking place on their territory and have the opportunity to act earlier. The purpose of this proposal is to ensure that the tax authorities of the destination Member States shall be informed more quickly than at present in connection with acquisitions occurring on their territory and thus having the opportunity to act earlier.

VII. Exemption from VAT on imports

Fraudulent use of VAT exemption on imports when it is followed by a provision or an intra-Community transfer has been identified as a weakness of the current rules of the detected VAT fraud

[11] COM(2012) 428 final, 31.7.2012

[12] COM(2009) 511 final, 29.9.2009

[13] Directive 2010/23/EU of March 16th, 2010 amending Directive 2006/112/EC on the common system of value added tax, with regard to optional and temporary application of the reverse charge mechanism to provide certain services susceptible to fraud (JO L 72 of 20.3.2010, p.1).

[14] Commission Decision (2012/C 198/05) from July 3rd, 2012 on the establishment of an EU Forum on VAT.

[15] COM (2008) 147 final, 17.3.2008

systems. Indeed, neither the information to be exchanged by the customs and tax administrations of the importing country are organized properly, nor relevant information is transmitted effectively to the following Member State. Therefore, the Commission will propose harmonized rules at Community level for the application of this exemption.

VIII. Strengthening cooperation between Member States

Periodic reporting of the functioning of administrative cooperation in the VAT field will focus on the new elements introduced with a view to improving administrative cooperation. Wherever certain information is of primary importance for an effective control in another Member State, they must be replaced automatically, this representing a primary goal of the Regulation since 2004. The mentioned report provides the opportunity to review these items and, if necessary, to modify them in order to enhance their effectiveness.

In addition, there were more actions undertaken in the framework of the Fiscalis programme in order to ensure an exchange of best practices and cooperation in the field of control. In the field of audit, the European Commission is working on the development and improvement of the electronic audit tools. At the same time it encourages Member States to use more multilateral controls, with the assistance of a guide designed to assist auditors and coordinators who are using this tool. In addition, project groups have been set up to examine topics concerning the quality of information exchanged between Member States, the exchange of best practices in the field of risk analysis and management (with the help of a manual) and of misuse of the cash registers. There were organized seminars and workshops to enable Member States to exchange experience and knowledge in the field of combating VAT fraud. Administrative cooperation is, indeed, a key element of the current VAT system, which cannot be managed separately by the Member States. The European Commission recognises that such cooperation requires human resources and, therefore, should be drawn up methods and good practices involving the fewest resources.

IX. Guidelines for traceability of financial flows

Taking into account the experience of Member States in this area and the financial intelligence units (FIUs) that already exist, the Commission will develop a common methodology and guidelines to improve tax administrations' access to information on financial flows, for example through credit cards and bank accounts established in the EU/*offshore*, thus facilitating significant transaction traceability. A first step has already been achieved with a thorough experience exchange within the framework of FISCALIS workshop that took place on this subject in October 2012.

X. Improved risk management techniques and, in particular, the management of risks related to compliance with the obligations

Risk management platform established in 2007 in the context of the FISCALIS programme is currently developing a strategic plan for managing risks associated with compliance. The main objective of the strategic plan is to ensure that all Member States will reach a higher level of compliance with the obligations of contributors, to facilitate cross-border risks and remedy fraud and to stimulate and strengthen cooperation between Member States. For a successful implementation of the strategic plan, it will be necessary for all Member States to declare their commitment. Structured exchanges of information between tax administrations and customs relating to strategies for the identification of non-compliance with the obligations could improve the knowledge of all these authorities, to ensure the coordinated risks assessments and would be integrated into the strategic plan.

XI. Automated access to data

Due to the fact that requests for basic information about the businesses established in other Member States shall be sent to the competent authorities of the Member States concerned, and this process takes time, we proposed the establishment of a solid legal framework, enabling a competent authority of a Member State to have automated access to the specific data available in the database of another Member State which are related to the identification and activities of a taxpayer. It is expected that, on the one hand, this automated access to reduce the number of requests and, as a result, the need for human resources, making, on the other hand, the exchange of information to be faster. Obviously, access to the database may not include sensitive information, such as those relating to the pricing policy etc.

XII. EUROFISC

The creation of a European network called Eurofisc, for a closer operational cooperation between Member States in combating fraud in the field of VAT is another promising approach. The main tasks of Eurofisc will be to provide a multilateral early warning mechanism for combating fraud in the field of VAT. It is hoped that this mechanism will result in a common way of risk assessment concerning intra-Community transactions and the exchange of information and of the activities carried out by the participating Member States in response to the warnings received, as was in the case of Eurocanet network created by the Belgian tax administration and supported by the Commission/European Anti-Fraud Office.

XIII. Promoting conduct simultaneous controls and the presence of foreign officials for audits

In the short term, in order to facilitate tax audits and to pave the way for possible future joint audits, it is essential that Member States to use existing legal provisions as widely as possible in order to organize simultaneous controls and to facilitate the presence of foreign officials in the offices of tax administrations and during administrative investigations. The analysis carried out in the framework of EUROFISC should contribute to strengthening the use of these tools.

XIV. Extending EUROFISC to direct taxation

This relatively new system could be extended to fulfill a similar function in the field of direct taxation, particularly for detecting and rapid dissemination of information regarding the recurrent fraud schemes, trends and aggressive tax planning. To this end, the Commission shall collect and assess the first results of EUROFISC for VAT purposes and will also continue the work related to the expansion of EUROFISC and of the early warning system to matters of direct taxation.

XV. Sanctions to taxpayers who do not submit their tax returns on time

Receiving declarations submitted by taxpayers is one of the most important activities in the tax administration process. A high level of voluntary compliance to declaration means a high level of discipline among taxpayers. Although the process of self-taxation powered by contributors do not automatically lead to the collection of tax revenue, the start of the subsequent enforcement procedures in order to collect tax revenues is conditional on the existence of a debt instrument or a tax return. In order to increase the level of voluntary compliance with the declaration, the legislature has provided penalties for failure to submitt each type of tax statement, so that under the current regulatory framework every delay in reporting must lead automatically to a penalty (warning, fine).

Even though the activity of receiving the statements has recorded a major progress in the last period (since 2011, the vast majority of tax returns are submitted by electronic means, directly over the Internet), the application of sanctions for late submissions still has a high level of subjectivism. Although there is a database, there are no automatic means of issuing minutes of finding and sanctioning contraventions in the case of economic agents who do not fulfill their declaratory obligations in

accordance with the legal provisions. Specifically, currently a sanction is applied manually by inspectors from managing the taxpayers register and receiving the tax return. To individualize the sanction (choice between a warning and a fine, namely the amount of the fine) there are no tools/information on taxpayer's record/criminal record in terms of sanctions for failure to submit or late submission of tax returns. In these conditions it is possible that some contributors to be punished repeatedly only with a warning while other economic agents are severely punished by the first contravention. There is no guide/procedure on the NAFA (National Agency for Fiscal Administration) level to ensure a coherent framework to individualize the administrative sanctions, so that this process is carried out only according to the judgment and good faith of the public officials.

XVI. Standard forms for exchange of information on tax matters

The Directive 2011/16/EU adopted on February 15th, 2011 provides the adoption of standard forms for information exchange on request, spontaneous information exchange, notification and feedback. The Commission adopted a regulation implementing such standard forms designed to increase the effectiveness and efficiency of information exchange. The Commission has also developed a computer application for these standard forms, in all EU languages, application that has already been made available to Member States and was released from January 1st, 2013.

XVII. "TIN EUROPE" Portal

It is a new practical tool for improving administrative cooperation in the field of direct taxation. Correct identification of taxpayers is essential for an efficient exchange of information between tax authorities of the Member States. This application provides samples of official identity documents containing national TINs (tax identification numbers). Thus it allows any third party, especially private financial institutions to identify and record quickly, easily and accurately the TINs in cross-border relations. In addition, an online control system similar to the VIES system (VAT Information Exchange System) makes possible to verify the correctness of the structure or algorithm of a particular TIN. This new application could be a first step towards a more coherent approach to TINs at EU level and will help improve the effectiveness of the automatic exchange of information.

XVIII. European Taxpayer's Code

The Commission launched a public consultation on this issue in early 2013. Improving relations between taxpayers and tax administrations, enhancing the transparency of tax rules, reducing the risk of errors that could have serious consequences for taxpayers and encouraging tax compliance, as well as encouraging Member States' administrations to apply a Taxpayer's Code will contribute to a more efficient collection of taxes.

XIX. Strengthening the fiscal governance

Inter-agency cooperation is essential to ensure an effective fight against tax fraud, tax evasion and tax-related crimes. Europol can play an important role in intensifying the information exchange, contributing to identify and dismantle the criminal networks/groups. In the context of preparing its legislative proposal for a review of the Third Money Laundering Directive (2005/60/EC) (MLD3 or 3MLD), the Commission is considering whether to explicitly mention tax offenses as major offenses of money laundering in accordance with the 2012 Financial Action Task Force (FATF) recommendations. This will facilitate cooperation between fiscal and judicial authorities and financial supervisory authorities to tackle serious violations of tax laws. Strengthening the anti-money laundering procedures with regard to due diligence towards clients, as well as a greater transparency of information on actual beneficiaries collected to combat money laundering in the MLD3 review could also facilitate the use of relevant data for tax purposes, i.e., to improve the effectiveness of the treatment of *offshore* investment

structures in accordance with the EU Directive on taxation of savings income. In addition, cooperation could be further facilitated by harmonization at EU level of the crime of money laundering, establishing a definition for it and the setting of appropriate sanctions. In this respect, it was proposed in 2013, in addition to reviewing the third MLD, a specific Directive on combating money laundering (MLD4).

Conclusions

Romania does not have the ability to have a modern tax system. We say this based on the concept that a tax system is not only an amount of taxes induced by legislation. That is why fiscal reform needs to be pursued on the basis of multiple and complex analyzes including calculations for quantifying the various influences, so that the tax system to better meet the requirements of fiscal policy at national and international level.

Sistemele fiscale occidentale sunt, în cea mai mare parte a lor, rezultatul unei evoluţii şi a unor acumulări treptate şi îndelung analizate până la consfinţirea lor prin legi fiscale. Cu toate acestea, şi aici se mai caută optimul reformei fiscale pentru a constitui un sprijin mai eficace în aplicarea politicilor fiscale ale statelor respective. Cu atât mai mult este necesară reformarea fiscală în ţara noastră, care trebuie să rezolve problemele privind asigurarea mijloacelor financiare pentru acoperirea cheltuielilor publice, utilizând impozitul ca pârghie fiscală la nivel macroeconomic şi alinierea la cerinţele unui sistem fiscal modern.

Most of the Western tax systems are the result of a gradual and long-term evolution and accumulation until they have been sanctioned by tax laws. However, here they also seek the optimum tax reform, in order to provide more effective support in the application of the financial policies of those States. The fiscal reform in our country is even more necessary, which has to solve the problems regarding the provision of the financial means to cover the public expenses, using tax as leverage at macroeconomic level and aligning to the requirements of a modern tax system.

Bibliography

[1] *** COM(2008) 727 final, 13.11.2008

[2] *** COM(2009) 644 final from 23.11.2009 and COM(2009) 648 final from 23.11.2009

[3] *** COM(2012) 428 final, 31.7.2012

[4] *** COM(2009) 511 final, 29.9.2009

[5] *** Directive 2010/23/EU of March 16th, 2010 amending Directive 2006/112/EC on the common system of value added tax (VAT), on an optional and temporary application of the reverse charge mechanism to provide certain services susceptible to fraud (JO L 72 of 20.3.2010, p.1)

[6] *** Commission Decision (2012/C 198/05) July 3rd, 2012 on the establishment of EU VAT Forum

[7] *** Council's conclusions of May 14th, 2013 on fraud and tax evasion (doc. 9549/13 – FISC 94 – ECOFIN 353)

[8] *** Committee of Experts on International Cooperation in Tax Matters, Seventh session, Geneva, 24-28 October 2011, Item 5 (h) of the provisional agenda, Revision of the Manual for the Negotiation of Bilateral Tax Treaties

[9] *** COM (2008) 147 final, 17.3.2008

THE IMPACT OF INDIRECT TAXES ON ECONOMIC GROWTH

Ana-Maria Uritescu, PhD student
Bucharest University of Economic Studies
Email: ana.uritescu@fin.ase.ro

Abstract: *This study analyzes the impact of indirect taxes on economic growth in Romania. Indirect taxes are represented by VAT and excise taxes. Annual data from 1993-1996 were used for the study. The data series consists of the weights of VAT in the GDP, the weights of excise duties in the GDP and the economic growth rate.*

The link between the three data series is tested by the autoregressive vector technique and the Granger-causality. The results of the model indicate that there is a long-term relationship between VAT, excise duty, and economic growth. The Granger test results show that the data series represented by the weight of VAT in GDP and the data series represented by the weight of excise duties in GDP cause Granger growth rate.

Keywords: VAT, excise, economic growth, var, Granger causality

Introduction

Economic growth is a topical subject. It has been studied over time in various countries and mentioned in the speciality literature. Economic growth can be achieved through the correct management of fiscal and budgetary policy, either by controlling budgetary expenditures and budgetary revenue or through the efficient use of fiscal policy instruments.

In the theory of economic growth, there were three trends: the neoclassical theory of economic growth, the endogenous theory of economic growth and economic growth models in which fiscal and budgetary policy variables are integrated. [16]

The models of economic growth that support neoclassical theory are those built by Ramsey (1928), Solow (1956), Swan (1956), Cass (1965), Koopmans (1965). The most important neoclassical models of economic growth are: a) the Solow-Swan model (1956), which states that the positive growth rate of income per capita is only possible through the continuous development of technology, the saving rate is constant; b) The Ramsey-Cass-Koopmans model asserts that the saving rate is determined by maximizing the utility of the representative household on the infinite horizon; c) the Diamond model refers to the fact that the economy at equilibrium behaves as in the first two models, but this model brings into question new aspects of economic growth-economies characterized by different initial conditions that can converge towards different balanced growth trajectories. [17]

The endogenous theory of economic growth was sustained by Romer (1990), Lucas (1998), Aghion-Howitt (1992), Grossman-Helpman (1991). Endogenous growth theory explores how innovation and technical progress generates economic growth.

Barro (1990) is among those who have developed models of economic growth in which fiscal and budgetary policy variables are introduced. These variables are represented by taxes and public expenditures.

[16] Laura Obreja Brasoveanu, "The impact of fiscal policy on growth economy", ASE Publishing House, Bucharest, 2011
[17] Laura Obreja Brasoveanu, "The impact of fiscal policy on growth economy", ASE Publishing House, Bucharest, 2011

The link between taxation and economic growth is a strong one. Fiscal policy instruments can have a positive or negative impact on economic growth. The most important indirect taxes are VAT and excise duties. The VAT was introduced in Romania in 1993, replacing the tax on the movement of goods, which had been levied up to this year, and the excise duties were introduced at the end of 1991.

VAT is an indirect tax charged on value added at each stage of production and distribution and not on the total value of the product or service performed.[18]

Excises are the special consumption taxes due to the state budget for certain products from the country and from import.[19]

The importance of these two indirect taxes is also due to the fact that they have been introduced for the purpose of harmonizing with the EU tax system.

Literature review

In the literature, studies focusing on the impact of taxation on economic growth had varied results. Some have led to the idea that fiscal policy has positive effects on economic growth, others have resulted in a negative influence of tax on economic growth. The variety and number of studies on the impact of taxation on economic performance are explained by the diversity of tax variables used to observe their influences on economic growth.

Paul Cahin (1995) develops an endogenous growth model that highlights the negative impact of public investment, public transfers and distortionary taxes on economic growth.

Helms Jay (1985) produces an econometric model whose results indicate that tax increases delay economic growth, demonstrating a negative effect and an inverse relationship between the two variables.

Charles B. Garrison, Feng-Yao Lee (1995), in the study "The effect of macroeconomic variables on economic growth rates: A cross-country study" studies for the period 1960-1987 the impact of macroeconomic variables on economic growth. One of the findings of the study is that there is a negative effect of high marginal tax rates on economic growth.

Eric M. Engen and Jonathan Skinner (1996) conducted a study to highlight the impact of taxation on US economic growth. The paper's conclusions were outlined by studying the impact of tax cuts on economic growth and, at the same time, by studying at the micro level of the supplied labour, investment demand, and productivity growth. The obtained results show that there is very little influence on the growth rate in response to changes in marginal tax rates by 5 percentage points and average rates by 2.5 percentage points, but these small effects may have a cumulatively higher impact on the standard of living.

Richard Kneller, Michael F. Bleaney, Norman Gemmell (1998) analyzes fiscal policy and economic growth in OECD countries. The conclusion of the study is that distortionary taxes reduce growth, and non-distortionary taxes don't. It also analyzes the influence of productive and non-productive costs on growth. Thus, the study indicates an increase in growth due only to productive government expenditures, not to non-productive expenditures. The study is made for 22 developed countries with data between 1970 and 1995.

[18] Luminiţa Ionescu, Control and economic, financial, and fiscal implication on indirect taxes, Economic Publishig House, Bucharest, 2001

[19] Luminiţa Ionescu, Control and economic, financial, and fiscal implication on indirect taxes, Economic Publishig House, Bucharest, 2001

Hubert G. Scarlett (2011) analyzes the impact of taxes on economic growth using quarterly data between 1990 and 2010 in Jamaica. According to this study, indirect taxation has a positive and significant impact on economic growth, while direct taxation has a negative long-term impact.

O. J. Ilaboya and C.O. Mgbame (2012) is conducting a study analyzing the impact of indirect taxes on economic growth in Nigeria. The results show a negative and insignificant relationship between indirect taxes and economic growth in that state.

Methodology of research

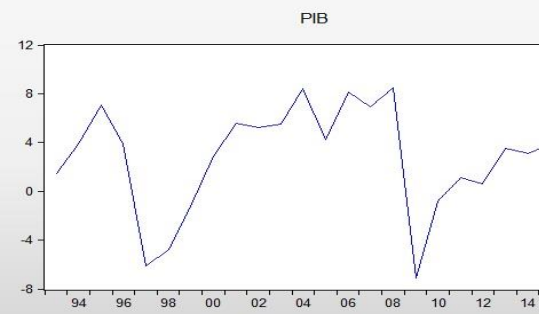
To study the impact of VAT and excise on economic growth, I created an econometric model using the autoregressive vector method and I tested Granger causality. The data used are from 1993 to 2016. I took them from the country reports provided by the International Monetary Fund. The data were processed in Eviews. Data series represented by VAT and excise duties consist of their weight in GDP, and economic growth is reflected in the real GDP growth rate.

The stages of identifying the link between VAT, excises and economic growth rates are: data analysis, testing the stationarity of time series, testing the cointegration of time series, creating the VAR model, testing Granger causality, interpretation of results.

Data series analysis

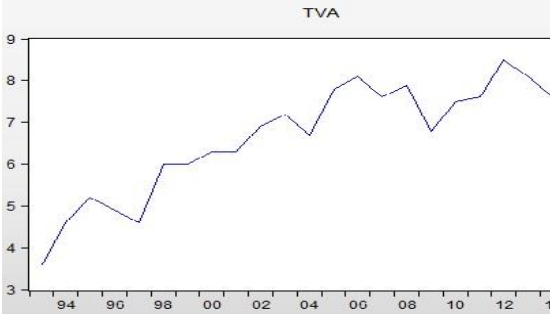
To analyze the three sets of data that I work with, I realized with the Eviews program both the graphical representation of the evolution of the three data series and the descriptive statistics. The following figures show the evolution in time of the economic growth rate, the weight of the VAT in the GDP and the evolution of the weight of excises in the GDP. Descriptive statistics of data give us the average, the standard variation, the minimum and maximum of the three data series.

Figure no. 1. Evolution of the economic growth rate



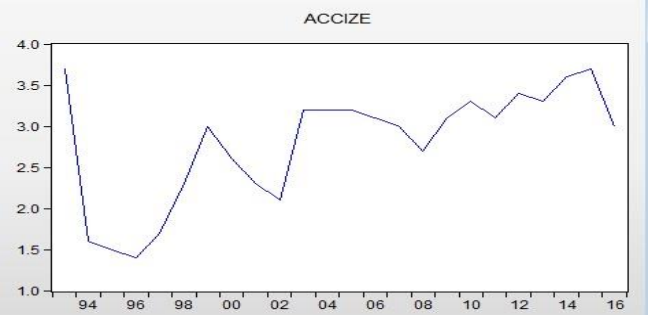
Source: own processing using Eviews 9

Figure no. 2. Evolution of the VAT weights in GDP



Source: own processing using Eviews 9

Figure no. 3. Evolution of excise duties weights in GDP



Source: own processing using Eviews 9

Table No. 1. Descriptive statistics of data series

	GDP	VAT	EXCISE
Mean	2.862500	6.650000	2.795833
Median	3.900000	6.650000	3.050000
Maximun	8.500000	8.500000	3.700000
Minimum	-7.100000	3.600000	1.400000
Std. Dev.	4.331765	1.332536	0.701848
Skewness	-0.871473	-0.629283	-0.735767
Kurtosis	3.052337	2.413012	2.353615
Jarque-Bera	3.040597	1.928542	2.583229
Probability	0.218647	0.381261	0.274827
Observations	24	24	24

Source: own processing

From previous images we can see that for the data series of the economic growth rate the maximum was reached in 2008 with 8.5%, followed by the minimum of the data series in 2009 of -7.5%. These values correspond with the beginning of the economic crisis (2008) and the peak of this stage in the Romanian economy (2009).

For VAT, the lowest value was in the first year in which this type of tax was introduced at 3.6% in 1993 and the maximum of 8.5% in 2012.

The minimum amount of excise duty weight in GDP was reached in 1996, with a value of 1.4%, and the maximum value of 3.7% was reached in 1993 and 2015.

Testing the stationarity of the data series

Testing the stationarity of each series was performed with the tests: Augmented Dickey-Fuller and Phillips Perron. The results of applying the two test for data series are highlighted in the table below:

Table No. 2. Results of the Augmented Dickey-Fuller test and of the Phillips Perron test

	t-statistic	1% level	5% level	10% level	Prob
ADF GDP	2.957523	3.752946	2.998064	2.638752	0.0542
ADF VAT	2.528740	3.752946	2.998064	2.638752	0.1220
ADF EXCISE	2.380119	3.752946	2.998064	2.638752	0.1578
PP GDP	2.957523	3.752946	2.998064	2.638752	0.0542

PP VAT	2.528740	3.752946	2.998064	2.638752	0.1220
PP EXCISE	2.641300	3.752946	2.998064	2.638752	0.0995

Source: own processing

As the test results indicate, all three sets of data are non-stationary. The results of the t-statistical test must be higher than the values associated with the relevance levels for the stationarity of a data series.

The autoregressive vector technique is applied only to stationary data series. Thus, in order to create the econometric model, I applied the first difference for the three data series and I obtained the following results:

Table No. 3. Results of applying the first difference

First difference	**t-statistic**	**1% level**	**5% level**	**10% level**	**Prob**
ADF GDP	5.524476	3.769597	3.004861	2.642242	0.0002
ADF VAT	4.997455	3.769597	3.004861	2.642242	0.0006
ADF EXCISE	4.124990	3.769597	3.004861	2.642242	0.0051
PP GDP	5.823711	3.769597	3.004861	2.642242	0.0001
PP VAT	4.997455	3.769597	3.004861	2.642242	0.0006
PP EXCISE	8.658604	3.769597	3.004861	2.642242	0.0000

Source: own processing

As can be seen, the T-statistics value is superior to all values associated with the relevance levels. Thus, by applying the first difference, the three data series become stationary.

Testing the cointegration of time series

Before testing the stationarity of data series I applied the Johansen Cointegration test to check which autoregressive vector model I use. If the test results indicate that the data series are not cointegrated, then I will use the unrestricted VAR model.

Table No. 4. Results of the Johansen Cointegration test

Sample (adjusted): 1995 2016
Included observations: 22 after adjustments
Trend assumption: Linear deterministic trend
Series: GDP VAT EXCISE
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.535238	26.91218	29.79707	0.1038
At most 1	0.233210	10.05511	15.49471	0.2765
At most 2 *	0.174288	4.213191	3.841466	0.0401

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: own processing

According to this test, the data series are not cointegrated. Considering this result, I will apply the model of an unrestricted autoregressive vector.

Creating the VAR model and interpreting the results

The application of the autoregressive vector with five lags for the three data series (economic growth rate, VAT and excise) generates the following results:

Table No. 5. Results of autoregressive vector estimation

	D_GDP	D_VAT	D_EXCISE
D_GDP (-1)	-0.333935	0.170290	0.048639
Standard errors	0.25095	0.04984	0.06107
T-statistic	-1.33071	3.41692	0.79650
D_GDP (-2)	0.276978	-0.020783	0.017032
Standard errors	0.19506	0.03874	0.04747
T-statistic	1.41997	-0.53650	0.35884
D_GDP (-3)	-0.351974	0.166285	0.050651
Standard errors	0.26231	0.05209	0.06383
T-statistic	-1.34183	3.19201	0.79351
D_GDP (-4)	0.503540	0.013092	0.000697
Standard errors	0.20644	0.04100	0.05024
T-statistic	2.43918	0.31944	0.01388
D_GDP (-5)	-0.523311	-0.105177	-0.043223
Standard errors	0.19294	0.03832	0.04695
T-statistic	-2.71231	-2.74490	-0.92061
D_VAT(-1)	1.198158	-0.282655	0.378870
Standard errors	1.44871	0.28771	0.35253
T-statistic	0.82705	-0.98243	1.07471
D_VAT (-2)	-6.524181	1.103923	0.558069
Standard errors	1.89513	0.37637	0.46117
T-statistic	-3.44260	2.93309	1.21013
D_VAT (-3)	-0.715878	-0.771037	-0.064973
Standard errors	-0.79840	0.35716	0.43763
T-statistic	-0.39806	-2.15882	-0.14847
D_VAT (-4)	-5.599413	-0.818583	-0.006223
Standard errors	1.91081	0.37948	0.46498
T-statistic	-2.93038	-2.15710	-0.01338
D_VAT (-5)	-0.692433	2.110648	0.770970
Standard errors	2.49959	0.49641	0.60826
T-statistic	-0.27702	4.25180	1.26751
D_EXCISE (-1)	14.74376	-2.855716	-1.403848
Standard errors	3.18566	0.63266	0.77521
T-statistic	4.62817	-4.51380	-1.81094
D_EXCISE (-2)	6.142155	-1.114191	-0.848970
Standard errors	2.14506	0.44586	0.54632
T-statistic	2.73585	-2.49895	-1.55398
D_EXCISE (-3)	6.282788	1.464841	-0.601931
Standard errors	1.95223	0.38771	0.47506
T-statistic	3.21826	3.77821	-1.26706
D_EXCISE (-4)	11.85597	-4.651764	-1.885913
Standard errors	4.87009	0.96719	1.18510
T-statistic	2.43445	-4.80958	-1.59136
D_EXCISE (-5)	1.133135	-0.219286	-0.297615

Standard errors	1.69245	0.33612	0.41184
T-statistic	0.66952	-0.65241	-0.72264
C	-1.188829	0.411894	0.205747
Standard errors	1.18208	0.23476	0.28765
T-statistic	-1.00571	1.75455	0.71527
R-squared	0.980173	0.971735	0.853620

Source: own processing

According to the results obtained by estimating the VAR model, we can see that the current GDP will increase on average by 0.33% if there is a 1% increase in the first-order GDP deviation, while the other variables remain constant. At the same time, for a 1% increase in second-order GDP delays, current GDP will increase by 0.27%. The sign of the coefficients for I, III and V delays indicates their negative impact on current GDP.

With regard to VAT, following the above table, it can be argued that for an I-time delay, a 1% increase in VAT in GDP generates GDP growth of 1.17% with a positive impact, but II, III, IV and V have a negative impact on GDP.

Regarding the impact of excise duties on GDP, it is noted that over time these have a positive impact on GDP.

R-Squared value of 0.980173% indicates a strong relationship between the three variables, but does not ensure that there is a positive link. In the long term, value added tax may have a negative impact on GDP and excise a positive impact.

Testing the Granger causality

After I estimated the autoregressive vector model, I tested Granger Causality for the three time series. Thus, I obtained the following results:

Table No. 6. Results of Granger Causality test

Var Granger Causality/ Block Exogeneity Wald Tests			
Sample 1993 2016			
Dependent variable: D_ GDP			
Excluded	Chi-sq	df	Prob.
D_ VAT	34.87858	5	0.0000
D_ EXCISE	43.75886	5	0.0000
ALL	78.51772	10	0.0000
Dependent variable: D_ VAT			
Excluded	Chi-sq	df	Prob.
D_ GDP	23.91442	5	0.0002
D_ EXCISE	33.86408	5	0.0002
ALL	53.87555	10	0.0000
Dependent variable:D_ EXCISE			
Excluded	Chi-sq	df	Prob.
D_ GDP	1.398608	5	0.9245
D_ VAT	3.867868	5	0.5686
ALL	5.437190	10	0.8601

Source: own processing

In the first part of the table are included the results in which the dependent variable is the GDP. To test Granger Causality if the GDP is a dependent variable starts from the null hypothesis that assumes that: D_VAT (lag 1, lag 2, lag 3, lag 4, lag 5) does not cause D_GBP. The probability value (p-value)

of 0.0000 is inferior to the 5% relevance level, indicating that the null hypothesis is rejected and the assumption that D_VAT causes Granger GDP is accepted.

Concerning the link between excise duty and D_ GBP dependent variable, the probability value of 0.0000, below the 5% relevance level, indicates the rejection of the null hypothesis. This implied that excise duties (lag 1, lag 2, lag 3, lag 4, lag 5) do not cause GDP.

If D_VAT is the dependent variable it is obtained that D_GBP and excise duty cause D_VAT. The probabilities associated with the 0.0002 and 0.0000 test are below the 5% level and indicate the rejection of the null hypotheses. These assumptions assume that D_ GBP (lag 1, lag 2, lag 3, lag 4, lag 5) does not cause D_VAT and D_EXCISE (lag 1, lag 2, lag 3, lag 4, lag 5) does not affect D_TVA.

For the case where the data series of the share of excise duties in GDP is the dependent variable, the probabilities associated with the 0.9245 and 0.5686 tests lead to the acceptance of the null hypotheses. These null hypotheses assume that the GDP does not cause the excise duty and the VAT does not cause the excises because their values are biggest then relevance level of 5%.

Conclusions

The aim of this study was to analyze the impact of indirect taxes, represented by VAT and excises, on economic growth in Romania.

Using the technique of the unrestricted autoregressive vector I created an econometric model consisting of three data series: the economic growth seen through the economic growth rate, the VAT represented by the weight of VAT receipts in the GDP, and the third series was consisting of the excise duties in GDP. Annual data were between 1993 and 2016.

In the first part of the paper, I presented some studies on the same subject. The results of the studies were different, some highlighted a positive link, others a negative link between indirect taxes and economic growth.

The result of the study made by Richard Kneller, Michael F. Bleaney, Norman Gemmell in 1998 on Fiscal Policy and Economic Growth in OECD countries was that the distortionary taxes reduce the growth and the non-distortionary taxes don't.

According to Hubert G. Scarlett's 2011 survey for Jamaica, indirect taxation has a positive and significant impact on economic growth, while direct taxation has a negative long-term impact.

Following the application of the autoregressive vector method for selected data from our country, I have obtained that in the long run the VAT has a negative influence on the economic growth rate, and the link between the excises and the economic growth rate is a positive one.

The high value of R-Squared indicates the strong link between the three datasets.

In the last part of the work on the data series, the Granger causality test is applied. The most important result of this test is the one that indicates the influence that the two series of data, consisting of the weight of VAT in GDP and the weight of excises in GDP, have on the economic growth rate. The probability values associated with the 0.0000 and 0.0001 test points out that VAT and EXCISE are causing GDP.

Bibliography

[1] Charles B. Garrison, Feng-Yao Lee (1995), „The effect of macroeconomic variables on economic, growth rates: A cross-country study", Journal of Macroeconomics, vol. 17, Issue 2 pp. 301-317

[2] D. Cass, (1965), „Optimum Growth in an Aggregative Model of Capital Accumulation", Review of Economic Studies, Vol 32, No. 3, pp. 233-240

[3] E. Engen, J. Skinner, „Taxation and Economic Growth, National Tax Journal", volume 49, Issue 4, pp. 617-642
[4] F. Ramsey, (1928), „A Mathematical Theory of Saving", Economic Journal, Vol. 38, No. 152, pp. 543-559
[5] G. Grossman, E. Helpman, (1991), „Innovation and Growth in the Global Economy", Cambridge MA, MIT Press
[6] Ilaboya, O.J., Mgbsme, (2012) C. O., „Indirect tax and economic growth, Research Journal of Finance and Accounting", Vol 3, No. 11
[7] J. Helms (1985), „The Effect of State and Local Taxes on Economic Growth: A Time Series-Cross Section Approach", The Review of Economics and Statistics, Vol 67, issue 4, 574-82
[8] Kneller, R., Bleaney, M., Gemmell, N. (1999), "Fiscal policy and growth: evidence from OECD countries", Journal of Public Economics 74, 171-190
[9] Laura Obreja Brasoveanu (2011), "The impact of fiscal policy on growth economy", ASE Publishing House, Bucharest
[10] Luminiţa Ionescu (2011), Control and economic, financial, and fiscal implication on indirect taxes, Economic Publishing House, Bucharest, 2001
[11] P. Cashin, (1995), Government Spending, Taxes and Economic Growth, IMF Staff Papers, vol. 42, issue 2, 237-269
[12] P. Aghion, P. Howitt, (1992), „A Model of Growth through Creative Destruction, Econometrica", 60(2), pp. 323-351
[13] P. Romer, (1990), „Endogenous Technological Change", Journal of Political Economy, vol. 98, No. 5, Part 2
[14] R. Solow, (1956), „A contribution to the Theory of Economic Growth", Quarteley Journal of Economic, Vol. 70, No. 1, pp. 65-94
[15] R. Barro (1990), „Government Spending in a Simple Model of Endogenous Growth", Journal of Political Economy, Vol. 98, No. 5, Part 2
[16] T. Swan, (1956), „Economic Growth and Capital Accumulation", Economic Record, Vol. 32, Issue 2, pp. 334-361
[17] T. Koopmans, (1965), „On the Concept of Optimal Economic Growth", The Econometric Approach to Development Planning, Pontificae Academiae Scientiarum Scripta Varia, 28, 225-287, Amsterdam
[18] Scarlett H. G. (2011), "Tax policy and economic growth in Jamaica", Bank of Jamaica working paper
[19] www.imf.org

INNOVATION IN SMEs - AN INTENSIVE PREOCCUPATION OF BUSINESS PEOPLE ALL AROUND THE WORLD

Ciprian Tudurachi, PhD
Valahia University from Targoviste
tudurachi.ciprian@gmail.com

Abstract: *Innovation in small and medium enterprises (SME) has been given rather little attention. The current field of research in SME innovation is still very limited and it is not very clear whether creative innovation is implemented in SMEs all around the world[20]. In spite of the fact that the openness towards innovation has developed rapidly and has defined a new trend of management research, the management of innovation, most accomplishments with innovative character belong to large companies in the manufactoring field[21].*

Keywords: innovation, creativity, competitiveness, SME, top level technologies

JEL classification: O14, O32

1. Introduction

Small companies face nowadays the conditions imposed by a tough, and very competitive market. The global economic and financial crisis highly affected the financial health of many SMEs, especially the ones that are active in industries on whose market there entered foreign, with low costs, thus endangering the survival of competing companies already present and active on the respective market. Also, the new international regulations might make a profitable business operated by an SME in a niche field become a real nightmare within weeks or months.

Startups in the field of top-level technologies, without needing production capabilities or distribution channels, may transform technology into a very profitable successful business. Therefore, the change in the market conditions forced small companies to adapt themselves to the new market conditions or to reinvent their business by means of new technologies or unique value. At the same time however, small companies must face several constraints concerning the differentiation of products and the change in their business model. Major responsibility consists in the fact that most often SMEs acutely lack internal financial resources and necessary technical capabilities. Consequently, they must cooperate with external partners, and successfully innovate to develop new sources of income and reach more profitable positions in the competitive landscape. The openness towards innovation is thus a logical solution for many SMEs[22].

[20] Kim, H. and Park, Y. (2010), The effects of open innovation activity on performance of SMEs: the case of Korea, International Journal of Technology Management, 52(3/4), 236-256

[21] Van de Vrande, V., De Jong J.P.J., Vanhaverbeke, W. and De Rochemont, M. (2009), Open innovation in SMEs: Trends, motives and management challenges, Technovation, 29(6-7),423-437

[22] Chesbrough H.W. (2003), Open innovation; The new imperative for creating and profiting from technology, Harvard Business School Press, Harvard : Boston: MA and Chesbrough, p.38

2. Innovation as a process

Innovation is a process whose initial moment is a new idea, and the final moment is its materialization by being introduced on the market[23]. Innovation occurs in the daily life and progressively changes the economy and the entire society[24].

Innovation and creativity are together main sources for the development of the knowledge society, which in its turn is dependent on the entrepreneurial spirit and also on the economic growth rate[25].

Used more and more often lately, innovation has come to represent one of the intense preoccupations of business people all around the world. By innovation they try to attract new clients, and the mass media ads emphasize the new characteristics of the products that they promote[26].

Also, academic research focuses more and more on the investigation of this field, and the decision makers responsible with designing and implementing macroeconomic strategies and policies emphasize innovation as an element that generates added value and economic prosperity. In this context, the promotion of principles specific for innovation becomes a priority for SMEs, but also for large companies looking for solutions to improve their innovative efficiency and capability, in ferm dependency of its own economic performance. To stimulate these preoccupations at the SME level, governments have developed a series of specific programs with regional emphasis with the purpose of growing performances in innovation, including by adopting the operating principles of this process.

From this macroeconomic perspective, innovation may significantly contribute to the development of developing states/regions[27].

From a microeconomic perspective, the approach of innovation revolves around the durable competitive advantage for the business success[28].

Innovation as a complex process makes possible the communication between the scientific community, market and technology[29], practically playing the role of a "progress engine" both from the viewpoint of the SME development and of the national economy[30].

In a general framework, one may say that innovation is synonimous with the introduction of a new concept, good, product, service, etc. But the definition agreed by the scientific community is the one published in the Oslo Manual, which says that innovation is „the implementation of a new or significantly improved product (good and/or service), an operational process (production and delivery

[23] Adaptation after Brad S., Mocan B., Brad E., Fulea M. (2014), Leading Innovation to Improve Complex Process Performances by Systematic Problem Analysis with TRIZ. In: EPFL Lausanne, TRIZ Future Conference 14, Global Innovation Convention. Lausanne, Switzerland, 29-31 October 2014. Lausanne – Switzerland: Elsevier

[24] Camelo C. (2010), Strategic consensus top management teams and innovation performance. International Journal of Manpower, 31 (6), pp. 678-695

[25] Dinu V., Grosu R.M., Săseanu A.S. (2015), Romanian Immigrant Entrepreneurship: Utopia or Reality? An Overview of Entrepreneurial Manifestations of Romanian Immi-grants in Andalusia, Spain. Transformations in Business & Economics, 14(1(34)), p. 48-64

[26] Jaramillo B., Jenkins C., Kermes F., Wilson L., Mazzocco J., Longo T. (2008), Positive Deviance: Innovation from the Inside Out. Nurse Leader, 6(2), p. 30-34.

[27] Grosu R.M.(2015), Best practices in the field of returnee entrepreneurship. Amfiteatru Economic,17(39), p. 799-814

[28] Maier A., Keppler T., Maier, D. (2014), Innovation the new trend in today's challenging economy. In: The Bucharest University of Economic Studies, The13th International Conference on Informatics in Economy, Education, Research & Business Technologies. Bucharest, Romania, 15-18 May 2014, Bucharest: Publisher Editura ASE

[29] Procopie R., Pamfilie R., Bobe M., Carceag M. (2009), Innovation - global vision on the product in the socio-economic environment. Textile Industry Journal, 60(2), p. 90-96

[30] Kao J.(2007), Innovation Nation: How America is losing its innovation edge, why it matters, and what we can so to get it back, New York: Free Press

methods), a marketing means (packaging, sale, or distribution methods) or new organizational or management methods or processes in the business practice, in the working environment or in the external relationships"[31].

3. Innovation and creativity – factors of economic growth

Innovation is one of the essential factors of growth and prosperity of the contemporaneous global economy[32]. In the current context, SMEs are as innovative as large companies, and innovation is much more important for SMEs than for other types of companies, as it generates competitiveness[33]. Also, SMEs may be a source of innovation for large companies, as the latter may cooperate to produce components necessary in the innovation process, especially as the most important suppliers of large companies are really SMEs. Thus one makes the step from a closed innovation system to an open one[34], as an effect of developing a company with respect to its size and results[35].

Innovation in a closed system means the absolute control of innovation, as the generators of innovative ideas are the very companies that later develop them. In contrast, open innovation uses both internal and external knowledge. They may be developed and used to create value, but also involve significant investments from the promoting companies.

In general, SMEs do not follow open innovation, and the results in their case are significantly different from the ones obtained by large companies, who follow this concept. The large companies have enough resources, while SMEs look for resources to focus on research and development. By their very nature, SMEs are not formalized, and this makes necessary another way of configuring the innovative process of the SME[36].

In spite of these aspects, open innovation does not involve significant risks or the initiation of major investments, as it may be the generating factor of success of a company. Nevertheless, this depends on the organizational culture, the features and the structure of the innovation process, but also on the adopted business model. An organizational culture open to innovation has at its foundation a series of principles of fruitful collaboration between the company and external experts, based on value-creating activities of research and development.

The advantages of adopting the principles of open innovation are, among many others: the growth of the learning potential by using sources outside the organization, obtaining complementary

[31] OECD (2005), OSLO manual, Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition, [online] http://epp.eurostat.ec.europa.eu/cache , p.46

[32] Maier A., Keppler T., Maier, D. (2014), Innovation the new trend in today's challenging economy. In: The Bucharest University of Economic Studies, The13th International Conference on Informatics in Economy, Education, Research & Business Technologies. Bucharest, Romania, 15-18 May 2014, Bucharest: Publisher Editura ASE

[33] Radas S., Bozic L. (2009), The antecedents of SME innovativeness in an emerging transition economy. Technovation, 29 (6-7), p. 438-450

[34] Tomlinson P.R., Fai F.M. (2013), The nature of SME co-operation and innovation: A multi-scalar and multi-dimensional analysis, International Journal of Production Economics, 141(1), p. 316-326

[35] Chesbrough H. (2006), Open Business Model: How to thrive in the new innovation landscape. Boston: Harvard Business School Press

[36] Stanislawski R., Lisowska R. (2015), The Relations between Innovation Openness (Open Innovation) and the Innovation Potential of SMEs. Procedia Economics and Finance, iss. Technovation, 29 (623), p. 1521-1526

knowledge and know-how for the improvement of the activity and developing the process of research and development, thus obtaining the minimization of the innovation costs[37].

4. Conclusions

The innovation process must be structured to include mechanisms of valorization of the knowledge from the internal and external sources, ideas, projects, methods and systems that facilitate the internal or external flows of this process. The flexibility and adaptability of the business models create opportunities that generate added value for the company.

The system of open innovation is especially relevant and very necessary for the SMEs of small sizes and with limited resources. This is why they must cooperate with large companies to use the knowledge and obtain the necessary equipment to unfold this process.

Open innovation offers the companies the increase of their chances to enhance their efficiecy in creating value and to become competitive in the environment in which they operate. SMEs must however place special focus on the knowledge that they outsource in the context of the innovation process, as it may lead to an increase of market competition.

5. References

[1] Brad S., Mocan B., Brad E., Fulea M. (2014), Leading Innovation to Improve Complex Process Performances by Systematic Problem Analysis with TRIZ. In: EPFL Lausanne, TRIZ Future Conference 14, Global Innovation Convention. Lausanne, Switzerland, 29-31 October 2014. Lausanne – Switzerland: Elsevier

[2] Camelo C. (2010), Strategic consensus top management teams and innovation performance. International Journal of Manpower, 31 (6), pp. 678-695

[3] Chesbrough H.W. (2003), Open innovation; The new imperative for creating and profiting from technology, Harvard Business School Press, Harvard : Boston: MA and Chesbrough, p.38

[4] Chesbrough H. (2006), Open Business Model: How to thrive in the new innovation landscape. Boston: Harvard Business School Press

[5] Dinu V., Grosu R.M., Săseanu A.S. (2015), Romanian Immigrant Entrepreneurship: Utopia or Reality? An Overview of Entrepreneurial Manifestations of Romanian Immi-grants in Andalusia, Spain. Transformations in Business & Economics, 14(1(34)), p. 48-64

[6] Grosu R.M.(2015), Best practices in the field of returnee entrepreneurship. Amfiteatru Economic,17(39), p. 799-814

[7] Jaramillo B., Jenkins C., Kermes F., Wilson L., Mazzocco J., Longo T. (2008), Positive Deviance: Innovation from the Inside Out. Nurse Leader, 6(2), p. 30-34

[8] Kao J.(2007), Innovation Nation: How America is losing its innovation edge, why it matters, and what we can so to get it back, New York: Free Press

[37] Spithoven A., Vanhaverbeke W., Roijakkers N. (2013), Open innovation practices in SMEs and large enterprises. Small Bus Econ, 41(3), p. 537-562

[9] Kim, H. and Park, Y. (2010), The effects of open innovation activity on performance of SMEs: the case of Korea, International Journal of Technology Management, 52(3/4), 236-256

[10] Maier A., Keppler T., Maier, D. (2014), Innovation the new trend in today's challenging economy. In: The Bucharest University of Economic Studies, The13th International Conference on Informatics in Economy, Education, Research & Business Technologies. Bucharest, Romania, 15-18 May 2014, Bucharest: Publisher Editura ASE

[11] Procopie R., Pamfilie R., Bobe M., Carceag M. (2009), Innovation - global vision on the product in the socio-economic environment. Textile Industry Journal, 60(2), p. 90-96

[12] Radas S., Bozic L. (2009), The antecedents of SME innovativeness in an emerging transition economy. Technovation, 29 (6-7), p. 438-450

[13] Spithoven A., Vanhaverbeke W., Roijakkers N. (2013), Open innovation practices in SMEs and large enterprises. Small Bus Econ, 41(3), p. 537-562

[14] Stanislawski R., Lisowska R. (2015), The Relations between Innovation Openness (Open Innovation) and the Innovation Potential of SMEs. Procedia Economics and Finance, iss. Technovation, 29 (623), p. 1521-1526

[15] Tomlinson P.R., Fai F.M. (2013), The nature of SME co-operation and innovation: A multi-scalar and multi-dimensional analysis, International Journal of Production Economics, 141(1), p. 316-326

[16] Van de Vrande, V., De Jong J.P.J., Vanhaverbeke, W. and De Rochemont, M. (2009), Open innovation in SMEs: Trends, motives and management challenges, Technovation, 29(6-7),423-437

[17] *** OECD (2005), OSLO manual, Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition, [online] http://epp.eurostat.ec.europa.eu/cache , p.46

DEBT SUSTAINABILITY AND FISCAL POLICY RULES IN THE EUROPEAN UNION

Ada Cristina MARINESCU, PhD
Department of Economics, Sociology and Law
School of Advanced Studies of the Romanian Academy
marinescu_ada@yahoo.com

Abstract: *The sustainability of fiscal policy represents a subject which was studied extensively and the general conclusion of these studies is that fiscal policy is sustainable provided the intertemporal budget constraint is satisfied. The future expected discounted primary surpluses should exceed the value of public debt in order for public debt to be sustainable. The ability of governments to repay the debt will depend on the capacity to achieve future primary surpluses and on the stock of past debts. Fiscal policies are thus dependent on the intertemporal budget constraint, in case this condition is not fulfilled, then governments will have to change fiscal policies.*

Keywords: fiscal policy, intertemporal budget constraint, primary surplus, public debt, fiscal rules

JEL Codes: H60, H63, E62

Introduction

The economic and financial crisis which started in 2008 had a negative impact on public debt in many EU countries. Because of these debt crises the debate about debt sustainability has become a common topic for many governments and international institutions. At the same time, the evolution of public debt is correlated with the possibility of default, therefore many governments pay attention to the evolution of this indicator.

European Union countries confront with high levels of public debt and bigger deficits as a result of the last economic crisis. This macroeconomic context, dominated by budget deficits and pro-cyclical policies, together with bigger tax burdens have determined European Union to adopt strict fiscal rules in order to cope with these situations.

The fiscal policies adopted by EU member countries must comply with the intertemporal budget constraint, that is the government can borrow only up to a certain limit, which is given by the fact that the governments must intertemporally balance their budget so that the current value of the debt is equal to the discounted sum of expected future surpluses. If the intertemporal budget constraint is not respected, then the fiscal policy will not be sustainable, because the rate of debt increase will surpass the rate of economic growth.

Debt sustainability means that any deviations from the sustainable path must be corrected and therefore it is not necessary that budgets be balanced all the time. When deficit

becomes too big, then the capacity of the government to pay the debt becomes problematic. A debt is considered sustainable as long as the government can afford to repay the debt and the interest of its future revenues. Solvency supposes that governments respect the intertemporal budget constraint, which represents the criteria for assessing debt sustainability usually used.

The European Union has strict fiscal rules concerning the level of debt and deficits, which were first stipulated in the Maastricht Treaty regarding the excessive deficit procedure. According to this rule, government deficit should not exceed 3% of GDP, while public debt should remain within the limit of 60% of GDP. Only deviations in exceptional situations are allowed, but under some very strict conditions. The Stability and Growth Pact contains more restrictive rules imposing to member states to maintain cyclically adjusted budgetary positions close to balance or in surplus.

Definition

There have been proposed several modalities in order to define debt sustainability – depending on the time horizon chosen, debt sustainability can be regarded as a short, medium or long-term concept. Debt and deficits can be measured gross or net, depending on the inclusion of social security contributions.

The definition proposed by Blanchard (1990) for public debt sustainability should answer the following question: Can the actual course of fiscal policy be sustained without affecting or provoking an explosion of debt? Or the government will have to resort to another solution such as increasing taxes, decreasing spending or resort to monetization or even repudiation?

The definition of debt sustainability proposed by the International Monetary Fund is that a debt is sustainable if it satisfies the solvency condition without a major correction […]given the costs of financing.

Literature review

In this context, two different empirical approaches to analyzing the sustainability of fiscal policies have been used. The first consists of testing the stationarity of the public debt or deficit. The results vary with the specification of the government budget constraint. Hamilton and Flavin (1986) showed that if deficits and government debt follow a stationary process, intertemporal budget balance is satisfied. They found stationarity of undiscounted U.S. debt under the assumption of constant real interest rates. Wilcox (1989) allows for stochastic interest rates and finds that discounted U.S. debt is nonstationary.

There are also studies using cointegration tests which search for a relation of cointegration between the primary deficit, the stock of outstanding debt and interest payments. Trehan and Walsh (1988, 1991) find support for the sustainability of U.S. fiscal policies. In contrast, Kremers (1991) and Hakkio and Rush (1991), allowing for stochastic real interest rates and for a growing economy, show that in recent years fiscal policy violates the intertemporal budget constraint.

Bohn (1995, 1998) has made a critique of these tests because they make assumptions on future states that are difficult to estimate from an observation of time series data. Bohn provides also a new econometric approach in order to test the sustainability of public debt, a sustainability test in order to find out whether a given time series of public debt is sustainable.

In a stochastic economy, discounting future government spending and revenues by the interest rate on government bonds is incorrect. The discount factor on future spending and revenues depends on the distribution of these variables across possible states. At the same time, Bohn proposes to test if the primary deficit to GDP ratio is a positive linear function of the debt to GDP ratio. If this test is satisfied, then the fiscal policy can be considered sustainable.

Bohn (1998) suggests a different interpretation for the inter-temporal budget constraint, using methods for testing whether the primary balance reacts in a positive manner to the public debt dynamics.

$$pb_t = qb_t + aZ_t + \in_t$$

where pb_t is the ratio of primary balance over GDP, b_t represents the ratio of public debt over GDP, while $\in_t$ is the error term. Z_t is a vector that includes several determinant variables of the primary balance other than public debt. When applying this model for U.S. data, Bohn concludes that q>0, thus implying a positive reaction coefficient of the primary balance to the increasing stock of debt. As a conclusion, the government fiscal policy function can be considered to be sustainable even in an uncertain world.

Bohn (1998, 2007) also relates the fiscal reaction function to the model proposed by Trehan and Walsh (1988, 1991). This model analyses the reaction of the government in order to adjust the budget balance to keep pace with changing public debt.

Trehan and Walsh (1991) state that the budget is sustainable if the present value of future stock of public debt converges to zero. The Non-Ponzi game condition is thus satisfied if the future discounted expected stock of debt will converge to zero. The authors have shown that in order for this condition to be satisfied public debt and deficit without interest must be co-integrated.

Mendova and Oviedo (2004) proposed a model for the evaluation of fiscal sustainability in a state of "fiscal crisis", a state that reveals for a specific country a "natural debt limit". This framework models precisely the intention of the government to remain solvent, under three main assumptions: the government is extremely averse to suffering a collapse in its outlays; there is a non-zero probability of facing a fiscal crisis and the government is averse on default on its debt.

Mendova and Oviedo have demonstrated that in the presence of a shock fiscal policies considered sustainable on a canonical long-term based analysis would not satisfy the condition of solvency. This condition excludes a Ponzi scheme, where the debt is permanently renewed. Without this condition, the government can cut current taxes without modifying future expenses.

The intertemporal budget constraint

The formal condition of sustainability is based on the inter-temporal budget constraint: the public sector is solvable when the actualized value of future primary surpluses is equal to the current value of public debt. This means that the debt will tend to zero in the long term and the public sector can not be a net debtor in terms of actualized value. Solvability requires that at a certain moment in the future the primary balance will become positive.

The equations of the inter-temporal budget constraint are:

$$d_t = (1 + r_t - y_t)d_{t-1} - s_t$$

$$\Delta d_t = d_t - d_{t-1} = (r_t - y_t)d_{t-1} - s_t$$

where d represents the debt, r is the interest rate for the debt and y is the rate of economic growth, while s represents the primary surplus. The increase of the debt represents thus the difference between the debt of previous period adjusted with the rate of economic growth. In case that the interest rate r exceeds the growth rate of the economy y, the debt ratio will increase if budgetary surpluses are not enough to compensate for the increasing debt.

The intertemporal budget constraint represents the key to understanding debt sustainability. According to the intertemporal budget constraint, the current spending on goods and services and the cost of interest for the current debt should be equal to government revenues and the new issued debt.

$$G_t + (1 + i_t)B_{t-1} = T_t + B_t$$

where G_t represents the government spending, T_t refers to the tax revenues in period t, and B_t is the government debt contracted in period t.

We can note by g_t, τ_t, b_t the ratios of government spending for goods and services, tax revenues, and debt issuance to GDP in period t, respectively.

Thus we have the following equation

$$d_t + \frac{1 + i_t}{1 + y_t} b_{t-1} = b_t$$

where $d_t = g_t - \tau_t$ is the primary budget deficit ratio and y_t is the growth rate of GDP. According to this equation, the debt ratio increases if the government runs a deficit and, at the same time, the nominal interest rate exceeds nominal GDP growth.

In the long run governments cannot run Ponzi games, specifically governments can not pursue fiscal policies that use the issuance of new debt in order to finance old debt and to pay the interest for the already contracted debt.

The present discounted value of government debt, calculed all over the future periods, must be zero. Thus, the government intertemporal budget constraint becomes like in the following equation:

$$\sum_{t=1}^{\infty} \left(d_t \prod_{s=1}^{t} \frac{1 + y_s}{1 + i_s} \right) + b_0 = 0$$

where b_0 is the current debt ratio. This condition must be respected in order for fiscal policy to be sustainable. The idea of this equation is that the present discounted value of primary deficits plus the value of current debt must be zero. A conclusion that derives from this equation is that running substantial deficits over a long time is compatible with sustainability only with the condition that these deficits can be compensated for by sufficiently high future surpluses.

The fiscal policy sustainability is mainly correlated to the evolution of the rate public debt/GDP. A fiscal policy is considered sustainable when the level of public debt is finite.

Public debt sustainability

There is another interpretation of sustainable fiscal policy which takes into account the evolution of debt on the medium term. Sustainability is considered as a reduction of the debt to GDP ratio over a given time horizon towards a certain target ratio. This modality of interpreting

debt sustainability starts from the observation that governments that have high debt levels are less likely to respond to adverse shocks, as high debt servicing costs do not allows enough space for fiscal policy measures.

The budget constraint of the government can be expressed in the following manner:

$$\Delta b_{t+1} = b_{t+1} - b_t = (r - n)\, b_t + d_{t+1}$$

where r denotes the real interest rate and n is the real GDP growth rate. Thus, in order to reduce the public debt ratio, the primary surplus must be larger than debt servicing, which can be expressed as

$$-d_{t+1} \geq (r - n)\, b_t$$

According to this equation, the debt ratio will increase indefinitely if the real interest rate is bigger than the rate of GDP growth unless the primary budget is in sufficient surplus.

As far as the econometric analysis of fiscal sustainability is concerned, there are two approaches usually implemented. According to the first theory, it is examined whether the time series of public debt is nonstationary, that is whether the debt to GDP ratio has an increasing trend and exceeds future discounted surpluses. In case it is not found to be the case, the fiscal policy is considered sustainable.

Fiscal rules

The high budgetary deficits have contributed to a change in the discretion of the fiscal policy and the introduction of fiscal rules. During the last 15 years, EU states have resorted to fiscal rules, which were expressed either by numbers or an explicit target for fiscal variables.

The adoption of fiscal rules represents an efficient modality to assess the performance of a government in the respect of public expenditures and budgetary deficits. A fiscal rule makes it easy to assess the performance of a government. The arguments for restricting the discretion of fiscal policy rely on three types of adverse effects that government policies can produce: excessive deficits; increased variability and pro-cyclicality of the fiscal policy. The benefits that come from restricting the behavior of fiscal policy are related to a better fiscal discipline and a better coordination between monetary and fiscal policies.

The reaction of fiscal policy to economic fluctuations has to be counter-cyclical: during the boom periods budgetary surplus and during recessions deficits. In many situations, the fiscal policy is procyclical, which means that during a period of boom the expenditures grow faster than revenues. Due to the fact that the elasticity of expenditures with reference to economic activity is smaller than the elasticity of revenues, a growth of expenditures during expansion period will lead to excessive deficits during recessions.

The fiscal rules can be differentiated depending on the budgetary variable targeted and application. These rules establish limits for the fiscal deficit or for the public debt and they can also re-equilibrate the budget structure, and stop the increase of some categories of expenditure.

According to a survey of the Working Group on the Quality of Public Finances realized in 2006, around 2/5 of the fiscal rules in vigor in the EU member countries are budget balance rules, around 1/4 impose restrictions on borrowing and debt, 1/4 target expenditures, and 1/10 revenues. The results of this study show also that the majority of deficit and public debt rules apply to regional and local budgets. While most expenditure rules refer to central and social security budgets.

Fiscal rules can be applied both at national and supranational level. The fiscal rules for the EU member states are established within the Stability and Growth Pact.

There are several criteria used for analyzing the quality of fiscal rules in EU.

For instance, Kopits and Symansky (1998) consider that an ideal fiscal rule should be well-defined (clear, simple, transparent, consistent, and flexible), should allow its effective implementation (by incorporating ex ante and ex post enforcing mechanisms, and also, the opportunities for an efficient monitoring process), and should be enforceable (with respect to decision, amendment and sanctions).

These criteria were used in order to evaluate the quality of domestic fiscal rules, on a national plan. In order for these rules to be valid at supranational level, these rules should be altered taking into account the principle of national sovereignty. Fiscal rules should be as neutral as possible with reference to the heterogeneous social preferences of the countries.

Inman (1996) considers that an efficient fiscal rule should target ex post and not the ex ante deficit; should be impossible to be temporarily suspended or abrogated by simple majority of the parliament; should offer free access to the information to all interested parts, to indicate eventually slippages; and should provide substantial penalties.

To summarize information about the coverage and the strength of the numerical fiscal rules, Ayuso-i-Casals *et al.*, (2007) design a Fiscal Rule Index, comprising the following aspects:

- statutory basis of the rule: statutory or legal base of the rule, and room for setting or revising objectives;
- body in charge of monitoring respect of the rule;
- body in charge of enforcement of the rule,
- enforcement mechanism of the rule, and
- media visibility of the rule.

By replacing the information on the strength of individual fiscal rules by information on the properties of each fiscal rule with respect to stabilization, the authors obtain the Fiscal Rule Cyclicality Index.

Conclusion

The UE debt crisis and the necessity to stabilize the large fiscal imbalances and high budget deficits of countries which implemented fiscal package of measures have led to an extensive application of fiscal rules as an instrument to support fiscal discipline and sustainability of public finances. Fiscal rules are defined as permanently restrictions on fiscal policy by limiting the values of the budget parameters. These fiscal rules are designed to ensure greater fiscal responsibility and sustainability of public debt through fiscal discipline which will lead to an efficient public finances management.

Motivation for the creation of rules guiding EU member countries emerged from the belief that a single rule applicable across countries was necessary to establish a single currency that would promote long-term fiscal responsibility and sustainability; and short-term macroeconomic stabilization.

References

1. Ayuso-i-Casals J., Hernandez, D.G., Moulin, L. and Turrini, A. (2007) „Beyond the SGP – Features and effects of the EU nationallevel fiscal rules," in: Ayuso-i-Casals J., Deroose, S., Flores Gual, E. si Moulin, L. (*eds.*) „The role of fiscal rules and budgetary institutions in shaping budgetary outcomes," European Economy − Economic Papers 275, Bruxelles: Comisia Europeana
2. Blanchard (1990), "The Sustainability of Fiscal Policy in the United States" in "Sustainability of Public Debt", MIT Press, 2008, p. 15–49
3. Bohn, H. (1995), "The Sustainability of Budget Deficits in a Stochastic Economy," Journal of Money, Credit and Banking, , no. 27 (1), p. 257–271
4. Bohn, H. (1998), "The Behavior of U.S. Public Debt and Deficits", The Quarterly Journal of Economics, 1998, no. 113 (3), p. 949–963
5. Bohn, H. (2007), "Are stationarity and cointegration restrictions really necessary for the intertemporal budget constraint?", Journal of Monetary Economics, , no. 54 (7), p. 1837–1847
6. Hakkio, C. S., Rush, M. (1991) "Is the budget deficit "too large?", Economic Inquiry, no. 29, p. 429–445, doi:10.1111/j.1465-7295.1991.tb00837.x
7. Hamilton, J. D. and Flavin, M. (1986) "On the Limitations of Governemnt Borrowing: A Framework for Empirical Testing", American Economic Review, vol. 76, no. 4, september 1986
8. Inman, R.P. (1996) „Do balanced budget rules work? U.S. experience and possible lessons for the EMU," NBER Working paper 5838
9. Kopits, G., Symansky, S. (1998) „Fiscal policy rules," IMF Occasional paper 162
10. Oviedo, M., Mendoza, E. G., (2004), "Public Debt, Fiscal Solvency and Macroeconomic Uncertainty in Emerging Markets: The Tale of the Tormented Insurer", Meeting Papers no. 14, Society for Economic Dynamics
11. Trehan, B., Walsh, C. (1988) "Common trends, the government budget constraint, and revenue smoothing", Journal of Economic Dynamics and Control, no.12, p. 425–444
12. Trehan, B., Walsh, C. (1991) "Testing intertemporal budget constraints: theory and applications to U.S. Federal budget and current account deficits", Journal of Money, Credit and Banking, no. 23, p. 210–223
13. Wilcox, D. W. (1989) "The Sustainability of Government Deficits: Implications of the Present-Value Borrowing Constraint", Journal of Money, Credit and Banking, Blackwell Publishing, vol. 21(3), p. 291-306

ANALYSIS AND MODELING OF NYSE ARCA OIL & GAS STOCK INDEX RETURNS

Violeta DUȚĂ, PhD candidate,
Bucharest University of Economic Studies
violeta.bleguduta@gmail.com

Abstract: *Through this study we have analyzed and modeled the returns of the NYSE ARCA OIL & GAS stock exchange index (symbol XOI). This index, previously called the AMEX Oil Index, comprises 20 of the most important oil companies operating in the oil industry. For a better overview, we have presented the factors that influence the price of oil and the effects of lowering its price on oil companies and on the economy of oil exporting states. The study was conducted between August 1983 and April 2017 on a daily frequency of data. In trying to identify the most appropriate predictive model for 10 periods, we tested several ARIMA, ARCH and GARCH models. Based on the AIC criterion, we selected the ARMA (2,1) - GARCH (1,1) model, which we predicted for the next 10 periods, the series of returns and the conditional volatility of the studied index. Predicted conditional volatility indicates a slight increase for the 10 periods of time, while the predicted series of returns evolve downward. The study thus confirmed the theoretical hypothesis that increased volatility in stock markets occurs when price declines are recorded, the impact of negative news on stock markets being stronger than positive news.*

Keywords: *returns, volatility, Garch model, stock index, prediction*

JEL classification: C32, C53, Q43

1. Introduction

Volatility of the capital market is a permanent source of stress for participants in the capital markets. Holders of financial assets seek to protect themselves against risks by diversifying their portfolio (national and / or international) or through hedging operations (using equity-specific instruments such as futures, forward, options, etc.).

The diversity and complexity of traded financial instruments has led to a sharp rise in capital market volatility over the past 20 years (as evidenced by the evolution of S&P 500) as compared to macroeconomic volatility at least in the US and Europe declining, reduced than the one 50 years ago (Bookstaber, 2007).

Financial asset prices are constantly in the public attention, regardless of whether or not our daily activity is directly related to stock markets. Evolution of stock indices, foreign exchange rates, oil and gold prices, interest rates are reported daily in the press and television.

Price variations of these assets may have a special amplitude, both positive and negative. For example, the price of oil climbed to 147 USD / barrel in July 2008, reaching $ 32 / barrel in December of that year and then rising to $ 60 in October 2009.

Detailed knowledge of the peculiarities and correlations between the evolution and volatility of oil prices (and other raw materials), foreign exchange rates has an obvious practical utility for economic operators in various sectors, for investors in the financial markets (natural and legal persons), for fund managers (mutual, pension), insurance companies, etc.

Aizenman J. and B. Pinto (2005) published a Volatility and Crisis Management Guide, which includes studies on the macroeconomic volatility-economic growth relationship, exchange rate volatility, interest rate, etc.

Volatility of oil prices has become a permanent source of uncertainty in the capital markets and beyond. The attempt to predict the evolution of the oil price is difficult, because are many factors that influence it: the demand-supply ratio (which has seen major changes in recent years), oil stocks, refining capacity utilization rates, quotations on futures markets, monetary factors such as the interest rate and the exchange rate of the dollar, along with geopolitical factors and psychological factors.

In January 2015, oil price volatility peaked in the last five years. Increased oil production in the US (as a result of the use of hydraulic fracturing and horizontal drilling technology), OPEC Gambit in November 2014, additional production resulting from oil shale exploits in Canada, continued production in Iraq (in spite of political tensions) the recovery of production in Libya, coupled with the decline in world oil demand (China becoming the main importer of black gold) has led to a sharp depreciation of oil prices in 2015.

The price of oil is not only influenced by oil transactions but also by derivative transactions with underlying asset the price of oil (derived products introduced on the American market since 1983).

The speculators' orientation towards the commodity market has made it more volatile than the currency and capital markets, which is not normal

Decreasing oil prices has a positive impact on the economies of oil importing countries: China, Japan, India, Indonesia, Turkey, Ukraine etc.

The impact on Romania (according to the NBR estimates) is insignificant, of only 2.3% of GDP, thanks to the domestic production. But the reduction in oil prices has an influence on inflation in our country. The NBR estimated that a 10 percent drop in the Brent crude price would result in a fall in gasoline and diesel prices by 3.3 percent for a quarter from the fall.

The transmission is marginally asymmetric, meaning that an increase in the price of oil is transmitted more quickly and with an higher amplitude in the price of the pump than in the case of a decrease in the price. The indirect effect of this decline is that about 17% of the price change of fuels is transferred to the consumer goods production prices over a one-year horizon. The change in the production prices of consumer goods is transferred in the proportion of about 70% to the basic inflation over the same one-year horizon. Basically, the 10% crude price depreciation dropped 0.2 percentage points to the CPI inflation rate over a one-year horizon.

The impact has been negative on oil-exporting countries such as Venezuela, Nigeria, Angola, Iran, which have experienced serious problems as a result of lower oil prices.

These countries do not have large foreign exchange reserves (such as Norway, Canada, Persian Gulf countries, except Iraq and Iran) and are at risk of high inflation, depreciation of the national currency, increasing deficits and, in some cases, becoming insolvent.

We have witnessed bankruptcies among small oil companies, but also a widespread trend of mergers and acquisitions between different companies in an attempt to consolidate prosperity in the market. Thus, Halliburton acquired Baker Hughes (a smaller rival) for $ 34.6 billion. Shell bought British Gas (BG) for $ 70 billion. It was the largest transaction in the oil industry over the past ten years, with the new company surpassing Chevron as market value. MOL Group also bought ENI Romania, including a number of 42 gas stations that are now operating under the MOL name.

The visible effects of lower oil prices are:

- rapid appreciation of USD and depreciation of currency from emerging economies (those dependent on raw material exports);
- the decline in oil-related financial assets (the possibility that some industrial operators will fail, with negative influences on the stability of credit banks and the spread of a chain reaction on the credit market and possible expansion in other sectors).
- growing the preoccupations of exporting countries to get rid of oil dependence. An example is Saudi Arabia, the world's largest oil producer, which in 2015 recorded a record budget deficit of 98 billion dollars, about 20 percent of GDP, the effect of oil price declines in recent years. As a result, Saudi Arabia has decided to list, in 2018, an 5% of Aramco Saudi, the largest oil company in the world, with reserves of about 265 billion barrels, accounting for 15% of world oil deposits. At a $1,000 billion Aramco rating, the 5% of the company would bring Saudi Arabia $ 50 billion.

Starting in 2016, we witnessed oil price rises, with the upward trend continuing until now. This is reflected in the agreement between OPEC member states to reduce oil supplies (which other countries like Russia have joined), the Iranian population protests (the world's third world oil producer in OPEC), the stagnation of operating activity in USA, etc

Volatility of financial assets is a variable that is constantly pursued by stock market participants. For example, in US markets we have volatility indices for commodities such as: NYMEX Crude Oil (WTI) Futures Index (CVF) for oil, COMEX Gold Volatility Index Futures (GVF) for gold, etc.

The paper is organized in four main areas: review of scientific literature, research data and methodology, results and conclusions of the study.

2. Literature review

Analyzing and forecasting the evolution of stock indices has been the subject of numerous previous analyzes, testing emerging and developed stock indices over different periods of time for different data frequencies and using various study models.

The ARMA model was proposed by Box and Jenkins (1976) and was used to study the volatility of financial assets. It was based on the hypothesis (proven later to be erroneous) that the price series of financial assets have a constant variance.

Bollerslev (1986) using ARMA and EGARCH models to study the American stock market.

Agray (1989) tested ARCH, EMWA and GARCH (1,1) to identify what are the time series properties for the expected earnings rate of US assets. The study revealed that GARCH (1.1) is the winning model.

The conclusion that the volatility of the S & P 500 index is more pronounced in times of recession as compared to expansion is the result of the study by Sill (1993).

Hansen and Lunde (2004) showed that a model Garch (1.1), which uses three parameters in the conditional variance equation, is sufficient for modeling the financial time series.

Franses and Djik (1998) made volatility predictions by applying different models such as Random Walk, GARCH (1.1), QGARCH (1.1) and GJR-GARCH (1.1) for stock indices in different countries : Germany, Italy, the Netherlands, Spain and Sweden.

Count (2001) surprised the "stylized properties" of the financial time series, such as the leptocurtotic character, the volatility clustering effect, the leverage effect, the fat tails, etc.

The GARCH-M model was tested by Pyun and Aruza (2002) for US stock indices (1926-1997).

The series of studies was continued by Harq et al. (2004). For 10 markets in Africa and the Middle East, they tested the Random Walk, ARMA and GARCh-M

The persistence of volatility on the Portuguese capital market (using the PSI20 index) was conducted by Caido (2004). The analysis revealed that the mean reverting is recorded for low frequencies (daily), but not for high frequencies.

Chang's analysis (2006) also came up with the same result. The leverage effect (the effect that news has on volatility) was first observed by Black (1976). He found that the impact of negative news on volatility is much higher than the positive ones.

Zhou (2009) concluded that the ARMA (0.2) -APARCH (1.1) model used to predict the evolution for the next 10 periods of conditional volatility of the US index S & P500 was better than ARMA (0.2) - GARCH (1.1).

Beckers and Strom (2014) made predictions over time for the Brent oil price using the Random Walk and VAR models. For short periods of time (12-24 months) and for increased volatility periods (starting in 2008), the most successful model proved to be the VAR model.

Effendi (2015) conducted an analysis of the most performing ARCH / GARCH models for the JKSE (Jakarta Composite Index) and stock indices from developed countries such as Nasdaq, FTSE and STI. The conclusion of the study was that the GARCH model (1.1) was most appropriate for the NASDAQ index.

We will continue the series of these studies, with that of the NYSE Arca Oil & Gas oil index over an extended period of time (August 1983 - April 2017). We will compare its evolution with the price of WTI oil and we will seek to highlight the causal relationship between these two variables.

3 Data and methodology of research

Formerly called the AMEX Oil Index, this index traded at NYSE, has 20 major oil companies.

The index, which measures the performance of the oil industry, was launched on August 27, 1984, with a benchmark of 125 points.

The index is calculated and maintained by NYSE Arca, which can change its component so that it reflects as accurately as possible the real situation of the oil industry and its component to find representative companies in this industry.

Table 1 - Oil companies included in the Arca Oil & Gas index

	Symbol	Company Name
1	CVX	Chevron Corporation

2	PBR	Petróleo Brasileiro S.A. – Petrobras
3	PTR	PetroChina Company Limited
4	OXY	Occidental Petroleum Corporation
5	STO	Statoil ASA
6	BP	BP p.l.c.
7	SU	Suncor Energy Inc.
8	MRO	Marathon Oil Corporation
9	MPC	Marathon Petroleum Corporation
10	COP	ConocoPhillips
11	RDS/A	RDS/A
12	NBL	Noble Energy, Inc.
13	HES	Hess Corporation
14	XOM	Exxon Mobil Corporation
15	TOT	TOTAL S.A.
16	APC	Anadarko Petroleum Corporation
17	EC	Ecopetrol S.A.
18	PSX	Phillips 66
19	VLO	Valero Energy Corporation
20	EOG	EOG Resources, Inc.

Source: Yahoo Finance

For the purpose of this study, we used daily data for the period August 26, 1986 to April 19, 2017. The daily data series was collected from www.yahoofinance.com. In order to get a first picture of NYSE Arca Oil & Gas (symbol XOI) stock index, we switched to the graphical representation of its daily data series parallel to West Texas Intermediate (symbol WTI).

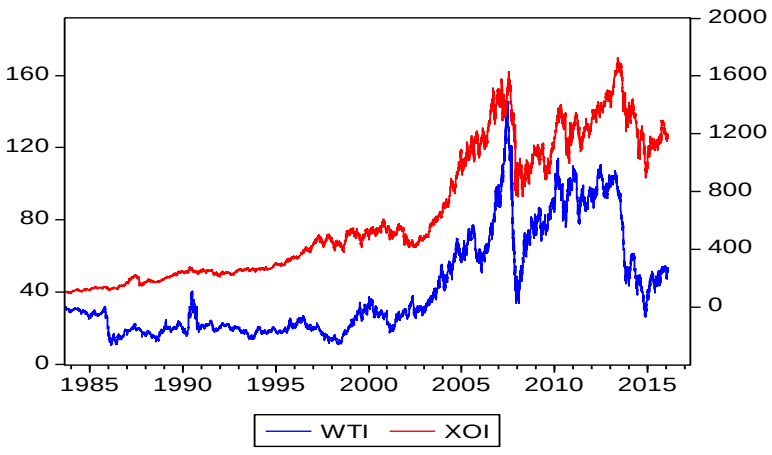


Figure 1 - Graphs of NYSE Arca Oil & Gas Index and West Texas Intermediate

Analyzing the XOI time series, it can be seen that it deviates significantly from the stationary property. The trend was upward until 2008 when obvious turmoil due to the financial crisis. After the extremely steep decline registered in 2008, the ^ XOI series returned to growth (2009-2013). In 2014, we witnessed sharp declines in the quote, but the situation recovered in 2016, and growth continuing until today.

After the graphical analysis, we also carried out a simple, descriptive statistical analysis of the initial data sample (Table 2). The statistical and econometric analysis program R allows such an analysis through the command "basicStats (XOI [, 5])".

Table no. 2 - Descriptive statistics for the initial data series

	^XOI
Nr obs.	8483
Mean	642.6897
Median	484.5800
Maximum	1726.2200
Minimum	94.92000
Std. Dev.	457.3986
Skewness	0.565685
Kurtosis	-1.147608
Jarque-Bera	918.0070
Probability	0.000000

Author's calculations

It can be seen that the NYSE Arca Oil & Gas data series is not normally distributed (Table 2). Normal distribution is characterized by Skewness = 0 and Kurtosis = 3. In our case, the average ($ 642.6897) does not coincide with the median ($ 484.58), the series being asymmetric to the left and having a negative kurtosis (k=-1.147608), indicating a more flattened distribution (platikurtotica) than a normal distribution.

Generally, in the case of real financial asset prices, kurtosis usually has values> 3, that is, a leptocurtotic distribution. Because we noticed that the price series is non-standard, it was necessary to stationarized the data before continuing the study.

The most efficient and simple way to stationarized time series of stock data is to apply the first order difference, in our case passed from price analysis to return analysis.

When we talk about returns, we can consider the calculated returns as the percentage difference between the current price and the previous price, but we can also discuss the compound compound returns, in which case we use the natural logarithm.

$$r_t = \ln(1 + R_t) = \ln \frac{P_t}{P_{t-1}} = \ln(P_t) - \ln(P_{t-1})$$

We continued to work with returns and that is why we switched to differentiating the XOI data series, obtaining the DXOI series of returns.

For a better image, we did the same thing with the WTI series (DXOI). The return series for the two financial assets are presented in the following picture (Figure 2).

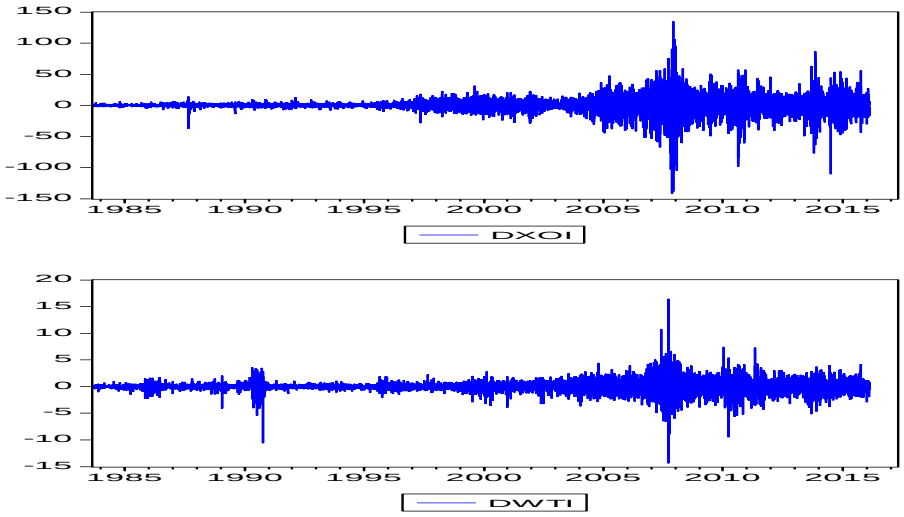


Figure 2 - Graphic representation of the Nyse Arca Oil & Gaz index and West Texas Intermediate

In order to better know the series of data obtained by logarithm and differentiation we again called the descriptive statistics of the series, applying the following code in the program R: basicStats(lXOI).

The result is presented below and indicates the main statistical properties of the new time series obtained by differentiation and logarithm.

Table no. 3 - Descriptive statistics for the return series

	^XOI
Nr obs.	8482
Mean	0.000279
Median	0.000444
Maximum	0.154457
Minimum	-0.225771
Std. Dev.	0.014258
Skewness	-0.742205
Kurtosis	17.696261
Jarque-Bera	119128.6
Probability	0.000000

Author's calculations

It can be noticed that this time the data series is not normally distributed. The kurtosis value is positive and is greater than 3, indicating a leptokurtotic distribution, specific to the real data series of financial assets (Table 3).

On the series of returns we apply the statistical test t to test whether the average of the sample is statistically significantly different from zero. The results of the t test (p-value 0.07121) cause us to accept the null hypothesis that the mean is zero.

This finding confirms the results of previous studies conducted by different authors on different types of stock markets, according to which, for high frequencies (intraday or daily data), the series of returns are very close to zero.

3.1 Testing for ARCH effects

Studying and forecasting volatility (volatility perceived as a source of risk by investors) has always been a research topic for researchers. The first model to estimate the volatility of financial assets was the ARMA model proposed by Box and Jenkins (1976).

The model was based on the hypothesis (proven later to be erroneous) that the price series of financial assets have a constant variance. The model was not able to capture certain peculiarities of the financial time series such as leptocurtotic character, volatility clustering, fat tails, leverage, etc.

In order to solve this limitation, Engle (1982, pp. 987-1008) proposed the Autoregressive Conditional Heteroscedasticity Model (ARCH), the model in which the variance depends on the previous squared error series, at its base being the empirical observations of the change in time of the volatility and its dependence on the previous values. In building an ARCH model are used two equations:

- first for conditioned media, the equation of evolution of the return of the financial asset
- the second for the conditioned variance, the volatility equation.

The limitation of this model was given by the weight of the estimation of its coefficients. Bollerslev (1986, pp. 307-327) improved the previous model, proposing the GARCH (p, q) model (Generalized Autoregressive Conditional Heteroscedasticity):

$$r_t = \beta_0 + \sum_{i=1}^{m} \beta_{1,i} L^i r_t + \sum_{j=1}^{n} \beta_{2,j} L^j \varepsilon_t + \varepsilon_t$$

$$h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1,i} L^i h_t + \sum_{j=1}^{q} \alpha_{2,j} L^j \varepsilon_t^2$$

In previous equations, rt (the individual asset yield) describes an ARMA process (m, n) while ht (volatility) is a process of ARCH (q) and GARCH (p). The condition to be met by the parameters of the ht equation, for the process to be covariant stationary is:

$$\sum_{i=1}^{p} \alpha_{1,i} + \sum_{j=1}^{q} \alpha_{2,i} < 1$$

Based on this model, it is attempted to predict the volatility of the next period, based on the long-term average of the variance, based on the previous variance (represented by the term GARCH) and the volatility observed in the previous period (expressed by the term ARCH).

The sum of the ARCH and GARCH coefficients (α1 + α2) represents the persistence of conditioned volatility. The terms ARCH and GARCH must be subunitary and positive.

When the sum of these coefficients is greater than 1, we are dealing with an explosive process that can be modeled using the IGARCH model. Next, I will test the existence of heteroskedasticity (ARCH terms). For this we will test the autocorrelation of the square errors of the regression equation.

The existence of this autocorrelation of square errors will indicate the presence of ARCH terms. The results of the test (p-value = 6.786e-08) lead us to reject the zero hypothesis, that of the inexistence of the data correlation. In conclusion, we have autocorrelation of the square errors until lag 20.

The existence of ARCH terms has been tested with the help of autocorrelation and partial autocorrelation functions, their grouped graphic representation being presented below

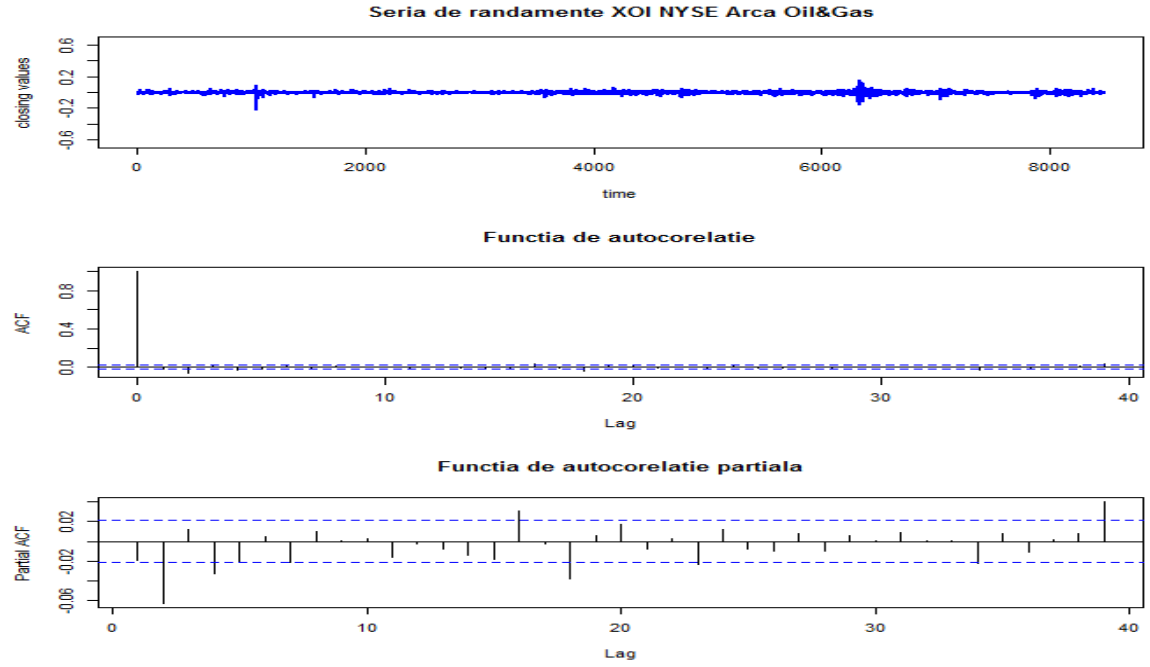


Figure 3 - Graphic representation of return series, autocorrelation function (AC) and partial autocorrelation (PAC) for the XOI index

From the graphical representation of the autocorrelation function, we can observe the presence of ARCH terms. From the same representation we can see that the data series values are autocorrelated to lag 20 and as such we will introduce an ARMA term to explain the autocorrelation on the linear side of the model.

We will still use a model that will contain an ARMA term. The code used in the R program for this operation is the following: m1=arima(lXOI,seasonal=list(order=c(0,0,1), period=5), include.mean=F). I extracted the residues from the above equation, m1, using the Box.test () test for square errors. "at =m1$residuals, Box.test(at^2,lag=12,type='Ljung')". The test results (p-value = 0.004385) presented above lead us to reject the zero hypothesis (H0: there is no autocorrelation up to lag 20). In conclusion, the square errors are autocorrelated to lag 20.

4. Results and interpretations

4.1. Determining the size order for the ARCH process

We then tested several ARCH, GARCH (with different lags) to be able to select the most appropriate.

The selection was made according to several criteria:

• the lowest information criterion (AIC)

• error values,

• the significance of the coefficients from a statistical point of view,

• fulfilling the condition that the process is stationary in the covariance.

It is necessary that the sum of the coefficients be subunit so that the process returns to the average, to be mean reverting. Otherwise, the data series is explosive and could not be modeled by GARCH models, but by IGARCH models. If the sum of the two coefficients is very close to 1, it means that the processes that generate these series return very slowly to the long-term mean.

To estimate the AR and MA process, we ran several autoregressive moving average (ARIMA) models, univariate models by which the dependent variable is modeled according to its own observations. For each model I used the stationary initial series. ARMA models were compared using the AIC information criterion. The results of model testing are synthesized below (Table 4).

Table 4 - Models tested and value of the AIC informational criterion

model 1	ARMA (0,5)	GARCH(1,1)	Distrib "std"	AIC - 6.065236
model 2	ARMA(1,1)	GARCH(1,1)	Distrib "std"	AIC - 6.065150
model 3	ARMA(1,1)	GARCH(1,1)	Distrib "sstd"	AIC - 6.065383
model 4	ARMA(1,2)	GARCH(1,1)	Distrib "std"	AIC - 6.065878
model 5	ARMA(1,2)	GARCH(1,1)	Distrib "sstd"	AIC - 6.066004
model 6	ARMA(2,1)	GARCH(1,1)	Distrib "std"	AIC - 6.065869
model 7	ARMA(2,1)	GARCH(1,1)	Distrib "sstd"	AIC – 6.066087
model 8	ARMA(0,2)	GARCH(1,1)	Distrib "std"	AIC – 6.064819
model 9	ARMA(0,2)	GARCH(1,1)	Distrib "sstd"	AIC – 6.064901
model 10	ARMA(0,2)	GARCH(2,1)	Distrib "std"	AIC - 6.064545
model 11	ARMA(0,2)	GARCH(2,1)	Distrib "sstd"	AIC - 6.064627
model 12	ARMA(0,1)	GARCH(1,1)	Distrib "std"	AIC - 6.064712

Author's calculations

4.2. Selection of the best model

Based on the above-mentioned selection criteria and the Akaike Informational Criteria with the lowest value (-6.066087), the ARMA (2.1) was the most advanced model.

This model combines both autoregressive lags of the dependent variable and the average mobile process error.

The ARMA model (2, 1) indicates that the present price of the XOI is due to the evolution of the previous days (day 1 and 2), but also to the shocks of the day 1.

Thus, the current price of XOI according to the ARMA process is influenced positively by the price of one day ago and in the negative sense of the price of 2 days ago, while the shocks of the previous day (day 1) have a negative impact on it (Table 5).

Table 5 Estimation of the ARMA Model (2,1) - GARCH (1,1)

Coefficients	*Value (p-value)*
mu	*5.607e-05 (0.07712)*
ar1	*9.024e-01 (< 2e-16)*
ar2	*-3.790e-02 (0.00124)*
ma1	*-8.837e-01 (< 2e-16)*
omega	*1.226e-06 (7.5e-06)*
alpha1	*6.115e-02 (< 2e-16)*
beta1	*9.331e-01 (< 2e-16)*
skew	*9.701e-01 (< 2e-16)*
shape	*7.279e+00 (< 2e-16)*

Author's calculations

From the previous table we can see that the two coefficients of the equation for the variant are positive and subunitary.

The sum of the coefficients is subunit (0.994247) but very close to 1, which means that the process returns very slowly to the long-term mean.

Statistical analysis of coefficients largely validates this model, most of which are statistically significant (at a 1% specification level), with the exception of the MU which is statistically significant at a specification level of 10%.

In order to see if the selected model is correctly specified, we will pass the standardized residue analysis**.**

4.3. Analysis of the ARMA (2.1) -GARCH (1.1) selected model errors.

If the model is correctly specified, standardized residues should no longer have serial correlation, conditional heteroskedasticity or any other non-linear dependence.

From testing the selected model, the information summarized in the following table was obtained (Table 6).

Table 6 Standardized residue analysis of ARMA (2,1) -GARCH (1,1)

Log Likelihood		25735.28
Jarque-Bera Test		*10814.49 (0)*
Ljung-Box Test	*R Q(10)*	*12.01626 (0.2839698)*
Ljung-Box Test	*R Q(15)*	*16.78606 0.331814*
Ljung-Box Test	*R Q(20)*	*23.46582 (0.2665046)*
Ljung-Box Test	*R^2 Q(10)*	*9.052129 (0.5271636)*
Ljung-Box Test	*R^2 Q(15)*	*11.01068 (0.7518366)*
Ljung-Box Test	*R^2 Q(20)*	*16.82529 (0.6642872)*
LM Arch Test		*10.31135 (0.5886661)*

Author's calculations

For a better image, we estimated the ACF and PACF functions of standardized residuals of the model and applied the Q test (Ljung-Box test) to investigate the existence of the serial correlation in residues. It can be noticed that they are no longer correlated starting with the second lag (Figure 4).

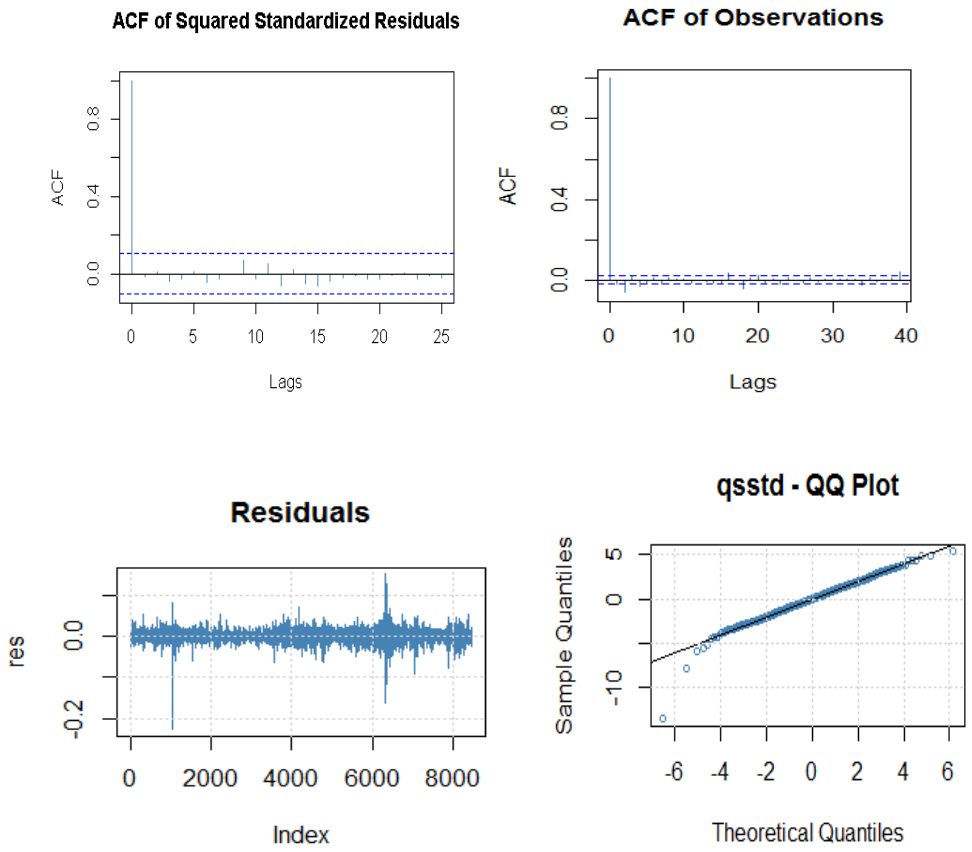


Figure 4. The graphical representation of the residue series, of the autocorrelation function for the standard yield and standardized quaternary residue and the quantitative

With LM Arch Test, we tested the existence of other ARCH effects that were likely to remain in the residuals.

A correctly specified pattern should remove these effects from the residuals series. The LM Arch Test result (Table 5) indicates a p-value of 0.5886661, which determines us to accept the zero hypothesis, that of the absence of ARCH effects in standardized residuals.

The graph with the ACF representation for standardized residuals comes to confirm the same thing we do not have ARCH effects in residuals.

The Jarque-Bera test presented in the model (table 6) has a p-value 0 indicating that model residuals are not yet distributed normally.

Applying the Q test (Ljung Box test) we tested the presence of the linear correlation in the square residuals of the model. The test results indicate a p-value = 0.5887, which shows that there is no autocorrelation in the squared residuals up to lag 20. Also, it can be noticed that the residuals do not show partial autocorrelation (Figure 5).

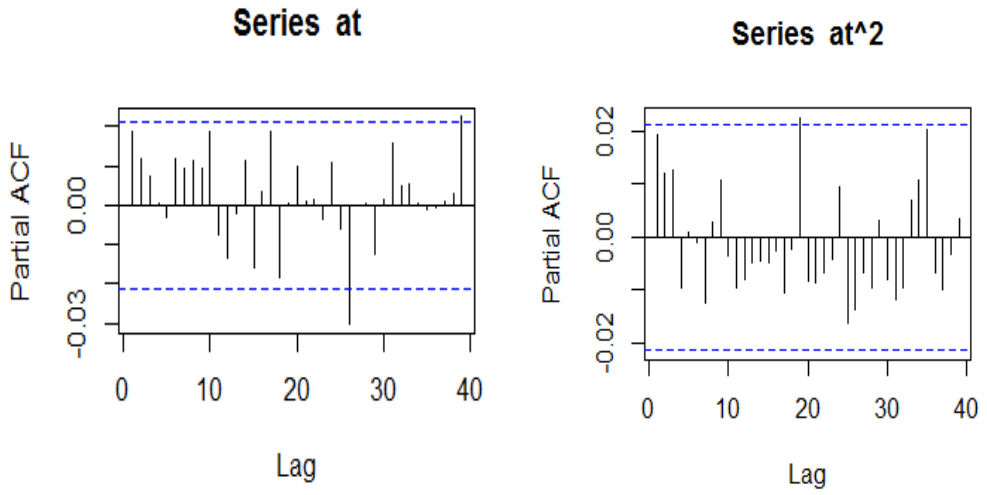


Figure 5. Graphic representation of the partial autocorrelation function for standardized residuals and standardized squared residuals of the model

Finding that all conditions are met, we can conclude that the ARMA (2.1) -GARCH (1.1) model is the correct one (the only reserve being the statistical significance of the mu coefficient). We will continue with predicting mean and conditional volatility over the next period using this model.

4.4. Perform the prediction using the selected model

Based on the daily stationary data and the most appropriate model, in our case m8, ARMA (2.1) -GARCH (1.1) we will make the prediction for the next 10 days.

Table 7 - Forecast for the next 10 periods of yields and volatility adjusted using the ARMA (2.1) -GARCH (1.1)

	MeanForecast	MeanError	Standard Deviation
1	0.000565921	0.01014788	0.010148
2	0.001167423	0.01018081	0.010179
3	0.001088069	0.01021394	0.01021
4	0.000993664	0.01024639	0.010241
5	0.000911484	0.01027824	0.010271
6	0.000840905	0.01030955	0.010301
7	0.000780331	0.01034038	0.010331
8	0.000728345	0.01037077	0.01036
9	0.00068373	0.01040076	0.01039
10	0.000645442	0.01043039	0.010419

Author's calculations

Media prediction is represented by the first column, while the volatility of this series is represented by the third column (standard deviation of the XOI data series). From the previous table, it can be seen that the predicted volatility for the next 10 periods is growing slightly.

The conclusion of the empirical observations was that financial market actors perceive volatility differently, depending on the daily fluctuation of stock prices (decline or growth). It has been noticed that volatility increases when stock prices decrease and remain low when trading prices increase.

5. Conclusions

We can conclude that the NYSE Arca Oil & Gas returns series follows an ARMA process (2.1) and that GARCH (1.1) is the most appropriate model for volatility modeling. So we used ARMA (2.1) -GARCH (1.1) model to estimate returns and volatility for the next 10 periods. The study found that future conditional volatility increased slightly amid a downward trend in the NYSE Arca Oil & Gas index. The time series included in the study was fairly long, from August 1983 to April 2017, the stock index being analyzed through periods of stability or slight growth (1983-2004), periods when the trend was much more pronounced (starting with the year 2004) and culminated in 2008 when the highest volatility was recorded for both the studied index and the WTI oil price. The WTI oil price influences the profitability of the component companies of this index (Figure 1). For both financial assets, volatility was maintained in the post-crisis period. The situation has improved since 2016, with the upward trend still being maintained. It would be recommended that the study be resumed over more recent periods using other models and frequencies of the time series to reflect as accurately as possible current market trends, all of which are to be a useful tool for investors in the process of substantiating the investment strategy.

6. References

1. Black, F., (1976). Studies in stock price volatility changes, Proceedings of the 1976 business meeting of the business and economics statistics section. American Statistical Association, pp.177-181.

2. Bollerslev, T., (1986). Generalized autoregressive conditional heteroskedasticity. Journal of Econometrics, **31(3),** pp.307-327.

3. Bollerslev, T., (1987). A conditional heteroskedastic time series model for speculative prices and rates of return. The Review of Economics and Statistics, **69(3),** pp.542–547.

4. Ding, Z., Engle, R.F., & Granger, C.W.J., (1993). A long memory property of stock market returns and a new model. Journal of Empirical Finance, **1,** pp.83-106.

5. Engle, R.F. (2001). GARCH 101: The use of ARCH/GARCH model in applied economics. Journal of Economic Perspectives, **15(4),** pp.157-168.

6. Fama, E.F., (1965). *The behaviour of stock market prices*, Journal of Business, 38, pp. 34 – 105.

7. Hamilton, J.D., (1994). Time Series Analysis, Princeton University Press, Princeton, New Jersey.

8. Hannan, E. J., (1980). The estimation of the order of an ARMA process. The Annals of Statistics, **8(5),** pp.1071-1081.

9. Ljung, G.M., Box, G. E. P., (1978). On a Measure of a Lack of Fit in Time Series Models. Biometrika, **65**, pp. 297-303.

10. Lambert, P., Laurent, S., (2001). Modelling financial time series using GARCH-type models and a skewed student density. Mimeo, Universite de Liege.

11. Laurent, S., Lambert, P., (2002). A tutorial for GARCH 2.3, a complete Ox package for estimating and forecasting ARCH models. GARCH 2.3 Tutorial, pp. 71.

12. Lupu, R., Lupu, I., (2007). *Testing for Heteroscedasticity on the Bucharest Stock Exchange*, The Romanian Economic Journal, **23**, pp. 19-28.

13. Taylor, S.J., (1986). Modeling financial time series, New York: John Wiley & son.

14. Zivot, E., Practical Issues in the Analysis of Univariate GARCH Models, Department of Economics, University of Washington, No UWEC-2008-03-FC, Working Papers from University of Washington, Department of Economics.

15. www.yahoo.finance.com

SHORT-TERM CHANGES IN WAGE DISTRIBUTION AFTER MINIMUM WAGE INCREASES IN ROMANIA

Madalina Ecaterina POPESCU, PhD
National Scientific Research Institute for Labour and Social Protection,
The Bucharest University of Economic Studies,
madalina.andreica@gmail.com

Eva MILITARU, PhD
National Scientific Research Institute for Labour and Social Protection,
militaru@incsmps.ro

Abstract

In this paper we focus on identifying the short-term changes of the net wage distribution in terms of gender inequalities. The case of Romania is discussed for the year 2014, using quarterly data. The AMIGO database with observable data at individual level is used. The period chosen for investigation corresponds to a time when the minimum wage registered two successive increases. Since the minimum wage policy is generally assumed to have several implications on the national wage distribution, the analysis will investigate the short-term quarterly dynamic of the wage distribution based on both individuals' social-demographic and economic characteristics. Our findings suggest that male employees are better represented than females in the higher wage deciles. Slight decreases among employees living in urban areas as compared to those living in rural areas were notices during 2014, as well as among the graduates of tertiary education. Moreover, a short-term decreasing tendency of the adult employed population (25-44 years) was noticed in favour of those ageing between 45-64 years, while the share of the elderly (over 65 years old) did not register any changes during the whole year 2014.

Keywords: *wage distribution, minimum wage, micro-datasets, socio-demographic factors, economic factors*

JEL Classification: J31, C81

1. Introduction

In this paper we aim to identify the most relevant changes in wage distribution in terms of gender inequalities. The case of Romania is discussed for the year 2014, using quarterly data. The AMIGO database with observable data at individual level is used. The choice of the year 2014 was based on data availability reasons and corresponds to a certain period of time which was intensively affected by two successive minimum wage adjustments. In 2014, the minimum wage registered the following changes: the first one occurred in January 2014 when the gross minimum wage rate increased from 800 to 850 lei, followed by a second increase in July 2014 up to the level of 900 lei.

Since the minimum wage policy is generally assumed to have several implications on the national wage distribution, the analysis will investigate the short-term quarterly dynamic of the wage distribution based on both individuals' social-demographic and economic characteristics.

Quantifying the net impact of minimum wage upon Romanian wage inequalities can only be conducted if proper microdata are used and microsimulation techniques are applied rigorously. Since

the AMIIGO database does not provide information on individuals' net wage but only the association with the corresponding decile in the wage distribution, the current paper will focus explicitly on studying wage inequalities and their short-term dynamic under the two successive adjustments of the minimum wage rate.

The literature review on the topic of wage inequalities is quite vast at international level (see, among others, Hosmer et al., 2013; Fournier and Koske, 2012; Tansel and Bircan, 2011; Buchinsky, 2001; Pereira and Martins, 2000). However, it is less generous at national level. For the case of Romania, some studies have focused on identifying the main determinants of wages (Andreica et al., 2010; Vasilescu, et al. 2010; Militaru et al., 2011), while others on wage inequalities between the public and the private sectors (Voinea and Mihăilescu, 2011). Identifying the main determinants of wage inequalities and wage distribution is of extreme importance, as it provides support to policy makers in order to reduce wage inequalities.

This paper is organized as follows: Section 2 briefly presents the data used in this study, Section 3 describes the main findings of the analysis, while the last section concludes.

2. Data description

In this study we analysed the changes registered in wage inequalities, using the AMIGO database that provides survey micro-data for the period Q1 2014 - Q4 2014. The chosen period corresponds to a time when the minimum wage registered two successive increases in Romania. Since the minimum wage policy is generally assumed to have several implications on the national wage distribution, the analysis focused on the short term quarterly dynamic registered during 2014.

The AMIGO database consists of a national representative survey micro-data that is collected on quarterly bases. Our analysis only focused on employed persons, having the following sample sizes for the period Q1 2014 - Q4 2014: 15372 individuals for Q1, 15631 for Q2, 15718 for Q3 and 15523 individuals for Q4 2014. Individual information regarding professional status, occupation, work, main and secondary activity and hours worked were available.

The following information at individual level was considered in our analysis structured as categorical variables:

Table 1. The types of information at individual level

Types of information	**Individual characteristics**	**Sub-categories**
Socio-demographic characteristics	**Age**	*age15-24, age25_44, age45_64, age 65+*
	Residence area	*Urban* and *Rural*
	Levels of education	*ISCED 0* for no education, *ISCED 1-2* for primary or lower secondary education level, *ISCED 3-4* for secondary or non-tertiary secondary education level and *ISCED 5-8* for higher education level
	Gender	*Male* and *Female*
Economic variables	**Economic sectors**	*Industry, Constructions, Agriculture, Private services, Public services* and *Other sectors*
	Major occupations	*GM0, GM1, GM2, GM3, GM4, GM5, GM6, GM7, GM8* and *GM9*

Source: authors own computations using AMIGO database

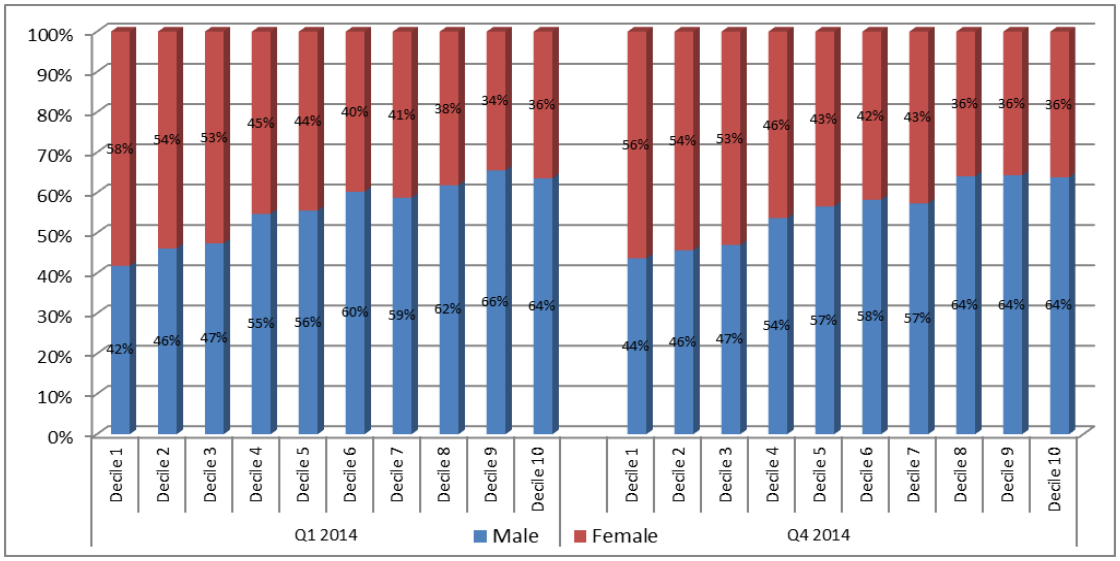
Some data transformation was required in order to group the initial economic sectors intro the following 6 sectors: *Industry*, *Constructions*, *Agriculture*, *Private services* (by grouping (G) Wholesale and retail trade; repair of motor vehicles and motorcycles, (H) Transportation and storage, (I) Accommodation and food service activities, (J) Information and communication, (K) Financial and insurance activities, (L) Real estate activities, (M) Professional, scientific and technical activities, (N) Administrative and support service activities), *Public services* (by grouping (O) Public administration and defence; compulsory social security, (P) Education, (Q) Human health and social work activities, as well as (R) Arts, entertainment and recreation), and *Other sectors* (including (S)Other service activities, (T) Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use, as well as (U) Activities of extraterritorial organisations and bodies).

Finally, although the information regarding individuals' occupation was available in the database at 3 digits codes, for the current study's purpose we only considered in the analysis the main major groups of occupations (1 digit).

3. Main findings

As shown in figure 1, male employees are better represented than females in the higher wage deciles. This trend is sustained throughout the four quarters of 2014, being actually notable starting with the 4th decile. For example, for the first quarter of 2014 the proportion of male employees in the 4th decile exceeded the female employees share by 10 percentage points, while the discrepancies continued to widen over the last 6 deciles, reaching a 28 percentage points difference in the last decile. In addition, it is noted that the employed women are best represented in the first decile, where the female share was higher by about 16 percentage points than the male share in the first quarter and slightly decreased in the last quarter to only 12 percentage points

Overall, during the year 2014, the share of male employees in the upper deciles followed a slightly decreasing trend, while females' representativeness in the 4th -9th deciles experienced modest improvements.



Source: authors own calculations using AMIGO database

Fig. 1 Gender distribution of net wages

In order to better explain the level of wage inequalities in Romania over the period under review the analysis was extended upon the main socio-economic determinants of gender gap. The summary of the results is presented in Table 2.

Concerning the average wage gap between men and women over the four quarters, we report that women employed are at a distance of a decile from male employees, fluctuations occurring at an average level, especially between the 5th and 6th decile of the net wage distribution.

Regarding the residence area, although both men and women have predominantly urban residence, the share of women employed in the urban area exceeds on average by about 7 percentage points the proportion of men.

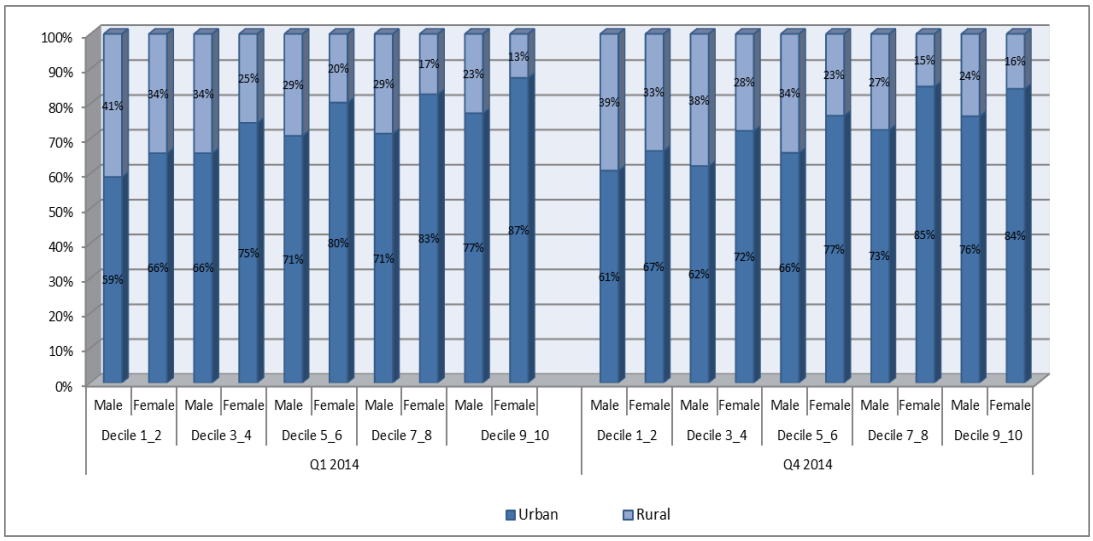
Table 2. Gender differences in net wage distribution and main socio-economic characteristics on Q1 2014 - Q4 2014

	Q1 2014		**Q2 2014**		**Q3 2014**		**Q4 2014**	
Variables	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Net wage average decile	5.70	4.84	5.86	4.76	5.76	4.99	5.75	4.92
Urban	0.69	0.76	0.69	0.75	0.68	0.75	0.68	0.76
Rural	0.31	0.24	0.31	0.25	0.32	0.25	0.32	0.24
age15_24	0.05	0.04	0.04	0.04	0.05	0.04	0.05	0.04
age25_44	0.51	0.55	0.50	0.56	0.50	0.54	0.49	0.54
age45_64	0.44	0.40	0.45	0.40	0.45	0.41	0.46	0.42
age65plus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EDUC0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EDUC1	0.10	0.08	0.12	0.09	0.11	0.09	0.11	0.08
EDUC2	0.69	0.65	0.68	0.63	0.69	0.65	0.70	0.66
EDUC3	0.21	0.27	0.20	0.28	0.20	0.27	0.20	0.26
Industry	0.35	0.30	0.35	0.30	0.35	0.30	0.35	0.30
Construction	0.12	0.02	0.13	0.02	0.14	0.02	0.13	0.02
Private services	0.34	0.38	0.34	0.38	0.34	0.39	0.34	0.38
Public services	0.14	0.29	0.13	0.29	0.13	0.28	0.13	0.28
Agriculture	0.04	0.01	0.05	0.01	0.05	0.02	0.05	0.02
Other sectors	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
GM0	0.02	0.00	0.02	0.00	0.01	0.00	0.02	0.00
GM1	0.02	0.02	0.02	0.01	0.02	0.01	0.02	0.01
GM2	0.14	0.23	0.14	0.24	0.14	0.24	0.14	0.24
GM3	0.07	0.10	0.07	0.10	0.07	0.11	0.07	0.10
GM4	0.04	0.10	0.04	0.09	0.04	0.09	0.04	0.09
GM5	0.12	0.27	0.12	0.26	0.12	0.26	0.12	0.26
GM6	0.01	0.00	0.02	0.01	0.01	0.01	0.01	0.01
GM7	0.29	0.12	0.29	0.12	0.30	0.12	0.30	0.12
GM8	0.21	0.09	0.21	0.09	0.21	0.09	0.21	0.09
GM9	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08

Source: authors own calculations using AMIGO database

When decomposing at wage deciles, we notice a deepening of the gender differences in favour of female employees as they advance in wage distribution. Thus, if in the first quarter of 2014, for instance, the differences between the share of employed female and male employed in urban areas in the first two deciles were around 7 percentage points, the differences increased within the distribution, reaching about 10 pp in the last two deciles. However, by the end of 2014 these differences slightly narrowed, especially within the first six wage deciles.

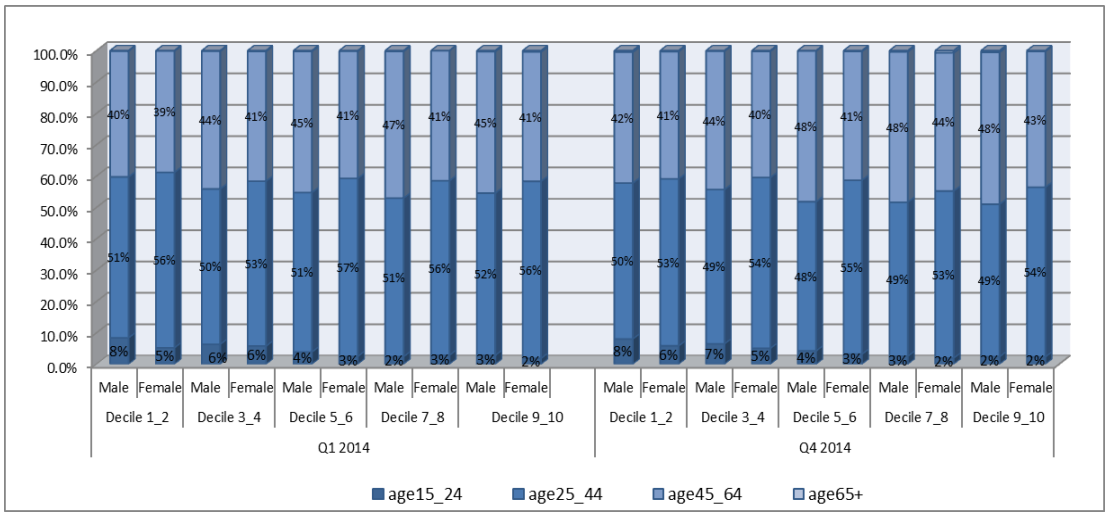
When analysing age subgroups, it is noted that the percentage of adult women (25-44 years) occupied in Romania is higher than the share of employed men belonging to the same age subgroup. However, the situation is reversed for the case of 45-64 age group when the share of male employees is about 4.5 pp higher than women.



Source: authors own calculations using AMIGO database

Fig. 2 Wage deciles distribution on gender and residence area

When decomposing at wage deciles, the most noticeable discrepancies are recorded for deciles 5 and 6 throughout all quarters of 2014, while a slight decrease in time is recorded for the 7th and 8th deciles (referring to the 4th quarter of 2014 vs. the first quarter of 2014).



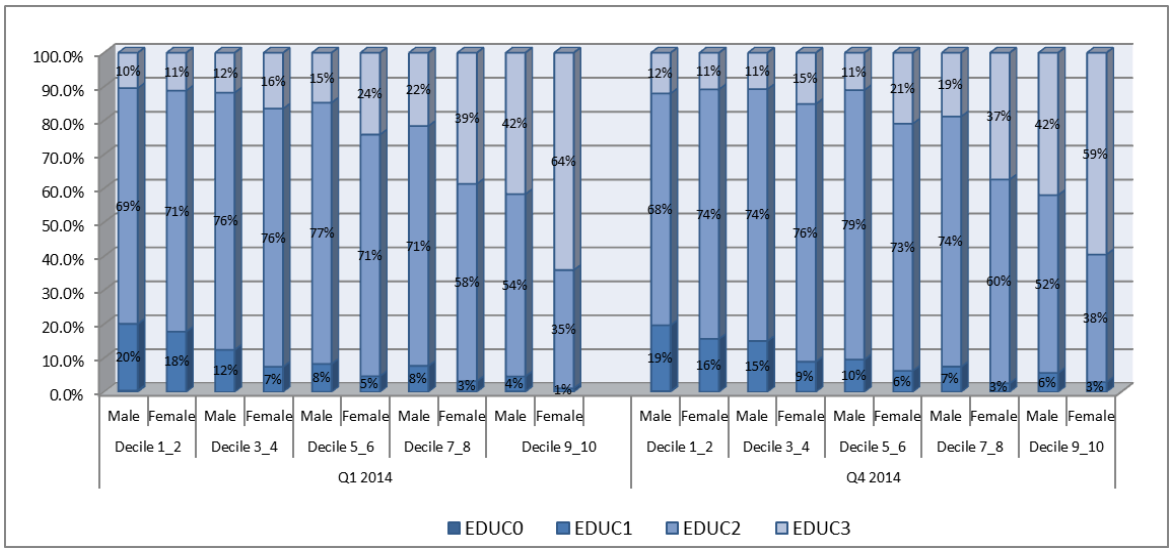
Source: authors own calculations using AMIGO database

Fig. 3 Wage deciles distribution on gender and age subgroups

As regards the level of education, we find that women with higher education (ISCED 5-8) outnumber men on average by approximately 6 pp, while the share of men with medium educational level exceeds that of women by about 4 pp in the case of primary or lower secondary education graduates (ISCED 1-2).

These differences particularly deepen in case of secondary or non-tertiary secondary education (ISCED3-4) graduates, when the percentage of male employed persons exceeds by approximately 6.5 pp the share of women employed and of the same educational level. At wage decile level, most notable cases are those corresponding to the 9^{th} -10^{th} and 7^{th} -8^{th} deciles respectively, when the share of women with higher education significantly exceeds the number of men within the same wage decile.

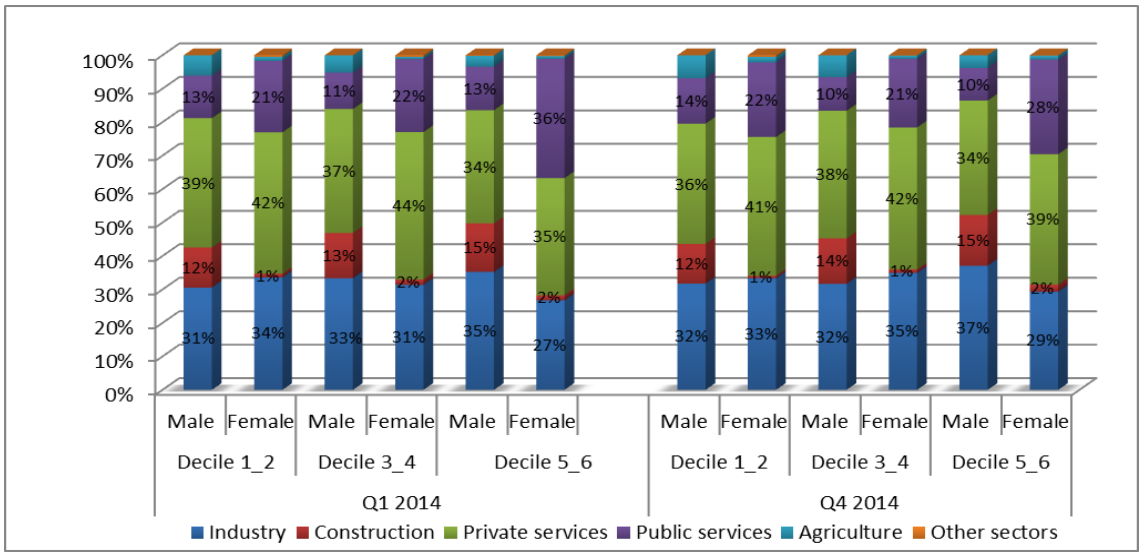
The analysis of gender differences in relation to the main sectors of activity revealed some particularities. Thus, it is noted that in the sectors of Industry, Construction and Agriculture the share of men exceeds the share of women employed, while women are much better represented in public services (significant difference of about 15 pp) and private services (by 4.5 pp).



Source: authors own calculations using AMIGO database

Fig. 4 Wage deciles distribution on gender and education level

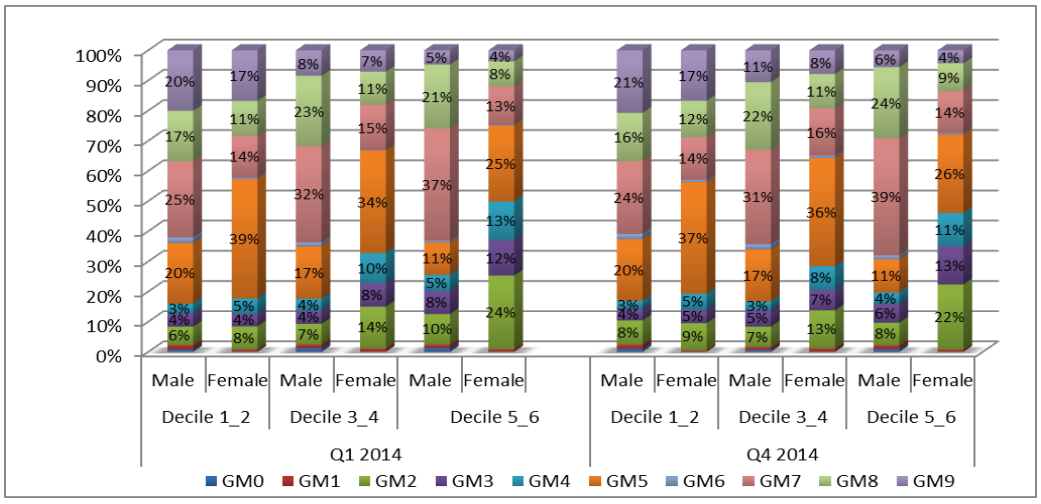
At wage deciles level, we notice significant differences in males versus females among all the economic sectors considered, generally confirming that a female majority is operating in Public and Private Services, while male employees are better represented in Construction and Industry sectors.



Source: authors own calculations using AMIGO database

Fig. 5 Wage deciles distribution on gender and economic sectors

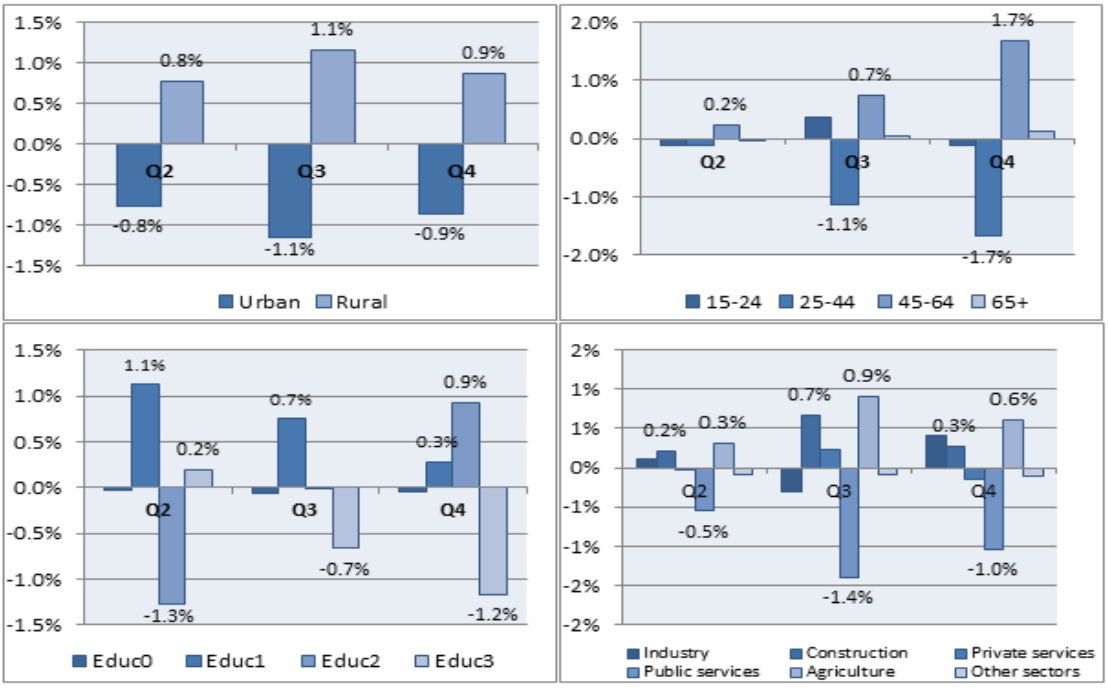
Last but not least, with regard to the major occupational groups of people working in the labour market, men are predominantly more numerous in the following major groups: GM0 - Armed Forces (1 per cent more than women), GM1- Members of the legislative, executive, senior public administration heads, senior officials and senior officials (1 per cent more than women), GM6 - Qualified workers in agriculture, forestry and fishing (1 pp more), GM7 - Qualified workers Assimilated (17.5 pp more) and GM8 - Plant and Machine Operators; Assemblers of machinery and equipment (12 pp more) compared to women. On the other hand, the share of women employed in GM2 - Specialists in various fields of activity, GM3 - Technicians and other technical specialists, GM4 - Administrative officers and GM5 - Service workers outstripped the proportion of men by approximately (10 pp, 3 pp, 5 pp and 14 pp respectively).



Source: authors own calculations using AMIGO database

Fig. 6 Wage deciles distribution on gender and major groups of occupations

When analysing the changes in dynamic recorded during the four quarters of 2014 on the main socio-economic characteristics of the persons employed, some relevant aspects are worth mentioning.



Source: authors own calculations using AMIGO database

Fig. 7 The quarterly variations of the socio-economic characteristics of individuals

Thus, compared to the first quarter of 2014, after the two successive adjustments of the minimum wage, we notice mainly slight decreases among employees living in urban areas as compared to those living in rural areas, as well as among the graduates of tertiary education. Moreover, there is a modest increasing trend registered in the number of graduates of primary or lower secondary education, but with decreasing rhythms.

At the same time, one can observe a short-term decreasing tendency of the adult employed population (ageing between 25-44 years), in favour of those ageing between 45-64 years, while the share of the elderly (over 65 years old) did not register any changes during the whole year 2014. The short-term dynamics of young employees was slightly oscillating, with small increases registered only in the third quarter of 2014.

Last but not least, regarding the economic characteristics of the analysed individuals, the comparative analysis in dynamics during the year 2014 did not reveal any noticeable variation in the structure of the employed population in the economic sectors and major occupational groups. At most, we can notice a slight reduction of 1 pp in the share of employees in GM5-service workers, as well as of those in Public Services during the last two quarters of 2014.

4. Conclusions

In this paper we aimed to identify the most relevant short-term changes in the net wage distribution in terms of gender inequalities. The case of Romania was discussed for the year 2014, using quarterly data observable at individual level. The choice of the year 2014 was based on data availability reasons.

The period of investigation corresponds to a time when the minimum wage registered two successive increases. Since the minimum wage policy is generally assumed to have several implications on the national wage distribution, the analysis investigated the short-term quarterly dynamic of the wage distribution. Moreover, due to the two successive increases of the minimum wage rate, we conducted a comparative analysis of the quarterly changes occurring during the period Q1 2014 - Q4 2014 upon gender wage inequalities. Both social-demographic and economic characteristics at individual level were investigated.

As a limitation of our study, we are aware of the data availability restrictions that prevented us from quantifying the net impact of minimum wage upon wage inequalities. However, we believe that this study brings valuable insights on the most relevant short-term changes in gender wage inequalities under a period of intense adjustments in the minimum wage level.

References

[1] Andreica M.E. and Cataniciu N. (2010), „Diagnosing the Wage Payment Process of the Medium-Sized Romanian Companies", Quality - Access to success, Vol. 11, no. 113 Special-2010, pp.731- 738

[2] Buchinsky, M. (2001), "Quantile regression with sample selection: Estimating women's return to education in the U.S". Empirical Economics, 26 (1), pp. 87-113

[3] Fournier J.M. and Koske, I. (2012), "The Determinants of Earnings Inequality – Evidence From Quantile Regressions", OECD Journal: Economic Studies, pp. 7-36

[4] Hosmer, D. W., Lemeshow, Jr., S. A. and Sturdivant R. X. (2013), "Applied Logistic Regression", 3rd ed. Hoboken, NJ: Wiley.

[5] Militaru, E., Stroe, C. and Cojanu, S. (2011), "Labor market participation, social benefits and wages in Romania", International Journal of Mathematical Models and Methods in Applied Sciences, 5, Issue 2.

[6] Pereira, P.T. and Martins, P.S. (2000), "Does Education Reduce Wage Inequality? Quantile Regressions Evidence from Fifteen European Countries", IZA Discussion Paper No. 120

[7] Tansel, A. and Bircan, F. (2011), "Wage Inequality and Returns to Education in Turkey: A Quantile Regression Analysis", Working Paper 1102

[8] Vasilescu, M.D., Aparaschivei, L., Andreica, M.E. and Cătăniciu, N. (2010), "The determinants of average wage: evidence from a panel of Romanian counties", Proceedings of the 5th International Conference on Applied Statistics, Bucharest, Romania.

[9] Voinea, L. and Mihaescu, F., (2011), „A contribution to the public-private wage inequality debate: the iconic case of Romania", The WIIW Balkan Observatory, Working Papers 093